



IECC Code Comparison Study

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Abstract

An analysis was conducted utilizing REM/Rate V16.0.6 software to compare the energy savings, utility cost savings, and emissions reductions associated with newly constructed Utah homes built to the Utah IECC 2015 code as compared to the IECC 2021 code. Four scenarios are considered – a home built to IECC 2015 using the prescriptive path, IECC 2015 using the ERI path, IECC 2021 using the prescriptive path, and IECC 2021 using the ERI path. Utility cost savings are based on energy prices and forecasts in Utah from the Energy and Information Administration (EIA). The analysis shows that building a home to IECC 2021 Code results in 11.5%-25% gas savings, 4.7%-10.3% electric savings, and 7.8%-16.7% utility cost savings as compared to a home built to IECC 2015 prescriptive code. In the same scenario, homeowners can save between \$3,435 and \$7,435 over the life of a 30-year mortgage. Carbon dioxide emissions from the home will be reduced by 7.9%-15.8% per year.

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Summary

The analysis compares the energy savings, emission reductions, and utility cost savings of four different homes – a home built to IECC 2015 using the prescriptive path, IECC 2015 using the ERI path, IECC 2021 using the prescriptive path, and IECC 2021 using the ERI path. Each home has the same general parameters, namely a two story home with 2,377 conditioned square feet, based on the Pacific Northwest National Labs (PNNL) prototype for a new home in Utah in Climate Zone 5. Other parameters (insulation levels, infiltration rates, etc.) are changed in the models to align with the respective version of code. More details on these building parameters are given in the methodology section of this report. Energy savings show the amount of gas and electricity saved by building to a more efficient code, while utility cost savings show the amount of money saved on utilities over the span of a 30-year mortgage. Additionally, building to a more efficient code significantly reduces the amount of emissions from the home.

Based on data from the Kem C. Gardner Policy Institute¹, over the past 10 years, an average of 14,136 new construction single-family homes have been built each year in the state of Utah. This consists of an average of 10,430 detached single-family homes per year, 3,462 condo/townhomes per year, and 244 duplex units per year. This study analyzes the energy savings and emissions reductions of homes built in Climate Zone 5, which encompasses the majority of Utah. If we assume that the level of energy savings and remissions reductions are similar for homes across Utah's other two climate zones, and if this rate of construction remains the same over the next 10 years, building all homes to IECC 2021 code would save ~56-122 million therms, ~249-540 million kWh, and would reduce CO2 emissions by ~621-1,243 thousand tons.

Methodology

REM/Rate v16.0.6 was used to predict the energy consumption of each scenario considered in the analysis. REM/Rate is an industry-accepted residential modeling software that simulates energy consumption of the entire home based upon detailed input parameters and local weather conditions. Four home prototypes were developed, homes built to IECC 2015 and IECC 2021 using both the prescriptive path and the ERI path. Each prototype was simulated in Climate Zone 5B.

General Building Parameters

The prototype home was based on the PNNL Residential Prototype Building Model for a new home in Utah in Climate Zone 5. The prototype is used by the U.S. Department of Energy and is accepted to reflect a standard homes in the area. The general characteristics for the home are presented in Table 1.

Table 1: General Characteristics – Single Family Utah Home

Home Characteristics	Prototype Model
Conditioned Floor Area	2,377
Number of Floors	2
Number of Bedrooms	3
Perimeter Dimensions	29.86' x 39.81'
Wall Height	8.5'
Total Wall Area	2,369
Total Attic Area	1,188
Window to Wall Ratio	12.4%
Total Window Area	294
Framing	2x6, 16" o.c.
Foundation Type	Unconditioned Basement

Detailed Model Inputs

Detailed simulation inputs involving thermal envelope, mechanical equipment, and appliances and lighting are presented in Table 2. Inputs for the prescriptive path homes use the inputs required to comply with code. Inputs for the ERI path homes use inputs that demonstrate a different path to comply with code than the prescriptive requirements. They demonstrate the

ability to tradeoff between certain requirements, being less efficient in one area and more efficient in another, as long as the home meets the required ERI score (69 for IECC 2015, 55 for IECC 2021). Note that in IECC 2021, a builder may avoid the use of continuous insulation if they desire, by increasing energy efficiency of mechanical equipment and windows.

