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COMPARING THE RESIDENTIAL PROVISIONS OF THE 2015 IECC WITH THE CORRESPONDING PROVISIONS OF THE 2012 IECC FOR SINGLE-FAMILY RESIDENTIAL CONSTRUCTION IN TEXAS

A Report

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EXECUTIVE SUMMARY

The purpose of this analysis was to determine the stringency of residential provisions in the 2015 IECC when compared to the corresponding provisions in the 2012 IECC for residential buildings in Texas. In order to perform the assessment, the mandatory, prescriptive and performance residential provisions were compared.

The analysis was performed in two steps:

- **Qualitative assessment:** A qualitative assessment was performed comparing all the sections in Chapter 4 [RE] of the 2015 and the corresponding sections in Chapter 4 [RE] of the 2012 IECC. The sections include mandatory, prescriptive and performance provisions in the codes.
- **Quantitative assessment:** A simulation test suite was conducted comparing the provisions for performance path compliance in in Chapter 4 (RE) of the 2015 and 2012 IECC.

Results from the qualitative assessment indicate that most sections of the 2015 IECC were as or more stringent as the corresponding sections in the 2012 IECC. It was also noted that the requirements in certain sections of the 2015 IECC were relaxed. These requirements are listed below:

- Equivalent U-factors for walls in certain climate zones
- Loosening provisions for sun-room fenestrations for certain climate zones
- Maximum allowable duct leakage
- Removing certain conditions for hot water pipe insulation

Based on the justifications provided in the documentation of ICC committee action hearings for proposed changes to the 2012 IECC (ICC 2013) and certain justifications provided in this report, it was concluded that for the three climate zones in Texas, relaxing the requirements in these sections does not have an impact on the overall stringency of this code, which is deemed to be as or more stringent than the 2012 IECC.

Results from quantitative assessment performed to assess the performance path provided in the codes indicate that for the selected simulation suite, annual energy consumption values from the 2015 and 2012 IECC were within 1 MMBtu from each other and within 1% of each other. From observing the similarity in results, it can be concluded that the residential provisions in the 2015 IECC is as stringent as the corresponding provisions in the 2012 IECC.

Hence the study concludes that for mandatory, prescriptive and performance residential provisions, the 2015 IECC is as stringent as the 2012 IECC.

This report is organized in the following order:

- Section 1: Provides a brief overview of the task.
- Section 2: Describes the qualitative assessment that was performed comparing the residential provisions in the 2015 IECC and the 2012 IECC.
- Section 3: Describes the quantitative assessment that was performed assessing the provisions for compliance with the performance path in the 2015 IECC and 2012 IECC.
- Section 4: Provides the conclusions from the study.

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1. OVERVIEW

The purpose of this analysis was to determine the stringency of residential provisions in the 2015 IECC when compared to the corresponding provisions in the 2012 IECC for residential buildings in Texas. In order to perform the assessment, the mandatory, prescriptive and performance residential provisions were compared.

A similar study conducted at the Pacific Northwest National Laboratory (PNNL) for both single-family and multi-family homes in the United States, claims source energy savings in the range of 0.93% - 1.19% for the three climate zones of Texas (Mendon et al. 2014). It should be noted that the PNNL report provides this assessment only for prescriptive provisions in the 2012 and 2015 versions of the IECC. By comparing prescriptive provisions, the report does not really assess the impact of lower U-values for walls and ceilings in their calculations. In addition, the report incorporates updated provisions for outdoor temperature setback control for hot water boilers, a very small fraction of which may be applicable to single family residential buildings in the climate zones of Texas. Furthermore, the report assesses new requirements for heated water circulation systems and heat trace systems as well as demand-activated control for recirculating systems. Savings obtained from these measures have been added to multifamily buildings. Finally, the report calculates the DHW pipe insulation requirements for both single family and multifamily homes. These calculations are performed independently and later are included in the results from simulation models. However, these requirements are prescriptive and do not impact the specifications in the performance path of the code.

The analysis in this was performed in two steps:

- **Qualitative assessment:** A qualitative assessment was performed comparing all the sections in Chapter 4 [RE] of the 2015 and the corresponding sections in Chapter 4 [RE] of the 2012 IECC. The sections include mandatory, prescriptive and performance provisions.
- **Quantitative assessment:** A simulation test suite was conducted comparing the provisions for performance path compliance in in Chapter 4 (RE) of the 2015 and 2012 IECC.

A discussion of the analysis and results is provided in the sections that follow.

2. DESK-CHECK COMPARING THE RESIDENTIAL PROVISIONS IN THE 2015 IECC AND 2012 IECC

A qualitative assessment was performed comparing all sections of Chapter 4 (RE) of the 2015 IECC with the corresponding sections of the 2012 IECC. The findings and comments are presented in the subsections below. The findings are also documented in a table format in Appendix A of this report. In sections where a discussion is required to provide justification to the proposed change in the 2015 IECC appropriate references are made to the documentation describing the proposed changes to the residential provisions in the International Energy Conservation Code (ICC 2013).

2.1 Comparing the Provisions in Section R401 'General'

The 2015 code now provides three options for compliance along with the mandatory provisions. These include: prescriptive, performance and energy rating index (ERI). Incorporating the ERI increases the options for compliance. A qualitative assessment cannot be used to determine the stringency of this provision in the 2015 code.

The 2015 code now provides a separate set of compliance requirements for buildings located in tropical zones at elevations below 2,400 feet above sea level. However, the specifications for this particular climate zone do not impact any of the locations in Texas.

The requirements for location of the compliance certificate have changed in the 2015 code. Other locations are now added for placement of the compliance certificate. This addition does not impact the stringency of the 2015 code over the 2012 code.

2.2 Comparing the Provisions in Section R402 'Building Thermal Envelope'

Section R402.1 of the 2015 code is modified to include exceptions for low energy buildings or portions separated by building thermal envelope assemblies to be exempt from meeting the provisions in the code.

Provisions for the vapor retarder are now included in Section R402.1.1 of the 2015 code. The specifications now point to appropriate provisions in the IRC. The IRC contains detailed vapor retarder provisions that apply specified R-Values for continuous insulation for vapor and condensation control. While such cross reference is typically not necessary, the vapor retarder provisions are the only place in the IRC that a specific thermal performance provision is called out. This change provides the necessary coordination between the IECC and the IRC. Incorporating this change makes the prescriptive provisions in the 2015 code more stringent. There is no impact on either the mandatory or the performance provisions of the 2015 code.

For Table R402.1.2 of the 2015 code, footnote h has been shortened to exclude provisions for structural sheathing. The requirements for structural sheathing have been moved to Section R402.2.7 of the code. This change does not impact the stringency of the 2015 code over the 2012 code.

In the Section R402.1.3, requirements are now in place when using insulated siding for compliance with the continuous insulation in Table R402.1.2 of the 2015 code. According to the updated provisions, the manufacturers labeled R-value for insulated siding shall be reduced by R-0.6 for the purpose of compliance. These specifications are more stringent for compliance with the 2015 code using both the prescriptive and performance path over the 2012 code.

Values for wall U-values have been changed in Table R402.1.4. The equivalent U-values for frame walls have become less stringent than the corresponding values in the 2012 code for Climate Zones 2, 3, 4 and 5 and more stringent than the corresponding values in the 2012 code for Climate Zone 6, 7 and 8. The intent of these changes is not to alter the stringency of the code by to rectify the conversion from R-values to U-values. This provision makes the 2015 code have no impact on either the mandatory or prescriptive provisions of the code. However, these provisions make the 2015 code less stringent for the performance compliance path provided when compared to the 2012 code.

In Section R402.2.1 on ceilings with attic spaces, text has been expanded to provide clarification for the requirements of reducing the ceiling insulation R-value. This does not impact either the stringency of either the prescriptive or the performance path provided in the 2015 code when compared to the 2012 code.

In Section R402.2.4 on access hatches and doors, vertical doors from conditioned to unconditioned spaces are now permitted to meet the fenestration requirements of Table R402.1.2. This provision has no impact on the stringency of either the prescriptive or the performance compliance paths provided in the 2015 code when compared to the 2012 code.

In Section R402.2.5 on mass walls, the 2015 code now specifies the heat capacity of qualifying mass walls. This provision has no impact on the stringency of either the prescriptive or the performance compliance paths provided in the 2015 code when compared to the 2012 code.

In Section R402.2.7 on walls with partial structural sheathing, text was relocated from footnote h, Table R402.1.2 without any modifications. This provision has no impact on the stringency of either the prescriptive or the performance compliance paths provided in the 2015 code when compared to the 2012 code.

