

# Virginia's Energy Codes

Energy related provisions of the Virginia codes were a topic of many discussions during the recent 2018 code update process, and in fact continue to attract opinion and discussion. In an effort to provide a comprehensive overview of energy code improvements in Virginia, the following information is being provided.

- Background on the evolution of Virginia's energy codes,
- Comparison of Virginia to surrounding states; and
- Update on efforts to improve implementation of the energy provisions of the codes:

**Virginia Energy Amendments:** This report includes a list of all of the Virginia amendments to the I-Codes (the International Energy Conservation Code, the International Residential Code, and the International Existing Building Code), related to energy efficiency. All of the existing amendments from previous cycles are included as well as all of the amendments recently approved for the 2018 codes. The three color-coded columns on the left of the sheet compare the Virginia requirement to the International Energy Conservation Code (IECC) requirement for that same edition of the codes. The two color coded columns on the right compare each edition of the Virginia Energy Conservation Code (VECC) to the previous edition of the VECC. Shades of green show the progression of the various amendments from the 2012 cycle through the 2018 cycle and yellow indicates a weakening amendment. This report shows that there has been continual improvement. There are no weakening amendments to the commercial energy provisions and only two requirements (wall insulation and maximum air changes per hour) in 2018 Virginia codes for residential energy efficiency that are less stringent than the national model code. The following changes, approved for the 2018 Virginia codes, related to residential energy efficiency, remove existing weakening amendments in the 2015 codes and brings the Virginia requirements in line with the 2018 model codes:

- Energy Certificates
- Ceiling Insulation and Ceiling U-Factor
- Blower Door Testing
- Replacement Fenestration

**2020 ACEEE State Energy Efficiency Scorecard:** The American Council for an Energy-Efficient Economy's (ACEEE) publishes an annual State Energy Efficiency Scorecard and recently published "The 2020 State Energy Efficiency Scorecard". This document highlights some information from that report related to Virginia's energy codes and energy related policies, including:

- **Virginia ranked 1st in the South**
- **Virginia scored 5 out of 6 for Energy Code Stringency and Compliance**

Virginia's energy codes are currently ranked (ACEEE and US DOE) equal to or better than all surrounding states, with the exception of Washington D.C. and Maryland.

## Energy Code Implementation

Over the last several years, DHCD has collaborated and supported Viridian and the Southeast Energy Efficiency Alliance (SEAA) in their efforts to evaluate and improve on the effectiveness of energy code implementation throughout Virginia. These efforts have included field studies, curriculum development of training to enhance deficiencies found in the field, mandatory training of all certified inspectors for this curriculum, follow-up circuit rider analysis and the development of resources for building departments to aid in implementation of residential energy codes.

