General Stakeholder Workgroup Meetings
June 7-15, 2022
9:00 a.m. Each Day
Virtual Meeting: https://vadhcd.adobeconnect.com/va2021cdc/

AGENDAS

June 9, 2022
(Begin at 9:00 am)

Energy Proposals

1. EC-C401.2(2)-21
2. EC-C403.7.7-21
3. EC-C405.10-21
4. EC-C405.11.1-21
5. EC-C405.13(2)-21
6. EC-C405.13(3)-21
7. EC-C407.6-21
8. EC-C502.3-21
9. EC-C503.3.2-21
10. EC-C1301.1.1-21
11. EC-C1301.1.1(2)-21
12. EC-C1301.1.1.1(2)-21
13. EC-Appendix CB-21
14. REC-R402.1.2 (1)-21
15. REC-R402.1.2 (2)-21
16. REC-R402.4-21
17. REC-R402.4.1.2-21
18. REC-R403.1.2-21
19. REC-R403.1.4-21
20. REC-R403.1.4(2)-21
21. REC-R403.3.3-21
22. REC-R404-21
23. REC-R404.2-21
24. REC-R404.4-21
25. REC-R503.1.2-21
26. REC-R503.1.2.1-21
27. REC-R1104.2-21

General Stakeholder Workgroup Meeting Descriptions
(Subject Groupings)

VCC: Virginia Construction Code (USBC Part I) including USBC Part I administrative provisions; IBC; VCS; VADR; IBSR; and MHSR (**Proposal Designations in cdpVA:** B; BF; IB; MH; CS; AD)
VEBC: Virginia Existing Building Code (USBC Part II) including USBC Part II administrative provisions; and IEBC (**Proposal Designations in cdpVA:** EB)
Energy: All technical energy provisions of the VCC, IECC and IRC; does not include administrative provisions (**Proposal Designations in cdpVA:** EC; REC)
VMC: Virginia Maintenance Code (USBC Part III) including USBC Part III administrative provisions (**Proposal Designations in cdpVA:** PM)
SFPC: Virginia Statewide Fire Prevention Code including SFPC administrative provisions (**Proposal Designations in cdpVA:** FP)
VRC: Residential technical provisions of the VCC and the IRC; does not include administrative or trades provisions (**Proposal Designations in cdpVA:** RB)
Trades: All technical trade provisions (mechanical, electrical, plumbing and fuel gas), including residential trade provisions, of the VCC, IRC, IPC, IMC, and IFGC; does not include administrative provisions (**Proposal Designations in cdpVA:** M; P; E; RE; RM; RP)

2021 cdpVA Proposal Subject Matter Designations
(cdpVA Proposal Name "Agenda Number" Prefixes)

The following prefixes will be utilized as part of each proposal name to assist in identifying the subject matter of the proposal. DHCD staff assign proposal names after they have been submitted, reviewed and before they are placed in "Ready for Public Comment" status.

B = Virginia Construction Code
EB = Virginia Existing Building Code
PM = Virginia Maintenance Code
FP = Statewide Fire Prevention Code
BF = Virginia Construction Code IFC
EC = Virginia Energy Conservation Code
M = Virginia Mechanical Code
P = Virginia Plumbing Code
E = VCC Electrical
RB = Virginia Residential Code
REC = Virginia Residential Code Energy
RE = Virginia Residential Code Electric
RM = Virginia Residential Code Mechanical
RP = Virginia Residential Code Plumbing
IB = Industrialized Building Safety Regulations
MH =Manufactured Home Safety Regulations
AD = Virginia Amusement Device Regulations
CS = Virginia Certification Standards

Example: cdpVA Proposal Agenda Number "**RM**2301.1-21" indicates a proposal to the mechanical provisions (VRC Section M2301.1) of the 2021 Virginia Residential Code.

EC-C401.2(2)-21

Proponents: Matthew Benka; John Avis (avisj@avisconstruction.com)

2021 International Energy Conservation Code

Revise as follows:

C401.2 Application. Commercial buildings shall comply with Section C401.2.1 or C401.2.2.

> Exception. In building areas where uses classified as Group F, S or U are located, the building envelope shall be permitted to comply with Appendix CB of this code.

Reason Statement: In consideration of discussion at the April 14 Energy General Workgroup Meeting, this proposal is offered as a potential alternative to EC-C1301.1.1-21 (ID 997).
The current energy code requirements are over burdensome for Factory Group F, Storage Group S, and Utility and Miscellaneous Group U. These use groups do not traditionally use a lot of energy as they are not heated or cooled to normal heating and cooling temperatures and or they create their own heat, etc. The change would eliminate unneeded and extra cost to the building owner. Additional insulation, roofing materials, and wall panel materials are being required in excess for buildings that will not fully utilize them. Many storage facilities are vacant most of the time and a lot of manufacturing and utility buildings will have the drive through doors open during production.

The General Assembly of Virginia enacted the following legislation in 2022.

HB 1289 Uniform Statewide Building Code; exemption for certain use and occupancy classifications.

1. § 1. That the Board of Housing and Community Development is directed to consider, during the next code development cycle, revising the Uniform Statewide Building Code (§ 36-97 et seq. of the Code of Virginia) to provide an exemption from any requirements in the energy efficiency standards established pursuant to 13VAC5-63-264 of the Virginia Uniform Statewide Building Code and the 2018 Virginia Energy Conservation Code, and any subsequent amendments to the Virginia Uniform Statewide Building Code and the 2018 Virginia Energy Conservation Code, 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.

Cost Impact: The code change proposal will decrease the cost of construction
The recent update to the *International Energy Conservation Code* causes undue hardship on building owners, developers, and contractors while they do not reap the full benefits of the standards.

For example,

1. A 7,200 SF building, with limited heating to be used for vehicle storage. This current energy code and building code would require a standing seam roof system and (R19/R11) insulation in the roof and (R25) insulation in the walls. When priced with a fasten down roof system and just R19 in the roof and R13 walls, the material and labor price goes down by $5.97/SF. That equates to a cost of $42,984. That is enough to keep this project from being built.

2. A 100,000SF warehouse project used for storage of materials with heat maintained at 60 degrees or less and no cooling. The current building code and energy code would require a standing seam roof system and (R19/R11) insulation in the roof (R25) and insulation in the walls. Maintaining the standing seam roof system but changing the insulation to 6” in roof and 4” in walls results in a $311,247 deduct just for material. With labor, material, and equipment the cost savings approach $5.00/SF or $500,000.

The systems required to meet the current energy code are complicated and time consuming. These systems have other drawbacks such a liner system that cover up the purlins and girts affecting other trades such as plumbing, HVAC, electrical, and sprinkler. (The added cost to the electrical and mechanical trades are in addition to the cost shown in the examples above.) The trims on overhead doors and window on the new required systems are deep. These trims make the wall accessories look recessed and some would say less attractive. The current energy code makes some architectural features more difficult to design and build around. For example, just adding a masonry wainscot becomes a challenge.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
This code change does not have an effect on the resiliency of buildings in terms of withstanding disasters.

Attached Files

- **APPENDIX CB (underlined).pdf**
  https://va.cdpaccess.com/proposal/1163/1649/files/download/688/

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: EC-C401.2(2)-21

This proposal doesn't have any public comments.

EC-C403.7.7-21

Proponents: Richard Grace (rgrace@culpepercounty.gov), VPMIA

2018 Virginia Energy Conservation Code

Revise as follows:

C403.7.7 Shutoff dampers (Mandatory). Outdoor air intake and exhaust openings and stairway and shaft vents shall be provided with Class I motorized dampers. The dampers shall have an air leakage rate not greater than 4 cfm/ft^2 (20.3 L/s • m^2) of damper surface area at 1.0 inch water gauge (249 Pa) and shall be labeled by an approved agency when tested in accordance with AMCA 500D for such purpose.

Exception: ~~Any~~ Where a grease duct serving a Type I hood is installed in accordance with IMC Section 506.3 ~~shall not be required to have a~~ motorized or gravity ~~damper.~~ dampers shall not be installed.

Outdoor air intake and exhaust dampers shall be installed with automatic controls configured to close when the systems or spaces served are not in use or during unoccupied period warm-up and setback operation, unless the systems served require outdoor or exhaust air in accordance with the *International Mechanical Code* or the dampers are opened to provide intentional economizer cooling.

Stairway and shaft vent dampers shall be installed with automatic controls configured to open upon the activation of any fire alarm initiating device of the building's fire alarm system or the interruption of power to the damper.

Exception: Nonmotorized gravity dampers shall be an alternative to motorized dampers for exhaust and relief openings as follows:

1. In buildings less than three stories in height above grade plane.
2. In buildings of any height located in *Climate Zones* 1, 2 or 3.
3. Where the design exhaust capacity is not greater than 300 cfm (142 L/s).

Nonmotorized gravity dampers shall have an air leakage rate not greater than 20 cfm/ft^2 (101.6 L/s • m^2) where not less than 24 inches (610 mm) in either dimension and 40 cfm/ft^2 (203.2 L/s • m^2) where less than 24 inches (610 mm) in either dimension. The rate of air leakage shall be determined at 1.0 inch water gauge (249 Pa) when tested in accordance with AMCA 500D for such purpose. The dampers shall be labeled by an approved agency.

Reason Statement: The current language does not prohibit motorized or gravity dampers from being installed in a grease duct. The language is more of a recommendation than a prohibition. "Shall not be required" is equivalent to "shall not be prohibited." VMC 506.3.7 states "duct systems serving a Type I hood shall be constructed and installed so that grease cannot collect in any portion thereof." Following that logic, VMC 506.3.11 states "fire dampers and smoke dampers shall not be installed in grease ducts." The ICC Commentary for IMC Section 503.11 states "Fire and smoke dampers are not compatible with grease ducts, and the duct enclosure requirements clearly account for the lack of such dampers where the ducts penetrate walls, floors and ceilings. Fire and smoke dampers would be made useless by the severe environment within grease ducts (e.g., high temperatures, grease, cleaning chemicals and water)." Motorized dampers, gravity dampers, backdraft dampers, barometric dampers, and any other type of damper that serves a purpose in a duct system would also be made useless by the severe environment within a grease duct.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
I believe the original intent was to prohibit motorized and gravity dampers from being installed in a grease duct, there fore this is a clarification change rather than a technical change that would have an effect on cost.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
I believe the original intent was to prohibit motorized and gravity dampers from being installed in a grease duct, therefore this is a clarification change rather than a technical change that has no effect on resiliency.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

☐ Consensus Approval
☐ Consensus Disapproval

- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: EC-C403.7.7-21

This proposal doesn't have any public comments.

Proposal # 1083

EC-C405.10-21

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Energy Conservation Code

Add new text as follows:

C202 General Definitions (Commercial). SECTION C202 GENERAL DEFINITIONS

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, electric motorcycles and the like, which is primarily powered by an electric motor that draws current from a rechargeable storage battery. A "plug-in hybrid" is a type of electric vehicle which relies on a combination of a rechargeable storage battery and another source of motive power.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or charging apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EV CAPABLE SPACE. A designated parking space which is provided with electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for EVSE, and with an adequately-sized raceway from the panel to a clearly identified location within three feet of the parking space, to support future EVSE.

EV READY SPACE. A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit and adequate electric panel capacity and space to electrify EVSE. The circuit shall terminate in a suitable termination point, such as a receptacle, junction box, or an EVSE, located within three feet of the parking space.

C405.10 Electric Vehicle (EV) charging for commercial construction.. New construction shall provide and facilitate future installation and use of Electric Vehicle Supply Equipment (EVSE) in accordance with the National Electrical Code (NFPA 70).

Exception: EVSE Installed, EV Ready Spaces and EV Capable Spaces are not required where no parking spaces are provided to residents.

C405.10.1 Large Residential Buildings. Residential buildings not covered by R404.2 shall provide EVSE Installed Spaces, EV Ready Spaces and EV Capable Spaces as set forth in C405.10.1.1 and C405.10.1.2. **Exception:** EVSE Installed, EV Ready Spaces and EV Capable Spaces are not required where no parking spaces are provided to occupants.

C405.10.1.1 Multifamily. Multifamily buildings not covered by R404.2 **(N1104.2)** shall provide EVSE Installed Spaces, EV Ready Spaces and EV Capable Spaces in proportion to the number of dwelling units in accordance with Table C405.10.1, such that the total number of such spaces equals the number of dwelling units for which parking spaces are made available to residents. Where the calculation of percentages of spaces to be served results in a fractional parking space, it shall round up to the next whole number. If a multifamily project is built in phases, the minimum number of required spaces shall be determined separately for each phase. EVSE shall be installed as residents of dwelling units acquire EVs and request EV charging facilities. Raceways to outdoor parking spaces shall be located underground and protected from water.

C405.10.1.2 Hotels and transient lodging .. Hotels and other transient lodging shall construct EVSE Installed Spaces, EV Ready Spaces and EV Capable Spaces in proportion to the number of sleeping units in accordance with Table C405.10.1, such that the total number of such spaces equals the number of sleeping units for which parking spaces are made available to occupants. Where the calculation of percentages of spaces to be served results in a fractional parking space, it shall round up to the next whole number. If a hotel or covered lodging is built in phases, the minimum number of required spaces shall be determined separately for each phase. Raceways to outdoor parking spaces shall be located underground and protected from water.

Table C405.10.1

Minimum EVSE Installed, EV Ready and EV Capable Spaces in Large Residential Buildings.

Type of space	Minimum number of spaces installed at completion of construction or phase of construction
EVSE Installed Spaces	Greater of 1 or 15% of total number of dwelling units or sleeping units
EV Ready Spaces	Greater of 1 or 15% of total number of dwelling units or sleeping units
EV Capable Spaces	Total number of dwelling units or sleeping units minus the sum of (EVSE Installed and EV Ready spaces)

C405.10.2 Non-Residential Construction . . To the extent new construction provides parking spaces for employees in mixed-use or other buildings, EVSE Installed Spaces, EV Ready Spaces and EV Capable Spaces shall be provided in accordance with Table C405.10.2. Where the calculation of percentages of spaces to be served results in a fractional parking space, it shall round up to the next whole number. If a project is built in phases, the minimum number of required spaces shall be determined separately for each phase. If parking spaces are planned to be shared by residents and employees in the same or different buildings, based on diversity of time utilization, then the total parking spaces with EVSE Installed, EV Ready and EV Capable Spaces will be the greater of the number of such category of spaces in Table R405.10.1 and Table R405.10.2.**Exception:** EVSE Installed, EV Ready Spaces and EV Capable Spaces are not required by this section if no parking spaces are provided to employees.

Table R405.10.2 Minimum EVSE Installed, EV Ready and EV Capable Spaces for Non-Residential Parking.

Type of space	Minimum number of spaces installed at completion of construction or phase of construction
EVSE Installed Spaces	Greater of 1 or 10% of total number of spaces for employees
EV Ready Spaces	Greater of 1 or 10% of total number of spaces for employees
EV Capable Spaces	20% of remaining parking spaces for employees

C405.10.3 Identification. The service panel or subpanel circuit directory shall identify the spaces reserved to support EV charging as "EVSE Installed," "EV Capable" or "EV Ready" and shall be updated as EVSE Installed Spaces are created. The raceway location shall be permanently and visibly marked as "EV Capable". Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EV chargers. Construction documents shall also provide information on amperage of future EVSE, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the EVSE.

Reason Statement: This provision is designed to provide electric charging readiness for the growing use of electric vehicles (EVs) and to meet the essential need to offer at-home charging to residents and at-work charging for workers many of whom own EVs or will own EVs in the next few years. It is designed to minimize costs through phasing of EV development, with an emphasis on installing infrastructure during initial construction. To limit costs, the proposal only addresses the needs of residents and employees, not the potential EV interests of customers or visitors.

In the case of multifamily construction, the proposal requires defined numbers of initial EV Installed, EV Ready spaces and EV Capable Spaces. The total of the three categories is tied to the number of dwelling units which are eligible for parking so that all residents have an opportunity to charge an EV when one is acquired. The intent is to provide a modest number of EV Installed and EV Ready Spaces from the outset, with EV Capable Spaces for the remainder up to the number of dwelling units for which parking is provided. Buildings that house individuals receiving medical or other care may not provide parking to serve residents of all dwelling units. The proposal will benefit residents and the public, saving money and cutting pollution.

Hotels, motels and other places of temporary lodging are important to travelers, many of whom will drive to the place of lodging, need to recharge overnight and move on. The proposal would tie the number of EVSE Installed, EV Ready and EV Capable spaces to the number of sleeping units (rather than dwelling units). Once the infrastructure is in place, the hotel would be readily able to expand EVSE services as demand grows.

Places of employment also need some level of EV charging at the workplace to accommodate employees' commuting needs. The proposal would not require as many at-work chargers on the assumption that some employees will be able to charge at home. Charging along the highway is a slow, less-convenient process than charging a vehicle while at work or at home.

EVs are growing in importance and will continue to grow in importance as climate risks compel shifting to vehicles that do not emit pollution and as more people recognize the potential value of owning or leasing EVs. EVs will save EV users up to $1900 per year in operating expenses compared to traditional vehicles.[1] Those operating savings will encourage EV sales growth and will greatly exceed the costs of pre-wiring garages and

installing other necessary infrastructure during construction. Installing during construction is much cheaper than doing so by retrofit.

Vehicles are Virginia's largest source of carbon-dioxide emissions from fossil fuel combustion.[2] Even based on today's mix of generation in Virginia, DOE estimates that EVs would reduce CO2 emissions by roughly two-thirds compared to vehicles combusting gasoline.[3] Emissions from generation that supplies EVs will decline more as utilities' zero-carbon renewable energy replaces fossil-fuel generation. EVs' direct emissions are non-existent, which also has substantial health and pollution benefits compared to gasoline or diesel vehicles. Furthermore, in addition to the EV user's savings on annual operating costs (energy and maintenance), EV charging during off-peak periods can lead to a reduction of electric rates to all utility customers.[4]There is a national goal to have 50% of new vehicles to be EVs by 2030.[5] Major vehicle manufacturers have committed to shift production to EVs over the next 10 years with a number of manufactures committing to shift to 100% EV production in the next 5-10 years. [6]At-home charging in conjunction with single or multifamily parking is particularly important to meeting the needs of EV owners and to encourage charging during utilities' off-peak periods. According to research by JD Power, "80% of EV charging is done at home—almost always overnight—or while a car is parked during the workday" and EV users strongly prefer Level 2 (220/240V) charging. [7] The capability for at-home charging will substantially reduce barriers to EV adoption that arise from the inconveniences that EV charging is slower than pumping gasoline, the public infrastructure for charging is still limited, and drivers have limited ability to take advantage of off-peak rates without home-charging. The need for convenient overnight charging is as important for travelers as for residents.Going forward, utilities may get the added benefit of being able to draw on the batteries of parked electric vehicles in order meet peak demands and balance fluctuating loads.

Installing the wiring and basic infrastructure during construction when walls are open, parking is being constructed and workers are present is much cheaper. Experience shows that installing a simple 220V/40 Ampere outlet (comparable to a dryer or stove outlet) for "Level 2" EV charging, in a garage or outside close to parking spaces (*e.g.*, on a wall near a single-family driveway), will enable an EV owner to reliably charge an EV at home, scheduling it at night or otherwise outside the utilities peak demand period for the lowest rates The same is true for employees who commute with EVs. The presence of the wiring from the beginning would permit low-cost installation of a different charging system preferred by the EV owner. Failure to install the EV during infrastructure will create barriers to EV adoption and to the cost and pollution reductions that will come from EV utilization. Those barriers will be particularly great in the context of multifamily dwellings where retrofit costs are much higher and landlords' interests conflict with those of tenants.
[1] *See* Consumer Reports, "EVs Offer Big Savings Over Traditional Gas-Powered Cars" (October 2020); Union of Concerned Scientists, https://www.ucsusa.org/about/news/rural-communities-could-benefit-most-electric-vehicles (up to $1900/year savings for rural EV owners); https://augustafreepress.com/deq-launches-clean-air-communities-program-aimed-at-driving-investment-in-electric-vehicle The police department of Westport Connecticut achieved operating and maintenance savings of over $17,000 in its first year of using a Tesla Model 3 police car instead of a fossil fuel vehicle. Among the department's conclusions: after four years the Tesla will have saved enough money to buy another Tesla, and each EV avoids emission of over 23 tons of CO2 per year and saves $8763 in environmental and health costs. https://www.teslarati.com/tesla-model-3-westport-police-department-financial-analysis/

[2]https://www.epa.gov/sites/production/files/2019-11/documents/co2ffc_2017.pdf

[3] DOE estimates that an EV in Virginia emits (via electric generation) less than a third as much CO2 as a gasoline-driven vehicle. https://afdc.energy.gov/vehicles/electric_emissions.html ; https://evtool.ucsusa.org/
[4] See June 23, 2020 Comments of the Sierra Club to the State Corporation Commission in SCC Docket PUR-2020-00051, Electrification of Motor Vehicles. As the comments explain, with managed off-peak charging and efficient rate structures, rising EV loads can drive down rates to all customers. Regarding operating costs, an EV has very little maintenance costs and EV's electricity cost equivalent to a gallon of gasoline, in Virginia, was $1.16 versus roughly $4.00/gallon today. https://www.energy.gov/maps/egallon
[5] https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/
[6] EV sales are already increasing, and every major vehicle manufacturer has committed to expand EV production and even to go all-electric over the next decade or so. Electric pick-up trucks will soon be available and there are long waiting lists for pick-ups. *See* https://www.reuters.com/business/autos-transportation/us-automakers-say-they-aspire-up-50-ev-sales-by-2030-sources-2021-08-04/ https://www.forbes.com/wheels/news/automaker-ev-plans/ ; https://www.cnbc.com/2022/01/05/chrysler-kicks-off-plans-to-go-all-electric-by-2028-with-airflow-concept.html
https://www.electrive.com/2021/08/05/us-carmakers-aim-for-40-50-ev-sales-by-2030/
[7] https://www.forbes.com/wheels/news/jd-power-study-electric-vehicle-owners-prefer-dedicated-home-charging-stations/ See also James Walkinshaw, Washington Post, Jan. 23, p.C4 (explaining the importance of home charging relative to public charging). Utilities' energy sales are lowest and cheapest in off-peak hours, particularly at night. A common utility strategy is to offer time-of-use rates with low night-time prices to encourage off-peak EV charging. For EV customers to make use of such incentives, they will need access to overnight charging at home where they spend the night.

Cost Impact: The code change proposal will increase the cost of construction
This code change proposal will somewhat increase the cost of constructing parking, but the increase will be small compared to the total cost of building construction and to the benefits to residents, employees and the public. EVs with at-home charging or at-work charging will save the users money and avoid the higher costs of retrofitting in the future.

The incremental cost of installing the electric equipment will be low when a residence is constructed. It is easy to install the wires, panel capacity and conduits for electric vehicle charging--along with the rest of a dwelling's wiring--when parking for multifamily dwelling or a nonresidential building is being constructed. It is much harder and much more expensive to do so as a retrofit. The branch circuit would cost a few dollars per foot, and raceways are also inexpensive.

In a large multifamily building, the cost would be greater than for a single-family dwelling due the larger garage or parking lot size and possibly the garage design. However, the costs of the infrastructure required by the proposal are still low compared to the overall construction cost, to potential retrofit costs, to residents' long-term savings from EVs, and to harm from impeding tenants' ability to reduce carbon and other pollutants which will reduce pollutants and benefit the public. The cost can be minimized by locating the EVSE (or future location for the EVSE) close to the electrical panels. The proposal limits the costs both by limiting the requirements to one covered space per dwelling unit and to a limited number of spaces planned for employees and by deferring of much of the costs with respect to EV Ready and EV Capable spaces.

In the case of multifamily projects, the proposed multifamily requirements are tied to the number of dwelling units and staged as spelled out in the Table, so that residents of every dwelling unit will have the opportunity to home-charge an EV, and the remaining electrical wiring and charger costs would only be incurred as occupant demand grows. The requirements for non-residential buildings are likely to be less than for multifamily. In submissions to the IECC as part of the 2021 IECC review process, data indicated that the cost of retrofitting commercial parking to EV ready status would be 3-8 times higher than doing to work at the time of building construction. See IECC Proposal CE217-19 Part 1(Cost Impact discussion). Such high retrofit costs will deter future retrofits and act as a barrier to EV access by residents of multifamily dwellings, potentially for decades.

Resiliency Impact Statement: This proposal will increase Resiliency

Expanding EV utilization will enhance resiliency in multiple ways.

It is anticipated that EV batteries can be connected to the grid to provide grid balancing and back up in the future.

Switching to EVs is also critical to resiliency because it will reduce CO2, CO, SO2, particulates, methane, and other harmful emissions from fossil-fuel combusting vehicles and from producing and delivering gasoline and diesel fuel for use in vehicles. Unlike traditional vehicles with internal combustion engines ("ICE"), electric vehicles emit no air pollution and are much more energy efficient than ICE vehicles. As Virginia's electric grid shifts to zero-carbon generation, the emission reduction benefits will grow.

According to Virginia's DEQ, "[t]he transportation sector is now the largest contributor of air pollutants and greenhouse gases in Virginia," and "[v]ehicle emissions are the largest single source of toxic and smog-forming air pollution in Northern Virginia and much of the rest of the country." https://www.deq.virginia.gov/air/clean-vehicles . Transportation accounts for 48.6% of Virginia's CO2 emissions. https://www.eia.gov/environment/emissions/state/

Polluting emissions from internal combustion vehicles compound the risks of climate change and adversely impact public health. CO2 and other emissions from fossil fuel combustion and production are the primary drivers of climate change. The most recent IPCC report confirms that rapid reductions of greenhouse gas emissions is essential to avoid catastrophic climate impacts around the world. IPCC Sixth Assessment Report (February 2022), https://www.ipcc.ch/report/ar6/wg2/ Substantial harm has already occurred nationally and locally from global warming and much worse will follow without rapid reductions of greenhouse gases (particularly CO2 and methane associated with fossil fuel production and combustion). Virginia's coastal areas are among the most vulnerable to sea level rise and destructive storms. They already experience "sunny day flooding," and sea level rise is accelerating. https://www.vims.edu/newsandevents/topstories/2020/slrc_2019.php 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 associated with fossil fuel production and combustion). The most recent report from NOAA indicates that Virginia may face 2 feet of sea level rise by 2050 due to worsening climate change from human greenhouse gas emissions. https://www.noaa.gov/news-release/us-coastline-to-see-up-to-foot-of-sea-level-rise-by-2050 Virginia faces climate-driven sea level rise of 6.69 feet this century; the rate of sea level rise is accelerating; the danger of climate-driven severe storms, storm-surges and flooding are rising; and climate change will increasingly harm human health and lives, agriculture, businesses, military installations, private and public property, and Virginia's economy. http://www.vasem.org/reports/2021-the-impact-of-climate-change-on-virginias-coastal-areas/ Growing dangers also include rising atmospheric and water temperatures that worsen heat-related illnesses, disruptions of economic activity, and harms to agriculture, fisheries, and our natural heritage.

Because atmospheric CO2 from emissions is cumulative, Virginia has less chance of mitigating and recovering from those harms the longer we delay maximizing energy savings and minimizing greenhouse gas pollution.