In Section R402.2.8 on floors, an exception has been provided to the specifications for floor framing-cavity insulation in the 2015 code. The floor framing-cavity insulation is now permitted to be in contact with the top side of sheathing or continuous insulation installed at the bottom side of the floor framing where combined with insulation that meets or exceeds the minimum wood frame wall R-value provided in Table 402.1.2. This provision has no impact on the stringency of either the prescriptive or the performance compliance paths provided in the 2015 code when compared to the 2012 code.

In Section R402.3.2 on glazed fenestration SHGC, the 2015 code makes provision to incorporate dynamic glazing to satisfy the SHGC requirements of the code. This provision for dynamic glazing has no impact on the stringency of either the prescriptive or the performance compliance paths in the 2015 code provided the switches and controls used to operate the glazing are set appropriately. This provision has no impact on the stringency of either the prescriptive or the performance compliance paths provided in the 2015 code when compared to the 2012 code.

In Section R402.3.5 for sunroom fenestration, the exceptions for higher U-values have now been extended to Climate Zones 2 through 8. The requirements were made to recognize the lower energy consumption of these structures due to their occasional / seasonal use. This change now sets the U-factor requirements the same for all the climate zones where requirements for sunroom fenestration exist, and corrects the discontinuity in the code between the requirements in Climate Zones 2, 3 and 4. This provision makes the 2015 code less stringent for both the prescriptive and the performance compliance paths provided in the 2015 code when compared to the 2012 code.

In Table 402.4.1.1 on air barrier and insulation installation, a column describing the insulation criteria was added to account for multiple inspectors. Other changes such as the addition of a section on sprinklers and the removal of the section on fireplaces to Section R402.4.2 have been made. In Section R402.4.1.2 on testing of air leakage, new ASTM standards have been added to the testing procedures described in the code. These provisions have no impact on the stringency of either the prescriptive or the performance compliance paths provided in the 2015 code when compared to the 2012 code.

In Section R402.4.2 on fireplaces, references to two UL standards are now incorporated to account for tight fitting doors. The 2015 code also introduces a new section for rooms containing fuel burning appliances. Section R402.4.4 on rooms containing fuel-burning appliances requires combustion opening to be located outside the thermal envelope or insulated according to the specifications in the 2015 code. These provisions have no impact on the stringency of either the prescriptive or the performance compliance paths provided in the 2015 code when compared to the 2012 code.

2.3 Comparing the Provisions in Section R403 'Systems'

In Section R403.1.1 on programmable thermostat, the 2015 code now clarifies the requirement of programmed set points to be set by the manufacturers eliminating the extra effort that was done onsite to verify these set points. The change also recognizes that forced air heating and air conditioning systems are not the only systems that may benefit from programmable thermostats. Hydronic, radiant electric and solar thermal systems could also be programmed for night or "unoccupied" setback periods. The change clarifies that the primary heating or cooling system, at minimum, is the system that should receive the programmable thermostat. This change is necessary for those residential dwelling units that have multiple systems; e.g., first floor / second floor forced air systems or radiant electric systems with thermostats in

each room. The section now also requires that the initial programming be performed by the manufacturer. These provisions have no impact on the stringency of either the prescriptive or the performance compliance paths provided in the 2015 code when compared to the 2012 code.

The 2015 code has introduced Section R403.2 on hot water boiler outdoor temperature setback. The new Section R403.2 now requires hot water boilers to have temperature setbacks based on outdoor conditions. This provision makes the 2015 code more stringent for both the prescriptive and the performance compliance paths provided in the 2015 code when compared to the 2012 code.

In Section R403.3.1 on duct insulation, the 2015 code bases the duct insulation R-value on the diameter of the duct. The duct insulation is now R-8 for both supply and return ducts in attics that are over 3 inches in diameter. This provision makes the 2015 code more stringent for both the prescriptive and the performance compliance paths provided in the 2015 code when compared to the 2012 code.

In Section R403.3.2 on duct sealing, exceptions provided in the 2015 code for duct sealing have been rewritten. The exceptions now exclude specifications for duct connections that are partially inaccessible. The exceptions also clarify the exclusion concerning ducts that have locking type joints. This provision makes the 2015 code more stringent for both the mandatory and the prescriptive compliance paths provided in the 2012 code. The 2015 IECC code has introduced Section R403.3.3 and Section R403.3.4 on duct testing and duct leakage respectively. The sections describe the conditions for duct testing and limits of duct leakage. The contents of these sections have been rearranged from the 2012 version of the code. Hence, these provisions have no impact on the stringency of the mandatory, prescriptive or the performance paths provided in the 2015 code when compared to the 2012 code. However, it should be noted that making maximum allowable duct leakage rates prescriptive allows for performance path trade-offs.

Section R403.5.1 provides specifications for the heated water circulation and temperature maintenance systems in the 2015 code. This section has been expanded to incorporate provisions for the hot water circulation systems and the heat trace systems to be in compliance with the 2015 code. Section R403.5.1.1 on circulation systems has been expanded in the 2015 code to provide specifications for hot water circulation systems such as requiring a circulation pump, dedicated return piping and automatic control. Section R403.5.1.2 on heat trace systems has been added with requirements for controls to be implemented for such systems. This provision makes the 2015 code more stringent for the mandatory, prescriptive and the performance compliance paths provided when compared to the 2012 code.

The 2015 code has introduced Section R403.5.2 to establish provisions for demand recirculation systems. The 2015 code introduced this section to regulate the operation of demand recirculating systems in order to comply. This provision makes the 2015 code more stringent for both the prescriptive and the performance compliance paths provided when compared to the 2012 code.

In section R403.5.3 on hot water pipe insulation, the 2015 IECC removes some of the conditions for hot water pipe insulation. The reason cited for making this change was because insulating hot water piping in residential homes was found to not be cost effective. However, specification for insulating pipes of $\frac{3}{4}$ inch diameter has been added. The removal of certain conditions make the 2015 code less stringent for both the prescriptive and the performance compliance paths provided when compared to the 2012 code. However, this loss of energy from removed insulation is compensated by the savings obtained from insulating pipes of $\frac{3}{4}$ inch in diameter. Pipes of $\frac{3}{4}$ inch in diameter are the most common pipe sizes used in trunk lines.

The 2015 IECC has introduced Section R403.5.4 to make provisions for drain water heat recovery units. The 2015 code introduces specifications for drain water heat recovery units. If installed, the drain water

heat recovery units shall now comply with standards referenced in the 2015 code. This provision makes the 2015 code more stringent for both the prescriptive and the performance compliance paths provided when compared to the 2012 code.

In Section R403.7 on equipment sizing and efficiency rating, the 2015 code now clarifies the reference to federal standards for new and replacement equipment. The change is relevant because in future federal minimums are expected to shift away from single nationwide efficiency levels to regionally based efficiency levels that vary from state to state. These provisions have no impact on the stringency of the mandatory, prescriptive or the performance paths provided in the 2015 code when compared to the 2012 code.

In Section R403.10.2 on pool heaters, the 2015 code provides added language clarifying the requirements for pool heaters. In Section R403.10.3 on time switches for pool heaters, the 2015 code clarifies the operation of such timers. In Section R403.10.4 on pool covers, the 2015 code clarifies that the specifications are only for outdoor heated pools and permanent spas. These provisions have no impact on the stringency of the mandatory, prescriptive or the performance paths provided in the 2015 code when compared to the 2012 code.

Section R403.11 on portable spas and Section R403.12 on residential pools and permanent residential spas are added in the 2015 code. Portable and permanent residential spas as well as residential pools now have to comply with appropriate APSP standards. This provision makes the 2015 code more stringent for both the mandatory, prescriptive and the performance compliance paths when compared to the 2012 code.

2.4 Comparing the Provisions in Section R404 'Electrical Power and Lighting Systems'

Section R404.1 on lighting equipment has been re-worded in the 2015 IECC. These provisions have no impact on the stringency of the mandatory, prescriptive or the performance paths provided in the 2015 code when compared to the 2012 code.

2.5 Comparing the Provisions in Section R405 'Simulated Performance Alternative'

Section R405.4.2 on compliance reports clarifies provisions made in the code to provide certificates for compliance. Jurisdictions, Builders, third party inspection companies and others are not clear of the process for completing and utilizing the simulated performance path. With all pathways through the energy code one must in essence declare how they will meet the intent of the code. For the simulated performance path they must currently submit a document demonstrating that the annual energy cost of the proposed design are less than or equal to the same home if it were built with the reference design specification. It becomes unclear how one demonstrates that they have carried out their proposed design. This section in the 2015 code outlines a process by which the proposed design is submitted, inspections take place, and additional analysis is performed to ensure that the proposed design was achieved or bettered for the purposes of compliance.