# VIRGINIA ENERGY AMENDMENT ANALYSIS

2012 VECC Compared to 2012 IECC	2015 VECC Compared to 2015 IECC	2018 VECC Compared to 2018 IECC	Virginia Amended Code Section	2015 VECC Compared to 2012 VECC	2018 VECC Compared to 2015 VECC
<b>COMMERCIAL</b>					
EQ	EQ	>	<b>Sections: C402.1.4.2; C402.1.4.2.1; C402.1.4.2.2; C402.1.4.2.3; C402.2.1; C402.2.1.1; C402.2.1.2; C402.2.1.3; C402.2.1.4 and C402.2.1.5 - amended during the 2018 USBC Code Development Cycle via code change proposal E402.1.4.2-18 (Clarifies roof insulation requirements):</b> The amendment clarifies several code requirements, such as the allowance for U-factor compliance method for roof/ceiling assemblies; how to calculate the U-factor contribution of tapered roof insulation; the existing requirements in Section C402.2; etc. The proposal is modeled after the 2021 IECC and is an improvement from the 2015 VECC/2018 IECC.	EQ	>
EQ	EQ	EQ	<b>Sections: C402.4.1.2; C402.4.2 and C402.4.2.2 - amended during the 2018 USBC Code Development Cycle via code change proposal E402.4.2-18 (Deletion of 2018 IECC requirements for minimum skylight fenestration area):</b> while the IECC requirements for minimum skylight fenestration area would appear to increase energy efficiency by requiring more daylight, in fact, it could have somewhat of a negative impact on energy by limiting the capacity of energy producing systems such as photovoltaic (PV) systems that could be installed on the roof of buildings. The roof real estate is already limited given the various items normally located on the roof. Items such as HVAC equipment, roof access hatches, penthouses, shafts extensions, etc. are commonly found on today's building roofs. Further limiting the area that could otherwise be utilized for the installation of PV systems, could deem the installation of such systems unworthy. When comparing the potential in energy savings from skylights vs. PV systems, while there are similarities between the two, there are some distinct differences. One evident similarity between the two is that both save/produce energy during daytime. One distinct difference is exemplified below. The energy savings from skylights are "in the moment", while the sun is shining brightly. The potential for energy savings increases and/or decreases throughout the day based on the location of the sun on the horizon. Additionally, during times the building is unoccupied; or, occupied at reduced levels, the potential for energy savings is very limited or non-existent. The PV systems, however, have the capability of storing energy and using it during peak demand and/or for other types of power utilization equipment (i.e. space conditioning; emergency lighting, etc.) during off hours such as night and/or weekends. Additionally, the PV technology is ever evolving. Unlike skylights, through the use of power optimizers, sun trackers and other similar technologies, PV systems are capable to fully harness the sun's energy anytime during daylight.	EQ	EQ
EQ	EQ	>	<b>Table C402.4, C402.4.3 and Table C402.4.3 (Fenestration, SHGC and Projection Factors):</b> Fenestration and SHGC adjustment multipliers table remain separate in the 2015 VECC (IECC tables combined). The 2015 VECC SEW values conform to the 2018 IECC values. Cardinal orientation and projection factor multiplier for SHGC are addressed in Table C402.4.3. The Virginia amendments to these sections result in equivalent efficiency at worst or increased efficiency at best, compared to the IECC. <b>Table C402.4.3 - amended during the 2018 USBC Code Development Cycle via code change proposal E402.4-18 (SHGC reduction from 0.40 to 0.36):</b> The change lowers the SHGC to a U-factor of 0.36 which coincides with the U-factor for SEW orientation in the 2018 IECC. This is an improvement from the 2015 VECC and provides for more efficient buildings than those complying with the 2018 IECC, particularly buildings facing N.	EQ	>
			<b>C403.2.4.3 (Grease Duct Dampers):</b> Adds an exception, not requiring dampers on grease ducts serving kitchen hoods. This is a fire safety concern that should take precedence over the minimal amount of energy savings that might be realized (when the fan is not operating) if a damper was required in all instances.		
EQ	EQ	EQ	<b>C403.2.6.3 (Dwelling Unit Mechanical Ventilation): This VECC amendment ensures compliance with the VMC requirement.</b> The 2015 VMC Section 401.2 requires <u>mechanical</u> ventilation for all Group R dwelling units, whereas the IECC allows either natural or mechanical ventilation when air infiltration rate is above 5 ACH. This change is specific to dwelling units and ensures adequate ventilation and improves air quality in dwelling units, which is critical in CZ4 to prevent moisture issues. Mechanical ventilation provides more consistent and controlled air movement and should improve efficiency, over natural ventilation.	>	EQ
			<b>Section C403.2.8 and Table C403.2.8 - amended during the 2018 USBC Code Development Cycle via code change proposal E403.2.8-18 (Deletes energy requirements associated with kitchen exhaust systems):</b> This change is the result of safety concerns regarding kitchen hoods. The IECC's allowed ventilation rates conflict with the minimum required ventilation rates specified by the IMC which are necessary to exhaust airborne grease particles produced during kitchen operations. Reducing the maximum allowed ventilation could defeat the purpose of installing such exhaust systems; and could potentially expose the buildings and their occupants to dangerous environments. Fire safety should take precedence over energy savings.		
EQ	EQ	EQ	<b>Section C404.5 (including subsections and table) - amended during the 2018 USBC Code Development Cycle via code change proposal E404.5-18 (Deletes certain requirements for heated water supply piping):</b> In order to comply with the IECC provisions, additional equipment/fixtures that utilize electrical energy (i.e. recirculation pumps, heat trace systems, etc.) would be necessary. As such, although the deletion could appear to reduce energy efficiency, it could actually save energy in some instances by reducing the electrical energy otherwise consumed by the equipment. Thus, the VA amendment appears to have, at worst, a neutral impact on energy efficiency.	EQ	EQ
>	EQ	EQ	<b>C405.5 (Exterior Lighting):</b> The amendment removes an IECC loop hole for exterior lighting that is not served by the building electric service and ensure that <u>ALL</u> exterior lighting is accounted for in the total allowed exterior lighting. While the VECC amendment exempts low voltage landscape lighting from the total exterior lighting allowance, it still closes a loophole in the IECC that would allow an unlimited amount of lighting to be served by a separate electric service and not have to be included in the total allowance.	EQ	EQ

