International Energy Conservation Code
Consensus Committee-Residential

Draft Meeting Agenda (9/20 update)

Webex Meeting Link

September 26 and 27 (if necessary), 2022
1:00 PM EST to 5 PM EST (4 hours)

Committee Chair: JC Hudgison, CBO, Assoc. AIA
Committee Vice Chair: Bridget Herring & Robin Yochum, LEED Green Associate

1. Call to order.

2. Meeting Conduct.
   a. Identification of Representation/Conflict of Interest
   b. ICC Council Policy 7 Committees: Section 5.1.10 Representation of Interests
   c. ICC Code of Ethics: ICC advocates commitment to a standard of professional behavior that exemplifies the highest ideals and principles of ethical conduct which include integrity, honesty, and fairness. As part of this commitment it is expected that participants shall act with courtesy, competence and respect for others.
   d. ICC Antitrust Compliance Guideline

3. Roll Call.

4. Approve Agenda

5. Approval of Minutes

6. Administrative issues-the following is the chronology of ballots to date

Ballot #1 posted July 5, 2022	Ballot #1 deadline August 5, 2022
Ballot #2 posted August 8. 2022	Ballot #2 deadline August 23, 2022
Ballot #3 posted August 24, 2022	Ballot #3 deadline September 7, 2022

7. Action Items
   a. Code Change Proposals (in numerical order)
   RECPI-6-21(EV Proposal R-3)
   RECPI-7-21(EV Proposal R-2)
   RECPI-8-21(Embodied energy)
   RECPI-10-21(Water Heater efficiency)
   REPI-7-21(Solar Ready)
   REPI-20-21(Additional energy efficiency option)

REPI-33-21(LBA cost effective proposal)
REPI-64-21(Air tightness improvements)
REPI-68-21(Cool Roofs)
REPI-69-21(Multi-family alignment)
REPI-70-21(Demand Response)
REPI-93-21(HRV and ERV)
REPI-111-21(Electrification)
REPI-115-21(Energy storage ready required)
REPI-122-21(Performance Path)
REPI-129-21(ERI on-site renewable backstop)

9. Other business.

10. Upcoming meetings. TBD

11. Adjourn.

FOR FURTHER IECC Residential INFORMATION BE SURE TO VISIT THE ICC WEBSITE:
IECC Residential Website

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Kristopher Stenger, AIA, CBO
Director of Energy Programs
International Code Council
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Updated Proposed modifications since 9/12 posting

RECPI-8-21 PROPOSED MODIFICATION 9/20/22
IECC®: R401.3, R406.7.2.2

Proponents: Gayathri Vijayakumar, Steven Winter Associates, Inc.

2021 International Energy Conservation Code

CHAPTER 2 [RE] DEFINITIONS
SECTION R202 GENERAL DEFINITIONS

Add new definitions as follows:

CO_2e INDEX. A numerical integer value, calculated in accordance with ANSI / RESNET / ICC 301 that represents the relative Carbon Dioxide equivalence (CO_2e) emissions of a *rated design* as compared with the CO_2e emissions of the CO_2e reference design and where an Index value of 100 represents the CO_2e performance of the CO_2e reference design and an Index value of 0 (zero) represents a home that emits zero net CO_2e annually.

Revise as follows:
CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY
SECTION R401 GENERAL

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 and CO_2e Index, 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.

SECTION R406 ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

Revise as follows:

R406.2 (N1106.2) ERI compliance.

Compliance based on the Energy Rating Index (ERI) requires that the rated design meets all of the following:

1. The requirements of the sections indicated within Table R406.2.
2. Maximum ERI values indicated in ~~of~~ Table R406.5.
3. Maximum *CO_2e Index* of 100, not including OPP, determined in accordance with ANSI/RESNET/ICC 301.

Revise as follows:

R406.7.2.2 Confirmed compliance report for a certificate of occupancy. A confirmed compliance report submitted for obtaining the certificate of occupancy shall be made site and address specific and include the following:

1. Building street address or other building site identification.
2. Declaration of ERI and CO_2e Index on title page and on building plans.
3. The name of the individual performing the analysis and generating the report.
4. The name and version of the compliance software tool.
5. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
6. A final confirmed certificate indicating that the confirmed rated design of the built home complies with Sections R406.2 and R406.4. The certificate shall report the energy features that were confirmed to be in the home, including: component-level insulation R-values or U-factors; results from any required duct system and building envelope air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water-heating equipment installed. Where on-site renewable energy systems have been installed on or in the home, the certificate shall report the type and production size of the installed system.

Revise as follows:

CHAPTER 6 [RE] REFERENCED STANDARDS

ICC **International Code Council, Inc.**
500 New Jersey Avenue NW6th Floor
Washington, DC 20001

ANSI/APSP/ICC 14—2019: American National Standard for Portable Electric Spa Energy Efficiency
R403.11

ANSI/APSP/ICC 15a—2020: American National Standard for Residential Swimming Pool and Spa Energy Efficiency
R403.12

ANSI/RESNET/ICC 301—~~2019~~ 2022: Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units using an Energy Rating Index

R406.4

Reason:

As stated in the Executive Summary of the "Path Forward on Energy and Sustainability to Confront a Changing Climate," reduction of greenhouse gas emissions is part of our mission on this Committee. This proposal is a simple step toward that goal, by simply reporting an index, similar to ERI, that helps a builder/homeowner understand the performance of their home with respect to GHG. The software that calculates an ERI in 2024 IECC R406 path will be done so in accordance with ANSI 301-2022. That Standard requires software to list this CO2e Index on labels & certificates. It is intended to be published in time for reference within the 2024 IECC to include an update to GHG emission factors (Addendum B).

This proposal doesn't mandate a maximum CO2e Index although it paves the way for a future proposal to do so.

It would also be possible to report GHG emissions, as calculated in accordance with the same standard, if the concept of the CO2e Index is too new to receive enough support.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction since the reporting of this value is already part of compliance with the referenced Standard.

Attached Files:

Until ANSI 301-2022 is published, this approved Addendum D to ANSI 301-2019 is being shared, to provide context for the CO2e Index, which will be modified by Addendum B above.
https://www.resnet.us/wp-content/uploads/FS_301-2019AdndmD_webpost.docx

A modification to correlate RECPI-10, REPI-136 & REPI-18 9/20/22

RECPI-10 (modified, with red text to clearly show changes from RECPI-10, REPI-136 and REPI-18)

TABLE R408.2
CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

R408.2.43-Reduced energy use in service water-heating options.

Measure Number	Measure Description		Credit Value							
		CZ 0 & 1	CZ 2	CZ 3	CZ 4	CZ 4C	CZ 5	CZ 6	CZ 7	CZ 8
R408.2.4 (1)	Fossil fuel service water heating system option 1	7	6	5	3	3	2	2	3	1
R408.2.4 (2)	Fossil fuel service water heating system option 2	7	6	5	3	3	2	2	3	1
R408.2.4 (23)	Electric service water heating system option 1High performance heat pump water heating system option 1	12	11	11	8	8	6	5	5	3
R408.2.4 (34)	Electric service water heating system High performance heat pump water heating system option 2	12	12	11	8	8	6	5	5	3
R408.2.4 (45)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.4 (56)	Compact hot water distribution	2	2	2	2	2	2	2	2	2

For measure numbers R408.2.4 (1) through R408.2.4 (5), tThe hot water system shall meet one of the following Uniform Energy Factors (UEF) or Solar Uniform Energy Factors (SUEF) efficiencies: in Table R408.2.34. For measure number R408.2.4 (6), the hot water system shall comply with R408.2.4.1.

1. Greater than or equal to 82 EF fossil fuel service water-heating system.
2. Greater than or equal to 2.0 EF electric service water-heating system.
3. Greater than or equal to 0.4 solar fraction solar water-heating system.

Table 408.2.34 Service water-heating efficiencies

Measure Number Option	Water Heater	Size and Usage Bin	Type	Efficiency

~~1.~~R408.2.4 (1)	Gas-fired storage water heaters ~~Uniform Energy Factor (UEF)~~	≤ 55 gallons, Medium Usage	~~Medium Draw Pattern~~	UEF ≥~~0.64~~ 0.81
		≤ 55 gallons, High Usage	~~High Draw Pattern~~	UEF ≥~~0.68~~ 0.86
	~~First-hour rating FHR ≥ 51 gallons per hour~~	>55 gallons, Medium or High Usage	~~Medium Draw Pattern~~	~~UEF ≥0.78~~ UEF ≥~~0.80~~ 0.86
			~~High Draw Pattern~~	
~~2.~~ R408.2.4 (2)	Gas-fired instantaneous water heater			UEF ≥~~0.87~~ 0.95
~~3.~~ R408.2.4 (3)	Electric water heaters		Integrated HPWH	UEF ≥ 3.30
R408.2.4 (4)	Electric water heaters ~~Uniform Energy Factor (UEF)~~		Integrated HPWH, 120 Volt/15 Amp Circuit	UEF ≥ 2.20
	~~First-hour rating FHR ≥ 45 gallons per hour~~		Split-system HPWH	UEF ≥ 2.20
~~4.~~ R408.2.4 (5)	Solar water heaters		Electric backup	SUEF ≥ 3.00
	~~Solar uniform energy factor (SUEF)~~		Gas backup	SUEF ≥ 1.80

R408.2.4.1. Compact hot water distribution. For Compact Hot Water Distribution system credit, the volume shall store not more than 16 ounces of water in the nearest source of heated water and the termination of the fixture supply pipe when calculated using section R403.5.4.

To ~~field or plan review,~~ verify that the system meets the prescribed limit, one of the following must be done:

a. At plan review, referencing ounces of water per foot of tube on plans as per Table R403.5.4.1
b. At rough in (plumbing), referencing ounces of water per foot of tube installed as per Table R403.5.4.1
c. At final inspection, in accordance with Department of Energy's Zero Energy Ready Home National Specification (Rev. 07 or higher) footnote on Hot water delivery systems.

REPI-136 (modified in red to correlate with REPI-18)

R408.2 Additional efficiency package options.

~~Buildings meeting the requirements~~ Additional efficiency package options for compliance with Section R401.2.1 are set forth in Sections R408.2.1 through R408.2.5.

R408.2.~~3~~2 More efficient HVAC equipment performance options. Heating and cooling *equipment* shall meet one of the following efficiencies:

~~Centrally Ducted Systems~~

~~1. Greater than or equal to 95 AFUE natural gas furnace and 16 SEER 15.2 SEER2 in Climate Zones 5, 6 and 7 and 16.0 SEER2 in other Climate Zones for air conditioner.~~

~~2. Greater than or equal to 95 AFUE natural gas furnace and 8.5 HSPF2/16.0 SEER2 air source heat pump.~~

~~3. Greater than or equal to 10 HSPF / 16 SEER 8.5 HSPF2/16.0 SEER2 air source heat pump.~~

~~4. Greater than or equal to 3.5 COP ground source heat pump.~~

~~Ductless Systems~~

~~1. Single Zone: 8.5HSPF2/16.9 SEER2 variable speed air source heat pump~~

~~2. Multi Zone: 8.5HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units)~~

~~3. Multi Zone: 8.5HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)~~

1. Greater than or equal to ~~95 AFUE natural gas furnace and~~ 16.9 SEER2 air conditioner in Climate Zones 1 and 2.
2. Greater than or equal to 16.0 SEER2 air conditioner in Climate Zones 1 and 2.
3. Greater than or equal to 15.2 SEER2 air conditioner in Climate Zones 1 and 2.
4. Greater than or equal to 96 AFUE natural gas furnace in Climate Zones 6-8.
5. Greater than or equal to ~~92 AFUE natural gas furnace~~. 96 AFUE natural gas furnace and 15.2 SEER2 air conditioner for Climate Zones 3-5.
6. Greater than or equal to ~~10 HSPF/16 SEER~~ 8.5 HSPF2/~~16.9~~ 18.7 SEER2 air source heat pump.
7. Greater than or equal to 8.2 HSPF2/16.9 SEER2 air source heat pump.
8. Greater than or equal to 8.0~~-~~1 HSPF2/15.2 SEER2 air source heat pump.
9. Greater than or equal to 3.5 COP ground source heat pump.

For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.

TABLE R408.2
CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		CZ 0 & 1	CZ 2	CZ 3	CZ 4	CZ 4C	CZ 5	CZ 6	CZ 7	CZ 8
R408.2.3 (1)	High performance cooling system option 1	7	6	5	3	3	3	1	1	1
R408.2.3 (2)	High performance cooling system	5	5	4	3	3	2	1	1	0

	option 2									
R408.2.3 (3)	High performance cooling system option 3	3	3	2	1	1	1	1	1	0
R408.2.3 (~~3~~4)	High performance gas furnace option 1	0	2	3	5	5	7	8	8	10
R408.2.3 (~~4~~5)	High performance gas furnace and cooling option 2	0	2	2	4	4	5	7	7	8
R408.2.3 (~~5~~6)	High performance heat pump system option 1	8	7	6	6	6	6	5	5	4
R408.2.3 (~~6~~7)	High performance heat pump system option 2	6	6	5	5	5	5	4	4	3
R408.2.3 (8)	High performance heat pump system option 3	5	5	4	4	4	4	3	3	2
R408.2.3 (~~7~~9)	Ground source heat pump	0	2	4	6	6	8	7	6	5
R408.2.5 (1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.5 (2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.5 (3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2

COMPROMISE /OMNIBUS PROPOSAL

List of proposal used to generate the omnibus:

RECPI-6 / RECPI-7 REPI-33 REPI-64 REPI-68 REPI-93 REPI-111

REPI-7 REPI-20 REPI-70 REPI-115 REPI-122

2021 International Energy Conservation Code

CHAPTER 2 [RE] DEFINITIONS

SECTION R202 GENERAL DEFINITIONS

Add new definitions 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 (EVSE). Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the *electric vehicle* connectors, attached 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*.

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 electrical infrastructure, 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*.

DEMAND RESPONSE SIGNAL. A signal that indicates a price or a request to modify electricity consumption for a limited time period.

DEMAND RESPONSIVE CONTROL. A control capable of receiving and automatically responding to a *demand response signal*.

LOW-SLOPED ROOF. A roof slope less than 2 units vertical in 12 units horizontal (17 percent slope).

STEEP-SLOPED ROOF. A roof slope 2 units vertical in 12 units horizontal (17 percent slope) or greater.

GRADE PLANE. A reference plane representing the average of the finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior wall, the reference plane shall be established by the lowest points withing the area between the building and the lot line or, where the lot line is more than 6 feet (1829 mm) from the building between the structure and a point 6 feet (1829 mm) from the building.

LIVING SPACE. Space within a dwelling unit utilized for living, sleeping, eating, cooking, bathing, washing and sanitation purposes.

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.

Add new as follows (REPI-7):

CHAPTER 1 [RE] SCOPE AND ADMINISTRATION

SECTION R103 CONSTRUCTION DOCUMENTS

R103.2.2 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.

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 required, 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.

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R401 GENERAL

R401.3 (N1101.14) 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, and dimensions.

Revise as follows (REPI-33):

SECTION R402 BUILDING THERMAL ENVELOPE

TABLE R402.1.2 (TABLE R1102.1.2) MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

	FENESTRATION U-FACTOR[f]	SKYLIGHT U-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING U-FACTOR	WOOD FRAME WALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.0~~26~~30	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.0~~26~~30	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.0~~24~~26	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.40	0.0~~24~~26	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.0~~24~~26	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.0~~24~~26	0.045	0.057	0.028	0.050	0.055

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

	FENESTRATION U-FACTOR[b, i]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[g]	MASS WALL R-VALUE[h]	FLOOR R-VALUE	BASEMENT[c,g] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c,g] WALL R-VALUE
0	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
2	0.40	0.65	0.25	~~49~~38	13 or 0 & 10ci	4/6	13	0	0	0
3	.30	0.55	0.25	~~49~~38		8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]

4 except Marine	.30	0.55	0.40	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	13/17	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
6	0.30[i]	0.55	NR	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	15/20	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
7 and 8	0.30[i]	0.55	NR	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	19/21	38	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci

Revise as follows (REPI-64):

SECTION R402 BUILDING THERMAL ENVELOPE

R402.4.1.3 (N1102.4.1.3) Prescriptive air leakage ~~Leakage~~ rate.

When complying with Section R401.2.1, the building or dwelling unit shall have an air leakage rate not exceeding 5.0 air changes per hour in Climate Zones 0, 1 and 2, 3.0 air changes per hour in Climate Zones 3 through 5, and ~~3.0~~ ~~2.0~~2.5 air changes per hour in Climate Zones ~~3~~6 through 8, when tested in accordance with Section R402.4.1.2.

TABLE R405.4.2(1) (TABLE N1105.4.2(1)) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air exchange rate	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zone 3, 4, and 5: 3.0 air changes per hour. Climate Zones ~~3~~6 through 8: ~~3.0~~ 2.5 air changes per hour.	The measured air exchange rate.[a]
	The mechanical ventilation rate shall be in addition to the air leakage rate and shall be the same as in the proposed design, but not greater than 0.01 × CFA + 7.5 × (N + 1) where: CFA = conditioned floor area, ft^2. N = number of bedrooms. The mechanical ventilation system type shall be the same as in the proposed design. Energy recovery shall not be assumed for mechanical ventilation.	The mechanical ventilation rate[b] shall be in addition to the air leakage rate and shall be as proposed.

Revise as follows (REPI-93):

SECTION R403 SYSTEMS

R403.6.1 Heat or energy recovery ventilation.

Dwelling units shall be provided with a heat recovery or energy recovery ventilation system in Climate Zones 6, 7, and 8. The system shall be balanced with a minimum sensible heat recovery efficiency of 65 percent at 32°F (0°C) at a flow greater than or equal to the design airflow.