In Table R405.5.2(1) describing specifications for the standard reference and proposed designs, the section has been modified to correct terminology for building components such as vertical glazing and opaque doors. The section was also modified to provide clarifications regarding specifications for thermal distribution systems. These provisions have no impact on the stringency of the performance compliance paths provided in the 2015 code when compared to the 2012 code.

2.6 Assessing the Provisions in Section R406 'Energy Rating Index Compliance Alternative'

Section R406 describes the Energy Rating Index compliance alternative that has been introduced in the 2015 code. A set of rating numbers is provided for the different climate zones that allow programs to meet the criteria for compliance using this alternative. The section provides guidelines for the development of the index, documentation to ensure compliance, and requires that an approved 3rd party verify that the building complies with the applicable ERI. The Reference Design home used in the ERI calculations is based on specifications in the 2006 IECC, which is consistent with the other ERI based programs such as the RESNET HERS Index (RESNET 2014). The section also sets the 2009 IECC residential envelope requirements as the least efficient level of efficiency for potential trade-offs for the Rated home used in the ERI calculations. Finally, the section requires complying with the applicable mandatory requirements of the 2015 code. ERI calculations are based on total energy used in residential buildings. These provisions have no impact on the stringency of the performance compliance paths provided in the 2015 code when compared to the 2012 code.

2.7 Assessing the Provisions in Chapter 5(RE) 'Existing Buildings'

Chapter 5 (RE) has been created in the 2015 code to provide clarification on the specific requirements that apply for additions, alterations, renovations and repairs to comply with the provisions of the energy code. Section R502 on additions provides an energy neutral method for demonstrating compliance for difficult to comply projects by requiring a buildings addition to uses no more energy than the existing building. This requirement will allow projects to take advantage of energy efficient alterations on the existing building to offset difficult to comply with features on the addition. An allowance is also included for adding a short duct run in unconditioned space by exempting up to 40 feet of new duct work. These provisions have no impact on the stringency of either the prescriptive or the performance compliance paths provided in the 2015 code. Provisions for alterations and repairs as well as change in occupancy are also described in in Section R503 and Section R504 respectively.

3. COMPARING THE PROVISIONS FOR COMPLIANCE WITH THE PERFORMANCE PATH IN THE 2015 IECC, 2012 IECC AND 2009 IECC

An analysis was performed comparing provisions for the performance section of the 2015 and 2012 IECC. To ensure consistency and continuity with the previous comparison studies performed at the laboratory, a comparison with the 2009 IECC was also performed.

Accordingly, Section R405 of the 2015 code with corresponding provisions in Section R405 the 2012 code and Section 405 of the 2009 code. The analysis was conducted using a simple residential house model that was designed to represent typical residential construction in Texas. IC3 BDL Version 4.01.11 was used to perform the analysis. According to the provisions outlined in the three codes for performance based compliance, the analysis includes the energy consumption from heating, cooling and hot water heating only as accounted for at source¹. The analysis was carried out for the three counties, which represent the three climate zones in Texas: Harris (Climate Zone 2), Tarrant (Climate Zone 3) and Potter (Climate Zone 4). The climate zones and selected counties are presented in Figure 1. TMY2 weather data for the three counties was used in the analysis. The assumptions adopted for the analysis and the results are presented in the sections below.

¹ The source energy multiplier of 3.16 was used for electricity and the source energy multiplier of 1.1 was used for natural gas (IECC 2009, 2012, 2015).

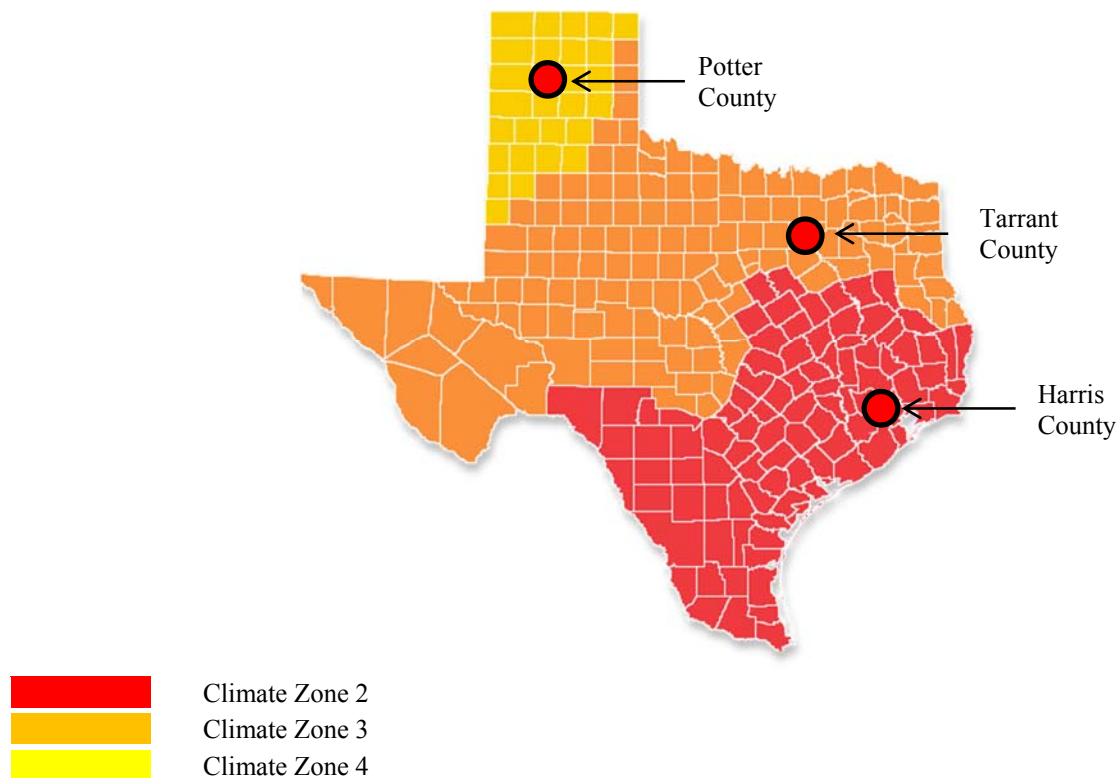


Figure 1: IECC Climate Zone Classifications and the Three Selected Counties

3.1 Description of base-case house used for the analysis

A simple model of the house was designed to represent the typical characteristics of residential construction in Texas. The base-case house implemented in this analysis was a single-family, single-story house with three bedrooms and a conditioned floor area of 2,500 ft². The ducts were positioned in an unconditioned ventilated attic. The front of the house faced south. The base-case model had a slab-on-grade floor construction. The window-to-wall area ratio (WWAR) was arbitrarily set at 15%. No exterior shading was implemented in the base-case model. The specifications are presented in Table 1 and are discussed in the sections that follow.

Table 1: Description of the base-case residential building used in the analysis of the provisions for the simulated performance alternative in the 2009, 2012 and 2015 IECC