**LEGEND:**

NA	=	Administrative type changes (i.e. relocation of existing revisions, etc.)
	=	Fire safety concerns; energy efficiency rating not assigned
<	=	Lower energy efficiency levels
EQ	=	Similar energy efficiency levels
>	=	Higher energy efficiency levels

## VIRGINIA ENERGY AMENDMENT ANALYSIS

2012 VECC Compared to 2012 IECC	2015 VECC Compared to 2015 IECC	2018 VECC Compared to 2018 IECC	Virginia Amended Code Section	2015 VECC Compared to 2012 VECC	2018 VECC Compared to 2015 VECC
<b>RESIDENTIAL</b>					
EQ	EQ	EQ	<b>R401.2 (Compliance Paths and REScheck):</b> The 2015 VECC amendments to this section allow for different methods of compliance. Although the VECC options are different, the changes in the methods do not result in decreased efficiency. The 2015 VECC allows the use of the REScheck compliance method, but includes a work around to allow the 2015 VECC reduced wall and ceiling R-Values. The 2018 VECC ( <a href="#">Code change proposal RE401.2 -18</a> ) still allows the REScheck compliance method, but eliminates the R-Value work around resulting in full compliance with the 2018 IECC.	>	>
<	<				
<	<	EQ	<b>Section R401.3 - modified via code change proposal RE401.3-18 (Restores the requirement for energy Certificate):</b> The requirements for energy certificate were deleted in the 2015 VECC. This amendment restores said provisions which brings the 2018 VECC in line with the 2018 IECC in this regard.	EQ	>
<	<	EQ	<b>Table R402.1.2 (Insulation Requirements):</b> The 2015 VECC minimum wall and ceiling R-Values for CZ4 are lower than the 2015 IECC. The 2018 VECC ceiling insulation requirements for CZ4 are increased to R-49 [ <a href="#">Code change proposal RE402.1.2(4)</a> ] which is the same as the 2018 IECC. The 2018 VECC wood frame wall minimum insulation requirement for CZ4 remains at R-15 or R-13+R-1.	EQ	EQ
<	<	<			>
<	<	EQ	<b>Table R402.1.4 (U Factors):</b> The 2015 VECC minimum wall and ceiling U-Factors for CZ4 are higher than the 2015 IECC. The 2018 VECC ceiling U-Factor for CZ4 is reduced to 0.26 [ <a href="#">Code change proposal RE402.1.2(4)</a> ] which is the same as the 2018 IECC. The 2018 VECC wood frame wall U-Factor for CZ4 remains at U-0.079.	EQ	EQ
<	<	<			>
EQ	EQ	EQ	<b>R402.2.4 (Attic Hatches):</b> Attic hatches and scuttle hole covers must be insulated to a level equivalent to the insulation on the surrounding surfaces, similar to the IECC. For vertical access doors, the VECC results in increased efficiency (lower U-Factor) for these types of doors. This increase is offset by a slight reduction in VECC efficiency for pull down stairs.	EQ	>
EQ	EQ	EQ	<b>R402.4 (Recessed Lighting):</b> An IECC error in Section R402.4, later corrected by errata, only included Sections R402.4.1 through R402.4.4, and did not include R402.4.5 (Recessed lighting). The VECC was based on an early version of the IECC, so it included the incorrect reference. However, Table R402.4.1.1 includes the same requirements as Section R402.4.5 and is still applicable. This amendment does not result in a change in efficiency.	>	>