~~**Exceptions:**~~

~~1. *Dwelling units* in single- and two-family dwellings and townhouses in Climate Zones 0–4.~~

~~2. *Dwelling units* in Group R occupancies that comply with Section C403.7.4.1.~~

Add new text as follows (REPI-111):

SECTION R404 ELECTRICAL POWER AND LIGHTING SYSTEMS

R404.4 (N1104.4) Electric readiness. Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.4.1 through R404.4.4. ~~All water heating systems shall comply with the space requirements of Section R404.4.5.~~

R404.4.1 (N1104.4.1) Cooking products. An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.

Exception: Cooking products not installed in an individual *dwelling unit.*

R404.4.2 (N1104.4.2) Household Clothes Dryers .

An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.

Exception: Clothes dryers that serve more than one *dwelling unit* and are located outside of a *dwelling unit.*

R404.4.3 (N1104.4.3) Water heaters.

An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.

Exception: Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.

R404.4.4 (N1104.4.4) Electrification-ready circuits.

The unused conductors required by Sections R404.4.1 through R404.4.3 shall be labeled with the word "spare." Space shall be reserved in the electrical panel in which the branch circuit originates for the installation of an overcurrent device. Capacity for the circuits required by Sections R404.4.1 through R404.4.3 shall be included in the load calculations of the original installation.

~~**R404.4.5 (N1104.4.5) Water heater space.**~~

~~An indoor space that is at least 3 feet (304 mm) by 3 feet (304 mm) wide by 7 feet (2133 mm) high shall be available surrounding or within 3 feet (304 mm) of the installed water heater.~~

~~**Exceptions:**~~

~~1. Installed heat pump, electric tankless, or fossil fuel tankless water heaters.~~

~~2. Water heaters in a centralized water heating system serving multiple *dwelling units* in a R-2 occupancy.~~

Add new text as follows (REPI-7):

R404.4 (N1104.4) Renewable energy infrastructure. The building shall comply with the requirements of R404.4.1 or R404.4.2.

R404.4.1 (N1104.4.1) 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 *dwelling unit* with a permanently installed on-site renewable energy system.
2. A *dwelling unit* with a solar-ready zone area that is less than 500 square feet (46 m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A *dwelling unit* with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
4. ~~A *dwelling unit* with a *solar-ready zone* area that is shaded for more than 70 percent of daylight hours annually.~~Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.
5. A *dwelling unit* that complies with Appendix RC.
6. A *dwelling unit* with a renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated whole-building electric use on an annual basis.
7. A *dwelling unit* less than or equal to 1,500 square feet of *living space* floor area located above *grade plane*.

R404.4.1.1 (N1104.4.1.1) Solar-ready zone area. The total area of the *solar-ready zone* shall not be less than 250 square feet (23.2 m^2) and shall be composed of areas not less than 5.5 feet (1676 mm) in ~~i~~be one direction and not less than 80 square feet (7.4 m^2) exclusive of access or set back areas as required by the *International Residential Code*.

Exception: Dwelling units in 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 (N1104.4.1.2) Obstructions. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

R404.4.1.3 (N1104.4.1.3) Electrical service reserved space. The main electrical service panel shall have a reserved space for a dual pole circuit breaker and shall be labeled "For Future Solar Electric." The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.

R404.4.1.4 (N1104.4.1.4) 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 a minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".

R404.4.2 (N1104.4.2) Group R occupancies. Buildings in Group R-2, R-3 and R-4 shall comply with Section C405.13.

Revise as follows:

SECTION 405 TOTAL BUILDING PERFORMANCE

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION[a]	TITLE
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.4	Renewable energy infrastructure
R404.4	Electric readiness
R404.4	Electric Vehicle Power Transfer Infrastructure

SECTION R406 ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

Revise as follows:

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.4	Renewable energy infrastructure
R404.4	Electric readiness
R404.4	Electric Vehicle Power Transfer Infrastructure

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

Add new text as follows (RECPI-6 & 7):

R404.4 Electric Vehicle Power Transfer Infrastructure. New *automobile parking spaces* for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.4.1 through R404.4.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.4.1 through R404.4.5.

R404.4.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one *EV-capable, EV-ready, or EVSE installed space* per dwelling unit. R-2 occupancies or allocated parking for R-2 occupancies in mixed-use buildings shall be provided with an EV capable space, EV ready space, or EVSE space for ~~75%~~ 40% of ~~each~~ dwelling units or automobile parking spaces, whichever is less.

R404.4.2 EV Capable Spaces. Each *EV capable space* used to meet the requirements of Section R404.4.1 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 capable space* and a suitable panelboard or other onsite electrical distribution equipment.

2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.4.4

3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-pole circuit breaker or set of fuses.

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

R404.4.3 EV Ready Spaces. Each branch circuit serving *EV ready spaces* shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each *EV ready space* it serves.

2. Have a minimum circuit capacity in accordance with R404.4.4.

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)."

R404.4.4 Circuit Capacity. For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each *EV capable space*, *EV ready space* and *EVSE space* shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each *EV capable space*, *EV ready space* or *EVSE space* it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each *EV capable space, EV ready space* and *EVSE* space shall comply with one of the following:

1. A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each *EV capable space*, *EV ready space* or *EVSE* space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.

2. The requirements of R404.4.4.1.

Exceptions:

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

2. ~~For R-2 occupancies, w~~Where substantiation has been approved that meeting the requirements of Section R404.4.4.1 will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the builder or developer by more than $400.00 per dwelling unit.

R404.4.4.1 Circuit capacity management. The capacity of each branch circuit serving multiple *EVSE spaces*, *EV ready space* or *EV capable spaces* designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.

R404.4.5 EVSE installation. For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.4.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.

R404.4.5.1 EVSE minimum charging rate.

Each installed EVSE shall comply with one of the following:

1. Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).

2. Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.4.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.

CHAPTER 6 [RE] REFERENCED STANDARDS

Add new standard(s) as follows:

UL	UL LLC 333 Pfingsten Road Northbrook IL 60062
UL 2202-2009	Electric Vehicle (EV) Charging System - with revisions through February 2018
UL	UL LLC 333 Pfingsten Road Northbrook IL 60062
UL 2594-2016	Standard for Electric Vehicle Supply Equipment

Revise as follows (REPI-68 correlating with REPI-18)

SECTION R408 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

R408.2.1. Enhanced envelope ~~performance~~ options. ~~The total building thermal envelope UA, the sum of U-factor times assembly area, shall be less than or equal to 95 percent of the total UA resulting from multiplying the U-factors in Table R402.1.2 by the same assembly area as in the proposed building. The UA calculation shall be performed in accordance with Section R402.1.5. The area-weighted average SHGC of all glazed fenestration shall be less than or equal to 95 percent of the maximum glazed fenestration SHGC in Table R402.1.2~~. The building thermal envelope shall meet the requirements of the following:

1. Section R408.2.1.1 or R408.2.1.2.
2. Section R408.2.1.3.

Section R408.2.1.3 Roof reflectance. Roofs ~~in Climate Zones 0 through 23~~ shall comply with one or more of the options in Table R408.2.1.3.

~~**Exceptions:**~~

~~1. Roofs with a radiant barrier with an emittance of 0.05 or less.~~

~~2. Portions of the roof that include or are covered by one or more of the following:~~

~~2.1. *On-site renewable energy* systems or components~~

~~2.2. Solar air or water heating systems or components~~

~~2.3. Vegetative roofs or landscaped roofs~~

~~2.4. Above-roof decks or walkways~~

~~2.5. Skylights~~

~~2.6. HVAC systems and components, and other opaque objects mounted above the roof~~

~~3. Portions of roof shaded during the peak sun angle of the summer solstice by permanent features of the building or by permanent features of adjacent buildings.~~

~~4. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (74 kg/m^2) or 23 psf (117 kg/m^2) pavers.~~

~~5. Roofs where portions exempted by exceptions 2, 3, and 4 make up not less than 75 percent of the total roof area.~~

TABLE R408.2.1.3 MINIMUM ROOF REFLECTANCE[a]

Roof Slope	Three-year aged solar reflectance index[b]
Low-slope	75[b,c]
Steep-slope	16

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year-aged solar reflectance in accordance with Section R408.2.1.3.1.

b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

c. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft 2 × °F (12 W/m 2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

R408.2.1.3.1 Aged solar reflectance. Where an aged solar reflectance required by Section R402.6 is not available, it shall be determined in accordance with Equation 4-X.

$$R_{aged}=[0.2+0.7(R_{initial}-0.2)] \quad \text{(Equation 4-X)}$$

where:
R_{aged}=The aged solar reflectance
$R_{initial}$=The initial solar reflectance determined in accordance with CRRC-S100

Measure Numberber	Measure Description	Credit Value								
		CZ 0 & 1	CZ 2	CZ 3	CZ 4	CZ 4C	CZ 5	CZ 6	CZ 7	CZ 8
R408.2.1.3	Cool Roof	TBD	TBD	TBD	TBD	TBD	0	0	0	0

CHAPTER 6 [RE] REFERENCED STANDARDS

Add new standard(s) as follows:

ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM C1549-2016	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E903-2012	Standard Test Method for Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres (Withdrawn 2005)
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E1918-06(2016)	Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-sloped Surfaces in the Field

ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E1980- 11	Standard Practice for Calculating Solar Reflectance of Horizontal and Low-sloped Opaque Surfaces
CRRC	Cool Roof Rating Council 2435 North Lombard Street Portland OR 97217
ANSI/CRRC-S100-2021	Standard Test Methods for Determining Radiative Properties of Materials

Revise as follows (REPI-33 and REPI-20, and correlation with REPI-18)

R408.2 (N1108.2) Additional energy efficiency credit requirements ~~package options~~.

Two a~~A~~dditional ~~efficiency~~ ~~package options for compliance with Section R401.2.1 are set forth in Sections Table R408.2.1 through R408.2.5.~~ measures shall be selected from Table R408.2 that ~~are cumulatively equal to or greater than~~ meet or exceed a total of ten. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of ~~conditioned~~ *living space* floor area located above g*rade plane*. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table 408.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.

Add new text as follows:

R408.2.11 Opaque walls ~~option~~.

For *buildings* in climate zones 4 and 5, the maximum U-factor of 0.060 shall be permitted to be used for wood frame walls for compliance with Table R402.1.2 where complying with one or more of the following:

1. ~~A heat pump is installed for~~ Primary space heating is provided by a heat pump that meets one of the efficiencies in R408.2.3.

2. All installed water heaters are heat pumps that meet one of the efficiencies in R408.2.4~~have a UEF equal to or greater than 2.0 or a COP of greater than 1.0~~.

3. In addition to the number of credits required by Section R408.2, three additional credits are achieved.

4. Renewable energy resources are installed to meet the requirements of R408.2.8.

Add new text as follows (REPI-70)

TABLE R408.2
CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		CZ 0 & 1	CZ 2	CZ 3	CZ 4	CZ 4C	CZ 5	CZ 6	CZ 7	CZ 8
R408.2.10	Demand Responsive Thermostat	1	1	1	1	1	1	1	1	1

R408.2.10 Demand Response

The thermostat controlling the primary heating or cooling system of each *dwelling unit* shall be provided with a *demand responsive control* capable of communicating with the Virtual End Node (VEN) using a wired or wireless bi-directional communication pathway that provides the occupant the ability to voluntarily participate in utility demand response programs, where available. The thermostat shall be capable of executing the following actions in response to a *demand response signal*:

1. Automatically increasing the zone operating cooling set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C), and 4°F (2°C).
2. Automatically decreasing the zone operating heating set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C), and 4°F (2°C).

Thermostats controlling single stage HVAC systems shall comply with Section R408.2.10.1. Thermostats controlling variable capacity systems shall comply with Section R408.2.10.2. Thermostats controlling multi-stage HVAC systems shall comply with either Section R408.2.10.1 or R408.2.10.2.

Where a *demand response signal* is not available the thermostat shall be capable of performing all other functions.

R408.2.10.1 Single stage HVAC system controls. Thermostats controlling single stage HVAC systems shall be provided with a *demand responsive control* that complies with one of the following:

1. Certified OpenADR 2.0a VEN, as specified under Clause 11, Conformance
2. Certified OpenADR 2.0b VEN, as specified under Clause 11, Conformance
3. Certified by the manufacturer as being capable of responding to a *demand response signal* from a certified OpenADR 2.0b VEN by automatically implementing the control functions requested by the VEN for the equipment it controls
4. IEC 62746-10-1
5. The communication protocol required by a controlling entity, such as a utility or service provider, to participate in an automated demand response program
6. The physical configuration and communication protocol of CTA 2045-A or CTA-2045-B

R408.2.10.2 Variable capacity and two stage HVAC system controls. Thermostats controlling variable capacity and two stage HVAC systems shall be provided with a *demand responsive control* that complies with the communication and performance requirements of AHRI 1380.

CHAPTER 6 [RE] REFERENCED STANDARDS

Add new standard(s) as follows:

CTA

Consumer Technology Association Technology & Standards Department
1919 S Eads Street
Arlington, VA 22202
CTA Consumer Technology Association Technology & Standards Department. ANSI/CTA-2045-B – 2018: Modular Communications
Interface for Energy Management

IEC

IEC Regional Centre for North America
446 Main Street 16th Floor
Worcester, MA 01608
IEC IEC Regional Centre for North America. IEC 62746-10-1 - 2018: Systems interface between customer energy management system and the power management system - Part 10-1: Open automated demand response

OpenADR

OpenADR Alliance
111 Deerwood Road, Suite 200

San Ramon, CA 94583
OpenADR OpenADR Alliance. OpenADR 2.0a and 2.0b – 2019: Profile Specification Distributed Energy Resources

AHRI

Air-Conditioning, Heating, & Refrigeration Institute
2111 Wilson Blvd, Suite 500
Arlington, VA 22201
AHRI 1380-2019 Demand Response through Variable Capacity HVAC Systems in Residential and Small Commercial
Applications

Add new text as follows:

CTA Consumer Technology Association Technology & Standards Department ANSI/CTA-2045-A – 2018:. Modular Communications
Interface for Energy Management

Revise as follows (REPI-122):

R102.1.1Above code programs. The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. *Buildings approved* in writing by such an energy-efficiency program shall be considered to be in compliance with this code where such buildings also meet the requirements identified in Table R405.2 and the proposed total *building thermal envelope* UA, which is the sum of *U*-factor times assembly area, shall be less ~~is greater~~ than or equal to the *building thermal envelope* UA using the prescriptive *U*-factors from Table R402.1.2 multiplied by ~~1.15~~1.08 in Climate Zones 0, 1, and 2, and by 1.15 in Climates Zones 3 through 8, in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30. ~~levels of efficiency and solar heat gain coefficients in Tables 402.1.1 and 402.1.3 of the 2009 *International Energy Conservation Code*.~~

For Climate Zones 0-2: $UA_{Proposed\ design} \leq 1.08 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)

For Climate Zones 3-8: $UA_{Proposed\ design} \leq 1.15 \times UA_{Prescriptive\ reference\ design}$

Revise as follows:

R401.2.5 Additional energy efficiency.

This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying with Section R401.2.1, one of the additional efficiency package options shall be installed according to Section R408.2.

~~2. For buildings complying under with Section R401.2.2 , the building shall meet one of the following:~~

~~2.1. One of the additional efficiency package Options in Section R408.2 shall be installed without including such measures in the proposed design under Section R405; or~~

~~2.2. The proposed design of the building under Section R405.3 shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design.~~

~~2~~3. ~~For buildings complying with the Energy Rating Index alternative Section R401.2.3, the Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified in Table R406.5.~~

The option selected for compliance shall be identified in the certificate required by Section R401.3.

R405.2 (N1105.2) Performance-based compliance.

Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.

2. The proposed total *building thermal envelope* UA, which is the sum of the U-factor times assembly area, shall be less ~~greater~~ than or equal to the *building thermal envelope* UA using the prescriptive *U*-factors from Table R402.1.2 multiplied by ~~1.15~~1.08 in Climate Zones 0, 1 and 2, and 1.15 in Climates Zones 3 through 8, in accordance with Equation 4-1.~~levels of efficiency and solar heat gain coefficients in~~

~~Table R402.1.1 or R402.1.3 of the 2009 *International Energy Conservation Code*.~~The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

~~Equation 4-1: UA proposed design <=1.15 x UA prescriptive reference design.~~

For Climate Zones 0-2: $UA_{Proposed\ design} \leq 1.08 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)

For Climate Zones 3-8: $UA_{Proposed\ design} \leq 1.15x\ UA_{Prescriptive\ reference\ design}$

3. For buildings without a fuel burning appliance for space heating or water heating, ~~An~~ the annual energy cost of the *proposed design* that is less than or equal to 85 percent of the annual energy cost of the *standard reference design* ~~or the additional efficiency credits as required in Section R408.2 shall be installed without including such measures in the proposed design under Section R405~~. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the *proposed design* that is less than or equal to 80 percent of the annual energy cost of the *standard reference design.* For *dwelling units* with greater than 5,000 square feet (465 m^2) of ~~conditioned~~ *living space* floor area located above *grade plane*, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design.

Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.

TABLE R405.4.2(1) (TABLE N1105.4.2(1)) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN		
Heating systems[d, e, j, k]		~~As proposed~~		
	Fuel Type/Capacity: Same as proposed design	As proposed		
	Product class: Same as proposed design	As proposed		
	Efficiencies:	As proposed		
	Heat pump: Complying with 10 CFR §430.32	As proposed		
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed		
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed		
Cooling systems[d, f, k]		~~As proposed~~		
	Fuel Type: Electric Capacity: Same as proposed design	As proposed		
	Efficiencies: Complying with 10 CFR §430.32	As proposed		

<table>
<tr><td>Service water heating[d, g, k]</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>Compactness ratio[i] factor</td><td></td><td>HWDS</td></tr>
<tr><td></td><td></td><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td></td><td></td><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td></td><td></td><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td></td><td></td><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td></td><td></td><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
<tr><td></td><td>Fuel Type: Same as proposed design</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Draw Pattern: Same as proposed design</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td><td></td><td></td></tr>
<tr><td>Thermal distribution systems</td><td>Duct insulation: in accordance with Section R403.3.1.

