Energy Sub-Workgroup Meeting

September 29, 2025

10:00 AM

Location: 4224 Cox Rd, Glen Allen, VA 23060 - **Virginia Housing Center**

AGENDA

1) Welcome

2) Introductions

3) Discussion

- Code Change Proposals For October 3rd Workgroup Meeting

  - B101.2
  - B101.2(1)
  - EC-C402.1.6-24
  - EC-C403.7.4.1-24
  - EC-C405.17-24
  - EC-C405.17(1)-24
  - EC-1301-24
  - REC-R402.1.2-24
  - REC-R402.1.2(1)-24*
  - REC-R402.1.2(2)-24*
  - REC-R402.1.2(4)-24
  - REC-R402.4.1.2-24*
  - REC-R402.4.1.2(1)-24
  - REC-R403.14-24
  - REC-R404.5-24
  - REC-R404.5(1)-24
  - REC-R404.6-24
  - REC-R404.7-24
  - REC-R405.2-24*
  - REC-R405.2(1)-24
  - REC-R408.2.9-24*

* - Indicates Code Change Proposal Carried Over From July 29th Workgroup Meeting

4) Assignments and Next Steps

5) Next Meeting Date

B101.2-24

VCC: 101.2

Proponents: Joseph Willis, Prince William County, representing Self (jwillis@pwcgov.org)

2021 Virginia Construction Code

Revise as follows:

101.2 Incorporation by reference. Chapters 2 – 35 of the 2021 *International Building Code* ®, published by the International Code Council, Inc. (ICC), are adopted and incorporated by reference to be an enforceable part of the USBC. The term "IBC®" means the 2021 *International Building Code* , published by the International Code Council, Inc. Any codes and standards referenced in the IBC are also considered to be part of the incorporation by reference, except that such codes and standards are used only to the prescribed extent of each such reference. In addition, any provisions of the appendices of the IBC specifically identified to be part of the USBC are also considered to be part of the incorporation by reference.

Notes:

1. The IBC references other International Codes and standards including the following major codes:

   2020 NFPA 70

   ~~2021 *International Energy Conservation Code* ® (IECC ®)~~

   2021 *International Fuel Gas Code* ® (IFGC ®)

   2021 *International Mechanical Code* ® (IMC ®)

   2021 *International Plumbing Code* ® (IPC ®)

   2021 *International Residential Code* ® (IRC ®)

2. The IRC is applicable to the *construction* of detached one-family and two-family dwellings and townhouses as set out in Section 310 .

Reason Statement: The requirements of the Energy Conservation Code and cumbersome and out of touch with reality. The strangle hold the Energy Conservation Code puts on businesses and business owners, especially those that are just getting started, is a cost that is sometimes more than they can handle.

Cost Impact: The code change proposal will decrease the cost

The actual economic impact is very difficult to estimate and vary wildly.

A small tenant space could save a minimum of $300 where a large warehouse, high rise, data center could easily saves thousands of dollars in just material and equipment alone not the mention the possibility of plan review resubmission and permit fees for these projects depending on the fee schedule of each locality.

B101.2(1)-24

VCC: 101.2

Proponents: Joseph Wages, representing National Electrical Manufacturers Association (NEMA) (joseph.wages@nema.org)

2021 Virginia Construction Code

Revise as follows:

101.2 Incorporation by reference. Chapters 2 – 35 of the 2021 *International Building Code* ®, published by the International Code Council, Inc. (ICC), are adopted and incorporated by reference to be an enforceable part of the USBC. The term "IBC®" means the 2021 *International Building Code* , published by the International Code Council, Inc. Any codes and standards referenced in the IBC are also considered to be part of the incorporation by reference, except that such codes and standards are used only to the prescribed extent of each such reference. In addition, any provisions of the appendices of the IBC specifically identified to be part of the USBC are also considered to be part of the incorporation by reference. The following appendices to the 2024 International Energy Conservation Code® (IECC®) have been adopted and are a part of this code.

- Appendix CH Electric-Ready Commercial Building Provisions
- Appendix CI Demand Responsive Controls
- Appendix CJ Electrical Energy Storage System
- Appendix RD Electric Energy Storage Provisions
- Appendix RI On-Site Renewable Energy
- Appendix RK Electric-Ready Residential Building Provisions
- Appendix RL Renewable Energy Infrastructure

Notes:

1. The IBC references other International Codes and standards including the following major codes:

   2020 NFPA 70

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   2021 *International Mechanical Code* ® (IMC ®)

   2021 *International Plumbing Code* ® (IPC ®)

   2021 *International Residential Code* ® (IRC ®)

2. The IRC is applicable to the *construction* of detached one-family and two-family dwellings and townhouses as set out in Section 310 .

Reason Statement: The requirements outlined in Appendices CH, CI, and CJ of the 2024 IECC-C and Appendices RD, RI, RK, and RL were all approved by the ICC appointed Energy Code Consensus Committees by a two-thirds majority vote to be included in the Chapter 4 of the 2024 IECC as mandatory provisions of the code. While certain stakeholders submitted an appeal to ICC making the argument that these requirements are not within scope of the IECC, the ICC Board appointed Appeals Board stated in their final report dated March 4, 2024: "With respect to each of the nine appeals, the Appeals Board finds that the appellants have not demonstrated a material and significant irregularity of process or procedure, and therefore recommends the ICC Board of Directors deny each appeal." NEMA was opposed the final ruling of the ICC Board that relocated these important requirements to the appendices undermining the entire consensus process and recommendation of their own appeal board and therefore recommend the 2024 VECC officially adopt and incorporate these seven appendices as mandatory requirements.

Cost Impact: The code change proposal will increase the cost

This proposal will increase the cost of compliance with the code, however, the requirements outlined in the seven adopted appendices have been shown to be cost effective by PNNL analysis during the 2024 IECC code development process.

It should be noted NEMA proposals are developed by a member consensus process where both our bylaws and federal regulations prohibit us from discussing prices, costs, and other financial details of electrical products.

EC-C402.1.6-24

VCC: 1301.1.1.1

Proponents: William Penniman, representing Sierra Club Virginia Chapter (wpenniman@aol.com)

2021 Virginia Construction Code

Revise as follows:

1301.1.1.1 Changes to the *International Energy Conservation Code* (IECC). (Portions of code section not shown remain unchanged.) The following changes shall be made to the IECC :

~~1. Add Section C402.1.6 to the IECC to read:~~

~~**C402.1.6 Groups F, S, and U.** Appendix CD may be used as an alternative to the *building thermal envelope* provisions of this code for Groups F, S, and U.~~

~~13. Add Appendix CD to the IECC to read:~~

~~**APPENDIX CD**~~
~~**BUILDING ENVELOPE**~~
~~**REQUIREMENTS**~~

~~**CD101 Scope**~~

~~**CD101.1 General.** These provisions shall be permitted as an alternative to building thermal envelope requirements for *building* areas containing uses that are classified as Group F, S or U.~~

~~**CD102 Building Envelope Requirements**~~

~~**CD102.1 Insulation and fenestration criteria.** The building thermal envelope shall meet the requirements of Tables CD102.2(1) and CD102.3 based on the climate zone specified in Chapter 3CE. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table CD102.3 shall comply with the building envelope provisions of ASHRAE/IESNA 90.1.~~

~~**CD102.2 Specific insulation requirements.** Opaque assemblies shall comply with Table CD102.2(1) .~~

~~**CD102.2.1 Roof assembly.** The minimum thermal resistance (*R* value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table CD102.2(1) , based on *construction* materials used in the roof assembly.~~

~~**Exception:** Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25.4 mm) or less and where the area weighted *U* factor is equivalent to the same assembly with the *R* value specified in Table CD102.2(1) .~~

~~Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.~~

~~**CD102.2.2 Classification of walls.** Walls associated with the building envelope shall be classified in accordance with Section CD102.2.2.1 or CD102.2.2.2.~~

~~**TABLE CD102.2(1)OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, *R*-VALUE[a] METHOD**~~

CLIMATE ZONE	3	4 EXCEPT MARINE 4	5 AND MARINE 4
Roofs			
Insulation entirely above roof deck	R-15 ci	R-15 ci	R-15ci
Metal buildings (with R-5 thermal blocks[a,b])	R-19	R-19	R-19
Attic and other	R-30	R-30	R-30
Walls, above grade			
Mass	R-5.7 ci[c,e]	R-5.7 ci[e]	R-7.6ci
Metal building[b]	R-13	R-13	R-13 + R-13ci
Metal framed	R-13	R-13	R-13 + R-3.8ci
Wood Framed and other	R-13	R-13	R-13
Walls, below grade			
Below-grade wall[d]	NR	NR	NR
Floors			
Mass	R-5 ci	R-10 ci	R-10ci
Joists/framing	R-19	R-19	R-19

CLIMATE ZONE	3	4 EXCEPT MARINE	5 AND MARINE 4
Slab-on-grade floors			
Unheated slabs	NR	NR	NR
Heated slabs	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 24" below
Opaque Doors			
Swinging	U-0.70	U-0.70	U-0.70
Roll-up or sliding	U-1.45	U-1.45	U-1.45

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.ci = Continuous Insulation, NR = No Requirement

a. Thermal blocks are a minimum R-5 of rigid insulation which extends 1-inch beyond the width of the purlin on each side, perpendicular to the purlin.

b. Assembly description can be found in Table CD102.2(2) .

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90 , ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2-°F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.

e. Insulation is not required for mass walls in Climate Zone 3A located below the "Warm-Humid" line, and in Zone 3B.

TABLE CD102.2(2)METAL BUILDING ASSEMBLY DESCRIPTIONS

~~ROOFS~~	~~DESCRIPTIONS~~	~~REFERENCE~~
~~R-19 + R-10~~	~~Filled Cavity Roof Thermal blocks are a minimum; R-5 of rigid insulation; which extends 1 in. beyond and the~~	~~ASHRAE/IESNA 90.1-2004 Table A2.3~~

~~ROOFS~~	~~DESCRIPTIONS~~	~~REFERENCE~~
	~~neaehside, perpendicular to the purlin.~~	
~~R-19~~	~~Standing seam with single insulation layer. Thermal blocks are a~~	~~ASHRAE/IESNA 90.1-2004 Table A2.3~~

ROOFS	DESCRIPTION	REFERENCE
	gid insulation; which extends in- beyond the width of the purlin on each side; perpendicular to the purlin.	

~~ROOFS~~	~~DESCRIPTIONS~~	~~REFERENCE~~
	~~R-19 insulation batts draped perpendicularly over the purlins. Thermal blocks are then placed above~~	

~~ROOFS~~	~~DESCRIPTIONS~~	~~REFERENCE~~
	~~the purlin/batt, and the roof deck is secured to the purlins.~~	
~~Walls~~		
~~R-13~~	~~Single insulation layer~~ ~~The first layer of R-13 insulation batts is~~	~~ASHRAE/IESNA 90.1-2004 Table A2.3~~

~~ROOFS~~	~~DESCRIPTIONS~~	~~REFERENCE~~
	~~sly perpendicular to the girts and is compressed as the metal skin is attached to the girts.~~	
~~R-13 + R-13ci~~	~~Double ins~~	~~ASHRAE/IESNA 90.1-2004 Table A2.3~~

~~ROOFS~~	~~DESCRIPTION~~	~~REFERENCE~~
	~~first layer of R-13 insulation bats is installed continuously perpendicular to the girts and is compressed as~~	

ROOFS	Opaque doors and opaque doors glazed with not more than 2 square feet of glass	REFERENCE
	Opaque doors glazed with more than 2 square feet of glass	

For SI: 1inch = 25.4 mm.

CD102.2.2.1 Above-grade walls. Above-grade walls are those walls covered by Section CD102.2.3 on the exterior of the *building* and completely above grade or walls that are more than 15 percent above grade.

CD102.2.2.2 Below-grade walls. Below-grade walls covered by Section CD102.2.4 are basement or first-story walls associated with the exterior of the *building* that are at least 85 percent below grade.

CD102.2.2.3 Above-grade walls. The minimum thermal resistance (*R* value) of the insulating material(s) installed in the wall cavity between the framing members and continuously on the walls shall be as specified in Table CD102.2(1) , based on framing type and construction materials used in the wall assembly. The *R* value of integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table CD102.2(1) . "Mass walls" shall include walls weighing at least (1) 35 pounds per square foot (170 kg/m^2) of wall surface area or (2) 25 pounds per square foot (120 kg/m^2) of wall surface area if the material weight is not more than 120 pounds per cubic foot (1,900 kg\m^3).

CD102.2.4 Below-grade walls. The minimum thermal resistance (*R* value) of the insulating material installed in, or continuously on, the below-grade walls shall be as specified in Table CD102.2(1) and shall extend to a depth of 10 feet (3048 mm) below the outside finish ground level, or to the level of the floor, whichever is less.

CD102.2.5 Floors over outdoor air or unconditioned space. The minimum thermal resistance (*R* value) of the insulating material installed either between the floor framing or continuously on the floor assembly shall be as specified in Table CD102.2(1) , based on construction materials used in the floor assembly. "Mass floors" shall include floors weighing at least (1) 35 pounds per square foot (170 kg/m^2) of floor surface area or (2) 25 pounds per square foot (120 kg/m^2) of floor surface area if the material weight is not more than 12 pounds per cubic foot (1900 kg/m^3).

CD102.2.6 Slabs on grade. The minimum thermal resistance (*R* value) of the insulation around the perimeter of unheated or heated slab-on-grade floors shall be as specified in Table CD102.2(1) . The insulation shall be placed on the outside of the foundation or on the inside of a foundation wall. The insulation shall extend downward from the top of the slab for a minimum distance as shown in the table or to the top of the footing, whichever is less, or downward to at least the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table.

CD102.3 Fenestration. Fenestration shall comply with Table CD102.3 .

CD102.2.7 Opaque doors. Opaque doors (doors having less than 50 percent glass area) shall meet the applicable requirements for doors a specified in Table CD102.2(1) and be considered as part of the gross area of above-grade walls that are part of the building envelope.

TABLE CD102.3BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	3	4 EXCEPT MARINE	5 AND MARINE 4
Vertical fenestration (40% mximum of above-grade wall)			
U factor			
Framing materials other than metal or without metal reinforcement or cladding			
U Factor	0.65	0.40	0.35
Metal framing with or wihtout thermal break			
Curtain Wall/Storefront *U* factor	0.60	0.50	0.45
Entrance Door *U* factor	.900	.85	.80
All Other *U* factor[a]	.65	.55	.55
SHGC All Frame Types			
SHGC: PF < 0.25	.25	.40	.40
SHGC: 0.25 < PF < 0.5	.33	NR	NR
SHGC: ≥ 0.5	0.40	NR	NR
Skylights (3% maximum)			
Class			

CLIMATE ZONE	3	4 EXCEPT MARINE	5 AND MARINE 4
U Factor	0.00	0.60	0.60
SHGC	0.40	0.40	0.40
Plastic			
U Factor	1.30	1.30	1.30
SHGC	0.35	0.62	0.62

NR = No Requirement, PF = Projection Factor (See Section CD102.3.2)

a. All others includes operable windows, fixed windows and non-entrance doors.

CD102.3.1 Maximum area. The vertical fenestration area (not including opaque doors) shall not exceed the percentage of the gross wall area specified in Table CD102.3 . The skylight area shall not exceed the percentage of the gross roof area specified in Table CD102.3 .

CD102.3.2 Maximum U-factor and SHGC. For vertical fenestration, the maximum *U* factor and solar heat gain coefficient (SHGC) shall be as specified in Table CD102.3 , based on the window projection factor. For skylights, the maximum *U* factor and solar heat gain coefficient (SHGC) shall be as specified in Table CD102.3 The window projection factor shall be determined in accordance with Equation CD-1

PF=A/B

$$PF = A/B$$

where: **(Equation CD-1)**

PF = Projection factor (decimal). *A* = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing. *B* = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.

Where different windows or glass doors have different PF values, they shall each be evaluated separately, or an area-weighted PF value shall be calculated and used for all windows and glass doors.

CD102.4 Air leakage.

CD102.4.1 Window and door assemblies. The air leakage of window and sliding or swinging door assemblies that are part of the building envelope shall be determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 , or NFRC 400 by an accredited, independent laboratory, and labeled and certified by the manufacturer and shall not exceed the values in Section 402.4.2 of the 2006 IECC.

Exception: Site-constructed windows and doors that are weatherstripped or sealed in accordance with Section CD102.4.3.

CD102.4.2 Curtain wall, storefront glazing and commercial entrance doors. Curtain wall, storefront glazing and commercial glazed swinging entrance doors and revolving doors shall be tested for air leakage at 1.57 pounds per square foot (psf) (75 Pa) in accordance with ASTM E283 . For curtain walls and storefront glazing, the maximum air leakage rate shall be 0.3 cubic foot per minute per square foot (cfm/ft^2) (5.5 m^3/h × m^2) of fenestration area. For commercial glazed swinging entrance doors and revolving doors, the maximum air leakage shall be 1.00 cfm/ft2 (18.3 m^3/h × m^2) of door area when tested in accordance with ASTM E283 .

CD102.4.3 Sealing of the building envelope. Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

CD102.4.4 Outdoor air intakes and exhaust openings. Stair and elevator shaft vents and other outdoor air intakes and exhaust openings integral to the building envelope shall be equipped with not less than a Class I motorized, leakage-rated damper with a maximum leakage rate of 4 cfm per square foot (6.8 L/s – C m^2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.

Exception: Gravity (nonmotorized) dampers are permitted to be used in *buildings* less than three stories in height above grade.

CD102.4.5 Loading dock weather seals. Cargo doors and loading dock doors shall be equipped with weather seals to restrict infiltration when vehicles are parked in the doorway.

CD102.4.6 Vestibules. A door that separates conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time.

Exceptions:

1. *Buildings* in Climate Zones I and 2 as indicated in Figure C301.1 and Table C301.1 .
2. Doors not intended to be used as a *building* entrance door, such as doors to mechanical or electrical equipment rooms.
3. Doors opening directly from a sleeping unit or dwelling unit.
4. Doors that open directly from a space less than 3,000 square feet (298 m^2) in area.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

~~**CD102.4.7 Recessed luminaires.** When installed in the building envelope, recessed luminaires shall meet one of the following requirements:~~

1. ~~Type IC rated, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity and sealed or gasketed to prevent air leakage into the unconditioned space.~~
2. ~~Type IC or non-IC rated, installed inside a sealed box constructed from a minimum 0.5-inch-thick (12.7 mm) gypsum wallboard or constructed from a preformed polymeric vapor barrier, or other airtight assembly manufactured for this purpose, while maintaining required clearances of not less than 0.5 inch (12.7 mm) from combustible material and not less than 3 inches (76 mm) from insulation material.~~
3. ~~Type IC rated, in accordance with ASTM E283 admitting no more than 2.0 cubic feet per minute (cfm) (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. The luminaire shall be tested at 1.57 psf (75 Pa) pressure difference and shall be labeled.~~

~~**CD102.5 Moisture control.** All framed walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder having a permeance rating of 1 perm (5.7×10^{-11} kg/Pa · s · m^2) or less, when tested in accordance with the dessicant method using Procedure A of ASTM E96 . The vapor retarder shall be installed on the warm-in-winter side of the insulation.~~

~~**Exceptions:**~~

1. ~~*Buildings* located in Climate Zones 1 through 3 as indicated in Figure C301.1 and Table C301.1 .~~
2. ~~In *construction* where moisture or its freezing will not damage the materials.~~
3. ~~Where other approved means to avoid condensation in unventilated framed wall, floor, roof and ceiling cavities are provided.~~

Reason Statement:

This proposal would remove an unsupported rollback of minimum envelope energy efficiency standards for commercial Categories F, S and U. That rollback, which was granted over strong objections in the 2021 Code Cycle, is contained in 1301.1.1.1, C402.1.6 and Appendix CD. [The proposal was called Appendix CB when introduced. It also did not include some references to the "2004" ASHRAE, which the draft 2024 Base Document appears to have added.]

Removing the rollback is required because applicable law requires Virginia's building code to be consistent with or at least as stringent as the IECC. Appendix CD moves the code backwards by more than 15 years overriding multiple Board-approved and IECC-approved updates since 2006. Failing to eliminate Appendix CD would waste energy, raise occupancy costs, potentially harm employees, increase air pollution, including climate pollution, and harm the "health, safety and welfare" of the residents of Virginia both now and for the decades these inefficient buildings are operated.

Moreover, the record underlying the rollback proposal showed that (a) no substantive evidence was submitted, in the 2021 cycle, that would support the decade-plus rollback for the 120+ types of buildings covered by the proposal; (b) builders successfully implemented Board-approved IECC standards for 2009, 2012, 2015 and 2018, and ASHRAE standards for every update since 2006; (c) U.S. DOE and PNNL had found that full implementation of the 2021 IECC standards and each update of IECC or ASHRAE efficiency standards from 2009-2018 would save energy and money; (d) far from suffering under unreasonable burdens, the warehouse market was booming under the then-effective 2018 IECC; and (e) there were no findings or analysis by either the proponent or the Board to support approving the non-consensus proposal.

1. <u>Virginia Law Requires Consistency with Model Building Codes</u>

Section 36-99A requires implementation of building code standards that "protect the health, safety and welfare of the residents of the Commonwealth, and that minimize costs "consistent with" recognized national standards, which in Virginia means the IECC.

> The provisions of the Building Code and modifications thereof shall be such as to protect the health, safety and welfare of the residents of the Commonwealth, provided that buildings and structures should be permitted to be constructed, rehabilitated and maintained at the least possible cost consistent with recognized standards of health, safety, energy conservation and water conservation, including provisions necessary to prevent overcrowding, rodent or insect infestation, and garbage accumulation; and barrier-free provisions for the physically handicapped and aged.

As recognized by the 2021 NOPR, keeping the code up to date with "recognized standards of health, safety, energy conservation and

water conservation" is critical. Construction costs should be reduced where possible, but only to the extent "consistent with" the IECC's "energy conservation" standards. Backtracking to weaker, out-of-date standards is not permissible.

Pursuant to 2021 legislation, VIRGINIA ACTS OF ASSEMBLY – 2021 SPECIAL SESSION I, CHAPTER 425, Section 1 ("H2227"), the Board was directed to "consider adopting Building Code standards that are at least as stringent as those contained in the new version of the IECC." Factors to be considered are "the public health, safety, and welfare benefits of adopting standards that are at least as stringent as those contained in the IECC, including potential energy savings and air quality benefits over time compared tothe cost of initial construction." Nothing in H227 authorized approval of less stringent standards.