Shifting to EVs is a critical piece of the solution to global warming. Continuing to construct buildings that will not support use of clean EVs will make it harder to achieve climate goals, particularly since the buildings will likely remain in place for 70 years or more. Constructing buildings that cannot provide electric charging will also delay residents' ability to access large economic and energy savings from EV usage.

Building codes already recognize that fumes from traditional vehicles are dangerous. More broadly, small particle, SO2 and other pollution from vehicles burning fossil fuels increases heart and lung disease, as well as cognitive and other disorders. https://blog.ucsusa.org/dave-reichmuth/air-pollution-from-cars-trucks-and-buses-in-the-u-s-everyone-is-exposed-but-the-burdens-are-not-equally-shared/ As Virginia's electric grid shifts to zero-carbon generation, the emission reduction benefits will grow particularly if we shift vehicles to clean electricity. Local air pollution harms caused by vehicle pollution will also be reduced which will particularly benefit high-traffic areas, including low-income urban areas.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: EC-C405.10-21

This proposal doesn't have any public comments.

EC-C405.11.1-21

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Construction Code

Add new text as follows:

C202 GENERAL DEFINITIONS. Add:

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, electric motorcycles and the like, which is primarily powered by an electric motor that draws current from a rechargeable storage battery. A "plug-in hybrid" is a type of electric vehicle which relies on a combination of a rechargeable storage battery and another source of motive power.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or charging apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EVSE INSTALLED SPACE. A designated parking space which is provided with EVSE, including an energized branch circuit with at least 40-ampere, 208/240 volts capacity that connects electric panel capacity to charging apparatus located within three feet of the parking space.

EV CAPABLE SPACE. A designated parking space which is provided with electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for EVSE, and with an adequately-sized raceway from the panel to a clearly identified location within three feet of the parking space, to support future EVSE.

EV READY SPACE. A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit and adequate electric panel capacity and space to electrify EVSE. The circuit shall terminate in a suitable termination point, such as a receptacle, junction box, or an EVSE, located within three feet of the parking space.

C405.11.1 EV Readiness for Certain Commercial Buildings Other Than Multifamily. Commercial construction other than multifamily that includes parking spaces for use by employees or students shall, at a minimum, provide EVSE Installed, EV Ready and EV Capable Parking Spaces shown in Table C405.11.1. Where the calculation of percentages of spaces to be served results in a fractional parking space, it shall round up to the next whole number. If a covered project is built in phases, the minimum number of required spaces shall be determined separately for each phase. Raceways to outdoor parking spaces shall be located underground and protected from water.
EXCEPTIONS: EVSE Installed, EV Ready and EV Capable Parking Spaces are not required for parking intended for vehicle inventory, vehicle storage, construction equipment, commercial customer use or farms.

TABLE C405.11.1
Number of EV Ready Spaces for Certain Non-Multifamily Construction.

Type of building/space	EVSE Installed	EV Ready	EV Capable
Office, manufacturing or processing plants with more than 10 parking spaces for employees	Greater of 1 or 5% of employee spaces	Greater of 1 or 10% of employee spaces	Greater of 1 or 20% of such spaces of employee spaces
Hotel, motel, extended stay, other temporary lodging	Greater of 1 or 5% of sleeping units if more than 10 such units	Greater of 1 or 10% of sleeping units if more than 10 such units	30% of sleeping units if more than 10 such units
Educational institutions if more than 10 spaces to be provided for faculty and other employees or students	Greater of 1 or 5% of spaces provided to faculty and other employees and 1 or 5% spaces provided to students	Greater of 1 or 10% of spaces provided to faculty and other employees and 1 or 5% of spaces provided to students	Greater of 1 or 20% of spaces provided to faculty and other employees and 1 or 10% of spaces provided to students

Reason Statement: This provision is designed to provide electric charging readiness for the growing use of electric vehicles (EVs) and to meet the need for some EV charging capabilities for certain workplaces, temporary lodgings, and educational venues. It recognizes that employees, travelers and students may travel considerable round-trip distances from home or may not have access to at-home charging. Substantially or fully charging an EV can take many hours, which fits with a typical workday or overnight at home, but not along the roadway as an addition to a typical commute. The proposal will benefit businesses and their employees and students. It will also benefit the public and enhance the economy by cutting air, water and climate pollution from internal combustion engines; by saving money for vehicle users; by saving time by charging vehicles when they are going to be parked anyway, and by reducing noise pollution. Reductions of air and climate pollution will have huge health, safety and infrastructure benefits.
The proposal is designed to minimize costs through phasing of EV development, with an emphasis on installing infrastructure during initial construction. Installing the wiring and basic infrastructure during construction is much cheaper than retrofitting. The proposal requires a relatively small upfront investment in infrastructure, with easy installation of additional chargers (EVSE) as needs grow. It assumes that there is a lesser need for workplace and customer EV charging than at-home charging (assuming at-home charging develops), but recognizes that some EV charging capabilities are needed at workplaces and commercial venues. Not everyone will have access to at-home EV charging, and many employees will

need some workplace charging to support expanded EV usage. Residents of older buildings and ones who rely on street parking are unlikely to get at-home charging for many years, if ever.
The proposal focuses on employees, travelers and students because of their unique needs and the likelihood that they will be able to use EV charging for a period of hours. Employees typically must work regular daily schedule; must commute farther to work than customers do for shopping; are likely to be at their workplace for extended periods; and have less time for roadside-charging. Travelers who drive will generally need overnight charging at places of lodging.

The intent is to provide a modest number of EV Installed and EV Ready Spaces from the outset, with EV Capable Spaces available for easy charging expansion as demand rises.
Providing access to at-work charging is also important as a matter of equity since residents of older, multifamily dwellings and townhouses are least likely to have access to at-home charging. Although the purchase cost of EVs is currently higher than the low end of vehicles with combustion engines, the purchase price is falling as competition grows and, more importantly, the EV savings in fuel and maintenance costs more than pay for the initial price difference. Also, air pollution from traditional vehicles is particularly harmful to low-income residents of Virginia.
EVs are growing in importance and will continue to grow in importance as climate risks compel shifting to vehicles that do not emit pollution and as more people recognize the potential value of owning or leasing EVs. EVs will save EV users up to $1900 per year in operating expenses compared to traditional vehicles (based on prices when those reviews were done, which were considerably lower than the $4.00/gallon or so seen today).[1] Those operating savings will encourage EV sales growth and will greatly exceed the costs of pre-wiring parking lots and installing other necessary infrastructure during construction. Installing during construction is much cheaper than doing so by retrofit.
Vehicles are Virginia's largest source of carbon-dioxide emissions from fossil fuel combustion.[2] Even based on today's mix of generation in Virginia, DOE estimates that EVs would reduce CO2 emissions by roughly two-thirds compared to vehicles combusting gasoline.[3] Emissions from generation that supplies EVs will decline more as utilities' zero-carbon renewable energy replaces fossil-fuel generation. EVs' direct emissions are non-existent, which also has substantial health and pollution benefits compared to gasoline or diesel vehicles.
Unfortunately, charging EVs is a time-consuming process. Even "Level 2" (40 amp, 208-240Volt) charging will only add 20-30 miles of range per hour of charging; while Level 1 provides approximately 5 miles per hour of charging. That creates a significant problem for individuals who cannot charge at work or home.
There is a national goal to have 50% of new vehicles to be EVs by 2030.[4] Major vehicle manufacturers have committed to shift production to EVs over the next 10 years with a number of manufactures committing to shift to 100% EV production in the next 5-10 years.[5]. According to research by JD Power, "80% of EV charging is done at home—almost always overnight—or while a car is parked during the workday" and EV users strongly prefer Level 2 (220/240V) charging. [6] The opportunity to charge at work is critical for long-distance commuter and for drivers who cannot install at-home charging due to their reliance on street parking or living in older buildings that lack parking or charging. The availability of at-work and at-home charging will substantially reduce barriers to EV adoption that arise from the inconveniences that EV charging is slower than pumping gasoline.. Going forward, utilities may get the added benefit of being able to draw on the batteries of parked electric vehicles in order meet peak demands and balance fluctuating loads..
[1] See Consumer Reports, "EVs Offer Big Savings Over Traditional Gas-Powered Cars" (October 2020); Union of Concerned Scientists, https://www.ucsusa.org/about/news/rural-communities-could-benefit-most-electric-vehicles (up to $1900/year savings for rural EV owners); https://augustafreepress.com/deq-launches-clean-air-communities-program-aimed-at-driving-investment-in-electric-vehicle The police department of Westport Connecticut achieved operating and maintenance savings of over $17,000 in its first year of using a Tesla Model 3 police car instead of a fossil fuel vehicle. Among the department's conclusions: after four years the Tesla will have saved enough money to buy another Tesla, and each EV avoids emission of over 23 tons of CO2 per year and saves $8763 in environmental and health costs. https://www.teslarati.com/tesla-model-3-westport-police-department-financial-analysis/ Those studies were based on much lower gas prices than exist today, which means that today's savings would be much larger. Regarding operating costs, an EV has very little maintenance costs and EV's electricity cost equivalent to a gallon of gasoline, in Virginia, was $1.16 versus roughly $4.00/gallon today. https://www.energy.gov/maps/egallon

[2]https://www.epa.gov/sites/production/files/2019-11/documents/co2ffc_2017.pdf

[3] DOE estimates that an EV in Virginia emits (via electric generation) less than a third as much CO2 as a gasoline-driven vehicle. https://afdc.energy.gov/vehicles/electric_emissions.html ; https://evtool.ucsusa.org/

[4] https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-americanleadership-forward-on-clean-cars-and-trucks/
[5] EV sales are already increasing, and every major vehicle manufacturer has committed to expand EV production and even to go all-electric over the next decade or so. Electric pick-up trucks will soon be available and there are long waiting lists for pick-ups. See https://www.reuters.com/business/autos-transportation/us-automakers-say-they-aspire-up-50-ev-sales-by-2030-sources-2021-08-04/ https://www.forbes.com/wheels/news/automaker-ev-plans/ ; https://www.cnbc.com/2022/01/05/chrysler-kicks-off-plans-to-go-all-electric-by-2028-with-airflow-concept.html https://www.electrive.com/2021/08/05/us-carmakers-aim-for-40-50-ev-sales-by-2030/
[6] https://www.forbes.com/wheels/news/jd-power-study-electric-vehicle-owners-prefer-dedicated-home-charging-stations/ See also James Walkinshaw, Washington Post, Jan. 23, p.C4 (explaining the importance of home charging relative to public charging). Utilities' energy sales are lowest and cheapest in off-peak hours, particularly at night. A common utility strategy is to offer time-of-use rates with low night-time prices to encourage off-peak EV charging. For EV customers to make use of such incentives, they will need access to overnight charging at home where they spend the night.

Cost Impact: The code change proposal will increase the cost of construction

The code change proposal will somewhat increase the cost of constructing parking, but the increase will be small compared to the total cost of construction and the benefits to employees, travelers, students and the public. Installing EV charging or at least readiness for EV charging at the covered locations will save users money on fuel and avoid the much higher costs of retrofitting parking in the future.The incremental cost of installing the electric equipment is much lower during initial construction. See PNNL-31576, "Electric Vehicle Charging for Residential and Commercial Energy Codes: Technical Brief" (July 2021). While the potential costs can vary widely, they are substantially reduced by addressing during initial construction, by taking advantage of upfront planning (e.g., as to locations of electrical systems and parking), and by economies of scale. The PNNL report (p.12) showed that 12 EV spaces in a 60-space parking structure would cost $860 per space with new construction or $2,370 per space with a retrofit, while 2 spaces in a 10 space lot would cost $930 per space with new construction or $3,710 per space in a retrofit. It states (p.7), "The availability and ease of access to Level 2 and DCFC EVSE is a critical barrier to EV adoption. A lack of pre-existing EV charging infrastructure, such as electrical panel capacity, raceways, and pre-wiring, can make the installation of a new charging station cost-prohibitive for a potential EV-owner. (fn omitted). Those costs would be a small fraction of new construction costs or rents, but a potential barrier to later installation.

In submissions to the IECC as part of the 2021 IECC review process, data indicated that the cost of retrofitting commercial parking to EV ready status would be 3-8 times higher than doing to work at the time of building construction. Such high retrofit costs will deter future retrofits and act as a barrier to EV expansion in Virginia.

It is easy to install the wires, panel capacity and conduits for electric vehicle charging--along with the rest of a dwelling's wiring--when a single or multifamily dwelling is built. It is much harder and much more expensive to do so as a retrofit, which may require tearing up walls or parking surfaces. The branch circuit for an EVSE Installed or EVSE Ready space would cost a few dollars per foot, and would not be required during construction for a EV Capable Space.

The cost can be minimized by locating the EVSE or future location for the EVSE close to the electrical infrastructure. The proposal limits the costs both by limiting the total requirement to many fewer than the total parking spaces to be constructed and by allowing deferral of some costs for EV Ready and EV Capable spaces. Also, while 40-Amp circuits are required for the initial EVSE Installed and EV Ready Spaces and the capacity is needed to handle future branch circuits in EV Capable raceways, the door is left open to the possibility that, with experience and new technology, lower-capacity wiring might eventually be installed in at least some EV Capable spaces.

Resiliency Impact Statement: This proposal will increase Resiliency

Expanding EV utilization will enhance resiliency in multiple ways.

Many potential EV users lack at-home EV charging capabilities, which means that some workplace coverage is essential. Travelers also need access to overnight charging during stays at hotels and motels. Even if an employee or student has access to EV charging at home, the ability to charge at work can offset power outages at home. EVSE can be designed to deliver electricity back to a building or to the utility grid. https://www.ford.com/trucks/f150/f150-lightning/2022/

Switching to EVs is also critical to resiliency because it will reduce CO2, CO, SO2, particulates, methane, and other harmful emissions from fossil fuel combusting vehicles and from producing and delivering gasoline and diesel fuel for use in vehicles. Unlike traditional vehicles with internal combustion engines ("ICE"), electric vehicles emit no air pollution and are much more energy efficient than ICE vehicles. As Virginia's electric grid shifts to zero-carbon generation, the emission reduction benefits will grow.

According to Virginia's DEQ, "[t]he transportation sector is now the largest contributor of air pollutants and greenhouse gases in Virginia," and "[v]ehicle emissions are the largest single source of toxic and smog-forming air pollution in Northern Virginia and much of the rest of the country." https://www.deq.virginia.gov/air/clean-vehicles . Transportation accounts for 48.6% of Virginia's CO2 emissions. https://www.eia.gov/environment/emissions/state/

Polluting emissions from internal combustion vehicles compound the risks of climate change and adversely impact public health. CO2 and other emissions from fossil fuel combustion and production are the primary drivers of climate change. The most recent IPCC report confirms that rapid reductions of greenhouse gas emissions is essential to avoid catastrophic climate impacts around the world. IPCC Sixth Assessment Report (February 2022), https://www.ipcc.ch/report/ar6/wg2/ Substantial harm has already occurred nationally and locally from global warming and much worse will follow without rapid reductions of greenhouse gases (particularly CO2 and methane associated with fossil fuel production and combustion). Virginia's coastal areas are among the most vulnerable to sea level rise and destructive storms. They already experience "sunny day flooding," and sea level rise is accelerating. https://www.vims.edu/newsandevents/topstories/2020/slrc_2019.php 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 associated with fossil fuel production and combustion). The most recent report from NOAA indicates that Virginia may face 2 feet of sea level rise by 2050 due to worsening climate change from human greenhouse gas emissions. https://www.noaa.gov/news-release/us-coastline-to-see-up-to-foot-of-sealevel-rise-by-2050 Virginia faces climate-driven sea level rise of 6.69 feet this century; the rate of sea level rise is accelerating; the danger of climate-driven severe storms, storm-surges and flooding are rising; and climate change will increasingly harm human health and lives, agriculture, businesses, military installations, private and public property, and Virginia's economy. http://www.vasem.org/reports/2021-the-impact-of-climatechange-on-virginias-coastal-areas/ Growing dangers also include rising atmospheric and water temperatures that worsen heat-related illnesses, disruptions of economic activity, and harms to agriculture, fisheries, and our natural heritage.

Because atmospheric CO2 from emissions is cumulative, Virginia has less chance of mitigating and recovering from those harms the longer we delay maximizing energy savings and minimizing greenhouse gas pollution. Shifting to EVs is a critical piece of the solution to global warming. Continuing to construct buildings that will not support use of clean EVs will make it harder to achieve climate goals, particularly since the buildings will likely remain in place for 70 years or more. Constructing buildings that cannot provide electric charging will also delay residents' ability to access large economic and energy savings from EV usage.

Building codes already recognize that fumes from traditional vehicles are dangerous. More broadly, small particle, SO2 and other pollution from vehicles burning fossil fuels increases heart and lung disease, as well as cognitive and other disorders. https://blog.ucsusa.org/dave-reichmuth/airpollution-from-cars-trucks-and-buses-in-the-u-s-everyone-is-exposed-but-the-burdens-are-not-equally-shared/ As Virginia's electric grid shifts to zero-carbon generation, the emission reduction benefits will grow particularly if we shift vehicles to clean electricity. Local air pollution harms caused by vehicle pollution will also be reduced which will particularly benefit high-traffic areas, including low-income urban areas.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: EC-C405.11.1-21

This proposal doesn't have any public comments.

EC-C405.13(2)-21

Proponents: DHCD Staff (sbco@dhcd.virginia.gov)

2021 International Energy Conservation Code

Add new text as follows:

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, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

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

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the *electric vehicle* connectors, attachment plugs, 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* .

C405.13 Electric Vehicle Power Transfer Infrastructure. New parking facilities for R-2 occupancies with 50 units or more shall be provided with *electric vehicle* power transfer infrastructure in compliance with Sections C405.13.1 through C405.13.6.

C405.13.1 Quantity. The number of required *EV spaces* shall be determined in accordance with Table C405.13.1, the Table requirements shall be based on the total number of dwelling units or the total number of automobile parking spaces, whichever is less.

Table C405.13.1 REQUIRED EV POWER TRANSFER INFRASTRUCTURE.

OCCUPANCY	EVSE SPACES
GROUP R-2	10%

C405.13.2 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 C405.13.1, serving either a single *EVSE space* or multiple *EVSE spaces*, shall comply with all of the following:

1. Have a minimum circuit capacity in accordance with C405.13.3.
2. Be located within 3 feet (914 mm) of each *EVSE space* it serves.
3. Be installed in accordance with Section C405.13.3.

C405.13.2.1 EVSE Minimum Charging Rate.

Each installed EVSE shall comply with one of the following:

1. Be capable of charging at a minimum rate of 6.2 kVA (or 30A at 208/240V).
2. When serving multiple *EVSE spaces* and controlled by an energy management system providing load management, be capable of simultaneously charing each *EVSE space* at a minimum rate of no less than 3.3 kVA.
3. When serving *EVSE spaces* allowed to have a minimum circuit capacity of 2.7 kVA in accordance with C405.13.3.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each *ESVE space* at a minimum rate of no less than 2.1 kVA.

C405.13.3 Circuit Capacity. The capacity of electrical infrastructure serving each *EV space* shall have a branch circuit with a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each *EVSE space* it serves.

C405.13.3.1 Circuit Capacity Management. The capacity of each branch circuit serving multiple EVSE spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall comply with one of the following:

1. Have a minimum capacity of 4.1 kVA per space.
2. Have a minimum capacity of 2.7 kVA per space when serving *EVSE spaces* for R-2 occupancies when all (100%) of the automobile parking spaces designated for R-2 occupancies are designed to be *EVSE spaces*.

3. Have a minimum capacity of 2.7 kVA per space when serving *EVSE spaces* for a building site when all (100%) of the automobile parking spaces are designed to be *EVSE spaces*.

C405.13.4 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 International Building Code Section 1107.

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.

Revise as follows:

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, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

Add new text as follows:

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

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the *electric vehicle* connectors, attachment plugs, 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* .

R404.4 Electric Vehicle Power Transfer Infrastructure. New parking facilities for R-2 occupancies with 50 units or more shall be provided with *electric vehicle* power transfer infrastructure in compliance with Sections R404.4.1 through R404.4.4.

R404.4.1 Quantity. The number of required *EV spaces* shall be determined in accordance with Table R404.4.1, the Table requirements shall be based on the total number of dwelling units or the total number of automobile parking spaces, whichever is less.

Table R404.4.1 REQUIRED EV POWER TRANSFER INFRASTRUCTURE.

OCCUPANCY	EVSE SPACES
GROUP R-2	10%

R404.4.2 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 R404.4.1, serving either a single *EVSE space* or multiple *EVSE spaces*, shall comply with all of the following:

1. Have a minimum circuit capacity in accordance with R404.4.3.
2. Be located within 3 feet (914 mm) of each *EVSE space* it serves.
4. Be installed in accordance with Section R404.4.4.

R404.4.2.1 EVSE Minimum Charging Rate. Each installed EVSE shall comply with one of the following:

1. Be capable of charging at a minimum rate of 6.2 kVA (or 30A at 208/240V).
2. When serving multiple *EVSE spaces* and controlled by an energy management system providing load management, be capable of simultaneously charing each *EVSE space* at a minimum rate of no less than 3.3 kVA.
3. When serving *EVSE spaces* allowed to have a minimum circuit capacity of 2.7 kVA in accordance with R404.4.3.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each *ESVE space* at a minimum rate of no less than 2.1 kVA.

R404.4.3 Circuit Capacity. The capacity of electrical infrastructure serving each *EV space* shall have a branch circuit with a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each *EVSE space* it serves.

R404.4.3.1 Circuit Capacity Management. The capacity of each branch circuit serving multiple EVSE spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall comply with one of the following:

1. Have a minimum capacity of 4.1 kVA per space.
2. Have a minimum capacity of 2.7 kVA per space when serving *EVSE spaces* for R-2 occupancies when all (100%) of the automobile parking spaces designated for R-2 occupancies are designed to be *EVSE spaces*.
3. Have a minimum capacity of 2.7 kVA per space when serving *EVSE spaces* for a building site when all (100%) of the automobile parking spaces are designed to be *EVSE spaces*.

R404.4.4 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 International Building Code Section 1107.

Reason Statement: This proposal was created by staff in response to a request from Delegates Reid and Bulova (letter attached) to "...make EV purchases a viable option for residents of multi-family dwelling units...". The proposal is partly based on CEPI-1-21, submitted for the 2024 IECC, but has been revised in several ways, including only addressing multi-family dwellings.

Cost Impact: The code change proposal will increase the cost of construction
This proposal will increase the cost of construction.

Resiliency Impact Statement: This proposal will increase Resiliency

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Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- ☐ Consensus Approval
- ☐ Consensus Disapproval
- ☐ Carry Over to Next Meeting
- ☐ Carry over to Final
- ☐ Non-Consensus
- ☐ None

Public Comments for: EC-C405.13(2)-21

This proposal doesn't have any public comments.

EC-C405.13(3)-21

Proponents: Ben Rabe (ben@newbuildings.org); Kimberly Newcomer (kim@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

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, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

Revise as follows:

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the *electric vehicle* connectors, attachment plugs, 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* .

Add new text as follows:

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

ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE). A designated *automobile parking space* that is provided with electrica l i nfrastructure, such as, but not limited to, raceways, cables, electrical capacity, and 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 either an outlet, junction box or receptacle, that will support an installed *EVSE* .

C405.13 Electric Vehicle Power Transfer Infrastructure. New parking facilities shall be provided with *electric vehicle* power transfer infrastructure i n compliance with Sections C405.13.1 through C405.13.6.C405.13.1 Quantity . The number of required *EV spaces* , *EV capable spaces* and *EV ready spaces* shall be determined in accordance with this Section and Table C405.13.1 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 readyspaces* 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 capablespaces* .**5.** Where the Where all (100%) parking serving R-2 occupancies are *EV ready spaces* , requirements for *EVSE spaces* for R-2 occupancies shall not apply.

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 C405.13.1 shall be used

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

Table C405.13.1 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	2%	0%	5%
GROUP F	2%	0%	5%
GROUP H	1%	0%	0%
GROUP I	2%	0%	5%
GROUP M	10%	0%	10%
GROUP R-1	20%	5%	75%
GROUP R-2	20%	5%	75%
GROUP R-3 AND R-4	2%	0%	5%
GROUP S exclusive of parking garages	1%	0%	0%
GROUP S-2 parking garages	1%	0%	0%

C405.13.2 EV Capable Spaces . Each *EV capable space* used to meet the requirements of Section C405.13.1 shall comply with all of 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 capablespace* and a suitable panelboard or other onsite electrical distribution equipment.

2. Installed raceway or cable assembly shall be sized and rated to supply an minimum circuit capacity in accordance with C405.13.5

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 supplyequipment* (EVSE)."

5. Reserved capacity shall be no less than 4.1 kVA (20A 208/240V) for each *EV capable space* .

C405.13.3 EV Ready Spaces . Each branch circuit serving EV ready spaces used to meet the requirements of Section C405.13.1 shall comply with all of 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 circuit capacity in accordance with C405.13.5.

3. The panelboard or other 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)."

C405.13.4 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 C405.13.1, serving either a single *EVSE space* or multiple *EVSE spaces* , shall comply with all of the following:

1. Have a minimum circuit capacity in accordance with C405.13.5.

2. Have a minimum charging rate in accordance with C405.13.4.1.

3. Be located within 3 feet (914 mm) of each *EVSE space* it serves.

4. Be installed in accordance with Section C405.13.6.

C405.13.4.1 EVSE Minimum Charging Rate . Each installed EVSE shall comply with one of the following:

1. Be capable of charging at a minimum rate of 6.2 kVA (or 30A at 208/240V).

2. When serving multiple *EVSE spaces* and controlled by an energy management system providing load management, be capable of simultaneously charging each *EVSE space* at a minimum rate of no less than 3.3 kVA.

3. When serving *EVSE spaces* allowed to have a minimum circuit capacity of 2.7 kVA in accordance with C405.13.5.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each *ESVE space* at a minimum rate of no l ess than 2.1 kVA.

C405.13.5 Circuit Capacity . The capacity of electrical infrastructure serving each *EV capable space* , *EV ready space* , and *EVSE space* shal l comply with one of the following:

1. A branch circuit shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each *EV ready space* or *EVSE space* it serves.

2. The requirements of C405.13.5.1.

C405.13.5.1 Circuit Capacity Management . The capacity of each branch circuit serving multiple EVSE spaces, EV ready spaces or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall comply with one of the following:

1. Have a minimum capacity of 4.1 kVA per space.

2. Have a minimum capacity of 2.7 kVA per space when serving *EV ready spaces* or *EVSE spaces* for a building site when all (100%) of the automobile parking spaces are designed to be *EV ready* or *EVSE spaces* .

C405.13.6 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 International Building Code Section 1107.

Revise as follows:

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062-2096

2202-2009 *Electric Vehicle (EV) Charging System- with revisions through February*

Add new text as follows:

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062

2594-2016 *Standard for Electric Vehicle Supply Equipment*

Reason Statement: Preparing our buildings for safe and convenient EV charging infrastructure is critical to deployment of electric vehicles. The transportation sector is the single largest source of GHG emissions in the nation. Near complete electrification of the transportation sector is necessary to achieve the GHG emission reductions needed to avoid the worst effects of climate change.
Electric vehicle sales increased by 80 percent from 2017 to 2018, and is expected to grow from 1 million vehicles at the end of 2018 to 18.7 million by 2030. As newer EVs with longer drive ranges enter the market, the older, shorter drive range EVs will move to the used vehicle market, and become readily accessible to a secondary market for which the accessibility of EV charging infrastructure at home and at work will be critical.