Duct location: <s>same as proposed design</s>

<table><tr><th>Foundation Type</th><th>Slab on grade</th><th>Unconditioned crawlspace</th><th>Basement or conditioned crawlspace</th></tr><tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic</td><td>One-story building: 100% in unconditioned crawlspace</td><td>50% inside conditioned space

-</td></tr></table></td><td>Duct insulation: as proposed.

Duct location: as proposed.

Duct System Leakage to Outside:

The measured total duct</td><td></td><td></td></tr>
</table>

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All other: 75% in unconditioned attic and 25% inside conditioned space

-</td>
<td>-

All other: 75% in unconditioned crawlspace and 25% inside conditioned space

-</td>
<td>50% unconditioned attic

-</td>
</tr>
</table>
Duct system leakage to outside:

For duct systems serving > 1,000ft^2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.

For duct systems serving ≤ 1,000ft^2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).
</td>
<td>system leakage rate shall be entered into the software as the duct system leakage to outside rate.

Exceptions:

1.. When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.

2. When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td>
<td></td>
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<tr>
<td></td>
<td>~~For all systems other than tested duct systems. a~~ For hydronic systems and ductless systems.a ~~A~~ thermal distribution system efficiency (DSE) of 0.88 shall be applied</td>
<td>~~As tested or, where not tested,~~ For hydronic</td>
<td></td>
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</table>

	to both the heating and cooling system efficiencies. ~~for all systems other than tested duct systems.~~ ~~**Exception:** For nonducted heating and cooling systems that do not have a fan, the standard reference design thermal distribution system efficiency (DSE) shall be 1.~~ ~~For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of *conditioned floorarea* at a pressure of differential of 0.1 inch w.g. (25 Pa).~~	systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).		

g. For a proposed design ~~with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design~~ without a proposed water heater, ~~a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed~~ the following assumptions shall be made for both the proposed design and standard reference design.
Fuel Type: Same as the predominant heating fuel type
Rated Storage Volume: 40 Gallons
Draw Pattern: Medium
Efficiency: Uniform Energy Factor complying with 10 CFR §130.32

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

k. For heating systems, cooling systems, or water heating systems not included in Table R405.4.2(1), the standard reference design shall be the same as proposed design.

TABLE R405.4.2(2) DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS[a]

Distribution system components located in unconditioned space	NA	0.95
~~Untested distribution~~ Distribution system ~~systems~~ components entirely located in conditioned space[c]	~~0.88~~NA	1
Ductless systems[d]	1	NA

a. Default values in this table are for untested distribution systems, which must still meet minimum requirements for duct system insulation.

b. Hydronic systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed-loop piping and that do not depend on ducted, forced airflow to maintain space temperatures.

c. Entire system in conditioned space shall mean that no component of the distribution system, including the air-handler unit, is located outside of the conditioned space.

d. Ductless systems shall be allowed to have forced airflow across a coil but shall not have any ducted airflow external to the manufacturer's air-handler enclosure.

Add new standard(s) as follows:

DOE	US Department of Energy c/o Superintendent of Documents 1000 Independence Avenue SW Washington DC 20585
10 CFR, Part 430-2021	Energy Conservation Program for Consumer Products: Energy and Water Conservation Standards and their compliance dates.

R406.3 Building thermal envelope. ~~Building and portions thereof shall comply with Section R406.3.1 or R406.3.2.~~

~~R406.3.1 On-site renewables are not included.~~ ~~Where on-site renewable energy is not included for compliance using the ERI analysis of Section R406.4, t~~The proposed total building thermal envelope UA, which is sum of *U*-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive *U*-factors from Table R402.1.2 multiplied by ~~1.15~~ 1.08 in Climate Zones 0, 1, and 2, and by 1.15 in Climates Zones 3 through 8, in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

~~$UA_{Proposed\ design} \leq 1.15 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)~~

For Climate Zones 0-2: $UA_{Proposed\ design} \leq 1.08 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)

For Climate Zones 3-8: $UA_{Proposed\ design} \leq 1.15 \times UA_{Prescriptive\ reference\ design}$

~~R406.3.2 On-site renewables are included.~~ ~~Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 *International Energy Conservation Code*.~~

(REPI-115)

APPENDIX XX
ELECTRIC ENERGY STORAGE PROVISIONS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION XX101
SCOPE

XX101.1 General. These provisions shall be applicable for new construction where solar-ready measures or an onsite solar PV system are required.

SECTION XX102
GENERAL DEFINITION

ENERGY STORAGE SYSTEM (ESS). One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time.

SECTION XX103
Electrical Energy Storage

One- and two-family dwellings, townhouse units, and Group R-3 occupancies shall either comply with RB103.1 or RB103.2. Buildings with Group R-2 and R-4 occupancies shall comply with RB103.3.

XX103.1 Electrical energy storage energy capacity. Each building shall have a ESS with a minimum rated energy capacity of 5 kWh with a minimum of four ESS supplied branch circuits.

XX103.2 Electrical energy storage system ready. Each building shall be energy storage ready in accordance with Sections RB103.2.1 through RB103.2.4.

XX103.2.1 Energy storage system space. Interior or exterior space with dimensions and locations in accordance with Section R328 of the *International Residential Code* and Section 110.26 of NFPA 70 shall be reserved to allow for the future installation of an *energy storage system.*

XX103.2.2 System Isolation Equipment Space. Space shall be reserved to allow for the future installation of a transfer switch within 3 feet (305mm) of the main panelboard. Raceways shall be installed between the panelboard and the transfer switch location to allow the connection of an ESS.

XX103.2.3Panelboard with backed-up load circuits. A dedicated raceway from the main service to a panelboard that supplies the branch circuits served by the ESS. All branch circuits are permitted to be supplied by the main service panel prior to the installation of an ESS. The trade size of the raceway shall be not less than one inch. The panelboard that supplies the branch circuits shall be labeled "Subpanel reserved for future battery energy storage system to supply essential loads."

XX103.2.4Branch circuits served by ESS. A minimum of four branch circuits shall be identified and have their source of supply collocated at a single panelboard supplied by the ESS. The following end uses shall be served by the branch circuits:

1. A refrigerator.

2. One lighting circuit near the primary egress.

3. A sleeping room receptacle outlet.

XX103.3 Electrical energy storage system. Buildings with Group R-2 and R-4 occupancies shall comply with C405.15.

The pages following are from the originally posted agenda on 9/12

RECPI-6-21

IECC®: SECTION 202 (New), R404.4 (New), R404.4.1 (New), R404.4.2 (New), R404.4.3 (New), R404.4.4 (New), R404.4.5 (New), UL Chapter 06 (New)

Proponents:
Mike Stone, representing IECC Residential Electrical Subcommittee (ieccreelectrical@iccsafe.org)

2021 International Energy Conservation Code

Add new definition 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 VEHICLES 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 protections system and all other fittings, devices, power outlets or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the *electric vehicle*.

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

ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE). A designated *automobile parking space* that is provided with electrical infrastructure, such as, but not limited to, raceways, cables, electrical capacity, 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*.

Add new text as follows:

R404.4 Electric Vehicle Power Transfer Infrastructure.

New *automobile parking spaces* for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.4.1 through R404.4.5

R404.4.1 Quantity.

New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one *EV-capable, EV-ready, or EVSE installed space* per dwelling unit.

R404.4.2 EV Capable Spaces.

Each *EV capable space* used to meet the requirements of Section R404.4.1 shall comply with all of the following:

- 1.

  EV capable space and a suitable panelboard or other onsite electrical distribution equipment.

  A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the

- 2.

  Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.4.4

- 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.

  electric vehicle supply equipment (*EVSE*)."

  The electrical enclosure or outlet and the electrical distribution equipment directory shall be marked: "For future

R404.4.3 EV Ready Spaces.

Each branch circuit serving *EV ready spaces* shall comply with all of the following:

- 1.

  EV ready space it serves.

  Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each

- 2.

  Have a minimum circuit capacity in accordance with R404.4.4.

- 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 equpment (EVSE)."

R404.4.4 Circuit Capacity.

The capacity of electrical infrastructure serving each *EV capable space*, *EV ready space* and *EVSE space* shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each *EV capable space*, *EV ready space* or *EVSE* space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.

R404.4.5 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.

Add new standard(s) as follows:

UL	UL LLC 333 Pfingsten Road Northbrook IL 60062
UL 2202-2009	Electric Vehicle (EV) Charging System - with revisions through February 2018
UL	UL LLC 333 Pfingsten Road Northbrook IL 60062
UL 2594-2016	Standard for Electric Vehicle Supply Equipment

RECPI-6-21 EV Proposal R-3

Voted Affirmative with comment (ballot 3):

Salcido, Robert

There have been several comments submitted against sending RECPI 6 and RECPI 7 out for public comment that deserve some further clarification. This affirmative comment is applicable to both RECPI-6 and RECPI-7 but for brevity has only been submitted once.

Several people have cited the low adoption rate of EV as a reason against adding EV charging requirements at this time. However, during July 2022 EV sales exceeded 5% of all automobile sales for the first time in the United States. According to research conducted by Bloomberg, 5% EV sales is a key indicator of a shift to widespread adoption in an EV market. Data from 18 other countries that have reached the 5% sales milestone shows an acceleration in EV sales after crossing that threshold. The United States has reached this tipping point and based on data from these 18 other countries it can be reasonably expected that EV sales could reach 10-15% of all auto sales within the next two years. The 2024 IECC represents a major opportunity to future proof new buildings with the necessary electrical infrastructure to support the shift from gasoline powered vehicles to electric vehicles.
https://www.bloomberg.com/news/articles/2022-07-09/us-electric-car-sales-reach-key-milestone?leadSource=uverify%20wall

Another argument made by several people is that this proposal is rigid and does not provide enough flexibility for future changes in battery or charging technology. Based on an evaluation of current and future charging technologies, this should not be a concern. The minimum EV capable requirement simply means a new building must have electrical infrastructure designed and sized to accommodate future electrical vehicle charging. Regardless of how battery technology or vehicle charging technology changes in the near future, buildings will still need to have the electrical capacity to charge electric vehicles. Whether cars have batteries that can charge faster or wireless chargers replace the need for plug in chargers, the infrastructure and wiring for those charging devices will still need to be in place.

For example, wireless charging technology exists today, but it still requires a charging terminal to be mounted near each parking space which must be connected into the building's electrical infrastructure.
https://www.greencarreports.com/news/1136234_why-wireless-charging-matters-for-electric-cars
https://www.pluglesspower.com/

Many examples were cited arguing that technology would no longer require traditional EV charging. Dynamic wireless charging (electric roadways), solar cars and battery swapping stations are all ideas that may one day be a viable business model here in the United States but there is no clear evidence that these will be viable within the timeframe needed to support the growing demand for electric vehicles. Dynamic wireless charging (electrified roadways) is still in the R&D phase with many technical challenges still to solve before this is ready for real world application.

https://www.toyota-global.com/innovation/partner_robot/news/202112_01.html#:~:text=Dynamic%20wireless%20power%20transfer%20uses,battery%20runs%20out%20of%20charge.

https://www.energy.gov/sites/default/files/2021-06/elt197_galigekere_2021_o_5-18_505pm_LR_TM.pdf

The solar car Lightyear 0, mentioned by NMHC, touts an annual 11,000 km (6,800 mi) solar charging range but the fine print shows this is based on the climate in southern Spain in Spring and Summer (note 4 in specs section) which has annual solar insolation in the range of 1650 kWh/kW, similar to southern California. www.lightyear.one/lightyear-0. In addition, the average distance driven by a car in the United States is 17,750 km (11,000mi) so a solar car in Southern California would still need to use a traditional charging method nearly 40% of the time to supplement its solar charging.

Another idea making the rounds recently is battery swapping stations. A 2021 Institute of Electrical and Electronics Engineers IEEE) article had a fairly negative overall assessment of battery swapping as a business model in the United States. https://spectrum.ieee.org/ev-battery-swapping-how-is-this-a-good-idea. While it may be a viable solution in China where it is largely supported by funding from the Chinese government, the US market does not seem poised to embrace swapping as an alternative to traditional charging methods. A battery swapping pilot was initiated by Tesla in the US back in 2014, however the organization abandoned the business model and publicly stated last year that it is, "riddled with problems and not suitable for widescale use". https://www.reuters.com/business/autos-transportation/inside-chinas-electric-drive-swappable-car-batteries-2022-03-24/

Another comment suggests that EV charging doesn't belong in Residential occupancies because charging infrastructure will be built out by third parties in other locations. The fact is US consumers want to charge their electric vehicles at home. A 3-year national EV charging study conducted by Idaho National Lab reports that, "About half of the study participants charged at home almost exclusively." https://avt.inl.gov/sites/default/files/pdf/arra/PluggedInSummaryReport.pdf

Additionally, a 2019 survey conducted by Consumer Reports found that 72% of respondents felt that at home charging twice a week was "completely convenient" or "very convenient" compared to only 50% that felt the same way about charging for 10 minutes at a nearby fast charging station. https://www.ucsusa.org/sites/default/files/attach/2019/07/2019-EV-Survey.pdf

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Voted Affirmative with comment (ballot 2):

Koban, Mary

Based on information received and discussed by my membership, AHRI would like to change our position on two code proposals.

AHRI would like to remove our negative comments on these two code proposals.

- RECPI-6-21
- RECPI-7-21

Wiley, Seth

I would support moving this Proposal to R408 and/or a new R409 Section inline with other Committee Member comments.

Proposed Text to resolve Negative Vote: - N/A

Voted Negative with Reason (Ballot 2)

Davis, Clifford

Should be in an appendix

Demers, Paul

EV charging, while important to a specific sector of energy use, it is not efficient to include them as a required component of a SFD. The need should be a choice of the owner and not a code requirement that could be considered wasteful to homes that never use an EV. If included in an appendix as a choice with other specialized options would make more sense to me.

Gobble, Kevin

Similar exceptions for RECPI-7 should apply and prefer to move to the appendix.

Mabe, Gavin

I agree with concerns expressed in the ballot comments on the following proposed changes.

Parks, Robert

At least the same exceptions that were approved for RECPI-7 should also apply here; preferably move to an appendix or make a jurisdictional option

My negative vote on these proposals is because I agree with the concerns and reasons statements already expressed in ballot comments on this proposed change

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Rossmiller, Gil

Needs to be an option rather than a requirement. As an appendix would allow jurisdictions the opportunity to adopt and provide guidance.

Voted Negative with Reason (Ballot 1)

Drumheller, Craig

EV Charging – Needs to be a jurisdictional option and placed in an appendix.

Heikkinen, Gary

- This proposal adds cost without any energy savings and by definition, is not cost effective.
- The proposal would burden ALL homes with this requirement and added cost, even though the infrastructure may never be used.
- Home owners who wish to install EV charging should bear the incremental cost and take advantage of available incentives and tax credits to help offset.

Hoeper, Shane

R404.4.4 – The capacity listed is confusing. With a 208/240 service, the capacity needed to supply a 40 amp charger would be a (40x1.25x208=) 10.4kw branch circuit, a 40 amp circuit would supply a (40x.8x208=) 6.67kw charger. With a 240 service, a 40 amp charger would need a (40x1.25x240=) 12.0kw branch circuit and a 40 amp circuit could supply a (40x.8x240=) 7.68kw charger.

Johnson, Ric

As currently written, this provision belongs in an Appendix, thus allowing local building departments the ability to match utility and governmental programs with currently available infrastructure and any local, statewide and or national incentive programs. Additionally, the exceptions found in RECPI-7-21 should be included as follows:

1. When the local electric distribution entity has certified in writing that it is not able to provide 100% of the necessary distribution capacity within two years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.

2. For R-2 occupancies, where substantiation has been approved that meeting the requirements of Section R404.4.1 will alter the local utility infrastructure on the utility side of the meter so as to increase the utility side cost to the builder or developer by more than $400.00 per dwelling unit.

Additionally, under the 2024 IECC Intent statement, greenhouse gas reduction measures, such as EV provision, are to be included in the non-mandatory appendices.

To vote for approval, this proposal:

Should be part of an appending and include the following:

1. When the local electric distribution entity has certified in writing that it is not able to provide 100% of the necessary distribution capacity within two years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.

2. For R-2 occupancies, where substantiation has been approved that meeting the requirements of Section R404.4.1 will alter the local utility infrastructure on the utility side of the meter so as to increase the utility side cost to the builder or developer by more than $400.00 per dwelling unit.

Koban, Mary

- AHRI has concerns with the cost benefits of this proposal which can significantly change or alter depending on jurisdictional implementation.
- AHRI notes stranded asset/costs may never be recovered if EV parking is not utilized, particularly in residential settings where public transportation is accessible.
- AHRI further notes that states are employing specific criteria for usage. In California, due to daytime wind and solar production, there are benefits for EV charging during the workday. Requiring R-1 and R-2 to have 100% EVSE spaces, EV ready spaces, EV capable spaces may not be the best requirement. This may lead to an increase in cost of construction without any benefit.
- Therefore, AHRI recommends this in an optional appendix, Jurisdictional option, or alternatively in a new non-mandatory section, i.e., R409.

Kochkin, Vladimir

- EV charging provisions should be moved to an appendix so that during the code adoption process jurisdictions can better align EV charging provisions with available utility programs, local Level 3 fast-charging infrastructure, and local policies on land development and infrastructure, affordable housing, incentives, etc.
- At a minimum, the following exceptions from RECPI-7-21 for R-2 occupancies should be also included in RECPI-6-21:
  1. *Where the local electric distribution entity has certified in writing that it is not able to provide 100% of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.*
  2. *For R-2 occupancies, where substantiation has been approved that meeting the requirements of Section R404.4.4.1 will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the builder or developer by more than $400.00 per dwelling unit.*
- These exceptions equally apply to R-3 and IRC occupancies where the same issues with electric distribution capacity can exist. Where the cost of providing the electric distribution capacity is

high, it's not fair to put the entire burden on the homebuyer. Utilities should help offset the development costs. These exceptions have been adopted from similar provisions used in California based on their experience with EV charging regulations. The purpose of the exceptions is to enable shared responsibility between stakeholders on policies related to electric infrastructure.