In 2022, at the request of certain builders, the GA adopted HB1289, which directed the Board "to consider during the next code development cycle, revising the Uniform Statewide Building Code…to provide an exemption from any requirements in the energy efficiency … for the following use and occupancy classifications pursuant to Chapter 3 of the 2018 Virginia Construction Code: (i) Section 306, Factory Group F; (ii) section 311, Storage Group S; and (iii) Section 312, Utility and Miscellaneous Group U."**[1]**

HB1289 called for consideration of an exemption, but it did not alter the statutory standards for building codes prescribed by 36-99A and H2227. Since the legislature did not change the applicable legal standards, its direction "to consider" is bound by otherwise applicable laws, which require adoption of code standards that protect the "health, safety and welfare" of Virginians, minimize costs "consistent with" national model codes, and be "at least as stringent" as the IECC.

2. No credible support was provided the rollback of code standards.

The proponent's supporting statement for the rollback proposed in the last cycle was very brief and conclusory. Neither the proponent nor any other participant provided any reasonable basis for rolling back conservation standards for any type of building. While Appendix CD would reduce some builders' construction costs, nothing demonstrated that the proposal would meet the relevant statutory standards of serving Virginians' "health, safety and welfare" or minimizing costs "consistent with" energy conservation standards or achieving energy efficiency "at least as stringent" as the latest IECC.

Since the 2006 IECC, the IECC adjusted and the Board repeatedly approved updated standards to recognize new industry developments and public needs. Nothing presented in the 2021 Cycle plausibly justified overturning all those decisions by the IECC and the Board.

In support of cutting back standards for dozens of types of buildings within the 3 broad categories Groups F, S and U, the proposal's Reason Statement and Cost Impact statement provided (a) two, sketchy examples of hypothetical buildings' compliance costs with no information about energy or energy cost savings; (b) a few generalized statements that some builders find compliance challenging and that some the affected buildings are "not heated or cooled to normal heating and cooling temperatures" or are "vacant" some of the time or might have "open doors" part of the time (which the IECC already addresses by exempting or reducing efficiency standards for buildings with such characteristics). There are absolutely no details about the energy usage, efficiency, costs, and characteristics of any 120+ types of buildings that are covered by the efficiency rollback.

Section 306 Factory Group F identifies over 50 types of factories; Section 311 Storage Group S lists over 60 types of storage facilities; and Section 312 Utility and Miscellaneous Group U identifies over a dozen categories. Some of the facilities store products (*e.g.*, food) that are temperature sensitive and require a great deal of energy (lessened only by energy efficiency) to achieve temperature goals. Other buildings involve manufacturing, greenhouses and other operations, which have still different energy and energy-efficiency profiles. Yet, apart scant information about two hypothetical warehouses, the proposal for the rollback provided no details or analysis of any other types of buildings or their energy footprints, available technologies, employee and customer needs, compliance costs, energy cost savings, pollution reductions or other factors relevant to the extreme, multi-group proposal.

The proposal provided no contextual information about its two hypothetical warehouses while omitting critical information. For example, it failed to disclose the huge volume of air to be heated and cooled in the two illustrations of warehouses: roughly 2.5 million cubic feet for the 100,000 Sf warehouse, and 144,000 cubic feet for the 7500 SF warehouse. Even the building claiming to heat only 60 degrees (assuming that temperature is not raised *after* the building is inspected) would require a huge amount of energy to achieve and maintain the targeted 60 degrees for 2.5 million cubic feet of space. Nor did the proponent address the huge, overall energy cost and use increases (waste) or pollution increases from rolling back established and new efficiency standards for multiple categories of buildings.

The proposal to return to 2006 standards claimed harms that ignored the 2021 IECC's flexibility provisions which exempt unheated and low-conditioned buildings and permitted buildings to be subdivided into an exempt unheated portion and a separate heated portion if, for example, heating for an office or other work area is needed. It also ignored ASHRAE's flexibility for low energy buildings.[2] The 2024 IECC also provides flexibility.

The proponent failed to compare the impact of its proposed standards to the many IECC standards it would override or to ASHRAE efficiency standards, which Appendix CD also undercuts.

Nor did the proponent provide data contradicting the many findings by DOE and PNNL that updates since 2006 would save energy and energy costs. The proponent's brief assertions about possible implementation being more difficult and possibly less attractive are too vague or irrelevant to support the extreme proposal. Had there been legitimate technical implementation problems, they would have been raised in the IECC and ASHRAE processes in each cycle from 2009 through 2018.

The proposal did not address or explain how Virginia had successfully implemented the higher conservation standards embodied in IECC updates from 2009-2018 or explain why the 2021 standards are unreasonable.

In fact, the evidence presented showed that the warehouse business was booming in the years the 2018 IECC standards were in effect. See, for example:

- **"Need for speed: Developers race to build warehouses amid site shortage,"** https://www.virginiabusiness.com/article/need-for-speed/ (Dec. 31, 2021) ("Geoff Poston [of Hampton Roads] likens the current market for building, buying and leasing warehouses and distribution centers to the mid-1800s California Gold Rush: Everybody wants in." The problem is land, not demand or ability to construct.);
- **"Making it rain: Increased e-commerce fuels wave of distribution centers,"** https://www.virginiabusiness.com/article/making-it-rain/ (April 29, 2021) ("For Hanover County Economic Development Director Linwood Thomas, things couldn't get much better. 'It's really been a perfect storm,' Thomas says. That storm — the good type — is a deluge of distribution centers and warehouses that have opened recently or are currently in the pipeline for the county of about 108,000 residents, located about 20 miles north of Richmond.… Over the past two years or so, Hanover has added about 1.5 million square feet of new space and about 80% of that has been leased. 'Then, we've got another almost 4 million square feet proposed in the next 24 months. These are tangible products that will put us over 5.5 million square feet of new space, which is huge,' says Thomas, noting that the new space will represent a nearly VASE% increase over the county's existing stock of 13.8 million square feet of industrial/warehouse space.");
- **"Industrial boom: Virginia continues to see more warehouses and distribution centers**," https://www.virginiabusiness.com/article/industrial-boom/ (July 27, 2018)("While Hampton and Southwest Virginia area also benefiting, …. Richmond's industrial warehouse market is currently undergoing a "golden age" in the distribution sector, according to a recent report from CBRE.")
- And, more recently, according to a Cushman and Wakefield survey, the Northern Virginia market for warehouse/distribution stayed strong in 2023, but weakened in 2024 – after the rollback took effect**.** https://assets.cushmanwakefield.com/-/media/cw/marketbeat-pdfs/2024/q1/us-reports/industrial/nova_americas_marketbeat_industrial_q1-2024.pdf?rev=6c6aad03f7024473b0a153e7bad3b0ca

Other considerations that require deleting Appendix CD and Section 402.1.6 which operationalizes Appendix CD, thereby returning to full compliance with the latest IECC, include:

The IECC's code provisions are built upon the hard work, expertise and negotiations of hundreds of industry and efficiency experts, architects, engineers, trade associations, environmental experts, government bodies and public review processes. They consider technological developments, costs, benefits and practicality. Nothing in the IECC standards was arbitrarily arrived at. It makes accommodations are made for different types of buildings and usage patterns, including low-energy building, through different standards, exemptions and performance alternatives.

DOE and PNNL have consistently found that ASHRAE and IECC standards save money for building users through energy savings compared to initial construction costs. https://www.energycodes.gov/sites/default/files/2021-07/Cost-effectiveness_of_ASHRAE_Standard_90-1-2019-Virginia.pdf (The Commercial Energy Efficiency chapter of the 2021 IECC (International Code Council, ICC 2021) allows users to either follow the provisions in the IECC or use Standard 90.1-2019 as an alternative compliance path.) In its 2023 Report "Impacts of Model Energy Codes" (PNNL-33251), PNNL found that, if fully implemented from 2010-2040, IECC's 2009-2021 commercial energy codes would save 8.16 Quads of energy and $78.22 billion (2021 dollars).

In its report"Energy and Energy Cost Savings Analysis of the 2021 IECC for Commercial Buildings" (September 2022)(PNNL-32816), PNNL found that full implementation the 2021 edition of the IECC for commercial buildings would result in site energy savings of 12.1% at the aggregate national level compared to the 2018 IECC edition. In addition, on a national weighted average basis, the 2021 IECC is 6.5% more efficient for site energy use than Standard 90.1-2019. The 2021 commercial IECC also provides a nationally aggregated energy cost savings of 10.6% and greenhouse gas emissions savings of 10.2% as compared to the 2018 edition. Warehouses were projected to save 8.4% energy on-site, with a 6.9% (energy cost index) savings and a 7.1% emissions reduction. (See also

https://www.energycodes.gov/determinations for recent and past determinations.)

In its report "Energy and Energy Cost Savings Analysis of the 2018 IECC for Commercial Buildings December 2018" (December 2018) (PNNL-28125), PNNL found that compared to the 2015 IECC, implementing the 2018 IECC would cause warehouses to save energy (11.1% EUI reduction) and energy costs (16.7% ECI reduction). That is more than was projected for commercial buildings generally.

In its report "Energy and Energy Cost Savings Analysis of the IECC for Commercial Buildings (August 2013) (PNNL-22760)", PNNL found that commercial buildings generally and warehouses specifically would save energy and energy costs by implementing the 2012 IECC compared to the 2006 and 2009 IECC. "On a weighted national basis, the 2009 IECC results in 8.7% energy savings over the 2006 IECC, and the 2012 IECC results in 18.6% energy savings over the 2006 IECC." For warehouses, the EUI savings from 2012 over 2006 would be 36.9% (with plug-and-process loads) to 41.1% (without plug-and-process loads), and 40.5% energy cost savings (without plug-and-process loads).

The proponent's supporting statement did not address energy savings or energy cost increases, over time, to building users or the impacts of rising energy costs, which are likely to occur as climate change drives up ambient temperatures.

The proponent provided no evidence on how the public, including building occupants, communities and residents of the Commonwealth – would be affected by exempting these three large categories of buildings from all energy conservation requirements. DOE has found, for example, that energy use reductions, under updated IECC standards, would reduce GHG emissions impacts and climate impacts. By reducing peak and off-peak energy demands, keeping up with the latest IECC would reduce pressure on utilities to raise rates charged to all customers to cover higher priced energy resources.

Despite short-term appeals to builders of reducing construction costs, continuing implementation of the rollback would increase the risk that the buildings would become obsolete more quickly as energy operating costs go up for occupants. Lower rents and vacancies could follow just as they have for older office buildings in many areas.

In sum, C402.1.6. and Appendix CD should be deleted from Virginia's building code, and the code should be restored to being "consistent with" the latest IECC. No substantive information has ever been presented to support rolling back envelope efficiency standards to the 2006 level for three broad categories of buildings.

[1] In the 2021 Cycle, the initial proposal for an exemption was Appendix CB [later changed Appendix CD] was replaced by a proposal for an appendix to rollback building envelope standards to 2006 for F, S and U, which was adopted without discussion even though it was a non-consensus proposal to be approved. The Staff presented a proposal for an exemption simply to assure that that concept was considered as called for by HB 1289. Staff presented no evidence or arguments in support, and that proposal was rejected by the Board.

Cost Impact: The code change proposal will increase the cost

Obviously, there would be cost increases from restoring compliance from the 2006 standards to the latest IECC. The changes in costs are justified by changes in technology, building techniques, energy savings and energy costs, all of which have been reviewed by the IECC, DOE, PNNL and even the Board, which approved updated standards from 2009 - 2018 IECCs, before approving a rollback for 3 groups of buildings.

Although construction costs to builders would go up compared to the 2006 IECC standards in Appendix CD, builders managed to successfully and profitably construct new structures under the IECCs for 2009, 2012, 2015 and 2018. As discussed in the Reason Statement, building warehouses was a booming business under the 2018 IECC commercial envelope standards, which had been adopted in full by the Board. (Warehouse building starts declined, according to a survey, after the rollback took effect in January 2024.)

DOE and PNNL have repeatedly found that implementing updated IECC and ASHRAE standards since 2006 and 2004 would save energy and energy costs for building occupants. Builders can choose to implement either the IECC or ASHRAE. In its 2023 Report "Impacts of Model Energy Codes" (PNNL-33251), PNNL found that, if fully implemented from 2010-2040, IECC's 2009-2021 commercial energy codes would save 8.16 Quads of energy and $78.22 billion of energy costs (2021 dollars).

In its report "Energy and Energy Cost Savings Analysis of the 2021 IECC for Commercial Buildings" (September 2022)(PNNL-32816), PNNL found that full implementation the 2021 edition of the IECC for commercial buildings would result in site energy savings of 12.1% at the aggregate national level compared to the 2018 IECC edition. In addition, on a national weighted average basis, the 2021 IECC is 6.5% more efficient for site energy use than Standard 90.1-2019. The 2021 commercial IECC also provides a nationally aggregated energy cost savings of 10.6% and greenhouse gas emissions savings of 10.2% as compared to the 2018 edition. Warehouses were projected to save 8.4% energy on-site, with a 6.9% (energy cost index) savings and a 7.1% emissions reduction.

In its report “Energy and Energy Cost Savings Analysis of the 2018 IECC for Commercial Buildings December 2018” (December 2018) (PNNL-28125), PNNL found that compared to the 2015 IECC, implementing the 2018 IECC would cause warehouses to save energy (11.1% EUI reduction) and energy costs (16.7% ECI reduction). That is more than was projected for commercial buildings generally.

In its report “Energy and Energy Cost Savings Analysis of the IECC for Commercial Buildings (August 2013) (PNNL-22760)”, PNNL found that commercial buildings generally and warehouses specifically would save energy and energy costs by implementing the 2012 IECC compared to the 2006 and 2009 IECC. “On a weighted national basis, the 2009 IECC results in 8.7% energy savings over the 2006 IECC, and the 2012 IECC results in 18.6% energy savings over the 2006 IECC.” For warehouses, the EUI savings from 2012 over 2006 would be 36.9% (with plug-and-process loads) to 41.1% (without plug-and-process loads), and 40.5% energy cost savings (without plug-and-process loads).

The scanty cost claims that were presented in support of the Section 402.1.6 and Appendix CD (then called Appendix CB) described two hypothetical warehouses (presumably in Group F) with a square footage and alleged cost savings from reducing insulation in ceilings and walls. There was no information about (a) any of costs or benefits for the many other types of buildings covered by Appendix CD, (b) the energy and energy cost savings that would result from the higher efficiency standards in either the 2021 or 2018 IECC, (c) any justifications for the many other changes embedded in Appendix CD, (d) how the so-called complications of construction had been successfully and profitably complied with for well over a decade, (e) why ASHRAE standards should be rolled back, (f) impacts on climate and other forms of air pollution, or any other issue relevant to the rollback of 8 single-spaced changes of standards. There was no plausibility for the proponent’s assertion that a $42,984 cost savings from weaker insulation would save a project: “That is enough to keep this project from being built.” In fact, weakening building code standards would lower construction cost for competitors, too, giving no advantage to anyone. Indeed, one point of building codes is to prevent builders from trying to undercut their competitors with poorly built buildings -- achieving savings at the expense of meeting recognized standards.

In short, under Virginia law, Section C402.1.6 and Appendix CD should be deleted. Repeated findings by PNNL and DOE show that energy use and energy costs are significantly reduced by implementing updated IECC (and ASHRAE) standards. No meaningful cost-benefit evidence supported the rollback in Appendix CD to standards that are demonstrably less stringent than and not "consistent with" modern IECC and ASHRAE standards. The rollback was entirely based on vague cost reduction claims without consideration of the other factors required by law. It fails to minimize costs to the extent “consistent with” the latest IECC’s standards and to adopt standards at least as stringent as the latest IECC when considering benefits, including user-cost savings over time and pollution reductions, not just costs. If the only issue was how to cut costs for builders then there would be no building codes or building code updates.

EC-C403.7.4.1-24

VECC: C403.7.4.1

Proponents: Joseph Willis, representing Prince William County (jwillis@pwcgov.org); Donna Rubino, Prince William County, representing Prince William County Building (drubino@pwcgov.org)

2021 Virginia Energy Code

Revise as follows:

C403.7.4.1 Nontransient dwelling units. Nontransient dwelling units shall be provided with outdoor air energy recovery ventilation systems with an *enthalpy recovery ratio* of not less than 50 percent at cooling design condition and not less than 60 percent at heating design condition.

Exceptions:

1. Nontransient dwelling units in Climate Zone 3C.
2. Nontransient dwelling units with not more than 500 square feet (46 m^2) of *conditioned floor area* in Climate Zones 0, 1, 2, 3, 4C and 5C.
3. *Enthalpy recovery ratio* requirements at heating design condition in Climate Zones 0, 1 and 2.
4. *Enthalpy recovery ratio* requirements at cooling design condition in Climate Zones 4, 5, 6, 7 and 8.
5. **Nontransient dwelling units where the ratio of required outdoor air to supply air is less than 10 percent.**

Reason Statement:

Individual HVAC systems for condos and apartments tend to range from 2-3 tons cooling capacity. The required ventilation air is typically 5% or less of the supply airflow. The mechanical code permits options to achieve this through inexpensive means (connect to the return air side of the air handler or mechanical exhaust).

Prior to the 2015 Mechanical Code, natural ventilation was permitted through operable windows. Since then, only mechanical ventilation is permitted for this application.

An enthalpy recovery ratio for an ERV of 50%, means that 50% of the energy difference between the outside air and the return air is recovered and used to precondition the supply air. I'm assuming that the enthalpy recovery ratio at cooling design will be less than 50% for these types of units, so I use Exception 4. (Is that what the exception means? It's not clear.)

Cost Impact: The code change proposal will decrease the cost

Requiring these systems to use individual energy recovery is an added expense (~$600 - $1000 per unit) that doesn't seem necessary at these low airflows. There are better options available when using energy recovery for outdoor air, such as large dedicated outdoor air units with energy recovery to provide fresh air to multiple units or corridors.

EC-C405.17-24

VECC: C405.17 (New), C405.17.1 (New), TABLE C405.17.1 (New), C405.17.2 (New), C405.17.3 (New), C405.17.4 (New), C405.17.5 (New), C405.17.5.1 (New), C405.17.5.2 (New), C405.17.5.3 (New), C405.17.5.3.1 (New), C405.17.5.3.2 (New), C405.17.6 (New)

Proponents: Joseph Wages, representing National Electrical Manufacturers Association (NEMA) (joseph.wages@nema.org)

2021 Virginia Energy Code

Add new text as follows:

C405.17 Electric Vehicle Power Transfer Infrastructure. Parking facilities shall be provided with electric vehicle power transfer infrastructure in accordance with Sections C405.14.1 through C405.14.6.

C405.17.1 Quantity. The number of required EV spaces, EV capable spaces and EV ready spaces shall be determined in accordance with this Section and Table C405.14.1 based on the total number of automobile parking spaces and shall be rounded up to the nearest whole number. For R-2 buildings, the Table requirements shall be based on the total number of dwelling units or the total number of automobile parking spaces, whichever is less.

- 1.Where more than one parking facility is provided on a building site, the number of required automobile parking spaces required to have EV power transfer infrastructure shall be calculated separately for each parking facility.
- 2.Where one shared parking facility serves multiple building occupancies, the required number of spaces shall be determined proportionally based on the floor area of each building occupancy.
- 3.Installed EVSE spaces that exceed the minimum requirements of this section may be used to meet minimum requirements for EV ready spaces and EV capable spaces.
- 4.Installed EV ready spaces that exceed the minimum requirements of this section may be used to meet minimum requirements for EV capable spaces.
- 5.Where the number of EV ready spaces allocated for R-2 occupancies is equal to the number of dwelling units or to the number of automobile parking spaces allocated to R-2 occupancies, whichever is less, requirements for EVSE spaces for R-2 occupancies shall not apply.
- 6.Requirements for a Group S-2 parking garage shall be determined by the occupancies served by that parking garage. Where new automobile spaces do not serve specific occupancies, the values for Group S-2 parking garage in Table C405.14.1 shall be used.

TABLE C405.17.1 Required EV Power Transfer Infrastructure.

Occupancy	EVSE Spaces	EV Ready Spaces	EV Capable Spaces
Group A	10%	0%	10%
Group B	15%	10%	30%
Group E	15%	10%	30%
Group F	2%	0%	5%
Group H	1%	0%	0%
Group I	15%	0%	30%
Group M	15%	10%	30%
Group R-1	20%	10%	70%
Group R-2	20%	10%	70%
Group R-3 and R-4	2%	0%	5%
Group S exclusive of parking garages	1%	0%	0%
Group S-2 parking garages	25%	10%	30%

C405.17.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section C405.14.1 shall comply with the following:

- 1.A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and electrical distribution equipment.

- 2.Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with Section C405.14.5.
- 3.The electrical distribution equipment to which the raceway or cable assembly connects shall have dedicated overcurrent protection device space and spare electrical capacity to supply a calculated load in accordance with Section C405.14.5.
- 4.The enclosure or outlet and the electrical distribution equipment directory shall be marked: "For electric vehicle supply equipment (EVSE)."

C405.17.3 EV Ready Spaces. Each branch circuit serving EV ready spaces used to meet the requirements of Section C405.14.1 shall comply with the following:

- 1.Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.
- 2.Have a minimum system and circuit capacity in accordance with C405.14.5.
- 3.The electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

C405.17.4 EVSE Spaces. An installed EVSE with multiple output connections shall be permitted to serve multiple EVSE spaces. Each EVSE installed to meet the requirements of Section C405.14.1, serving either a single EVSE space or multiple EVSE spaces, shall comply with the following:

- 1.Have a minimum system and circuit capacity in accordance with Section C405.14.5.
- 2.Have a nameplate rating not less than 6.2kW.
- 3.Be located within 3 feet (914 mm) of each EVSE space it serves.
- 4.Be installed in accordance with Section C405.14.6.

C405.17.5 System and circuit capacity. The system and circuit capacity shall comply with C405.14.5.1 and C405.14.5.2.