Table 2: Detailed Model Inputs

Home Characteristics	IECC 2015 Prescriptive	IECC 2015 ERI	IECC 2021 Prescriptive	IECC 2021 ERI
Thermal Performance				
Foundation (Floor) Insulation	R-30	R-30	R-30	R-30
Above-Grade Wall Insulation	R-20	R-20	R-20 + R-5 continuous	R-23
Below-Grade Wall Insulation	R-15 continuous	R-15 continuous	R-15 continuous	R-15 continuous
Attic Insulation	R-49	R-38	R-60	R-60
Windows	U-Value: 0.32 / SHGC: 0.35	U-Value: 0.35 / SHGC: 0.35	U-Value: 0.30 / SHGC: 0.35	U-Value: 0.27 / SHGC: 0.30
Whole-House Infiltration	3.5 ACH50	5 ACH50	3 ACH50	3 ACH50
Ventilation	60 cfm bathroom exhaust 1.4 cfm/W	60 cfm bathroom exhaust 1.4 cfm/W	60 cfm bathroom exhaust 2.8 cfm/W	60 cfm bathroom exhaust 2.8 cfm/W
Mechanical Equipment Information				
Furnace Size	32 kBtu	32 kBtu	32 kBtu	32 kBtu
Furnace Efficiency	80% AFUE	90% AFUE	80% AFUE	95% AFUE
AC Size	2.19 ton	2.19 ton	2.19 ton	2.19 ton
AC Efficiency	13 SEER	13 SEER	13 SEER	14 SEER
Water Heater Size	Storage, 40 gal	Storage, 40 gal	Storage, 40 gal	Storage, 40 gal
Water Heater Efficiency	0.58 EF	0.65 EF	0.58 EF	0.90 EF
Duct Location	50% Cond, 50% Uncond	50% Cond, 50% Uncond	50% Cond, 50% Uncond	50% Cond, 50% Uncond
Duct Insulation	R-8 in Uncond Basement	R-8 in Uncond Basement	R-8 in Uncond Basement	R-8 in Uncond Basement
Duct Leakage	6 cfm / 100 sq ft	6 cfm / 100 sq ft	4 cfm / 100 sq ft	4 cfm / 100 sq ft
Appliances & Lighting				
Refrigerator	Standard Eff. Refrigerator	Standard Eff. Refrigerator	Standard Eff. Refrigerator	Standard Eff. Refrigerator
Dishwasher	Standard Eff. Dishwasher	Standard Eff. Dishwasher	Standard Eff. Dishwasher	Standard Eff. Dishwasher
Lighting	75% LED	75% LED	100% LED	100% LED

SEER: Seasonal Energy Efficiency Ratio, cooling efficiency for air conditioners and heat pumps.
 AFUE: Annual Fuel Utilization Ratio, heating efficiency for gas fired heating appliances
 EF: Efficiency Factor, efficiency metric used for water heaters

Mechanical Systems Simulated

Note that for each of the four homes considered in this analysis, the mechanical equipment consists of a gas furnace and an air conditioner. Appendix A contains an alternative analysis, comparing the same homes, but now with a dual fuel heat pump system. Model inputs and all results, including energy savings, emissions reductions, and utility cost savings can be found in that appendix.

Energy Savings, Utility Cost Savings, and Emissions Reductions

Energy Savings

The gas and electric savings for the four scenarios are presented in Tables 3 and 4, respectively. Both gas and electric savings are broken down by end use, including heating, cooling, hot water, and lights/appliances. Savings in each scenario are in comparison to a home built to IECC 2015 prescriptive code.

Table 3: Gas Savings

Energy Savings - Gas											
Category	IECC 2015 Prescriptive		IECC 2015 ERI			IECC 2021 Prescriptive			IECC 2021 ERI		
	Gas (therms)	% Savings Over IECC 2015 Prescriptive	Gas (therms)	Therms Savings / Year	% Savings Over IECC 2015 Prescriptive	Gas (therms)	Therms Savings / Year	% Savings Over IECC 2015 Prescriptive	Gas (therms)	Therms Savings / Year	% Savings Over IECC 2015 Prescriptive
Heating	386	-	411	-25	-6.5%	312	74	19.2%	301	85	22.0%
Cooling	0	-	0	0	0.0%	0	0	0.0%	0	0	0.0%
DHW	181	-	159	22	12.2%	182	-1	-0.6%	108	73	40.3%
Lights/Appliances	66	-	66	0	0.0%	66	0	0.0%	66	0	0.0%
Total Gas	633	-	636	-3	-0.5%	560	73	11.5%	475	158	25.0%

Table 4: Electric Savings

Energy Savings - Electricity											
Category	IECC 2015 Prescriptive		IECC 2015 ERI			IECC 2021 Prescriptive			IECC 2021 ERI		
	kWh	% Savings Over IECC 2015 Prescriptive	kWh	kWh Savings / Year	% Savings Over IECC 2015 Prescriptive	kWh	kWh Savings / Year	% Savings Over IECC 2015 Prescriptive	kWh	kWh Savings / Year	% Savings Over IECC 2015 Prescriptive
Heating	412	-	311	101	24.5%	355	57	13.8%	189	223	54.1%
Cooling	1452	-	1413	39	2.7%	1424	28	1.9%	1216	236	16.3%
DHW	0	-	0	0	0.0%	0	0	0.0%	0	0	0.0%
Lights/Appliances	4895	-	4895	0	0.0%	4659	236	4.8%	4659	236	4.8%
Total Electricity	6759	-	6619	140	2.1%	6438	321	4.7%	6064	695	10.3%

Utility Cost Savings

Both gas and electric savings result in utility cost savings for the homeowner. Table 5 presents the utility cost savings for the first year for each home as compared to the IECC 2015 prescriptive code. Cost savings are broken down by end use. The EIA provides average gas² and electric³ rates for the state of Utah, which are used in this analysis. Then, in order to see the cost savings over the lifetime of these measures, the savings are shown for the duration of a 30 year mortgage. The EIA provides estimated escalation rates⁴ over the next 30 years for electric and gas utility rates, which are used in this analysis. These rates are adjusted for expected inflation, so all numbers are in 2021 dollars rather than nominal dollars. These results are presented in Table 6, and summarized in Table 7.