- Infill construction where upgrading utility infrastructure can be expensive or not feasible is one example where these exceptions are critical.
- NFPA 70 currently does not allow charging on a shared circuit with a dryer or a range. This is another reason to locate these provisions in an appendix. Using a shared circuit can be a practical and more cost-effective strategy for adding EV charging capability to buildings and should be available to designers.
- As a point of reference regarding local EV adoption policies, on June 7 of 2022 the governor of Colorado vetoed bill HB22-1218 on EV charging: (https://www.documentcloud.org/documents/22056015-hb22-1218-veto-statement).
- Level 3 fast-charging stations used by many EVs can become a more practical strategy for serving both existing buildings and new buildings.
- It is further noted that the 2024 IECC Intent statement directs greenhouse gas reduction measures (such as EV provisions) to be included in non-mandatory appendices. The Intent statement was an integral part of the ICC's transition to the new standards development process and ICC's call for committee members. ICC staff's interpretation of the Intent statement in the February 15th, 2022 memo contradicts the plain language of R101.3.
- Solution: Move the provisions to an appendix. The two exceptions should be included in the appendix.

Madrid, Ricardo

Allow for local control for when a jurisdiction or even state entity and the industry is prepared to move forward. Possible appendix for awareness and planning on a larger scale.

Marston, Thomas

Do not support. An EV charging mandate is a societal and social benefit if the building owner does not own or plans to purchase transportation that can recharge. I would support this measure if it was contained in an appendix that focuses on societal and social benefits of carbon reduction. I would support this measure if it were part of R408 and joined with Renewable Energy Measures. I would support measure when a new category exists in the code that grouped together measures that do not have an energy reducing capability such as EV Charging.

Martino, Amy

Comment 1:

Add exceptions from RECPI-7 for utility/ grid deficiencies to RECPI-6 .

R404.4.4 Circuit Capacity.

Exceptions:

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

2.Where substantiation has been approved that meeting the requirements of Section R404.4.4.1 will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the builder or developer by more than $400.00 per dwelling unit.

Reason:

This permits exceptions incorporated and accepted in the EV multifamily committee proposal to be consistent for one- and two-family dwellings and townhouses. RECPI-7 was developed and voted subsequent to RECPI-6

Comment 2: Remove reference to NPFA 70 for shared or managed circuits. "R404.4.4 Circuit Capacity. ... Where a circuit is shared or managed it shall be in accordance with manufacturers' specifications."

Reason:

2020 and 2023 NFPA 2nd revision Section 625.40 requires an individual branch circuit for charging EVs and does not permit shared circuits with other appliances (Range, Oven or Dryer) Intent is to utilize EV energy managed systems for circuits to reduce electrical service to building and reduce the impact on electrical grid. "manufacturer's specifications" has been added to replace NFPA 70. Working group acknowledged this during discussion.

Comment 3:

Remove specific electrical requirements to commentary and reference " manufacturers' specifications and requirements" to make this a performance base code requirement vs. a prescriptive one

Reason:

The current requirements set in 2016 and 2018 may not be required with future technology. Current Level 1 110V outlets may be adequate for level 2 charging with changing technology. The current Level 2 charging requirements may be Level 3 in the future. Wireless charging may be the future.

Comment 4:

Move entire section to new Section 409: Optional Jurisdiction / Developer Opt-Ins

Reason:
Not all jurisdictions may need or require 100% new homes to have EV charging. This allows the jurisdiction and developer to set the % and transition upgrades to their local utility grid to accommodate.

Section 409: Optional Jurisdictional Provisions

The section can provide a true glidepath from 2024 to 2027 to 2030 IECC and give jurisdictions reasonable time to facilitate, transition and plan due to their own local capacity to implement needed changes, upgrades, agreements and incentives which are responsive to community needs and restrictions. The alternate choice for a jurisdiction may simply be to not adopt them in any form or to modify them substantially. This gives jurisdictions the ability to set their own thresholds and to lean forward into advanced energy saving concepts. Points applied to section 408 may be a consideration.

This new section would be provisions in the IECC which may address the following:

- Provisions which technically do not save building energy
- Provisions which are based on increased costs for future retrofit which may not be required or utilized in the future (stranded technology)
- Provisions with significant uncertainty regarding their cost-justification
- Provisions which require a larger community consensus to implement including utility grid capacity, required upgrades and expansion plans, jurisdictional financial incentives (affordable housing, etc.), community land acquisition, agreements and maintenance plans.
- Provisions which may increase electrical utility rates
- Provisions which benefit the local community but would require coordination and agreements specific to the jurisdiction to implement. (Example: Community and utility scale renewables, REC's, etc.)
- Provisions addressing credits for upgrades to existing homes which are not likely to be required to be improved. (Points for increased insulation, replacing windows and doors, improving thermal envelope, increased energy efficiency for replacing equipment and lighting (HVAC, Hot water heating, appliances, etc.)
- Provisions which due to geographical and climatic reasons have marginal benefits for every jurisdiction adopting the IECC
- Provisions addressing decarbonization and climate change which affect more than the jurisdiction or community.

Examples which are optimal for Section 409 include

- Community and Utility scale renewables
- EV charging
- Electrical readiness
- All electrification
- PV solar readiness
- Battery energy storage readiness
- Above code programs
- Zero net energy
- Cool roofs
- Additional existing building (non-mandatory) upgrades

The following is an example section from ASHRAE 189.1 which utilizes Jurisdictional options.

4.2 Jurisdictional Options. The jurisdictional options listed in Table 4.2 provide jurisdictions the flexibility to adopt the code in a manner that is best suited to meet their unique environmental and regional goals and needs. The informative symbol "[JO]" after the section number indicates jurisdictional option provisions.

Table 4.2 may be used for the code adoption ordinance:

a. Where "No" boxes are provided, the jurisdiction checks the box to indicate where that section is not to be enforced as a requirement in the jurisdiction. Where the "No" box is not checked, that section is adopted.

b. Where a numerical value is listed to specify the level of performance, the jurisdiction shall indicate the required value to be adopted. Where a numerical value is not indicated, the value in the text is adopted without change

Raymer, Robert

A great deal of work went into this proposal, and it does belong in the code. However, there is concern with jurisdictional feasibility, which suggests this proposal be either a compliance option in R408 or placed in a new Section R409 for jurisdictional consideration. It is also unclear whether the exception for grid capacity (see RECPI-7-21) will apply to single family construction, which we feel it should. The same goes for the $400 cost cap on infrastructure.

Revise as Follows:

- Ensure that both exceptions provided for in RECPI-7-21 apply to single-family home construction as well, and
- Provide compliance credit in R408, or place in a new section R409 for jurisdictional consideration

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Shanks, Brian

Depending on the resource, I read a Pew Research Group report dated Jun 7, 2021 and a Finances Online report where it was stated as of 2020 ~1-2MM of ~287MM US Vehicles were electric/hybrid or roughly ~0.007% of all registered vehicles. In the Finances Online report Edison Electric Institute (2018) was referenced as predicting there will be ~19MM EV/Hybrid vehicles by 2030. If no additional internal combustion vehicles were sold, the EV/Hybrid market share of all registered vehicles would increase to ~0.07% by 2030. With EV/Hybrid market penetration at less than 1% by 2030 it isn't warranted to include EV Ready provisions in all homes.

Possible Remedy

Move to appendix

Truitt, Richard

This proposal does not fit within the Intent statement for inclusion into the body of the Code within Section R101.3 and N1101.3 as issued by the ICC Board. The installation of EV charging equipment has no relevancy to energy efficiency for buildings. Within the Intent statement contains the following language. "The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others." This language provides for clear direction that the Board is open to such provisions but they must be placed in an appendix for use and adoption by Jurisdictions.

Wright, Jeremy

1. EV charging should be placed in an appendix. The will allow EV charging provisions to better align with utility programs. Local level three fats charging, and local infrastructure and local policies on development, and affordable housing.

2. The following exceptions should be included from RECPI-7-21:

> 1. Where the local electric distribution entity has certified in writing that it is not able to provide 100% of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.
>
> 2. For R-2 occupancies, where substantiation has been approved that meeting the requirements of Section R404.4.4.1 will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the builder or developer by more than $400.00 per dwelling unit.

RECPI-7-21

IECC®: SECTION 202 (New), R404.4 (New), R404.4.1 (New), R404.4.2 (New), R404.4.3 (New), R404.4.4 (New), R404.4.4.1 (New), R404.4.5 (New), R404.4.5.1 (New), UL Chapter 06 (New)

Proponents:
Mike Stone, IECC RE Electrical Power, Lighting, Renewables, Storage, representing IECC Residential Electrical Subcommittee (ieccreelectrical@iccsafe.org)

2021 International Energy Conservation Code

Add new definition 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 (EVSE). Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the *electric vehicle* connectors, attached plugs, personal protection system and all other fittings, devices, power outlets or apparatus installed specifically for the purpose of tranferring energy between the premises wiring and the *electric vehicle*.

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

ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE). A designated *automobile parking space* that is provided with electrical infrastructure, such as, but not limited to, raceways, cables, electrical capacity, 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*.

Add new text as follows:

R404.4 Electric Vehicle Power Transfer Infrastructure.

New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.4.1 through R404.4.5

R404.4.1 Quantity.

R-2 occupancies or allocated parking for R-2 occupancies in mixed-use buildings shall be provided with an *EV capable space, EV ready space*, or *EVSE* space for each *dwelling unit* or *automobile parking space*, whichever is less.

R404.4.2 EV Capable Spaces.

Each *EV capable space* used to meet the requirements of Section R404.4.1 shall comply with all of the following:

- 1.

  EV capable space and a suitable panelboard or other on-site electrical distribution equipment.

  A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the

- 2.

  Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.4.4.

- 3.

  The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-pole circuit breaker or set of fuses.

- 4.

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

R404.4.3 EV Ready spaces.

Each branch circuit serving *EV ready spaces* shall comply with all of the following:

- 1.

  EV ready space it serves.

  Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each

- 2.

  Have a minimum circuit capacity in accordance with R404.4.4

- 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)."

R404.4.4 Circuit Capacity.

The capacity of electrical infrastructure serving each *EV capable space, EV ready space* and *EVSE* space shall comply with one of the following:

- 1.

  EV capable space, EV ready space or *EVSE* space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.

  A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each

- 2.

  The requirements of R404.4.4.4.1.

Exceptions:

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

2. For R-2 occupancies, where substantiation has been approved that meeting the requirements of Section R404.4.4.1 will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the builder or developer by more than $400.00 per dwelling unit.

R404.4.4.1 Circuit capacity management.

The capacity of each branch circuit serving multiple *EVSE spaces*, *EV ready space* or *EV capable spaces* designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.

R404.4.5 EVSE installation.

EVSE shall be installed in accordance with NFPA 70 and Section R404.4.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.

R404.4.5.1 EVSE minimum charging rate.

Each installed EVSE shall comply with one of the following:

- 1.

  Be capable of charing at a rate of not less than 6.2 kVA (or 30A at 208/240V).

- 2.

  Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.4.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.

Add new standard(s) as follows:

UL	UL LLC 333 Pfingsten Road Northbrook IL 60062
UL 2202-2009	Electric Vehicle (EV) Charging System - with revisions through February 2018
UL	UL LLC 333 Pfingsten Road Northbrook IL 60062
UL 2594-2016	Standard for Electric Vehicle Supply Equipment

RECPI-7-21 EV Proposal R-2

Voted Affirmative with comment (ballot 3):

Salcido, Robert

The affirmative comment submitted for RECPI-6 is also applicable for RECPI-7 but for brevity was not submitted twice.

Voted Affirmative with comment (ballot 2):

Koban, Mary

Based on information received and discussed by my membership, AHRI would like to change our position on two code proposals.

AHRI would like to remove our negative comments on these two code proposals.

- RECPI-6-21
- RECPI-7-21

Voted Negative with Reason (ballot 2):

Davis, Clifford

Should not be 100% compliance for multifamily. Should be moved to appendix

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Demers, Paul

EV charging, while important to a specific sector of energy use, it is not efficient to include them as a required component of a SFD. The need should be a choice of the owner and not a code requirement that could be considered wasteful to homes that never use an EV. If included in an appendix as a choice with other specialized options EV charging, while important to a specific sector of energy use, it is not efficient to include this in the main body of the code as a requirement for all multi-family structures and may be more appropriate in an appendix to the code. As an appendix it becomes a need based option vs a required item that may be more efficient relative to the cost of an item that may not be used or replaced by better technology that could be on the market before the code is widely used to guide new construction. Would make more sense to me.

Mabe, Gavin

I agree with concerns expressed in the ballot comments on the following proposed changes.

Rossmiller, Gil

Needs to be an option rather than a requirement. As an appendix would allow jurisdictions the opportunity to adopt and provide guidance.

Voted Negative with Reason (ballot 1):

Drumheller, Craig

EV Charging – Needs to be a jurisdictional option and placed in an appendix.

Gobble, Kevin

I do not agree that every dwelling should be required to have EV ready items installed. In some cases requiring additional dedicated space in the panel will require larger size panels and even meters which will increase the costs for an item that may not be needed. Under R404.4.2 remove or strike through #3 and #4.

Heikkinen, Gary

- This proposal adds cost without any energy savings and by definition, is not cost effective.
- The proposal would burden ALL MF buildings with this requirement and added cost, even though the infrastructure may never or seldom be used.
- MF builders who wish to install EV charging should bear the incremental cost and take advantage of available incentives and tax credits to help offset.

Hoeper, Shane

R404.4.4 – See above. Also, the exceptions are arbitrary.

Exception 1 – The additional capacity needed to charge at the rates required in R404.4.5.1 is minimal. Managed EV charging requirement – 2.1kw, in comparison a toaster is apx. 1.4 kw (120 volts x 12amps).

Exception 2 – I don't believe a dollar amount should be in any code. Additionally, there is no cost analysis for the $400 amount.

R404.4.5.1 – The charging rate is anemic. A 60 amp battery discharged 80% will take 24 hours to charge to full.

Johnson, Ric

As currently written, this provision belongs in an Appendix, thus allowing local building departments the ability to match utility and governmental programs with currently available infrastructure and any local, statewide and or national incentive programs. Additionally, 100% compliance will be amended by many departments. More flexibility is needed to allow for the various designs of Multifamily buildings and parking options, as well as future technologies in both battery design and charging. As mentioned

above, under the 2024 IECC Intent statement, greenhouse gas reduction measures, such as EV provision, are to be included in the non-mandatory appendices.

To vote for approval, this proposal:

Should be moved to an appendix.

Koban, Mary

- AHRI notes very similar concerns with this code proposal as those for RECPI-6-21.
- Cost benefits which can significantly change or alter depending on jurisdictional implementation.
- Therefore, AHRI recommends this in an optional appendix, Jurisdictional option, or alternatively in a new non-mandatory section, i.e., R409.

Kochkin, Vladimir

- EV charging provisions should be moved to an appendix so that during the code adoption process jurisdictions can better align EV charging provisions with available utility programs, local Level 3 fast-charging infrastructure, and local policies on land development and infrastructure, affordable housing, incentives, etc.
- The requirement for 100% compliance is an overreach and is likely to be amended by most jurisdictions. As a point of reference regarding local EV adoption policies, on June 7 of 2022 the governor of Colorado vetoed bill HB22-1218 on EV charging: (https://www.documentcloud.org/documents/22056015-hb22-1218-veto-statement)
- In structured parking, which is common for MF buildings, future installation of EV infrastructure will not require removal of finishes. The cost-effectiveness analysis did not account for this scenario. More flexibility should be provided to accommodate the diversity of MF buildings and parking options across various types of communities around the country.
- More flexibility should be provided to accommodate various business models for providing charging to the consumer. The current proposal focuses on the most convenient method of charging – at the residence for use by a single vehicle. However, there are more cost-effective infrastructure models that can be centered around Level 3 fast-charging stations used by many vehicles.
- More flexibility should be provided to accommodate future charging technologies and future battery advancements.
- The 2024 IECC Intent statement directs greenhouse gas reduction measures (such as EV provisions) to be included in non-mandatory appendices.

Solution: Move the provisions to an appendix. The total amount of required EV parking should also be left up to the jurisdiction to determine during adoption.

NAHB also shares comments from the National Multifamily Housing Council (NMHC) on RECPI-007-21. NMHC represents the apartment industry and has a significant vested interest and responsibility in serving multifamily communities.

NMHC Comment

The intent of RECPI-7-21 is praiseworthy – to 'futureproof' new multifamily buildings going forward by requiring electric vehicle (EV) charging infrastructure to be installed when it would be at the least expense to the building's owner. It is this premise upon which the entire cost-justification of RECPI-7-21 and similar proposals rest – that future retrofit cost would be so onerous that today's costs are justified.

The logical fallacies baked into this approach are that it assumes:

- *that technology is static and that there will be no advances in charging technology and battery characteristics, which, as each day passes, becomes clearly less likely to be true, and,*
- *that every parking facility in the future would need to have building finishes destroyed to install EV power supply runs and infrastructure.*

Structured parking facilities, like those frequently found under or adjacent to R-2 occupancies, typically do not have 'finished' interiors. Rather, these parking facilities are generally enclosed by exposed concrete or masonry structures which readily accommodate exposed raceways and cabling runs. Somewhat ironically, in this type of structure it is common to have the building's main electrical service located in the parking garage. Setting aside inflation, it would be no more expensive to install exposed raceways and cabling runs in the future than it would be the day before the Certificate of Occupancy was issued. The cost-justification upon which CEPI-1-21 rests collapses in these circumstances, which are a significant portion of the R-2 building sector.