Inclusion in the IECC of EV Infrastructure requirements is critical in the prevention of the use of extension cords to inappropriate outlets for the purpose of vehicle charging. We must be building structures that will address the vehicles that the major automakers have already shown us they are producing, especially as they close out the production of ICE vehicles and switch to total EV manufacturing.

Buildings built in 2022 should last 50 years. By 2045 Ernst & Young predicts internal combustion engine (ICE) vehicles will make up less than 1% of new car sales globally. Bloomberg reports that the automakers' capital expenditures on capital equipment for electric vehicle manufacturing is important because it is the culmination of a manufacturer's multi-year exploration of the future; "Capex is Destiny." *

Shouldn't we be building structures to accommodate the vehicles that the automakers are telling us they are switching to? Shouldn't we be installing the infrastructure when it is least expensive to install? Shouldn't we be addressing the single largest source of GHG emissions?

Cost Impact: The code change proposal will increase the cost of construction
Recent analysis by NBI and partners using cost data from RSMeans and the PNNL medium office prototype found that the average total cost of an EVSE space in a commercial parking lot was $4702: $1558 in materials and $3145 in labor. These costs include a dual-head commercial Clipper Creek EVSE mounted on a commercial pedestal, raceways, and all electrical conductors. If the electrical panel and onsite transformer have to be upsized – something that will only happen on some projects – there would be an additional cost of $1200 per space.

Using the same prototype and data sources, each EV capable space required an additional cost of $123 per space for conduit (assuming an

average 100' run) and junction boxes if no capacity upgrade is required. If the panel and onsite transformer have to upsized to accommodate design loads, then that cost could increase by $1200 per space.

However, with the future demand for EVs and EV charging discussed in the reason statement, commercial parking facilities that do not include EV spaces during new construction will face substantially higher costs to retrofit those spaces in the future. For example, a cost-effectiveness study for the City and County of San Francisco conducted by Pacific Gas & Electric (PG&E) showed that the cost of an EV Ready space (full circuit for level 2 charging) installed during new construction was $860-$920, while a retrofit would cost $2370-$3710,[1] 3-4 times the cost. An analysis conducted by the California Air Resource Board found much higher cost savings of $7000 from avoided retrofit costs when EV spaces are installed during construction rather than retrofit, with the majority of the cost delta due to the cost of retrenching parking lots and doing costly panel and transformer upgrades.[2] The EV Capable spaces required by this proposal avoid nearly all of these incremental retrofit costs by including the most difficult elements to retrofit (trenching and panels) during new construction.

These EV chargers will also yield substantial economic benefits for both the individual that owns the EV and the building owner. For individuals, EVs cost much less to fuel and maintain than gas-powered vehicles. According to AAA, an electric vehicle (EV) will save roughly $1,039 per year in total fuel and maintenance costs compared to a comparable gasoline vehicle. Although Electric Vehicles are often more expensive than gasoline powered vehicles, Bloomberg New Energy Finance on battery costs suggests EVs could reach upfront cost parity with gasoline vehicles by the early-to-mid 2020s. For building owners, installing EV chargers will increase property values, attract new customers or tenants and improve staff and tenant retention.

With the growing market demand for EVs and the growing demand for charging they create, it not a question of if EV spaces will be needed, but when. Building owners and tenants will be paying for this cost now or in the future. Failing to install a minimal number of EVSE spaces and EV capable spaces now will saddle building owners and tenants with substantially higher costs due to costly future retrofits.

Resiliency Impact Statement: This proposal will increase Resiliency
As electric vehicles (EVs) become more prevalent (as noted in reason statement) they will provide a valuable resource to the electric grid. EVs will essentially become mobile batteries available to the grid to help absorb load at renewable peak generation, or supply buildings to help smooth load peak demand or during emergency events. Beyond their contribution to the buildings they plug into and the grid they interact with, EVs will remove another direct combustion source from climate equation, helping prevent the worst impacts of climate change. Providing charging infrastructure to new commercial and multifamily building will help speed the EV transition.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- ☐ Consensus Approval
- ☐ Consensus Disapproval
- ☐ Carry Over to Next Meeting
- ☐ Carry over to Final
- ☐ Non-Consensus
- ☐ None

Public Comments for: EC-C405.13(3)-21

This proposal doesn't have any public comments.

EC-C407.6-21

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Energy Conservation Code

Add new text as follows:

C407.6 Zero Energy Commercial Construction. Any Commercial building constructed or rehabilitated and sold, leased, advertised or otherwise held out to be a “zero energy” building or “net zero energy building” or made subject to an equivalent claim must satisfy the standards set forth in Appendix CC Zero Energy Commercial Building Provisions, in addition to any other energy efficiency and renewable energy standards that are applicable to such building. A building inspection and independent confirmation of compliance with Appendix CC must be conducted and supporting documentation must be submitted to demonstrate full compliance with Appendix CC. The building code official may require additional information, as appropriate, to demonstrate compliance.

R406.8 Zero Energy Residential Construction. Any residential building constructed or rehabilitated and sold, leased, advertised or otherwise held out to be as “zero energy” building or “net zero energy” or made subject to an equivalent claim must satisfy the standards set forth in Appendix RC Zero Energy Residential Building Provisions in addition to any other energy efficiency and renewable energy standards applicable to such construction or rehabilitation. Inspection and independent confirmation of compliance with Appendix RC must be conducted and documentation provided, consistent with the provisions of R406, R407 (including R407.1-R407.6) to confirm compliance with Appendix RC Zero Energy Residential Building Provisions. The building code official may require additional information, as appropriate, to demonstrate compliance.

N1106.8 Zero Energy Residential Construction.
Any residential building constructed or rehabilitated and sold, leased, advertised or otherwise held out to be as “zero energy” building or “net zero energy” or made subject to an equivalent claim must satisfy the standards set forth in Appendix RC Zero Energy Residential Building Provisions in addition to any other energy efficiency and renewable energy standards applicable to such construction or rehabilitation. Inspection and independent confirmation of compliance with Appendix RC must be conducted and documentation provided, consistent with the provisions of N1106, N1107 (including N1107.1-N407.6) to confirm compliance with Appendix RC Zero Energy Residential Building Provisions. The building code official may require additional information, as appropriate, to demonstrate compliance.

Reason Statement: The 2021 IECC adds two appendices specifying the requirements for "zero energy" construction: "Appendix CC Zero Energy Commercial Building Provisions" and "Appendix RC Zero Energy Residential Building Provisions".

The purpose of this proposal is to activate the standards set forth in these two appendices by making them applicable and mandatory for any buildings constructed and sold or leased as being "zero energy" or "net zero energy" or equivalent labels. It does not require builders to go beyond the generally applicable terms of the 2021 IECC, but it protects buyers, residents and competing "zero energy" builders by assuring that buildings claimed to be "zero energy" actually meet recognized "zero energy" energy conservation standards. The appendices are new and will be incorporated into Virginia's 2021 building code update.

Zero energy buildings are hugely valuable for residents and landlords because they eliminate energy costs of occupancy, over time, through a combination of enhanced energy efficiency and renewable energy. Such buildings are becoming increasingly popular, particularly since they cut both occupancy costs and pollution driving climate change. In reality, a shift to zero energy (net zero energy) housing will be critical to keeping global temperatures at levels that will prevent catastrophic climate harms. Given that new housing will operate for 70 or more years, it is vital that quality zero carbon construction begin sooner rather than later. Even though it does not mandate zero carbon construction, this proposal will at least establish minimum standards for such construction.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal does not require construction of zero energy buildings. It merely assures that buildings meet basic standards of construction and truth in advertising if they are built and sold or leased as "zero energy" buildings.

Resiliency Impact Statement: This proposal will increase Resiliency
This proposal will increase resiliency in several ways. Individual zero energy buildings and their occupants will be more resilient because they will (a) consume less energy, (b) produce zero-carbon renewable energy equal to or in excess of their energy needs, (c) retain heat or cooling during periods of utility outages, (d) be more capable of self-supplying energy during periods of utility outages, and (e) less exposed to economic harm from fluctuating energy prices. These are large resiliency benefits for residents in zero energy dwellings and their lenders or landlords.

This proposal will also increase resiliency for the public by reducing greenhouse gas emissions, reducing demands on utilities during critical supply and price periods and reducing risks of loan and lease defaults attributable to fluctuating energy prices.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: EC-C407.6-21

Discussion by William Penniman
Apr 1, 2022 18:58 UTC

Questions were raised about the proposal's references to selling or marketing a building as "zero energy." Tying this to marketing seems reasonable to me because the standard is meaningless if builders can sell non-complying buildings as "zero energy". This is equivalent to designing a building for a particular purpose, which is addressed in other places in the code.

A linkage was also made during the discussion to statements in the permanent certificate. With that in mind, I propose to modify the language of the proposal by adding language along the following lines, which we can discuss at the ESWG and WG meetings.

Add to proposed C407.6 (or a new C407.6.1):
In addition to other required submissions, the builder or other approved party shall submit a signed statement to the Building Inspector stating (a) whether the building is being sold or marketed as “zero energy” or “net zero energy” or using equivalent terms and (b) whether the building qualifies as Zero Energy pursuant to Appendix CC, accompanied by test results demonstrating compliance. A copy of the statements and report shall be delivered to the buyer or owner prior to closing.

Add to proposed R406.8/N1106.8 (or to a new R406.8.1/N1106.8.1):
The builder or other approved party shall submit a signed statement to the Building Inspector, following completion of air leakage testing, stating (a) whether the building is being sold or marketed as “zero energy” or “net zero energy” or using equivalent terms and (b) whether the building qualifies as Zero Energy pursuant to Appendix RC, accompanied by test results demonstrating compliance. A copy of the statements and report shall be delivered to the buyer prior to closing.

Add to the permanent certificate requirement of R401.3/N1101.3 (whether existing Virginia or 2021 IECC) language stating that "the permanent certificate shall state whether the building does or does not qualify as “Zero Energy” in compliance with Appendix RC. An exact copy of the Permanent Certificate shall be delivered to buyer prior to closing."

EC-C502.3-21

Proponents: Ben Rabe (ben@newbuildings.org); Kimberly Newcomer (kim@newbuildings.org); Diana Burk (diana@newbuildings.org)

2021 International Energy Conservation Code

Revise as follows:

C502.3 Compliance. *Additions* shall comply with Sections C502.3.1 through ~~C502.3.6.2.~~ C502.7 .

Add new text as follows:

C502.7 Additional energy efficiency credits. *Additions* shall achieve a total of 10 credits in accordance with Section C506. *Alterations* to the existing building that are not part of an *addition* , but permitted with an *addition* , may be used to achieve the required credits.
Exceptions:

1. *Buildings* in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, High-Hazard Group H

2. *Additions* less than 1,000 ft^2 and less than 50% of existing floor area.

3. *Additions* that do not include the addition or replacement of equipment covered in Section C403.3 or C404.2 that achieve a total of 5 credits.

4. *Additions* that do not contain *conditioned space* that achieve a total of 5 credits.

5. *Buildings* in Residential Group R and Institutional Groups I in climate zones 3C, 4B, 4C, 5C that achieve a total of 5 credits

6. Where the *addition* alone or the existing building and *addition* together comply with Section C407

C503. Additional energy efficiency credits.. *Alterations* shall achieve a total of 5 credits in accordance with Section C506.
Exception:

1. *Alterations* that include replacement of no more than one of the following:

1.1. HVAC unitary systems or HVAC central heating or cooling equipment serving the *alteration* area.

1.2. 50% or more of the lighting fixtures in the *alteration* area.

1.3. 50% or more of the area of interior surfaces in the alteration area

1.4. 50% or more of the area of the *building's exterior wall envelope*

2. *Alterations* that are part of an *addition* complying with section C502.

3. *Alterations* that comply with Section C407.

506
ADDITIONAL EFFICIENCY CREDITS
. C506.1 General. Where required in Section C502 or C503, credits shall be achieved from Tables C406.1 (1) through C406.1 (5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of Section C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables of calculation shall be achieved where a building complies with one or more of the following:
1. More efficient HVAC performance in accordance with Section C406.2.

2. Reduced lighting power in accordance with Section C406.3.

3. Enhanced lighting controls in accordance with Section C406.4.

4. On-site supply of renewable energy in accordance with Section C406.5.

5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.

6. High-efficiency service water heating in accordance with Section C406.7.

7. Enhanced envelope performance in accordance with Section C406.8.

8. Reduced air infiltration in accordance with Section C406.9

9. Where not required by Section C405.12, include an energy monitoring system in accordance with Section C406.10.

10. Where not required by Section C403.2.3, include a fault detection and diagnostics (FDD) system in accordance with Section C406.11.

11. Efficient kitchen equipment in accordance with Section C406.12.

Reason Statement: Since 2012, the IECC has leveraged Section C406 to achieve additional efficiency in the prescriptive path. This section has received steady improvements over the subsequent code cycles with an expansion in the number of options and the adoption of a more flexible credit approach to the additional efficiency option. However, there is one significant gap in C406, it does not apply to additions or alterations. C502 and C503 do not reference C406 in the sections with which additions and alterations must comply. The exclusion from C406 is a significant loophole. Additions and large alterations are prime opportunities for achieving greater energy efficiency utilizing C406.
This missed opportunity is particularly significant given the advent of Building Performance Standards (BPS). These policies set performance requirements that subject existing buildings need to meet. States and local jurisdiction around the country including the states of WA and CO and cities like New York, Boston, Washington DC, and St Louis have already adopted Building Performance Standards (BPS). Many more cities are considering this policy tool as they come to realize that meeting their climate goals will require achieving significant energy and/or carbon improvements in existing buildings. This creates a need for the IECC to be much more proactive in tailoring requirements specifically for existing buildings. Building energy retrofits that are implemented as part of alterations, additions and changes in occupancy are far more cost-effective than stand-alone retrofit projects implemented only to meet a BPS. By incorporating reasonable and cost-effective retrofits into typical existing building projects, the IECC will both provide additional energy, carbon and cost savings to building owners and tenants and help ensure that more building retrofits are undertaken at opportune and cost-effective times.

This proposal creates a framework to apply C406 to additions and large alterations. It creates a new Section C506 that provides guidance for how to utilize C406 for existing buildings. C506.1 essentially replaces and mirrors C406.1, providing charging language for how to calculate credit totals and utilize the sections (C406.2-12) that establish the requirements for each credit option. This section C506 is utilized by new sections in C502 and C503 to set credit requirements for additions and alterations, respectively.

The new Section C502.2.7.1 sets requirements for additions. As additions generally have to meet the requirements for new construction, the credit requirement has been set at 10 credits, the same as C406 for new construction. The section specifically allows additions and alterations to comply together under this section, eliminating the possibility that a building with both an addition and alteration would have to achieve credits for each individually. The section includes a number of important exceptions for situations where achieving the full 10 credits would be less feasible due to lower energy building types, more limited credit options and more limited project scope:

1. Occupancies such as storage, utility, factory and high hazard that generally have low energy usage.

2. Small additions

3. Additions that do not include new HVAC or hot water systems that achieve 5 credits

4. Additions that do not include conditioned space that achieve 5 credits

5. Group R and I occupancies in more temperate climate zones that achieve 5 credits

6. Additions that comply with C407.

The new section C503.7 requires that large alterations achieve 5 credits. The section includes important exceptions:

1. The first exception ensures that the requirements only apply to large additions with significant scope. The exemption is worded to address small alterations that only impact one of the main buildings systems: envelope (C402), HVAC (C403), water heating (C404) and lighting (C405). Alterations that impact two or more of these systems – and must therefore comply with two or more of these sections – will have a larger scope with more opportunities to choose from among the available credit options.

2. An exception that reflects the allowance for alterations and additions to comply together under C502.

3. An exception for buildings that model using C407.

By limiting requirement to large alterations and keeping the credit requirement low, the proposal ensures that projects will likely have sufficient credit options within the existing scope of the project. The project team will be able to pick credit options that apply to building elements that are already within the project scope.

The savings for this proposal would be at least 2.5% for additions and 1.25% for alterations based on the modeling for the C406 credit options done by PNNL for the 2021 edition of the IECC. However, the savings should be higher for alterations in particular since the baselines for alterations include many below-code existing building features. Depending on how inefficient the rest of the building is, the impact of this proposal could be substantially higher without any greater cost than new construction C406 measures.

Cost Impact: The code change proposal will increase the cost of construction
This proposal is crafted so that it will only impact major renovations / large-scope alterations that are already impacting the major systems that serve as the basis for credits under C406. This means that these projects are already undertaking the cost of bringing two or more of these major systems up to current code requirements, and the incremental cost is therefore only the cost from code rather than the cost of a standalone retrofit. Therefore, the costs for this proposal are the same as the costs for C406 requirements for new construction. However, savings for each package will generally be much higher since the rest of the building will nearly always have specifications that fall short of the latest energy code and each package will deliver greater savings. As a result, any package that is cost effective for new construction will be even more cost effective for major alterations.

Resiliency Impact Statement: This proposal will increase Resiliency
Resiliency is an essential component of adapting to the effects of climate change. Encouraging energy efficient retrofits helps to reduce building energy use. This reduces the buildings overall reliance on energy, reducing carbon emissions directly and indirectly, lessening the impact on climate change and climate related events. For the building's own resilience, the proposed efficiency credits focus on more efficient systems overall – even in an event like a black out, these more efficient systems require less energy to run, making any back up generation energy source last longer – providing extended comfort and safety to building users. For energy infrastructure resilience, the electric grid's ability to deliver capacity to an increasing number of buildings will become increasingly important. By reducing overall energy use, this measure may contribute to a reduction in peak demand increasing the resiliency of the grid during high usage events.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: EC-C502.3-21

This proposal doesn't have any public comments.

EC-C503.3.2-21

Proponents: Ben Rabe (ben@newbuildings.org); Kimberly Newcomer (kim@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

C503.3.2 System sizing.
New heating and cooling equipment that is part of an alteration shall be sized in accordance with Section C403.1.1 based on the existing building features as modified by the alteration.
Exception: Where is has been demonstrated to the code official that compliance with this section would result in heating or cooling equipment that is incompatible with the rest of the heating or cooling system.

Reason Statement: Historically, HVAC equipment has been routinely oversized. Studies have found very high rates of equipment oversizing; for example, 60% of RTU units in CA were found to be oversized. Oversized equipment results in increased energy use, decreased occupant comfort and increased wear-and-tear on equipment. Oversized equipment is also less effective at dehumidification. Like-for-like equipment replacement are particularly vulnerable to oversizing. The original equipment may have been installed when code requirements for "right-sizing" equipment did not exist or was not enforced. The materials markups that are common practice among contractors disincentivize them to install smaller, right-sized equipment. Changes to building use could have occurred since the original equipment was installed, creating a mismatch between current design loads and the original equipment. The building may have modified, particularly by energy efficiency programs, altering the design loads of the building. Lighting especially stands out here. Fluorescent and LED lighting is ubiquitous, but many HVAC systems were designed to account for incandescent lamps that convert over 75% of the energy they consume into heat.
With all of these considerations, it is reasonable to assume that the existing equipment sizing is more likely to be wrong than right, yet many equipment replacements use existing system sizing to size new equipment. This proposal explicitly requires that new equipment installed as part of an alteration be sized based on current building characteristics and loads, using current sizing standards. The resulting installations will be more efficient and more effective and many will be less costly to install as owners stop paying for more equipment than they need.

Savings will vary based on the amount that existing equipment is oversized. "Right-sizing" has been found to result in about 0.2% energy savings for every 1% reduction in oversizing.3

Cost Impact: The code change proposal will decrease the cost of construction
As "wrong-sized" equipment is generally oversized, this proposal will generally decrease the cost of installation. Smaller, right-sized equipment will generally be less costly to install. Savings will vary based on the amount that existing equipment is oversized. "Right-sizing" has been found to result in about 0.2% energy savings for every 1% reduction in oversizing.

Resiliency Impact Statement: This proposal will increase Resiliency
Resiliency is an essential component of adapting to the effects of climate change. As noted in the reason statement, right sizing equipment typically results in small systems, reducing building energy use. This reduces the buildings overall reliance on energy, reducing carbon emissions directly and indirectly, lessening the impact on climate change and climate related events. For the building's own resilience, the proposed efficiency credits focus on more efficient systems overall – even in an event like a black out, these more efficient systems require less energy to run, making any back up generation energy source last longer – providing extended comfort and safety to building users. Systems that are correctly sized will operate more optimally, avoiding system "short-cycling". This will provide for overall longevity of the systems as well – creating a different type of resilience and reliability for everyday operations and the building owner. For energy infrastructure resilience, the electric grid's ability to deliver capacity to an increasing number of buildings will become increasingly important. By reducing overall energy use, this measure may contribute to a reduction in peak demand increasing the resiliency of the grid during high usage events, of critical importance for air conditioning loads during summer months (the most common to be oversized in this climate zone).

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

☐ Consensus Approval

- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: EC-C503.3.2-21

This proposal doesn't have any public comments.

Proposal # 1070

EC-C1301.1.1-21

Proponents: Matthew Benka (Matt@mdbstrategies.com); John Avis (avisj@avisconstruction.com)

2018 Virginia Construction Code

Revise as follows:

[E] 1301.1.1 Criteria. Buildings shall be designed and constructed in accordance with the *International Energy Conservation Code.*
Exception. Buildings with occupancy classifications of Factory Group F, Storage Group S or Utility and Miscellaneus Group U.

Reason Statement: The current energy code requirements are over burdensome for Factory Group F, Storage Group S, and Utility and Miscellaneous Group U. These use groups do not traditionally use a lot of energy as they are not heated or cooled to normal heating and cooling temperatures and or they create their own heat, etc. The change would eliminate unneeded and extra cost to the building owner. Additional insulation, roofing materials, and wall panel materials are being required in excess for buildings that will not fully utilized them.
Many storage facilities are vacant most of the time and a lot of manufacturing and utility buildings will have the drive through doors open during production.

The General Assembly of Virginia enacted the following legislation in 2022.

HB 1289 Uniform Statewide Building Code; exemption for certain use and occupancy classifications.

1. *§ 1. That the Board of Housing and Community Development is directed to consider, during the next code development cycle, revising the Uniform Statewide Building Code (§ 36-97 et seq. of the Code of Virginia) to provide an exemption from any requirements in the energy efficiency standards established pursuant to 13VAC5-63-264 of the Virginia Uniform Statewide Building Code and the 2018 Virginia Energy Conservation Code, and any subsequent amendments to the Virginia Uniform Statewide Building Code and the 2018 Virginia Energy Conservation Code, 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.*

Cost Impact: The code change proposal will decrease the cost of construction
The recent update to the *International Energy Conservation Code* causes undue hardship on building owners, developers, and contractors while they do not reap the full benefits of the standards.

For example,

1. A 7,200 SF building, with limited heating to be used for vehicle storage. This current energy code and building code would require a standing seam roof system and (R19/R11) insulation in the roof and (R25) insulation in the walls. When priced with a fasten down roof system and just R19 in the roof and R13 walls, the material and labor price goes down by $5.97/SF. That equates to a cost of $42,984. That is enough to keep this project from being built.

2. A 100,000SF warehouse project used for storage of materials with heat maintained at 60 degrees or less and no cooling. The current building code and energy code would require a standing seam roof system and (R19/R11) insulation in the roof (R25) and insulation in the walls. Maintaining the standing seam roof system but changing the insulation to 6” in roof and 4” in walls results in a $311,247 deduct just for material. With labor, material, and equipment the cost savings approach $5.00/SF or $500,000.

The systems required to meet the current energy code are complicated and time consuming. These systems have other drawbacks such a liner system that cover up the purlins and girts affecting other trades such as plumbing, HVAC, electrical, and sprinkler. (The added cost to the electrical and mechanical trades are in addition to the cost shown in the examples above.) The trims on overhead doors and window on the new required systems are deep. These trims make the wall accessories look recessed and some would say less attractive. The current energy code makes some architectural features more difficult to design and build around. For example, just adding a masonry wainscot becomes a challenge.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
This code change does not have an effect on the resiliency of buildings in terms of withstanding disasters.

Attached Files

- **HB1289.pdf**

EC-C1301.1.1(2)-21

Proponents: DHCD Staff (sbco@dhcd.virginia.gov)

2018 Virginia Construction Code

Revise as follows:

~~**[E]**~~ **1301.1.1 Criteria.** Buildings shall be designed and constructed in accordance with the *International Energy Conservation Code.*
Exception. Buildings with occupancy classifications of Factory Group F, Storage Group S or Utility and Miscellaneous Group U.

Reason Statement: This proposal is based on legislation (Full text provided below) directing the Board of Housing and Community Development to consider to provide an exemption from any requirements in the energy efficiency standards in the current USBC and subsequent amendments for use groups and occupancy classifications F, S and U. This proposal is a replica of EC-C1301.1.1 which is being considered for revisions by the proponent based on workgroup feedback.
In the event that proposal EC-C1301.1.1 is NOT amended, this proposal will be withdrawn.

CHAPTER 407
An Act to direct the Board of Housing and Community Development to consider, during the next code development cycle, certain revisions to the Uniform Statewide Building Code regarding energy efficiency requirements for certain use and occupancy classifications.

[H 1289]Approved April 11, 2022
Be it enacted by the General Assembly of Virginia:

1. *§ 1. That the Board of Housing and Community Development is directed to consider, during the next code development cycle, revising the Uniform Statewide Building Code (§ 36-97 et seq. of the Code of Virginia) to provide an exemption from any requirements in the energy efficiency standards established pursuant to 13VAC5-63-264 of the Virginia Uniform Statewide Building Code and the 2018 Virginia Energy Conservation Code, and any subsequent amendments to the Virginia Uniform Statewide Building Code and the 2018 Virginia Energy Conservation Code, 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.*

Cost Impact: The code change proposal will decrease the cost of construction
This proposal will decrease the cost of construction.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
This code change does not have an effect on the resiliency of buildings in terms of withstanding disasters (copied from EC-C1301.1.1).

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- ☐ Consensus Approval
- ☐ Consensus Disapproval
- ☐ Carry Over to Next Meeting
- ☐ Carry over to Final
- ☐ Non-Consensus
- ☐ None

Public Comments for: EC-C1301.1.1(2)-21

This proposal doesn't have any public comments.

EC-C1301.1.1.1(2)-21

Proponents: William Penniman (wpenniman@aol.com)

2018 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:

1. Add Sections C402.1.4.2, C402.1.4.2.1, C402.1.4.2.2, C402.1.4.2.3, C402.2.1.2, C402.2.1.3, C402.2.1.4, C402.2.1.5 and Change Section C402.2.1.1 to read:

C402.1.4.2 Roof/ceiling assembly. The maximum roof/ceiling assembly *U*-factor shall not exceed that specified in Table C402.1.4 based on *construction* materials used in the roof/ceiling assembly.