Table 5: Utility Cost Savings

Utility Costs											
Category	IECC 2015 Prescriptive		IECC 2015 ERI			IECC 2021 Prescriptive			IECC 2021 ERI		
	\$	% Savings Over IECC 2015 Prescriptive	\$	\$ Savings / Year	% Savings Over IECC 2015 Prescriptive	\$	\$ Savings / Year	% Savings Over IECC 2015 Prescriptive	\$	\$ Savings / Year	% Savings Over IECC 2015 Prescriptive
Heating	\$365	-	\$375	-\$10	-2.7%	\$297	\$68	18.6%	\$271	\$94	25.8%
Cooling	\$151	-	\$147	\$4	2.6%	\$148	\$3	2.0%	\$126	\$25	16.6%
DHW	\$152	-	\$133	\$19	12.5%	\$152	\$0	0.0%	\$90	\$62	40.8%
Lights/Appliances	\$564	-	\$564	\$0	0.0%	\$539	\$25	4.4%	\$539	\$25	4.4%
Total	\$1,232	-	\$1,219	\$13	1.1%	\$1,136	\$96	7.8%	\$1,026	\$206	16.7%

Table 6: Utility Cost Savings Over Life of a 30 Year Mortgage

30 Year Mortgage Utility Cost Savings								
Mortgage Year	IECC 2015 Prescriptive		IECC 2015 ERI		IECC 2021 Prescriptive		IECC 2021 ERI	
	\$ Savings	Total \$ Saved	\$ Savings	Total \$ Saved	\$ Savings	Total \$ Saved	\$ Savings	Total \$ Saved
Year 1	-	-	\$12.05	\$12.05	\$94.41	\$94.41	\$204.37	\$204.37
Year 2	-	-	\$11.96	\$24.01	\$95.53	\$189.94	\$206.79	\$411.16
Year 3	-	-	\$11.86	\$35.87	\$96.68	\$286.62	\$209.27	\$620.43
Year 4	-	-	\$11.77	\$47.64	\$97.85	\$384.47	\$211.80	\$832.24
Year 5	-	-	\$11.67	\$59.31	\$99.04	\$483.51	\$214.39	\$1,046.63
Year 6	-	-	\$11.57	\$70.89	\$100.27	\$583.78	\$217.04	\$1,263.67
Year 7	-	-	\$11.48	\$82.36	\$101.52	\$685.29	\$219.74	\$1,483.41
Year 8	-	-	\$11.38	\$93.74	\$102.79	\$788.09	\$222.50	\$1,705.91
Year 9	-	-	\$11.28	\$105.01	\$104.10	\$892.18	\$225.33	\$1,931.24
Year 10	-	-	\$11.17	\$116.19	\$105.43	\$997.61	\$228.21	\$2,159.45
Year 11	-	-	\$11.07	\$127.26	\$106.79	\$1,104.40	\$231.16	\$2,390.60
Year 12	-	-	\$10.97	\$138.23	\$108.18	\$1,212.58	\$234.17	\$2,624.77
Year 13	-	-	\$10.86	\$149.09	\$109.60	\$1,322.18	\$237.24	\$2,862.01
Year 14	-	-	\$10.76	\$159.85	\$111.05	\$1,433.23	\$240.38	\$3,102.39
Year 15	-	-	\$10.65	\$170.50	\$112.53	\$1,545.76	\$243.59	\$3,345.98
Year 16	-	-	\$10.54	\$181.04	\$114.05	\$1,659.81	\$246.87	\$3,592.85
Year 17	-	-	\$10.43	\$191.48	\$115.60	\$1,775.41	\$250.22	\$3,843.06
Year 18	-	-	\$10.32	\$201.80	\$117.18	\$1,892.58	\$253.64	\$4,096.70
Year 19	-	-	\$10.21	\$212.01	\$118.79	\$2,011.37	\$257.13	\$4,353.83
Year 20	-	-	\$10.10	\$222.11	\$120.44	\$2,131.81	\$260.70	\$4,614.52
Year 21	-	-	\$9.98	\$232.09	\$122.12	\$2,253.93	\$264.34	\$4,878.86
Year 22	-	-	\$9.87	\$241.96	\$123.84	\$2,377.77	\$268.06	\$5,146.93
Year 23	-	-	\$9.75	\$251.71	\$125.60	\$2,503.37	\$271.86	\$5,418.79
Year 24	-	-	\$9.63	\$261.35	\$127.39	\$2,630.76	\$275.74	\$5,694.53
Year 25	-	-	\$9.51	\$270.86	\$129.22	\$2,759.98	\$279.71	\$5,974.24
Year 26	-	-	\$9.39	\$280.25	\$131.09	\$2,891.07	\$283.75	\$6,257.99
Year 27	-	-	\$9.27	\$289.52	\$133.00	\$3,024.07	\$287.89	\$6,545.88
Year 28	-	-	\$9.14	\$298.67	\$134.95	\$3,159.02	\$292.11	\$6,837.99
Year 29	-	-	\$9.02	\$307.68	\$136.94	\$3,295.96	\$296.42	\$7,134.40
Year 30	-	-	\$8.89	\$316.58	\$138.97	\$3,434.94	\$300.82	\$7,435.22

Table 7: Summary of Utility Cost Savings Over Life of a 30 Year Mortgage

Home Type	\$ Saved Over 30 Year Mortgage (2021 Dollars - Adj for Inflation)
IECC 2015 Prescriptive	-
IECC 2015 ERI	\$316.58
IECC 2021 Prescriptive	\$3,434.94
IECC 2021 ERI	\$7,435.22

Emissions Reductions

The use of more efficient equipment in a home will result in the reduction of emissions from that home, which can have a big environmental impact. Important emissions include carbon dioxide, sulfur dioxide, and nitrogen oxide. The emissions reported represent both on-site gas combustion and electric grid produced power. Site-to-source energy multipliers and air emissions data used in REM/Rate are taken from the US EPA eGRID2012 database, which is state-specific. The

emissions reductions for each home are presented in Table 8, as compared to the home built to IECC 2015 prescriptive code.