Characteristics	2009 IECC STANDARD REFERENCE HOUSE				2012 IECC STANDARD REFERENCE HOUSE				2015 IECC STANDARD REFERENCE HOUSE			
	Assumptions and Specifications			Information Source 2009 IECC	Assumptions and Specifications			Information Source 2012 IECC	Assumptions and Specifications			Information Source 2015 IECC
	CZ 2A (Harris)	CZ 3A (Tarrant)	CZ 4B (Potter)		CZ 2A (Harris)	CZ 3A (Tarrant)	CZ 4B (Potter)		CZ 2A (Harris)	CZ 3A (Tarrant)	CZ 4B (Potter)	
CONSTRUCTION												
Foundation Floor: Type	As proposed Slab-on-Grade				As proposed Slab-on-Grade				As proposed Slab-on-Grade			
Foundation Floor: Perimeter Insulation	R-0	R-0	R-10, 2ft	Table 402.1.1	R-0	R-0	R-10, 2ft	Table R402.1.1	R-0	R-0	R-10, 2ft	Table R402.1.2
Roof: Type	Composition shingle on wood sheathing			Table 405.5.2(1)	Composition shingle on wood sheathing			Table R405.5.2(1)	Composition shingle on wood sheathing			Table R405.5.2(1)
Roof: Absorptance	0.75			Table 405.5.2(1)	0.75			Table R405.5.2(1)	0.75			Table R405.5.2(1)
Roof: Emittance	0.9			Table 405.5.2(1)	0.9			Table R405.5.2(1)	0.9			Table R405.5.2(1)
Ceiling: Type	Wood Frame			Table 405.5.2(1)	Wood Frame			Table R404.5.2(1)	Wood Frame			Table R405.5.2(1)
Ceiling: Insulation (Btu/hr-sq.ft.-°F)	0.035	0.035	0.03	Table 405.5.2(1) Table 402.1.3	0.03	0.03	0.026	Table R405.5.2(1) Table R402.1.3	0.03	0.03	0.026	Table R405.5.2(1) Table R402.1.4
Wall: Construction	Wood Frame			Table 405.5.2(1)	Wood Frame			Table R405.5.2(1)	Wood Frame			Table R405.5.2(1)
Wall: Absorptance	0.75			Table 405.5.2(1)	0.75			Table R405.5.2(1)	0.75			Table R405.5.2(1)
Wall: Emittance	0.9			Table 405.5.2(1)	0.9			Table R405.5.2(1)	0.9			Table R405.5.2(1)
Wall: Insulation (Btu/hr-sq.ft.-°F)	U-0.082	U-0.082	U-0.082	Table 405.5.2(1)	U-0.082	U-0.057	U-0.057	Table R405.5.2(1)	U-0.084	U-0.060	U-0.060	Table R405.5.2(1) Table R402.1.4
Glazing: U-Factor (Btu/hr-sq.ft.-°F)	0.65	0.5	0.35	Table 405.5.2(1) Table 402.1.1	0.4	0.35	0.35	Table R405.5.2(1) Table R402.1.1	0.4	0.35	0.35	
Solar Heat Gain Coefficient (SHGC)	0.3	0.3	NR (0.4)	Table 405.5.2(1) Table 402.1.1	0.25	0.25	0.4	Table R405.5.2(1) Table R402.1.1	0.25	0.25	0.4	
Window: Area	15%			Table 405.5.2(1)	15%			Table R405.5.2(1)	15%			Table R405.5.2(1)
Interior Shading	Summer = 0.7 (All hours when heating is required) Winter = 0.85 (All hours when heating is required)			Table 405.5.2(1)	Interior shade fraction: 0.92 - (0.21 x SHGC for standard reference design house)			Table R405.5.2(1)	Interior shade fraction: 0.92 - (0.21 x SHGC for standard reference design house)			Table R405.5.2(1)
Exterior Shading	None			Table 405.5.2(1)	None			Table R405.5.2(1)	None			Table R405.5.2(1)
Skiylights	None			Table 405.5.2(1)	None			Table R405.5.2(1)	None			Table R405.5.2(1)
Doors: Area	40 sqft, North Orientation			Table 405.5.2(1)	40 sqft, North Orientation			Table R405.5.2(1)	40 sqft, North Orientation			Table R405.5.2(1)
Doors: U-value	0.65	0.5	0.35	Table 405.5.2(1)	0.4	0.35	0.35	Table R405.5.2(1)	0.4	0.35	0.35	Table R405.5.2(1)

Note: Cells marked in red indicate a change in value on going from 2012 IECC to 2015 IECC.

Table 1: Continued

Characteristics	2009 IECC STANDARD REFERENCE HOUSE			2012 IECC STANDARD REFERENCE HOUSE			2015 IECC STANDARD REFERENCE HOUSE					
	Assumptions and Specifications			Information Source 2009 IECC	Assumptions and Specifications			Information Source 2012 IECC	Assumptions and Specifications			Information Source 2015 IECC
	CZ 2A (Harris)	CZ 3A (Tarrant)	CZ 4B (Potter)		CZ 2A (Harris)	CZ 3A (Tarrant)	CZ 4B (Potter)		CZ 2A (Harris)	CZ 3A (Tarrant)	CZ 4B (Potter)	
SPACE CONDITIONS												
Air Exchange Rate	SLA = 0.00036			Table 405.5.2(1)	5 ACH ₅₀	3 ACH ₅₀	3 ACH ₅₀	Table R405.5.2(1)	5 ACH ₅₀	3 ACH ₅₀	3 ACH ₅₀	Table R405.5.2(1)
Mechanical Ventilation	None			Table 405.5.2(1)	0.01 x CFA + 7.5 x (Nbr+1) CFM 0.03942 x CFA + 29.565 x (Nbr + 1) kWh/yr			Table R405.5.2(1)	0.01 x CFA + 7.5 x (Nbr+1) CFM 0.03942 x CFA + 29.565 x (Nbr + 1) kWh/yr			Table R405.5.2(1)
Space Temperature Setpoint	72°F Heating, 75°F Cooling, No set-back			Table 405.5.2(1)	72°F Heating, 75°F Cooling, No set-back			Table R405.5.2(1)	72°F Heating, 75°F Cooling, No set-back			Table R405.5.2(1)
Internal Heat Gains	Igain = 17,900 + 23.8 x CFA + 4104 x Nbr BTU/day			Table 405.5.2(1)	Igain = 17,900 + 23.8 x CFA + 4104 x Nbr BTU/day			Table R405.5.2(1)	Igain = 17,900 + 23.8 x CFA + 4104 x Nbr BTU/day			Table R405.5.2(1)
MECHANICAL SYSTEMS												
HVAC System Type	As Proposed Cooling: Electric Heating: Natural gas / Heat pump			Table 405.5.2(1)	As Proposed Cooling: Electric Heating: Natural gas / Heat pump			Table R405.5.2(1)	As Proposed Cooling: Electric Heating: Natural gas / Heat pump			Table R405.5.2(1)
HVAC System Efficiency	As Proposed AC: SEER 13 Gas furnace: 0.78 AFUE Heat pump: 7.7			Table 405.5.2(1)	As Proposed AC: SEER 13 Gas furnace: 0.78 AFUE Heat pump: 7.7			Table R405.5.2(1)	As Proposed AC: SEER 13 Gas furnace: 0.78 AFUE Heat pump: 7.7			Table R405.5.2(1)
Cooling Capacity (Btu/hr)	Sized in accordance with Section M1401.3 of the IRC / ACCA Manual J specifications			Table 405.5.2(1)	Sized in accordance with Section M1401.3 of the IRC / ACCA Manual J specifications			Table R405.5.2(1)	Sized in accordance with ACCA Manual J specifications			Table R405.5.2(1)
Heating Capacity (Btu/hr)				Table 405.5.2(1)				Table R405.5.2(1)				
DHW System Type	Gas Electric			Table 405.5.2(1)	Gas Electric			Table R405.5.2(1)	Gas Electric			Table R405.5.2(1)
DHW Heater Energy Factor	As proposed Gas EF: 0.67 - 0.0019V Electric EF: 0.97 - 0.00132V			Table 405.5.2(1)	As proposed Gas EF: 0.67 - 0.0019V Electric EF: 0.97 - 0.00132V			Table R405.5.2(1)	As proposed Gas EF: 0.67 - 0.0019V Electric EF: 0.97 - 0.00132V			Table R405.5.2(1)
Thermal Distribution	Tested: Leakage to the outside of 8 CFM/100 sqft of CFA Tested Duct Location: Unconditioned attic			Section 403.2.2 Table 405.5.2(1) Table 405.5.2(2)	Tested: Total leakage of 4 CFM/100 sqft of CFA Tested Duct Location: Unconditioned attic			Section R403.2.2 Table R405.5.2(1) Table R405.5.2(2)	Tested: Total leakage of 4 CFM/100 sqft of CFA Tested Duct Location: Unconditioned attic			Table R405.5.2(1)
Duct Insulation	Supply: R-8 Return: R-6			Section 405.2	Supply: R-8 Return: R-6			Section R405.2	Supply: R-8 Return: R-8			Section 403.3.1

Note: Cells marked in red indicate a change in value on going from 2012 IECC to 2015 IECC.

3.1.1 Building Envelope

The envelope is described in terms of the following building components: above grade walls, ceilings, roofs, attics, vertical glazing and opaque doors. The above grade walls were wood frame walls. The overall U-factor for wall assembly set for the three codes is described below:

- For the 2009 code, an overall U-factor of 0.082 was modeled for the three climate zones.
- For the 2012 code, an overall U-factor of 0.082 was modeled for Climate Zone 2 and a U-factor of 0.057 was modeled for Climate Zone 3 and 4.
- For the 2015 code, an overall U-factor of 0.084 was modeled for Climate Zone 2 and a U-factor of 0.060 was modeled for Climate Zone 3 and 4.

The ceilings were also wood frame construction, with the insulation located above the horizontal ceiling. The overall U-factor for ceilings set for the three codes is described below:

- For the 2009 code, the overall U-factor of the ceiling construction was set at 0.035 for Climate Zone 2 and 3, and 0.030 for Climate Zone 4.
- For the 2012 and 2015 code, the overall U-factor for the ceiling construction was set at 0.03 for Climate Zone 2 and 3, and 0.026 for Climate Zone 4.