Recent advances in battery technology include Quantumscape's solid-state batteries, whose cells have completed 400 consecutive 15-minute fast-charge cycles, replenishing from 10% to 80% capacity while still retaining over 80% of the initial energy. Quantumscape believes it can bring EV charge times down within several minutes of gas station fill-ups. Similarly, engineers at Drexel University are developing a lithium-sulfur battery, which, after more than a year of testing, remains stable and has not degraded in 4,000 charge-discharge cycles, which is equivalent to 10 years of regular use. And, as predicted, the battery's capacity is more than three times that of a lithium-ion batteries currently used in EVs.

Advances are occurring in lithium-ion battery technology as well. StoreDot is testing hundreds of prototypes of a lithium-ion battery that will charge from a flat battery to full charge in just five minutes. Contemporary Amperex Technology, a lithium-ion battery maker, revealed a new battery that provides electric vehicles with a driving range of over 1,000 km (600 miles) on a single charge which takes just 10 minutes in fast mode. Note that there are several EVs now in the market that have ranges exceeding 600 miles.

Regarding the speed of charging, Nybolt's battery promises to charge to 90% capacity in 5 minutes and a team of scientists from the Center for Theoretical Physics of Complex Systems is investigating quantum charging which can drop fast charging times to mere seconds when the technology is fully developed.

Batteries that charge faster and last longer mitigate the need for as many charging stations.

In addition to battery advancements, cordless charging strategies are being developed. Of particular note is robotic EV charging which, dependent upon the number spaces served, could mean parking facilities would need a single hardwired charging station for recharging robots that would in turn charge EVs. This would eliminate the need for any 'just-in-case' or 'future-proofing' infrastructure requirements for R-2 occupancies in the energy code.

More esoteric wireless charging options are also under development. Electrified roads have proven that on-the-move, in-road EV charging is possible. Stellantis is the latest automaker to explore the capabilities of Dynamic Wireless Power Transfer (DWPT) — the tech that allows EVs to recharge as they travel over specially equipped, dedicated road lanes.

The US Navy is contributing to wireless power transfer. It has wirelessly beamed 1.6 kW of power a kilometer using microwaves. Likewise, the Air Force Research Laboratory's Space Vehicles Directorate, the DOE's National Renewable Energy and private industry partners are progressing on a project whereby solar power can be collected in space and beamed down to Earth to power military and civilian installations, vehicles, and devices.

Finally, on charging technology, solar powered EVs charge themselves while driving or when the EV is parked outdoors in the sunlight. Production has begun on the Lightyear 0. With a solar yield of up to 11,000 kilometers a year, assuming a daily commute of 35 kilometers (21 miles), Lightyear 0 owners can drive for months in summer without using a charging station.

RECPI-7-21 also assumes, regarding R-2 occupancies, that no other charging opportunities exist, which is obviously not true, particularly given the $5 Billion being invested in a national EV charging network over the next 5 years via the 2022 bipartisan infrastructure law. Similarly, GM and Bechtel are partnering to build thousands of EV fast-charging stations across the United States, ChargePoint has raised more than $500M in funding to enable a most comprehensive, world-wide smart EV charging network, EVgo has received California Energy Commission grants of $3.6M to install new high-powered DC fast chargers near multi-family housing units, Volkswagen Group subsidiary Electrify America raised $450M to support its goal of more than doubling its footprint to 10,000 ultra-fast chargers across 1,800 charging stations in in Canada and the USA by 2026, and Tesla is opening its supercharger network in the US to other EVs, which will add 13,000 or more fast charging stalls to the broader US network.

Further, it will be a very long time before all vehicles being driven by the occupants of R-2 occupancies will need EV charging. Current forecasts for EV sales predict that about 5 million or 30 percent, of vehicles sold in year 2030 will be EV, meaning 70 percent will not be EVs. This means any requirement for 100 percent EV infrastructure in the main body of the code – at least for the next three or more editions of the code - is requiring a building's owner to put financial capital and an investment in embodied carbon into infrastructure that may not be used for decades - if ever; certainly, well after predicted advances in other charging applications have occurred.

Note that a few other assumptions for R-2 EV requirements should be challenged.

- *Proponents have argued that EV's could serve as batteries for R-2 buildings, back-feeding power to the building in the event of the loss of grid power to the building. That will not happen. EV owners cannot be compelled to give electricity to the building owner and very few will be willing to voluntarily*

give up their power during a power blackout, particularly given the additional wear on the EV battery. Charging and discharging batteries cause them to lose efficiency over time. This is inescapable; having to supply energy to a building during a blackout would reduce the life expectancy of the battery and the overall value of the vehicle. The EV as battery may make sense for single family dwellings, but it makes no sense otherwise and the argument should be put to rest.

- *For a R-2 building, with more than a handful of parking spaces, the only way to avoid assigned EV parking spaces by unit or tenant will be to use an energy management system (EMS) to allocate EV charge loading appropriately. EMS's are frequently leased or require maintenance contracts. These costs, EMS procurement and maintenance, were not factored into the cost-justification used to support CECPI-1-21.*

- *Many domestic couples with two vehicles are likely, for the foreseeable future, to have one EV and one internal combustion vehicle. This would reflect a conscious decision to have redundant travel capacity regardless of the availability of any individual fuel or power source and regardless of climactic conditions. This is analogous to the common practice in colder climates of families having a smaller car for the mileage benefit and a SUV or comparable all-weather vehicle for winter travel. Charging spaces will not be needed for the internal combustion vehicle.*

- *There is a real question of how many local grid operators can serve new EV loads at individual R-2 building locations. Although the growth of EVs and their associated charging stations has a positive impact on the environment and the economic viability of countries, it can have detrimental effects on the power grid. These effects need to be understood before moving to possible remedies or ways to mitigate them. For instance, the high charging loads associated with fast charging stations result in:*

  - *Increased peak demand*
  - *Reduced reserve margins*
  - *Voltage instability*
  - *Reliability problems*

To forestall the argument, onsite solar is unlikely to have the capacity to both adequately power the building and charge EVs during a blackout. "In order to power a single 150 kilowatt fast charger, a company like Electrify America would need to install 469 solar panels. A single 350 kilowatt charger would require 1,094 solar panels under ideal conditions covering about 20,000 square feet. And that's just for one charger. Most charging stations with solar canopies have a dozen or so fast chargers requiring several megawatts of electricity when in use. Solar company Oya says a 5 megawatt solar farm requires some 30 to 40 acres.

For the preceding reasons we compromise regarding having any R-2 EV charging requirement by not objecting to EV capable requirements for R-2 occupancies in a voluntary appendix, with an exception for structured parking. This will permit jurisdictions to better align local onsite EV charging capacity with other charging methods, improved battery performance, and the availability of offsite charging options.

Draft language has been provided to that effect.

Resolution:

Create new appendix:

Appendix RD

Electric Vehicle Charging Infrastructure for R-2 Occupancies

End of NMHC Comment

Madrid, Ricardo

Much like REPI 6-21, allow for local control for when a jurisdiction or even state entity and the industry is prepared to move forward. Possible appendix for awareness and planning on a larger scale.

Marston, Thomas

Do not support. I would support this measure if contained in an appendix that focuses on societal and social benefits of carbon reduction. Also consider building a section like R408 and placing this measure inside a table that has a point value like R408. Assign greater points for perceived or actual value to society.

Martino, Amy

Comment 1:

Remove reference to NPFA 70 for shared or managed circuits. "R404.4.4 Circuit Capacity. ... Where a circuit is shared or managed it shall be in accordance with manufacturers' specifications."

Reason:
2020 and 2023 NFPA 2nd revision Section 625.40 requires an individual branch circuit for charging EVs and does not permit shared circuits with other appliances (Range, Oven or Dryer) Intent is to utilize EV energy managed systems for circuits to reduce electrical service to building and reduce the impact on electrical grid."manufacturers specifications" has been added to replace NFPA 70. Working group acknowledged this during discussion.

Comment 2:
Remove specific electrical requirements to commentary and reference " manufacturers' specifications and requirements" to make this a performance base code requirement vs. a prescriptive one

Reason:
The current requirements set in 2016 and 2018 may not be required with future technology. Current Level 1 110V outlets may be adequate for level 2 charging with changing technology. The current Level 2 charging requirements may be Level 3 in the future. Wireless charging may be the future. The current

requirements set in 2016 and 2018 may not be required with future technology. Current Level 1 110V outlets may be aqequate for level 2 charging with changing technology. The current Level 2 charging requirements may be Level 3 in the future. Wireless charging may be the future.

Comment 3:
Move entire section to new Section 409: Optional Jurisdictional Provisions

Reason:
Not all jurisdictions may need or require 100% new homes to have EV charging. This allows the jurisdiction and developer to set the % and transition upgrades to their local utility grid to accommodate.

Parks, Robert

The intent of RECPI-7-21 to require electric vehicle (EV) charging infrastructure to be installed when it would be at the least expense to the building's owner. It is this premise upon which the entire cost-justification of RECPI-7-21 and similar proposals rest – that future retrofit cost would be so onerous that today's costs are justified. The logic is flawed when the cost is weighed in requiring all structures to be prewired in comparison to the relatively limited number of buildings that will actually utilize that feature.

Raymer, Robert

Like RECPI-6-21, this EV-ready proposal for low-rise multi-family may be problematic for some local jurisdictions. Once again, it may be more appropriate for this proposal to start off as a compliance option in R408 or be available for local consideration in a new Section R409.

Revise as Follows:

Provide compliance credit in R408 or relocate in a new section R409 for jurisdictional consideration.

Shanks, Brian

Same reason as RECPI-6-21

Possible Remedy:

Move to appendix

Truitt, Richard

This proposal does not fit within the Intent statement for inclusion into the body of the Code within Section R101.3 and N1101.3 as issued by the ICC Board. The installation of EV charging equipment has no relevancy to energy efficiency for buildings. Within the Intent statement contains the following language. "The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others." This language

provides for clear direction that the Board is open to such provisions but they must be placed in an appendix for use and adoption by Jurisdictions.

Wright, Jeremy

1. EV charging should be placed in an appendix. The will allow EV charging provisions to better align with utility programs. Local level three fats charging, and local infrastructure and local policies on development, and affordable housing.

2. More options should be provided to accommodate different business models for providing charging. The proposal focuses on the easiest method of charging. (At the residence for use by one vehicle) There are more cost-effective infrastructure models that can be centered around Level Three charging stations uses by most vehicles.

3. There should be consideration for future charging technology. I feal this proposal is based on dated technology. New battery technology offers reduced charge times, wireless charging, solar charging and other advancement that quickly date this proposal and could add burdensome consequences when the end user switches to newer technology.

RECPI-8-21

IECC®: R401.3, R406.7.2.2, ICC Chapter 06

Proponents:
Ian Finalyson, IECC RE Econ Modeling Metrics Subcommittee, representing IECC Residential Economics Modeling Whole Building Metrics Subcommittee

2021 International Energy Conservation Code

Revise as follows:

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 and CO2e Index, 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.

R406.7.2.2 Confirmed compliance report for a certificate of occupancy.

A confirmed compliance report submitted for obtaining the certificate of occupancy shall be made site and address specific and include the following:

- 1.

  Building street address or other *building site* identification.

- 2.

  Declaration of ERI and CO2e Index on title page and on building plans.

- 3.

  The name of the individual performing the analysis and generating the report.

- 4.

  The name and version of the compliance software tool.

- 5.

  Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.

- 6.

  A final confirmed certificate indicating that the confirmed rated design of the built home complies with Sections R406.2 and R406.4. The certificate shall report the energy features that were confirmed to be in the home, including: component-level insulation *R*-values or *U*-factors; results from any required duct system and building envelope air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water-heating equipment installed. Where on-site renewable energy systems have been installed on or in the home, the certificate shall report the type and production size of the installed system.

ICC	International Code Council, Inc. 500 New Jersey Avenue NW6th Floor Washington DC 20001
ANSI/RESNET/ICC 301—~~2019~~2022	Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units using an Energy Rating Index-Includes Addendum B

RECPI-8-21 Embodied energy

Voted Affirmative with comment (ballot 3):

Rossmiller, Gil

In conversation with colleagues, I am removing my negative comment.

Vijayakumar, Gayathri

The comments in Ballot 1 and 2 indicate some confusion on the intent of the proposal. It is possible this would pass without modification, if there is opportunity to clarify & answer some of the questions raised via comments.

1. **Scope**: RECPI-8 only affects builders choosing the ERI Path (R406). It does not apply to the other Paths.
2. **No pass/fail MAX value**: There is still value in reporting it since it enables local AHJs to establish their own CO2e Index MAX between now and adoption of 2027 IECC, should they want to. It also enables builders to become familiar with their homes CO2e performance, before there is a MAX value.
3. **Effort/Cost**: There is no added effort or cost since this CO2e Index is being reported anyway in the label/report for the energy rating index, in accordance with ANSI 301-2022.
4. **Index changes over time/grid impacts:** Where comments indicated this index changes over time and that it takes the grid into consideration, the same is true in R405, which this Committee strongly supported a change to the source energy calculation (REPI-121) to allow regional values. Cost savings have long been used in R405 and are also dependent on the utility and also change over time.
5. **Purpose in the IECC:** CO2e Index can provide a pathway for a home with gas to demonstrate the same GHG performance as an all-electric home.
6. **Lack of definition:** CO2e Index could be easily defined and added; for context, ERI is a similar index used in the 2021 IECC and is not defined either.
    - **Potential Mod:** ADD the following definition for CO2e Index: **CO_2e INDEX.** A numerical integer value, calculated in accordance with ANSI / RESNET / ICC 301 that represents the relative Carbon Dioxide equivalence (CO_2e) emissions of a *rated design* as compared with the CO_2e emissions of the CO_2e reference design and where an Index value of 100 represents the CO_2e performance of the CO_2e reference design and an Index value of 0 (zero) represents a home that emits zero net CO_2e annually.

Voted Affirmative with comment (ballot 2):

Wiley, Seth

Great to see support and discussion on this Proposal. I am voting Affirmative with Comment. Here's some information that is hopefully useful, based on Committee Member comments organized by topic:

- Topic: There needs to be a target value, without which reporting this serves no purpose.
  - Information: A target value would be good, but given the substantial work required to get to the current point of consensus, adding a target value may be unrealistic. If there were a Working Group established to develop target CO2e values, I would be willing to contribute; values could in part be developed based on developed EPA averages cited in REPI-5.
- Topic: It is not applicable to this energy code because it pertains in part to the grid rather then the building itself.
  - Information: REPI-5 proposed reporting emissions from electric usages separately from fossil fuel usage – which would have addressed this topic, but the Committee didn't support that Proposal. This Proposal reports emissions in 1 combined value, which can of course be split, improved, and changed in future Code cycles and as reference Standards continue to develop.
- Topic: Reporting will cause confusion, cause delays, and increase costs:
  - Information: The reporting will transpose a value from a RESNET 301 Report, which doesn't seem any more confusing or to take any more time than transposing any other value. And it's part of the Report, so doesn't seem to have any increased cost.
- Topic: The value will be misleading and lacks consensus.
  - Information: Code Users could go to the cited RESNET 301 Standard and evaluate its basis and history, just as Code Users can do for any other referenced standard.
- Topic: The value will change over time, will create unreasonable liability, and could vary by home depending on grid connection.
  - Information: We report things like R-value and air tightness, and they change over time. So it seems unreasonable to slight this Proposal based on the fact that the value may change over time. As far as liability, reporting a value from a RESNET 301 Report doesn't seem to create more liability than reporting any other standardized reported value.
- Topic: It should be located in an Appendix given ICC direction or in a new Section R409.
  - Information: Given the importance of understanding and limiting GHG emissions as well as the fact that this Proposal is bringing in the reported value and not creating a target nor maximum value, it seems reasonable and rather important to include in the base Code.
- Topic: Proposal should include a definition and calculation methodology.
  - Information: I agree that the Energy Code should have a definition of GHG Emissions, CO2, and CO2e, but those definitions seem appropriate to add when the Code is addressing those things more

directly rather than via referenced standard. (As reference, REPI-5 had a definition and calculation of CO2e but that Proposal did not receive Committee support.) The definition and calculation methodology would be part of the referenced standard.

- Topic: It would be better to associate it with all homes rather than just R406.

◦ Information: REPI-5 proposed it for all dwellings, existing and new, but the Committee did not support that and supported this Proposal RECPI-8, which is much simpler than REPI-5 and just focuses on R406 given that's the pathway that includes the referenced RESNET Report. If there is healthy Committee support for an expanded Proposal to address other new and existing compliance pathways, possibly a Working Group should be created and I'd be willing to contribute information as able.

Proposed Text to resolve Negative Vote: N/A

Voted Affirmative with comment (ballot 1):

Rodriguez, Mark

The CO2 Index report has no code bearing and the results are not used to determine compliance with any particular regulation. This proposal adds cost without a tangible benefit.

Voted Negative with Reason (ballot 2)

Davis, Clifford

No consensus on calculation method. Outside scope of IECC

Demers, Paul

The intent of the proposal statement is not consistent with the provisions of code sections R101.3 and N1101.3. The reporting of CO2 emissions would be more valid as a non-mandatory appendix. I do not oppose the inclusion of reporting only the inclusion in the main body of the code.

Mabe, Gavin

I agree with concerns expressed in the ballot comments on the following proposed changes.

Marston, Thomas

Do not support. Co2e index should not exist in the main body of 2024. This index can exist in the appendix as a standalone item or because the appendix also includes ACP's such as Energy Star, which reports CO2 reduction values in that program's rating reports

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Parks, Robert

Not a relevant metric for 2024 IECC, no compliance criteria, beyond the scope of IECC and conflicts with the Intent statement

My negative vote on these proposals is because I agree with the concerns and reasons statements already expressed in ballot comments on this proposed change

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Rossmiller, Gil

The CO2e index is not part of any current compliance path. Not certain why this needs to be on the energy compliance certificate

Voted Negative with Reason (ballot 1)

Drumheller, Craig

CO2e Index- It is not appropriate to include a numerical value without a target CO2e Index. Disapprove

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Gobble, Kevin

I am not in favor of adding arbitrary information as a requirement to a certificate. The added information "and CO2e Index should be removed from both #6 under R401.3 and R406.7.2.2. This requirement will cause confusion, result in misleading information being posted on the certificates and in my opinion cause additional delays in obtaining a Certificate as well as increase costs.