Table 8: Emissions Reductions

Category	Emissions										
	IECC 2015 Prescriptive		IECC 2015 ERI			IECC 2021 Prescriptive			IECC 2021 ERI		
	Emissions	% Reduction Over IECC 2015 Prescriptive	Emissions	Reduction / Year	% Reduction Over IECC 2015 Prescriptive	Emissions	Reduction / Year	% Reduction Over IECC 2015 Prescriptive	Emissions	Reduction / Year	% Reduction Over IECC 2015 Prescriptive
CO2 (tons/yr)	10.1	-	10	0.1	1.0%	9.3	0.8	7.9%	8.5	1.6	15.8%
SO2 (lbs/yr)	7.8	-	7.6	0.2	2.6%	7.4	0.4	5.1%	7	0.8	10.3%
Nox (lbs/yr)	29.4	-	29	0.4	1.4%	27.3	2.1	7.1%	25	4.4	15.0%

Conclusions and Discussion

The analysis shows significant energy savings, utility cost savings, and emissions reductions when building a home to IECC 2021 code as compared to IECC 2015 code. The results are 11.5%-25% gas savings, 4.7%-10.3% electric savings, and 7.8%-16.7% utility cost savings. Homeowners can save between \$3,435 and \$7,435 over the life of a 30-year mortgage. Additionally, carbon dioxide emissions from the home will be reduced by 7.9%-15.8%.

The incremental costs associated with building a home to IECC 2021 code as compared to IECC 2015 code will be determined at a later date. A table is included in Appendix B that will be used to log these costs.

Using data from the Kem C. Gardner Policy Institute¹ it is known that over the past 10 years, an average of 14,136 new construction single-family homes have been built each year in the state of Utah. This consists of an average of 10,430 detached single-family homes per year, 3,462 condo/townhomes per year, and 244 duplex units per year. Assuming that homes continue to be built at this rate over the next 10 years, and using the data from the energy models discussed in this report, Figure 1 shows the total cumulative gas savings if all homes are built to a more efficient code as compared to all homes being built to IECC 2015 Prescriptive code. Figure 2 shows the total cumulative electric savings over the next 10 years for the same scenario, and Figure 3 shows the total cumulative CO2 reductions. This study analyzes the energy savings and emissions reductions of homes built in Climate Zone 5, which encompasses the majority of Utah. Figures 1, 2, and 3 assume that the level of savings are similar for Utah's other two climate zones.

Figure 1. Total cumulative statewide gas savings over the next 10 years assuming rate of new construction remains the same as the previous 10 years. Each scenario assumes all homes are built to a specific code (specified in the legend), and savings are as compared to IECC 2015 Prescriptive Code.

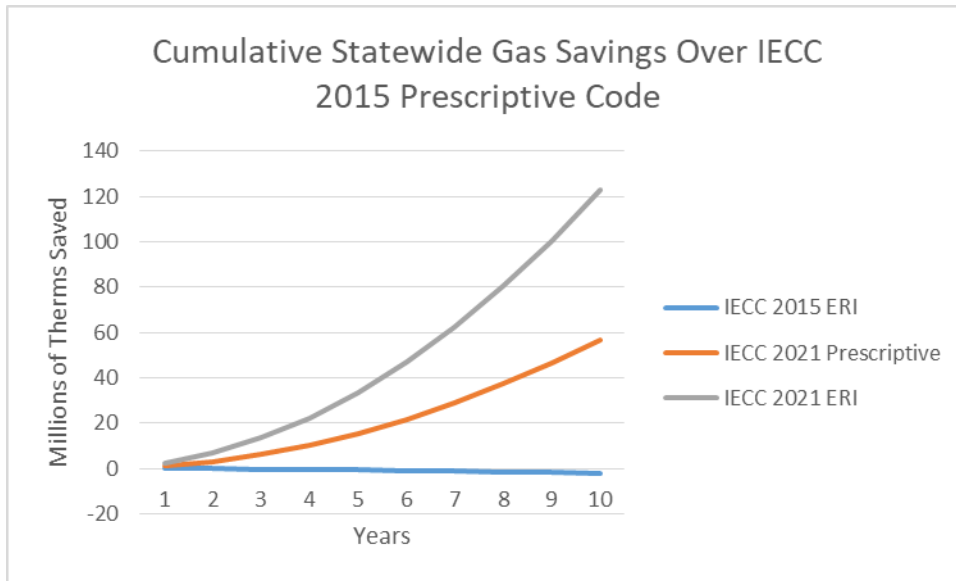


Figure 2. Total cumulative statewide electric savings over the next 10 years assuming rate of new construction remains the same as the previous 10 years. Each scenario assumes all homes are built to a specific code (specified in the legend), and savings are as compared to IECC 2015 Prescriptive Code.