C405.17.5.1 System capacity. The electrical distribution equipment supplying the branch circuit(s) serving each EV capable space, EV ready space, and EVSE space shall comply with one of the following:

- 1.Have a calculated load of 7.2 kVA or the nameplate rating of the equipment, whichever is larger, for each EV capable space, EV ready space, and EVSE space.
- 2.Meets the requirements of Section C405.14.5.3.1

C405.17.5.2 Circuit Capacity. The branch circuit serving each EV capable space, EV ready space, and EVSE space shall comply with one of the following:

- 1.Have a rated capacity not less than 50 amperes or the nameplate rating of the equipment, whichever is larger.
- 2.Meets the requirements of Section C405.14.5.3.2.

C405.17.5.3 System and circuit capacity management. Where system and circuit capacity management is selected in Section C405.14.5.1(2) or Section C405.14.5.2(2), the installation shall comply with Sections C405.14.5.3.1 and C405.14.5.3.2.

C405.17.5.3.1 System capacity management. The maximum equipment load on the electrical distribution equipment supplying the branch circuits(s) serving EV capable spaces, EV ready spaces, and EVSE spaces controlled by an energy management system shall be the maximum load permitted by the energy management system, but not less than 3.3 kVA per space.

C405.17.5.3.2 Circuit Capacity Management. Each branch circuit serving multiple EVSE spaces, EV ready spaces or EV capable spaces controlled by an energy management system, shall comply with one of the following:

- 1.Have a minimum capacity of 25 amperes per space.
- 2.Have a minimum capacity of 20 amperes per space for R-2 occupancies when all automobile parking spaces are EV ready spaces or EVSE spaces.

C405.17.6 EVSE Installation. EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. EVSE shall be accessible in accordance with Virginia Construction Code Section 1107.

Reason Statement:

This proposal adds a new section covering Electric Vehicle Power Transfer Infrastructure as a mandatory requirement in Chapter 4 similar to Appendix CG in the 2024 IECC. These requirements were approved by the ICC appointed commercial energy code consensus committee by a two-thirds majority vote during the 2024 IECC development cycle. Adding EV ready requirements to the 2024 VECC-C ensures new commercial parking facilities have the electrical infrastructure necessary for the installation of EV charging equipment at time of construction or any time in the future. This will provide a significant cost and labor savings.

Cost Impact: The code change proposal will increase the cost

The code change proposal will increase the cost of premises-wiring systems and parking facilities for commercial projects. However, the initial cost of EV ready infrastructure is considerably less expensive compared to retrofitting and altering the electrical system and parking facility in the future. The actual cost associated with this proposal is heavily dependent on the scale and scope of the commercial project.

It should be noted NEMA proposals are developed by a member consensus process where both our bylaws and federal regulations prohibit us from discussing prices, costs, and other financial details of electrical products.

EC-C405.17(1)-24

IECC: C405.17 (New), C405.17.1 (New), C405.17.2 (New), C405.17.2.1 (New), C405.17.2.2 (New), C405.17.2.3 (New), C405.17.2.4 (New), C405.17.2.5 (New), C405.17.2.5.1 (New), C405.17.2.5.2 (New), C405.17.2.5.3 (New), C405.17.2.5.3.1 (New), C405.17.2.5.3.2 (New), C405.17.2.6 (New)

Proponents: William Penniman, representing Sierra Club Virginia Chapter (wpenniman@aol.com)

2024 International Energy Conservation Code [CE Project]

Add new text as follows:

C405.17 ELECTRIC VEHICLE POWER TRANSFER.

C405.17.1 Definitions. AUTOMOBILE PARKING SPACE. A space within a building or private or public parking lot, exclusive of driveways, ramps, columns, office and work areas, for the parking of an automobile.
ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, electric vehicle supply equipment (EVSE), a rechargeable storage battery, a fuel cell, a photovoltaic array or another source of electric current.

ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE). A designated automobile parking space that is provided with electrical infrastructure such as, but not limited to, raceways, cables, electrical capacity, a panelboard or other electrical distribution equipment space necessary for the future installation of an EVSE.

ELECTRIC VEHICLE READY SPACE (EV READY SPACE). An automobile parking space that is provided with a branch circuit and an outlet, junction box or receptacle that will support an installed EVSE.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). Equipment for plug-in power transfer, including ungrounded, grounded and equipment grounding conductors; electric vehicle connectors; attached plugs; any personal protection system; and all other fittings, devices, power outlets or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

ELECTRIC VEHICLE SUPPLY EQUIPMENT INSTALLED SPACE (EVSE SPACE). An automobile parking space that is provided with a dedicated EVSE connection.

C405.17.2 Electric vehicle power transfer infrastructure. Parking facilities shall be provided with electric vehicle power transfer infrastructure in accordance with Sections C405.17.2.1 through C405.17.2.6.

C405.17.2.1 Quantity. The number of required electric vehicle (EV) spaces, EV capable spaces and EV ready spaces shall be determined in accordance with this section and Table C405.17.2.1 based on the total number of automobile parking spaces and shall be rounded up to the nearest whole number. For R-2 buildings, the C405.17.2.1 requirements shall be based on the total number of dwelling units or the total number of automobile parking spaces, whichever is less.

1. Where more than one parking facility is provided on a building site, the number of required automobile parking spaces required to have EV power transfer infrastructure shall be calculated separately for each parking facility.
2. Where one shared parking facility serves multiple building occupancies, the required number of spaces shall be determined proportionally based on the floor area of each building occupancy.
3. Installed electric vehicle supply equipment installed spaces (EVSE spaces) that exceed the minimum requirements of this section may be used to meet the minimum requirements for EV ready spaces and EV capable spaces.
4. Installed EV ready spaces that exceed the minimum requirements of this section may be used to meet the minimum requirements for EV capable spaces.
5. Where the number of EV ready spaces allocated for R-2 occupancies is equal to the number of dwelling units or to the number of

automobile parking spaces allocated to R-2 occupancies, whichever is less, requirements for EVSE spaces for R-2 occupancies shall not apply.

6. Requirements for a Group S-2 parking garage shall be determined by the occupancies served by that parking garage. Where new automobile spaces do not serve specific occupancies, the values for Group S-2 parking garage in Table C405.17.2.1 shall be used

Exception: Parking facilities serving occupancies other than R2 with fewer than 10 automobile parking spaces.

TABLE C405.17.2.1—REQUIRED EV POWER TRANSFER INFRASTRUCTURE

OCCUPANCY	EVSE SPACES	EV READY SPACES	EV CAPABLE SPACES
Group A	10%	0%	10%
Group B	15%	0%	30%
Group E	15%	0%	30%
Group F	2%	0%	5%
Group H	1%	0%	0%
Group I	15%	0%	30%
Group M	15%	0%	30%
Group R-1	20%	5%	75%
Group R-2	20%	5%	75%
Groups R-3 and R-4	2%	0%	5%
Group S exclusive of parking garages	1%	0%	0%
Group S-2 parking garages	15%	0%	30%

C405.17.2.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section C405.17.2.1 shall comply with the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with Section C405.17.2.5.
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have dedicated overcurrent protection device space and electrical capacity to supply a calculated load in accordance with Section C405.17.2.5.
4. The enclosure or outlet and the electrical distribution equipment directory shall be marked: “For electric vehicle supply equipment (EVSE).”

C405.17.2.3 EV Ready Spaces. Each branch circuit serving EV ready spaces used to meet the requirements of Section C405.17.2.1 shall comply with the following:

1. Terminate at an outlet or enclosure located within 3 feet (914 mm) of each EV ready space it serves.
2. Have a minimum system and circuit capacity in accordance with Section C405.17.2.5.
3. The electrical distribution equipment directory shall designate the branch circuit as “For electric vehicle supply equipment (EVSE)” and the outlet or enclosure shall be marked “For electric vehicle supply equipment (EVSE).”

C405.17.2.4 EVSE Spaces. An installed EVSE with multiple output connections shall be permitted to serve multiple EVSE spaces. Each EVSE installed to meet the requirements of Section C405.17.2.1, serving either a single EVSE space or multiple EVSE spaces, shall comply with the following:

1. Have a minimum system and circuit capacity in accordance with Section C405.17.2.5.
2. Have a nameplate rating not less than 6.2 kW.
3. Be located within 3 feet (914 mm) of each EVSE space it serves.
4. Be installed in accordance with Section C405.17.2.6.

C405.17.2.5 System and circuit capacity. The system and circuit capacity shall comply with Sections C405.17. 2.5.1 and C405.17.2.5.2.

C405.17.2.5.1 System capacity. The electrical distribution equipment supplying the branch circuit(s) serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:

1. Have a calculated load of 7.2 kVA or the nameplate rating of the equipment, whichever is larger, for each EV capable space, EV ready space and EVSE space.

2. Meets the requirements of Section C405.17.2.5.3.1.

C405.17.2.5.2 Circuit capacity.
The branch circuit serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:

1. Have a rated capacity not less than 50 amperes or the nameplate rating of the equipment, whichever is larger.
2. Meets the requirements of Section C405.17.2.5.3.2.

C405.17.2.5.3 System and circuit capacity management. Where system and circuit capacity management is selected in Section C405.17.2.5.1 or C405.17.2.5.2, the installation shall comply with Sections C405.17. 2.5.3.1 and C405.17.2.5.3.2.

C405.17.2.5.3.1 System capacity management. The maximum equipment load on the electrical distribution equipment supplying the branch circuits(s) serving EV capable spaces, EV ready spaces and EVSE spaces controlled by an energy management system shall be the maximum load permitted by the energy management system, but not less than 3.3 kVA per space.

C405.17.2.5.3.2 Circuit capacity management. Each branch circuit serving multiple EVSE spaces, EV ready spaces or EV capablespaces controlled by an energy management system shall comply with one of the following:

1. Have a minimum capacity of 25 amperes per space.

2. Have a minimum capacity of 20 amperes per space for R-2 occupancies where all automobile parking spaces are EV ready spaces or EVSE spaces.

C405.17.2.6 EVSE installation. EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 (2009 with revisions through February 2018) or UL 2594 (2016). EVSE shall be accessible in accordance with Section 1107 of the International Building Code.

Reason Statement:

The purpose of this proposal is to incorporate into Virginia's residential building code the substance of 2024 IECC's Appendix CG, which spells out requirements to install electric vehicle charging infrastructure in connection with new commercial construction. AppendixCG comes with the 2024 IECC, but activation of Appendix CG requires inserting language into the Virginia Construction Code for residential construction, which this proposal would do by adding a new Section C405.17.

Adoption of this proposal would benefit occupants and users of new commercial building—whether owners, employees, customers, or visitors—by facilitating convenient electric vehicle charging, which can readily be expanded as the need grows. Implementation would

benefit residents and the public with cost savings, pollution reduction (including greenhouse gases, ozone and carbon monoxide) and more equitable access to EVs and EV charging for residents. It would avoid the much higher costs of having to retrofit parking areas and building electrical systems.

Under the proposed Section C405.17, builders would have to provide basic levels of EV charging readiness: EV Capable Space (basic infrastructure for future installation of a branch circuit and charger); or EV Ready Space (basic infrastructure plus a branch circuit, outlet, junction box or receptacle); or EVSE Space (includes actual charging). The number of each type of EV space depends upon the type of building for which parking is provided. The numbers are tailored to reflect expected times for users to stay at a building and the fact that, while most EV charging now occurs at home, many people do not have access to EV charging where they live. Under the proposal, the greatest number of EV-related spaces are required in multifamily residential buildings, but lesser levels are required in other types of buildings. The three types of EV spaces are designed to minimize future EV charging installation costs, since retrofits are much more costly than incorporating EV infrastructure into initial construction.

By agreement among members of the ICC's committee to develop the 2024 IECC, these EV charging requirements were to have been included in the main body of the 2024 IECC (as proposed here). It was shifted to an appendix on appeal. Activating an appendix requires text in the code itself, which is the purpose of this proposal.

Virginians would benefit from a requiring minimum levels of EV charging infrastructure in new construction. EVs have many economic and health benefits for vehicle users. EVs are cheaper to use and maintain compared to vehicles with internal combustion engines (ICE). While most charging currently occurs at home, many EV owners and potential buyers do not have EV infrastructure at their dwellings or even the potential to install charging in the future. Locating at least a minimum number of chargers at places of work and business, will help to alleviate this barrier to EV adoption and afford residents of older buildings access to the benefits of EVs.

Growing EV usage is very important to Virginia for additional reasons. As explained in the ICC commentary accompanying the 2024 IECC, "The U.S. transportation sector accounted for 29 percent of the nation's greenhouse gas (GHG) emissions in 2019." That is specifically due to the traditional predominance of vehicles with internal combustion engines (ICE). Greenhouse gases from charging and operating EVs are less than 30% of GHG emissions from fueling and operating ICE vehicles. https://theicct.org/why-evs-are-already-much-greener-than-combustion-engine-vehicles-jul25/ EVs are also far more energy efficient than burning fuels in vehicle engines.

Reducing GHG emissions is a stated policy goal in Virginia law because climate change is a current and growing danger for Virginians. (See., e.g., § 45.2-1706.1. Commonwealth Clean Energy Policy. "A. The Commonwealth recognizes that effectively addressing climate change and enhancing resilience will advance the health, welfare, and safety of the residents of the Commonwealth. The Commonwealth further recognizes that addressing climate change requires reducing greenhouse gas emissions across the Commonwealth's economy sufficient to reach net-zero emission by 2045 in all sectors, including the electric power, transportation, industrial, agricultural, building, and infrastructure sectors….") Virginia faces growing threats, including more heat-illnesses, disruption of outdoor work, worsening storms, flooding, sea level rise, supply-chain disruption, damage to crops, trees and natural resources, arrival of diseases and pests, etc.

Bringing on EVs will also reduce other air pollutants that also threaten Virginian's health and welfare. ICE vehicles are a major source of ozone and other pollutants, including carbon monoxide risks in homes with garages.

Providing EV electric infrastructure as part of new construction is no different from the building code's requiring electrical infrastructure for HVAC, machinery and appliances likely to be used in the future or from the code's requiring more efficient equipment and lighting in new buildings.

Facilitating adoption of EVs requires that drivers have access to convenient, cost-effective EV charging. That can most easily be provided as part of new construction. As recognized in the IECC commentary on Appendix CG, it is very costly and complicated to renovate EV charging infrastructure into existing buildings.

The importance of incorporating EV charging into new construction is particularly great in the case of buildings whose parking is governed by condominium or common-interest-area boards, which divergent interests can use high retrofit costs to block EV adoption by some occupants.

Cost Impact: The code change proposal will increase the cost

The cost of installing infrastructure would depend on which of the three types of EV infrastructure is involved. The costs would be lower for an EV Capable Space and not much more for the EV Ready Space option if the electrical room or panel is close to the chosen spaces. Since electricity will be installed anyway (e.g. for garage or parking lighting, fans etc.), it would not be difficult or very costly to go the extra steps during building construction when an electrician is on site.

EC-1301-24

VCC: SECTION 1301, [E] 1301.1, [E] 1301.1.1, 1301.1.1.1

Proponents: William Penniman, representing Sierra Club Virginia Chapter (wpenniman@aol.com)

2021 Virginia Construction Code

SECTION 1301
GENERAL

[E] 1301.1 Scope. This chapter governs the design and construction of buildings for energy efficiency.

[E] 1301.1.1 Criteria. Buildings shall be designed and constructed in accordance with the *International Energy Conservation Code* .

Revise as follows:

1301.1.1.1 Changes to the *International Energy Conservation Code* (IECC). The following changes shall be made to the IECC :
-Proposal Note: While some content in items 1-5, 13-20, and 22-25 is not shown or may appear unstricken, these items are proposed to be deleted entirely. Other items in the list (6-12, 21, and 26-33) that are not shown remain unchanged.

1. ~~Add Section C402.1.6 to the IECC to read:~~

   ~~**C402.1.6 Groups F, S, and U.** Appendix CD may be used as an alternative to the *building thermal envelope* provisions of this code for Groups F, S, and U.~~

2. ~~Add an exception to the first paragraph of Section C403.7.7 of the IECC to read:~~

   ~~**Exception:** Where a grease duct serving a Type I hood is installed in accordance with Section 506.3 of the *International Mechanical Code*, motorized or gravity dampers shall not be installed.~~

3. ~~Add Section C403.2.2.1 to the IECC to read:~~

   ~~**C403.2.2.1 Dwelling unit mechanical ventilation.** Mechanical ventilation shall be provided for dwelling units in accordance with the *International Mechanical Code* .~~

4. ~~Delete Section C403.7.5 and Table C403.7.5 of the IECC.~~

5. ~~Delete Sections C404.5 through C404.5.2.1 of the IECC, including Tables.~~

13. ~~Add Appendix CD to the IECC to read:~~ (DELETE ENTIRE APPENDIX CD, INCLUDING ITEMS NOT SHOWN IN APPENDIX)

   ~~**APPENDIX CD**~~
   ~~**BUILDING ENVELOPE REQUIREMENTS**~~

   ~~**CD101 Scope**~~

   ~~**CD101.1 General.** These provisions shall be permitted as an alternative to building thermal envelope requirements for *building* areas containing uses that are classified as Group F, S or U.~~

   ~~**CD102 Building Envelope Requirements**~~

   ~~**CD102.1 Insulation and fenestration criteria.** The building thermal envelope shall meet the requirements of Tables CD102.2(1) and CD102.3 based on the climate zone specified in Chapter 3CE. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table CD102.3 shall comply with the building envelope provisions of ASHRAE/IESNA 90.1.~~

CD102.2 Specific insulation requirements. Opaque assemblies shall comply with Table CD102.2(1) .

CD102.2.1 Roof assembly. The minimum thermal resistance (*R* value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table CD102.2(1) , based on *construction* materials used in the roof assembly.

Exception: Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25.4 mm) or less and where the area weighted *U* factor is equivalent to the same assembly with the *R* value specified in Table CD102.2(1) .

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

CD102.2.2 Classification of walls. Walls associated with the building envelope shall be classified in accordance with Section CD102.2.2.1 or CD102.2.2.2.

TABLE CD102.2(1)OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD

TABLE CD102.2(2)METAL BUILDING ASSEMBLY DESCRIPTIONS

CD102.2.2.1 Above-grade walls. Above-grade walls are those walls covered by Section CD102.2.3 on the exterior of the *building* and completely above grade or walls that are more than 15 percent above grade.

CD102.2.2.2 Below-grade walls. Below-grade walls covered by Section CD102.2.4 are basement or first-story walls associated with the exterior of the *building* that are at least 85 percent below grade.

CD102.2.2.3 Above-grade walls. The minimum thermal resistance (*R* value) of the insulating material(s) installed in the wall cavity between the framing members and continuously on the walls shall be as specified in Table CD102.2(1) , based on framing type and construction materials used in the wall assembly. The *R* value of integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table CD102.2(1) . "Mass walls" shall include walls weighing at least (1) 35 pounds per square foot (170 kg/m^2) of wall surface area or (2) 25 pounds per square foot (120 kg/m^2) of wall surface area if the material weight is not more than 120 pounds per cubic foot (1,900 kg\m^3).

CD102.2.4 Below-grade walls. The minimum thermal resistance (*R* value) of the insulating material installed in, or continuously on, the below-grade walls shall be as specified in Table CD102.2(1) and shall extend to a depth of 10 feet (3048 mm) below the outside finish ground level, or to the level of the floor, whichever is less.

CD102.2.5 Floors over outdoor air or unconditioned space. The minimum thermal resistance (*R* value) of the insulating material installed either between the floor framing or continuously on the floor assembly shall be as specified in Table CD102.2(1) , based on construction materials used in the floor assembly. "Mass floors" shall include floors weighing at least (1) 35 pounds per square foot (170 kg/m^2) of floor surface area or (2) 25 pounds per square foot (120 kg/m^2) of floor surface area if the material weight is not more than 12 pounds per cubic foot (1900 kg/m^3).

CD102.2.6 Slabs on grade. The minimum thermal resistance (*R* value) of the insulation around the perimeter of unheated or heated slab-on-grade floors shall be as specified in Table CD102.2(1) . The insulation shall be placed on the outside of the foundation or on the inside of a foundation wall. The insulation shall extend downward from the top of the slab for a minimum distance as shown in the table or to the top of the footing, whichever is less, or downward to at least the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table.

CD102.2.7 Opaque doors. Opaque doors (doors having less than 50 percent glass area) shall meet the applicable requirements for doors a specified in Table CD102.2(1) and be considered as part of the gross area of above-grade walls that are part of the building envelope.

CD102.3 Fenestration. Fenestration shall comply with Table CD102.3 .

TABLE CD102.3BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CD102.3.1 Maximum area. The vertical fenestration area (not including opaque doors) shall not exceed the percentage of the gross wall area specified in Table CD102.3 . The skylight area shall not exceed the percentage of the gross roof area specified in Table CD102.3 .

CD102.3.2 Maximum U-factor and SHGC. For vertical fenestration, the maximum *U* factor and solar heat gain coefficient (SHGC) shall be as specified in Table CD102.3 , based on the window projection factor. For skylights, the maximum *U* factor and solar heat gain coefficient (SHGC) shall be as specified in Table CD102.3 The window projection factor shall be determined in accordance with Equation CD-1

PF=A/B

$$PF = A/B$$

where: **(Equation CD-1)**

PF = Projection factor (decimal). *A* = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing. *B* = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.

Where different windows or glass doors have different PF values, they shall each be evaluated separately, or an area-weighted PF value shall be calculated and used for all windows and glass doors.

CD102.4 Air leakage.

CD102.4.1 Window and door assemblies. The air leakage of window and sliding or swinging door assemblies that are part of the building envelope shall be determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 , or NFRC 400 by an accredited, independent laboratory, and labeled and certified by the manufacturer and shall not exceed the values in Section 402.4.2 of the 2006 IECC.

Exception: Site-constructed windows and doors that are weatherstripped or sealed in accordance with Section CD102.4.3.

CD102.4.2 Curtain wall, storefront glazing and commercial entrance doors. Curtain wall, storefront glazing and commercial glazed swinging entrance doors and revolving doors shall be tested for air leakage at 1.57 pounds per square foot (psf) (75 Pa) in accordance with ASTM E283 . For curtain walls and storefront glazing, the maximum air leakage rate shall be 0.3 cubic foot per minute per square foot (cfm/ft^2) (5.5 m^3/h × m^2) of fenestration area. For commercial glazed swinging entrance doors and revolving doors, the maximum air leakage shall be 1.00 cfm/ft2 (18.3 m^3/h × m^2) of door area when tested in accordance with ASTM E283 .