EQ	EQ	EQ	<b>Table R402.4.1.1 (Air Barrier Details):</b> The VECC amendment adds footnotes and additional details to ensure proper installation of air barriers behind tubs and at headers. This VECC amendment should provide increased efficiency.	>	>
<	<	EQ	<b>R402.4.1.2 (Blower Door Testing):</b> The 2015 VECC allows a visual inspection for air leakage. The 2018 VECC requires blower door testing. <b>Sections R402.4.1.2; R402.4.1.2.1; R42.4.1.2.2 and R402.4.1.3 - amended during the 2018 USBC Code Development Cycle via code change proposal RE402.4.1.2-18 (Eliminates the thermal envelope Visual Inspection Option):</b> Under the 2015 VECC, the thermal envelope tightness can be verified by means of Visual Inspection, or blower door test. The Visual Inspection Option will no longer be allowed by the 2018 VECC. Although the allowed air changes per our differ from those in the 2018 IECC, the amendment is an improvement over the 2015 VECC.	EQ	>
EQ	<	<	<b>R402.4.1.3 (Envelope Air Leakage):</b> The VECC amendment increases the maximum allowable air leakage from 3 ACH to 5 ACH, but the 2018 VECC will require blower door testing to verify compliance which will result in an overall increase in compliance and efficiency related to air leakage.	EQ	>
EQ	EQ	EQ	<b>Section R403.3.5 - amended during the 2018 USBC Code Development Cycle via code change proposal RE403.3.5-18 (Allows building framing cavities to be used as air plenums):</b> The amendment removes a conflict between the mechanical and energy provisions of the VRC. Although the 2018 IECC prohibits the use of framing cavities as air plenums, given the fact that wall cavities in outside walls are not allowed by the mechanical provisions of the VRC, there is no difference between the 2018 IECC and the 2018 VECC/VRC as it relates to energy efficiency.	EQ	EQ
EQ	EQ	EQ	<b>R403.7 (High Efficiency HVAC Equipment Sizing):</b> The Virginia amendment adds an exception to the prescriptive sizing requirements where HVAC systems that utilize special technology (multi-stage, variable refrigerant flow, etc.) are chosen to achieve increased efficiency.	EQ	EQ
EQ	EQ	EQ	<b>Table R406.4 (ERI):</b> The 2015 VECC ERI for CZ4 was higher than the 2015 IECC, to provide a reasonable and achievable number and encourage use of the ERI compliance path, ultimately resulting in increased efficiency compared to a building using another compliance path, as well as more buildings with such improvements. The 2015 VECC ERI for CZ4 was brought forward from the 2018 IECC.	>	>
<	<	EQ	<b>R503.1.1.1 (Replacement Fenestration):</b> The VECC deleted this requirement to align with the VEBC requirements in Section 102.2.2. Leaving this requirement in the VECC would not ensure compliance as the option still exists in the VEBC to replace fenestration with materials of similar efficiency. The 2018 VECC, however, reintroduces this requirement via code change proposal EB601.4(3) in Section "601.4.4 Fenestration." of the 2018 VEBC. As such the 2018 USBC is consistent with the 2018 IECC in this regard.	EQ	>

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## VIRGINIA ENERGY AMENDMENT ANALYSIS