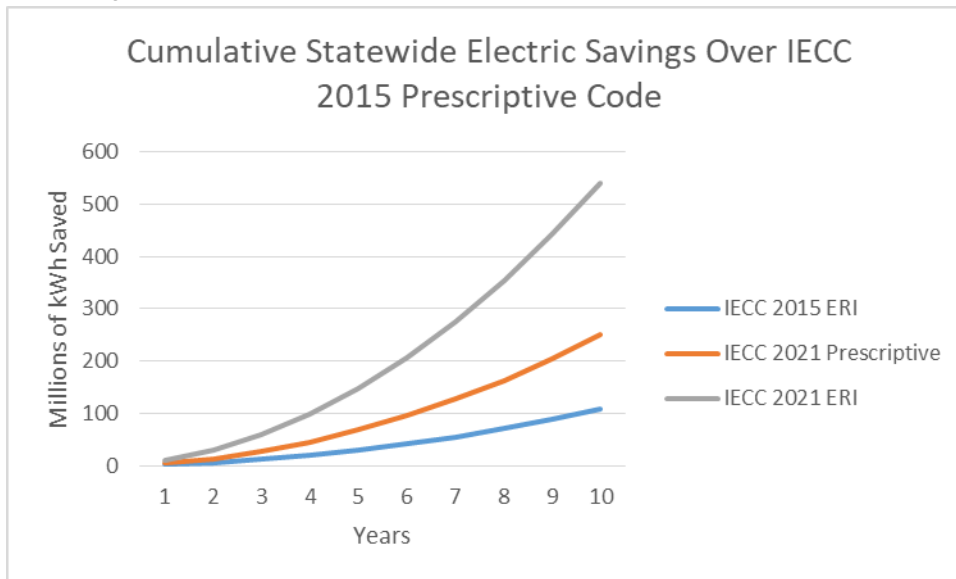
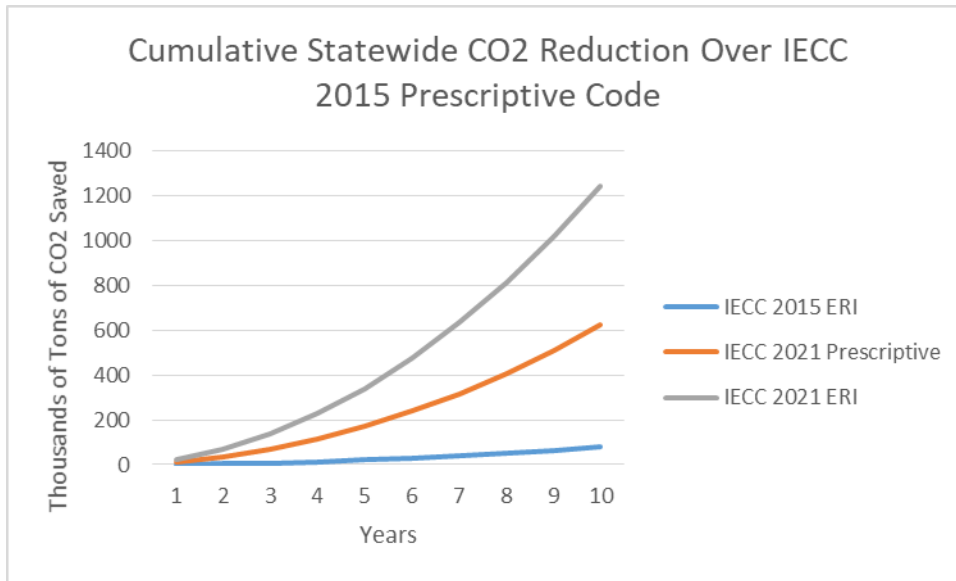


Figure 3. Total cumulative statewide CO2 reductions over the next 10 years assuming rate of new construction remains the same as the previous 10 years. Each scenario assumes all homes are built to a specific code (specified in the legend), and savings are as compared to IECC 2015 Prescriptive Code.



References

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Appendix A – Dual Fuel Heat Pump Homes

The tables in this section are the same as Tables 2-8, and Figures 1-3, but are for homes with dual fuel heat pumps rather than gas furnaces and air conditioners. Results show higher utility cost savings due to the fact that the majority of the fuel used is electricity rather than gas, and the higher cost of electricity.

Detailed Model Inputs

Home Characteristics	IECC 2015 Prescriptive	IECC 2015 ERI	IECC 2021 Prescriptive	IECC 2021 ERI
Thermal Performance				
Foundation (Floor) Insulation	R-30	R-30	R-30	R-30
Above-Grade Wall Insulation	R-20	R-20	R-20 + R-5 continuous	R-23
Below-Grade Wall Insulation	R-15 continuous	R-10 continuous	R-15 continuous	R-15 continuous
Attic Insulation	R-49	R-38	R-60	R-60
Windows	U-Value: 0.32 / SHGC: 0.35	U-Value: 0.35 / SHGC: 0.35	U-Value: 0.30 / SHGC: 0.35	U-Value: 0.30 / SHGC: 0.33
Whole-House Infiltration	3.5 ACH50 60 cfm bathroom exhaust	5 ACH50 60 cfm bathroom exhaust	3 ACH50 60 cfm bathroom exhaust	3 ACH50 60 cfm bathroom exhaust
Ventilation	1.4 cfm/W	1.4 cfm/W	2.8 cfm/W	2.8 cfm/W
Mechanical Equipment Information				
Furnace Size	32 kBtu	32 kBtu	32 kBtu	32 kBtu
Furnace Efficiency	80% AFUE	90% AFUE	80% AFUE	95% AFUE
HP Size	2.19 ton	2.19 ton	2.19 ton	2.19 ton
HP Cooling Efficiency	13 SEER	13 SEER	13 SEER	14 SEER
HP Heating Efficiency	8.2 HSPF	9 HSPF	8.2 HSPF	9 HSPF
Water Heater Size	Storage, 40 gal	Storage, 40 gal	Storage, 40 gal	Storage, 40 gal
Water Heater Efficiency	0.58 EF	0.70 EF	0.58 EF	0.90 EF
Duct Location	50% Cond, 50% Uncond	50% Cond, 50% Uncond	50% Cond, 50% Uncond	50% Cond, 50% Uncond
Duct Insulation	R-8 in Uncond Basement	R-8 in Uncond Basement	R-8 in Uncond Basement	R-8 in Uncond Basement
Duct Leakage	6 cfm / 100 sq ft	6 cfm / 100 sq ft	4 cfm / 100 sq ft	4 cfm / 100 sq ft
Appliances & Lighting				
Refrigerator	Standard Eff. Refrigerator	Standard Eff. Refrigerator	Standard Eff. Refrigerator	Standard Eff. Refrigerator
Dishwasher	Standard Eff. Dishwasher	Standard Eff. Dishwasher	Standard Eff. Dishwasher	Standard Eff. Dishwasher
Lighting	75% LED	75% LED	100% LED	100% LED