CD102.4.3 Sealing of the building envelope. Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

CD102.4.4 Outdoor air intakes and exhaust openings. Stair and elevator shaft vents and other outdoor air intakes and exhaust openings integral to the building envelope shall be equipped with not less than a Class I motorized, leakage-rated damper with a maximum leakage rate of 4 cfm per square foot (6.8 L/s – C m^2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.

Exception: Gravity (nonmotorized) dampers are permitted to be used in *buildings* less than three stories in height above grade.

CD102.4.5 Loading dock weather seals. Cargo doors and loading dock doors shall be equipped with weather seals to restrict infiltration when vehicles are parked in the doorway.

CD102.4.6 Vestibules. A door that separates conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time.

Exceptions:

1. *Buildings* in Climate Zones I and 2 as indicated in Figure C301.1 and Table C301.1 .
2. Doors not intended to be used as a *building* entrance door, such as doors to mechanical or electrical equipment rooms.
3. Doors opening directly from a sleeping unit or dwelling unit.
4. Doors that open directly from a space less than 3,000 square feet (298 m^2) in area.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

CD102.4.7 Recessed luminaires. When installed in the building envelope, recessed luminaires shall meet one of the following requirements:

1. Type IC rated, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity and sealed or gasketed to prevent air leakage into the unconditioned space.
2. Type IC or non-IC rated, installed inside a sealed box constructed from a minimum 0.5-inch-thick (12.7 mm) gypsum wallboard or constructed from a preformed polymeric vapor barrier, or other airtight assembly manufactured for this purpose, while maintaining required clearances of not less than 0.5 inch (12.7 mm) from combustible material and not less than 3 inches (76 mm) from insulation material.
3. Type IC rated, in accordance with ASTM E283 admitting no more than 2.0 cubic feet per minute (cfm) (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. The luminaire shall be tested at 1.57 psf (75 Pa) pressure difference and shall be labeled.

CD102.5 Moisture control. All framed walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder having a permeance rating of 1 perm (5.7×10^{-11} kg/Pa· s · m^2) or less, when tested in accordance with the dessicant method using Procedure A of ASTM E96 . The vapor retarder shall be installed on the warm-in-winter side of the insulation.

Exceptions:

1. *Buildings* located in Climate Zones 1 through 3 as indicated in Figure C301.1 and Table C301.1 .
2. In *construction* where moisture or its freezing will not damage the materials.
3. Where other approved means to avoid condensation in unventilated framed wall, floor, roof and ceiling cavities are provided.

14. Change the wood frame wall *R* value categories for Climate Zones 3A, 4A and 5A in Table R402.1.3 to read:

		Wood Frame Wall *R* Value
		15 or 13+1[h]

15. Change the frame wall *U* factor categories for Climate Zones 3A, 4A and 5A in Table R402.1.2 to read:

		Frame Wall *U* Factor
		0.079

16. Add an exception to Section R401.3 of the IECC to read:

Exception: Where approved, certificates for multifamily dwelling units shall be permitted to be located off site at an identified location.

17. Change Section R402.2.4 of the IECC to read:

R402.2.4 Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated in accordance with the following values:

1. Hinged vertical doors shall have a minimum overall R-5 insulation value.
2. Hatches and scuttle hole covers shall be insulated to a level equivalent to the insulation on the surrounding surfaces.
3. Pull down stairs shall have a minimum of 75 percent of the panel area having R-5 rigid insulation.

Access shall be provided to all equipment that prevents damaging or compressing the insulation. A wood-framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose-fill insulation from spilling into the living space when the attic access is opened and to provide a permanent means of maintaining the installed R-value of the loose-fill insulation.

18. Change the title of the "Insulation Installation Criteria" category of Table R402.4.1.1 ; change the "Shower/tub on exterior wall" category of Table R402.4.1.1 , and add footnotes "c" and "d" to Table R402.4.1.1 to read: (PROPOSAL NOTE: Delete remainder of item #18, including changes to Tables)

19. Change Section R402.4.1.2 of the IECC to read:

R402.4.1.2 Testing. The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). A written report of the results of the test shall be signed by the party conducting the test and provided to the building official. Testing shall be conducted by a Virginia licensed general contractor, a Virginia licensed HVAC contractor, a Virginia licensed home inspector, a Virginia *registered design professional*, a certified BPI Envelope Professional, a certified HERS rater, or a certified duct and envelope tightness rater. The party conducting the test shall have been trained on the equipment used to perform the test. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.

Note: Should additional sealing be required as a result of the test, consideration may be given to the issuance of a temporary certificate of occupancy in accordance with Section 116.1.1 .

During testing:

1. Exterior windows and doors and fireplace and stove doors shall be closed, but not sealed beyond the intended weatherstripping or other infiltration control measures.
2. Dampers, including exhaust, intake, makeup air, backdraft and flue dampers, shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, if installed at the time of the test, shall be open.
4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.
5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
6. Supply and return registers, if installed at the time of the test, shall be fully open.

20. Change Section R402.4.1.3 of the IECC to read:

R402.4.1.3 Leakage rate. When complying with Section R401.2.1 , the building or dwelling unit shall have an air leakage rate not exceeding 5.0 air changes per hour in Climate Zones 3 through 5, when tested in accordance with Section R402.4.1.2 .

22. Change the last paragraph of Section R403.3.5 of the IECC to read:

A written report of the results of the test shall be signed by the party conducting the test and provided to the code official. The licensed mechanical contractor installing the mechanical system shall be permitted to perform the duct testing. The contractor shall have been trained on the equipment used to perform the test.

23. Change Section R403.3.7 of the IECC to read:

R403.3.7 Building cavities. *Building* framing cavities used as ducts or plenums shall comply with VRC Section M1601.1.1 .

~~24. Change Section R403.7 of the IECC to read:~~

~~**R403.7 Equipment and appliance sizing.** Heating and cooling equipment and appliances shall be sized in accordance with ACCA Manual S or other approved sizing methodologies based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.~~

~~**Exception:** Heating and cooling equipment and appliance sizing shall not be limited to the capacities determined in accordance with Manual S or other approved sizing methodologies where any of the following conditions apply:~~

1. ~~The specified equipment or appliance utilizes multi-stage technology or variable refrigerant flow technology and the loads calculated in accordance with the approved heating and cooling methodology fall within the range of the manufacturer's published capacities for that equipment or appliance.~~

2. ~~The specified equipment or appliance manufacturer's published capacities cannot satisfy both the total and sensible heat gains calculated in accordance with the approved heating and cooling methodology and the next larger standard size unit is specified.~~

3. ~~The specified equipment or appliance is the lowest capacity unit available from the specified manufacturer.~~

~~25. Change Section R406.3.2 to read:~~

~~Section N1106.3.2 (R406.3.2) Onsite renewables are included. When onsite renewable energy is included for compliance using the Energy Rating Index (ERI) analysis per Section N1106.4 (R406.4), the building thermal envelope shall be greater than or equal to levels of energy efficiency and solar heat gain coefficient in Table N1102.1.2 (R402.1.2), with a ceiling U-factor of 0.026 and a frame wall U-factor of 0.060, or Table N1102.1.3 (R402.1.3), with a ceiling R-value of 49 and a wood frame wall R-value of 20 or 13+5.~~

Reason Statement:

The purpose of this proposal is to make Virginia's energy efficiency standards for new construction "at least as stringent as" the latest IECC for new commercial and residential construction. It would remove past weakening amendments to the IECC for new construction. (Efficiency standards for construction involving existing buildings are left for separate consideration.)

Virginia's residential building code has been behind the IECC's energy efficiency standards for over a decade -- since the 2012 IECC update. Virginia is even farther behind today since it failed to strengthen code standards for key building efficiency measures in the cycles that have followed. To make matters worse, in the 2021 cycle, it rolled back standards to 2006 levels for several broad categories of commercial buildings (F,S & U) which appear may include some data centers – the largest users of electricity in the state which threaten to upend rates for all Virginians. That rollback was not supported by any substantial evidence concerning the many types of buildings; nor has there been any substantial evidence for any of the other weakening amendments that would be eliminated by this proposal. Each weakening amendment is allowed to roll forward cycle after cycle, despite the IECC being reaffirmed or made even more stringent.

The IECC has repeatedly tightened energy efficiency standards over the past 20 years. Apart from a relaxation of ceiling insulation standards for some zones between the 2021 and 2024 cycles, the IECC has resisted pleas to weaken efficiency standards. Evidence of practical experience and new technologies has supported the IECC's continued enhancement of efficiency standards.

On the other hand, in the 2024 cycle the IECC introduced new levels of design and equipment flexibility to give builders a greater

variety of ways to meet the overall levels of efficiency required. The increase in energy efficiency options while still improving overall efficiency strongly undercuts arguments to retain past weakening amendments. Indeed, retaining those outdated amendments would undercut the overall efficiency targets set by the IECC as weaker prescriptive standards would undermine Simulated Performance and ERI energy savings targets.

Improving energy efficiency in new buildings is important to occupants and users —whether owners or tenants or employees or producers of goods or services --, since it would help them save money and energy, increase indoor comfort, make for healthier buildings, and improve workplaces for decades. Greater energy efficiency will also serve the public by reducing pressure on utilities to raise rates in order to build and operate more energy delivery capabilities, and by reduce the air pollution that drives climate impacts and other harms to Virginia's health, property and economy.

Importantly, the U.S. Department of Energy and the Pacific Northwest National Laboratories have analyzed energy efficiency standards for residential and commercial building codes for more than 20 years. They have consistently found that full adoption of the IECC and ASHRAE updates so far this century will save energy and money. They have also found that, by reducing building energy usage, these model code updates will reduce pollution, including climate pollution.

Adoption of this proposal is vital to properly implementing Virginia law. Sections 36-99A and 36-99B of the Virginia Code states that building codes are required to "protect the health, safety and welfare of the residents of the Commonwealth" and that adjustments to reduce construction costs must nevertheless be "consistent with recognized standards of health, safety, energy efficiency and water efficiency." VIRGINIA ACTS OF ASSEMBLY – 2021 SPECIAL SESSION I, CHAPTER 425, Section 1 (referred to herein as "H2227"), which was enacted in 2021, calls for adoption of energy efficiency standards that are "at least as stringent" as the latest IECC considering factors such as consumer costs "over time" and air pollution. The accumulated evidence from DOE and PNNL leave no doubt that weakening amendments should be removed from the energy efficiency standards applicable to new residential and commercial construction.

This proposal attempts to delete only standards that are not "at least as stringent" as the latest IECC. If any of the proposed deletions are beneficial and "at least as stringent" as the latest IECC, we would discuss amending this proposal.

Cost Impact: The code change proposal will increase the cost

Fully implementing the latest IECC will add to construction costs. However, as DOE and PNNL have shown, building owners, residents and users will save money and energy for decades after the buildings are constructed. Thus, the net costs will be reduced.

Further, as discussed in the Reason section, Virginia law states that construction costs should be minimized "consistent with" the latest model codes and that cost considerations must reflect the cost savings over time, not just initial costs. Further, building codes must be designed to serve the public's health, safety and welfare, including the benefits from reducing air pollution.

REC-R402.1.2-24

VRC: TABLE N1102.1.2 (R402.1.2), TABLE N1102.1.3 (R402.1.3); IRC: TABLE N1102.1.3 (R402.1.3)

Proponents: DeAnthony Pierce, City of Roanoke, representing Virginia Building & Code Officials Association (deanthony.pierce@roanokeva.gov)

2021 Virginia Residential Code

Revise as follows:

TABLE N1102.1.2 (R402.1.2) MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

Portions of table not shown remain unchanged.

CLIMATE ZONE	FRAME WALL *U*-FACTOR
3	~~0.079~~ 0.060
4 except Marine	~~0.079~~ 0.060
5 and Marine 4	~~0.079~~ 0.060

For SI: 1 foot = 304.8 mm.

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zones 0 and 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.

c. In Warm Humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

d. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 0 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

e. There are no SHGC requirements in the Marine Zone.

f. A maximum U-factor of 0.32 shall apply in Marine Climate Zone 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:

1. Above 4,000 feet in elevation above sea level, or

2. In windborne debris regions where protection of openings is required by Section R301.2.1.2.

TABLE N1102.1.3 (R402.1.3) INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Portions of table not shown remain unchanged.

CLIMATE ZONE	WOOD FRAME WALL *R*-VALUE[g]
3	~~15 or 13+1~~[g] 20 or 13&5ci or 15&2.9ci [g]

CLIMATE ZONE	WOOD FRAME WALL *R*-VALUE
4 except Marine	~~15 or 13+1~~[g] 20 or 13&5ci or 15&2.9ci[g]
5 and Marine 4	~~15 or 13+1~~[g] 20 or 13&5ci or 15&2.9ci[g]

For SI: 1 foot = 304.8 mm.

NR = Not Required.

ci = continuous insulation.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 0 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. “5ci or 13” means R-5 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. “10ci or 13” means R-10 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. “15ci or 19 or 13&5ci” means R-15 continuous insulation (ci) on the interior or exterior surface of the wall; or R-19 cavity insulation on the interior side of the wall; or R-13 cavity insulation on the interior of the wall in addition to R-5 continuous insulation on the interior or exterior surface of the wall.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab-edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation shall not be required in Warm Humid locations as defined by Figure N1101.7 and Table N1101.7.

g. The first value is cavity insulation; the second value is continuous insulation. Therefore, as an example, “13&5” means R-13 cavity insulation plus R-5 continuous insulation.

h. Mass walls shall be in accordance with Section N1102.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

i. A maximum *U*-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:

1. Above 4,000 feet in elevation, or

2. In windborne debris regions where protection of openings is required by Section R301.2.1.2.

2024 International Residential Code

Revise as follows:

TABLE N1102.1.3 (R402.1.3) INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Portions of table not shown remain unchanged.

For SI: 1 foot = 304.8 mm.NR = Not Required, ci = Continuous Insulation.

h. ~~"30 or 19+7.5ci or 20ci" means R-30 cavity insulation alone or R-19 cavity insulation with R-7.5 continuous insulation or R-20 continuous insulation alone.~~ "20 or 13+ 5ci or 15+2.9ci" means R-20 cavity insulation alone or R-13 cavity insulation with R-5 continuous insulation or R-15 cavity insulation with R-2.9 continuous insulation.

Reason Statement:

This proposal is meant to be a replace Virginia's Amended "R-15 or 13+1" wall insulation requirement, which has been in-place since the 2012 Code Cycle.

When the Amendment was adapted, it generally aligned with the requirements in the Model I-Codes. Since than, prescriptive insulation values have incrementally increased in the Model I-Codes, while Virginia's Wall insulation has remained the same.

This proposal will put Virginia's insulation requirements, roughly in-line with the 2018 Model I-Codes.

Cost Impact: The code change proposal will increase the cost

If adopted, this code change will increase the cost to builders who generally use 2x4 framing, and R-15 batt insulation, since it will require the use of either 2x6 framing, or added continuous insulation on the exterior.

The cost of framing would also increase since window framing around exterior window and door openings would have to be extended, to facilitate the continuous insulation, or if 2x6 studs are used.

2.9 continuous insulation with R-15 batt insulation was determined to be roughly equivalent to R-13 + 5 continuous. Through preliminary research, R-2.9 rigid board insulation was regularly available at retail chains such as Lowes and Home Depot. For this reason, R-15 with 2.9 continuous was added as an option for builders who prefer to build with 2x4 studs, and use R-15 insulation.

Attached Files

- **VBCOA 2024 Code Change Proposal_N1102 Tables.pdf**
  https://va.cdpaccess.com/proposal/1408/2011/files/download/946/

REC-R402.1.2(1)-24

IRC: TABLE N1102.1.2 (R402.1.2), TABLE N1102.1.3 (R402.1.3)

Proponents: Eric Lacey, representing Responsible Energy Codes Alliance (eric@reca-codes.com)

2024 International Residential Code

Revise as follows:

TABLE N1102.1.2 (R402.1.2) MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

Portions of table not shown remain unchanged.

CLIMATE ZONE	3	4 EXCEPT MARINE	5 AND MARINE 4
CEILING *U*-FACTOR	~~0.030~~0.026	~~0.026~~0.024	~~0.026~~0.024

For SI: 1 foot = 304.8 mm.

a. Nonfenestration *U*-factors and *F*-factors shall be obtained from measurement, calculation, an approved source or Appendix NF where such appendix is adopted or approved.

b. Mass walls shall be in accordance with Section N1102.2.6. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zones 0 and 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.

c. In Warm Humid locations as defined by Figure N1101.7 and Table N1101.7, the *basement wall U*-factor shall not exceed 0.360.

d. A maximum *U*-factor of 0.30 shall apply in Marine Climate Zone 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:

   1. Above 4,000 feet in elevation above sea level, or

   2. In windborne debris regions where protection of openings is required by Section R301.2.1.2.

e. *F*-factors for slabs shall correspond to the *R*-values of Table N1102.1.3 and the installation conditions of Section N1102.2.10.1.

TABLE N1102.1.3 (R402.1.3) INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Portions of table not shown remain unchanged.

CLIMATE ZONE	3	4 EXCEPT MARINE	5 AND MARINE 4
CEILING *R*-VALUE	~~38~~ 49	~~49~~ 60	~~49~~ 60

For SI: 1 foot = 304.8 mm.NR = Not Required, ci = Continuous Insulation.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. "5ci or 13" means R-5 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. "10ci or 13" means R-10 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. "15ci or 19 or 13&5ci" means R-15 continuous insulation (ci) on the interior or exterior surface of the wall; or R-19 cavity insulation on the interior side of the wall; or R-13 cavity insulation on the interior of the wall in addition to R-5 continuous insulation on the interior or exterior surface of the wall.

c. Slab insulation shall be installed in accordance with Section N1102.2.10.1.

d. Basement wall insulation shall not be required in Warm Humid locations as defined by Figure N1101.7 and Table N1101.7.

e. The first value is cavity insulation; the second value is continuous insulation. Therefore, as an example, "13&5" means R-13 cavity insulation plus R-5 continuous insulation.

f. Mass walls shall be in accordance with Section N1102.2.6. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

g. A maximum *U*-factor of 0.30 shall apply in Marine Climate Zone 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:

1. Above 4,000 feet in elevation.

2. In windborne debris regions where protection of openings is required by Section R301.2.1.2.

h. "30 or 19+7.5ci or 20ci" means R-30 cavity insulation alone or R-19 cavity insulation with R-7.5 continuous insulation or R-20 continuous insulation alone.

Reason Statement:

This proposal reverses an efficiency rollback incorporated into the 2024 *IECC* by restoring the ceiling insulation R-values to R-60 for Virginia's climate zones (which is the current requirement in the Uniform Construction Code). This requirement was rolled back in the 2024 *IECC* as part of a large compromise among *IECC*-Residential Development Committee Members referred to as the "omnibus." However, significant portions of the omnibus related to electrification and decarbonization were removed from the 2024 *IECC* by the ICC Board of Directors as a result of several appeals, leaving in place several material efficiency rollbacks. These rollbacks would not have been approved in the 2024 *IECC* but for the omnibus compromise, and we recommend that Virginia adopt prescriptive envelope requirements at least as efficient as the 2021 *IECC*. Ceiling insulation is one of the longest-lasting efficiency measures in a building and will provide comfort and energy savings for occupants in all seasons, as well as improved passive survivability in the event of natural disasters and long-term power outages.

Cost Impact: The code change proposal will not increase or decrease the cost

This proposal will maintain Virginia's current ceiling insulation prescriptive baseline, so there will be no increase in construction costs.

However, if Virginia reduces ceiling insulation requirements (per the 2024 IECC), this would increase costs for homeowners over the 70-100 year useful life of the building.

REC-R402.1.2(2)-24

VRC: TABLE N1102.1.2 (R402.1.2), TABLE N1102.1.3 (R402.1.3); VCC: 1301.1.1.1

Proponents: Eric Lacey, representing Responsible Energy Codes Alliance (eric@reca-codes.com)

2021 Virginia Residential Code

Revise as follows:

TABLE N1102.1.2 (R402.1.2) MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

Portions of table not shown remain unchanged.

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
3	0.30	0.55	0.25	0.026	0.060 ~~0.079~~	0.098	0.047	0.091c	0.136
4 except Marine	0.30	0.55	0.40	0.024	0.045 ~~0.079~~	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.40	0.024	0.045 ~~0.079~~	0.082	0.033	0.050	0.055

For SI: 1 foot = 304.8 mm.

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zones 0 and 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.

c. In Warm Humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

d. The SHGC column applies to all glazed fenestration.

   Exception: In Climate Zones 0 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

e. There are no SHGC requirements in the Marine Zone.

f. A maximum U-factor of 0.32 shall apply in Marine Climate Zone 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:

   1. Above 4,000 feet in elevation above sea level, or

   2. In windborne debris regions where protection of openings is required by Section R301.2.1.2.

TABLE N1102.1.3 (R402.1.3) INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Portions of table not shown remain unchanged.

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
3	0.30	0.55	0.25	49	20 or 13&5ci or 0&15ci ~~15 or 13+1~~[g]	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	0.30	0.55	0.40	60	30 or 20&5ci or 13&10ci or 0&20ci ~~15 or 13+1~~[g]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13

5 and Marine 4	0.30	0.55	0.40	60	30 or 20&5ci or 13&10ci or 0&20ci ~~15 or 13+1~~[g]	13/17	30	15ci or 19 or 13&5ci	10ci, 4 ft	15ci or 19 or 13&5ci

For SI: 1 foot = 304.8 mm.