2018 VEBC Compared to 2018 IECC	EXISTING BUILDINGS	2015 VEBC Compared to 2012 VEBC	2018 VEBC Compared to 2015 VEBC
EQ	<b>VEBC Section 601.4: Code change proposal EB601.4(3)-18 (Increases the energy efficiency requirements applicable to existing buildings):</b> The 2015 VEBC provisions dealing with the energy efficiency are enhanced by this proposal "by providing important details about efficiency requirements that apply to common alterations to existing buildings" (excerpt from the proponent's reason statement). The proposal covers requirements applicable to the alteration of several different building component types such as wall; ceiling; floor; fenestration; roof replacement. When directly comparing the 2018 VEBC requirements with the 2018 IECC provisions, the former are in most cases as or more stringent than the latter. The only VEBC item that could be perceived as being less stringent than the 2018 IECC is the threshold set on the roof area replacement. However, unlike the IECC, the VEBC roof replacement provisions also require compliance with Section C402.2.1 which has been substantially augmented by code change proposal E402.1.4.2-18. The overall result of the proposal is an increase in energy efficiency levels of existing buildings being altered.	EQ	>
NA	<b>Code change proposal E501.1-18 (Deletes energy provisions applicable to existing buildings from the VECC and refers the reader to the VEBC):</b> given that buildings under the purview of the VRC can currently comply with either the VECC or the VEBC, the proposed change has no impact on energy efficiency.	NA	NA
NA	<b>Code change proposal E502-18 (Relocates energy provisions, related to existing buildings, from the VECC to VEBC):</b> this is an administrative type change and there are no reductions in energy efficiency when compared with the 2018 IECC.	NA	NA
NA	<b>Code change proposal E503-18 (Relocates energy provisions, related to existing buildings, from the VECC to the VEBC):</b> VECC alteration provisions are deleted and a reference to Chapter 6 of the VEBC has been added. Section 601.4 of the VEBC requires compliance with the VECC/VRC as it relates to new construction. No reduction in energy efficiency appears to occur as a result of this amendment.	NA	NA
NA	<b>Code change proposal E504.1-18 (Relocates energy provisions, related to existing buildings, from the VECC to the VEBC):</b> The "Repair" provisions are relocated from the VECC to the VEBC. This appears to be an administrative change with no impact on energy conservation.	NA	NA

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# 2020 ACEEE State Energy Efficiency Scorecard

## BACKGROUND

The American Council for an Energy-Efficient Economy (ACEEE) produces an annual report that ranks U.S. states on their policy and program efforts to save energy and pursue efficiency as a cost-effective, critical tool for reducing emissions and meeting state clean energy goals. The report ranks states based on five categories: Utility and Public Benefits Programs & Policies (20 pts), Transportation Policies (12 pts), Building Energy Efficiency Policies (9 pts), State Government Initiatives (6pts), and Appliance Efficiency Standards (3 pts).

## VIRGINIA'S RANKINGS

Of particular note is Virginia's ranking of lead state in the Southeastern region and was recognized in the report as one of the states to watch in future reports, primarily due to Virginia's designation as one of the most-improved states since the 2019 State Energy Efficiency Report Card. The report also praises Virginia as one of the "top energy stories of 2020" and declared the passage of the Virginia Clean Economy Act (VCEA) as "a major victory for efficiency in the Southeast." Virginia was also recognized as being the first southern state to join the Regional Greenhouse Gas Initiative (RGGI).

The report listed Virginia as a "Leading and Trending State" that has taken significant steps in recent years to strengthen efficiency offerings for low-income customers, citing the 2018 Grid Transformation & Security Act, the VCEA, and other environmental justice measures that consider low-income areas and historically disadvantaged communities.

## VIRGINIA'S BUILDING ENERGY EFFICIENCY SCORES

Of further note is Virginia's performance in its Building Energy Efficiency Policies. With regard to Energy Code Stringency, Virginia scored 3.5 points out of a possible 4 points.

**Note:** The information used to evaluate Virginia's energy codes was based on the current (2015) edition of the Virginia codes and does not yet take into account the recent approval to adopt the 2018 energy codes. Once the 2018 codes become effective this year, the recent 2018 model code adoption, as well as all of the improvements to existing Virginia amendments should be reflected in the next ACEEE Scorecard.

The other category related to state residential and commercial energy codes, Code Compliance is based on the level of activity to support code compliance and Virginia scored 1.5 out of 2 possible points.