C402.1.4.2.1 Tapered, above-deck insulation based on thickness. Where used as a component of a maximum roof/ceiling assembly *U*-factor calculation, the tapered roof insulation *R*-value contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value per inch (per mm) for *U*-factor compliance as prescribed in Section C402.1.4.

C402.1.4.2.2 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the assembly *U*-factor of the roof/ceiling *construction.*

C402.1.4.2.3 Multiple layers and staggered joints. Continuous insulation board shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered. Multiple layers and staggered joints are not required where insulation tapers to the *roof deck* at a gutter edge, roof drain or scupper.

C402.2.1 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 C402.1.3, based on *construction* materials used in the *roof assembly*.

C402.2.1.1 Tapered, above-deck insulation based on thickness. Where used as a component of a roof/ceiling assembly *R*-value calculation, the tapered roof insulation *R*-value contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value per inch (per mm) for *R*-value compliance as prescribed in Section C402.1.3.

C402.2.1.2 Minimum thickness, lowest point. The minimum thickness of above-deck roof insulation at its lowest point, gutter edge, roof drain or scupper, shall be no less than 1 inch (25 mm).

C402.2.1.3 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the minimum thermal resistance (*R*-value) of roof insulation in roof/ceiling *construction.*

C402.2.1.4 Multiple layers and staggered joints. Continuous insulation board shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered. Multiple layers and staggered joints are not required where insulation tapers to the *roof deck* at a gutter edge, roof drain or scupper.

C402.2.1.5 Skylight curbs. Skylight curbs shall be insulated to the level of roofs with insulation entirely above the deck or R-5, whichever is less.

Exception: Unit skylight curbs included as a component of a skylight listed and labeled in accordance with NFRC 100 shall not be required to be insulated.

2. Change the SHGC for Climate Zone 4 (Except Marine) of Table C402.4 to read:

3. Delete Section C402.4.1.2, change Sections C402.4.2, C402.4.2.1, C402.4.2.2 and C402.4.3.

C402.4.2 Skylight area with daylight response controls. The skylight area shall be permitted to be not more than 5 percent of the roof area provided daylight responsive controls complying with Section C405.2.3.1 are installed in daylight zones under skylights.

C402.4.2.1 Daylight Zone Controls under skylights. Daylight responsive controls complying with Section C405.2.3.1 shall be provided to control all electric lights within daylight zones under skylights.
C402.4.2.2 Haze factor. Skylights that are installed in office, storage, automotive service, manufacturing, nonrefrigerated warehouse, retail store and distribution/sorting area spaces shall have a glazing material or diffuser with a haze factor greater than 90 percent when tested in accordance with ASTM D1003.

Exception: Skylights designed and installed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles or the geometry of skylight and light well.

C402.4.3 Maximum *U*-factor and SHGC. The maximum *U*-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.4.

The window projection factor shall be determined in accordance with Equation 4-5.

$$PF = A/B \qquad \textbf{(Equation 4-5)}$$

where:

PF = Projection factor (decimal).

A = Distance measured horizontally from the farthest continuous extremity of any overhand, 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.

Where the fenestration projection factor for a specific vertical fenestration product is greater than or equal to 0.20, the required maximum SHGC from Table C402.4 shall be adjusted by multiplying the required maximum SHGC by the multiplier specified in Table C402.4.3 corresponding with the orientation of the fenestration product and the projection factor.

4. Add Table C402.4.3 to read:

5. Add an exception to the first paragraph of Section 403.7.7 to read:

Exception: Any grease duct serving a Type I hood installed in accordance with the *International Mechanical Code* (IMC) Section 506.3 shall not be required to have a motorized or gravity damper.

6. Add Section C403.2.2.1 to read:

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

7. Delete Section C403.7.5 and Table C403.7.5.

8. Delete Sections C404.5 through C404.5.2.1, including Tables.

9. Change Section C405.4 to read:

C405.4 Exterior lighting (Mandatory). All exterior lighting, other than low-voltage landscape lighting, shall comply with Section C405.4.1.

Exception: Where *approved* because of historical, safety, signage, or emergency considerations.

10. Change Section C502.1 to read:

C502.1 General. Additions to an existing building, building system or portion thereof shall conform to the provisions of Section 805 of the *Virginia Existing Building Code* (VEBC).

11. Delete Sections C502.2 through C502.2.6.2.

12. Change Section C503.1 to read:

C503.1 General. Alterations to any *building* or *structure* shall comply with the requirements of Chapter 6 of the VEBC.

13. Delete Sections C503.2 through C503.6.

14. Change Section C504.1 to read:

C504.1 General. *Buildings* and *structures*, and parts thereof, shall be repaired in compliance with Section 510 of the VEBC.

15. Delete Section C504.2.

~~16. Change Section R401.2 to read:~~

~~**R401.2 Compliance.** Projects shall comply with all provisions of Chapter 4 labeled "Mandatory" and one of the following:~~

~~1. Sections R401 through R404.~~

~~2. Section R405.~~

~~3. Section R406.~~

~~4. The most recent version of REScheck, keyed to the 2018 IECC.~~

~~17. Change Section R401.3 to read:~~

~~**R401.3** A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label, or other required labels. Where *approved*, certificates for multifamily *dwelling units* shall be permitted to be located off-site at an identified location. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, basement walls, crawl space walls and floors, and ducts outside conditioned spaces; *U*-factors of fenestration and the solar heat gain coefficient (SHGC) of fenestration; and the results from any required duct system and *building* envelope air leakage testing performed on the *building*. Where there is more than one value for each component, the certificate shall indicate the value covering the largest area. The certificate shall indicate the types and efficiencies of heating, cooling, and service water heating *equipment*. Where a gas-fired unvented room heater, electric furnace, or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace," or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces, and electric baseboard heaters.~~

~~18. Change the wood frame wall *R*-value categories for Climate Zone 4 (Except Marine) in Table R402.1.2 to read:~~

~~19. Change the frame wall *U*-factor categories for Climate Zone 4 (Except Marine) in Table R402.1.4 to read:~~

~~20. Change Section R402.2.4 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; and~~

~~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.~~

21. Change Sections R402.4 and R402.4.1.1 to read:

R402.4 Air leakage. The *building* thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

R402.4.1.1 Installation (Mandatory). The components of the *building* thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of *construction*. Where required by the code official, an *approved* third party shall inspect all components and verify compliance.

22. 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 "b" and "c" to Table R402.4.1.1 to read:

23. Change Section R402.4.1.2 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 in Climate Zone 4. 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; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

24. Change Section R403.3.3 to read:

R403.3.3 Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exception: A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.

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.

25. Delete Section R403.3.5.

~~26. Change Section R403.7 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 multistage 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.~~

~~27. Change footnote "a" in Table R406.4 to read:~~

~~a. When onsite renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2 and the building thermal envelope shall be greater than or equal to levels of energy efficiency and solar heat gain coefficient in Table R402.1.2, with a ceiling *R*-value of 49 and a wood frame wall *R*-value of 20 or 13 + 5, or Table R402.1.4, with a ceiling *U*-factor of 0.026 and a frame wall *U*-factor of 0.060.~~

28. Change Section R501.1 to read:

R501.1 Scope. The provisions of the *Virginia Existing Building Code* (VEBC) shall control the alteration, repair, addition and change of occupancy of existing *buildings* and *structures*.

29. Delete Sections R501.1.1 through R501.6.

30. Change Section R502.1 to read:

R502.1 General. Additions to an existing *building*, *building* system or portion thereof shall conform to the provisions of Section 811 of the VEBC.

31. Delete Sections R502.1.1 through R502.1.2.

32. Change Section R503.1 to read:

R503.1 General. Alterations to any *building* or *structure* shall comply with the requirements of Chapter 6 of the VEBC.

33. Delete Sections R503.1.1 through R503.2

34. Change Section R504.1 to read:

R504.1 General. *Buildings*, structures and parts thereof shall be repaired in compliance with Section 510 of the VEBC.

35. Delete Section R504.2.

~~TABLE C402.4 BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS~~

~~CLIMATE ZONE~~	~~4 EXCEPT MARINE~~
~~SHGC~~	~~0.36~~

TABLE C402.4.3 SHGC ADJUSTMENT MULTIPLIERS

PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATIONS
$0.2 \leq PF < 0.5$	1.1	1.2
$PF \geq 0.5$	1.2	1.6

TABLE R402.1.2 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	WOOD FRAME WALL *R*-VALUE
4 except Marine	15 or 13 + 1[h]

~~TABLE R402.1.4 EQUIVALENT U-FACTORS[a]~~

~~CLIMATE ZONE~~	~~FRAME WALL *U*-FACTOR~~
~~4 except Marine~~	~~0.079~~

~~**TABLE R402.4.1.1 AIR BARRIER AND INSULATION INSTALLATION[a]**~~

~~**COMPONENT**~~	~~**AIR BARRIER CRITERIA**~~	~~**INSULATION INSTALLATION CRITERIA[b]**~~
~~Shower/tub on exterior wall[c]~~	~~The air barrier installed at exterior walls adjacent to showers and tubs shall be installed on the interior side and separate the exterior walls from the showers and tubs.~~	~~Exterior walls adjacent to showers and tubs shall be insulated.~~

Reason Statement: This proposal is intended to fully adopt and implement the 2021 IECC with respect to NEW CONSTRUCTION by eliminating exceptions that the Base Document would cause to displace language in the 2021 IECC with respect to NEW CONSTRUCTION. Full adoption of the 2021 IECC will best carry out Virginia law and protect both residents and the public generally and we support adopting the IECC with respect to new and existing buildings. However, this proposal focuses on the IECC's 2021 updates for new construction, recognizing that Virginia law has a special provision addressing rehabilitation of existing buildings and that, per the Base Document, 2021 IECC updates for new construction would be picked up for certain work done on existing buildings to the same extent as is now provided in the VECC. Specific additional amendments can be addressed in the VECC update process.

Nevertheless, the proposal would carryout the Commonwealth's goals at least with respect to new buildings. The BHCD's NOIRA published November 22, 2021, https://townhall.virginia.gov/L/viewstage.cfm?stageid=9475 states:

> "The 2021 editions of the International Codes are now completed and available from ICC. *The use of the newest available model codes and standards in the USBC assures that the statutory mandate is met to base the regulation on the latest editions of nationally recognized model codes to assure the protection of the health, safety and welfare of the residents of Virginia and that buildings and structures are constructed and maintained at the least possible cost.*"

The BHCD's NOIRA also states: "As the basis for Virginia's building code it is important to stay in sync with the national model codes." These statements are consistent with Section 36-99A of the Virginia Code has long prescribed that the purposes of the USBC are to protect the public and implement recognized standards of energy conservation and water conservation:

> "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*…."

Legislation (H2227), enacted by the General Assembly and signed by the Governor in 2021, supplements the pre-existing law's commitment to protecting residents and the public "consistent with recognized standards of … energy conservation" by specifically endorsing adoption of energy standards "at least as stringent as" the latest IECC when the benefits "over time" to residents and the public exceed the incremental costs of construction.

In view of the NOIRA and applicable law, Virginia should, at a minimum, adopt the full 2021 IECC with respect to new construction. More stringent standards and non-weakening amendments may be proposed, but the expectation is that the code should be "at least as stringent" as the 2021 IECC. Adopting such standards would perform the important function of keeping Virginia's building code "in sync with the national model codes," except where more stringent standards are feasible and beneficial to residents and the public.

In further support of benefits residents and the public will gain from full implementation of the 2021 IECC, we note:

- The ICC process that produced the IECC was a multi-year effort that carefully vetted the amendments that were eventually adopted.
- DOE and the Pacific Northwest National Laboratory (PNNL) have already published findings demonstrating that the net savings to Virginia residents and to the public from implementing the full 2021 IECC exceed the incremental costs of construction. https://www.energycodes.gov/technical-assistance/publications?page=29
- DOE/PNNL has reached the same conclusion on a national basis. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-31437.pdf
- The DOE/PNNL studies show that the public will benefit from reductions of air and climate pollution as measured by the Social Cost of Carbon.
- DOE/PNNL has previously found that earlier IECC updates dated 2012, 2015 and 2018 produced savings and benefits greater than construction costs. Consequently, moving implementation the 2021 IECC from pre-2012 standards that still apply to wall insulation and air leakage will result in net benefits and savings.
- Remaining more than a decade out of date in key areas, such as wall insulation and air leakage, is plainly inconsistent with Virginia law and the economic and health interests of residents and the public.
- Improved insulation, reduced air leakage and more efficient equipment will improve residents' comfort and health, reduce residents' problems of utility bill fluctuations, and improve their resiliency to low and high temperatures during power outages. Measures to reduce air leakage will have the added benefit of reducing access to dwellings by rodents and insects, which is a distinct concern identified in the Virginia Code.

Cost Impact: The code change proposal will increase the cost of construction
The code change proposals will increase the cost of construction, but lower the cost of occupancy thereby saving residents money and reducing risks of mortgage or lease default.

As documented by DOE/PNNL, the cost savings to residents from fully implementing the 2021 IECC exceed the increased cost of construction on both a life-cycle and simple payback basis. The savings to building occupants are shown to be large, and the construction cost impacts are small relative to the prices for new buildings. The DOE/PNNL analysis also shows that the public's savings even more greatly exceed the incremental costs of construction.

- https://www.energycodes.gov/technical-assistance/publications?page=29
- https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-31437.pdf

No data presented would justify failing to adopt the full 2021 IECC at least with respect to new construction.

In addition to saving residents money and energy, adoption and implementation will create added benefits including enhanced comfort, healthier indoor and outdoor air, and greater economic stability by reducing the impacts of fluctuating energy costs,

Resiliency Impact Statement: This proposal will increase Resiliency
Although it focuses on new construction, this proposal will increase resiliency in multiple ways, including:

- Local and regional power outages are a recurring problem that will get worse as climate impacts (storms, floods, rising seas, higher temperatures) make power outages more frequent and consequential. Better insulated houses with lower air leakage will continue to provide comfort to residents for longer periods during power outages.
- Better insulated houses with lower air leakage will better protect residents from power outages since homes will stay comfortable longer. More efficient homes will also help to protect residents from the economic consequences of rate and bill increases due to energy price increases and fluctuations. This enhanced economic resiliency is very important. High utility bills and energy consumption can result in residents falling behind on mortgages and rents, potentially resulting in eviction or loss of homes. Evictions have adverse impacts to people, especially seniors, parents and children, that extend beyond a need to change dwellings.
- Landlords, lenders and surrounding communities will indirectly benefit from energy conservation measures that reduce risks of customer defaults.
- By reducing health impacts from air pollution, temperature impacts of power outages or cost-driven reductions of heating or cooling, and evictions, conservation measures will improve health resiliency for residents and communities.
- Buildings are a major direct and indirect cause of climate pollution, and the 70+ years of expected building operation make building energy efficiency a critical path to addressing the climate crisis.
- The most recent IPCC report confirms that rapid reductions of greenhouse gas emissions is essential to avoid catastrophic climate impacts around the world. IPCC Sixth Assessment Report (February 2022), https://www.ipcc.ch/report/ar6/wg2/ Substantial harm has already occurred nationally and locally from global warming and much worse will follow without rapid reductions of greenhouse gases (particularly CO2 and methane associated with fossil fuel production and combustion). Virginia's coastal areas are among the most vulnerable to sea level rise and destructive storms. They already experience “sunny day flooding,” and sea level rise is accelerating. https://www.vims.edu/newsandevents/topstories/2020/slrc_2019.php 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 associated with fossil fuel production and combustion). The most recent report from NOAA indicates that Virginia may face 2 feet of sea level rise by 2050 due toworsening climate change from human greenhouse gas emissions. https://www.noaa.gov/news-release/us-coastline-to-see-up-to-foot-of-sealevel-rise-by-2050 Virginia faces climate-driven sea level rise of 6.69 feet this century; the rate of sea level rise is accelerating; the danger ofclimate-driven severe storms, storm-surges and flooding are rising; and climate change will increasingly harm human health and lives, agriculture, businesses, military installations, private and public property, and Virginia’s economy. http://www.vasem.org/reports/2021-the-impact-of-climatechange-on-virginias-coastal-areas/ Growing dangers also include rising atmospheric and water temperatures that worsen heat-related illnesses, disruptions of economic activity, and harms to agriculture, fisheries, and our natural heritage.
- Because atmospheric CO2 from emissions is cumulative, Virginia has less chance of mitigating and recovering from those harms the longer we delay maximizing energy savings and minimizing greenhouse gas pollution

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Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: EC-C1301.1.1.1(2)-21

This proposal doesn't have any public comments.

EC-Appendix CB-21

Proponents: Matthew Benka; John Avis (avisj@avisconstruction.com)

2021 International Energy Conservation Code

Add new text as follows:

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

APPENDIX CB
BUILDING ENVELOPE REQUIREMENTS

CB101
Scope

CB101.1 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.

CB102
Building Envelope Requirements

CB102.1 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Tables CB102.2(1) and CB102.3 based on the climate zone specified in Chapter 3[CE]. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table CB102.3 shall comply with the building envelope provisions of ASHRAE/IESNA 90.1.

CB102.2 Specific insulation requirements. Opaque assemblies shall comply with Table CB102.2(1).

CB102.2.1 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 CB102.2(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 CB102.2(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.

CB102.2.2 Classification of walls. Walls associated with the building envelope shall be classified in accordance with Section CB102.2.2.1 or CB102.2.2.2.

CB102.2.2.1 Above-grade walls. Above-grade walls are those walls covered by Section CB102.2.3 on the exterior of the building and completely above grade or walls that are more than 15 percent above grade.

CB102.2.2.2 Below-grade walls. Below-grade walls covered by Section CB102.2.4 are basement or first-story walls associated with the exterior of the building that are at least 85 percent below grade.

CB102.2.2.3 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 CB102.2(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 CB102.2(1). "Mass walls" shall include walls weighing at least (1) 35 pounds per square foot (170 kg/m2) of wall surface area or (2) 25 pounds per square foot (120 kg/m2) of wall surface area if the material weight is not more than 120 pounds per cubic foot (1,900 kg\m3).

CB102.2.4 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 CB102.2(1) and shall extend to a depth of 10 feet I (3048 mm) below the outside finish ground level, or to the level of the floor, whichever is less.

CB102.2.5 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 CB102.2(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/m2) of floor surface area or (2) 25 pounds per square foot (120 kg/m2) of floor surface area if the material weight is not more than 12 pounds per cubic foot (1,900 kg/m3).

CB102.2.6 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 CB102.2(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.

CB102.2.7 Opaque doors. Opaque doors (doors having less than 50 percent glass area) shall meet the applicable requirements for doors as specified in Table CB102.2(1) and be considered as part of the gross area of above-grade walls that are part of the building envelope.

Revise as follows:

TABLE C402.1.3 OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a]

CLIMATE ZONE	3	4 EXCEPT MARINE	5 AND MARINE 4
Roofs			
Insulation entirely above roof deck	R-15ci	R-15ci	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-5.7ci[c, e]	R-5.7ci[c]	R-7.6ci
Metal building[b]	R-13	R-13	R-13 + R-13
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-5ci	R-10ci	R-10ci
Joist/framing	R-19	R-19	R-19
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 purli

b. Assembly description can be found in Table CB102.2(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 ce

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

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

Add new text as follows:

TABLE CB102.2(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 the width of the purlin on each side, perpendicular to the purlin.	ASHRAE/IESNA 90.1 Table A2.3
R-19	Standing seam with single insulation layer. Thermal blocks are a minimum R-5 of rigid insulation, which extends 1 in. beyond the width of the purlin on each side, perpendicular to the purlin. This construction R-19 insulation batts draped perpendicularly over the purlins. Thermal blocks are then placed above the purlin/batt, and the roof deck is secured to the purlins.	ASHRAE/IESNA 90.1 Table A2.3
Walls		
R-13	Single insulation layer The first layer of R-13 insulation batts is installed constinuously perpendicular to the girts and is compressed as the metal skin is attached to the girts.	ASHRAE/IESNA 90.1 Table A3.2
R-13 + R-13	Double insulation layer The first layer of R-13 insulation batts is installed continuously perpendicular to the girts and is compressed as the metal skin is attached to the girts.	ASHRAE/IESNA 90.1 Table A3.2

For SI: 1inch = 25.4 mm.

CB102.3 Fenestration. Fenestration shall comply with Table CB102.3.

CB102.3.1 Maximum area. The vertical fenestration area (not including opaque doors) shall not exceed the percentage of the gross wall area specified in Table CB102.3. The skylight area shall not exceed the percentage of the gross roof area specified in Table CB102.3.

CB102.3.2 Maximum U-factor and SHGC. For vertical fenestration, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table CB102.3, based on the window projection factor. For skylights, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table CB102.3.

The window projection factor shall be determined in accordance with Equation CB-1.

PF = A/B (Equation CB-1)

where:

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.

CB102.4
Air leakage

CB102.4.1 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 I 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.

Exception: Site-constructed windows and doors that arc weatherstripped or sealed in accordance with Section CB102.4.3.

CB102.4.2 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 E 283. For

curtain walls and storefront glazing, the maximum air leakage rate shall be 0.3 cubic foot per minute per square foot (cfm/ft2) (5.5 m3/h x m2) of fenestration area. For commercial glazed swinging entrance doors and revolving doors, the maximum air leakage shall be 1.00 cfm/ft2 (18.3 m3/h x m2) of door area when tested in accordance with ASTM E 283.

CB102.4.3 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.

CB102.4.4 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 m2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance 1.0 inch with AMCA 500D.

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

CB102.4.5 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.

CB102.4.6 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 m2) in area.

5. Revolving doors.

6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

Revise as follows:

TABLE CB102.3 BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	3	4 EXCEPT MARINE	5 AND MARINE 4
Vertical fenestration (40% maximum of above-grade wall)			
***U*-factor**			
Framing materials othe rthan metal with or without metal reinforcement or cladding			
U-factor	0.65	0.40	0.35
Metal framing with or without thermal break			
Curtain Wall/Storefront U-factor	0.60	0.50	0.45
Entrance Door U-factor	.90	.85	.80
All Other U-factor[a]	.65	.55	.55
SHGC-All Fram 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)			
Glass			
U-Factor	0.90	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 CB102.3.2.

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

Add new text as follows:

CB102.4. 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 air-tight 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 E 283 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.

CB102.5 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 x 10-11 kg/Pa· s · m2) or less, when tested in accordance with the dessicant method using Procedure A of ASTM E 96. 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: In consideration of discussion at the April 14 Energy General Workgroup Meeting, this proposal is offered as a potential alternative to EC-C1301.1.1-21 (ID 997). The proposed appendix is a companion to EC-C401.2-21 (ID 1163) and represents the building envelope requirements of the 2006 IECC.

The current energy code requirements are over burdensome for Factory Group F, Storage Group S, and Utility and Miscellaneous Group U. These use groups do not traditionally use a lot of energy as they are not heated or cooled to normal heating and cooling temperatures and or they create their own heat, etc. The change would eliminate unneeded and extra cost to the building owner. Additional insulation, roofing materials, and wall panel materials are being required in excess for buildings that will not fully utilize them.

Many storage facilities are vacant most of the time and a lot of manufacturing and utility buildings will have the drive through doors open during production.

The General Assembly of Virginia enacted the following legislation in 2022.

HB 1289 Uniform Statewide Building Code; exemption for certain use and occupancy classifications.

1. § 1. That the Board of Housing and Community Development is directed to consider, during the next code development cycle, revising the Uniform Statewide Building Code (§ 36-97 et seq. of the Code of Virginia) to provide an exemption from any requirements in the energy efficiency standards established pursuant to 13VAC5-63-264 of the Virginia Uniform Statewide Building Code and the 2018 Virginia Energy Conservation Code, and any subsequent amendments to the Virginia Uniform Statewide Building Code and the 2018 Virginia Energy Conservation Code, 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.

Cost Impact: The code change proposal will decrease the cost of construction
The recent update to the *International Energy Conservation Code* causes undue hardship on building owners, developers, and contractors while they do not reap the full benefits of the standards.

For example,

1. A 7,200 SF building, with limited heating to be used for vehicle storage. This current energy code and building code would require a standing seam roof system and (R19/R11) insulation in the roof and (R25) insulation in the walls. When priced with a fasten down roof system and just R19 in the roof and R13 walls, the material and labor price goes down by $5.97/SF. That equates to a cost of $42,984. That is enough to keep this project from being built.

2. A 100,000SF warehouse project used for storage of materials with heat maintained at 60 degrees or less and no cooling. The current building code and energy code would require a standing seam roof system and (R19/R11) insulation in the roof (R25) and insulation in the walls. Maintaining the standing seam roof system but changing the insulation to 6” in roof and 4” in walls results in a $311,247 deduct just for material. With labor, material, and equipment the cost savings approach $5.00/SF or $500,000.

The systems required to meet the current energy code are complicated and time consuming. These systems have other drawbacks such a liner system that cover up the purlins and girts affecting other trades such as plumbing, HVAC, electrical, and sprinkler. (The added cost to the electrical and mechanical trades are in addition to the cost shown in the examples above.) The trims on overhead doors and window on the new required systems are deep. These trims make the wall accessories look recessed and some would say less attractive. The current energy code makes some architectural features more difficult to design and build around. For example, just adding a masonry wainscot becomes a challenge.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency
This code change does not have an effect on the resiliency of buildings in terms of withstanding disasters.

Attached Files

- **APPENDIX CB (underlined).pdf**
  https://va.cdpaccess.com/proposal/1196/1650/files/download/689/

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: EC-Appendix CB-21

This proposal doesn't have any public comments.

REC-R402.1.2 (1)-21

Proponents: Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com)

2018 Virginia Energy Conservation Code

Revise as follows:

TABLE R402.1.2 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT [a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR [b]	SKYLIGHT [b] *U*-FACTOR	GLAZED FENESTRATION SHGC [b, e]	CEILING R-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE [i]	FLOOR *R*-VALUE	BASEMENT [c] WALL *R*-VALUE	SLAB [d] *R*-VALUE & DEPTH	CRAWL SPACE [c] WALL *R* VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.30	0.55	0.25	38	20 or 13 + 5 ci or 0 + 15ci [h]	8/13	19	5/13 [f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	30 or 20 + 5ci or 13 + 10ci or 0 + 20ci ~~15 or 13+1~~ [h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	30 or 20 + 5ci or 13 + 5 ci or 0 + 20ci [h]	13/17	30 [g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5 [h] or 13+10 [h]	15/20	30 [g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5 [h] or 13+10 [h]	19/21	38 [g]	15/19	10, 4 ft	15/19

NR = Not Required.

For SI: 1 foot = 304.8 mm.

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 1 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. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall.

   "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

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 is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. 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.

i. Mass walls shall be in accordance with Section R402.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.

TABLE R402.1.4 EQUIVALENT U-FACTORS [a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR [b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091 [c]	0.136
4 except Marine	0.32	0.55	0.026	0.~~079~~ 45	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	0.~~060~~ 45	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

2018 Virgina Residential Code

Revise as follows:

TABLE N1102.1.2 (R402.1.2) INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.25	30	13	¾	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13 + 5ci[h] or 0 + 15ci	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	30 or 20 + 5ci or 13 + 10ci or 0 + 20ci ~~15 or 13 + 1~~[h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	30 or 20 + 5ci or 13 + 10ci or 0 + 20ci~~5~~[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20 + 5[h] or 13 + 10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

For SI: 1 foot = 304.8 mm.