NR = Not Required.

ci = continuous insulation.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

   Exception: In Climate Zones 0 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "5ci or 13" means R-5 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. "10ci or 13" means R-10 continuous insulation (ci) on the interior or exterior surface of the wall or R-13 cavity insulation on the interior side of the wall. "15ci or 19 or 13&5ci" means R-15 continuous insulation (ci) on the interior or exterior surface of the wall; or R-19 cavity insulation on the interior side of the wall; or R-13 cavity insulation on the interior of the wall in addition to R-5 continuous insulation on the interior or exterior surface of the wall.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab-edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation shall not be required in Warm Humid locations as defined by Figure N1101.7 and Table N1101.7.

g. The first value is cavity insulation; the second value is continuous insulation. Therefore, as an example, "13&5" means R-13 cavity insulation plus R-5 continuous insulation.

h. Mass walls shall be in accordance with Section N1102.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

i. A maximum *U*-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:

   1. Above 4,000 feet in elevation, or

   2. In windborne debris regions where protection of openings is required by Section R301.2.1.2.

2021 Virginia Construction Code

Revise as follows:

1301.1.1.1 Changes to the *International Energy Conservation Code* (IECC). The following changes shall be made to the IECC :

~~14. Change the wood frame wall *R* value categories for Climate Zones 3A, 4A and 5A in Table R402.1.3 to read:~~

		~~Wood Frame Wall *R* Value~~
		~~15 or 13+1[h]~~

~~15. Change the frame wall *U* factor categories for Climate Zones 3A, 4A and 5A in Table R402.1.2 to read:~~

		~~Frame Wall *U* Factor~~
		~~0.079~~

Reason Statement:

This proposal will reduce energy costs for homeowners and improve comfort and passive survivability in new homes by adopting the wall insulation requirements as they appear in the 2021 and 2024 IECC. Virginia is now several cycles behind the model energy code in requirements that apply to wall insulation.

	IECC Wall Insulation R-Value (CZ4)	VA UCC Wall Insulation R-Value (CZ4)
2009	13	13
2012	20 or 13+5	15 or 13+1
2015	20 or 13+5	15 or 13+1
2018	20 or 13+5	15 or 13+1
2021	30 or 20+5 or 13+10 or 0+20	15 or 13+1
2024	30 or 20+5 or 13+10 or 0+20	

Virginia currently allows 75% higher wall U-factors (less stringent) than the 2021/24 IECC. That means Virginia homes allow 75% more heat transfer through the opaque walls than a home built to the 2021 or 2024 IECC. While we understand that initial construction costs are higher with increased insulation requirements, the long-term benefits in lower energy bills and increased comfort for the building owners/occupants are well-documented. Wall insulation is most cost-effectively installed at construction and is likely to remain unchanged over the useful life of the building. The homes constructed today will generate roughly 1200 utility bills (100 years x 12 months), and the amount of wall insulation will directly impact what the homeowner pays every month. It is critical to build new homes to reduce energy use wherever feasible, particularly in the systems and components that will last the longest. Because the IECC provides a wide range of compliance options -- prescriptive, Total UA, simulated performance, Energy Rating Index -- an increase in wall insulation requirements may not require a complete redesign of the proposed home, as long as the home achieves the same overall level of energy savings.

Cost Impact: The code change proposal will increase the cost

In its analysis for the efficiency improvements in the 2021 IECC, the U.S. Department of Energy estimated that the increased construction cost of an additional R-5 continuous insulation would be $0.98/ft2 wall area, or $374.96 for the multifamily prototype/$1,961.96 for the single-family prototype. This improvement was part of a 30-year life-cycle energy cost savings of $2,243 in climate zone 4, with an estimated payback period of 12.4 years. *See* U.S. Department of Energy, *National Cost-Effectiveness of the Residential Provisions of the 2021 IECC* (June 2021).

REC-R402.1.2(4)-24

VCC: 1301.1.1.1 (New)

Proponents: William Penniman, representing Sierra Club Virginia Chapter (wpenniman@aol.com)

2021 Virginia Construction Code

Revise as follows:

1301.1.1.1 Changes to the IECC. The following changes shall be made to the IECC:. (Portions of code section not shown remain unchanged.) ~~15. Change the frame wall U-factor categories for Climate Zones 3A, 4A and 5A in Table R402.1.2 to read:~~

	~~Frame Wall U-Factor~~
	~~0.079~~

~~16. Change the wood frame wall R-Value categories for Climate Zones 3A, 4A, and 5A in Table R402.1.3 to read:~~

	~~Wood Frame Wall R-Value~~ ~~Wood Frame Wall R-Value~~
	~~15 or 13+1~~

Reason Statement:

The purpose of this proposal is to bring Virginia's standards for wall insulation into compliance with the 2024 IECC.

Virginia's residential building code has been behind the IECC's wall energy efficiency standards for over a decade -- since the 2012 IECC update. Virginia is even farther behind today since it failed to strengthen code standards for wall insulation to adopt the 2021 IECC standards, which strengthened wall insulation standards beyond the IECC's 2012 level, and which remain in the 2024 IECC standards.

Despite a decade of actual experience, IECC never weakened the wall insulation standards to levels below the 2012 IECC standards. Instead, as noted, the IECC strengthened the wall insulation standards in 2021.

Tightening wall insulation standards is important to residents —whether owners or tenants--, since it would help them save money, and experience greater comfort and a healthier home for decades after the dwelling is built.

Tightening prescriptive construction standards for wall insulation will help to

- **(a) reduce occupancy costs, including for heating and conditioning of air in the dwelling,**
- **(b) reduce exposure to mold that can build up in walls,**
- **(c) increase residents' comfort,**
- **(d) increase physical and economic resiliency to power outages, climate change and rising energy prices,**
- **(e) reduce gaps for pests to enter the dwelling,**
- **(f) reduce pressure on utilities to raise rates in order to build and operate more energy delivery capabilities, and**
- **(g) reduce the air pollution that drives climate impacts and other harms to Virginia's health, property and economy.**

Legal Standards. Remaining at 5.0 ACH level would leave Virginia's building code out of compliance with statutory standards. **Sections 36-99A and 36-99B of the Virginia Code** states that building codes are required to "protect the health, safety and welfare of the residents of the Commonwealth" and that adjustments to reduce construction costs must nevertheless be **"consistent with recognized standards of health, safety, energy efficiency and water efficiency."** VIRGINIA ACTS OF ASSEMBLY – 2021 SPECIAL SESSION I, CHAPTER 425, Section 1 (referred to herein as "**H2227")**, which was enacted in 2021, calls for adoption of energy efficiency standards that are "at least as stringent" as the latest IECC considering factors such as consumer costs "over time" and air pollution.

Cost and energy savings. Beginning with its review of the 2012 IECC, in which the 3.0 ACH standard was first adopted, the U.S. Department of Energy and the Pacific Northwest National Laboratories (collectively DOE) has found that residents would save money from full implementation of each IECC update from 2012-2024 even after considering incremental purchase and mortgage costs. Focusing on the three most significant IECC updates containing the 3.0 ACH standard, DOE found that, over 30 years, lifecycle savings (i.e., net of additional purchase and mortgage costs): **full implementation of the 2012 IECC** (which introduced the 3.0 ACH requirement for Virginia's climate zone) would save average Virginia residents **$5,836, if adopted**; **full implementation of the 2021 IECC** would save Virginia residents **$8,376, if adopted**; and **full implementation of the 2024 IECC** would save residents of Virginia's Climate Zone 4 **$3,790 and Zones 2 and 5 an average of $2,502 compared to 2021 IECC**. Savings would have been achieved year in and year out, with rapid payback and lasting for decades. [2]

Collectively, Virginians would save billions of dollars in energy costs from full implementation of the IECC, greatly benefiting residents and Virginia's economy. In its July 2021 report on "Cost-Effectiveness of the 2021 IECC for Residential Buildings in Virginia" (PNNL-31627), PNNL found that aggregate energy cost savings for Virginia residents from adopting the full 2021 IECC would be $7,192,000 in the first year and $2,487,000,000 over 30 years. Virginia would achieve substantial pollution reductions and add jobs.

Significantly, even as it preserved the 2021 IECC's prescriptive wall insulation standards, the 2024 IECC offered 's builders greater flexibility to achieve total efficiency targets through Simulated Building Performance and ERI compliance paths. These performance-based paths permit builders to trade some efficiency measures for other efficiency measures, provided they meet the code's overall efficiency goals. Importantly, however, the 2024 IECC's compliance flexibility are expressly tied to the 2024 Prescriptive Path's standards for envelope efficiency, including wall insulation. **The added flexibility was not intended to permit builders to reduce efficiency from a state-weakened baseline below the 2024 IECC's prescriptive standards for walls or otherwise**. Such double-dipping would be anything but "consistent with" or "at least as stringent as" the 2024 IECC.

Pollution Reductions. DOE has also repeatedly found that full compliance with the IECC's updates will reduce energy use and air pollution, including greenhouse gas pollution, which is critical to Virginians' future. Energy use in buildings is one of the largest drivers of CO2 emissions in Virginia. By cutting energy usage, **full implementation of the IECC's efficiency standards without weakening amendments would reduce air pollution, including greenhouse gas pollution that is driving climate change**. DOE found that full implementation of the 2024 IECC alone would reduce carbon emissions by 6.5% compared to the 2021 IECC, and the 2021 IECC would reduce carbon emissions by 8.7% compared to the prior IECC. (Full implementation of just the 2021 IECC "**will reduce statewide CO2 emissions over 30 years by 28,420,000 metric tons,** equivalent to the annual CO2 emissions of 6,181,000 cars on the road (1 MMT CO2 = 217,480 cars driven/year).") Applying the social cost of carbon to the CO2 reductions recognizes huge economic savings from to Virginia and the U.S. [3]

Given the 50-100 lifespans of new buildings, the accumulation of more efficient buildings over years will have significant impacts on reducing future climate and other pollution. Conversely, permitting less efficient new building to be constructed under weaker building code standards will have the opposite effect: driving up pollution and climate driven harms to all Virginians.

Climate change is already harming Virginia, and the harms will get much worse if we do not sharply reduce GHG emissions (particularly CO2 and methane). Growing climate dangers include harms to communities, infrastructure, people, property and the economy from rising seas, worsening storms and more severe rainfall events. Growing dangers also include rising atmospheric and water temperatures that threaten worsening heat-related illnesses, limits on economic activity, agriculture, fisheries, and our natural heritage. The likelihood of mitigating and recovering from those harms declines the longer we delay maximizing energy efficiency and minimizing GHG pollution.

--[1] See IECC; https://basc.pnnl.gov/information/infiltration-meets-ach50-requirements ; http://passivehousebuildings.com/books/phc-2019/five-principles-of-passive-house-design-and-construction/ .

--[2] The U.S. Department of Energy and Pacific Northwest National Laboratories found that **full compliance with the 2012 IECC, including its stronger standards for wall insulation,** would save money even after considering purchase and mortgages costs and otherwise benefit residents compared to earlier standards. DOE/PNNL, National Energy Cost Savings for New Single and Multifamily Homes, A Comparison of the 2006, 2009, and 2012 Editions of the IECC, https://www.energycodes.gov/sites/default/files/documents/NationalResidentialCostEffectiveness.pdf Subsequently, DOE found that the 2021 IECC update, which strengthened wall insulation standards again, would reduce energy use and save money over the life of the dwelling, even after considering purchase and mortgage costs. DOE/PNNL, **Cost-Effectiveness of the 2021 IECC for Residential Buildings in Virginia** (July 2021). And, DOE/PNNL found that the 2024 IECC would save money for residents even after considering purchase and mortgage costs, **Energy Savings Analysis: 2024 IECC for Residential Buildings** (Dec. 2024); https://www.energycodes.gov/national-and-state-analysis. PNNL, **National Cost-Effectiveness of the Residential Provisions of the 2024 IECC** (January 2025). See also https://www.energycodes.gov/determinations

--[3] PNNL, Impacts of Model Building Energy Codes (Nov. 2023) (estimating climate and health benefits in excess of $40,000,000,000 2010-2040 from residential energy building code). See also Notes [1][2] and PNNL report cited above.

Cost Impact: The code change proposal will increase the cost

Increasing the amount of wall insulation will somewhat increase construction costs. However, many choices affect the incremental costs, and the flexibility afforded by the Simulated Performance and ERI paths will enable builders to reduce costs.

Moreover, as discussed in the Reason Statement, **repeated findings by DOE and PNNL have shown that there is a net reduction of**

costs to residents when the IECC is fully implemented: (a) the cost increases are more than offset by the resulting energy cost savings; (b) the cost savings will last for decades and be accompanied by other important benefits, including more comfortable and healthier dwellings and greater resiliency to power outages and energy cost increases.

As found by DOE/PNNL (see notes in Reason Statement), residents will save money by keeping up with the IECC. Looking at the three IECC updates relevant to wall insulation, the savings are substantial.

Savings from Full Adoption of 2024, 2021 and 2012 IECC

National or Virginia Average	Life-cycle Cost Savings
Nat'l – Full 2024 IECC Savings CZ 4, 3 & 5	CZ4 -$3,790 CZ3 - $2,509 CZ5 - $2,496
VA - Full 2021 IECC Savings	$8,376
VA- Full 2012 IECC Savings	$5,836

Energy cost savings over time are critical to defining "affordability" of housing.

- By reducing residents' occupancy costs (including utilities) and making dwellings more resilient, the 2024 IECC's energy efficiency requirements will make housing more affordable for owner-occupants and tenants for decades, not just at a buyer's closing date.
- H2227 which requires a decision based on savings and other benefits over time compared to construction costs, not by just looking at construction costs.
- State and federal laws and policies define "affordability" in terms of occupancy costs, including mortgages, rents and utility costs.
- Insulation represents only a small component of total construction costs. Insulation represents 0.017 of the cost of construction, according to a published survey. *"How Much Does It Cost To Build A House In 2023?"* https://www.forbes.com/home-improvement/contractor/cost-to-build-a-house/_ Yet, unlike other housing construction costs, energy efficiency saves money for residents during many years of occupancy, making housing more affordable.
- There are programs in Virginia to assist low-income residents with costs of downpayments, mortgages and rents and to subsidize builders' construction of low-income housing. *See* JLARC, *Report to the Governor and the General Assembly, Affordable Housing in Virginia 2021.*

REC-R402.4.1.2-24

VRC: N1102.4.1.2, N1102.4.1.3; VCC: 1301.1.1.1

Proponents: Eric Lacey, representing Responsible Energy Codes Alliance (eric@reca-codes.com)

2021 Virginia Residential Code

Delete without substitution:

~~**N1102.4.1.2 (R402.4.1.2) Testing.** The building or *dwelling unit* shall be tested and verified as having an air leakage rate not exceeding 5 air changes per hour. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779, or ASTM E1827 and reported at a pressure of 0.2 inches w.g. (50 Pa). A written report of the results of the test shall be signed by the party conducting the test and provided to the building official. Testing shall be conducted by a Virginia licensed general contractor, a Virginia licensed HVAC contractor, a Virginia licensed home inspector, a Virginia registered design professional, a certified BPI Envelope Professional, a certified HERS rater, or a certified duct and envelope tightness rater. The party conducting the test shall have been trained on the equipment used to perform the test. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.~~

~~**Note:** Should additional sealing be required as a result of the test, consideration may be given to the issuance of temporary certificate of occupancy in accordance with Section 116.1.1.~~

~~**During testing:**~~

1. ~~Exterior windows and doors and fireplace and stove doors shall be closed, but not sealed beyond the intended weather stripping or other infiltration control measures;~~
2. ~~Dampers, including exhaust, intake, makeup air, backdraft, and flue dampers shall be closed, but not sealed beyond intended infiltration control measures;~~
3. ~~Interior doors, if installed at the time of the test, shall be open;~~
4. ~~Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;~~
5. ~~Heating and cooling systems, if installed at the time of the test, shall be turned off; and~~
6. ~~Supply and return registers, if installed at the time of the test, shall be fully open.~~

~~**Exception:** When testing individual *dwelling units*, an air leakage rate not exceeding 0.30 cubic feet per minute per square foot [0.008 $m^3/(s \times m^2)$] of the *dwelling unit* enclosure area, tested in accordance with ANSI/RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch water gauge (50 Pa), shall be permitted in all climate zones for:~~

1. ~~Attached single- and multiple-family building *dwelling units.*~~
2. ~~Buildings or *dwelling units* that are 1,500 square feet (139.4 m^2) or smaller.~~

~~Mechanical *ventilation* shall be provided in accordance with Section M1505 of this code or Section 403.3.2 of the *International Mechanical Code*, as applicable, or with other *approved* means of *ventilation*.~~

~~**N1102.4.1.3 (R402.4.1.3) Leakage rate.** When complying with Section N1101.2.1 (R401.2.1), the building or *dwelling unit* shall have an air leakage rate not exceeding 5 air changes per hour in Climate Zones 3 through 5, when tested in accordance with Section N1102.4.1.2 (R402.4.1.2).~~

2021 Virginia Construction Code

Revise as follows:

1301.1.1.1 Changes to the *International Energy Conservation Code* (IECC). The following changes shall be made to the IECC :

~~**[V] Changes to the *International Energy Conservation Code* (IECC).** The following changes shall be made to the IECC:~~

~~19. Change Section R402.4.1.2 of the IECC to read:~~

~~**R402.4.1.2 Testing.** The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). A written report of the results of the test shall be signed by the party conducting the test and provided to the building official. Testing shall be conducted by a Virginia licensed general contractor, a Virginia licensed HVAC contractor, a Virginia licensed home inspector, a Virginia *registered design professional*, a certified BPI Envelope Professional, a certified HERS rater, or a certified duct and envelope tightness rater. The party conducting the test shall have been trained on the equipment used to perform the test. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.~~

~~**Note:** Should additional sealing be required as a result of the test, consideration may be given to the issuance of a temporary certificate of occupancy in accordance with Section 116.1.1 .~~

~~**During testing:**~~

~~1. Exterior windows and doors and fireplace and stove doors shall be closed, but not sealed beyond the intended weatherstripping or other infiltration control measures.~~

~~2. Dampers, including exhaust, intake, makeup air, backdraft and flue dampers, shall be closed, but not sealed beyond intended infiltration control measures.~~

~~3. Interior doors, if installed at the time of the test, shall be open.~~

~~4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.~~

~~5. Heating and cooling systems, if installed at the time of the test, shall be turned off.~~

~~6. Supply and return registers, if installed at the time of the test, shall be fully open.~~

~~20. Change Section R402.4.1.3 of the IECC to read:~~

~~**R402.4.1.3 Leakage rate.** When complying with Section R401.2.1 , the building or dwelling unit shall have an air leakage rate not exceeding 5.0 air changes per hour in Climate Zones 3 through 5, when tested in accordance with Section R402.4.1.2 .~~

Reason Statement:

This proposal would improve the efficiency and durability of residential buildings and help maintain healthier indoor air quality by incorporating the air leakage testing requirements of the 2024 IECC into Virginia's code. Since the 2012 edition, the IECC has required all new residential dwellings in Virginia's climate zones to be tested and to verify a maximum total envelope leakage of 3.0 ACH50. However, Virginia did not adopt a testing requirement until the 2018 edition of the VCC, and set the maximum leakage allowance at 5.0 ACH50. That requirement remained unchanged in the 2021 VCC update, even though the 2021 IECC adopted additional flexibility that allows code users several alternatives for meeting the air tightness requirements. We believe Virginia is ready to catch up with the IECC envelope air leakage requirements. A well-sealed, verified thermal envelope will provide energy savings and promote better indoor air quality over the 70- to 100-year useful life of the home.

This proposal intends to delete the VA-specific amendments in order to incorporate the 2024 IECC air leakage testing requirements as published. This would result in the following changes:

1. All new dwelling units would be required to be air leakage tested, but the maximum allowable leakage for prescriptive compliance would improve from 5.0 ACH50 to 3.0 ACH50 in all Virginia climate zones.

2. The performance path baseline (R405) would be set at 3.0 ACH50, but dwellings could test as high as 5.0 ACH50 as long as efficiency losses are accounted for in other efficiency improvements. This allows considerable flexibility for code users who still find it challenging to achieve 3.0 ACH50, while maintaining the same overall efficiency required by the code.

3. Multifamily dwelling units (of any size) and buildings with 1500 square feet or less of conditioned floor area have the option to be tested to 0.27 cfm/min/ft2 of testing unit enclosure area. This will help address the challenges of achieving low ACH in smaller dwellings.

Cost Impact: The code change proposal will increase the cost

It is possible that some additional time or materials will be required to achieve the lower air leakage number; however, we note that the largest cost is typically the cost of the blower door test itself, which is already required under the VA UCC.

REC-R402.4.1.2(1)-24

VCC: 1301.1.1.1

Proponents: William Penniman, representing Sierra Club Virginia Chapter (wpenniman@aol.com)

2021 Virginia Construction Code

Revise as follows:

1301.1.1.1 Changes to the *International Energy Conservation Code* (IECC). (Portions of code section not shown remain unchanged.) The following changes shall be made to the IECC :

19. ~~Change Section R402.4.1.2 of the IECC to read:~~

~~**R402.4.1.2 Testing.** The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). A written report of the results of the test shall be signed by the party conducting the test and provided to the building official. Testing shall be conducted by a Virginia licensed general contractor, a Virginia licensed HVAC contractor, a Virginia licensed home inspector, a Virginia *registered design professional*, a certified BPI Envelope Professional, a certified HERS rater, or a certified duct and envelope tightness rater. The party conducting the test shall have been trained on the equipment used to perform the test. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope.~~

~~**Note:** Should additional sealing be required as a result of the test, consideration may be given to the issuance of a temporary certificate of occupancy in accordance with Section 116.1.1 .~~

~~**During testing:**~~

1. ~~Exterior windows and doors and fireplace and stove doors shall be closed, but not sealed beyond the intended weatherstripping or other infiltration control measures.~~
2. ~~Dampers, including exhaust, intake, makeup air, backdraft and flue dampers, shall be closed, but not sealed beyond intended infiltration control measures.~~
3. ~~Interior doors, if installed at the time of the test, shall be open.~~
4. ~~Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.~~
5. ~~Heating and cooling systems, if installed at the time of the test, shall be turned off.~~
6. ~~Supply and return registers, if installed at the time of the test, shall be fully open.~~

20. ~~Change Section R402.4.1.3 of the IECC to read:~~

~~**R402.4.1.3 Leakage rate.** When complying with Section R401.2.1 , the building or dwelling unit shall have an air leakage rate not exceeding 5.0 air changes per hour in Climate Zones 3 through 5, when tested in accordance with Section R402.4.1.2 .~~

Reason Statement:

The purpose of this proposal is to bring Virginia's standards for air leakage rates into compliance with the 2024 IECC.

Virginia needs to adopt the IECC's 3.0 ACH (or 3 ACH50) air leakage standard, which has been in the national code since the 2012 IECC update. There is no valid reason for Virginia to continue a prescriptive air leakage standard that dates back to 2009.