Heikkinen, Gary

- Not applicable to energy code.
- No consensus on how to calculate CO2e, especially for electricity.
- As the grid changes, emissions will too.

Johnson, Ric

I cannot understand why this is even part of the IECC standard. The index concerns the emissions from electrical generation and is outside the scope of the IECC. Additionally, the proponent offers no method to calculate a CO2e index, nor includes how a builder/developer can determine this index, nor how the builder/developer's future liability be determined should a negative result five, ten, or twenty years after the fact is actually determined. The Standard has no way to determining how much carbon the house is going to emit, as the actual home owner activities and uses will determine the actual CO2e number. Again, the 2024 IECC Intent Statement directs greenhouse gas reduction measures (If this would even qualify) to be included in non-mandatory appendices.

Koban, Mary

- AHRI notes several concerns with the CO2e index definition and the conversion factors used in this code proposal.
- The scope for CO2e index should include the generation of the electricity used(cradle) up to and including the building (grave). This only looks at limited value for CO2e (truncated value versus the entire life cycle). The CO2e Index addresses emissions from electricity generation by utilities, which is outside the scope of the IECC. Furthermore, since the value noted here is not part of a cradle to grave methodology for calculating a comprehensive CO2e, this code proposal is not even close to prime time.
- No cost justification for CO2e index (interesting, but no details showing how this provides cost savings.)
- Therefore, AHRI suggests modifying this proposal and/or deleting this code proposal until a more complete and descriptive CO2e index can be determined.

Kochkin, Vladimir

- The added CO2e Index is not associated with a compliance criteria and does not serve a technical purpose in the 2024 IECC.
- The scope of the CO2e Index extends beyond the building and its site. The CO2e Index addresses emissions from electricity generation by utilities – this is outside of the scope of the IECC.
- CO2e Index is a moving target: as the grid generation mix changes overtime, the CO2e Index will change as well. Therefore, the CO2e Index provided with the Certificate of Occupancy will become out-of-date very quickly. Builders are concerned with potential liability of reporting this index.
- Two identically-designed buildings located near each other but serviced by two different utilities can have large differences in the CO2e Index that cannot be addressed through building design or operation.
- The CO2e Index uses an all-electric house as the reference baseline case. This method will require fuel switching for homes designed with a gas or a propane appliance. The concept of fuel switching does not exist in the IECC, it potentially violates federal preemption, and it has not been discussed by the consensus committee at any point.
- The proposal does not explicitly define CO2e Index and does not provide a method for calculating a CO2e Index.
- The Intent statement for the 2024 IECC directs greenhouse gas reduction measures to be included in non-mandatory appendices. The Intent statement was an integral part of the ICC's transition to the new standards development process and ICC's call for committee members. ICC staff's interpretation of the Intent statement in the February 15th, 2022 memo contradicts the plain language of R101.3.

Madrid, Ricardo

How is the conducted or even proven. I cannot expect a builder to be tasked in doing the reporting.

Martino, Amy

Move entire section to new Section 409: Optional Jurisdictional Provisions

Reason:

Due to my understanding that the CO2 index is not currently accurate and subject to change, it is a potential liability for builders if not accurate. Homeowners may hold a builder responsible if it fluctuates, calculations change or vary in the future. Until a more accurate universal accepted standard is used, it should not be on a Confirmed compliance report which can be a liability for builders.

Raymer, Robert

While well intended, this goes beyond the scope of the IECC as this index extends beyond the building and the immediate area around the structure by attempting to address emissions from electricity generation by utilities. This means the number will change over time as utilities integrate more renewable energy into their portfolio. As NAHB points out, two identical homes service by different utility companies could have different scores on the CO2 index.

Shanks, Brian

The CO2e metric will be a valuable internal tool for homebuilders but, as it is untested, isn't ready to be a performance metric included in code. If it were ready, associating it only with compliance through R406 would leave most homes without benefit of the CO2e information providing minimal public benefit.

Possible Remedy

Table for consideration with the next code iteration where after implementation it will have been fully vetted.

Truitt, Richard

This proposal does not fit within the Intent statement for inclusion into the body of the Code within Section R101.3 and N1101.3 as issued by the ICC Board. The installation of EV charging equipment has no relevancy to energy efficiency for buildings. Within the Intent statement contains the following language. "The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others." This language provides for clear direction that the Board is open to such provisions but they must be placed in an appendix for use and adoption by Jurisdictions.

Wright, Jeremy

1. The scope of CO2e goes beyond the building site. The CO2e Index considers emissions from electric generation by utilities. The is outside the scope of the IECC.

2. Two building built the same can have varying CO2e Index that can't be addressed through building design.

3. The proposal doesn't define CO2e Index and doesn't provide a method for calculation.

4. The CO2e Index is based on a total electric home as the baseline. This method will cause home to be switched from gas appliances. This concept doesn't exist in the IECC.

5. The intent of 2024 IECC directs greenhouse gas reduction to be included in optional appendices.

RECPI-10-21

IECC®: R408.2.3, Table R408.2.3 (New)

Proponents:
John Hensley, representing IECC RE HVACR & Water Heating Subcommittee (ieccrehvacr@iccsafe.org)

2021 International Energy Conservation Code

Revise as follows:

R408.2.3 Reduced energy use in service water-heating option.

The hot water system shall meet one of the ~~following~~ efficiencies in Table R408.2.3~~:~~.

- 1.

  ~~Greater than or equal to 82 EF fossil fuel service water-heating system.~~

- 2.

  ~~Greater than or equal to 2.0 EF electric service water-heating system.~~

- 3.

  ~~Greater than or equal to 0.4 solar fraction solar water-heating system.~~

Add new text as follows:

Table R408.2.3 Service water-heating efficiencies

OPTION	WATER HEATER	SIZE	TYPE	EFFICIENCY
1.	Gas-fired storage water heaters	≤55 gallons	Medium Draw Pattern	UEF≥0.64
-	Uniform Energy Factor (UEF)	-	High Draw Pattern	UEF≥0.68
-	First-hour rating FHR≥51 gallons per hour	>55 gallons	Medium Draw Pattern	UEF≥0.78
-	-	-	High Draw Pattern	UEF≥0.80

2.	Gas-fired instantaneous water-heater	-	-	UEF≥0.87
3.	Electric water heaters	-	Integrated HPWH	UEF≥3.30
-	Uniform Energy Factor (UEF)	-	Integrated HPWH, 120 Volt/15 Amp Circuit	UEF≥2.20
-	First-hour rating FHR≥45 gallons per hour	-	Split-system HPWH	UEF≥2.20
4.	Solar water heaters	-	Electric backup	SUEF≥3.00
-	Solar uniform energy factor (SUEF)	-	Gas backup	SUEF≥1.80

RECPI-10-21 Water heater efficiency

Voted Affirmative with comment (ballot 3):

Wiley, Seth

Reason Statement:

I have changed my vote on RECPI-10 to 'Affirmative with Comment' because, though not a perfect Proposal, it is a good Proposal (better than current Code) and so seems important to support such that it is included on the Public Comments Draft. I still oppose condoning and rewarding the use of fossil fuel burning water heaters in the Code on the basis of their on-site GHG emissions footprint, but a Proposal such as this to improve their required efficiency is the right thing to do in lieu of their elimination.

Proposed Text to resolve Negative Vote:

- N/A

Voted Affirmative with comment (ballot 2):

Dent, Stephen

Content of these REPI's should be incorporated into REPI – 18 which is an excellent proposal to move to a clear, point based system for extra energy conservation measures.

Voted Negative with Reason (ballot 3):

Salcido, Robert

The proposed changes to R408 (REPI-18) should reflect the most efficient technologies that will be available when IECC 2024 is approved. For gas water heaters I propose levels listed in the Energy Star Residential Water Heaters Specification Version 5.0, published July 18, 2022[1].

[1] https://www.energystar.gov/products/spec/residential_water_heaters_specification_version_5_0_pd

Proposed modifications:

Table R408.2.3:

Option	Water Heater	Size	Type	Efficiency
1.	Gas-fired storage water heaters	≤ 55 gallons	Medium Draw Pattern	UEF≥~~0.64~~ 0.81
			High Draw Pattern	UEF≥~~0.68~~ 0.86
		>55 gallons	Medium Draw Pattern	UEF≥~~0.78~~ 0.86
			High Draw Pattern	UEF≥~~0.80~~ 0.86
2.	Gas-fired instantaneous water-heater			UEF≥~~0.87~~ 0.95
3.	Electric water heaters		Integrated HPWH	UEF≥3.30
	Uniform Energy Factor (UEF)		Integrated HPWH, 120 Volt/15 Amp Circuit	UEF≥2.20
	First-hour rating FHR≥0.45 gallons per hour		Split-system HPWH	UEF≥2.20
4.	Solar water heaters		Electric backup	SUEF≥3.00
	Solar uniform energy factor (SUEF)		Gas backup	SUEF≥1.80

Williams, Jeremy

DOE agrees that the water heating portion of Section R408 should update its outdated "EF" metric to the current "UEF" metric. However, this proposal is based on energy efficiency requirements in Energy Star Water Heater Specification Version 4.0, which are outdated and represent a decrease in energy efficiency for certain products when compared to the 2021 IECC section R408. We are committed to supporting a revised proposal that uses values from Energy Star version Water Heater Specification Version 5.0 (released on July 18, 2022), which are better aligned with the 2021 IECC section R408.

Voted Negative with Reason (ballot 2):

Amann, Jennifer

Optional efficiency measures in R408 (REPI-18) should meet a higher level of energy efficiency than average equipment. ENERGY STAR specifications are developed to represent the most efficient 25% of currently available technologies. In June 2022, the new ENERGY STAR version 5.0 specification was adopted with an effective date of April 18, 2023. We propose modifications to Table R408.2.3 to align the 2024 energy code with the ENERGY STAR v5.0 specification.

Table R408.2.3:

Option	Water Heater	Size	Type	Efficiency
1.	Gas-fired storage water heaters	≤ 55 gallons	Medium Draw Pattern	UEF≥~~0.64~~ 0.81
			High Draw Pattern	UEF≥~~0.68~~ 0.86
		>55 gallons	Medium Draw Pattern	UEF≥~~0.78~~ 0.86
			High Draw Pattern	UEF≥~~0.80~~ 0.86
2.	Gas-fired instantaneous water-heater			UEF≥~~0.87~~ 0.95
3.	Electric water heaters		Integrated HPWH	UEF≥3.30

	Uniform Energy Factor (UEF)		Integrated HPWH, 120 Volt/15 Amp Circuit	UEF≥2.20
	First-hour rating FHR≥0.45 gallons per hour		Split-system HPWH	UEF≥2.20
4.	Solar water heaters		Electric backup	SUEF≥3.00
	Solar uniform energy factor (SUEF)		Gas backup	SUEF≥1.80

Chawla, Patricia

This proposal is an optional efficiency measure that will be placed in R408 and should reflect the most efficient technologies that are currently available.
We propose the following tables as a replacement to existing tables as a modification to RECPI-10:

RECPI-10 (modified, with red text to clearly show changes from RECPI-10 and REPI-18)

TABLE R408.2

CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description		Credit Value							
		CZ 0 & 1	CZ 2	CZ 3	CZ 4	CZ 4C	CZ 5	CZ 6	CZ 7	CZ 8
R408.2.4 (1)	Fossil fuel service water heating system option 1	7	6	5	3	3	2	2	3	1
R408.2.4 (2)	Fossil fuel service water heating system option 2	7	6	5	3	3	2	2	3	1
R408.2.4 (~~2~~3)	Electric service water heating system option 1~~High performance heat pump water heating system option 1~~	12	11	11	8	8	6	5	5	3
R408.2.4 (~~3~~4)	Electric service water heating system ~~High performance heat pump water heating system~~ option 2	12	12	11	8	8	6	5	5	3
R408.2.4 (~~4~~5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.4 (~~5~~6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2

R408.2.~~4~~3 Reduced energy use in service water-heating options. For measure numbers R408.2.4 (1) through R408.2.4 (5), t~~T~~he hot water system shall meet one of the ~~following~~ Uniform Energy Factors

(UEF) or Solar Uniform Energy Factors (SUEF) ~~efficiencies:~~ in Table R408.2.~~3~~4. For measure number R408.2.4 (6), the hot water system shall comply with R408.2.4.1.

~~1. Greater than or equal to 82 EF fossil fuel service water-heating system.~~
~~2. Greater than or equal to 2.0 EF electric service water-heating system.~~
~~3. Greater than or equal to 0.4 solar fraction solar water-heating system.~~

Table 408.2.~~3~~4 Service water-heating efficiencies

Measure Number ~~Option~~	**Water Heater**	**Size and Usage Bin**	**Type**	**Efficiency**
~~1.~~R408.2.4 (1)	Gas-fired storage water heaters ~~Uniform Energy Factor (UEF)~~	≤ 55 gallons, Medium Usage	~~Medium Draw Pattern~~	UEF ≥~~0.64~~ 0.81
		≤ 55 gallons, High Usage	~~High Draw Pattern~~	UEF ≥~~0.68~~ 0.86
	~~First-hour rating FHR ≥ 51 gallons per hour~~	>55 gallons, Medium or High Usage	~~Medium Draw Pattern~~	~~UEF ≥0.78~~
			~~High Draw Pattern~~	UEF ≥~~0.80~~ 0.86
~~2.~~ R408.2.4 (2)	Gas-fired instantaneous water heater			UEF ≥~~0.87~~ 0.95
~~3.~~ R408.2.4 (3)	Electric water heaters		Integrated HPWH	UEF ≥ 3.30
R408.2.4 (4)	Electric water heaters ~~Uniform Energy Factor (UEF)~~		Integrated HPWH, 120 Volt/15 Amp Circuit	UEF ≥ 2.20
	~~First-hour rating FHR ≥ 45 gallons per hour~~		Split-system HPWH	UEF ≥ 2.20
~~4.~~ R408.2.4 (5)	Solar water heaters		Electric backup	SUEF ≥ 3.00
	~~Solar uniform energy factor (SUEF)~~		Gas backup	SUEF ≥ 1.80

R408.2.4.1. Compact hot water distribution. For Compact Hot Water Distribution system credit, the volume shall store not more than 16 ounces of water in the nearest source of heated water and the termination of the fixture supply pipe when calculated using section R403.5.4.

To ~~field or plan review,~~ verify that the system meets the prescribed limit, one of the following must be done:

a. At plan review, referencing ounces of water per foot of tube on plans as per Table R403.5.4.1
b. At rough in (plumbing), referencing ounces of water per foot of tube installed as per Table R403.5.4.1
c. At final inspection, in accordance with Department of Energy's Zero Energy Ready Home National Specification (Rev. 07 or higher) footnote on Hot water delivery systems.

Gonzalez-Laders, Emma

The proposed Table R408.2.3 should align with and reflect the most recent efficiency targets currently available for water heaters as indicated in Energy Star's Residential Water Heaters Specification Version 5.0.

Modify Table R408.2.3 as follows:

Option	Water Heater	Size	Type	Efficiency
1.	Gas-fired storage water heaters	≤ 55 gallons	Medium Draw Pattern	UEF≥~~0.64~~ 0.81
			High Draw Pattern	UEF≥~~0.68~~ 0.86
		>55 gallons	Medium Draw Pattern	UEF≥~~0.78~~ 0.86
			High Draw Pattern	UEF≥~~0.80~~ 0.86
2.	Gas-fired instantaneous water-heater			UEF≥~~0.87~~ 0.95
3.	Electric water heaters		Integrated HPWH	UEF≥3.30
	Uniform Energy Factor (UEF)		Integrated HPWH, 120 Volt/15 Amp Circuit	UEF≥2.20
	First-hour rating FHR≥45 gallons per hour		Split-system HPWH	UEF≥2.20
4.	Solar water heaters		Electric backup	SUEF≥3.00
	Solar uniform energy factor (SUEF)		Gas backup	SUEF≥1.80

Reason: Energy Star V5 has undergone extensive review and comment by stakeholders with the "Final Specification" version published in July 18th, 2022. The efficiency factors in the final version are deemed to be "the best balance of savings, availability, and cost."

[1] EPA. ENERGY STAR® Residential Water Heaters Version 5.0 Final Draft Specification Stakeholder Comment Matrix

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Marston, Thomas

Do not support. This proposal should be disapproved so it can be modified and align with REPI-18 and the table in R408. It is necessary to indicate UEF where applicable in the final version of the R408 table, so it aligns with the most current performance values

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Rossmiller, Gil

Table needs to be updated with the most current data.

Wiley, Seth

Same as italicized text below on this Proposal.

Proposed Text to resolve Negative Vote:

- Within Section R408, incentive electric and solar water heating, and do not reward the use of natural gas and propane water heating. Ultimately, if that Proposed modification fails, Propose that the Efficiency Values in the Table be Energy Star Version 5.0 Values.

- Lowering GHG emissions is part of the IECC development purview.

- Improving equipment efficiency of fossil fuel burning equipment typically results in lower GHG emissions.

- Equipment with efficiency values as proposed in the text below appear to be cost-competitive and market-ready.

- Values proposed in the text below are closer to Energy Star than those in RECPI-10.

Proposed Text to resolve Negative Vote:

- Change RECPI-10 proposed Option 1 text to indicate: Gas-fired storage water heater <55 gallons Medium and High Draw Patterns shall be UEF equal or greater than 0.70.

- Change RECPI-10 proposed Option 2 text to indicate: Gas-fired instantaneous water heater shall be UEF equal or greater than 0.90.

Vijayakumar, Gayathri

I am submitting a negative vote on RECPI-10 so that the modification can be discussed at the September meeting. A modification is needed so that these edits can be properly integrated into R408 (as modified by REPI-18) and then reviewed & approved by the voting members.