The building had a slab-on-grade floor construction, which is typical across the three climate zones in the state. The insulation for slab-on-grade set for the three codes is described below:

- For the 2009, 2012 and 2015 codes, the slab-on-grade floor insulation was set at R-0 for Climate Zone 2 and 3, and R-10 for Climate Zone 4.

The glazing for the base-case house was arbitrarily set at 15% of conditioned wall area and was equally distributed on all four orientations (N, E, S & W). No external shading was modeled for the base-case building. The overall SHGC and U-factor for vertical glazing implemented for the three codes is described below:

- For the 2009 code, a SHGC of 0.3 was assumed in Climate Zone 2 and 3. A SHGC of 0.4 was assumed in Climate Zone 4. The fenestration had a U-factor of 0.65 for Climate Zone 2, a U-factor of 0.5 for Climate Zone 3, and a U-factor of 0.35 for Climate Zone 4.
- For the 2012 and 2015 codes, a SHGC of 0.3 was assumed in Climate Zone 2 and 3. A SHGC of 0.4 was assumed in Climate Zone 4. The fenestration had a U-factor of 0.65 for Climate Zone 2, a U-factor of 0.5 for Climate Zone 3, and a U-factor of 0.35 for Climate Zone 4.

3.1.2 Building Space Conditions

The space conditions included: space temperature set-points, air exchange rate, mechanical ventilation, and internal gains. The space temperature set points were set at 72°F for space heating and 75°F for space cooling across the three codes. No thermostat set back was simulated. A vented, unconditioned attic was modeled above the ceiling of the conditioned space. The attic was vented, with 1 ft² of leakage area per 300 ft² of ceiling area assumed across the three codes.

The infiltration leakage rates assumed for the three codes is described below:

- In the 2009 code, the infiltration leakage rate was assumed to be 0.00036.
- In the 2012 and 2015 codes, the infiltration leakage rate for Climate Zone 2 was set to 5 ACH₅₀ and for Climate Zone 3 and 4 was set to be 3 ACH₅₀.

Mechanical ventilation was incorporated along with the infiltration rates in certain cases. A ‘supply-only’ system was assumed to provide mechanical ventilation. The mechanical ventilation rate was calculated using the equation provided in the codes:

$$\text{Mech. Ventilation (CFM)} = 0.01 \times \text{CFA} + 7.5 \times (\text{Nbr} + 1)$$

Where, CFA = Conditioned floor area, and
Nbr = Number of bedrooms.

Additional energy consumption from mechanical ventilation was added to the annual energy consumption from ventilation fans. The additional energy consumption from mechanical ventilation was calculated using the equation provided in the codes:

$$\text{Mech. Ventilation (kWhr/yr)} = 0.03942 \times \text{CFA} + 29.565 \times (\text{Nbr} + 1)$$

Where, CFA = Conditioned floor area, and
Nbr = Number of bedrooms.

The mechanical ventilation rates assumed for the three codes are described below:

- No mechanical ventilation was assumed for the three climate zones in the 2009 code.
- No mechanical ventilation was assumed for Climate Zone 2 in the 2012 and 2015 codes.
- Mechanical ventilation rates were incorporated along with the infiltration rates in Climate Zone 3 and 4 in the 2012 and 2015 codes.

The internal heat gains across the three codes were calculated using the equation:

$$\text{Igain} = 17,900 + 23.8 \times \text{CFA} + 4104 \times \text{Nbr. (Btu/day per dwelling unit)}$$

Where, CFA = Conditioned floor area, and
Nbr = Number of bedrooms.

The value for internal heat gain was set using the equation described above. The schedules for internal heat gain are set as constant for all hours of the day.

3.1.3 Building Mechanical Systems

The mechanical systems variables included: duct leakage, duct insulation, heating and cooling system efficiencies and domestic water heating systems efficiencies. The base-case house was assumed to have electric cooling and natural gas heating. For the base-case house with ducts positioned in the attic, the duct leakage rates are described below:

- In the 2009 code, the duct leakage was modeled at a leakage rate of 8 CFM to the outside per 100 ft² of conditioned floor area.
- In the 2012 and 2015 code, the duct leakage was set at a total leakage rate of 4 CFM per 100 ft² of conditioned floor area.

The duct insulation rates are described below:

- In the 2009 and 2012 code, the value of supply duct insulation and was set at R-8 and for return duct insulation was set at R-6.
- In the 2015 code, the value of both the supply and return duct insulation and was set at R-8.

The cooling system fuel type was electricity, with minimum efficiency set at SEER 13 implemented in the three codes according to the current NAECA standards. The cooling system for the base-case house for the three codes in was sized in accordance to the specifications provided in ACCA Manual J (Rutkowski 2006).

Two options were modeled for the space heating systems: natural gas furnace (i.e. electric-gas) and electric air-source heat pump (all-electric). The natural gas furnace was modeled with a minimum efficiency of 0.78 AFUE implemented in the three codes according to the current NAECA standards. The natural gas furnace was modeled with a minimum efficiency of 0.78 AFUE implemented in the three

codes according to the current NAECA standards. The heating system for the base-case house for the three codes in was sized in accordance to the specifications provided in Manual J.

Two options were modeled for domestic hot water heating systems: gas water heater for the electric-gas house and electric water heater for the all-electric house. The tank temperature was set at 120°F according to the requirement in the three codes. A 40 gallon tank was assumed for the analysis (ASHRAE 2003). The efficiency for gas water heater was calculated by the following equation implemented in the three codes:

$$\text{Energy Factor for Natural Gas Fired Water Heaters} = 0.67 - 0.0019V$$

Where V = Storage capacity of the DHW tank

This results in a minimum efficiency of 0.594 for the base-case building with three bedrooms.

The efficiency for electric water heater was calculated by the following equation implemented in the three codes:

$$\text{Energy Factor for Electric Water Heaters} = 0.97 - 0.00132V$$

Where V = Storage capacity of the DHW tank

This results in a minimum efficiency of 0.917 for the base-case building with three bedrooms.

Domestic hot water usage was calculated using the following equation:

$$\text{Usage} = 30 + 10 \times \text{Nbr (gal/day)}$$

Where Nbr = Number of bedrooms.

3.2 Results and discussion

The results are presented in terms of energy consumption for space cooling, space heating and hot water heating only as required by the three IECC codes. The results are also presented in terms of corresponding source energy consumption. The results are presented in Table 2 and Figure 2² through Figure 5.

For a house with space and hot water heating provided by natural gas, when considering improvement of 2012 code over the 2009 code in terms of site energy consumption:

- For Climate Zone 2, the savings are 14.3%.
- For Climate Zone 3, the savings are 22.6%
- For Climate Zone 4, the savings are 26.8%

When considering improvement of 2012 code over the 2009 code in terms of source energy consumption:

- For Climate Zone 2, the savings are 12.9%.
- For Climate Zone 3, the savings are 20.2%
- For Climate Zone 4, the savings are 23.5%

When considering improvement of 2015 code over the 2009 code in terms of site energy consumption:

- For Climate Zone 2, the savings are 13.8%.
- For Climate Zone 3, the savings are 22.1%
- For Climate Zone 4, the savings are 26.2%

When considering improvement of 2015 code over the 2009 code in terms of source energy consumption:

- For Climate Zone 2, the savings are 12.2%.
- For Climate Zone 3, the savings are 19.7%

² Figure 2 and Figure 4 include site energy consumption from lighting and appliances. Figure 3 and Figure 5 do not include source energy consumption from lighting and appliances.

- For Climate Zone 4, the savings are 22.8%

When considering improvement of 2015 code over the 2012 code in terms of site energy consumption:

- For Climate Zone 2, the savings are -0.6%.
- For Climate Zone 3, the savings are -0.7%
- For Climate Zone 4, the savings are -0.8%

When considering improvement of 2015 code over the 2012 code in terms of source energy consumption:

- For Climate Zone 2, the savings are -0.8%.
- For Climate Zone 3, the savings are -0.6%
- For Climate Zone 4, the savings are -0.8%

For a house with space and hot water heating provided by electricity, when considering improvement of 2012 code over the 2009 code in terms of site energy consumption:

- For Climate Zone 2, the savings are 10.2%.
- For Climate Zone 3, the savings are 18.3%
- For Climate Zone 4, the savings are 21.1%

When considering improvement of 2012 code over the 2009 code in terms of source energy consumption:

- For Climate Zone 2, the savings are 10.2%.
- For Climate Zone 3, the savings are 18.3%
- For Climate Zone 4, the savings are 21.1%

When considering improvement of 2015 code over the 2009 code in terms of site energy consumption:

- For Climate Zone 2, the savings are 9.9%.
- For Climate Zone 3, the savings are 18.3%
- For Climate Zone 4, the savings are 20.9%

When considering improvement of 2015 code over the 2009 code in terms of source energy consumption:

- For Climate Zone 2, the savings are 9.9%.
- For Climate Zone 3, the savings are 18.3%
- For Climate Zone 4, the savings are 20.9%

When considering improvement of 2015 code over the 2012 code in terms of site energy consumption:

- For Climate Zone 2, the savings are -0.3%.
- For Climate Zone 3, the savings are 0.0%
- For Climate Zone 4, the savings are -0.3%

When considering improvement of 2015 code over the 2012 code in terms of source energy consumption:

- For Climate Zone 2, the savings are -0.3%.
- For Climate Zone 3, the savings are 0.0%
- For Climate Zone 4, the savings are -0.3%

Table 2: Savings over the 2009 IECC on Implementing Specifications for Simulated Performance Alternative Provided in the 2012 IECC and 2015 IECC

IECC CODE	CLIMATE ZONE	IECC SITE ³ ENERGY		IECC SOURCE ⁴ ENERGY	
		Electric-Gas House	All-Electric House	Electric-Gas House	All-Electric House
2012 IECC vs 2009 IECC	Climate Zone 2 Harris	14.3%	10.2%	12.9%	10.2%
	Climate Zone 3 Tarrant	22.6%	18.3%	20.2%	18.3%
	Climate Zone 4 Potter	26.8%	21.1%	23.5%	21.1%
2015 IECC VS 2009 IECC	Climate Zone 2 Harris	13.8%	9.9%	12.2%	9.9%
	Climate Zone 3 Tarrant	22.1%	18.3%	19.7%	18.3%
	Climate Zone 4 Potter	26.2%	20.9%	22.8%	20.9%
2015 IECC VS 2012 IECC	Climate Zone 2 Harris	-0.6%	-0.3%	-0.8%	-0.3%
	Climate Zone 3 Tarrant	-0.7%	0.0%	-0.6%	0.0%
	Climate Zone 4 Potter	-0.8%	-0.3%	-0.8%	-0.3%

³ 'IECC site energy' refers to energy accounted for at site, which includes energy consumption from space heating, cooling and hot water only.

⁴ 'IECC source energy' refers to energy accounted for at source, which includes energy consumption from space heating, cooling and hot water only.

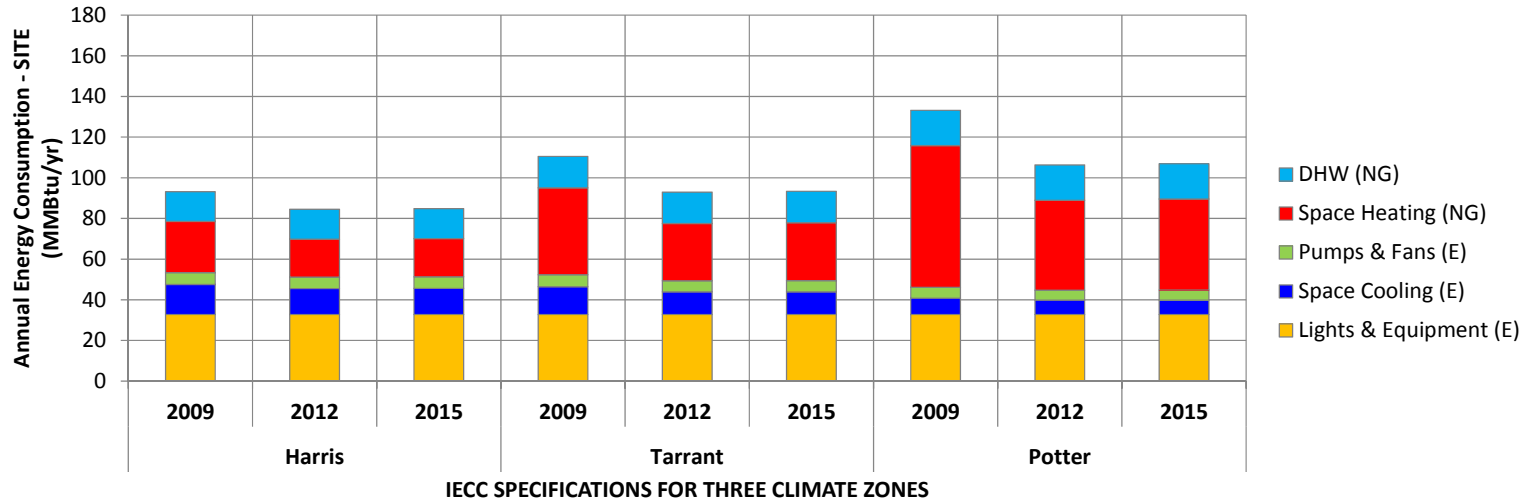


Figure 2: Comparing Site Energy Consumption for Electric-Gas House Using the Simulated Performance Alternative Provided in the 2009 IECC, 2012 IECC and the 2015 IECC

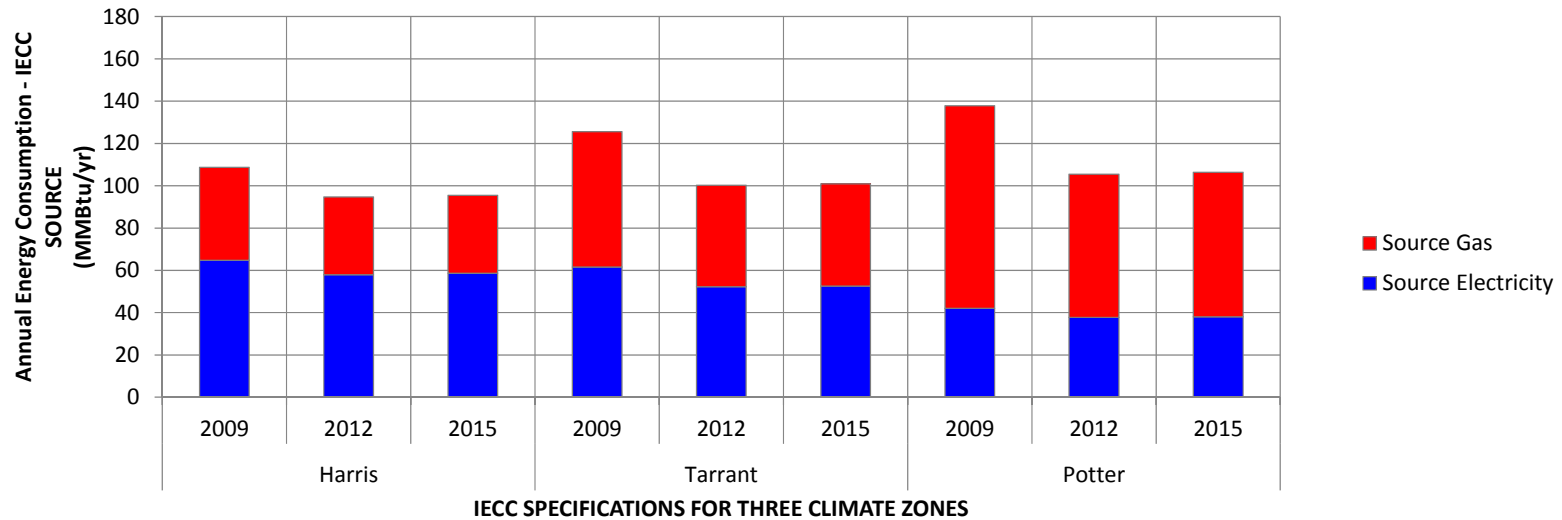


Figure 3: Comparing Source Energy Consumption for Electric-Gas House Using the Simulated Performance Alternative Provided in the 2009 IECC, 2012 IECC and the 2015 IECC