The 2024 IECC is the fifth consecutive IECC to set the prescriptive standard for Virginia's climate zones at a maximum of 3.0 ACH. The IECC would not have repeatedly prescribed a 3.0 ACH maximum if actual experience had demonstrated that compliance was either impractical or raised costs or burdens that outweighed the benefits. The IECC has had four cycles, since 2012, to raise the

ACH from 3.0 to 5.0, but it has not done so.

Tightening building air sealing to 3.0 ACH is important to residents—both owners and tenants--, since it would help them save money, and experience greater comfort and a healthier home for decades after the dwelling is built. Virginia's 5.0 ACH standard allows 67% more air changes per hour than the IECC's 3.0 ACH standard.

Tightening prescriptive construction standards to 3.0 ACH will help to

(a) reduce occupancy costs, including for heating and conditioning of air in the dwelling,
(b) reduce exposure to mold that can build up in walls,
(c) increase residents' comfort,
(d) increase physical and economic resiliency to power outages, climate change and rising energy prices,
(e) reduce gaps for pests to enter the dwelling,
(f) reduce pressure on utilities to raise rates in order to build and operate more energy delivery capabilities, and
(g) reduce the air pollution that drives climate impacts and other harms to Virginia's health, property and economy.

It is noteworthy that, while the 2024 IECC retains the 3.0 ACH prescriptive standard, It also **offers builders some flexibility to trade efficiency measures, including to allow up to 4.0 ACH of air leakage, when implementing Simulated Building Performance and ERI implementation methods. However, the 2024 IECC's addition of trading flexibility is premised on full adoption of the IECC's prescriptive baseline code, including 3.0 ACH.**

Legal Standards. Remaining at 5.0 ACH level would leave Virginia's building code out of compliance with statutory standards. **Sections 36-99A and 36-99B of the Virginia Code make clear that building codes are required to "protect the health, safety and welfare of the residents of the Commonwealth" and that adjustments to reduce construction costs must nevertheless be "consistent with recognized standards of health, safety, energy efficiency and water efficiency."** **H2227**, which was enacted in 2021, calls for adoption of energy efficiency standards that are **"at least as stringent" as the latest IECC considering factors such as consumer costs "over time" and air pollution.** VIRGINIA ACTS OF ASSEMBLY – 2021 SPECIAL SESSION I, CHAPTER 425, Section 1 (referred to herein as "H2227"). Thus, like energy costs over time, pollution is a named factor to be considered in connection with building code efficiency standards.

Broad Consensus. There is a broad consensus among recognized standards that tighter sealing of walls protects the health, safety and welfare of residents, and some recognized programs have stricter standards, which is part of why the IECC has incorporated the 3.0 ACH prescriptive standard in five consecutive IECC cycles from 2012-2024.

In its commentary on its 2024 ACH levels for new residential construction, the ICC explains the importance of its air leakage standards: "**Insulation alone is not enough to moderate indoor temperatures. Sealing the building envelope is critical to good thermal performance of the building.** Insulation is important because it traps pockets of air creating stagnant air resistant to temperature change, but the air barrier is needed to stop the movement of air from scrubbing away those pockets of air. **Regardless of the compliance option chosen in Section R401.2, air leakage limits apply, and all air leakage requirements of this section must be met**." Citing EPA, the IECC commentary states that air leakage "can account for 25 to 40 percent of the energy used for heating and cooling in a typical residence." (ICC, 2024 IECC Code and Commentary.)

In EnergyStar: A complete Thermal Enclosure System (2017), EPA advised: "The energy savings from comprehensive air sealing can quickly add up when you consider all the places hot or cool air can enter or escape from your home. Having a well-sealed home also means better air quality because dirt, pollen, pests, and moisture can't get in as easily. In addition, good sealing practices help protect your home against mold and moisture damage that can be caused by condensation."

Even the NAHB has advised builders of the importance of air sealing and strategies to go below 3.0 ACH. See NAHB, et al., "TechNote – Building Tightness Code Compliance & Air Sealing Overview", which (a) states "Air leakage in a building should be minimized;" (b) identifies benefits to residents including ""Heating & cooling energy savings; Reduced potential for moisture movement through the building thermal enclosure; Improved insulation effectiveness and reduced risk of ice dams; Reduced peak heating and cooling loads resulting in smaller HVAC equipment; Improved comfort (reduces drafts and noise); Improved indoor air quality (limits contaminants from garages, crawl spaces, attics, and adjacent units)" and (c) suggests a possible construction strategy with a goal of 2.5 ACH – stricter than the IECC.

The feasibility of meeting a 3.0 ACH standard is underscored by the IECC's repeated adoption of 3.0 ACH for Virginia's climate zones; by its adoption of a 2.5 ACH standard for Climate Zones north of Virginia's; by use of 3.0 in the EnergyStar program; by DOE's use of tighter standards in its net-zero ready program (2.5 ACH for CZ3-4 and 2.0 for CZ 5); and by the PassiveHouse standard of 0.6 ACH for its program.[1]

Cost and energy savings. Beginning with its review of the 2012 IECC, in which the 3.0 ACH standard was first adopted, the U.S. Department of Energy and the Pacific Northwest National Laboratories (collectively DOE) has found that residents would save money from full implementation of each IECC update from 2012-2024 even after considering incremental purchase and mortgage costs. Focusing on the three most significant IECC updates containing the 3.0 ACH standard, DOE found that, over 30 years, lifecycle savings (i.e., net of additional purchase and mortgage costs): **full implementation of the 2012 IECC** (which introduced the 3.0 ACH requirement for Virginia's climate zone) would have saved average Virginia residents **$5,836**; **full implementation of the 2021 IECC** would have save Virginia residents **$8,376**; and full implementation of the 2024 IECC would save Virginia residents of Virginia's Climate Zone 4 **$3,790 and Zones 2 and 5 an average of $2,502 compared to 2021 IECC**. Savings would have been achieved year in and year out, with rapid payback and lasting for decades. [2]

Collectively, Virginians would save billions of dollars in energy costs from full implementation of the IECC, greatly benefiting residents and Virginia's economy. In its July 2021 report on "Cost-Effectiveness of the 2021 IECC for Residential Buildings in Virginia" (PNNL-31627), PNNL found that aggregate energy cost savings for Virginia residents from adopting the full 2021 IECC would be $7,192,000 in the first year and $2,487,000,000 over 30 years. Virginia would achieve substantial pollution reductions and add jobs.

Pollution Reductions. DOE has also repeatedly found that full compliance with the IECC's updates will reduce energy use and air pollution, including greenhouse gas pollution, which is critical to Virginians' future. Energy use in buildings is one of the largest drivers of CO2 emissions in Virginia. By cutting energy usage, **full implementation of the IECC's efficiency standards without weakening amendments would reduce air pollution, including greenhouse gas pollution that is driving climate change**. DOE found that full implementation of the 2024 IECC alone would reduce carbon emissions by 6.5% compared to the 2021 IECC, and the 2021 IECC would reduce carbon emissions by 8.7% compared to the prior IECC. (Full implementation of just the 2021 IECC "**will reduce statewide CO2 emissions over 30 years by 28,420,000 metric tons,** equivalent to the annual CO2 emissions of 6,181,000 cars on the road (1 MMT CO2 = 217,480 cars driven/year).") Applying the social cost of carbon to the CO2 reductions recognizes huge economic savings from to Virginia and the U.S. [3]

The accumulation of more efficient buildings over years will have significant impacts on reducing future climate and other pollution. Conversely, allowing less efficient new building to be constructed under weaker building code standards will have the opposite effect: driving up pollution and climate driven harms to all Virginians.

Climate change is already harming Virginia, and the harms will get much worse if we do not sharply reduce GHG emissions (particularly CO2 and methane). Growing climate dangers include harms to communities, infrastructure, people, property and the economy from rising seas, worsening storms and more severe rainfall events. Growing dangers also include rising atmospheric and water temperatures that threaten worsening heat-related illnesses, limits on economic activity, agriculture, fisheries, and our natural heritage. The likelihood of mitigating and recovering from those harms declines the longer we delay maximizing energy efficiency and minimizing GHG pollution.

--[1] See IECC; https://basc.pnnl.gov/information/infiltration-meets-ach50-requirements ; http://passivehousebuildings.com/books/phc-2019/five-principles-of-passive-house-design-and-construction/ .

--[2] The U.S. Department of Energy found that full compliance with the 2012 IECC would save money and benefit residents compared to earlier standards. DOE/PNNL, National Energy Cost Savings for New Single and Multifamily Homes, A Comparison of the 2006, 2009, and 2012 Editions of the IECC, https://www.energycodes.gov/sites/default/files/documents/NationalResidentialCostEffectiveness.pdf DOE found that the 2024 and 2021 IECC updates would reduce energy use and save money over the life of the dwelling, even after considering mortgage costs. U.S. Department of Energy, **Energy Savings Analysis: 2024 IECC for Residential Buildings** (Dec. 2024); DOE/PNNL, **Cost-Effectiveness of the 2021 IECC for Residential Buildings in Virginia** (July 2021), https://www.energycodes.gov/national-and-state-analysis. Following promulgation of the 2012 IECC, DOE found that the 2012 IECC changes improved efficiency and were cost effective for occupants because they saved money year after year for decades, more than recouping the cost of construction. DOE/PNNL, **National Energy Cost Savings for New Single and Multifamily Homes, A Comparison of the 2006, 2009, and 2012 Editions of the IECC**, https://www.energycodes.gov/sites/default/files/documents/NationalResidentialCostEffectiveness.pdf See also https://www.energycodes.gov/determinations

--[3] PNNL, Impacts of Model Building Energy Codes (Nov. 2023) (estimating climate and health benefits in excess of $40,000,000,000 2010-2040 from residential energy building codes). See Notes [1][2] and PNNL report cited above.

Cost Impact: The code change proposal will increase the cost

Bringing Virginia in line with the IECC's 3.0 ACH air leakage standards may modestly increase the cost of construction, but those costs will be outweighed by reduced occupancy costs and improved health, comfort and resiliency for residents. The excess of benefits over costs is why the IECC has required 3.0 ACH for Virginia's Climate Zones for 5 consecutive updates: 2012-2024. (See Reason Statement, above.)

The costs of additional caulking, weather-stripping, gaskets, taping and other sealing measures are very limited, since workers will be on site, and the quantity of additional material is small. Planning, care and attention by builders during the framing, insulating and sealing processes is mainly what is needed to achieve the 3.0 ACH standard.

According to GreenBuildingAdvisor, “Once builders get their crews trained, 3 ACH50 should cost them the same as 5 or 7 ACH50.” https://www.greenbuildingadvisor.com/article/how-much-air-leakage-in-your-home-is-too-much

Having had more than a decade to train their crews to seal gaps and to meet blower door tests, Virginia builders should be fully capable of meeting the 3.0 ACH prescriptive standard. In addition to the time since the IECC’s 2012 adoption of 3.0 ACH, Virginia builders will have a year from the effective date of Virginia’s 2024 update to adjust their construction practices to meet the long-recognized model standard.

Under the 2024 IECC, cost impacts can also mitigated by the 2024 IECC’s permitting builders to go to 4.0 ACH with trading options for Simulated Performance and ERI compliance paths. However, that flexibility was premised upon full implementation of the IECC's prescriptive standards.

Achieving 3.0 ACH or better during initial construction is critical. Leaving buyers to retrofit after a house has been purchased would be very expensive since it would require the owner to reopen, close and refinish walls, replace windows and doors, etc. In addition to energy cost saving, comfort and health benefits from achieving 3.0 ACH, minimizing the need for future retrofits and repairs should be recognized as a cost benefit to residents.

REC-R403.14-24

IECC: R403.14 (N1103.14) (New)

Proponents: William Penniman, representing Sierra Club Virginia Chapter (wpenniman@aol.com)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

R403.14 (N1103.14) Ceiling fans. R403.14 (N1103.14). A ceiling fan (with variable speeds and reversible direction) shall be installed in each bedroom and in the dwelling's planned principal living area (such as family room, living room, den).

Exception: such fans are not required in rooms with ceilings less than 8 feet high.

Reason Statement:

Ceiling fans save energy and improve comfort for residents. They are an inexpensive, well-established technology.

The U.S. Department of Energy (https://www.energy.gov/energysaver/fans-cooling) states:

"Ceiling fans are the most effective type of circulating fan. They help improve comfort year-round by effectively circulating air throughout a room.

- **Summer Use:** Run ceiling fans counterclockwise to create a cooling breeze.
- **Winter Use:** Reverse the direction to clockwise and set to low speed to circulate warm air from the ceiling down to living spaces.
- **Energy Savings:** Using a ceiling fan allows you to raise the thermostat setting by about 4°F without reducing comfort. In moderate climates, ceiling fans can sometimes replace air conditioning altogether."

Distributing air with a ceiling fan will also improve comfort in rooms cooled by mini-splits or window air conditioners.

The potential energy and energy cost savings are very large when residents have the ability to live comfortably with temperatures set up to 4 degrees higher during the summer air-conditioning season. The benefits from ceiling fans will grow as climate change extends and exacerbates the annual air-conditioning season. As noted by DOE, winter demand can be reduced as well as summer demand.

Reduced demands for electricity will also reduce the driver of utilities' capital and operating costs. That will reduce rates for all customers and reduce utilities' need for intrusive and harmful construction projects to build or modify generation, transmission, distribution. Those reductions will benefit all Virginians.

Cost Impact: The code change proposal will increase the cost

Installing ceiling fans will modestly increase costs of construction but it will save money and improve comfort for residents for many years. The ability to reduce air conditioning demands by up to 4.0 F degrees will provide large savings for occupants and for utilities.

A 52-inch ceiling fan with a light, variable speeds and reversible directions can be purchased at retail for as little as $60, and installation is no different from (and can even replace) installing a ceiling light. See, e.g., https://www.amazon.com/Ohniyou-Ceiling-Profile-Control-Dimmable/dp/B0DXFLNKCJ?crid=3J2IIQUXNZIAI&dib=eyJ2IjoiMSJ9.035Rew5g2JQX-yOrWMaQ5X0_PCf-9ByTBjHjo0-RBTi2jXK9VQXVyNm-b0XSNpGg2bn8xdtXMa2VLwNz2nzmOwhwcgNY-njojkzwSNqvMRHFfb18LpOVgDkbCbvHcHgAl6j69IOfmzLvDiAeOCeSzv1UqZCINgXXnxBXDT9FOl-FGzOcv3qGrmoct76tOrzsitPHrxTYkV1qRnofgIOhcPakbcl1GPRy4T796CzzMVGBZw-Fcm-G2VfTw3KWYvqtn3JiI1V7JZFuFw6SITZKj0q6N05ZNVVB0XnLvDVWvIY.dfokKyMLwF_aIO4ZXX5iNK2K7HXLDwPfArQeIuh0taQ&dib_tag=16&th=1.

REC-R404.5-24

IECC: 404.5 (N1104.5) (New), 404.5.1 (N1104.5.1) (New), 404.5.2 (N1104.5.2) (New), 404.5.2.1 (N1104.5.2.1) (New), 404.5.2.2 (N1104.5.2.2) (New), 404.5.2.3 (N1104.5.2.3) (New), 404.5.2.4 (N1104.5.2.4) (New), 404.5.2.5 (N1104.5.2.5) (New)

Proponents: William Penniman, representing Sierra Club Virginia Chapter (wpenniman@aol.com)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

404.5 (N1104.5) ELECTRIC VEHICLE POWER TRANSFER.

404.5.1 (N1104.5.1) Definitions.

AUTOMOBILE PARKING SPACE. A space within a building or private or public parking lot, exclusive of driveways, ramps, columns, office and work areas, for the parking of an automobile.

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, electric vehicle supply equipment (EVSE), a rechargeable storage battery, a fuel cell, a photovoltaic array or another source of electric current.

ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE). A designated automobile parking space that is provided with electrical infrastructure such as, but not limited to, raceways, cables, electrical capacity, a panelboard or other electrical distribution equipment space necessary for the future installation of an EVSE.

ELECTRIC VEHICLE READY SPACE (EV READY SPACE). An automobile parking space that is provided with a branch circuit and an outlet, junction box or receptacle that will support an installed EVSE.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). Equipment for plug-in power transfer, including ungrounded, grounded and equipment grounding conductors; electric vehicle connectors; attached plugs; any personal protection system; and all other fittings, devices, power outlets or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

ELECTRIC VEHICLE SUPPLY EQUIPMENT INSTALLED SPACE (EVSE SPACE). An automobile parking space that is provided with a dedicated EVSE connection.

404.5.2 (N1104.5.2) Electric vehicle power transfer infrastructure. New residential automobile parking spaces for residential buildings shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.5.2.1 through R404.5.2.5.

404.5.2.1 (N1104.5.2.1) Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other on-site private parking provided adjacent to the dwelling unit shall be provided with one EV capable, EV ready or EVSE space per dwelling unit. R-2 occupancies or allocated parking for R-2 occupancies in mixed-use buildings shall be provided with an EV capable space, EV ready space or EVSE space for 40 percent of the dwelling units or automobile parking spaces, whichever is less.

Exceptions:

1. Where the local electric distribution entity certifies in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated certificate of occupancy date, the required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.

2. Where substantiation is approved that meeting the requirements of Section R404.5.2.5 will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the builder or developer by more than $450 per dwelling unit.

404.5.2.2 (N1104.5.2.2) EV Capable Spaces. R404.5.2.2 (N1104.5.2.2)EV capable spaces.
Each EV capable space used to meet the requirements of Section R404.5.2.1 shall comply withall of the following:

1. A continuous raceway or cable assembly shall be installed between a suitable panelboard or other on-site electrical distribution equipment and an enclosure or outlet located within 6 feet (1828 mm) of the EV capable space.

2. The installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with Section R404.5.2.5.

3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a two-pole circuit breaker or set of fuses.

4. The electrical enclosure or outlet and the electrical distribution equipment directory shall be marked: “For future electric vehicle supply equipment (EVSE).”

404.5.2.3 (N1104.5.2.3) EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply withall of the following:
1. Termination at an outlet or enclosure, located within 6 feet (1828 mm) of each EV ready space it serves and marked “For electric vehicle supply equipment (EVSE).”

2. Service by an electrical distribution system and circuit capacity in accordance with Section R404.5.2.5.

3. Designation on the panelboard or other electrical distribution equipment directory as “For electric vehicle supply equipment (EVSE).”

404.5.2.4 (N1104.5.2.4) EVSE Spaces. An installed EVSE with multiple output connections shall be permitted to serve multiple EVSE spaces. Each EVSE serving either a single EVSE space or multiple EVSE spaces shall comply with the following:
1. Be served by an electrical distribution system in accordance with Section R404.5.2.5.

2. Have a nameplate charging capacity of not less than 6.2 kVA (or 30A at 208/240V) per EVSE space served. Where an EVSE serves three or more EVSE spaces and is controlled by an energy management system in accordance with Section R404.5.2.5, the nameplate charging capacity shall be not less than 2.1 kVA per EVSE space served.

3. Be located within 6 feet (1828 mm) of each EVSE space it serves.

4. Be installed in accordance with NFPA 70 and be listed and labeled in accordance with UL 2202 (Electric Vehicle (EV) Charging System Equipment—with revisions through February 2018) or UL 2594 (Standard for Electric Vehicle Supply Equipment Standard for Electric Vehicle Supply Equipment.)

404.5.2.5 (N1104.5.2.5) Electrical distribution system capacity. The branch circuits and electrical distribution system serving each EV capable space, EV ready space and EVSE space used to comply with Section R404.5.2.1 shall comply with one of the following:
1. Sized for a calculated EV charging load of not less than 6.2 kVA per EVSE, EV ready or EV capable space. Where a circuit is shared or managed, it shall be in accordance with NFPA 70.

2. The capacity of the electrical distribution system and each branch circuit serving multiple EVSE spaces, EV ready spaces or EV capable spaces designed to be controlled by an energy management system in accordance with NFPA 70 shall be sized for a calculated EV charging load of not less than 2.1 kVA per space. Where an energy management system is used to control EV charging loads for the purposes of this section, it shall not be configured to turn off electrical power to EVSE or EV used to comply with Section R404.5.2.1.

Reason Statement:

The purpose of this proposal is to incorporate into Virginia's residential building code the substance of 2024 IECC's Appendix RE which spells out requirements to install electric vehicle charging infrastructure in connection with new residential construction. Appendix RE comes with the 2024 IECC, but activation of Appendix RE requires inserting language into the Virginia Construction Code for residential construction, which this proposal would do by adding a new Section R404.5 and N1104.5.

Adoption of this proposal would benefit residents of new buildings by facilitating convenient electric vehicle charging, which can readily be expanded as the need grows. Implementation would benefit residents and the public with cost savings, pollution reduction (including greenhouse gases, ozone and carbon monoxide) and more equitable access to EVs and EV charging for residents. It would avoid the much higher costs of having to retrofit parking areas and building electrical systems.

Under Section 405, builders would be able to choose among three levels of EV charging readiness: EV Capable Space (raceway and basic infrastructure for future installation of a branch circuit and charger); or EV Ready Space (basic infrastructure plus a branch circuit, outlet, junction box or receptacle); or EVSE Space (includes actual charging).

The optionality allows builders to minimize construction costs while still making easier and much less costly for the owner to add an EV charger in the future. As explained in the IECC Commentary, "EV capable spaces are the first step towards the preparation of future electric vehicle charging infrastructure. The raceways, electrical capacity, and panelboard placed and sized accordingly will ease future installations and reduce future costs."

By agreement among members of the ICC's committee to develop the 2024 IECC, these EV charging requirements were to have been included in the main body of the 2024 IECC (as proposed here). It was shifted to an appendix on appeal but activating an appendix requires text in the code itself.

It would serve Virginians' near and long-term interest to require minimum levels of EV charging infrastructure in new construction. Given the savings to vehicle users and the pollution reduction benefits to the community, requiring installation of EV charging infrastructure is just as appropriate as it is for the building code to require lighting and other electric infrastructure for lighting and future equipment (HVAC, appliances, etc.), as well as safety measures like carbon monoxide alarms needed for houses with garages for traditional gas/diesel fired vehicles.

EVs have many economic and health benefits for vehicle users, and assuring installation of basic electric infrastructure to serve EVs as their usage grows will best serve Virginia and its residents. EVs are cheaper to use and maintain compared to vehicles with internal combustion engines (ICE).