The Building Energy Efficiency Policies category provides an opportunity for a maximum of 9 points (Code Stringency 4 pts; Code Compliance 2 pts; and Building Energy Use Transparency 3 pts). In addition to the 5 energy code related points earned (3.5 points for Energy Code Stringency and 1.5 points for Code Compliance), Virginia added an additional .5 points for Building Energy Use Transparency, for 5.5 out of 9 points, placing them No. 1 in the Southern region.

## Energy Code Implementation

The U.S. Department of Energy (DOE) conducts research studies on building energy code implementation to assist states in measuring energy code compliance and improving training initiatives. Southeast Energy Efficiency Alliance (SEEA) led the initiative in Virginia and provided funding for Viridiant to conduct a field study in 2017-2018 to assess residential energy code implementation in new construction single-family buildings. DHCD supported the grant and provided in-kind services to Viridiant. Follow-up grants were supported by DHCD and collaboration continues today through ongoing work to improve on the effectiveness of energy code implementation throughout Virginia.

### FIELD STUDY

The field study identified that significant energy and cost savings potential existed through increased compliance with existing energy codes, and recommended focusing on energy code compliance-improvement programs including education, training, and outreach initiatives. Duct leakage and envelope air leakage measures showed the greatest potential for energy savings.

### CODE ENFORCEMENT TRAINING

As a result of the field study, Viridiant identified specific areas to be addressed through training. Subsequently, DHCD partnered with Viridiant in the training development and implementation process to develop a four-hour training offered as an in-person classroom program as well as an online self-paced program to address the identified need areas.

The Board of Housing and Community Development, with the support of VA Building and Code Officials Association made this class mandatory for the following certificate holders:

- Building Code Official
- Residential Building Inspector
- Combination Residential Building Inspector
- Mechanical Inspector
- Residential Plan Reviewer
- Mechanical Plan Reviewer

Although the date to complete the training was December 2020, the online version remains available as a resource to all local code enforcement personnel with more than 720 people having completed the instructor led or online version to date. Additionally DHCD supported the development of a two-hour version of the training specifically designed for contractors. This online training is an ongoing available resource for contractors as well. It should be noted that this training is available and provided at no cost to anyone wishing to take it.

### CIRCUIT RIDER PROGRAM

In 2019, Viridiant partnered with DHCD to secure SEEA grant funds with the intent to evaluate compliance of energy codes in new construction. Viridiant's grant proposal specifically focused on identifying the knowledge and application gaps related to enforcement of the energy codes in Virginia. Viridiant conducted grant supported surveys, questionnaires, and site research exploring both contractors and the code community's knowledge and understanding of the energy code. Based on these findings, a plethora of training materials and resources were developed by Viridiant.

## CODE ENFORCEMENT RESOURCES

Viridiant worked with urban, rural, and suburban localities of varying population sizes to compile information to aid in the VA Residential Energy Code implementation and resource development. The following Virginia Residential Energy Code Resources were recently completed and will be available to all stakeholders soon:

- Manual J, D & S Brochures
- Residential Plans Examiner HVAC Form Cheat Sheet
- Understanding and Using the HVAC Design Review Form
- Recommended Best Practices for Remote Virtual Inspections
- HVAC Installation Tips for Meeting Virginia Residential Energy Code
- Insulation Installation Tips for Meeting Virginia Residential Energy Code
- Lighting Tips for Meeting Virginia Residential Energy Code
- Indoor Air Quality, Code & COVID Guide
- Duct Test Report Form
- Duct Blaster Test Training Video
- Insulation & Air Barrier Guide
- Insulation & Air Barrier Field Checklist
- Whole-House Fresh Air Ventilation Guide
- Slab Edge Insulation Guide
- Duct Sealing & Testing Guide
- Suggested Website Layout for Easy Navigating
- Accessing the Jack A. Proctor Virginia Building Code Academy

These resources are intended to support and provide deeper context and understanding of the implementation of the residential provisions of Virginia's Energy Codes.