Gas Savings

Category	Energy Savings - Gas										
	IECC 2015 Prescriptive		IECC 2015 ERI			IECC 2021 Prescriptive			IECC 2021 ERI		
	Gas (therms)	% Savings Over IECC 2015 Prescriptive	Gas (therms)	Therms Savings / Year	% Savings Over IECC 2015 Prescriptive	Gas (therms)	Therms Savings / Year	% Savings Over IECC 2015 Prescriptive	Gas (therms)	Therms Savings / Year	% Savings Over IECC 2015 Prescriptive
Heating	206	-	215	-9	-4.4%	162	44	21.4%	131	75	36.4%
Cooling	0	-	0	0	0.0%	0	0	0.0%	0	0	0.0%
DHW	183	-	145	38	20.8%	183	0	0.0%	108	75	41.0%
Lights & Appliance	66	-	66	0	0.0%	66	0	0.0%	66	0	0.0%
Total Gas	455	-	426	29	6.4%	411	44	9.7%	305	150	33.0%

Electric Savings

Category	Energy Savings - Electricity										
	IECC 2015 Prescriptive		IECC 2015 ERI			IECC 2021 Prescriptive			IECC 2021 ERI		
	kWh	% Savings Over IECC 2015 Prescriptive	kWh	kWh Savings / Year	% Savings Over IECC 2015 Prescriptive	kWh	kWh Savings / Year	% Savings Over IECC 2015 Prescriptive	kWh	kWh Savings / Year	% Savings Over IECC 2015 Prescriptive
Heating	1344	-	1535	-191	-14.2%	1111	233	17.3%	1105	239	17.8%
Cooling	1367	-	1320	47	3.4%	1341	26	1.9%	1264	103	7.5%
DHW	0	-	0	0	0.0%	0	0	0.0%	0	0	0.0%
Lights & Appliance	4895	-	4895	0	0.0%	4659	236	4.8%	4659	236	4.8%
Total Electricity	7606	-	7750	-144	-1.9%	7111	495	6.5%	7028	578	7.6%

Utility Cost Savings

Utility Costs											
Category	IECC 2015 Prescriptive		IECC 2015 ERI			IECC 2021 Prescriptive			IECC 2021 ERI		
	\$	% Savings Over IECC 2015 Prescriptive	\$	\$ Savings / Year	% Savings Over IECC 2015 Prescriptive	\$	\$ Savings / Year	% Savings Over IECC 2015 Prescriptive	\$	\$ Savings / Year	% Savings Over IECC 2015 Prescriptive
Heating	\$311	-	\$338	-\$27	-8.7%	\$251	\$60	19.3%	\$224	\$87	28.0%
Cooling	\$142	-	\$137	\$5	3.5%	\$139	\$3	2.1%	\$131	\$11	7.7%
DHW	\$153	-	\$121	\$32	20.9%	\$153	\$0	0.0%	\$90	\$63	41.2%
Lights & Applian	\$564	-	\$564	\$0	0.0%	\$539	\$25	4.4%	\$539	\$25	4.4%
Total	\$1,170	-	\$1,160	\$10	0.9%	\$1,082	\$88	7.5%	\$984	\$186	15.9%