At-home charging is important for EV owners. It accounts for approximately 80% EV charging today and is much more convenient than searching for public chargers. However, many EV owners and potential buyers do not have EV infrastructure at their dwellings or even the potential to install charging in the future. That is a barrier to EV adoption and the inherent benefits of EVs for residents.

Growing EV usage is very important to Virginia. As explained in the ICC commentary accompanying the 2024 IECC, "The U.S. transportation sector accounted for 29 percent of the nation's greenhouse gas (GHG) emissions in 2019." That is specifically due to the traditional predominance of vehicles with internal combustion engines (ICE). Greenhouse gases from charging and operating EVs are less than 30% of GHG emissions from fueling and operating ICE vehicles. https://theicct.org/why-evs-are-already-much-greener-than-combustion-engine-vehicles-jul25/ Emissions will go down further as the electric system adopts more to zero-carbon energy sources. EVs are also far more energy efficient than burning fuels in vehicle engines.

Reducing GHG emissions is a stated policy goal in Virginia law because climate change is a current and growing danger for Virginians.

(See., e.g., § 45.2-1706.1. Commonwealth Clean Energy Policy. “A. The Commonwealth recognizes that effectively addressing climate change and enhancing resilience will advance the health, welfare, and safety of the residents of the Commonwealth. The Commonwealth further recognizes that addressing climate change requires reducing greenhouse gas emissions across the Commonwealth's economy sufficient to reach net-zero emission by 2045 in all sectors, including the electric power, transportation, industrial, agricultural, building, and infrastructure sectors….”) Virginia faces growing threats, including more heat-illnesses, disruption of outdoor work, worsening storms, flooding, sea level rise, supply-chain disruption, damage to crops, trees and natural resources, arrival of diseases and pests, etc.

Bringing on EVs will also reduce other air pollutants that also threaten Virginian’s health and welfare. ICE vehicles are a major source of ozone and other pollutants, including carbon monoxide risks in homes with garages.

Providing EV electric infrastructure as part of new construction is no different from the building code’s requiring electrical infrastructure for HVAC and other appliances likely to be used in the future or from its requiring more efficient equipment in homes (heat pumps, high-efficiency appliances and lighting). (The infrastructure for future EV charging could be used for other purposes if a resident were to choose to do so.)

Facilitating adoption of EVs requires that drivers have access to convenient, cost-effective EV charging. That can most easily be provided as part of new construction. It is very costly and complicated to renovate EV charging infrastructure into existing buildings. In the absence of a raceway from the electric panel to the garage, retrofitting would require reopening and repairing walls, which is very expensive and disruptive. Expanding EV charging at home is important and cannot be replicated by the slow process of trying to grow a highway-based charging system. That is why so much charging occurs at home.

The importance of incorporating into new construction is particularly great in the case of buildings whose parking is governed by condominium or common-interest-area boards. The high costs of retrofitting is a particularly large and a common barrier in apartment buildings where residents’ choices are restricted by the need for third-party approvals and possible financial interests.

Cost Impact: The code change proposal will increase the cost

The cost of installing infrastructure would depend on the builder’s choice among the three levels of EV charging readiness, which are provided by this proposal. The costs would be minimal for an EV Capable Space and not much more for the EV Ready Space option if the panel box is in or near a garage or outdoor parking space and low regardless of the location. Since electricity will be installed anyway (e.g. for garage or parking lighting at a minimum), it would not be difficult or costly to go the extra steps during building construction—far less than undertaking to install EV charging capabilities as a retrofit.

REC-R404.5(1)-24

VECC: R404.5 (New), R404.5.1 (New), R404.5.2 (New), R404.5.3 (New), R404.5.4 (New), R404.5.5 (New)

Proponents: Joseph Wages, representing National Electrical Manufacturers Association (NEMA) (joseph.wages@nema.org)

2021 Virginia Energy Code

Add new text as follows:

R404.5 Electric Vehicle Power Transfer Infrastructure. Residential automobile parking spaces for residential buildings shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.5.1 through R404.5.5

R404.5.1 Quantity. One- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE space per dwelling unit. R-2 occupancies or allocated parking for R-2 occupancies in mixed-use buildings shall be provided with an EV capable space, EV ready space, or EVSE space for 40 percent of dwelling units or automobile parking spaces, whichever is less.

R404.5.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section R404.5.1 shall comply with all of the following:

- 1.A continuous raceway or cable assembly shall be installed between a suitable panelboard or other onsite electrical distribution equipment and an enclosure or outlet located within 6 feet (1828mm) of the EV capable space.
- 2.Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with Section R404.5.5.
- 3.The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-pole circuit breaker or set of fuses.
- 4.The electrical enclosure or outlet and the electrical distribution equipment directory shall be marked: "For future electric vehicle supply equipment (EVSE)."

R404.5.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:

- 1.Terminate at an outlet or enclosure, located within 6 feet (1828 mm) of each EV ready space it serves and marked "For electric vehicle supply equipment (EVSE)".
- 2.Be served by an electrical distribution system and circuit capacity in accordance with Section R404.5.5.
- 3.Be designated on the panelboard or other electrical distribution equipment directory as "For electric vehicle supply equipment (EVSE)."

R404.5.4 EVSE spaces. An installed EVSE with multiple output connections shall be permitted to serve multiple EVSE spaces. Each EVSE serving either a single EVSE space or multiple EVSE spaces shall comply with the following:

- 1.Be served by an electrical distribution system in accordance with Section R404.5.5
- 2.Have a nameplate charging capacity of not less than 6.2 kVA (or 30A at 208/240V) per EVSE space served. Where an EVSE serves three or more EVSE spaces and is controlled by an energy management system in accordance with Section R404.5.5, the nameplate charging capacity shall be not less than 2.1 kVA per EVSE space served.
- 3.Be located within 6 feet (1828 mm) of each EVSE space it serves.
- 4.Be installed in accordance with NFPA 70 and be listed and labeled in accordance with UL 2202 or UL 2594.

R404.5.5 Electrical distribution system capacity.. The branch circuits and electrical distribution system used to comply with Section R404.7.1 shall comply with one of the following:

- 1.Sized for a calculated EV charging load of not less than 7.2 kVA per EVSE, EV ready, or EV capable space. Where a circuit is

shared or managed it shall be in accordance with NFPA 70.

- 2.The capacity of the electrical distribution system and each branch circuit serving multiple EVSE spaces, EV ready spaces, or EV capable spaces designed to be controlled by an energy management system in accordance with NFPA 70, shall be sized for a calculated EV charging load of not less than 2.1 kVA per space. Where an energy management system is used to control EV charging loads for the purposes of this section, it shall not be configured to turn off electrical power to EVSE or EV ready spaces used to comply with Section R404.5.1.

Reason Statement: This proposal adds a new section covering Electric Vehicle Power Transfer Infrastructure as a mandatory requirement in Chapter 4 similar to Appendix RE in the 2024 IECC. These requirements were approved by the ICC appointed residential energy code consensus committee by a two-thirds majority vote during the 2024 IECC development cycle. Adding EV ready requirements to the 2024 VECC-R ensures new residential parking facilities have the electrical infrastructure necessary for the installation of EV charging equipment at time of construction or any time in the future. This will provide a significant cost and labor savings.

Cost Impact: The code change proposal will increase the cost

The code change proposal will increase the cost of premises-wiring systems and parking facilities for residential projects. However, the initial cost of EV ready infrastructure is considerably less expensive compared to retrofitting and altering the electrical system and parking facility in the future. The actual cost associated with this proposal is heavily dependent on the scale and scope of the residential project.

It should be noted NEMA proposals are developed by a member consensus process where both our bylaws and federal regulations prohibit us from discussing prices, costs, and other financial details of electrical products.

REC-R404.6-24

IECC: R404.6 (N1104.6) (New), R404.6.1 (N1104.6.1) (New), R404.6.2 (N1104.6.2) (New), R404.6.3 (N1104.6.3) (New), R404.6.4 (N1104.6.4) (New), R404.6.5 (N1104.6.5) (New), R404.6.6 (N1104.6.6) (New), R404.6.7 (N1104.6.7) (New), R404.6.8 (N1104.6.8) (New), R404.6.9 (N1104.6.9) (New)

Proponents: William Penniman, representing Sierra Club Virginia Chapter (wpenniman@aol.com)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

R404.6 (N1104.6) Solar Ready Provisions - Detached One- and Two Story-Dwellings and Townhouses.

R404.6.1 (N1104.6.1) General. New detached one- and two-family dwellings, and townhouses with not less than 600 square feet (55.74 m2) of roof area oriented between 110 degrees and 270 degrees of true north shall comply with Sections R404.6.2 (N1104.6.2) through R404.6.9 (N1104.6.9).

Exceptions:

1. New residential buildings with a permanently installed on-site renewable energy system.

2. A building where all areas of the roof that would otherwise meet the requirements of this Section and Section R404.6.3 (N1104.6.3) are in full or partial shade for more than 70 percent of daylight hours annually.

R404.6.2 (N1104.6.2) General Definitions. -SOLAR-READY ZONE. A section or sections of the roof or building overhang designated and reserved for the future installation of a solar photovoltaic or solar thermal system.

R404.6.3 (N1104.6.3) Solar-ready zone area. The total solar-ready zone area shall be not less than 300 square feet (27.87 m2) exclusive of mandatory access or setback areas as required by the International Fire Code. New townhouses three stories or less in height above grade plane and with a total floor area less than or equal to 2,000 square feet (185.8 m2) per dwelling shall have a solar-ready zone area of not less than 150 square feet (13.94 m2). The solar-ready zone shall be composed of areas not less than 5 feet (1524 mm) in width and not less than 80 square feet (7.44 m2) exclusive of access or setback areas as required by the International Fire Code.

R404.6.4 (N1104.6.4) Obstructions. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof mounted equipment.

R404.6.5 (N1104.6.5) Shading. The solar-ready zone shall be set back from any existing or new permanently affixed object on the building or site that is located south, east or west of the solar zone a distance not less than two times the object's height above the nearest point on the roof surface. Such objects include, but are not limited to, taller portions of the building itself, parapets, chimneys, antennas, signage, rooftop equipment, trees and roof plantings.

R404.6.6 (N1104.6.6) Capped roof penetration sleeve. A capped roof penetration sleeve shall be provided adjacent to a solar-ready zone located on a roof slope of not greater than 1 unit vertical in 12 units horizontal (8 percent slope). The capped roof penetration sleeve shall be sized to accommodate the installed or future photovoltaic system conduit, but shall have an inside diameter of not less than 11/4 inches (32 mm).

R404.6.7 (N1104.6.7) Construction document requirements. Construction documents shall clearly indicate

1.the solar-ready zone;
2.the structural design loads for roof dead load and roof live load;
3.pathways for routing of conduit or plumbing from the solar-ready zone to the electrical service panel or service hot water system.

R404.6.8 (N1104.6.8) Electrical service reserved space. The main electrical service panel shall have a reserved space to allow installation of a dual pole circuit breaker for future solar electric installation and shall be labeled "For Future Solar Electric." The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location.

R404.6.9 (N1104.6.9) Construction documentation certificate. A permanent certificate, indicating the solar-ready zone and other requirements of this section, shall be posted near the electrical distribution panel, water heater or other conspicuous location by the builder or registered design professional.

Reason Statement:

This proposal adopts the provisions contained in IECC APPENDIX RB. The provisions of APPENDIX RB have been reorganized for greater clarity, but no substantive changes were made to the appendix. Adoption of this proposed section is needed since IECC appendices are not mandatory unless specifically referenced or otherwise incorporated in a state's building code. This proposed section is intended to support future potential improvements for detached one- and two-family dwellings and townhouses for solar electric and solar thermal systems. This provision requires a capped roof penetration sleeve in a solar-ready zone area, but does not require:

- The installation of conduit, prewiring or pre-plumbing.
- Any specific physical orientation of a residential building.
- Any increased load capacities for residential roofing systems.

Having important information and documentation available to the building department, solar contractor and homeowner will assist in supporting the accelerated working environment many municipalities have mandated.

This proposed section is intended to identify the areas of a residential building roof, called the solar-ready zone, for potential future installation of renewable energy systems. The ability to plan for possible future solar equipment starts with documenting necessary solar-ready zone information on the plans, some of which may already be required in permit construction documents. This proposal also requires the builder to post specific information about the home for use by the homeowner.

This definition clarifies the term "solar-ready zone" as an area of the roof or building where photovoltaic or thermal may be installed in the future.

The proposal does not apply to low-rise residential with more than two units or dwellings less than 600 square feet of roof area. For solar equipment to be effective, it must be adequately oriented to the sun. This section clarifies that the appendix only applies to roof area oriented between 110 degrees and 270 degrees of true north. Note that this is the orientation for the northern hemisphere; if the appendix were applied in the southern hemisphere, the equipment would need to be on a roof oriented between 110 degrees and 270 degrees of true south.

Exceptions are provided for buildings that already have permanently installed systems or are too shaded for the equipment to be viable.

To be solar-ready requires that the existing structure is capable of providing the required support for the future installation of a solar system. The benefit of the solar-ready provisions is to avoid the potential exponential costs of having to structurally retrofit a building for a future solar installation. Therefore, the design criteria provided within the construction documents for the proposed structure must indicate the structure is designed and will be built to the loading conditions necessary for a future solar installation.

This section establishes minimum dimensions and square footage for the solar-ready zones while balancing the need for a minimum area of solar access, fire safety and roof area.

For photovoltaics or thermal storage to be effective, unobstructed sun is important. This section simply clarifies that the solar access zone must not be located in an area where other rooftop obstructions will shade the equipment.

This section provides clarification for the term "shade" as used in Section RB103.1, Exception 2. The section also specifies how far the designated solar-ready zone should be set back from permanently affixed objects.

As with other readiness requirements, the installation of roof penetration elements during initial construction is more cost effective than retrofitting existing construction. Due to other considerations, for roofs with a pitch over one unit vertical in 12 units horizontal this section is not applicable.

Planning ahead for electrical connections avoids retrofitting to accommodate the equipment. This section identifies the routing pathways

for electrical and plumbing connections.

This section specifies the requirements for labeling on the electrical service panel, ensuring adequate capacity for a dualpole circuit breaker.

The certificate requirements complement those of Chapter 4 (see commentary, Section R401.3). The required certificate provides easy-to-reference information to building owners and contractors for future installation of solar equipment. The builder or other approved party must complete the certificate and place it in an approved location in the building, preferably near the electrical box. The permanent certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels.

The documentation of solar-ready zones and roof load calculations (already performed during the design phase) will assist building departments as well as any future solar contractors seeking to install renewable energy systems on a roof. The builder/designer is knowledgeable on the intricacies of each model and plan and can easily identify unobstructed roof areas as well as spaces where conduit, wiring and plumbing can be routed from the roof to the respective utility areas. This will save building departments and solar designers time and effort when installing future solar systems. If a homeowner wishes to install a solar energy system later, this documentation can save thousands of dollars in labor, installation, design and integration of the solar system into the house or townhouse.

Cost Impact: The code change proposal will not increase or decrease the cost

Like the IECC Appendix RB whose terms it incorporates, this proposed section does not require any specific construction cost changes, except the minimal cost of a roof-penetration sleeve which could be offset by simplification of the roof design. It mainly defines and requires documents describing areas of solar readiness and future pathways to connect to the electrical service panel.

REC-R404.7-24

IECC: R404.7 (N1104.7) (New), R404.7.1 (N1104.7.1) (New), R404.7.2 (N1104.7.2) (New), R404.7.3 (N1104.7.3) (New), R404.7.4 (N1104.7.4) (New)

Proponents: William Penniman, representing Sierra Club Virginia Chapter (wpenniman@aol.com)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

R404.7 (N1104.7) Electric Readiness. Water heaters, household clothes dryers and cooking appliances that use fuel gas or liquid fuel shall comply with Sections R404.7.1 through R404.7.4.

R404.7.1 (N1104.7.1) Cooking appliances. A dedicated branch circuit outlet with a rating not less than 240 volts and not less than 40 amperes shall be installed and terminate within 3 feet (914 mm) of conventional cooking tops, conventional ovens or cooking appliances combining both.

Exception: Cooking appliances not installed in an individual dwelling unit.

R404.7.2 (N1104.7.2) Household clothes dryers. A dedicated branch circuit with a rating not less than 240 volts and not less than 30 amperes shall be installed and terminate within 3 feet (914 mm) of each household clothes dryer.

Exception: Clothes dryers not installed in an individual dwelling unit.

R404.7.3 (N1104.7.3) Water heaters. A dedicated branch circuit with a rating either not less than 240 volts and not less than 30 amperes, or not less than 120 volts and not less than 20 amperes, shall be installed and terminate within 3 feet (914 mm) of each water heater.

Exception: Water heaters serving multiple dwelling units in a R-2 occupancy.

R404.7.4 (N1104.7.4) Electrification-ready circuits. The unused conductors required by Sections R404.7.1 through R404.7.3 shall be labeled with the word “spare.” Space shall be reserved in the electrical panel in which the branch circuit originates for the installation of an overcurrent device. Capacity for the circuits required by Sections R404.7.1 through R404.7.3shall be included in the load calculations of the original installation.

Reason Statement:

This section incorporates into Virginia’s code the text of Appendix RK in the 2024 IECC. It was originally agreed upon by participants as part of a package of measures for inclusion in the 2024 IECC but was shifted to an appendix on appeal.

Adoption of the proposed language would enhance customer choices by making it easy for homeowners to choose either electric or gas appliances and water heating equipment. It is a low-cost measure to improve residents’ health and safety by reducing a much larger cost barrier of requiring retrofitting new branch circuits into a dwelling after walls have been enclosed and initial construction has been completed. In addition to the health and safety benefits from shifting to electricity discussed below, large amounts of energy can be saved, particularly by replacing combustion appliances with far more efficient electric-heat-pump water heaters and dryers and with induction cook tops. Availability of these options is growing, and consumer awareness will grow more in the future.

By helping insulate customers from potential high retrofit costs from gas to electric appliances, this “readiness” requirement also recognizes residents’ and the public’s long-term interest in shifting to electric appliances in order to reduce air pollution both indoors and outdoors and to reduce climate risks from CO2 and methane emissions. Virginia’s building code already recognizes the dangers of indoor carbon-monoxide air pollution from gas appliances and thus requires CO monitors be installed and interconnected in dwellings with fuel burning appliances. (See N311.2 and N311.3.)

Indoor air pollution from gas-fired appliances has been increasingly recognized as a health and safety hazard for residents, as well as for

the public. In addition to fire hazards, onsite fuel combustion also poses dangers from indoor air pollution from leakage of methane (CH4), as well as combustion byproducts, such as CO and CO2. See, e.g., https://rmi.org/insight/gasstoves-pollution-health Gas stoves are a particularly large source of indoor air pollution. https://rmi.org/insight/gas-stoves-pollution-health .

Electrification of appliances is one critical component of decarbonization strategies to reduce climate-pollution, especially CO2 and methane that result from producing, transmitting and combusting fossil fuels. Reducing CO2 and methane is essential to stabilizing and eventually reducing global warming. See, e.g., https://www.vox.com/2016/9/19/12938086/electrify-everything; https://rmi.org/eight-benefits-of-building-electrification-for-households-communities-and-climate/ ; https://www.rff.org/publications/explainers/electrification-101/ . While CO2 has gotten greater attention, methane is a much more powerful greenhouse gas than carbon dioxide per unit emitted--approximately 86 times more potent than carbon dioxide as a heat-trapping gas, over 20 years. UCS, *The Natural Gas Gamble: A Risky Bet on America's Clean Energy Future* (March 2015). Substituting electric energy for on-site combustion is a necessary step to mitigating harms from climate change and meeting internationally recognized goals. Electricity is much cleaner and will become more so as Virginia utilities move toward zero-carbon renewable energy.

Increasingly, customers are concerned about health and climate impacts from fossil fuel combustion, in addition to energy efficiency and bills. Harmful indoor fumes that they may have ignored initially are getting greater attention. As a result, they may want to transition from fossil fuels to electric appliances to take advantage of the climate and efficiency benefits.

Cost Impact: The code change proposal will increase the cost

The proposal will modestly raise costs by requiring installation of branch circuits from the electrical panel to the vicinity of certain combustion driven appliances if such appliances are installed. The precise costs would depend on the appliances installed and their location. During construction, the additional line for future use could easily be installed along with the basic conductor going to the appliance resulting in little cost beyond the future conductors themselves. The cost impact would be much less than if the wiring were to be added in a retrofit after walls are closed and construction is completed.

Residents switching to newer, more efficient electric appliances will save money as well as energy. They can also save money by not having to replace CO alarms as the initial ones wear out. The cost, health, safety and environmental benefits from facilitating future appliance changes outweigh the modest initial costs.

REC-R405.2-24

IRC: N1105.2 (R405.2), TABLE N1105.4.2(1) [R405.4.2(1)]

Proponents: Eric Lacey, representing Responsible Energy Codes Alliance (eric@reca-codes.com)

2024 International Residential Code

Revise as follows:

N1105.2 (R405.2) Simulated building performance compliance. Compliance based on *simulated building performance* requires that a *building* comply with the following:

1. The requirements of the sections indicated within Table N1105.2.
2. The proposed total *building thermal envelope* thermal conductance (TC) shall be less than or equal to the required total *building thermal envelope* TC using the prescriptive *U-factors* and *F-factors* from Table N1102.1.2 multiplied by 1.08 in *Climate Zones* 0, 1 and 2, and 1.15 in Climates Zones 3 through 8, in accordance with Equation 11-6 and Section N1102.1.5. The area-weighted maximum *fenestrationSHGC* permitted in Climate Zones 0 through 3 shall be 0.30.

$$\text{For Climate Zones 0–2: } TC_{Proposed\ design} \le 1.08 \times TC_{Prescriptive\ reference\ design}$$
$$\text{For Climate Zones 3–8: } TC_{Proposed\ design} \le 1.15 \times TC_{Prescriptive\ reference\ design}$$

Equation 11-6

3. For each *dwelling unit*~~with one or more fuel-burning *appliances* for space heating, water heating, or both, the annual *energy cost* of the *dwelling unit* shall be less than or equal to 80 percent of the annual *energy cost* of the *standard reference design*. For all other *dwelling units*,~~ the annual *energy cost* of the *proposed design* shall be less than or equal to 89 ~~85~~percent of the annual *energy cost* of the *standard reference design*. For each *dwelling unit* with greater than 5,000 square feet (465 m^2) of *living space* located above *grade plane*, the annual *energy cost* of the *dwelling unit* shall be reduced by an additional 5 percent of annual *energy cost* of the *standard reference design*. Energy prices shall be taken from an *approved source*, such as the US Energy Information Administration's State Energy Data System prices and expenditures reports. Code officials shall be permitted to require time-of-use pricing in *energy cost* calculations.