NR = Not Required.

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 1 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. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation on the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

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. Alternatively, insulation sufficient to fill the framing cavity providing not less than an *R*-value of R-19.

h. 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.

i. 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.

TABLE N1102.1.4 (R402.1.4) EQUIVALENT U-FACTORS[a]

CLIMATE ZONE	FENESTRATION *U*- FACTOR	SKYLIGHT *U*- FACTOR	CEILING *U*- FACTOR	FRAME WALL *U*- FACTOR	MASS WALL *U*- FACTOR[b]	FLOOR *U*- FACTOR	BASEMENT WALL *U*- FACTOR	CRAWL SPACE WALL *U*- FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.32	0.55	0.026	~~0.079~~ 0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	~~0.060~~ 0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

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

b. Mass walls shall be in accordance with Section N1102.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 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.

2018 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:

~~18. Change the wood frame wall *R*-value categories for Climate Zone 4 (Except Marine) in Table R402.1.2 to read:~~

~~19. Change the frame wall *U*-factor categories for Climate Zone 4 (Except Marine) in Table R402.1.4 to read:~~

TABLE R402.1.2 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	WOOD FRAME WALL *R*-VALUE
4 except Marine	15 or 13 + 1[h]

~~**TABLE R402.1.4 EQUIVALENT U-FACTORS[a]**~~

~~CLIMATE ZONE~~	~~FRAME WALL *U*-FACTOR~~
~~4 except Marine~~	~~0.079~~

Reason Statement: This proposal improves the comfort, efficiency, and resiliency of Virginia homes by improving the wall insulation requirements. It will also make Virginia's energy code consistent with the 2021 IECC requirements for wall insulation. The U.S. DOE found the 2021 IECC to be cost-effective for Virginia (*see* https://www.energycodes.gov/sites/default/files/2021-07/VirginiaResidentialCostEffectiveness_2021.pdf), and improvements to the thermal building envelope are important to the long-term efficiency and cost-effectiveness of new buildings. Using the U.S. Department of Energy methodology for reviewing code change proposals, and using BEopt modeling software, our analysis found that an improvement from R-15 to R-20+5 in wall insulation will result in a 13.1% improvement in efficiency, and a simple payback period of less than 5 years. Wall insulation is easiest (and most cost-effective) to install during construction. Given that there may only be limited opportunities to upgrade the walls in the future, it is important to construct well-insulated walls from the very beginning. Better-insulated buildings are clearly an investment in Virginia's energy future. We recommend maintaining consistency with the 2021 IECC requirements.
The wall insulation R-values in the 2021 IECC do not require the use of any specific product and can be achieved with either 2X4 or 2X6 wall construction. The values in the prescriptive R-value table are only a few of many different options. For additional wall insulation options, builders can use one of several compliance paths, each of which provides multiple options and combinations for meeting the code requirements:

- The U-factor alternative table (R402.1.2)
- The Total UA Alternative (R402.1.5)
- U.S. DOE's REScheck software (www.energycodes.gov)
- The Simulated Performance Alternative (R405)
- The Energy Rating Index (R406)

This proposal also updates the equivalent U-factors to be consistent with the 2021 IRC/IECC, which is important for builders and design professionals who intend to use DOE's free REScheck compliance software or other energy rating programs. We recommend that Virginia adopt equivalent U-factor values that will be consistent with the latest version of the IECC, both to maximize cost-effective energy efficiency and to improve the resiliency of every new home built in the Commonwealth.

Cost Impact: The code change proposal will increase the cost of construction
The improvement in wall insulation will increase initial construction cost, but is clearly cost-effective to the homeowner. Using the U.S. Department of Energy methodology for evaluating code change proposals, and using BEopt modeling software, we estimated that the average incremental increase in cost for climate zone 4 is $735.00. The average improvement in energy cost savings is 13.1%, which means simple payback is achieved within 4.4 years, on average. Obviously, results will vary based on which compliance option is selected by the builder, unique characteristics of each building, and so on. But given that walls are unlikely to be altered over the expected 70-100 year useful lifetime of the building, wall insulation is a vitally important measure to incorporate at the time of construction.

Resiliency Impact Statement: This proposal will increase Resiliency
This proposal will increase resiliency in Virginia's residential buildings. The International Code Council published a white paper titled *The Important Role of Energy Codes in Achieving Resilience* regarding the role of energy efficiency in resiliency. *See* https://www.iccsafe.org/wp-content/uploads/19-18078_GR_ANCR_IECC_Resilience_White_Paper_BRO_Final_midres.pdf. Specifically, the ICC found that increased insulation requirements support passive survivability and reduce energy burdens on low-income families, grid impacts by reducing energy demand, ice-dams, and condensation, limiting mold and mildew.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- ☐ Consensus Approval
- ☐ Consensus Disapproval
- ☐ Carry Over to Next Meeting
- ☐ Carry over to Final
- ☐ Non-Consensus
- ☐ None

Public Comments for: REC-R402.1.2 (1)-21

Discussion by Ross Shearer
Feb 9, 2022 20:31 UTC

Virginia is now two iterations behind the IECC residential model for wall R values. Walls comprise a majority share of the above grade exposed surface of residential buildings.

Comment by Ross Shearer
Feb 9, 2022 22:31 UTC

Virginia is currently at the 2009 code for walls: R-13 insulation in the cavities of a 3 by 5 stud wall structure. This framing and insulating approach has been the custom since the 70s with the R-13 rating since 1990. (A change in the process of manufacturing fiberglass increased from R-11 to R-13 the resistance to heat movement in 3.5 inches of fiberglass.) Builders did not have to change their wall structures or insulation practices in 1990 or in 2009 when Virginia adopted the 2009 IECC model. It appears they have not had to change their practices since the mid 70s. After nearly one-half century's passage, change is way overdue, and Virginians deserve full adoption of the 2021 IECC residential wall model.

Laura Baker and Eric Lacey have provided information from a study showing that adoption of the IECC model wall provisions will yield at least 13% in energy savings, capable of recouping the added construction costs of meeting this requirement within less than 5 years, a return on investment rate that is significantly better than the long term average of securities markets. Denying these savings to future homeowners (and tenants) over the period of homeownership (and the 70 to 100 year life of houses) should be unacceptable to all. In addition to these material benefits, full adoption of this efficiency standard offers other less tangible, but valuable benefits including increased resiliency during lengthy utility outages and lower mortgage default rates. All these factors contribute to stabilization of families and neighborhoods during utility outages and economic recessions.

For those who have reservations about the results of a study obtained by those advocating for responsible energy codes, the DHCD should request a similar analysis from the Pacific Northwest National Lab. If requested by DHCD, **PNNL will run its data to compare Virginia's current residential code to Virginia adopting only the 2021 requirements for above grade walls as proposed.** PNNL indicated to me that "We would be able to analyze the codes in any form as they are adopted/modified. We typically analyze the entire code and not just portions of the code. So we would compare any stock code year to a modified code, wall changes only, or any change."

I urge all stakeholders to support this highly cost effective code change. For any stakeholders harboring reservations about the effectiveness claimed, I ask those stakeholders support a request by DHCD for a specific wall insulation analysis by PNNL, as I state above in bold.

REC-R402.1.2 (2)-21

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Energy Conservation Code

Revise as follows:

TABLE R402.1.2 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT [a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR [b]	SKYLIGHT [b] *U*-FACTOR	GLAZED FENESTRATION SHGC [b, e]	CEILING R-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE [i]	FLOOR *R*-VALUE	BASEMENT [c] WALL *R*-VALUE	SLAB [d] *R*-VALUE & DEPTH	CRAWL SPACE [c] WALL *R* VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5 or 0+15ci [h]	8/13	19	5/13 [f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	~~15 or 13+1~~ 30 or 20+5ci or 13+10ci or 20ci [h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	~~20 or 13+5~~30 or 20+5ci 13+10ci or 20ci [h]	13/17	30 [g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5 [h] or 13+10 [h]	15/20	30 [g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5 [h] or 13+10 [h]	19/21	38 [g]	15/19	10, 4 ft	15/19

NR = Not Required.

For SI: 1 foot = 304.8 mm.

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 1 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. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall.

   "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

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 is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. 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.

i. Mass walls shall be in accordance with Section R402.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.

TABLE R402.1.4 EQUIVALENT U-FACTORS [a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR [b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091 [c]	0.136
4 except Marine	0.32	0.55	0.026	~~0.079~~ 0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	~~0.060~~ 0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

Reason Statement: The purpose of this proposal is to have Virginia adopt the full wall insulation efficiency requirements of the 2021 IECC. These updates are critical since Virginia is still implementing the 2009 wall insulation standards, making it a *more than a decade* behind the IECC. Continuing to lag years behind the IECC is inconsistent with Virginia law governing building codes. Sections 36-99A and 36-99B of the Virginia Code require the USBC to protect the public, to adhere to recognized standards of energy conservation and water conservation, and to reduce construction and rehabilitation costs only to the extent the results are consistent with the recognized code standards. ("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….") H2227, which was enacted in 2021, specifically calls for efficiency standards Virginia's code to be "at least as stringent" as the most current IECC.
Residents' welfare is plainly harmed by failing to adopt the 2021 IECC building efficiency standards. The incremental costs of construction are more than outweighed by the energy cost savings and other benefits to residents from tighter, more energy-efficient construction. The 2021 IECC incorporates wall insulation changes in addition to those made in the 2012 IECC. DOE/PNNL found, years ago, that the 2012 IECC would save residents money every year compared to the 2009 standards even considering the impacts of construction costs on residents' full occupancy costs.[1] In 2021, it found that updating to the 2021 IECC would save residents money compared to the 2012 IECC standards. Its findings support 2021 IECC compliance both nationally and for Virginia.[2] DOE/PNNL's lifecycle cost-benefit analysis considered all the costs of ownership, including the mortgage and tax impacts attributable to incremental construction costs and the savings from reduced energy usage.

Structural energy efficiency measures, including wall insulation, are extremely important in dwellings that have an expected life of 70 years or more.[3] They will benefit all residents whether owners or tenants. The ongoing burden of inefficient construction harms everyone, but it particularly harms low-income and moderate-income residents.[4]
Other benefits to residents from implementing the 2021 IECC envelope insulation (and leakage) standards include (a) health benefits, (b) added comfort, (c) greater resilience, and (d) avoidance of future need for more costly wall retrofits. The general public would also benefit from implementing the 2021 IECC envelope standards by (i) reducing climate harms from carbon pollution, (ii) reducing other health impacts from fossil fuel pollution, (iii) reducing overall utility bills by avoiding peak and annual fuel costs and minimizing facility construction costs.

It is vital to implement the IECC's envelope insulation standards during initial construction. The cost of *retrofitting* insulation in walls is much higher because it would require removing, replacing and refinishing walls. As a result, retrofitting to achieve the 2021 requirements for new construction is less likely to be undertaken. Indeed, the Base Document would continue a practice of not requiring any insulation upgrades unless walls are opened for some other purpose. Thus, residents and the public would suffer long-term harm from continuing to permit builders to under-insulate walls.
To make matters worse, the public and utility customers are paying for efficiency upgrades of some dwellings in order to offset poor efficiency in existing buildings. Virginia is on-course to spend over $1 billion, this decade, on improving energy efficiency primarily in existing dwellings--vastly more than it would have cost to build the housing well in the first place. There is no basis for assuming that utilities will continue to spend ratepayer money to make up for construction practices that are not "at least as stringent" as those in the latest IECC.
In sum, it would harm both residents and the public to continue implementing outdated building code standards that results from construction standards that are not at least as stringent as the 2021 IECC.
[1] 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
[2] https://www.energycodes.gov/national-and-state-analysis
[3] Alliance to Save Energy, https://www.ase.org/buildings
[4] The VA Poverty Law Center reports that "On average Virginia households experience an already higher than average electricity burden of 3.1%, compared to a national average of 2.7%. 'Electricity burden' is the percentage amount of your household income that is spent on electricity costs. Financial advisors agree that an average of 6% for your entire energy burden is 'affordable.' Virginian's higher than average electricity burden is unaffordable for over 75% of Virginia's households." https://vplc.org/electricity-burden-and-the-myth-of-virginias-rate-utopia/

Cost Impact: The code change proposal will increase the cost of construction
Adopting these long-overdue energy saving measures will add marginally to construction costs, but will provide greater long-term savings to residents and mitigate costs to the public generally, as outlined in the Reason and Resliency Statements. DOE/PNNL calculate that implementing the 2021 IECC will save Virginia residents $8,376 on a lifecycle basis, with positive cash flow to residents annually. DOE/PNNL, *Cost-Effectiveness of the 2021 IECC for Residential Buildings in Virginia* (July 2021), https://www.energycodes.gov/national-and-state-analysis DOE/PNNL analysis showed that the 2012-2018 IECC standards, including for wall insulation, also would save residents thousands of dollars -- if Virginia had adopted them on a timely basis. 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

In other words, residents will experience net annual and monthly costs savings for many years compared to living in dwellings built based on pre-2012 IECC standards. Since the benefits to residents from full compliance with the 2021 IECC clearly outweigh the incremental construction costs, the statutory standards to adopt standards "at least as stringent" as the 2021 IECC have been more than satisfied. (Although the data published by DOE/PNNL amply demonstrates that full compliance satisfies the statutory standards, more detailed data and analysis can be requested by DHCD from PNNL, if desired.)

Resiliency Impact Statement: This proposal will increase Resiliency
The proposed measures will help to enhance resiliency by protecting residents, reducing energy demand, helping to mitigate climate impacts and preparing Virginia's buildings and economy for a future that requires the least energy usage and energy-driven pollution possible.
Improving envelope efficiency will help residents and communities to withstand power outages from storms or other causes. During power outages, buildings with tighter, better insulated envelopes remain comfortable much longer because more efficient envelopes better maintain indoor heat in cold periods and indoor coolness in warm periods. Reducing demand through greater building efficiency will reduce burdens on utilities. That will help utilities to hold down operating and capital costs, in addition to helping them better cope with storms and other difficulties. All rate payers and the entire community benefits from this greater resilience and lower costs.

Reduced demand for energy will also mitigate climate change impacts. 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. These harms extend well beyond coastal communities. 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 of recovering from those harms declines the longer we delay maximizing energy savings and minimizing GHG pollution. Sensible investments now in energy conserving measures will reduce future rehabilitation and adaptation costs, as well as future harms.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- ☐ Consensus Approval
- ☐ Consensus Disapproval
- ☐ Carry Over to Next Meeting
- ☐ Carry over to Final
- ☐ Non-Consensus
- ☐ None

Public Comments for: REC-R402.1.2 (2)-21

Discussion by Andrew Clark

Mar 18, 2022 15:16 UTC

Contrary to the proponent's reason statement, HB 2227 does not "specifically endorse" the adoption of the latest International Energy Conservation Code. The legislation, as enacted by the General Assembly and signed by the Governor, simply states that the Board of Housing and Community Development "…*consider* adopting amendments to the Uniform Statewide Building Code (Building Code) to address changes in the IECC relating to energy efficiency and conservation" (emphasis added). If the proponent's logic were to be accepted – and the provisions of HB 2227 be interpreted as a mandate to adopt the latest IECC – they would effectively be endorsing the provisions of HB 1289, which was passed by the General Assembly during the 2022 Session and contained nearly identical provisions directing the Board "…to consider…" exempting several use and occupancy classifications from any energy efficiency standards in the Virginia Uniform Statewide Building Code/2018 Virginia Energy Conservation Code. As originally introduced, both HB 1289 and HB 2227 were mandates to the Board to adopt certain code provisions – however, the General Assembly made it clear, through their public comments and amendments to both bills, that they did not want to "legislate the building code" or mandate that the Board to adopt certain building code provisions.

Comment by William Penniman
Mar 23, 2022 15:09 UTC

Unlike HR1298 (2022) referenced by Mr. Clark, the 2021 amendment to the code (H2227) requires consideration of standards "at least as stringent" as those in the IECC *and provides a clear standard for adopting the IECC or more stringent standards,* which overlays the pre-existing statutory guidance for keeping Virginia's building codes consistent with national codes. That is, in addition to directing the BHCD to *consider* code proposals "at least as stringent" as the latest IECC, H2227 states: "*In conducting its review, the Board shall assess 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 to the cost of initial construction."* Taken as a whole, the law calls for adoption of energy standards "at least as stringent as" the latest IECC when the long-term savings and other benefits to residents and the public exceed the incremental costs of construction.

Thus, as spelled out more fully in the reason statement to EC1301.1.1.1-21:

> The BHCD's NOIRA published November 22, 2021, https://townhall.virginia.gov/L/viewstage.cfm?stageid=9475 states:
>
> > "The 2021 editions of the International Codes are now completed and available from ICC. *The use of the newest available model codes and standards in the USBC assures that the statutory mandate is met to base the regulation on the latest editions of nationally recognized model codes to assure the protection of the health, safety and welfare of the residents of Virginia and that buildings and structures are constructed and maintained at the least possible cost*."
>
> The BHCD's NOIRA also states: "As the basis for Virginia's building code it is important to stay in sync with the national model codes." These statements are consistent with Section 36-99A of the Virginia Code has long prescribed that the purposes of the USBC are to protect the public and implement recognized standards of energy conservation and water conservation:
>
> > "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*…."
>
> Legislation (H2227), enacted by the General Assembly and signed by the Governor in 2021, supplements the pre-existing law's commitment to protecting residents and the public "consistent with recognized standards of … energy conservation" by specifically endorsing adoption of energy standards "at least as stringent as" the latest IECC when the benefits "over time" to residents and the public exceed the incremental costs of construction.

We believe that our proposals meet the applicable tests under Virginia law. We will work with builders who identify ways to meet or exceed the IECC's efficiency standards at lower construction costs where possible.

REC-R402.4-21

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Construction Code

Revise as follows:

1301.1.1.1 Changes to the International Energy Conservation Code (IECC).

21. ~~Change Sections R402.4 and R402.4.1.1 to read:~~

> **~~R402.4 Air leakage.~~** ~~The *building* thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.~~
>
> > **~~R402.4.1.1 Installation (Mandatory).~~** ~~The components of the *building* thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of *construction.* Where required by the code official, an *approved* third party shall inspect all components and verify compliance.~~

22. ~~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 "b" and "c" to Table R402.4.1.1 to read:~~

23. ~~Change Section R402.4.1.2 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 in Climate Zone 4. 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; and~~
> > 6. ~~Supply and return registers, if installed at the time of the test, shall be fully open.~~

24. ~~Change Section R403.3.3 to read:~~

~~R403.3.3 Duct testing (Mandatory).~~ ~~Ducts shall be pressure tested to determine air leakage by one of the following methods:~~

1. ~~Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.~~
2. ~~Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.~~

~~Exception:~~ ~~A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.~~

~~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.~~

Reason Statement: The purpose of this proposal is to bring Virginia's standards for air leakage testing and air leakage rates into full compliance with the 2021 IECC from which the new language is drawn.

The air leakage level permitted by Virginia's 2018 Energy Conservation Code predates the 2012 IECC, which required air leakage to not exceed 3.0 air changes per hour in Virginia's climate zones. Retaining the 5.0 ACH level would make Virginia's USBC more than a decade behind the IECC, and plainly 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 deviations 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.

Reducing the maximum air infiltration to 3 air changes per hour was established as technically and economically viable when the 2012 IECC was promulgated. Following promulgation of the 2012 IECC, DOE found that the changes from 2009 improved efficiency and was cost effective for occupants in that they saved money every year and quickly recouped 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

The IECC requirement has remained at 3 air changes per hour in the 2015, 2018 and 2021 IECCs. If there were any technical or economic reason to adopt 5 ACH in Virginia's climate zones, the ICC has had three cycles to make the adjustments, but it has not done so. There is no valid reason for Virginia to continue to permit leaky houses that require additional heating and cooling in order to offset the infiltration of outside air.

Tightening building air sealing to test at 3 (versus 5) air changes per hour (a.k.a. "3 ACH" or "3 ACH50") is important to residents who will save money, experience greater comfort and a healthier home. Every additional air change requires additional heating and conditioning of air in the dwelling, and reflects poor sealing which leaves gaps for pests to enter the dwelling. While indoor humidity can be an issue in buildings (regardless of the tightness of construction) during periods in which spaces are not being heated or cooled, it is not a valid reason for refusing to implement the IECC's long-established standards for 3 ACH since greater air to flow through walls and ceilings increases the risks that moisture will be captured inside walls and insulation increasing the risks of mold and deterioration.

There is a broad consensus among recognized standards that tighter sealing of walls protects the health, safety and welfare of residents. To address indoor air issues, the IECC has long required whole-house mechanical ventilation for buildings that test at less than 5 ACH and has modified the envelope barrier standards. DOE has even tighter standards (2.5 ACH50 for Climate Zone 4) for its Zero-Energy program, and Passive House standards call for 0.6 ACH50. https://basc.pnnl.gov/information/infiltration-meets-ach50-requirements ; http://passivehousebuildings.com/books/phc-2019/five-principles-of-passive-house-design-and-construction/ The National Association of Home Builders has also recognized many benefits from minimizing air leakage.[1] And, EPA encourages tighter sealing of walls to reduce air infiltration (including infiltration of humid air), reduce energy waste, reduce the risks of indoor air pollution, reduce humidity and mold in walls, and reduce risks of infiltration by insects and rodents—another specific concern in Virginia's building code, which we cited. As EPA has stated, in *EnergyStar: A complete Thermal Enclosure System* (2017):

> 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.

[1] 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.

Cost Impact: The code change proposal will increase the cost of construction

The code change proposal will increase the cost of construction in some, but not all projects, *i.e.,* primarily when blower door tests reveal an excess of air leakage between 3 and 5 ACH. A well planned and built house should meet the 3 ACH standard, and the additional costs of caulking and other sealing techniques are limited. To the extent a blower door test reveals leaks between 3 and 5 ACH, the additional cost will typically involve filling envelope gaps with caulk and other materials which are not costly. It may take some looking to find the gaps, but it shouldn't be hard to block the leaks. Greater care by builders during the framing, insulating and sealing processes will avoid having to go back and fix leaks.

On the other hand, residents will save money and experience other benefits by reducing the volume of air changes that have to be reheated, re-cooled or dehumidified. Retrofitting to achieve the same level of tightness after walls have been closed up could require going behind walls and would be much more difficult and costly to building owners than doing the job well during the construction phase. As noted in the Reason Statement, DOE/PNNL found that the 2012 IECC changes, including the air tightness standards, would save residents money year in and year out, on a life-cycle basis. 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 If the costs had outweighed the benefits of the 3.0 ACH leakage standard, the ICC could have raised the permissible leakage rate any time in the four cycles 2012-2021. It did not, and Virginia should no longer deny the benefits to occupants of newly constructed dwellings. (Although the data published by DOE/PNNL amply demonstrates that full compliance satisfies the statutory standards, more detailed data and analysis can be requested by DHCD from PNNL, if desired.)

Resiliency Impact Statement: This proposal will increase Resiliency

Improving building energy efficiency with the 3 ACH standard will increase resiliency compared to Virginia's outdated 5 ACH standard. By reducing the volume of air that needs to be reheated or cooled every day, the proposal will reduce energy usage and cost burdens. By better preserving indoor conditioned temperatures, it will help residents and communities withstand periods of power outages from storms or other causes. Improving envelope efficiency will also reduce burdens on utilities which will help them better cope with storms and other difficulties.

By reducing demands for energy generation, tightening construction will also help mitigate climate impacts and prepare Virginia's buildings and economy for a future that requires the least energy usage and related pollution possible. 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 savings and minimizing GHG pollution.

Furthermore, saving energy will reduce occupants' utility bills while increasing their comfort. Reducing energy cost burdens will improve the *economic resiliency* of all residents, but particularly low and moderate income customers most harmed by high bills. It will also the *economic resiliency* of lenders, landlords and communities by reducing loan defaults and residents' choices between paying energy bills and rent, mortgages and other basic family needs. With buildings lasting 70 or more years, there is no excuse for not meeting standards established 10 years ago.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- ☐ Consensus Approval
- ☐ Consensus Disapproval
- ☐ Carry Over to Next Meeting
- ☐ Carry over to Final
- ☐ Non-Consensus
- ☐ None

Public Comments for: REC-R402.4-21

Discussion by Andrew Clark

Mar 18, 2022 15:17 UTC

Contrary to the proponent's reason statement, HB 2227 does not "specifically endorse" the adoption of the latest International Energy Conservation Code. The legislation, as enacted by the General Assembly and signed by the Governor, simply states that the Board of Housing and Community Development "…*consider* adopting amendments to the Uniform Statewide Building Code (Building Code) to address changes in the IECC relating to energy efficiency and conservation" (emphasis added). If the proponent's logic were to be accepted – and the provisions of HB 2227 be interpreted as a mandate to adopt the latest IECC – they would effectively be endorsing the provisions of HB 1289, which was passed by the General Assembly during the 2022 Session and contained nearly identical provisions directing the Board "…to consider…" exempting several use and occupancy classifications from any energy efficiency standards in the Virginia Uniform Statewide Building Code/2018 Virginia Energy Conservation Code. As originally introduced, both HB 1289 and HB 2227 were mandates to the Board to adopt certain code provisions – however, the General Assembly made it clear, through their public comments and amendments to both bills, that they did not want to "legislate the building code" or mandate that the Board to adopt certain building code provisions.

Comment by William Penniman
Mar 23, 2022 15:12 UTC

Unlike HR1298 (2022) referenced by Mr. Clark, the 2021 amendment to the code (H2227) requires consideration of standards "at least as stringent" as those in the IECC *and provides a clear standard for adopting the IECC or more stringent standards,* which overlays the pre-existing statutory guidance for keeping Virginia's building codes consistent with national codes. That is, in addition to directing the BHCD to *consider* code proposals "at least as stringent" as the latest IECC, H2227 states: "*In conducting its review, the Board shall assess 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 to the cost of initial construction."* Taken as a whole, the law calls for adoption of energy standards "at least as stringent as" the latest IECC when the long-term savings and other benefits to residents and the public exceed the incremental costs of construction.

Thus, as spelled out more fully in the reason statement to EC1301.1.1.1-21:

> The BHCD's NOIRA published November 22, 2021, https://townhall.virginia.gov/L/viewstage.cfm?stageid=9475 states:
>
> > "The 2021 editions of the International Codes are now completed and available from ICC. *The use of the newest available model codes and standards in the USBC assures that the statutory mandate is met to base the regulation on the latest editions of nationally recognized model codes to assure the protection of the health, safety and welfare of the residents of Virginia and that buildings and structures are constructed and maintained at the least possible cost*."
>
> The BHCD's NOIRA also states: "As the basis for Virginia's building code it is important to stay in sync with the national model codes." These statements are consistent with Section 36-99A of the Virginia Code has long prescribed that the purposes of the USBC are to protect the public and implement recognized standards of energy conservation and water conservation:
>
> > "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*…."
>
> Legislation (H2227), enacted by the General Assembly and signed by the Governor in 2021, supplements the pre-existing law's commitment to protecting residents and the public "consistent with recognized standards of … energy conservation" by specifically endorsing adoption of energy standards "at least as stringent as" the latest IECC when the benefits "over time" to residents and the public exceed the incremental costs of construction.