TABLE R408.2
CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description		Credit Value							
		CZ 0 & 1	CZ 2	CZ 3	CZ 4	CZ 4C	CZ 5	CZ 6	CZ 7	CZ 8
R408.2.4 (1)	Fossil fuel service water heating system option 1	7	6	5	3	3	2	2	3	1
R408.2.4 (2)	Fossil fuel service water heating system option 2	7	6	5	3	3	2	2	3	1
R408.2.4 (3)	Electric service water heating system option 1	12	11	11	8	8	6	5	5	3
R408.2.4 (4)	Electric service water heating system option 2	12	12	11	8	8	6	5	5	3
R408.2.4 (5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.4 (6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2

R408.2.~~3~~4 ~~3~~Reduced energy use in service water-heating options. For measure numbers R408.2.4 (1) through R408.2.4 (5), t~~T~~he hot water system shall meet one of the ~~following~~ Uniform Energy Factors (UEF) or Solar Uniform Energy Factors (SUEF) ~~efficiencies:~~ in Table R408.2.~~3~~4. For measure number R408.2.4 (6), the hot water system shall comply with R408.2.4.1.

~~4. Greater than or equal to 82 EF fossil fuel service water-heating system.~~
~~5. Greater than or equal to 2.0 EF electric service water-heating system.~~
~~6. Greater than or equal to 0.4 solar fraction solar water-heating system.~~

Table 408.2.~~3~~4 Service water-heating efficiencies

Measure Number ~~Option~~	Water Heater	Size and Usage Bin	Type	Efficiency
~~1.~~R408.2.4 (1)	Gas-fired storage water heaters ~~Uniform Energy Factor (UEF)~~	≤ 55 gallons, Medium Usage	~~Medium Draw Pattern~~	UEF ≥~~0.64~~ 0.81
		≤ 55 gallons, High Usage	~~High Draw Pattern~~	UEF ≥~~0.68~~ 0.86
	~~First-hour rating FHR ≥ 51 gallons per hour~~	>55 gallons, Medium or High Usage	~~Medium Draw Pattern~~	~~UEF ≥0.78~~ UEF ≥~~0.80~~ 0.86
			~~High Draw Pattern~~	
~~2.~~R408.2.4 (2)	Gas-fired instantaneous water heater			UEF ≥~~0.87~~ 0.95

~~3.~~ R408.2.4 (3)	Electric water heaters		Integrated HPWH	UEF ≥ 3.30
R408.2.4 (4)	Electric water heaters ~~Uniform Energy Factor (UEF)~~		Integrated HPWH, 120 Volt/15 Amp Circuit	UEF ≥ 2.20
	~~First-hour rating FHR ≥ 45 gallons per hour~~		Split-system HPWH	UEF ≥ 2.20
~~4.~~ R408.2.4 (5)	Solar water heaters		Electric backup	SUEF ≥ 3.00
	~~Solar uniform energy factor (SUEF)~~		Gas backup	SUEF ≥ 1.80

R408.2.4.1. Compact hot water distribution. For Compact Hot Water Distribution system credit, the volume shall store not more than 16 ounces of water in the nearest source of heated water and the termination of the fixture supply pipe when calculated using section R403.5.4.

To ~~field or plan review,~~ verify that the system meets the prescribed limit, one of the following must be done:

d. At plan review, referencing ounces of water per foot of tube on plans as per Table R403.5.4.1
e. At rough in (plumbing), referencing ounces of water per foot of tube installed as per Table R403.5.4.1
f. At final inspection, in accordance with Department of Energy's Zero Energy Ready Home National Specification (Rev. 07 or higher) footnote on Hot water delivery systems.

Voted Negative with Reason (ballot 1):

Boyce, Amy

Optional efficiency measure that will be placed in R408 (REPI-18) should reflect the most efficient technologies that are currently available, as indicated by Energy Star.

Suggest changes as per below:

Option	Water Heater	Size	Type	Efficiency
1.	Gas-fired storage water heaters	≤ 55 gallons	Medium Draw Pattern	UEF≥~~0.64~~ 0.81
			High Draw Pattern	UEF≥~~0.68~~ 0.86
		>55 gallons	Medium Draw Pattern	UEF≥~~0.78~~ 0.86
			High Draw Pattern	UEF≥~~0.80~~ 0.86
2.	Gas-fired instantaneous water-heater			UEF≥~~0.87~~ 0.95

Chawla, Patricia

This proposal is an optional efficiency measure that will be placed in R408 and should reflect the most efficient technologies that are currently available.

We propose the following Table R408.2.3 as a replacement to Table R408.2.3 as a modification to RECPI-10:

Option	Water Heater	Type	Efficiency
1.	Gas-fired storage water heaters First-hour rating FHR≥51 gallons per hour	Tank Volume >20 gallons and ≤ 55 gallons	Medium Draw Pattern: UEF≥0.81
			High Draw Pattern: UEF≥0.86
		Tank Volume > 55 gallons	UEF≥0.86
2.	Gas-fired instantaneous water-heater		UEF≥0.95
3.	Electric water heaters First-hour rating FHR≥45 gallons per hour	Integrated HPWH	UEF≥3.30
		Integrated HPWH, 120 Volt/15 Amp Circuit	UEF≥2.20
		Split-system HPWH	UEF≥2.20
4.	Solar water heaters	Electric backup	SUEF≥3.00
	Solar uniform energy factor (SUEF)	Gas backup	SUEF≥1.80

Reason: The ENERGY STAR product directory and the AHRI database currently lists 23 storage water heaters smaller than 55 gallons with a UEF greater than 0.80. Given that this is an optional efficiency measure and that that there are commercially available products that meet the UEF threshold we think that this metric should apply to all gas storage water heaters.

Edminster, Ann

The proposed changes to R408 (REPI-18) should reflect the most efficient technologies that will be available when IECC 2024 is approved. For gas water heaters I propose levels listed in the Energy Star Residential Water Heaters Specification Version 5.0, published July 18, 2022[1].

[1] https://www.energystar.gov/products/spec/residential_water_heaters_specification_version_5_0_pd

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Finlayson, Ian

Options such as this one for efficiency improvements within Section R408 should be updated to incentivize not just efficiency improvements but also the critical importance of reducing fossil fuel use in new construction. This is accomplished in the proposed modifications below by only incentivizing electric and solar water heating. This does not restrict the use of gas and propane water heating, but it does not reward these common fossil-fuel water heating systems with points within Section R408.

Propose the following modifications to Table R408.2.3:

Option	Water Heater	Size	Type	Efficiency
~~1.~~	~~Gas-fired storage water heaters~~	~~≤ 55 gallons~~	~~Medium Draw Pattern~~	~~UEF≥0.64~~
			~~High Draw Pattern~~	~~UEF≥0.68~~
		~~>55 gallons~~	~~Medium Draw Pattern~~	~~UEF≥0.78~~
			~~High Draw Pattern~~	~~UEF≥0.80~~
~~2.~~	~~Gas-fired instantaneous water heater~~			~~UEF≥0.87~~
~~3.~~ 1.	Electric water heaters		Integrated HPWH	UEF≥3.30
	Uniform Energy Factor (UEF)		Integrated HPWH, 120 Volt/15 Amp Circuit	UEF≥2.20
	First-hour rating FHR≥0.45 gallons per hour		Split-system HPWH	UEF≥2.20
~~4.~~2.	Solar water heaters		Electric backup	SUEF≥3.00
	Solar uniform energy factor (SUEF)		Gas backup	SUEF≥1.80

Reason: The table removes additional incentives for fossil fueled water heating in order to provide builders and developers with an optional incentive to use clean energy sources. Absent this change REPI-10 is unlikely to accomplish any change from existing water heating specifications.

Koban, Mary

- AHRI notes that the new EPA Energy Star v5.0 will take effect in April 2023.
- AHRI further notes that above code energy proposals should align with DOE Energy Star programs because it provides a clear direction for manufacturers what is above code and a clear indication for consumers what constitutes energy savings.
- Therefore, AHRI suggests that the code align with Energy Star v5.0 for all water heaters noted in this proposal.

Lindburg, Alison and Lyles, Mark

This proposal is an optional efficiency measure that will be placed in R408 (REPI-18) and should reflect the most efficient technologies that are currently available, as indicated by Energy Star.

Proposed modifications:

Table R408.2.3:

Option	Water Heater	Size	Type	Efficiency
1.	Gas-fired storage water heaters	≤ 55 gallons	Medium Draw Pattern	UEF≥~~0.64~~ 0.81
			High Draw Pattern	UEF≥~~0.68~~ 0.86
		>55 gallons	Medium Draw Pattern	UEF≥~~0.78~~ 0.86
			High Draw Pattern	UEF≥~~0.80~~ 0.86
2.	Gas-fired instantaneous water-heater			UEF≥~~0.87~~ 0.95
3.	Electric water heaters		Integrated HPWH	UEF≥3.30
	Uniform Energy Factor (UEF)		Integrated HPWH, 120 Volt/15 Amp Circuit	UEF≥2.20
	First-hour rating FHR≥0.45 gallons per hour		Split-system HPWH	UEF≥2.20
4.	Solar water heaters		Electric backup	SUEF≥3.00
	Solar uniform energy factor (SUEF)		Gas backup	SUEF≥1.80

Reason: The updates to this table reflect the proposed changes to Energy Star V5, which published on June 1st. Given that this is being proposed for the 2024 energy code, the equipment in R408 should align with the updated Energy Star standard.

Noble, Michael

This proposal is a modification to section R408, optional efficiency measures. To be up to date when the 2024 code is final, Fresh Energy believes that these values must align with the ENERGY STAR standards that will be current at that time. These are the new values published this year.

Option	Water Heater	Size	Type	Efficiency
1.	Gas-fired storage water heaters	≤ 55 gallons	Medium Draw Pattern	UEF≥~~0.64~~ 0.81
			High Draw Pattern	UEF≥~~0.68~~ 0.86
		>55 gallons	Medium Draw Pattern	UEF≥~~0.78~~ 0.86
			High Draw Pattern	UEF≥~~0.80~~ 0.86
2.	Gas-fired instantaneous water-heater			UEF≥~~0.87~~ 0.95

Shanks, Brian

Through discussion with a major manufacturer of storage water heaters they indicated the federal minimum requirements were still not established. As such they could not commit to meeting or exceeding the proposed values.

Possible Remedy:

Confirm the source of the values used in Table R408.2.3 and consider replacing Draw Pattern with BIN which is how the manufacturer refers to the performance metric

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Urbanek, Lauren

This proposal modifies section R408, which outlines optional efficiency measures. Updated ENERGY STAR specifications for residential water heaters were recently finalized. To be labeled as an ENERGY STAR product, any water heater manufactured as of April 18, 2023 must meet the updated version 5.0 specification. We propose to modify the efficiency table as follows, to align with the ENERGY STAR specifications that will be in place once the 2024 IECC is adopted:

Option	Water Heater	Size	Type	Efficiency
1.	Gas-fired storage water heaters	≤ 55 gallons	Medium Draw Pattern	UEF≥~~0.64~~ 0.81
			High Draw Pattern	UEF≥~~0.68~~ 0.86
		>55 gallons	Medium Draw Pattern	UEF≥~~0.78~~ 0.86
			High Draw Pattern	UEF≥~~0.80~~ 0.86
2.	Gas-fired instantaneous water-heater			UEF≥~~0.87~~ 0.95

Vijayakumar, Gayathri

I am submitting a negative vote on RECPI-10 so that a modification can be discussed at the September meeting. A modification is needed so that these edits can be properly integrated into R408 (as modified by REPI-18) and then reviewed & approved by the voting members.

Wiley, Seth

- Lowering GHG emissions is part of the IECC development purview.

- Improving equipment efficiency of fossil fuel burning equipment typically results in lower GHG emissions.

- Equipment with efficiency values as proposed in the text below appear to be cost-competitive and market-ready.

- Values proposed in the text below are closer to Energy Star than those in RECPI-10.

Proposed Text to resolve Negative Vote:

- Change RECPI-10 proposed Option 1 text to indicate: Gas-fired storage water heater <55 gallons Medium and High Draw Patterns shall be UEF equal or greater than 0.70.

- Change RECPI-10 proposed Option 2 text to indicate: Gas-fired instantaneous water heater shall be UEF equal or greater than 0.90.

REPI-7-21

IECC®: SECTION 202 (New), R103.2.2 (New), R105.2.3, R105.2.5 (New), R105.2.5, R401.3, R404.4 (N1104.4) (New), R404.4.1 (N1104.4.1) (New), R404.4.1.1 (N1104.4.1.1) (New), R404.4.1.2 (N1104.4.1.2) (New), R404.4.1.3 (N1104.4.1.3) (New), R404.4.1.4 (N1104.4.1.4) (New), R404.4.2 (N1104.4.2) (New), TABLE R405.2, TABLE R406.2

Proponents:
Kim Cheslak, NBI, representing NBI (kim@newbuildings.org); Ben Rabe, representing Fresh Energy (rabe@fresh-energy.org); Bryan Bomer, representing Department of Permitting Services (bryan.bomer@montgomerycountymd.gov); Lauren Urbanek, representing Natural Resources Defense Council (lurbanek@nrdc.org); Howard Wiig, representing Hawaii State Energy Office (howard.c.wiig@hawaii.gov); Kim Burke, representing Colorado Energy Office (kim.burke@state.co.us); Chris Castro, representing City of Orlando (chris.castro@orlando.gov); Brad Smith, representing City of Fort Collins (brsmith@fcgov.com); Amber Wood, representing ACEEE (awood@aceee.org)

2021 International Energy Conservation Code

Add new definition as follows:

R202 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.

Add new text as follows:

R103.2.2 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.

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 required, 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.

R401.3 (N1101.14) 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, and dimensions.

Add new text as follows:

R404.4 (N1104.4) Renewable energy infrastructure.

The building shall comply with the requirements of R404.4.1 or R404.4.2

R404.4.1 (N1104.4.1) One- and two- family dwellings and townhouses.

***Dwelling units* one- and two-family dwellings and townhouses shall comply with Sections R404.4.1.1 through R404.4.1.4.**

Exceptions:

1. A dwelling unit with a permanently installed on-site renewable energy system.

2. A dwelling unit with a solar-ready zone area that is less than 500 square feet (46 m2) of roof area oriented between 110 degrees and 270 degrees of true north.

3. A dwelling unit with less than 500 square feet (46m2) of roof area oriented between 110 degrees and 270 degrees of true north.

4. A dwelling unit with a solar-ready zone area that is shaded for more than 70 percent of daylight hours annually.

5. A dwelling unit that complies with Appendix RC.

6. A dwelling unit with a renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated whole-building electric use on an annual basis.

R404.4.1.1 (N1104.4.1.1) Solar-ready zone area.

The total area of the *solar-ready zone* shall not be less than 250 square feet (23.2 m^2) and shall be composed of areas not less than 5.5 feet (1676 mm) in ibe direction and not less than 80 square feet (7.4 m^2) exclusive of access or set back areas as required by the *International Residential Code*.

Exception: Dwelling units in 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 (N1104.4.1.2) Obstructions.

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

R404.4.1.3 (N1104.4.1.3) Electrical service reserved space.

The main electrical service panel shall have a reserved space for a dual pole circuit breaker and shall be labeled "For Future Solar Electric." The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.

R404.4.1.4 (N1104.4.1.4) 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 a minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official.
Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".

R404.4.2 (N1104.4.2) 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
R404.2	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
R404.2	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.

REPI-7-21 Solar ready

Voted Affirmative with comment (ballot 3):

Wiley, Seth

Reason Statement:

I would support moving this to Proposal R408 and/or a new R409 Section inline with other

Committee Member comments.

Proposed Text to resolve Negative Vote:

- N/A

Voted Affirmative with comment (ballot 2):

Lindburg, Alison

Opportunities to install on-site solar should be considered before dwellings are required to install renewable-ready infrastructure as required by REPI-7. Therefore language should be incorporated to prioritize the installation of on-site renewable energy systems, allowing PV-ready requirements of REPI-7 only as a secondary option. Analysis developed in support of REPI-114 determined that on-site renewable energy is cost effective is most climate zones for residential dwellings. It is critical for our energy codes to continue to advance clean energy generation as a key action to meeting our climate action goals.

Proposed modifications:

R404.4 (N1104.4) Renewable energy ~~infrastructure~~. The building shall comply with the requirements of R404.4.1 or R404.4.2

R404.4.1 (N1104.4.1) One- and two- family dwellings and townhouses. Dwelling units one- and two-family dwellings and townhouses shall install an on-site renewable energy system with a nameplate DC power rating measured under standard test conditions, of no less than 2kw, or shall comply with Sections R404.4.1.1 through R404.4.1.4.

Exceptions:

1. ~~A dwelling unit with a permanently installed on-site renewable energy system.~~ A building with a permanently installed domestic solar water heating system with a solar savings fraction of not less than 0.5.

2. A dwelling unit with a solar-ready zone area that is less than 5300 square feet (46 m) of roof area oriented between 110 degrees and 270 degrees of true north.

3. A dwelling unit with less than 500 square feet (46m) of roof area oriented between 110 degrees and 270 degrees of true north.

4. A dwelling unit with a solar-ready zone area that is shaded for more than 70 percent of daylight hours annually.

5. A dwelling unit that complies with Appendix RC.

6. A dwelling unit with a renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated whole-building electric use on an annual basis.

Lyles, Mark

Opportunities to install on-site solar should be considered before dwellings are required to install renewable-ready infrastructure as required by REPI-7. Therefore we suggest adding language that would prioritize the installation of on-site renewable energy systems, allowing PV-ready requirements of REPI-7 only as a secondary option. The following recommended modifications to REPI-7 are shown below.

Proposed modifications:

R404.4 (N1104.4) Renewable energy ~~infrastructure~~. The building shall comply with the requirements of R404.4.1 or R404.4.2

R404.4.1 (N1104.4.1) One- and two- family dwellings and townhouses. Dwelling units one- and two-family dwellings and townhouses shall install an on-site renewable energy system with a nameplate DC power rating measured under standard test conditions, of no less than 2kw, or shall comply with Sections R404.4.1.1 through R404.4.1.4.