   Exceptions:

   1. The energy use based on source energy expressed in *Btu* or *Btu* per square foot of *conditioned floor area* shall be permitted to be substituted for the *energy cost*. The source energy multiplier for electricity shall be 2.51 . The source energy multipliers shall be 1.09 for natural gas, 1.15 for propane, 1.19 for *fuel oil*, and 1.30 for imported liquified natural gas.
   2. The energy use based on site energy expressed in *Btu* or *Btu* per square foot of *conditioned floor area* shall be permitted to be substituted for the *energy cost.*

TABLE N1105.4.2(1) [R405.4.2(1)] SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS
Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems[d, e, j, k]	Fuel Type/Capacity: same as proposed design.	As proposed.
	Product class: same as proposed design.	As proposed.
	Efficiencies: For other than electric heating without a heat pump: same as proposed design. Where the proposed design utilizes electric heating without a heat pump, the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the *IECC* – Commercial Provisions.	As proposed.
	~~Heat pump: complying with 10 CFR §430.32~~	~~As proposed~~
	~~Fuel gas and liquid fuel furnaces: complying with 10 CFR §430.32~~	~~As proposed.~~
	~~Fuel gas and liquid fuel boilers: complying with 10 CFR §430.32~~	~~As proposed.~~

<table>
<tr><th>BUILDING COMPONENT</th><th>STANDARD REFERENCE DESIGN</th><th>PROPOSED DESIGN</th></tr>
<tr><td>Cooling systems[d, f, k]</td><td>Fuel Type: electric
Capacity: same as proposed design</td><td>As proposed.</td></tr>
<tr><td></td><td>Efficiencies: ~~complying with 10 CFR §430.32~~ Same as proposed design.</td><td>As proposed.</td></tr>
<tr><td rowspan="8">Service water heating[d, g, k]</td><td rowspan="6">Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td><td>Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – $HWDS$)
where:
N_{br} = number of bedrooms.
$HWDS$ = factor for the compactness of the hot water distribution system.
<table>
<tr><th colspan="2">Compactness ratio[l] factor</th><th>HWDS</th></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table></td></tr>
<tr><td>Fuel type: same as proposed design</td><td>As proposed.</td></tr>
<tr><td>Rated storage volume: same as proposed design</td><td>As proposed.</td></tr>
<tr><td>Draw pattern: same as proposed design</td><td>As proposed.</td></tr>
<tr><td>Efficiencies: ~~Uniform Energy Factor complying with 10 CFR §430.32~~ Same as proposed design.</td><td>As proposed.</td></tr>
<tr><td>Tank temperature: 120° F (48.9° C)</td><td>Same as standard reference design.</td></tr>
<tr><td rowspan="6">Thermal distribution systems</td><td>Duct insulation: in accordance with Section N1103.3.3.</td><td>Duct insulation: as proposed.[m]</td></tr>
<tr><td>Duct location: Same as proposed design.</td><td>Duct location: as proposed.[l]</td></tr>
<tr><td>
<table>
<tr><td>~~Foundation type~~</td><td>~~Slab on grade~~</td><td>~~Unconditioned crawl space~~</td><td>~~Basement or conditioned crawl space~~</td></tr>
<tr><td>~~Duct location (supply and return)~~</td><td>~~One story building: 100% in unconditioned attic
All other: 75% in unconditioned attic and 25% inside conditioned space~~</td><td>~~One story building: 100% in unconditioned crawl space
All other: 75% in unconditioned crawl space and 25% inside conditioned space~~</td><td>~~75% inside conditioned space 25% unconditioned attic~~</td></tr>
</table></td><td>—</td></tr>
<tr><td rowspan="2">Duct system leakage to outside: for duct systems serving > 1,000 ft^2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm per 100 ft^2 of conditioned floor area.
For duct systems serving ≤ 1,000 ft^2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm.</td><td>Duct system leakage to outside: The measured total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>Where duct system leakage to outside is tested in accordance ANSI/RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>Where total duct system leakage is measured without space conditioning equipment installed, the simulation value shall be 4 cfm per 100ft^2 of conditioned floor area.</td></tr>
</table></td></tr>
<tr><td>Distribution System Efficiency (DSE): for hydronic systems and ductless systems a thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies.</td><td>Distribution System Efficiency (DSE): f or hydronic systems and ductless systems, DSE shall be as specified in Table N1105.4.2(2).</td></tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F – 32)/1.8, 1 degree = 0.79 rad, 1 cubic foot per minute = 28.317 L/min.

a. Hourly calculations as specified in the ASHRAE Handbook of Fundamentals , or the equivalent, shall be used to determine the energy loads resulting from infiltration.

b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE Handbook of Fundamentals , page 26.24 and the “Whole-house Ventilation” provisions of 2001 ASHRAE Handbook of Fundamentals , page 26.19 for intermittent mechanical ventilation.

c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.

d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.

e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.

f. For a proposed design without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

g. For a proposed design with a nonstorage-type water heater,For a proposed design without a proposed water heater, the following assumptions shall be made for both the proposed design and standard reference design. For a proposed design with a heat pump water heater, the following assumptions shall be made for the standard reference design, except the fuel type shall be electric:

   Fuel Type: Same as the predominant heating fuel type

   Rated Storage Volume: 40 gallons

   Draw Pattern: Medium

   Efficiency: Uniform Energy Factor complying with 10 CFR §430.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine glazing area:

   $AF = A_S \times FA \times F$

   where:

   AF = Total glazing area.

   A_S = Standard reference design total glazing area.

   FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).

   F = (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

   and where:

   - Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.
   - Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.
   - Below-grade boundary wall is any thermal boundary wall in soil contact.
   - Common wall area is the area of walls shared with an adjoining dwelling unit.

i. The factor for the compactness of the hot water distribution system is the ratio of the area of the rectangle that bounds the source of hot water and the fixtures that it serves (the “hot water rectangle”) divided by the floor area of the dwelling.

1. Sources of hot water include water heaters, or in multiple-family buildings with central water heating systems, circulation loops or electric heat traced pipes.

2. The hot water rectangle shall include the source of hot water and the points of termination of all hot water fixture supply piping.

3. The hot water rectangle shall be shown on the floor plans and the area shall be computed to the nearest square foot.

4. Where there is more than one water heater and each water heater serves different plumbing fixtures and appliances, it is permissible to establish a separate hot water rectangle for each hot water distribution system and add the area of these rectangles together to determine the compactness ratio.

5. The basement or attic shall be counted as a story when it contains the water heater.

6. Compliance shall be demonstrated by providing a drawing on the plans that shows the hot water distribution system rectangle(s), comparing the area of the rectangle(s) to the area of the dwelling and identifying the appropriate compactness ratio and *HWDS* factor.

j. For a proposed design with electric resistance heating, a split system heat pump complying with 10 CFR §430.32 (2021) shall be assumed modeled in the standard reference design.

k. For heating systems, cooling systems, or water heating systems not included in this table, the standard reference design shall be the same as proposed design.

l. Only sections of ductwork that are installed in accordance with Section N1103.3.4, Items 1 and 2 are assumed to be located completely inside conditioned space. All other sections of ductwork are not assumed to be located completely inside conditioned space.

m. Sections of ductwork installed in accordance with Section N1103.3.5.1 are assumed to have an effective duct insulation *R*-value of R-25.

Reason Statement:

The proposed changes above will reverse the largest efficiency rollbacks incorporated into the 2024 *IECC* and maintain Virginia's current performance path approach to efficiency trade-offs for heating, cooling, and water heating equipment. It will also eliminate an unnecessary new credit for duct location. The proposal will also incorporate a single efficiency improvement to buildings with all equipment types based on the U.S. Department of Energy's Determination that the 2024 IECC reduced annual energy costs by roughly 6.6% as compared to the 2021 IECC. We believe the combination of these changes will allow Virginia code users to continue to use the performance path essentially as they do today, avoiding the controversies that have accompanied the 2024 IECC revisions to this section.

All of these new trade-off credits were included in the 2024 *IECC* as part of a large compromise among *IECC*-R Development Committee Members referred to as the “omnibus.” However, significant portions of the omnibus related to electrification and decarbonization were removed from the 2024 *IECC* by the ICC Board of Directors as a result of several appeals, leaving in place several material efficiency rollbacks. These rollbacks would not have been approved in the 2024 *IECC* but for the omnibus compromise, and we recommend that Virginia eliminate these trade-off credits to be consistent with the 2021 *IECC* and the current VA Construction Code approach to equipment efficiency in the performance path.

Equipment trade-offs were correctly eliminated in the 2009 version of the *IECC* (and in Virginia's adoption of the 2009 IRC/IECC) and were consistently rejected in every *IECC* and Virginia code update cycle until the ICC Residential Committee-developed 2024 *IECC*. Nearly every state that adopts the *IECC* has eliminated these trade-offs as well. Equipment trade-offs reduce building efficiency because commonly installed cooling, heating, and water heating equipment typically exceeds the federal minimum efficiencies, but states are unable to set more reasonable efficiency requirements (or more reasonable assumptions in the standard reference design baseline) because of federal preemption. **The result is an unwarranted trade-off credit that allows buildings to be constructed 11-22% less efficient overall than if the trade-offs were not allowed**. *See* ICF International, *Review and Analysis of Equipment Trade-offs in Residential Energy Codes,* at ii (Sep. 23, 2013).

Although proponents of equipment trade-offs argue that they are “energy neutral,” the reality is that they are a short-term trade-off that will

have long-term negative impacts on homeowners –who are often unaware that such trade-offs are taking place. For example, if a trade-off is permitted for water heater efficiency, an instantaneous natural gas water heater would allow the builder to reduce the efficiency of the rest of the home by an average of 9%. The remaining home will be 9% less efficient for its entire useful lifetime. As the water heater is replaced every 10-15 years, the envelope of that home will continue to underperform by 9%. By contrast, under the current Virginia Construction Code (and the 2021 *IECC*), no trade-off credit is awarded for the instantaneous water heater, which means the rest of the home will be built to meet the code. As the water heater is swapped out in future years, a home built to the current Virginia UCC-compliant home will outperform a home built using a water heater performance trade-off allowed by 9%.

Regarding duct location, the current Virginia Uniform Construction Code does not award performance path trade-off credit for ducts located inside conditioned space. In both the prescriptive path and the performance path, builders are neither penalized nor credited for the location of duct systems. Although it is generally good building practice to locate all ducts and air handlers inside conditioned space, many builders in Virginia already do this.

The 2024 *IECC* already provides another performance-based alternative that provides credit for equipment efficiency and duct location (the Energy Rating Index), as well as multiple credits for equipment and duct location in Table R408.2. Both of these compliance paths do not carry such a high risk of free ridership (and reduced overall efficiency) as the proposed performance path credits. The simulated performance path lacks several of the built-in protections of the ERI path, and thus cannot guarantee an equivalent level of performance. We strongly recommend eliminating these loopholes from the performance path and implementing provisions consistent with the Virginia Construction Code and the 2021 *IECC*.

Finally, this proposal replaces the two multipliers in Section N1105.2(3)/R405.2(3) with a single multiplier. Although we do not oppose setting a different multiplier based on whether a home uses fossil fuel-fired or electric appliances, for a starting place we recommend setting a multiplier that is consistent with the U.S. Department of Energy's Determination on energy cost savings associated with the prescriptive path of the 2024 IECC, and one that properly reflects the impact of equipment trade-offs (if any). In December of 2024, U.S. DOE found that homes built to the 2024 IECC prescriptive path will have 6.6% lower annual energy costs than homes built to the 2021 IECC, on average. *See* U.S. Department of Energy, *Notification of Determination*, 89 Fed. Reg. 106458 (Dec. 30, 2024). The current Virginia Construction Code already requires that the proposed home in Section R405 not exceed 95% of the annual energy costs of the standard reference design home. A 6.6% reduction in energy costs is roughly 89%, and that number is proposed above as a single multiplier. We note, however, that if efficiency trade-offs are allowed for heating, cooling, water heating equipment, or for duct location, there would need to be additional changes to the multiplier, and the result would likely be lower than the 80/85% in the published 2024 IECC. However, for purposes of this proposal, assuming the equipment trade-offs and duct location credit are deleted, we view 89% as a reasonable starting place that would maintain consistency across compliance paths.

Cost Impact: The code change proposal will increase the cost

This proposal improves the overall efficiency of the performance path by roughly 6.6%, which may increase costs depending on decisions made by code users. However, these changes, taken as a single package, would maintain consistency with improvements made in the prescriptive path.

REC-R405.2(1)-24

IECC: R405.2

Proponents: William Penniman, representing Sierra Club Virginia Chapter (wpenniman@aol.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated building performance compliance.. Compliance based on *simulated building performance* requires that a *building* comply with the following:

1. The requirements of the sections indicated within Table R405.2 (N1105.2).
2. The proposed total *building thermal envelope* thermal conductance (TC) shall be less than or equal to the required total building thermal envelope TC using the prescriptive *U*-factors and *F*-factors from Table R402.1.2 multiplied by 1.08 in Climate Zones 0, 1 and 2, and 1.15 in Climate Zones 3 through 8, in accordance with Equation 4-2 and Section R402.1.5. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

$$\text{For Climate Zones 0–2: } TC_{Proposed\ design} \leq 1.08 \times TC_{Prescriptive\ reference\ design}$$
$$\text{For Climate Zones 3–8: } TC_{Proposed\ design} \leq 1.15 \times TC_{Prescriptive\ reference\ design}$$

Equation 4-2

3. For each *dwelling unit* with one or more fuel-burning appliances for space heating, water heating, or both, the annual ~~*energy cost*~~ site energy use expressed in Btu or Btu per square foot of conditioned floor area of the *dwelling unit* shall be less than or equal to 80 percent of the ~~annual *energy cost*~~ site energy use of the *standard reference design*. For all other *dwelling units*, the ~~annual *energy cost of the proposed design*~~ site energy use expressed in Btu or Btu per square foot of conditioned floor area shall be less than or equal to 85 percent of the annual ~~*energy cost*~~ site energy use of the *standard reference design*. For each dwelling unit with greater than 5,000 square feet (465 m^2) of *living space* located above grade plane, the annual ~~*energy cost of the dwelling unit*~~ site energy use expressed in Btu or Btu per square foot of conditioned floor area shall be reduced by an additional 5 percent of ~~annual *energy cost*~~ site energy use of the *standard reference design*. ~~Energy prices shall be taken from an *approved* source, such as the US Energy Information Administration's State Energy Data System prices and expenditures reports. Code officials shall be permitted to require time-of-use pricing in *energy cost* calculations.~~

   ~~**Exceptions:**~~

   1. ~~The energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the *energy cost*. The source energy multiplier for electricity shall be 2.51. The source energy multipliers shall be 1.09 for natural gas, 1.15 for propane, 1.19 for fuel oil, and 1.30 for imported liquified natural gas.~~
   2. ~~The energy use based on site energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost.~~

Reason Statement: This proposal provides that the TC calculations are to be based upon estimated the site energy usage of the specific building, not the imagined costs of miscellaneous fuels. This specifies use of one of the code options (Exception 2) presented by the IECC in Section 405.2, and prevents potentially inconsistent application of standards across the Commonwealth. The ICC's commentary recognizes that "some jurisdictions may require the comparison to be done on the basis of 'site energy' versus 'annual energy cost.'" It explains "Because of the fact that utility charges for various types of energy can change over time, some code officials may prefer that the comparison be made based on the amount of energy delivered to a residential building instead of the cost of that energy."

Making use of site-energy consistent across Virginia makes sense. Site energy usage is the only factor that can be consistently applied to assess new dwellings' energy efficiency, and it is also the only thing a builder or an occupant can control. Adopting a site-energy test will avoid basing Simulated Performance calculations upon past or current energy cost estimates that bear no

relation to actual energy costs that will be incurred while a dwelling is occupied. It will also eliminate risks of inconsistent implementation if designers or inspectors are left to choose among different tests.

Trying to compare the impact of energy efficiency choices based upon future upstream or delivered fuel and energy prices makes no sense.

Energy prices vary wildly over time. Just in the period 2020-2024, natural gas and coal prices varied as follows:

Natural gas Henry Hub	$1.49-$8.81/Mcf	https://www.eia.gov/dnav/ng/hist/rngwhhdm.htm
Natural gas delivered to citygate	$3.05-$12.10/Mcf	https://www.eia.gov/dnav/ng/hist/n3050us3m.htm
Natural gas residential prices	$9.19-$25.39/Mcf	https://www.eia.gov/dnav/ng/hist/n3010us3m.htm
Coal prices	$50-$435/Ton	https://tradingeconomics.com/commodity/coal
Crude oil prices	$15.18-$113.77/ Barrel	https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=f000000__3&f=m

Over the likely 50-100+ years in which a dwelling will operate, energy prices will swing even more wildly than in the past five years.

Neither builders, nor inspectors nor the Board can reliably forecast future energy costs, which will change dramatically between code updates and change differently in the service areas of the multiple utilities operating in Virginia, including the IOUs, Coops, and municipal systems. Each has a different mix of supply costs, operating and fixed costs and rates.

The shift to zero-carbon sources for electricity over the next 20-25 years, as called for by Virginia law, will change the cost mix since wind and solar have zero fuel costs.

Utilities' future demand mixes and rate structures will likely change significantly, as will their supply mixes.

The multipliers assumed for upstream fuel supplies are not based on realistic data or assumptions specific to Virginia now or in the future. Again, each utility has a different mix of fuels – including growing zero-cost energy production – and a different mix of generators with different efficiencies. These will change annually depending on many factors including price fluctuations, future markets and weather changes driven by climate change.

Imagined fuel costs do not consider on-site renewable energy, which may be installed with initial construction or by the owner in the future.

Assumed fuel costs and multipliers do not take into account either pollution or climate costs from different fuels or the likely prices for carbon emissions, which will be restored when Virginia law requiring RGGI participation is enforced as it is written. Moreover, despite political vicissitudes it is generally recognized that there will be a price on carbon within the lives of buildings constructed under the 2024 code updates, and, if not, the damage costs to persons, properties and the economy will be far worse. None of these costs are reflected in the use of imagined fuel costs or multipliers.

Basing comparisons upon on-site energy usage will enhance resiliency. Residents of better-insulated buildings will be able to withstand periods of energy supply disruptions for longer periods.

In sum, the only reasonable measure is on-site energy consumption, which can be estimated based upon the construction choices.

Cost Impact: The code change proposal will not increase or decrease the cost

There are no foreseeable construction cost impacts. Attempting to estimate future fuel costs may or may not alter construction decisions but one cannot predict how. Incorporating estimated upstream and delivered fuel/energy costs will cause more confusion than benefits. This proposal should simplify implementation of the performance option.

REC-R408.2.9-24

IRC: N1108.2.9 (R408.2.9)

Proponents: Eric Lacey, representing Responsible Energy Codes Alliance (eric@reca-codes.com)

2024 International Residential Code

Delete without substitution:

~~**N1108.2.9 (R408.2.9) Opaque walls.** For *buildings* in Climate Zones 4 and 5, the maximum *U-factor* of 0.060 shall be permitted to be used for wood-framed walls for compliance with Table N1102.1.2 where complying with one or more of the following:~~

1. ~~Primary space heating is provided by a *heat pump* that meets one of the efficiencies in Section N1108.2.2.~~
2. ~~All installed *water heaters* are *heat pumps* that meet one of the efficiencies in Section N1108.2.3.~~
3. ~~In addition to the number of credits required by Section N1108.2, three additional credits are achieved.~~
4. ~~*Renewable energy resources* are installed to meet the requirements of Section N1108.2.7.~~

Reason Statement:

New Section R408.2.9 is an efficiency loophole incorporated into the 2024 *IECC* with potential long-term negative impacts. It allows a reduction in wall insulation where one of four conditions is met. There are several problems with this section:

1. None of the specific measures will provide efficiency for as long as the wall insulation being traded off. Measures 1 and 2 have significantly shorter useful lifetimes than wall insulation; measure 4 creates an efficiency trade-off for renewable energy, which is not allowed in either the prescriptive or performance paths of the *IECC*; and measure 3 allows a code user to select 3 more credits from Table R408.2, effectively creating a prescriptive envelope trade-off for 40+ measures that may or may not match the longevity or efficiency of wall insulation. No analysis was provided to justify this trade-off or to quantify whether these measures could save a comparable amount of energy as well-insulated walls.

2. Some advocates have been urging states to allow double-counting of these measures, effectively reducing envelope efficiency without any improvements elsewhere in the building. The charging language does not clarify whether measures 1, 2, and 4 are *in addition to* measures already used to comply with Section R408.2, or whether a code user may simply double-count these measures and reduce envelope efficiency. Neither the proponent's reason statement for this measure (REPI-33-21) nor any of the debate in the 2024 IECC development cycle addressed the possibility of double-counting, and it would seem to contradict language in measure 3 (which requires 3 credits "in addition to the number of credits required by Section R408.2"). Yet advocates at the state and national level have argued that code users should receive credit for these measures both to comply with Section R408.2 and to receive the benefits of an insulation reduction under R408.2.9.

This entire section is problematic, and will only to lead to reduced efficiency. The only reason it is included in the 2024 IECC is because it was part of a deal among IECC Residential Consensus Committee members where sustainability measures and efficiency rollbacks that failed to achieve the required number of votes were grouped into a large "omnibus" package. In response to several appeals, the ICC Board of Directors later reversed the portions of the omnibus related to sustainability, but left in place the efficiency rollbacks, making the 2024 IECC less stringent than the 2021 IECC in several places. Other states considering the 2024 IECC have either deleted this controversial section or are in the process of debating it. We strongly recommend deleting the entire section and maintaining the stringency of the IECC.

Cost Impact: The code change proposal will not increase or decrease the cost

This section is a problematic and confusing exception that was introduced in the 2024 IECC. Eliminating it does not change the base efficiency requirements of the code, so it will neither increase nor decrease costs for code users.