We believe that our proposals meet the applicable tests under Virginia law. We will work with builders who identify ways to meet or exceed the IECC's efficiency standards at lower construction costs where possible.

REC-R402.4.1.2-21

Proponents: Laura Baker (laura@reca-codes.com); Eric Lacey (eric@reca-codes.com)

2018 Virginia Energy Conservation Code

Revise as follows:

R402.4.1.2 Testing. The building or *dwelling unit* shall be tested ~~and verified as having an~~ for air leakage. ~~rate not exceeding five air changes per hour in *Climate Zone* 4.~~ The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 5.0 air changes per hour or 0.28 cubic feet per minute (CFM) per square foot [0.0079 m^3/(s x m^2)] of the dwelling unit enclosure area. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. 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.~~ envelope have been sealed.

~~**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.~~

Exception: For heated, attached private garages and heated, detached private garages accessory to one- and two-family dwellings and townhouses not more than three stories above *grade plane* in height, building envelope tightness and insulation installation shall be considered acceptable where the items in Table R402.4.1.1, applicable to the method of construction, are field verified. Where required by the code official, an *approved* third party independent from the installer shall inspect both air barrier and insulation installation criteria. Heated, attached private garage space and heated, detached private garage space shall be thermally isolated from all other habitable, conditioned spaces in accordance with Sections R402.2.12 and R402.3.5, as applicable.

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; 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 x 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 w.g. (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 the *International Residential Code* or Section 403.3.2 of the *International Mechanical Code*, as applicable, or with other *approved* means of ventilation.

Add new text as follows:

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 house in Climate Zones 0, 1 and 2, and 3.0 air changes per hour in Climate Zones 3 through 8, when tested in accordance with Section R402.4.1.2.

2018 Virgina Residential Code

Revise as follows:

N1102.4.1.2 (R402412) Testing. The *building* or dwelling unit shall be tested ~~and verified as having an~~ for air leakage ~~rate not exceeding five air changes per hour in Climate Zone 4 4.~~. The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 5.0 air changes per hour or 0.28 cubic feet per minute (CFM) per square foot [0.0079 m^3/(s x m^2)] of the dwelling unit enclosure area. Testing shall

be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, or ASTM E1827 and reported at a pressure of 0.2 inches w.g. (50 Pa). Where required by the *code official* , testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the ~~building building~~ code 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* have been sealed.

~~**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.~~

Exception: For heated, attached private garages and heated, detached private garages accessory to one- and two-family dwellings and townhouses not more than three stories above *grade plane* in height, building envelope tightness and insulation installation shall be considered acceptable where the items in Table R402.4.1.1, applicable to the method of construction, are field verified. Where required by the code official, an *approved* third party independent from the installer shall inspect both air barrier and insulation installation criteria. Heated, attached private garage space and heated, detached private garage space shall be thermally isolated from all other habitable, conditioned spaces in accordance with Sections R402.2.12 and R402.3.5, as applicable.

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; 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 w.g. (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 the *International Residential Code* or Section 403.3.2 of the *International Mechanical Code* , as applicable, or with other *approved* means of ventilation.

Add new text as follows:

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 5.0 air changes per hour in Climate Zones 0, 1, and 2, and 3.0 air changes per hour in Climate Zones 3 through 8, when tested in accordance with Section N1102.4.1.2 (R402.4.1.2).

2018 Virginia Construction Code

Revise as follows:

1301.1.1.1 Changes to the International Energy Conservation Code (IECC). Error creating auto-diffed output. (0x01)
The following changes shall be made to the IECC:

1. Add Sections C402.1.4.2, C402.1.4.2.1, C402.1.4.2.2, C402.1.4.2.3, C402.2.1.2, C402.2.1.3, C402.2.1.4, C402.2.1.5 and Change Section C402.2.1.1 to read:

C402.1.4.2 Roof/ceiling assembly. The maximum roof/ceiling assembly *U*-factor shall not exceed that specified in Table C402.1.4 based on *construction* materials used in the roof/ceiling assembly.

C402.1.4.2.1 Tapered, above-deck insulation based on thickness. Where used as a component of a maximum roof/ceiling assembly *U*-factor calculation, the tapered roof insulation *R*-value contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value-per-inch (per-mm) for *U*-factor compliance as prescribed in Section C402.1.4.

C402.1.4.2.2 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the assembly *U*-factor of the roof/ceiling *construction*.

C402.1.4.2.3 Multiple layers and staggered joints. Continuous insulation board shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered. Multiple layers and staggered joints are not required where insulation tapers to the *roof deck* at a gutter edge, roof drain or scupper.

C402.2.1 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 C402.1.3, based on *construction* materials used in the *roof assembly*.

C402.2.1.1 Tapered, above-deck insulation based on thickness. Where used as a component of a roof/ceiling assembly *R*-value calculation, the tapered roof insulation *R*-value contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value per inch (per mm) for *R*-value compliance as prescribed in Section C402.1.3.

C402.2.1.2 Minimum thickness, lowest point. The minimum thickness of above-deck roof insulation at its lowest point, gutter edge, roof drain or scupper, shall be no less than 1 inch (25 mm).

C402.2.1.3 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the minimum thermal resistance (*R*-value) of roof insulation in roof/ceiling *construction*.

C402.2.1.4 Multiple layers and staggered joints. Continuous insulation board shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered. Multiple layers and staggered joints are not required where insulation tapers to the *roof deck* at a gutter edge, roof drain or scupper.

C402.2.1.5 Skylight curbs. Skylight curbs shall be insulated to the level of roofs with insulation entirely above the deck or R-5, whichever is less.

Exception: Unit skylight curbs included as a component of a skylight listed and labeled in accordance with NFRC 100 shall not be required to be insulated.

2. Change the SHGC for Climate Zone 4 (Except Marine) of Table C402.4 to read:

3. Delete Section C402.4.1.2, change Sections C402.4.2, C402.4.2.1, C402.4.2.2 and C402.4.3.

C402.4.2 Skylight area with daylight response controls. The skylight area shall be permitted to be not more than 5 percent of the roof area provided daylight responsive controls complying with Section C405.2.3.1 are installed in daylight zones under skylights.

C402.4.2.1 Daylight Zone Controls under skylights. Daylight responsive controls complying with Section C405.2.3.1 shall be provided to control all electric lights within daylight zones under skylights.
C402.4.2.2 Haze factor. Skylights that are installed in office, storage, automotive service, manufacturing, nonrefrigerated warehouse, retail store and distribution/sorting area spaces shall have a glazing material or diffuser with a haze factor greater than 90 percent when tested in accordance with ASTM D1003.

Exception: Skylights designed and installed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles or the geometry of skylight and light well.

C402.4.3 Maximum *U*-factor and SHGC. The maximum *U*-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.4.

The window projection factor shall be determined in accordance with Equation 4-5.

$$PF = A/B \qquad \textbf{(Equation 4-5)}$$

where:

PF = Projection factor (decimal).

A = Distance measured horizontally from the farthest continuous extremity of any overhand, 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.

Where the fenestration projection factor for a specific vertical fenestration product is greater than or equal to 0.20, the required maximum SHGC from Table C402.4 shall be adjusted by multiplying the required maximum SHGC by the multiplier specified in Table C402.4.3 corresponding with the orientation of the fenestration product and the projection factor.

4. Add Table C402.4.3 to read:

5. Add an exception to the first paragraph of Section 403.7.7 to read:

Exception: Any grease duct serving a Type I hood installed in accordance with the *International Mechanical Code* (IMC) Section 506.3 shall not be required to have a motorized or gravity damper.

6. Add Section C403.2.2.1 to read:

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

7. Delete Section C403.7.5 and Table C403.7.5.
8. Delete Sections C404.5 through C404.5.2.1, including Tables.
9. Change Section C405.4 to read:

C405.4 Exterior lighting (Mandatory). All exterior lighting, other than low-voltage landscape lighting, shall comply with Section C405.4.1.

Exception: Where *approved* because of historical, safety, signage, or emergency considerations.

10. Change Section C502.1 to read:

C502.1 General. Additions to an existing building, building system or portion thereof shall conform to the provisions of Section 805 of the *Virginia Existing Building Code* (VEBC).

11. Delete Sections C502.2 through C502.2.6.2.
12. Change Section C503.1 to read:

    C503.1 General. Alterations to any *building* or *structure* shall comply with the requirements of Chapter 6 of the VEBC.

13. Delete Sections C503.2 through C503.6.
14. Change Section C504.1 to read:

    C504.1 General. *Buildings* and *structures*, and parts thereof, shall be repaired in compliance with Section 510 of the VEBC.

15. Delete Section C504.2.
16. Change Section R401.2 to read:

    R401.2 Compliance. Projects shall comply with all provisions of Chapter 4 labeled “Mandatory” and one of the following:

    1. Sections R401 through R404.
    2. Section R405.
    3. Section R406.
    4. The most recent version of REScheck, keyed to the 2018 IECC.

17. Change Section R401.3 to read:

    R401.3 A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label, or other required labels. Where *approved*, certificates for multifamily *dwelling units* shall be permitted to be located off-site at an identified location. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, basement walls, crawl space walls and floors, and ducts outside conditioned spaces; *U*-factors of fenestration and the solar heat gain coefficient (SHGC) of fenestration; and the results from any required duct system and *building* envelope air leakage testing performed on the *building.* Where there is more than one value for each component, the certificate shall indicate the value covering the largest area. The certificate shall indicate the types and efficiencies of heating, cooling, and service water heating *equipment.* Where a gas-fired unvented room heater, electric furnace, or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” "electric furnace," or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces, and electric baseboard heaters.

18. Change the wood frame wall *R*-value categories for Climate Zone 4 (Except Marine) in Table R402.1.2 to read:

19. Change the frame wall *U*-factor categories for Climate Zone 4 (Except Marine) in Table R402.1.4 to read:

20. Change Section R402.2.4 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; and
    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.

21. Change Sections R402.4 and R402.4.1.1 to read:

R402.4 Air leakage. The *building* thermal envelope shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

R402.4.1.1 Installation (Mandatory). The components of the *building* thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of *construction*. Where required by the code official, an *approved* third party shall inspect all components and verify compliance.

22. 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 "b" and "c" to Table R402.4.1.1 to read:

23. Change Section R402.4.1.2 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 in Climate Zone 4. 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; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

24. Change Section R403.3.3 to read:

R403.3.3 Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exception: A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.

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.

25. Delete Section R403.3.5.

26. Change Section R403.7 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 multistage 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.

27. Change footnote "a" in Table R406.4 to read:

a. When onsite renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2 and the building thermal envelope shall be greater than or equal to levels of energy efficiency and solar heat gain coefficient in Table R402.1.2, with a ceiling *R*-value of 49 and a wood frame wall *R*-value of 20 or 13 + 5, or Table R402.1.4, with a ceiling *U*-factor of 0.026 and a frame wall *U*-factor of 0.060.

28. Change Section R501.1 to read:

R501.1 Scope. The provisions of the *Virginia Existing Building Code* (VEBC) shall control the alteration, repair, addition and change of occupancy of existing *buildings* and *structures*.

29. Delete Sections R501.1.1 through R501.6.

30. Change Section R502.1 to read:

R502.1 General. Additions to an existing *building*, *building* system or portion thereof shall conform to the provisions of Section 811 of the VEBC.

31. Delete Sections R502.1.1 through R502.1.2.

32. Change Section R503.1 to read:

R503.1 General. Alterations to any *building* or *structure* shall comply with the requirements of Chapter 6 of the VEBC.

33. Delete Sections R503.1.1 through R503.2

34. Change Section R504.1 to read:

R504.1 General. *Buildings*, structures and parts thereof shall be repaired in compliance with Section 510 of the VEBC.

35. Delete Section R504.2.

Reason Statement: The purpose of this code change proposal is to improve efficiency and maintain compliance flexibility for code users by modifying the air leakage testing requirements to be consistent with the 2021 IECC. Specifically, the proposal improves the baseline envelope tightness requirement from 5.0 ACH50 to 3.0 ACH50, but adds a performance path trade-off option for air tightness up to 5.0 ACH50, as long as the efficiency losses are accounted for. The proposal also adds a cfm/sq.ft. compliance option for attached dwelling units and small single-family dwelling units in order to provide more options for builders.
This proposal includes a cost-effective incremental improvement from Virginia's 2018 USBC by tightening the air leakage rate from 5.0 ACH50 to 3.0 ACH50. Based on an analysis of this code change using the U.S. Department of Energy's methodology and using BEopt modeling software, we estimate that this improvement will achieve 9.2% lower energy costs, with a simple payback period of less than 2 years. Results will obviously vary based on the characteristics and size of the home, as well as how much additional work is necessary to achieve the lower leakage rates, but given the long-term benefits of a tighter envelope -- lower energy costs, more efficient system operation, better indoor air quality, etc. -- this improvement is well-justified.

The prescriptive air leakage rate of 3.0 ACH50 has been in the code since the 2012 edition of the IECC. In the 2018 USBC update, Virginia implemented mandatory blower door testing at a rate of 5.0 ACH50, which was short of the full requirement in the 2018 IECC. Now that builders have had some additional experience with mandatory blower door testing and sealing techniques, we believe it is reasonable to further improve the

requirements. At the same time, for projects that are not yet able to achieve envelope air tightness of 3.0, there is an alternative to comply via the performance path or Energy Rating Index, which will allow leakage rates up to 5.0 ACH50. This proposal also clarifies the maximum air leakage rates as 3.0 and 5.0 air changes per hour. While most code users understand the maximum air leakage rates as already being at 3.0 and 5.0 changes per hour, the addition of another digit will pre-empt any “round up” vs. “round-down” arguments from code users, providing additional support for building code officials who are simply trying to enforce the code. This part of the proposal does not change any actual requirements, but rather provides clarification and reduces inconsistency and confusion.

Cost Impact: The code change proposal will increase the cost of construction
For buildings not already achieving 3 ACH50 or less, this code change will likely increase construction costs. Based on an analysis using the U.S. DOE methodology for reviewing code changes, and using BEopt modeling software, we estimate that the average marginal cost increase of this proposal is $144. However, our analysis also showed a 9.2% improvement in overall efficiency, which would result in a simple payback of less than 2 years. We also note that for any project for which the prescriptive requirement may be infeasible, builders will have the flexibility to meet the current air leakage requirement from the 2018 USBC using tradeoffs under another compliance path.

Resiliency Impact Statement: This proposal will increase Resiliency
This proposal will increase the resiliency of homes. A properly sealed home will help maintain better indoor air quality and improve the long-term durability of the home. It will also reduce the volatility of indoor temperature swings and maintain more livable conditions during power outages due to natural emergencies.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: REC-R402.4.1.2-21

This proposal doesn't have any public comments.

REC-R403.1.2-21

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Existing Building Code

Add new text as follows:

603.5.2 Heat Pump as Primary Space Heat Source. Electric resistance heat shall not be used as the primary electric heat source for space heating in new residential construction or as a replacement for a heat pump in existing dwelling units

2018 Virginia Energy Conservation Code

Revise as follows:

R403.1.2 Heat pump ~~supplementary~~ heat (Mandatory). Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.
Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load. Except in emergency heating mode, the supplementary electric-resistance heat in heat pump systems installed in new construction may not energize unless the outdoor temperature is below 40º F (4º C).

Add new text as follows:

R403.1.3 Heat Pump as Primary Space Heat Source. Electric resistance heat shall not be used as the primary electric heat source for space heating in new residential construction or as a replacement for a heat pump in existing dwelling units

Reason Statement: Electric resistance heat is a highly inefficient form of space heating when compared to electric heat pumps. Heat pumps are roughly 300% more efficient. https://mygreenmontgomery.org/2021/environmental-and-economic-advantages-of-switching-to-an-electric-heat-pump/ Baseboard electric heating also distributes heat poorly compared to ducted systems or mini-splits.Reliance on electric resistance heat for a primary heat source (as opposed to a supplemental resistance element in a heat pump for especially cold conditions) raises heating costs for residents compared to electric heat pumps. Electric resistance heating also imposes substantial seasonal and peak-period cost burdens on electric utilities, which get passed on to other utility customers.
Compared to resistance heating, heat pumps substantially reduce a customer's heating bills--by 50% compared to resistance heat according to DOE.https://www.energy.gov/energysaver/heat-and-cool/heat-pump-systems For these reasons, the proposal would restrict installation of electric resistance heating and of heat pumps that are designed to activate resistance back-up when outdoor temperatures are above 40ºF.
Heat pumps also incorporate air conditioning, which provides customers with the health and comfort benefits of cooling in the summer and avoids the cost of installing air conditioning units during construction. Builders have the option to install whole-house, ducted heat pumps or "mini-split" heat pumps without no ducts. Heat pumps are appropriate for large or small dwellings and additions.

The proposal is modeled on a Georgia building code provision (R403.1.2).

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal may, but will not necessarily, increase the cost of construction. However, it will substantially reduce total costs occupancy and lifecycle to residents.

Resistance space heating may be cheaper to install than a standard heat pump or mini-split heat pump. However, it does not provide air conditioning which is an inherent part of a heat pump, including a mini-split. Adding a stand-alone air conditioning unit to a resistance heating unit can make the total cost greater. Like baseboard electric heat, mini-splits do not require duct work. Comparable duct work would be required for both electric furnaces and central heat pumps.

The additional upfront cost of a heat pump or mini-split compared to resistance heat will be recovered by the owner or tenant through energy cost savings attributable to a heat pump's much greater energy efficiency. As noted, DOE reports that heat pumps can reduce heating costs by 50% compared to resistance heat. https://www.energy.gov/energysaver/heat-and-cool/heat-pump-systems.

Since a heat pump or mini-split provides air conditioning, it will also provide a form of seasonal comfort, including summer dehumidification, not produced by any form of electric resistance unit. Cooling in periods of intense heat is important for the health of residents, as has been recognized by the BHCD. The hazards of heat illness are growing with climate change and the associated health care costs need to be considered.

By reducing demands on utilities for expensive generation to meet peak demands and by reducing air pollution emissions from power generation, heat pumps will also reduce costs to utility customers generally and pollution costs to the public generally.

Resiliency Impact Statement: This proposal will increase Resiliency
This proposal will increase Resiliency. Heat pumps effectively heat dwellings while reducing the peak demands placed on utilities in winter months. Such demand reductions reduce risks of utility outages. Heat pumps also provide year round comfort since they both heat and cool.

Climate change poses an ever-greater resiliency threat the longer we fail to reduce greenhouse gas (GHG) emissions. It poses an ever-growing risk of heat-illness, floods, storms, sea level rise, air and ocean heating, and other disasters that threaten residents and the economy. The need to swiftly reduce carbon emissions has been recognized by multiple agencies of the U.S. government (e.g., EPA, DOE, NAS, Global Change Research Program), by international agencies (e.g., U.N., IPCC, IEA), as well as by Virginia (e.g., in Governor Northam's Executive Order 43 (2019) and in 2020 legislation by the General Assembly). Improving the efficient use of energy is recognized as a critical measure to reduce GHG emissions and harmful climate impacts, as well as to reduce land and water pollution and overall utility costs to consumers. This proposal will replace highly inefficient resistance heating with much more efficient heat pumps.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: REC-R403.1.2-21

This proposal doesn't have any public comments.

REC-R403.1.4-21

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Construction Code

Add new text as follows:

R403.1.4 On-site combustion as primary heat source. On-site combustion of a fossil fuel shall not be used as the primary heat source for space heating, water heating or cooking in new residential construction.

N1103.1.4
On-site combustion as primary source of heat.. On-site combustion of a fossil fuel shall not be used as the primary heat source for space heating, water heating or cooking in new residential construction.

Reason Statement: This proposal would preclude the use of on-site combustion of fossil fuels as the primary source of heat in new residential construction. It would not preclude use of firewood or any form of back-up heating, outdoor grills or fireplaces.
The building code's primary purpose is to protect the health, safety and welfare of residents of the Commonwealth. To fulfill that goal, the Board should use those powers to adopt code provisions that prohibit future installations of appliances that rely on on-site combustion to generate heat for space heating, water heating or cooking.
Electrification of buildings, in place of on-site combustion, is a critical component of decarbonization strategies to reduce climate-pollution (especially CO2 and methane from producing, transmitting and combusting fossil fuels) and to stabilize global warming at or below a 1.5ºC increase over pre-industrial levels. 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/ Shifting to electricity to heat space, water and cooking will reduce indoor and outdoor pollution. Such pollution is harmful to human health and to the climate, particularly since off-site combustion of fuel to generate electricity is being displaced by non-polluting energy sources in Virginia and nationally.

The consequences from global warming are extremely harmful to people, property, infrastructure, the economy and our natural heritage. Virginia is particularly vulnerable to worsening storms and sea level rise, as well as heat illness, cardio-vascular harms.

Indoor, on-site combustion equipment produces harmful indoor air pollution in multiple forms (e.g., carbon monoxide, carbon dioxide, and methane) and pose greater risks of fire and explosions. Indoor pollution (NO2, CO, CO2, methane, etc.) from cooking with natural gas and propane is particularly harmful to residents. [1]

In-home combustion of gas or other fuels is less energy efficient than heating space or water with electric heat pumps due to the higher (300%) coefficient of performance of heat pumps. In addition, electric induction stoves are far more energy efficient than cooking with gas or propane. All on-site combustion (whether gas, oil, coal or other fuel) is dirtier and more harmful than using electric heat pumps. Virginia's electric energy is already cleaner will get cleaner still as Virginia increasingly generates electricity with zero-carbon technologies, a conversion that is planned by Virginia's major utilities.
Methane leaks from all fossil fuel production, as well as from natural gas transportation/deliveries, and combustion appliances. Methane is 86 times worse than CO2 as a greenhouse gas over 20 years. [2] It is thus a particular danger during this period in which we must dramatically reduce greenhouse gas emissions in order to avoid catastrophic warming. We cannot afford to keep adding fossil fuel users that contribute to greenhouse gas emissions. Propane also leaks (along with methane) when produced, transported, delivered to storage tanks, and used.

In addition, combustion furnaces are more costly in Virginia compared to heat pumps taking into account costs of piping inside and outside a dwelling (including to gas mains), storage in the case of propane or fuel oil, the need to install a separate air conditioner, and fuel costs.In sum,lower total costs, the growing climate crisis and the importance of reducing indoor and outdoor air pollution warrant implementation of this limitation on using combustion heating as the primary heat source in new dwellings.

[1] Although combustion furnaces are generally designed to vent emissions outdoors, they still pose risks of carbon monoxide, carbon dioxide, methane and other fumes, and installing a natural gas furnace will increase the probability that a gas stove will also be installed. Gas stoves are a particularly large source of indoor air pollution. https://rmi.org/insight/gas-stoves-pollution-health .

[2] "The drilling and extraction of the fuel from wells, as well as its processing, transmission, distribution, and storage, also result in the leakage of methane—a primary component of natural gas that is 34 times stronger than carbon dioxide at trapping heat over a 100-year period and 86 times stronger over 20 years (Myhre et al. 2013)." Union of Concerned Scientists, The Natural Gas Gamble: A Risky Bet on America's Clean Energy Future (March 2015), p. 16. The report adds: "Although there is still uncertainty about the precise quantity of these so-called fugitive methane emissions, preliminary studies and field measurements range from 1 to 9 percent of total natural gas production.

Cost Impact: The code change proposal will decrease the cost of construction
Installing an electric heat pump is cheaper than installing both an electric air conditioner and a fossil-fuel combustion furnace with its associated infrastructure (piping, venting and storage). (A builder's choice to install a hybrid system would require incurrence of those infrastructure costs.)

Once installed, the operating efficiencies and operating costs favor electric heat pumps in Virginia, which will result in a net cost savings to

residents. Reducing pollution from on-site combustion will also result in a cleaner, healthier dwelling and in a cleaner and healthier environment. Reducing environmental harms will reduce costs and harms to the public.

Thus, installing and operating an electric heat pump is likely to save money and improve lives when all factors are considered.

Resiliency Impact Statement: This proposal will increase Resiliency
The proposed measure will save energy; increase reliance on zero-carbon energy sources for heating; help mitigate climate impacts; and prepare Virginia's buildings and economy for a future that requires the least energy usage and related pollution possible. 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 savings and minimizing GHG pollution.

Since both rely on electricity, neither heat pumps nor gas furnaces would operate during a power outage.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: REC-R403.1.4-21

This proposal doesn't have any public comments.

REC-R403.1.4(2)-21

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Energy Conservation Code

Add new text as follows:

R403.1.4 Heat Pumps for Cooling and Heating. An electric heat pump system shall be installed as the primary space cooling and heating system in any dwelling in which central, ducted air conditioning would otherwise be installed. A ductless heat pump system shall be installed to serve any portion of a dwelling in which a ductless heating or cooling system would otherwise be installed.

2018 Virgina Residential Code

Add new text as follows:

N1103.1.4 Heat Pumps for Cooling or Heating. An electric heat pump system shall be installed as the primary space cooling and heating system in any dwelling in which central, ducted air conditioning would otherwise be installed. A ductless heat pump system shall be installed to serve any portion of a dwelling in which a ductless heating or cooling system would otherwise be installed.

Reason Statement: This proposal addresses new dwellings in which air conditioning is to be installed. It will provide both construction and operational efficiencies. Although heat pumps with electric auxiliary and emergency heating would be better, the proposal does not restrict the source of auxiliary or emergency heating for periods in which heat pumps need supplementation due to very cold weather or power outages. Heat pumps will still reduce energy consumption and pollution, and improved heat pump performance should minimize the periods in which on-site combustion occurs on a back-up basis.

Electric heat pumps are highly energy efficient for both heating and cooling in Virginia. The combination of heating and cooling in a heat pump will greatly reduce energy consumption and energy costs, as well as construction costs, compared to installing and operating separate air conditioning and other heating systems. Heat pumps use the same technology as air conditioners for space cooling and also for heating. They are are much more energy efficient than either combustion or resistance units for space heating. Energy efficiencies are up to 300% of resistance heat and potentially more compared to combustion heat.

Electric heat pumps conserve energy and provide year round comfort and better quality indoor air than combination systems that use electricity for air conditioning but combustion or resistance heat for space heating.

Importantly, electric heat pumps also reduce air pollution, climate harms and water pollution compared to combustion-based space heating. Cooling and heating with electric heat pumps is vital for achieving the Commonwealth's and the world's goals for reducing GHG emissions. Recent reports confirm that rapid reductions of CO2 and other GHG emissions are critical, and shifting to heat pumps is vital to achieving those goals. https://www.sierraclub.org/articles/2020/04/new-analysis-heat-pumps-slow-climate-change-every-corner-country ; 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/ .

The proposal would help to implement Virginia's stated Clean Energy Policy (§ 45.2-1706.1. (Effective October 1, 2021) Commonwealth Clean Energy Policy) which supports decarbonization and states that it is "the policy of the Commonwealth to: ...8. Promote building and construction practices that reduce emissions associated with built environment, including energy efficiency targets, new building standards, and transit-oriented and other sustainable development practices...."

Cost Impact: The code change proposal will decrease the cost of construction
The proposal will reduce construction costs by providing cooling and heating with a single system rather than separate equipment for each. It will also save residents money in their year round costs of space conditioning while providing greater comfort and a cleaner environment both indoors and outdoors.