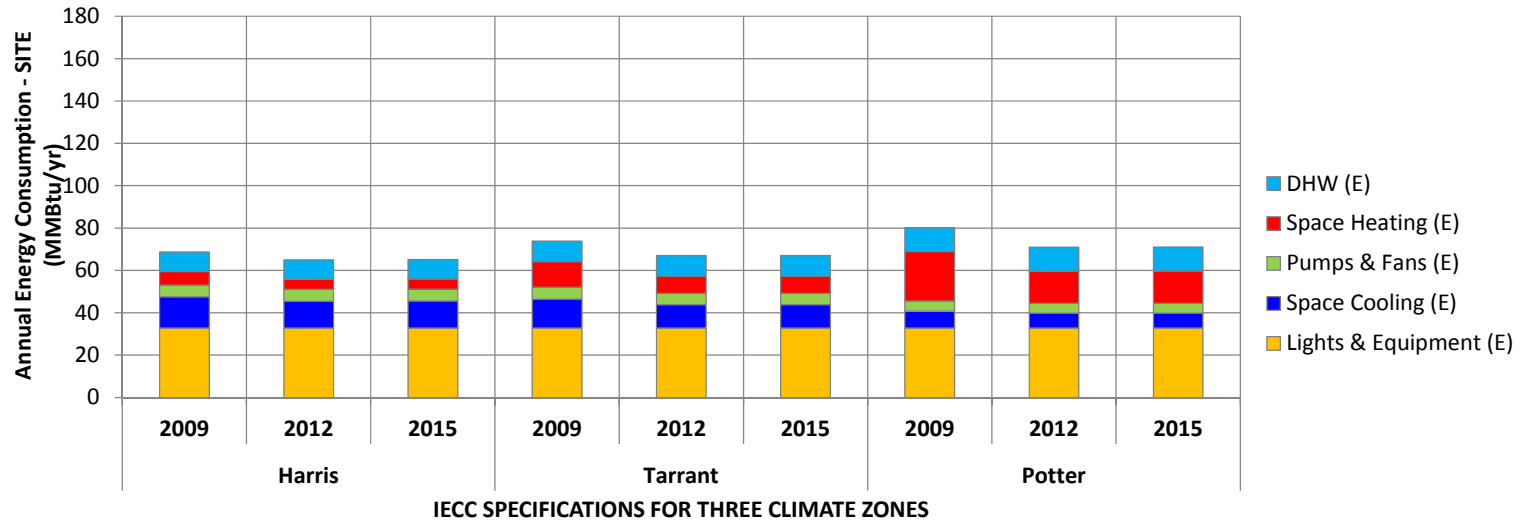


Figure 4: Comparing Site Energy Consumption for All-Electric House Using the Simulated Performance Alternative Provided in the 2009 IECC, 2012 IECC and the 2015 IECC

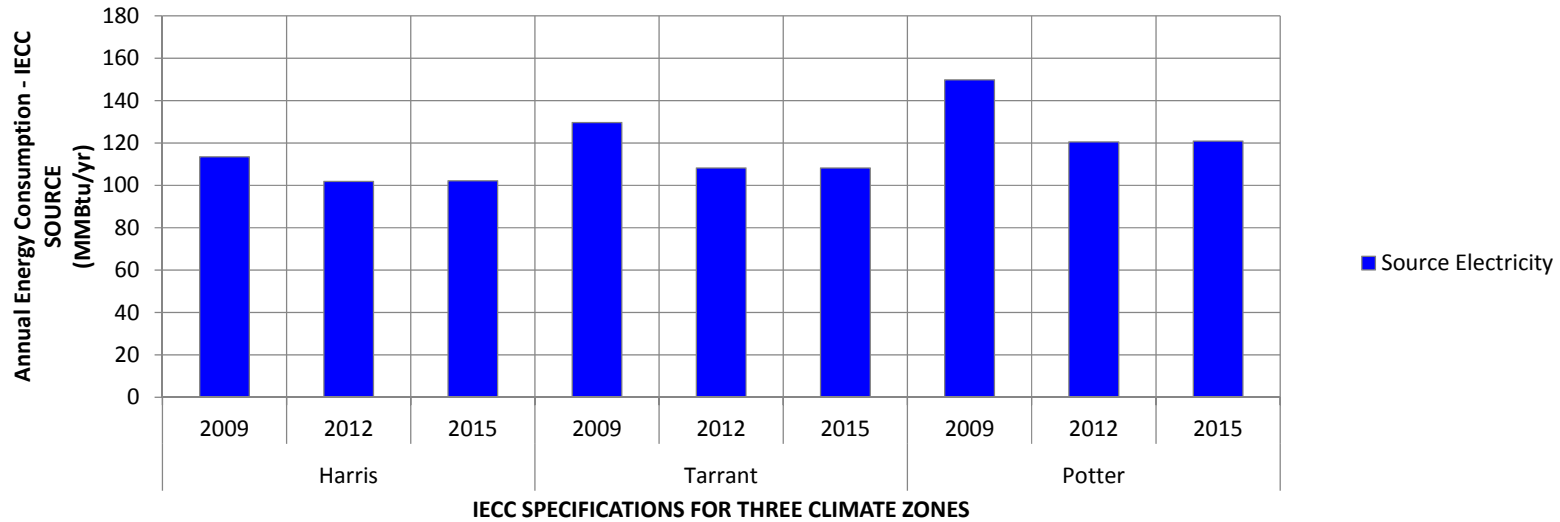


Figure 5: Comparing Source Energy Consumption for All-Electric House Using the Simulated Performance Alternative Provided in the 2009 IECC, 2012 IECC and the 2015 IECC

4. CONCLUSIONS

The purpose of this analysis was to determine the stringency of the 2015 IECC when compared to the 2012 IECC.

In order to perform the assessment, The analysis was performed in two steps:

- **Qualitative assessment:** A qualitative assessment was performed comparing all the sections in Chapter 4 [RE] of the 2015 and the corresponding sections in Chapter 4 [RE] of the 2012 IECC. The sections include mandatory, prescriptive and performance provisions in the codes.
- **Quantitative assessment:** A simulation test suite was conducted comparing the provisions for performance path compliance in in Chapter 4 (RE) of the 2015 and 2012 IECC.

Results from the desk-check indicate that most sections of the 2015 IECC were as or more stringent as the corresponding sections in the 2012 IECC. The requirements in certain sections of the 2015 IECC were relaxed. These requirements are listed below:

- Equivalent U-factors for walls in certain climate zones
- Loosening provisions for sun-room fenestrations for certain climate zones
- Maximum allowable duct leakage
- Removing certain conditions for hot water pipe insulation.

Based on the justifications provided in the documentation of ICC committee action hearings for proposed changes to the 2012 IECC (ICC 2013), it was concluded that relaxing the requirements in these sections does not have an impact on the overall stringency of this code, which is deemed to be as or more stringent than the 2012 IECC.

Results from the simulation analysis performed to assess the performance path provided in the codes indicate that for the selected simulation suite, annual energy consumption values from the 2015 and 2012 IECC were within 1MMBtu from each other and within 1% of each other. From observing the similarity in results, it can be concluded that the residential provisions in the 2015 IECC are as stringent as the corresponding provisions in the 2012 IECC.

Hence the study concludes that for mandatory, prescriptive and performance residential provisions, the 2015 IECC is as stringent as the corresponding provisions in the 2012 IECC.

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APPENDIX A: Desk-check Comparing the Residential Provisions in the 2015 IECC and the 2012 IECC

Section No.		Comments	Impact on Energy Efficiency			
Chapter 4 (RE) Residential Energy Efficiency	R401 General	R401.2 Compliance	The 2015 code provides three options with compliance along with the mandatory provisions. These include: prescriptive, performance and energy rating index (ERI).	No Impact		
		R401.2.1 Tropical zone	The 2015 code provides a separate set of compliance requirements for buildings located in tropical zones at elevations below 2,400 feet above sea level. However, the specifications for this particular climate zone do not impact any location in Texas.	Not Applicable		
		R401.3 Certificate	Reworded in the 2015 code. The section added other locations for placement of the compliance certificate.	No Impact		
	R402 Building Thermal Envelope	R402.1 General (Prescriptive)	R402.1 General (Prescriptive)	Exceptions are provided for low-energy buildings to be exempt from the thermal envelope provisions in the 2015 code.	No Impact	
			R402.1.1 Vapor retarder	Provisions for a vapor retarder included in the 2015 code. The specifications now point to appropriate provisions in the IRC.	More Stringent	
			R402.1.2 Insulation and fenestration criteria	Table R402.1.2 Insulation and Fenestration Requirements by Component Footnote h has been shortened to exclude provisions for structural sheathing. The note on structural sheathing has been moved to section R402.2.7 of the 2015 code.	No Impact	
			R402.1.3 R-value computation	Specifications are provided for the use of insulated siding for compliance with requirements of continuous insulation in Table 402.1.2 of the 2015 code. According to the provisions in the 2015 code, the manufacturers labeled R-value for insulated siding shall be reduced to by R-0.6.	More Stringent	
			R402.1.4 Total UA alternative	Table R402.1.4 Equivalent U-factors The equivalent U-factors for frame walls have become less stringent for Climate Zones 2,3,4 and 5 and more stringent for Climate Zones 6,7 and 8. The intent of these changes is not to alter the stringency of the code, but rectify the conversion from R-Value to U-Factor.	Less Stringent	
			R402.2 Specific insulation requirements (Prescriptive)	R402.2.1 Ceilings with attic spaces	The text in this section is expanded to provide clarification of the requirements for reduction of ceiling insulation R-value.	No Impact
				R402.2.4 Access hatches and doors	Vertical doors from conditioned to unconditioned spaces are now permitted to meet the fenestration requirements of Table R402.1.2.	No Impact
				R402.2.5 Mass walls	The 2015 code now specifies the heat capacity of qualifying mass walls. Any wall having a heat capacity greater than or equal to 6Btu/sqft F can be qualified as a mass wall.	No Impact
				R402.2.7 Walls with partial structural sheathing	This section was relocated from footnote h, Table R402.1.2 without any modifications to the text.	No Impact
				R402.2.8 Floors	An exception has been provided to the specifications for floor framing-cavity insulation in the 2015 code. The floor framing-cavity insulation is now permitted to be in contact with the top side of sheathing or continuous insulation installed at the bottom side of the floor framing where combined with insulation that meets or exceeds the minimum wood frame wall R-value provided in Table 402.1.2.	No Impact
				R402.3 Fenestration (Prescriptive)	R402.3.2 Glazed fenestration SHGC	The 2015 code makes provisions for dynamic glazing to satisfy the SHGC requirements of the code.