Utility Cost Savings Over Life of a 30 Year Mortgage

DFHP									
Mortgage Year	IECC 2015 Prescriptive		IECC 2015 ERI		IECC 2021 Prescriptive		IECC 2021 ERI		
	\$ Savings	Total \$ Saved	\$ Savings	Total \$ Saved	\$ Savings	Total \$ Saved	\$ Savings	Total \$ Saved	
Year 1	-	-	\$9.27	\$9.27	\$88.26	\$88.26	\$185.51	\$185.51	
Year 2	-	-	\$9.80	\$19.07	\$88.85	\$177.11	\$187.84	\$373.35	
Year 3	-	-	\$10.34	\$29.40	\$89.44	\$266.55	\$190.22	\$563.57	
Year 4	-	-	\$10.89	\$40.29	\$90.05	\$356.60	\$192.65	\$756.22	
Year 5	-	-	\$11.45	\$51.73	\$90.68	\$447.29	\$195.13	\$951.35	
Year 6	-	-	\$12.01	\$63.75	\$91.32	\$538.61	\$197.67	\$1,149.02	
Year 7	-	-	\$12.59	\$76.34	\$91.99	\$630.60	\$200.26	\$1,349.27	
Year 8	-	-	\$13.18	\$89.53	\$92.66	\$723.26	\$202.91	\$1,552.18	
Year 9	-	-	\$13.79	\$103.31	\$93.36	\$816.61	\$205.61	\$1,757.79	
Year 10	-	-	\$14.40	\$117.71	\$94.07	\$910.68	\$208.37	\$1,966.16	
Year 11	-	-	\$15.02	\$132.73	\$94.80	\$1,005.48	\$211.19	\$2,177.36	
Year 12	-	-	\$15.66	\$148.39	\$95.54	\$1,101.02	\$214.08	\$2,391.44	
Year 13	-	-	\$16.30	\$164.69	\$96.31	\$1,197.33	\$217.02	\$2,608.46	
Year 14	-	-	\$16.96	\$181.65	\$97.09	\$1,294.42	\$220.03	\$2,828.48	
Year 15	-	-	\$17.63	\$199.28	\$97.90	\$1,392.31	\$223.10	\$3,051.58	
Year 16	-	-	\$18.31	\$217.59	\$98.72	\$1,491.03	\$226.23	\$3,277.82	
Year 17	-	-	\$19.01	\$236.60	\$99.56	\$1,590.59	\$229.44	\$3,507.26	
Year 18	-	-	\$19.72	\$256.32	\$100.42	\$1,691.02	\$232.71	\$3,739.97	
Year 19	-	-	\$20.44	\$276.76	\$101.31	\$1,792.32	\$236.05	\$3,976.01	
Year 20	-	-	\$21.17	\$297.93	\$102.21	\$1,894.53	\$239.46	\$4,215.48	
Year 21	-	-	\$21.92	\$319.85	\$103.14	\$1,997.67	\$242.94	\$4,458.42	
Year 22	-	-	\$22.69	\$342.54	\$104.08	\$2,101.75	\$246.50	\$4,704.92	
Year 23	-	-	\$23.46	\$366.00	\$105.05	\$2,206.81	\$250.13	\$4,955.05	
Year 24	-	-	\$24.25	\$390.26	\$106.05	\$2,312.86	\$253.84	\$5,208.89	
Year 25	-	-	\$25.06	\$415.32	\$107.06	\$2,419.92	\$257.63	\$5,466.52	
Year 26	-	-	\$25.88	\$441.20	\$108.10	\$2,528.02	\$261.49	\$5,728.02	
Year 27	-	-	\$26.72	\$467.92	\$109.17	\$2,637.19	\$265.44	\$5,993.46	
Year 28	-	-	\$27.57	\$495.49	\$110.25	\$2,747.44	\$269.47	\$6,262.93	
Year 29	-	-	\$28.44	\$523.93	\$111.37	\$2,858.81	\$273.59	\$6,536.52	
Year 30	-	-	\$29.33	\$553.26	\$112.51	\$2,971.32	\$277.79	\$6,814.30	

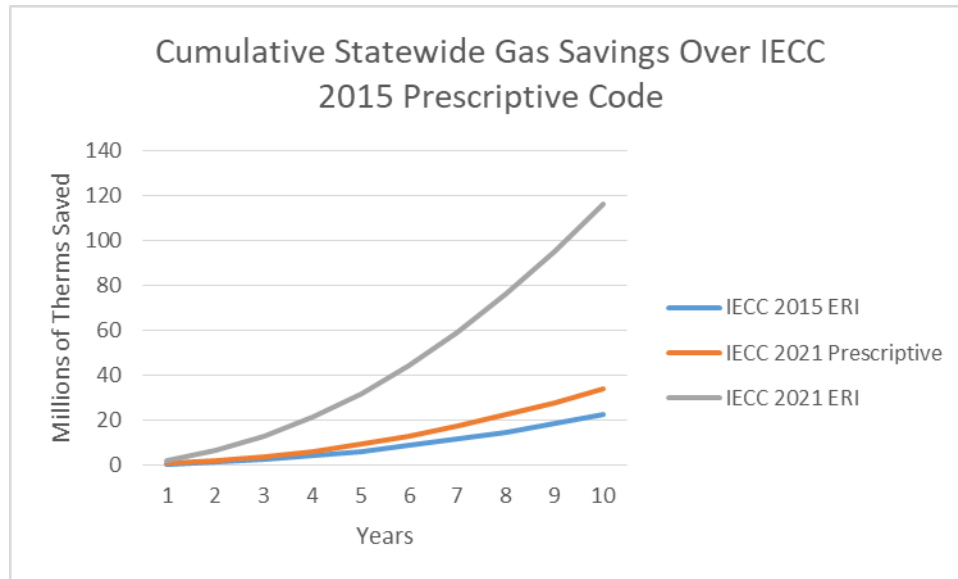
Summary of Utility Cost Savings Over Life of a 30 Year Mortgage

Home Type	\$ Saved Over 30 Year Mortgage (2021 Dollars - Adj for Inflation)
IECC 2015 Prescriptive	-
IECC 2015 ERI	\$553.26
IECC 2021 Prescriptive	\$2,971.32
IECC 2021 ERI	\$6,814.30