Resiliency Impact Statement: This proposal will increase Resiliency
This proposal will increase resiliency by reducing carbon and other greenhouse gas emissions, which are increasingly harming our lives, property, economy and natural heritage. These dangers are not theoretical for Virginia. Sea level rise, more intense rainfall events, more severe storms, increased heat-illness and asthma are already impacting Virginians, their infrastructure and property. Forecasts for sea level rise now reach 2 feet by 2050, if GHG emissions are not drastically reduced.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: REC-R403.1.4(2)-21

This proposal doesn't have any public comments.

REC-R403.3.3-21

Proponents: Eric Lacey (eric@reca-codes.com)

2018 Virgina Residential Code

Revise as follows:

N1103.3.3 (R40333) Duct testing (Mandatory). Ducts shall be pressure tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1-inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1-inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exception: A duct air leakage test shall not be required ~~where the ducts and air handlers are located entirely within the *building thermal envelope.*~~ for ducts serving heating, cooling or ventilation systems that are not integrated with ducts serving heating or cooling systems.

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.

N1103.3.4 (R403.3.4) Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

~~4 3 4~~
1.

4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area where the air handler is installed at the time of the tes

3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.

2.

4.0 cubic feet per minute (113.3 L/ min) per 100 square feet (9.29 m^2) of conditioned floor area.

3. Test for ducts within thermal envelope: Where all ducts and air handlers are located entirely within the building thermal envelope, total leakage sh

N1103.3.5 (R40335) Building cavities (Mandatory). ~~(Section deleted.)~~
Building framing cavities shall not be used as ducts or plenums.

Reason Statement: This proposal updates the code provisions related to duct testing to be consistent with the 2021 IECC. A few of the changes proposed (such as the requirement that building cavities not be used as ducts or plenums) have been in the IECC for several editions; others (such as the addition of a duct test for ducts inside conditioned space) were added in the 2021 IECC update. It incorporates the changes brought about by proposals RE112-19, RE114-19, and RE118-19.
This proposal establishes a maximum level of allowable duct leakage -- regardless of the location of the ducts. From the proponent's original reason statement in proposal RE115:

"The purpose of this code change proposal is to help ensure long-term energy savings, occupant comfort and promote good building quality by establishing a maximum level of duct leakage permitted as a trade-off backstop for duct tightness. We propose a backstop that would still permit substantial flexibility – double the allowable leakage rate as the prescriptive requirement -- but that would establish a “worst case scenario” for all tested homes in all compliance paths.There is currently no upper limit on duct leakage in the IECC. In the 2012 IECC, all ducts (except those in conditioned space) were required on a mandatory basis to meet the prescriptive levels. The mandatory nature of the requirement was removed in 2015, allowing duct tightness to be fully traded off for other efficiency measures. We believe some trade-off is acceptable, but that a minimum level of duct tightness is necessary to ensure some reasonable level of duct performance occurs in the home. When ducts are excessively leaky, there is no assurance that conditioned air is provided where it is needed for adequate comfort. The failure to properly distribute conditioned air is likely to result in excess energy usage when the occupants adjust the thermostat to counter an inadequate distribution of conditioned air. Many of the

intended benefits of high-performance homes are negated if occupants are uncomfortable and adjust the thermostat in response."

We note that this proposal (RE115) was recommended for approval by the IECC-Residential Committee and no public comments were filed, meaning that no stakeholders opposed its incorporation into the 2021 IECC.This proposal also removes the exception from duct leakage testing for systems located entirely within the building envelope. This proposal (RE112) was recommended for approval by the IECC-Residential Committee, and then was approved by over 87% of the Governmental Member Voting Representatives at ICC for inclusion in the 2021 IECC. From the proponent's original reason statement in proposal RE112: The purpose of this code change proposal is to help ensure occupant comfort, proper heating and cooling system performance, and resulting long-term energy savings by requiring a duct leakage test for all new homes, including homes with all ducts inside conditioned space. This action will also help reduce the likelihood of builder callbacks for poorly-functioning, uncomfortable HVAC systems. The IECC currently exempts homes from duct testing requirements where the air handler and all ducts are located inside conditioned space. Although moving all ducts inside conditioned space may have a positive impact on energy efficiency overall, this practice alone cannot guarantee that the ducts will be tight enough to deliver conditioned air to all occupied areas of the home. Uncomfortable occupants commonly adjust thermostat settings to counteract the effect of poor delivery of conditioned air, leading to huge losses in energy efficiency. And these homes are at far greater risk for builder callback. This proposal will improve building quality and keep occupants more comfortable by requiring a duct test for all new homes, although the allowable leakage rate will be set at twice the prescriptive rate when all ducts are located inside conditioned space.Duct leakage rates can be extremely high when ducts are not tested. We do not believe that builders intentionally cut corners in duct sealing when they know that the system will not be tested. However, without an objective test as a means of quality assurance, even careful builders may not be aware of missed connections or poor sealing. In a recent DOE field study of residential homes in Kentucky, homes received duct leakage tests even where all supply and return ducts were located inside conditioned space. The results were striking – **of the 24 homes tested (that would have qualified for the test exemption under the IECC), all 24 homes had higher leakage rates than the 2018 IECC requirement. Tested duct leakage for these homes averaged 18.5 cfm/sq.ft., with individual homes ranging from 6.26 cfm/sq.ft. to as high as 40.36 cfm/sq.ft.** *See* https://www.energycodes.gov/compliance/energy-code-field-studies. We note that 40 other homes in the same study were required to be tested (because at least some ducts were located outside conditioned space), and these homes achieved leakage rates of 9.7 cfm/sq.ft., on average – roughly half the leakage rate of homes that qualified for the exemption. Obviously, this is a small sample size, but the Field Studies found similar results in Pennsylvania, where “exempt” homes (with all ducts inside conditioned space) averaged almost 31 cfm/sq.ft. leakage, while homes required to be tested averaged almost 18 cfm/sq.ft. leakage. Although the results vary across the states sampled, these results point to a shortcoming in the IECC’s “complete exemption” approach to homes with all ducts inside conditioned space.

The concept of requiring a test for all new homes is not new. DOE’s Building America Program recommends that “[e]ven in conditioned space, ducts should be insulated to reduce the risk of condensation and mold. They should be tightly sealed and tested for leakage.” *See* https://www.energy.gov/sites/prod/files/2014/01/f6/1_1g_ba_innov_ductsconditionedspace_011713.pdf. Likewise, the International Association of Certified Home Inspectors recommends that ducts be located entirely within conditioned space and tested to ensure air tightness. Air leakage rates at air handlers, even when all ducts are located in conditioned space, can lead to significant reduction in comfort, leading homeowners to adjust the thermostat and significantly increase energy use. *See* https://www.nachi.org/inspecting-hvac-cabinet-seams-air-leakage-sealing.htm.

Cost Impact: The code change proposal will increase the cost of construction
For homes that would not have been required to test ducts (because they are located inside conditioned space), this proposal will result in a construction cost increase of about $200 for a duct test. However, the proposal substantially reduces homeowner risk, because the test will objectively verify that the heating and cooling systems are operating as intended, and will provide an opportunity for the builder to correct any mistakes. The test will also reduce the likelihood of a builder callback.

Resiliency Impact Statement: This proposal will neither increase nor decrease Resiliency

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Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- ☐ Consensus Approval
- ☐ Consensus Disapproval
- ☐ Carry Over to Next Meeting
- ☐ Carry over to Final
- ☐ Non-Consensus
- ☐ None

Public Comments for: REC-R403.3.3-21

This proposal doesn't have any public comments.

Proposal # 1049

REC-R404-21

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Energy Conservation Code

Add new text as follows:

RE404.2-18

VECC: R404.2 (N1104.2) (New), R404.2.1 (N1104.2.1) (New), R404.2.2 (N1104.2.2) (New), R404.2.3 (N1104.2.3) (New); VRC: N1104.2 (New),

N1104.2.1 (New), N1104.2.2 (New), N1104.2.3 (R404.2.3) (New)
Electric Readiness. R404.2 (N1104.2) Electric readiness (Mandatory) Systems using gas or propane water heaters, dryers, or conventional cooking equipment to serve individual dwelling units shall comply with the requirements of Sections R404.2.1 through R404.2.3. All water heating systems shall comply with the space requirements of Section R404.2.3 B.
R404.2.1 (N1104.2.1) Household Ranges and Cooking Appliances An individual branch circuit and outlet with a minimum rating of 250-volts, 40-amperes shall be installed within 3 feet from each gas or propane range or permanently installed cooking appliance. Alternatively, a clearly labeled raceway sized in accordance with NFPA 70 for at least a 40-amperes branch circuit shall be installed from the electrical panel to an electrical box located within 3 feet from each gas or propane range or permanently installed cooking appliance. A label stating the intended future purpose and the location of the raceway shall be placed on the panel and the electrical box.

R404.2.2 (N1104.2.2) Household Clothes Dryers and Water Heaters An individual branch circuit and outlet with a minimum rating of 250-volts,30-amperes shall be installed within three feet of each gas or propane clothes dryer and water heater or any water heater using fuel oil. Alternatively, a clearly labeled raceway sized in accordance with NFPA 70 for at least a 30-amperes branch circuit shall be installed from the electrical panel to an electrical box located within 3 feet from each gas or propane clothes dryer or water heater or any water heater using fuel oil. A label stating the intended future purpose and the location of the raceway shall be placed on the panel and the electrical box.

R404.2.3 (N1104.2.3) Electrification-ready circuits or raceways and water heater space. A. The unused conductors required by Sections R404.2.1 or R404.2.2 shall be labeled with the word "spare" and be electrically isolated. The ends of unused raceways, if any, shall be visible or located behind a plate where the appliance outlet will go and shall be labeled with the intended use. Space shall be reserved in the electrical panel in which the branch circuit originates (or will originate if a raceway is initially installed) for the installation of an overcurrent device. Capacity for the circuits described by Sections R404.2.1 or R404.2.2 shall be included in the load calculations of the original installation.

B. An indoor space that is at least 3 feet by 3 feet by 7 feet high shall be available within 3 feet of the water heater.**Exception:** The water heater space requirement does not need to be met where a heat pump water heater is installed.

Add new text as follows:

N1104.2 Electric readiness (Mandatory) Systems using gas or propane water heaters, dryers, or conventional cooking equipment to serve individual dwelling units shall comply with the requirements of Sections N1104.2.1 (R404.2.1) through N1104.2.3 A. All water heating systems shall comply with Section N1104.2.3 B (R404.2.3 B).

N1104.2.1 Household Ranges and Cooking Appliances An individual branch circuit and outlet with a minimum rating of 250-volts, 40-amperes shall be installed within three feet of each household range and permanently installed cooking appliance. Alternatively, a clearly labeled raceway sized in accordance with NFPA 70 for at least a 40-amperes branch circuit shall be installed from the electrical panel to an electrical box located within 3 feet from each gas or propane clothes dryer or water heater. A label stating the intended future purpose and the location of the raceway shall be placed on the panel and the electrical box.

N1104.2.2 Household Clothes Dryers and Water Heaters An individual branch circuit and outlet with a minimum rating of 250-volts, 30-amperes shall be installed within three feet of each gas or propane clothes dryer and water heater or any water heater using fuel oil. Alternatively, a clearly labeled raceway sized in accordance with NFPA 70 for at least a 30-amperes branch circuit shall be installed from the electrical panel to an electrical box located within 3 feet from each gas or propane clothes dryer or water heater or any water heater using fuel oil . A label stating the intended future purpose and the location of the raceway shall be placed on the panel and the electrical box.

N1104.2.3 (R404.2.3) Electrification ready circuits and water heater space. Electrification-ready circuits and water heater space.

A. The unused conductors required by Sections N1104.2.1 (R404.2.1) and N11.04.2.1 (R404.2.2) shall be labeled with the word "spare" and be electrically isolated. The ends of unused raceways, if any, shall be visible or located behind a plate where the appliance outlet will go and shall be labeled with the intended use. Space shall be reserved in the electrical panel in which the branch circuit originates (or will originate if a raceway is initially installed) for the installation of an overcurrent device. Capacity for the circuits described by Sections N1104.2.1 and N1104.2.2 shall be included in the load calculations of the original installation.

B. An indoor space that is at least 3 feet by 3 feet by 7 feet high shall be available within 3 feet of the water heater.

Exception: The water heater space requirement does not need to be met where a heat pump water heater is installed.

Reason Statement: This proposal enhances customer choice by making it easy for property owners to choose either electric or gas appliances in the future.When a dwelling is being constructed, it is easy and inexpensive to installing wiring and equipment with appropriate capacities or, alternatively, under this proposal, a raceway and related equipment may be installed. During construction, walls are open, wiring is being routed, and tradesmen are present. Retrofitting would be much more costly and could require opening and repairing walls. By ensuring that a dwelling built with gas or propane can easily accommodate future electric appliances and equipment, this proposal protects homeowners from future conversion costs if a customer decides to switch to electric energy for any reason. In Virginia, an electric heat pump is already more cost effective than a gas furnace and heat pumps also provide air conditioning and cleaner indoor air. A heat pump is also cleaner and will get progressively cleaner as electricity generation shifts to zero-carbon sources.There are several potential reasons an occupant may wish to switch in the future. For example, gas prices fluctuate more than electric rates and could become less affordable. Electric heat pump technology has a high level of energy efficiency, moderates indoor humidity and incorporates air conditioning into a single system. Electric heat pumps offer pollution reduction benefits over onsite gas combustion, and those benefits will grow as the efficiency of electric heat pumps continues to rise and as Virginia's electricity generation transitions from fossil fuels to zero-carbon sources. Virginia's largest utilities are now required to steadily shift to zero-carbon generation, close coal plants, and achieve all zero-carbon generation by 2045.

Onsite fuel combustion also poses a risk of indoor air pollution that is increasingly recognized. https://rmi.org/insight/gasstoves-pollution-health

Electrification of buildings, in place of on-site combustion, is one critical component of decarbonization strategies to reduce climate-pollution (especially CO2 and methane from producing, transmitting and combusting fossil fuels) and stabilize global warming at or below a 1.5ºC increase over pre-industrial levels. 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/ .

Increasingly, customers are concerned about climate and health impacts from fossil fuel combustion, in addition to energy efficiency and bills. As a result, they may want to transition from natural gas to electric space and water heating and possibly to cooking to take advantage of the climate and efficiency benefits, particularly since a heat pump is up to 300% efficient compared to a gas-fired furnace. Further, federal, state, and local environmental and public health policies may encourage, or even require the transition from fossil fuels in some areas over the life of the building. Although gas may be cleaner than coal, it is dirtier than zero-carbon electric generation or a mix including significant zero-carbon generation, and methane emissions which occur at every stage of the process, including in homes, are a much more powerful greenhouse gas than carbon dioxide per unit emitted. UCS, *The Natural Gas Gamble: A Risky Bet on America's Clean Energy Future* (March 2015).
In sum, this *electric-ready* requirements will protect customers' options and pocketbooks and promote the public's interest in reducing carbon emissions. Indeed, electrification is a critical strategy for meeting climate pollution reduction goals. Transitioning to electricity for all forms of heating (space, water and cooking) is important to reducing climate impacts from fossil fuel combustion. Having electric infrastructure and raceways in place will eliminate the retrofit cost barrier to doing so.

Cost Impact: The code change proposal will increase the cost of construction
The cost of meeting these electric-ready requirements are low when the house is being built, walls are open, and the trades are already on-site. Wiring will already be extended to gas, oil or propane appliances and this merely requires also extending wires capable of handling a heavier load or, at least, installing raceways and equipment facilitating future branch circuit connections. In comparison, the cost of retrofitting a building to install new branch circuits after walls have been closed can be orders of magnitude higher and require opening, patching and repainting walls. While requiring full electrification of new dwellings, at the outset, would provide greater benefits to customers and the public, adopting this electric-ready requirement for new buildings would, at least, reduce cost barriers to future conversions to electric heating appliances, such as HVAC, hot water, stoves and dryers. As noted, electrification is a critical component of strategies to decarbonize the economy in order to combat climate change. This would help homeowners avoid potentially very high retrofit costs in the future. Such avoidable cost barriers would inhibit customers' choosing clean energy sources and act as a barrier to achieving the health, welfare and resiliency benefits of cleaner electricity and heat pump efficiencies.

Resiliency Impact Statement: This proposal will increase Resiliency
Adopting this proposal will facilitate a smoother transition to clean energy sources and reductions of GHG emissions that are threatening Virginia's citizens, property, heritage and economy.
Climate change poses an ever-greater resiliency threat the longer we fail to reduce greenhouse gas emissions. The need to swiftly reduce carbon emissions has been recognized by scientists worldwide and by the governments of Virginia, the U.S. and nearly every country on the globe. Virginia's coastal communities, economy, agriculture and human health are increasingly being harmed by climate change and its impacts. Combustion of fossil fuels is the primary source of GHG emissions that are driving climate changes.
Electrification helps to address.those climate risks by reducing GHG emissions, and the pollution-reduction benefits will grow as more electricity is generated by zero-carbon energy sources. Virginia's major utilities have committed to increase their use of zero-carbon sources steadily into the future, so they generate zero carbon emissions by 2045. Other forms of pollution will decline as well. That shift to zero-carbon electricity production

will steadily increase the already substantial health, welfare and resiliency benefits from switching to all-electric appliances.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: REC-R404-21

This proposal doesn't have any public comments.

REC-R404.2-21

Proponents: William Penniman (wpenniman@aol.com)

2018 Virginia Energy Conservation Code

Add new text as follows:

R404.2 SOLAR-READY CONSTRUCTION FOR DETACHED ONE- AND TWO-FAMILY DWELLINGS AND TOWNHOUSES. New detached one- and two-family dwellings, and townhouses with not less than 600 square feet (55.74 m^2) of roof area oriented between 110 degrees and 270 degrees of true north shall comply with Appendix RA Solar Ready Provisions--Detached One- and Two-Family Dwellings and Townhouses. [NOTE: denominated Appendix RB in 2021 IECC].
Exceptions:

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

2. A building with a solar-ready zone that is shaded for more than 70 percent of daylight hours annually.

2018 Virginia Construction Code

Add new text as follows:

N1104.2 Solar Ready Construction for Detached One- And Two-Family Dwellings and Townhouses. New detached one- and two-family dwellings, and townhouses with not less than 600 square feet (55.74 m^2) of roof area oriented between 110 degrees and 270 degrees of true north shall comply with Appendix RA Solar Ready Provisions--Detached One- and Two-Family Dwellings and Townhouses. [NOTE: denominated Appendix RB in 2021 IECC].
Exceptions: .

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

2. A building with a solar-ready zone that is shaded for more than 70 percent of daylight hours annually.

Reason Statement: This proposed addition to the body of the building code is designed to require builders to make new one- and two-family dwellings and townhouses "solar ready", subject to certain specific exceptions. The proposal does not require builders to install solar. However, it would enable buyers to arrange for cheaper, easier installation of rooftop solar if they choose to do so in the future. It is a low-cost measure that will reduce the cost of adding solar at a later date. The proposal is based up on the Appendix RA in the 2018 Virginia building code, which has been updated as Appendix RB in the 2021 IECC. Since the Appendix is in the current code and has not been modified from the 2018 code, it will presumptively follow the 2021 IECC's equivalent appendix, Appendix RB.

Rooftop solar energy production will reduce occupants' utility bills by reducing the quantity of energy they need to purchase for heating, lighting and other purposes. That will tend to stabilize and reduce their annual energy costs. Further, distributed generation will reduce the quantity of energy that utilities need to generate or purchase, the generation and transmission facilities to be constructed, and the line losses that would result from transmitting energy to markets from central power stations. Distributed energy production will help to save overall energy costs.

Distributed zero-carbon generation will also reduce greenhouse gas emissions, which are the primary driver of climate change and its many harmful impacts, including rising seas, flooding, dangerous high temperatures, agricultural disruption and threats to infrastructure.

Cost Impact: The code change proposal will increase the cost of construction
There will be a small increase in the initial cost of construction, which will be offset by encouraging building owners to install money-saving, GHG-reducing rooftop solar in the future. (Obviously, builders decide to install and profitably market the dwelling with rooftop solar if they desire to do so.)
The principal material cost would be a 1-inch electrical conduit, which can be purchased for $2.00/foot or less, i.e., less than $100 from the roof to the electrical panel. During construction, the cost of installation will be a small increment given that the walls will be open and tradesmen will be installing similar conduits and/or wiring in the building. The costs of retrofitting are likely to be much higher after walls are closed and construction completed. Reopening and repairing walls could be required.
The small upfront costs will have little impact on a resident's annual mortgage costs, particularly when compared to the savings that will result from self-generated solar energy and from the much higher cost of retrofitting.

Resiliency Impact Statement: This proposal will increase Resiliency
This low-cost proposal will increase resiliency for residential customers who install solar and for the utility system. Residential customers with solar

will generate energy on-site, which will lower energy and total occupancy costs, reducing risks of lease and mortgage defaults. In combination with on-site battery storage, the on-site solar can power the house during periods of power outages. Distributed solar can also support utility's regional reliability when power outages occur at remote central generating stations.
Solar generation is zero-carbon, which makes it a necessary measure to mitigate worsening climate impacts which harms Virginia and its residents generally. The most recent IPCC report confirms that rapid reductions of greenhouse gas emissions is essential to avoid catastrophic climate impacts around the world. *IPCC Sixth Assessment Report* (February 2022), https://www.ipcc.ch/report/ar6/wg2/
Substantial harm has already occurred nationally and locally from global warming and much worse will follow without rapid reductions of greenhouse gases (particularly CO2 and methane associated with fossil fuel production and combustion). Virginia's coastal areas are among the most vulnerable to sea level rise and destructive storms. The most recent report from NOAA indicates that Virginia may face 2 feet of sea level rise by 2050 due to worsening climate change from human greenhouse gas emissions. https://www.noaa.gov/news-release/us-coastline-to-see-up-to-foot-of-sea-level-rise-by-2050
Growing climate dangers include harms to communities, infrastructure, people (e.g., heat-related illnesses, disease vectors and ability to work), agriculture, property (inland and coastal) and the economy. These result from many climate-driven forces, including rising temperatures and seas, wildfires, worsening storms, more severe rainfall events and damage to crops and infrastructure. In addition, by cutting greenhouse gas emissions, solar generation will help to mitigate the growing impacts that warming seas and ocean acidification have on sea life and Virginia's fisheries. Even if Virginia were not directly endangered, its residents, economy and access to resources would be endangered by the growing harms to the rest of the nation and the world.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: REC-R404.2-21

This proposal doesn't have any public comments.

REC-R404.4-21

Proponents: Ben Rabe (ben@newbuildings.org); Diana Burk (diana@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

R103.2.3 Solar-ready system . . The construction documents shall provide details for dedicated roof area, structural design for roof dead and live load, and routing of conduit or pre-wiring from *solar-ready zone* to electrical service panel or plumbing from *solar-ready zone* to *service water heating* system for the *solar-ready zone* shall be represented on the construction documents.

Revise as follows:

R105.2.3 Plumbing rough-in inspection. Inspections at plumbing rough-in shall verify compliance as required by the code and *approved* plans and specifications as to types of insulation and corresponding *R*-values and protection, and required controls. Where the solar-ready zone is installed for solar water heating, inspections shall verify pathways for routing of plumbing from solar-ready zone to service water heating system.

Add new text as follows:

R105.2.5 Electrical rough-in inspection.. Inspections at electrical rough-in shall verify compliance as required by the code and the approved plans and specifications as to the locations, distribution, and capacity of the electrical system. Where the solar-ready zone is installed for electricity generation, inspections shall verify conduit or pre-wiring from solar-ready zone to electrical panel.

Revise as follows:

~~**R105.2.5**~~ **R105.2.6 Final inspection.** The *building* shall have a final inspection and shall not be occupied until *approved*. The final inspection shall include verification of the installation of all required *building* systems, equipment and controls and their proper operation and the required number of high-efficacy lamps and fixtures.

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.

R401.3 Certificate. A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required labels. The certificate shall indicate the following:

1. The predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, *crawl space walls* and floors and ducts outside *conditioned spaces.*
2. *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration. Where there is more than one value for any component of the building envelope, the certificate shall indicate both the value covering the largest area and the area weighted average value if available.
3. The results from any required duct system and building envelope air leakage testing performed on the building.
4. The types, sizes and efficiencies of heating, cooling and service water-heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.
5. Where on-site *photovoltaic panel* systems have been installed, the array capacity, inverter efficiency, panel tilt and orientation shall be noted on the certificate.
6. For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score, both with and without any on-site generation, shall be listed on the certificate.
7. The code edition under which the structure was permitted and the compliance path used.
8. Where a *solar-ready zone* is provided, the certificate shall indicate the location, dimensions, and capacity reserved on the electrical service panel.

Add new text as follows:

R404.4 Renewable energy infrastructure. The building shall comply with the requirements of R404.4.1 or R404.4.2
R404.4.1 One- and two- family dwellings and townhouses. One- and two-family dwellings and townhouses shall comply with Sections R404.4.1.1 through R404.4.1.4.

Exceptions:

1. A *building* with a permanently installed on-site renewable energy system.

2. A *building* with a solar-ready zone area that is less than 600 square feet (55 m^2) of roof area oriented between 110 degrees and 270 degrees of true north.

3. A *building* with a solar-ready zone area that is shaded for more than 70 percent of daylight hours annually.

R404.4.1.1 Solar-ready zone area. The total area of the *solar-ready zone* shall not be less than 300 square feet (28 m^2) and shall be composed of areas not less than 5.5 feet (1676 mm) in width and not less than 80 square feet (7.4 m^2) exclusive of access or set back areas as required by the International Fire Code.

Exception: 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 (186 m^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).

R404.4.1.2 Obstructions . Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

R404.4.1.3 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.

R404.4.1.4 Electrical interconnection. An electrical junction box shall be installed within 24 inches (610 mm) of the main electrical service panel and shall be connected to a capped roof penetration sleeve or a location in the attic that is within 3 feet (914 mm) of the *solar ready zone* by one of the following:

1. Minimum ¾-inch nonflexible conduit

2. Minimum #10 Metal copper 3-wire

Where the interconnection terminates in the attic, location shall beno less than 12” (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled “For Future Solar Electric”.

R404.4.2 Group R occupancies. Buildings in Group R-2, R-3 and R-4 shall comply with Section C405.13.

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION[a]	TITLE
General	
R401.2.5	Additional energy efficiency
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
R402.2.10.1	Crawl space wall insulation installations
R402.4.1.1	Installation
R402.4.1.2	Testing
R402.5	Maximum fenestration U-factor and SHGC
Mechanical	
R403.1	Controls
R403.3, including R403.3.1, except Sections R403.3.2, R403.3.3 and R403.6	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water circulation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
404.2	Interior lighting controls
R404.4	Renewable Energy Infrastructure

a. Reference to a code section includes all the relative subsections except as indicated in the table.