Note: Cells marked in green indicate greater stringency of the 2015 IECC over the 2012 IECC. Cells marked in red indicate lower stringency of the 2015 IECC when compared to the 2012 IECC.

Section No.		Comments	Impact on Energy Efficiency				
Chapter 4 (RE) Residential Energy Efficiency	R402 Building Thermal Envelope	R402.3 Fenestration (Prescriptive)	R402.3.5 Sunroom fenestration	The exceptions for fenestration in sunrooms with thermal isolation and enclosing conditioned spaces is now applicable to Climate Zones 2 through 8.	Less Stringent		
		R402.4 Air leakage (Mandatory)	R402.4.1 Building thermal envelope	R402.4.1.1 Installation	Table 402.4.1.1 Air Barrier and Insulation Installation	A section on concealed sprinklers is added. The note on fireplaces was removed from the table and moved into section R402.4.2 of the 2015 code. A column describing the insulation criteria is added to account for multiple inspectors.	No Impact
				R402.4.1.2 Testing		New ASTM standards have been added to the testing procedures described in the code.	No Impact
			R402.4.2 Fireplaces		References to two UL standards are incorporated to account for tight-fitting doors.	No Impact	
			R402.4.4 Rooms containing fuel-burning appliances		The code introduces a new section for rooms containing fuel-burning appliances. The code now requires combustion openings to be located outside the thermal envelope or insulated according to the specifications provided in the 2015 code..	No Impact	
			R403 Systems	R403.1 Controls (Mandatory)	R403.1.1 Programmable thermostat (Mandatory)		The 2015 code now requires a programmable thermostat on both cooling and heating systems, whereas the 2012 code required programmable thermostat on forced air furnaces only. The section in the 2015 code now also requires that the initial programming be performed by the manufacturer.
		R403.2 Hot water boiler outdoor temperature setback			A new section has been added that requires hot water boilers to have temperature setbacks based on outdoor conditions.	More Stringent	
		R403.3 Ducts	R403.3.1 Insulation (Prescriptive)		This section of the 2015 code bases the duct insulation R-value on the diameter of the duct. The duct insulation is now R-8 for both supply and return ducts in attics that are over 3inches in diameter.	More Stringent	
	R403.3.2 Sealing (Mandatory)			Exceptions provided in the 2015 code for duct sealing have been rewritten. The exceptions now exclude specifications for duct connections that are partially inaccessible. The exceptions clarifies the exclusion concerning ducts that have locking type joints.	More Stringent		
	R403.3.3 Duct testing (Mandatory)			A new section has been added in the 2015 code that describes the conditions for duct testing. The contents of this section have been rearranged from the 2012 version of the code.	No Impact		
	R403.3.4 Duct leakage (Prescriptive)			A new section has been added in the 2015 code that specifies the limits for duct leakage. The contents of this section have been rearranged from the 2012 version of the code.	No Impact		
		R403.5 Service hot water systems (Mandatory)	R403.5.1 Heated water circulation and temperature maintenance systems (Mandatory)		This section has been expanded in the 2015 code to incorporate provisions for the circulation systems and heat trace systems.	More Stringent	
	R403.5.1.1 Circulation systems				This section has been expanded in the 2015 code to provide specifications for hot water circulation systems such as requiring a circulation pump, dedicated return piping and automatic control.	More Stringent	
	R403.5.1.2 Heat trace systems				This section in the 2015 code adds requirements for controls of heat trace systems.	More Stringent	
R403.5.2 Demand recirculation systems			The 2015 code introduces this section to regulate the operation of demand recirculating systems.	More Stringent			

Note: Cells marked in green indicate greater stringency of the 2015 IECC over the 2012 IECC. Cells marked in red indicate lower stringency of the 2015 IECC when compared to the 2012 IECC.

Section No.		Comments	Impact on Energy Efficiency		
Chapter 4 (RE) Residential Energy Efficiency	R403 Systems	R403.5 Service hot water systems	R403.5.3 Hot water pipe insulation (Prescriptive)	Some conditions for the hot water pipe insulation have been removed in the 2015 code. The maximum run length table has been removed from the 2015 code. However, DHW pipe insulation has been added for 3/4 inch pipes, which effectively makes it more stringent than the 2012 code.	More Stringent
		R403.5.4 Drain water heat recovery units	The 2015 code introduces specifications for drain water heat recovery units. If installed, the drain water heat recovery units shall now comply with CSA standards referenced in the 2015 code.	More Stringent	
	R403.7 Equipment sizing and efficiency rating (Mandatory)	This section now clarifies the reference to federal standards for new and replacement equipment.	No Impact		
	R403.10 Pools and permanent spa energy consumption (Mandatory)	R403.10.2 Heaters	The 2015 code provides added language clarifying the requirements for pool heaters.	No Impact	
		R403.10.3 Time switches	Reworded in the 2015 code.	No Impact	
		R403.10.4 Covers	Reworded in the 2015 code. This section now clarifies that the specifications are only for outdoor heated pools and permanent spas.	No Impact	
	R403.11 Portable spas (Mandatory)	The 2015 code adds a new section for portable spas to comply with the code. Portable spas now have to comply with APSP standards.	More Stringent		
	R403.12 Residential pools and permanent residential spas	The 2015 code adds a new section for household residential pools and permanent spas to comply with the code. Pools and spas now have to comply with APSP standards.	More Stringent		
	R404 Electric Power and Lighting Systems	R404.1 Lighting equipment (Mandatory)	This section has been reworded in the 2015 code.	No Impact	
	R405 Simulated Performance Alternative	R405.4 Documentation	R405.4.2 Compliance report	The section has been further expanded into compliance reports for permit applications and for certificate of occupancy. Separate compliance reports have now to be submitted for permit application and for certificate of occupancy.	No Impact
			R405.4.2.1 Compliance report for permit application		
			R405.4.2.2 Compliance report for certificate of occupancy		
	R405.5 Calculation procedure	R405.5.2 Residential specifications	Table 405.5.2(1) Specifications for the Standard Reference and Proposed Design	In Table R405.5.2(1) describing specifications for the standard reference and proposed designs, the section has been modified to correct terminology for building components such as vertical glazing and opaque doors. The section was also modified to provide clarifications regarding specifications for thermal distribution systems.	No Impact

Note: Cells marked in green indicate greater stringency of the 2015 IECC over the 2012 IECC. Cells marked in red indicate lower stringency of the 2015 IECC when compared to the 2012 IECC.

Section No.		Comments	Impact on Energy Efficiency
Chapter 4 (RE) Residential Energy Efficiency	R406 Energy Rating Index Compliance Alternative	A separate section has been created in the 2015 code to describe a new option for compliance. To show compliance using this option, all mandatory requirements in Chapter 4 for residential buildings have to be met by the Rated house. In addition, the Rated house has to meet all the specifications for thermal envelope from the 2009 IECC with an exception of duct insulation. The duct insulation shall be set to a minimum of R-6. Total net purchased energy shall be used to calculate the energy rating index. The ERI Reference Design house is configured to the requirements of the 2006 IECC. The loads of the Rated house have to be less than the corresponding loads of the Reference house. In order to show compliance, the Rated house is required to show an ERI less than or equal to the appropriate value listed in the 2015 code.	No Impact
Chapter 5 (RE) Existing Buildings		A new chapter has been added to the 2015 IECC. The chapter provides information and specifications to assess alterations, repair, addition and change of occupancy of existing buildings and structures. Existing sections in the prior code have been relocated and consolidated in this chapter and no new language has been added. Additional language includes a description for providing compliance for additions.	

Note: Cells marked in green indicate greater stringency of the 2015 IECC over the 2012 IECC. Cells marked in red indicate lower stringency of the 2015 IECC when compared to the 2012 IECC.