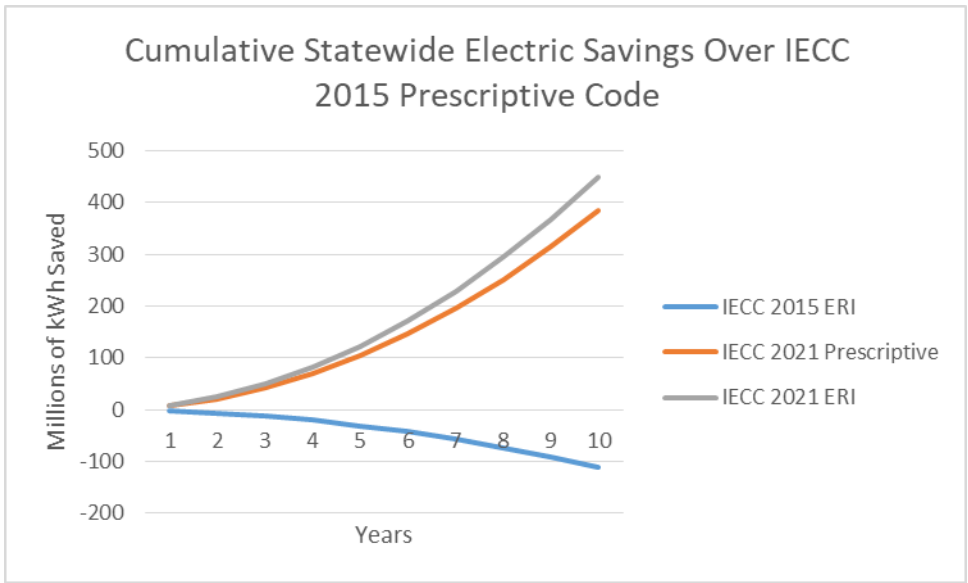
Emissions Reductions

Category	Emissions										
	IECC 2015 Prescriptive		IECC 2015 ERI			IECC 2021 Prescriptive			IECC 2021 ERI		
	Emissions	% Reduction Over IECC 2015 Prescriptive	Emissions	Reduction / Year	% Reduction Over IECC 2015 Prescriptive	Emissions	Reduction / Year	% Reduction Over IECC 2015 Prescriptive	Emissions	Reduction / Year	% Reduction Over IECC 2015 Prescriptive
CO2 (tons/yr)	9.8	-	9.7	0.1	1.0%	9.1	0.7	7.1%	8.3	1.5	15.3%
SO2 (lbs/yr)	8.7	-	8.9	-0.2	-2.3%	8.2	0.5	5.7%	8.1	0.6	6.9%
Nox (lbs/yr)	29.2	-	29.2	0	0.0%	27.1	2.1	7.2%	25.3	3.9	13.4%

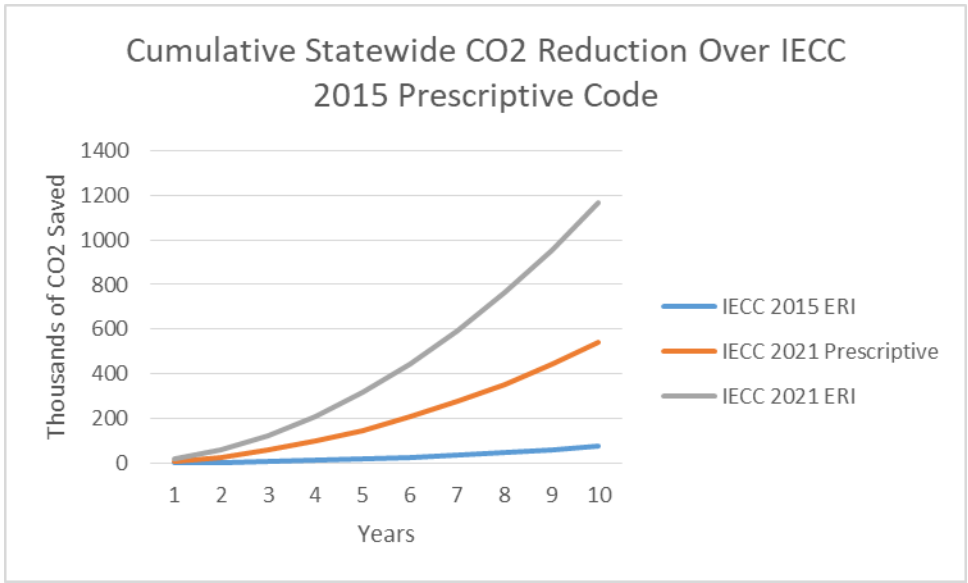
Total cumulative statewide gas savings over the next 10 years assuming rate of new construction remains the same as the previous 10 years. Each scenario assumes all homes are built to a specific code (specified in the legend), and savings are as compared to IECC 2015 Prescriptive Code



Total cumulative statewide electric savings over the next 10 years assuming rate of new construction remains the same as the previous 10 years. Each scenario assumes all homes are built to a specific code (specified in the legend), and savings are as compared to IECC 2015 Prescriptive Code.



Total cumulative statewide CO2 reductions over the next 10 years assuming rate of new construction remains the same as the previous 10 years. Each scenario assumes all homes are built to a specific code (specified in the legend), and savings are as compared to IECC 2015 Prescriptive Code.



Appendix B – Incremental Costs

The table in this appendix contains a table for the incremental costs associated with building a home to IECC 2021 code as compared to IECC 2015 code. This table is to be filled out at a later date.

Measure	Baseline	Upgrade	Incremental Cost (\$)
Wall Insulation (2,369 sq ft)	R-20	R-20 + R-5 continuous	
Attic Insulation (1,188 sq ft)	R-49	R-60	
Windows (294 sq ft)	U-Value: 0.32	U-Value: 0.30	
Duct Leakage	6 cfm / 100 sq ft	4 cfm / 100 sq ft	
Infiltration	3.5 ACH	3 ACH	
Bathroom Exhaust Fan	60 cfm, 1.4 cfm/W	60 cfm, 2.8 cfm/W	
Lighting	75% LEDs	100% LEDs	