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION[a]	TITLE
General	
R401.2.5	Additional efficiency packages
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
R402.2.10.1	Crawl space wall insulation installation
R402.4.1.1	Installation
R402.4.1.2	Testing
Mechanical	
R403.1	Controls
R403.3 except Sections R403.3.2, R403.3.3 and R403.3.6	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water calculation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
404.2	Interior lighting controls
R404.4	Renewable Energy Infrastructure
R406.3	Building thermal envelope

a. Reference to a code section includes all of the relative subsections except as indicated in the table.

Reason Statement: In 2020, renewable energy sources were responsible for 21% of U.S. electricity generation. In order to cost-effectively achieve a Biden's goal to create a carbon-free power sector by 2035, we must make sure our buildings are capable of cost effectively installing renewable energy now. According to a recent study entitled "A New Roadmap for the Lowest Cost Grid", the least expensive grid involves a large amount of centralized renewables and a large amount of distributed renewables located on the building site. More renewables placed on site enables more clean utility-scale renewables to be deployed efficiently. It is therefore crucial for new residential buildings to be solar-ready so that the U.S. can reach its 100% carbon-free electricity goal by 2035 in the most cost-effective manner. Installing renewables on-site will also allow homeowners to economically benefit from the transition towards a low-carbon economy and benefit from additional resiliency during disruptions in centrally supplied power.
In addition, this solar-ready requirement would help grow good paying jobs. According to the Bureau of Labor Statistics, the two fastest growing occupations in the US are solar PV and wind turbine service technician. The Interstate Renewable Energy Council estimates that to reach Biden's target of 100% renewable energy by 2035, the industry will need to employ three times the number of workers employed in 2020.

The proposed revisions and additions to the code have been moved from the 2021 IECC Appendix RB Solar-Ready Provisions to the most appropriate place in the base code. The amendments would require all new homes to be solar ready by requiring a designated 300 square foot minimum "solar ready zone" on the roof. Conduit and wire from this zone must be installed and space in the electrical panel must be reserved for a future solar array. Homes where solar is not feasible due to shading or not enough solar exposure due to orientation are exempt. Information on compliance with this requirement must be placed on the construction documents to improve compliance and so that future homeowners know their home is solar-ready. Revisions to Table R405.2 and R406.2 make this a mandatory requirement in the energy code. This amendment points multifamily buildings (Group R-2 and R-3 occupancies) to a similar amendment in the commercial energy code. If the residential committee chooses

to accept this amendment but the commercial solar amendment is not accepted by the commercial committee, this amendment should be revised accordingly.

References:

Renewables Became the Second-Most Prevalent U.S. Electricity Source in 2020 , U.S. Energy Information Administration, https://www.eia.gov/todayinenergy/detail.php?id=48896.

Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies, The White House, 22 Apr. 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/.

Why Local Solar For All Costs Less: A New Roadmap for the Lowest Cost Grid, Vibrant Clean Energy, Dec. 2020, www.vibrantcleanenergy.com/wp-content/uploads/2020/12/WhyDERs_ES_Final.pdf.

The National Solar Job Census 2020, Interstate Renewable Energy Council, May 2021, https://irecusa.org/wp-content/uploads/2021/07/National-Solar-Jobs-Census-2020-FINAL.pdf.

Richardson, Jake. *Solar and Wind Tech Are the Fastest Growing Jobs in US*, Red, Green, and Blue, 28 Jan. 2019, http://redgreenandblue.org/2019/01/27/solar-wind-tech-fastest-growing-jobs-us/.

Cost Impact: The code change proposal will increase the cost of construction
Recent analysis by NBI and partners using cost data from RSMeans indicates that adding the infrastructure to make a home solar ready would cost $216 or $0.09 per square foot for a typical home at the time of construction. According to an NREL report, if a home is not made solar ready but chooses to add solar at a later date, the cost of the retrofit (if the retrofit is feasible) is $4,373 or $1.84 per square foot, assuming a 2,376 s.f. home. Therefore, adding the infrastructure to make a home solar ready now saves $4,157 or $1.75 per square foot for homeowners who choose to add solar at a later date.

References:

Solar Ready: An Overview of Implementation Practices, National Renewable Energy Laboratory, Jan. 2012, www.nrel.gov/docs/fy12osti/51296.pdf.

Resiliency Impact Statement: This proposal will increase Resiliency
Resiliency is an essential component of adapting to the effects of climate change. As we see increasing number of severe weather events, the electric grid's ability to withstand these events will become increasingly important. Community resilience will be increasingly dependent on distributed generation, and more localized production can help buildings and communities keep power when other areas of the grid may be offline. This local production of power can support critical functions and provide life supporting functions of small/at home medical devices that require on power, allowing for needed cell phone charging to stay in touch during an emergency, and literally keeping the lights on for safety and security.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: REC-R404.4-21

This proposal doesn't have any public comments.

Proposal # 1061

REC-R503.1.2-21

Proponents: Ben Rabe (ben@newbuildings.org)

2021 International Energy Conservation Code

Revise as follows:

R503.1.2 Heating and cooling systems. ~~HVAC ducts newly installed as~~ New heating and cooling and duct systems that are part of ~~an~~ the alteration ~~shall~~ shall comply with Section ~~R403~~. R403 and this section.
Exception: Where ducts from an existing heating and cooling system are extended to an *addition*.

R503.1.2.2 System Sizing. New heating and cooling equipment that is part of an *alteration* shall be sized in accordance with Section R403.7 based on the existing *building* features as modified by the *alteration.*

Reason Statement: Historically, HVAC equipment has been routinely oversized. Studies have found very high rates of equipment oversizing; for example, 60% of RTU units in CA were found to be oversized. Oversized equipment results in increased energy use, decreased occupant comfort and increased wear-and-tear on equipment. Oversized equipment is also less effective at dehumidification. Like-for-like equipment replacement are particularly vulnerable to oversizing. The original equipment may have been installed when code requirements for "right-sizing" equipment did not exist or was not enforced. The materials markups that are common practice among contractors disincentivize them to install smaller, right-sized equipment. Changes to building use could have occurred since the original equipment was installed, creating a mismatch between current design loads and the original equipment. The building may have modified, particularly by energy efficiency programs, altering the design loads of the building. Lighting especially stands out here. Fluorescent and LED lighting is ubiquitous, but many HVAC systems were designed to account for incandescent lamps that convert over 75% of the energy they consume into heat.
With all of these considerations, it is reasonable to assume that the existing equipment sizing is more likely to be wrong than right, yet many equipment replacements use existing system sizing to size new equipment. This proposal explicitly requires that new equipment installed as part of an alteration be sized based on current building characteristics and loads, using current sizing standards. The resulting installations will be more efficient and more effective and many will be less costly to install as owners stop paying for more equipment than they need

Savings will vary based on the amount that existing equipment is oversized. "Right-sizing" has been found to result in about 0.2% energy savings for every 1% reduction in oversizing.

Cost Impact: The code change proposal will decrease the cost of construction
As "wrong-sized" equipment is generally oversized, this proposal will generally decrease the cost of installation. Smaller, right-sized equipment will generally be less costly to install. Savings will vary based on the amount that existing equipment is oversized. "Right-sizing" has been found to result in about 0.2% energy savings for every 1% reduction in oversizing.

Resiliency Impact Statement: This proposal will increase Resiliency
Resiliency is an essential component of adapting to the effects of climate change. As noted in the reason statement, right sizing equipment typically results in small systems, reducing home energy use. This reduces the buildings overall reliance on energy, reducing carbon emissions directly and indirectly, lessening the impact on climate change and climate related events. For the home's resilience, the proposed measure will provide more efficient systems overall – even in an event like a black out, these more efficient systems require less energy to run, making any back up generation energy source last longer – providing extended comfort and safety to homeowners. Systems that are correctly sized will operate more optimally, avoiding system "short-cycling". This will provide for overall longevity of the systems as well – creating a different type of resilience and reliability for everyday operation and the homeowner. For energy infrastructure resilience, the electric grid's ability to deliver capacity to an increasing number of buildings will become increasingly important. By reducing overall energy use, this measure may contribute to a reduction in peak demand increasing the resiliency of the grid during high usage events, of critical importance for air conditioning loads during summer months (the most common to be oversized in this climate zone).

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: REC-R503.1.2-21 Part I

This proposal doesn't have any public comments.

Proposal # 1073

REC-R503.1.2.1-21

Proponents: Ben Rabe (ben@newbuildings.org)

2021 International Energy Conservation Code

Add new text as follows:

R503.1.2.1 Controls. New heating and cooling equipment that are part of the *alteration* shall be provided with controls that comply with Section R403.1 and R403.2 .

Reason Statement: The IECC only requires that new portions of HVAC systems comply with the requirements for new construction. This leaves unaltered portions of the HVAC system unaffected, including controls. Controls are a vital component of effective and efficient operation of heating and cooling systems and older controls that do not meet current code requirements significantly hamper efficiency in buildings. Obsolete controls also increase the operational costs for building owners and tenants. The IECC has relied on HVAC controls as a cost-effective means of delivering energy efficiency in buildings, so this is a significant missed opportunity. Equipment replacement is an ideal time to also upgrade controls. Contractors are onsite, operation of the HVAC system is already disrupted, and the cost of controls would generally be a small line-item cost in the project.
This proposal requires that thermostats be brought into compliance with current control requirements when equipment is replaced. The proposal does not require the installation of new controls, so if the existing controls already meet current code requirements, they would already be in compliance with this new section.

Cost Impact: The code change proposal will increase the cost of construction
Cost will vary depending on the type of control and how obsolete existing controls are. In most systems subject to this requirement, compliance would require replacing one thermostat with another. Modern, wireless thermostats can be used to control costs when existing control wiring is insufficient to support modern controls. Utilities have consistently found thermostat retrofits to be cost effective efficiency incentive measures.

Resiliency Impact Statement: This proposal will increase Resiliency
Resiliency is an essential component of adapting to the effects of climate change. Requiring thermostat controls in alterations to meet the same requirements as new construction helps to reduce overall home energy use. This reduces the home's overall reliance on energy, reducing carbon emissions directly and indirectly, lessening the impact on climate change and climate related events. By reducing overall energy use, this measure may contribute to a reduction in peak demand increasing the resiliency of the grid during high usage events.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- ☐ Consensus Approval
- ☐ Consensus Disapproval
- ☐ Carry Over to Next Meeting
- ☐ Carry over to Final
- ☐ Non-Consensus
- ☐ None

Public Comments for: REC-R503.1.2.1-21 Part II

This proposal doesn't have any public comments.

REC-R1104.2-21

Proponents: William Penniman (wpenniman@aol.com)

2018 Virgina Residential Code

Add new text as follows:

N202 General Definitions. Add following definitions:
ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, electric motorcycles and the like, which is primarily powered by an electric motor that draws current from a rechargeable storage battery. A "plug-in hybrid" is a type of electric vehicle which relies on a combination of a rechargeable storage battery and another source of motive power.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or charging apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EVSE INSTALLED SPACE. A designated parking space which is provided with EVSE, including an energized branch circuit with at least 40-ampere, 208/240 volts capacity that connects electric panel capacity to charging apparatus located within three feet of the parking space.

EV CAPABLE SPACE. A designated parking space which is provided with reserved electrical panel space to support a minimum 40-ampere, 208/240-volt branch circuit for EVSE and with an adequately-sized raceway for such a branch circuit from the panel to a clearly identified location within three feet of the parking space, to support future EVSE.

EV READY SPACE. A designated parking space which is provided with reserved electric panel capacity and space to serve at least a 40-ampere, 208/240-volt dedicated branch circuit to electrify EVSE. The circuit shall terminate in a suitable termination point, such as a power outlet, junction box, or EVSE apparatus, located within three feet of the parking space.

N1104.2 Electric Vehicle Readiness. New construction shall install or facilitate future installation and use of Electric Vehicle Supply Equipment (EVSE) in accordance with the National Electrical Code (NFPA 70) and N1104.2.1. **Exception:** EV supportive spaces are not required where no parking spaces are provided to residents.

N1104.2.1 EV Ready Installations. For each dwelling unit, provide at least one EV Ready Space or EVSE Installed Space in a garage or outdoor parking area. Additional EVSE Ready or EVSE Installed or EV Capable Spaces may be provided. The branch circuit for an EV Ready Space shall be identified as "EV Ready" in the service panel or subpanel directory, and the termination location shall be marked as "EV Ready". The outdoor conduit for an external EV Ready Space, EVSE Installed Space or EV Capable Space shall be located underground and be protected from water. Construction documents shall identify the location and capacity of branch circuits and raceways and the document the adequacy of electric panel and service capacity.

2018 Virginia Energy Conservation Code

Add new text as follows:

R202 (N202) General Definitions.
Add the following definitions;
ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, electric motorcycles and the like, which is primarily powered by an electric motor that draws current from a rechargeable storage battery. A "plug-in hybrid" is a type of electric vehicle which relies on a combination of a rechargeable storage battery and another source of motive power.
ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or charging apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.
EVSE INSTALLED SPACE. A designated parking space which is provided with EVSE, including an energized branch circuit with at least 40-ampere, 208/240 volts capacity that connects electric panel capacity to charging apparatus located within three feet of the parking space.
EV CAPABLE SPACE. A designated parking space which is provided with reserved electrical panel space to support a minimum 40-ampere, 208/240-volt branch circuit for EVSE and with an adequately-sized raceway for such a branch circuit from the panel to a clearly identified location within three feet of the parking space, to support future EVSE.
EV READY SPACE. A designated parking space which is provided with reserved electric panel capacity and space to serve at least a 40-ampere, 208/240-volt dedicated branch circuit to electrify EVSE. The circuit shall terminate in a suitable termination point, such as a power outlet, junction box, or EVSE apparatus, located within three feet of the parking space.

R404.2 (N1104.2) Electric Vehicle Readiness. New construction shall install or facilitate future installation and use of Electric Vehicle Supply Equipment (EVSE) in accordance with the National Electrical Code (NFPA 70) and R404.2.1. **Exception:** EV supportive spaces are not required where no parking spaces are provided to residents.

R404.2.1 (N1104.2.1) EV Ready Installations. For each dwelling unit, provide at least one EV Ready Space or EVSE Installed Space in a garage or

outdoor parking area. Additional EVSE Ready or EVSE Installed or EV Capable Spaces may be provided. The branch circuit for an EV Ready Space shall be identified as “EV Ready” in the service panel or subpanel directory, and the termination location shall be marked as “EV Ready”. The outdoor conduit for an external EV Ready Space, EVSE Installed Space or EV Capable Space shall be located underground and be protected from water. Construction documents shall identify the location and capacity of branch circuits and raceways and the document the adequacy of electric panel and service capacity.

Reason Statement: This provision is designed to provide electric charging readiness for the growing use of electric vehicles (EVs) and to meet the essential need to offer at-home charging to residents many of whom own EVs or will own EVs in the next few years. It is designed to minimize costs through phasing of EV development, with an emphasis on installing infrastructure during initial construction. Parking provided for one and two family dwellings and townhouses will only require the basic wiring and panel capacity of a single parking space. The owner can add the charger or outlet when needed. The capacity of the EV Ready circuit is at least 40 Amp, 208-240 Volts (adequate for what is commonly called "Level 2" charging), which is sufficient for timely vehicle charging. (Nothing is required if parking spaces are not provided to residents.)

The proposal will benefit residents and the public, saving money and cutting pollution. Providing access to home charging is important as a matter of practicality, money saving, a cleaner environment and equity. As a practical matter, EV charging takes time and is mostly done using at-home chargers. EVSE Ready spaces afford the ability to install "Level 2" chargers assures the ability to achieve a full battery charge overnight, providing users' range confidence and reducing costs by charging during utilities' off-peak hours. A builder may choose to add the charger to create an EVSE Installed space. (The developer may also installed additional EV Capable Spaces which only require the raceway capacity for Level 2 charging.)

EVs save money on fuel and maintenance. Annual savings were estimated at up to $1900--before gas prices jumped over $4/gallon. [1] While all EV users will benefit from fuel and maintenance savings, rural users are at the higher end of the potential savings because they tend to use more fuel for driving, and costs. All will also benefit by reducing the inconvenience of routine oil changes and other maintenance. Although the purchase cost of EVs is currently higher than the low end of vehicles with combustion engines, the purchase price is expected to fall as competition grows and, more importantly, the EV savings in fuel and maintenance costs more than pay for the initial price difference over time.

As more fully discussed in the Resiliency discussion, mitigation of climate change and air pollution generally are strong additional reasons to facilitate the shift to EVs. While EV sales and leases are growing due to their operating cost savings and other operating benefits, they will continue to grow in importance as climate risks encourage (or compel) shifting to vehicles that do not emit pollution. Vehicles are Virginia’s largest source of carbon-dioxide emissions from fossil fuel combustion.[2] Even based on today’s mix of generation in Virginia, DOE estimates that EVs would reduce CO2 emissions by roughly two-thirds compared to vehicles combusting gasoline.[3] Emissions from generation that supplies EVs will decline more as utilities' zero-carbon renewable energy replaces fossil-fuel generation. EVs’ direct emissions are non-existent, which also has substantial health and pollution benefits compared to gasoline or diesel vehicles, which is particularly important to low-income residents who are disproportionately impacted by air pollution from traditional vehicles. The harms to Virginians from climate change are present now and growing faster the longer we fail to slash emissions of CO2. methane and other greenhouse gases.
At-home charging increases EV charging during off-peak periods, which opens the door to lower off-peak rates for users and to a reduction of electric rates to all utility customers.[4]

There is a national goal to have 50% of new vehicles to be EVs by 2030.[5] Major vehicle manufacturers have committed to shift production to EVs over the next 10 years with a number of manufactures committing to shift to 100% EV production in the next 5-10 years.[6]At-home charging in conjunction with single or multifamily parking is particularly important to meeting the needs of EV owners and to encourage charging during utilities’ off-peak periods. According to research by JD Power, “80% of EV charging is done at home—almost always overnight—or while a car is parked during the workday” and EV users strongly prefer Level 2 (220/240V) charging. [7] The capability for at-home charging will substantially reduce barriers to EV adoption that arise from the inconveniences that EV charging is slower than pumping gasoline, the public infrastructure for charging is still limited, and drivers have limited ability to take advantage of off-peak rates without home-charging.Already Ford is advertising that its F-150 EV pickup will be able to provide back-up power for households. Going forward, utilities may get the added benefit of being able to draw on the batteries of parked electric vehicles in order meet peak demands and balance fluctuating loads.
Installing the wiring and basic infrastructure during construction when walls are open and workers are present is much cheaper than retrofitting which may damage wall board and require more difficult extensions of wiring. Experience shows that installing a simple 220V/40 Ampere branch circuit (comparable to a dryer or stove outlet) for "Level 2" EV charging, in a garage or outside close to parking spaces (e.g., on a wall near a single-family driveway), will enable an EV owner to reliably charge an EV at home, scheduling it at night or otherwise outside the utilities peak demand period for the lowest rates. The presence of the wiring from the beginning would permit low-cost installation of a different charging system preferred by the EV owner. Failure to install the EV during infrastructure will create barriers to EV adoption and raise long-term costs to residents.

.[1] *See* Consumer Reports, “EVs Offer Big Savings Over Traditional Gas-Powered Cars” (October 2020); Union of Concerned Scientists, https://www.ucsusa.org/about/news/rural-communities-could-benefit-most-electric-vehicles (up to $1900/year savings for rural EV owners); https://augustafreepress.com/deq-launches-clean-air-communities-program-aimed-at-driving-investment-in-electric-vehicle The police department of Westport Connecticut achieved operating and maintenance savings of over $17,000 in its first year of using a Tesla Model 3 police car instead of a fossil fuel vehicle. Among the department’s conclusions: after four years the Tesla will have saved enough money to buy another Tesla, and each EV avoids emission of over 23 tons of CO2 per year and saves $8763 in environmental and health costs. https://www.teslarati.com/tesla-model-3-westport-police-department-financial-analysis/ Those studies were based on much lower gas prices than exist today, which means that today’s savings would be much larger.

[2]https://www.epa.gov/sites/production/files/2019-11/documents/co2ffc_2017.pdf

[3] DOE estimates that an EV in Virginia emits (via electric generation) less than a third as much CO2 as a gasoline-driven vehicle. https://afdc.energy.gov/vehicles/electric_emissions.html ; https://evtool.ucsusa.org/

[4] See June 23, 2020 Comments of the Sierra Club to the State Corporation Commission in SCC Docket PUR-2020-00051, Electrification of Motor Vehicles. As the comments explain, with managed off-peak charging and efficient rate structures, rising EV loads can drive down rates to all customers. Regarding operating costs, an EV has very little maintenance costs and EV's electricity cost equivalent to a gallon of gasoline, in Virginia, was $1.16 versus roughly $4.00/gallon today. https://www.energy.gov/maps/egallon

[5] https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/

[6] EV sales are already increasing, and every major vehicle manufacturer has committed to expand EV production and even to go all-electric over the next decade or so. Electric pick-up trucks will soon be available and there are long waiting lists for pick-ups. *See* https://www.reuters.com/business/autos-transportation/us-automakers-say-they-aspire-up-50-ev-sales-by-2030-sources-2021-08-04/ https://www.forbes.com/wheels/news/automaker-ev-plans/ ; https://www.cnbc.com/2022/01/05/chrysler-kicks-off-plans-to-go-all-electric-by-2028-with-airflow-concept.html ; https://www.electrive.com/2021/08/05/us-carmakers-aim-for-40-50-ev-sales-by-2030/

[7] https://www.forbes.com/wheels/news/jd-power-study-electric-vehicle-owners-prefer-dedicated-home-charging-stations/ See also James Walkinshaw, Washington Post, Jan. 23, p.C4 (explaining the importance of home charging relative to public charging). Utilities' energy sales are lowest and cheapest in off-peak hours, particularly at night. A common utility strategy is to offer time-of-use rates with low night-time prices to encourage off-peak EV charging. For EV customers to make use of such incentives, they will need access to overnight charging at home where they spend the night.

Cost Impact: The code change proposal will increase the cost of construction

The code change proposal will slightly increase the cost of residential construction, but the increase will be very small compared to the total cost of construction and to the savings and other benefits to residents and the public. EVs with home charging will save occupants money and avoid the higher costs of retrofitting in the future.

It is easy to install the wires, panel capacity and conduits for electric vehicle charging--along with the rest of a dwelling's wiring--when a single or multifamily dwelling is built. It is much harder and much more expensive to do so as a retrofit. The branch circuit would cost a few dollars per foot. In a single-family dwelling garage or carport, for example, a branch circuit would need to be run from the circuit breaker, which is simple when other circuits and outlets are being installed during construction. However, as a retrofit, this basic wiring could require much higher costs from complicated feeding of a line and the potential need to open walls and repair wall damage.

The incremental cost of installing the branch circuit and related equipment during construction residence is constructed (likely 0.0005-0.003 or less of the cost of an average new home). If an electric panel is located in a garage, the added cost of EV readiness could easily be less than $100.

Resiliency Impact Statement: This proposal will increase Resiliency

Expanding EV utilization will enhance resiliency in multiple ways.

EVSE can be designed to deliver electricity back to a dwelling, which would protect residents during periods of power outages. https://www.ford.com/trucks/f150/f150-lightning/2022/ It is anticipated that EV batteries can also be connected to the grid to provide grid balancing and back up in the future.

Switching to EVs is also critical to resiliency because it will reduce CO2, CO, SO2, particulates, methane, and other harmful emissions from fossil-fuel combusting vehicles and from producing and delivering gasoline and diesel fuel for use in vehicles. Unlike traditional vehicles with internal combustion engines ("ICE"), electric vehicles emit no air pollution and are much more energy efficient than ICE vehicles. As Virginia's electric grid shifts to zero-carbon generation, the emission reduction benefits will grow.

According to Virginia's DEQ, "[t]he transportation sector is now the largest contributor of air pollutants and greenhouse gases in Virginia," and "[v]ehicle emissions are the largest single source of toxic and smog-forming air pollution in Northern Virginia and much of the rest of the country." https://www.deq.virginia.gov/air/clean-vehicles . Transportation accounts for 48.6% of Virginia's CO2 emissions. https://www.eia.gov/environment/emissions/state/

Polluting emissions from internal combustion vehicles compound the risks of climate change and adversely impact public health. CO2 and other emissions from fossil fuel combustion and production are the primary drivers of climate change. The most recent IPCC report confirms that rapid reductions of greenhouse gas emissions is essential to avoid catastrophic climate impacts around the world. IPCC Sixth Assessment Report (February 2022), https://www.ipcc.ch/report/ar6/wg2/ Substantial harm has already occurred nationally and locally from global warming and much worse will follow without rapid reductions of greenhouse gases (particularly CO2 and methane associated with fossil fuel production and combustion).

Virginia's coastal areas are among the most vulnerable to sea level rise and destructive storms. They already experience "sunny day flooding," and sea level rise is accelerating. https://www.vims.edu/newsandevents/topstories/2020/slrc_2019.php 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 associated with fossil fuel production and combustion). The most recent report from NOAA indicates that Virginia may face 2 feet of sea level rise by 2050 due to worsening climate change from human greenhouse gas emissions. https://www.noaa.gov/news-release/us-coastline-to-see-up-to-foot-of-sea-level-rise-by-2050 Virginia

faces climate-driven sea level rise of 6.69 feet this century; the rate of sea level rise is accelerating; the danger of climate-driven severe storms, storm-surges and flooding are rising; and climate change will increasingly harm human health and lives, agriculture, businesses, military installations, private and public property, and Virginia's economy. http://www.vasem.org/reports/2021-the-impact-of-climate-change-on-virginias-coastal-areas/

Climate dangers, however, are not limited to coastal areas. https://www.wvtf.org/news/2022-04-28/study-shows-virginia-at-increased-risk-for-flash-floods-and-landslides Growing dangers also include rising atmospheric and water temperatures that worsen heat-related illnesses, disruptions of economic activity, and harms to agriculture, fisheries, and our natural heritage.

Because atmospheric CO2 from emissions is cumulative, Virginia has less chance of mitigating and recovering from those harms the longer we delay maximizing energy savings and minimizing greenhouse gas pollution.

Shifting to EVs is a critical piece of the solution to global warming. Continuing to construct buildings that will not support use of clean EVs will make it harder to achieve climate goals, particularly since the buildings will likely remain in place for 70 years or more. Constructing buildings that cannot provide electric charging will also delay residents' ability to access large economic and energy savings from EV usage.

Building codes already recognize that fumes from traditional vehicles are dangerous. More broadly, small particle, SO2 and other pollution from vehicles burning fossil fuels increases heart and lung disease, as well as cognitive and other disorders. https://blog.ucsusa.org/dave-reichmuth/air-pollution-from-cars-trucks-and-buses-in-the-u-s-everyone-is-exposed-but-the-burdens-are-not-equally-shared/ As Virginia's electric grid shifts to zero-carbon generation, the emission reduction benefits will grow particularly if we shift vehicles to clean electricity. Local air pollution harms caused by vehicle pollution will also be reduced which will particularly benefit high-traffic areas, including low-income urban areas.

Workgroup Recommendation

2021 Workgroups Workgroup Action: None

2021 Workgroups Reason:

Workgroup Action

- [ ] Consensus Approval
- [ ] Consensus Disapproval
- [ ] Carry Over to Next Meeting
- [ ] Carry over to Final
- [ ] Non-Consensus
- [ ] None

Public Comments for: REC-R1104.2-21

This proposal doesn't have any public comments.