Exceptions:

1. ~~A dwelling unit with a permanently installed on-site renewable energy system.~~ A building with a permanently installed domestic solar water heating system with a solar savings fraction of not less than 0.5.

2. A dwelling unit with a solar-ready zone area that is less than 5300 square feet (46 m) of roof area oriented between 110 degrees and 270 degrees of true north.

3. A dwelling unit with less than 500 square feet (46m) of roof area oriented between 110 degrees and 270 degrees of true north.

4. A dwelling unit with a solar-ready zone area that is shaded for more than 70 percent of daylight hours annually.

5. A dwelling unit that complies with Appendix RC.

6. A dwelling unit with a renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated whole-building electric use on an annual basis.

Noble, Michael

The code should prioritize rooftop solar installations over “renewable ready infrastructure” because rooftop solar is cost-effective in most climate zones, and with the new IRA incentives available through 2032, rooftop PV will be even more cost-effective.

Wiley, Seth

I would support moving this to Proposal R408 and/or a new R409 Section inline with other Committee Member comments.

Proposed Text to resolve Negative Vote: - N/A

Voted Negative with Reason (ballot 2)

Davis, Clifford

Should be in an appendix

Demers, Paul

This is a costly and potentially wasteful addition to the initial construction of a home that may never utilize a system. If this were to be included anywhere in the code document it should be in an appendix that would allow for the conditional use of such provisions rather than an unused requirement. The practicality of this being a useful preplanning tool would be lost if not readily available to the owner or their future contractors which is very typical. Most applications would be better served to verify conditions at the time of construction of such a system to assure compliance with the code in the event design parameters change or unintended alteration have compromised the initial design.

Johnson, Ric

During initial review, we disapproved REPI-114-21. The reasoning was that for many areas of the country, PV Solar is not cost effective. This proposal should be disapproved along the same lines as it is not cost effective in a great many jurisdictions. This proposal should be placed in R408 as a compliance credit as it can be used in some areas or as a jurisdictional option.

Kochkin, Vladimir

I share some of the concerns expressed in ballot comments.

Voted Negative with Reason (ballot 1)

Drumheller, Craig

PV Ready - Should be put in R408 for credit or remain as an appendix.

Finlayson, Ian

Opportunities to install on-site solar should be considered before dwellings are required to install renewable-ready infrastructure as required by REPI-7. Therefore language should be incorporated to prioritize the installation of on-site renewable energy systems, allowing PV-ready requirements of REPI-7 only as a secondary option. The following modifications to REPI-7 are shown below.

R404.4 (N1104.4) Renewable energy infrastructure. The building shall comply with the requirements of R404.4.1 or R404.4.2

R404.4.1 (N1104.4.1) One- and two- family dwellings and townhouses. Dwelling units one- and two-family dwellings and townhouses shall install an on-site renewable energy system with a nameplate DC power rating measured under standard test conditions, of no less than 2kw, or shall comply with Sections R404.4.1.1 through R404.4.1.4.

Exceptions:

1. ~~A dwelling unit with a permanently installed on-site renewable energy system.~~ A building with a permanently installed domestic solar water heating system with a solar savings fraction of not less than 0.5.

2. A dwelling unit with a solar-ready zone area that is less than 5300 square feet (46 m) of roof area oriented between 110 degrees and 270 degrees of true north.

3. A dwelling unit with less than 500 square feet (46m) of roof area oriented between 110 degrees and 270 degrees of true north.

4. A dwelling unit with a solar-ready zone area that is shaded for more than 70 percent of daylight hours annually.

5. A dwelling unit that complies with Appendix RC.

6. A dwelling unit with a renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated whole-building electric use on an annual basis.

Reason: Analysis developed in support of REPI-114 determined that on-site renewable energy is cost effective is most climate zones for residential dwellings. It is critical for our energy codes to continue to advance clean energy generation as a key action to meeting our climate action goals.

Gobble, Kevin

While Solar-Ready Zone should be added to the definitions, I do not believe it should be required on all construction submittals. Strike through R103.2.2, as this will increase costs on architectural services and may not be used for future projects.

Heikkinen, Gary

- This proposal adds cost without any energy savings and by definition, is not cost effective.
- The proposal would burden ALL homes with this requirement and added cost, even though the infrastructure may never be used.
- Home owners who wish to install PV should bear the incremental cost and take advantage of available incentives and tax credits to help offset.

Hensley, Edwin

Clarity is required on the cost versus the benefit in order to communicate the rationale to our constituency. Regional and urban/rural variations in cost are significant. We cannot contribute language to the proposals that would change our vote.

Hensley, John

With changing technology the requirement of this change as proposed R404.4.1.1 (N1104.4.2.2 is limiting removing builder/owner flexibility for design. Should be put in R408 for credit or become a jurisdictional option in a new R409.

Hoeper, Shane

R404.4.1 – Town house units should replace townhouses

I think “building” is more appropriate than ”dwelling unit”

Exception 4: 70% shading is an excessive exception – the inverse is more reasonable

R404.4.1.1- The requirements of this section are not harmonious with the exceptions in R404.4.1. A solar ready zone can face any direction, be as small as 80sf and be 100% shaded. All allowable exceptions. There should be guidance for solar ready zones even if they are not required due to the exceptions.

Koban, Mary

- AHRI appreciates that PV are one of the options available to provide energy savings. However, this code overly enables one technology versus others that are possible. There are several other renewable energy sources (i.e., wind, hydroelectric, etc.)available. This proposal limits options.

- Furthermore, there are some technical limitations to this code proposal. Heat pump water heaters are unique compared to other water heaters. A heat pump water heater's performance and efficiency are dependent on the conditions in which they are operated to include the inlet water temperature. Higher inlet water temperatures result in a lower heat pump water heater efficiency. The unintended consequences of requiring plumbing from the solar-ready zone to service water heating system, would be that pre-heated water from the solar system would result in a lower heat pump water efficiency.
- AHRI recommends that the code be provided as an optional compliance or added in section R408 as a credit option or become a jurisdictional option in a new section ,i.e., R409.

Lindburg, Alison

Opportunities to install on-site solar should be considered before dwellings are required to install renewable-ready infrastructure as required by REPI-7. Therefore language should be incorporated to prioritize the installation of on-site renewable energy systems, allowing PV-ready requirements of REPI-7 only as a secondary option. Analysis developed in support of REPI-114 determined that on-site renewable energy is cost effective is most climate zones for residential dwellings. It is critical for our energy codes to continue to advance clean energy generation as a key action to meeting our climate action goals.

Proposed modifications:

R404.4 (N1104.4) Renewable energy ~~infrastructure~~. The building shall comply with the requirements of R404.4.1 or R404.4.2

R404.4.1 (N1104.4.1) One- and two- family dwellings and townhouses. Dwelling units one- and two-family dwellings and townhouses shall install an on-site renewable energy system with a nameplate DC power rating measured under standard test conditions, of no less than 2kw, or shall comply with Sections R404.4.1.1 through R404.4.1.4.

Exceptions:

1. ~~A dwelling unit with a permanently installed on-site renewable energy system.~~ A building with a permanently installed domestic solar water heating system with a solar savings fraction of not less than 0.5.

2. A dwelling unit with a solar-ready zone area that is less than ~~5~~300 square feet (46 m) of roof area oriented between 110 degrees and 270 degrees of true north.

3. A dwelling unit with less than 500 square feet (46m) of roof area oriented between 110 degrees and 270 degrees of true north.

4. A dwelling unit with a solar-ready zone area that is shaded for more than 70 percent of daylight hours annually.

5. A dwelling unit that complies with Appendix RC.

6. A dwelling unit with a renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated whole-building electric use on an annual basis.

Lyles, Mark

Opportunities to install on-site solar should be considered before dwellings are required to install renewable-ready infrastructure as required by REPI-7. Therefore language should be incorporated to prioritize the installation of on-site renewable energy systems, allowing PV-ready requirements of REPI-7 only as a secondary option. The following modifications to REPI-7 are shown below.

R404.4 (N1104.4) Renewable energy ~~infrastructure~~. The building shall comply with the requirements of R404.4.1 or R404.4.2

R404.4.1 (N1104.4.1) One- and two- family dwellings and townhouses. Dwelling units one- and two-family dwellings and townhouses shall install an on-site renewable energy system with a nameplate DC power rating measured under standard test conditions, of no less than 2kw, or shall comply with Sections R404.4.1.1 through R404.4.1.4.

Exceptions:

1. ~~A dwelling unit with a permanently installed on-site renewable energy system.~~ A building with a permanently installed domestic solar water heating system with a solar savings fraction of not less than 0.5.

2. A dwelling unit with a solar-ready zone area that is less than 5300 square feet (46 m) of roof area oriented between 110 degrees and 270 degrees of true north.

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5. A dwelling unit that complies with Appendix RC.

6. A dwelling unit with a renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated whole-building electric use on an annual basis.

Reason: Analysis developed in support of REPI-114 determined that on-site renewable energy is cost effective is most climate zones for residential dwellings. It is critical for our energy codes to continue to advance clean energy generation as a key action to meeting our climate action goals.

Madrid, Ricardo

This will work well as a credit.

Marston, Thomas

Do not support. I would support this measure if it were part of R408 and joined with Renewable Energy Measures. Alternatively, create a section that mirrors R408 and enables all stakeholders to agree to support a measure such as PV Ready conditions. The builder would opt-in and install hardware. The jurisdiction having authority would opt-in and wave all additional fees to inspect hardware that is not operational. For example, routing DC conduit is the cost of the builder, and the inspection department agrees to wave all associated fees.

Martino, Amy

Move entire section to new Section 409: Optional Jurisdictional Provisions

Reason:

Due to the fact that PV solar is not efficient and cost effective in many areas of the country, it should be applied to jurisdications where it makes sense and should not be mandated in areas which it does not work and will not be used. This proposal addresses only a minimal installation of PV solar. If more PV panels are desired or added in the future, the requirements will not suffice. In addition if community or utility scale renewables are available, the code mandate will not be utilized.

Raymer, Robert

Earlier this year, REPI 114 was disapproved by the Residential Consensus Committee by a significant margin. Among the concerns raised, the question of cost-effectiveness in many parts of the country was frequently brought up. Specifically, the use of an average price for electricity for the entire United States seems questionable given the wide variation of electricity prices among local utility districts. While rooftop solar is cost-effective in most of California, it isn't cost-effective in much of neighboring Nevada. Before PV-ready provisions are mandated in the IECC, the proposal needs to be refined to allow for the use of local utility rates in the cost-effectiveness calculation. However, with the growing desire to have rooftop solar in some parts of the country, there should be provisions in the code to allow this option.

Revise as Follows:

Take the proposal as written and place it in Section R408 for compliance credit or allow it to become a jurisdictional option in a new Section R409.

Shanks, Brian

I am not convinced that PV Ready is right for all areas of the country. Even with the exemptions cited this feels like a proposal that belongs in an appendix where jurisdictions' that benefit from favorable solar conditions can adopt at will

Truitt, Richard

This proposal does not fit within the Intent statement for inclusion into the body of the Code within Section R101.3 and N1101.3 as issued by the ICC Board. The proposed provisions to ensure solar ready roofs has no relevancy to energy efficiency for buildings at the time of construction. Within the Intent statement contains the following language. "The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others." This language provides for clear direction that the Board is open to such provisions, but they must be placed in an appendix for use and adoption by Jurisdictions. Additionally, as proposed within the body of the code the proposal will create undue burdens on jurisdictions to endure compliance after first occupancy not only at plan review but during inspections since to ensure that future renovations to not adversely affect reserved areas established at time of initial construction. Per Section R103.5 and N1103.5 construction documents are only required to be maintained for a period of not less than 180 days from the date of completion.

REPI-20-21

IECC®: R405.2, R408.2

Proponents:
Dan Wildenhaus, representing Northwest Energy Efficiency Alliance (dwildenhaus@trccompanies.com); Kevin Rose, representing Northwest Energy Efficiency Alliance (NEEA) (krose@neea.org)

2021 International Energy Conservation Code

Revise as follows:

R405.2 Performance-based compliance.

Compliance based on total building performance requires that a *proposed design* meets all of the following:

- 1.

  The requirements of the sections indicated within Table R405.2.

- 2.

  The building thermal envelope shall be greater than or equal to levels of efficiency and solar heat gain coefficients in Table R402.1.1 or R402.1.3 of the 2009 *International Energy Conservation Code*.

- 3.

  An annual energy cost of the proposed design that is less than or equal to 90 percent of the annual energy cost of the standard reference design or the additional efficiency credits as required in Section R408.2 shall be installed without including such measures in the proposed design under Section R405. For *dwelling units* with greater than 5,000 square feet (465 m^2) of *conditioned floor area*, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the *standard reference design* . Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.

  Exception: The energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.

R408.2 Additional energy efficiency ~~package options~~credit requirements.

Two of the additional ~~Additional~~ measures shall be selected from Table R408.2 that meet or exceed a total of ten credits. Five additional credits shall be selected for *dwelling units* with greater than 5,000 square feet (465 m^2) of *conditioned floor area*. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as indicated in the table for the specific climate zone. Interpolation of credits between measures shall not be permitted. ~~efficiency package options for compliance with Section R401.2.1 are set forth in Sections R408.2.1 through R408.2.5.~~

REPI-20-21 Additional energy efficiency option

Voted Affirmative with comment (ballot 3):

Salcido, Robert

REPI-18: Expands the additional efficiency options to energy credits for measures by climate zone

REPI-20: Sets R405 compliance at 90% of the standard reference home to align with energy credits and adds an additional 5% for homes over 5,000 square feet of conditioned floor area

Comment: REPI-18 aligns the additional efficiency requirements strategy with the commercial energy credits to allow credits by measure type and climate zone as developed by simulation analysis. Cost effectiveness analysis helps determine the energy credits target for compliance. Energy credits strategy allows flexibility in design to meet the efficiency requirements of the code on a path toward net-zero energy homes in code. We agree with the energy credits methodology and have assisted with simulation analysis in the development of these credits. Builders can use the credits that best suit their climate zones and realize the most efficiency for their location.

We also agree with the additional efficiency requirement of 5% for homes over 5,000 square feet. Analyses have proven that larger homes comply much more easily. The RESNET ERI takes size into account with an Index Adjustment Factor (IAF) so this proposal helps align the R405 compliance path with the R406 compliance path.

Wiley, Seth

Reason Statement:

- N/A

Proposed Text to resolve Negative Vote:

- N/A

Voted Affirmative with comment (ballot 2):

Lyles, Mark

The provisions of REPI-20 need to be incorporated into REPI-18.

Reasons: To address some of the concerns raised about how the R408 proposals are being incorporated in into REPI-18 I think the proponents of REPI-20 and REPI-18 should work together to pull the requirements into a consensus draft of REPI-18 for the committee to consider at the 9/26 committee meeting.

Voted Negative with Reason (ballot 3):

Demers, Paul

I would support a negative position on REPI – 20, 5000 sf. Residential structure electrification standard so that the proposal can be brought to the table for further discussion in the upcoming Committee Meetings. I feel that with some minor adjustments to the language that the group could move the proposal forward. I feel the penalty for size could be discussed regarding consideration to only above grade portions and maybe some adjustment to better recognize these unique structures.

Madrid, Rick

I overlooked this REPI on previous ballots. This repi needs more discussion and clarification. The 5000 square foot above grade is an issue.

Truitt, Richard

Based upon further review this proposal is intended to increase energy efficiency for homes that have a square footage of 5000 sf or above. I fail to see justification to require a higher degree of compliance for larger homes than ones less than 5000 sf. If as presented RESNET and other energy rating programs have included this into their calculations this provision would not only be redundant but when applied to the prescriptive compliance paths would penalize and increase cost of construction for larger homes.

Voted Negative with Reason (ballot 2)

Davis, Clifford

Needs to be revised to 5,000 square feet above grade floor area

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Gobble, Kevin

The wording needs to be clear and I would edit to read 5,000 square feet above grade plane. This aligns with other codes and definitions and is clear language.

Mabe, Gavin

I agree with concerns expressed in the ballot comments on the following proposed changes.

Marston, Thomas

Do not support in current form. Below grade space that is unfinished at time of permit could be converted to finished space during construction and address a family emergency that enables a family member such as elderly parent to occupy this space. If the home is designed as a 2600 square foot ranch

home and the finished basement of 2600 square feet should not require a code-mandated change in energy performance.

Parks, Robert

Needs to be revised to read 5,000 square feet above grade floor area

My negative vote on these proposals is because I agree with the concerns and reasons statements already expressed in ballot comments on this proposed change

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Rossmiller, Gil

Basements should not be included with in the 5000 s.f. area. Recommend adding “above grade plane” The IRC defines the grade plane elevation and when a story is above or below grade plans.

Possible solution

3. An annual energy cost of the proposed design that is less than or equal to 90 percent of the annual energy cost of the standard reference design or the additional efficiency credits as required in Section R408.2 shall be installed without including such measures in the proposed design under Section R405. For dwelling units with greater than 5,000 square feet (465 m) of conditioned floor in above grade plane area, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design . Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration’s State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.

Add two definitions

[RB] GRADE PLANE. A reference plane representing the average of the finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than 6 feet (1829 mm) from the building between the structure and a point 6 feet (1829 mm) from the building.

[RB] STORY ABOVE GRADE PLANE. Any story having its finished floor surface entirely above grade plane, or in which the finished surface of the floor next above is either of the following:

1. More than 6 feet (1829 mm) above grade plane.

2. More than 12 feet (3658 mm) above the finished ground level at any point.

Wiley, Seth

Given Committee support for this Proposal and that it addresses Section R408, this Proposal should be coordinated with REPI-18 (which has received strong Committee support) by Staff.

Proposed Text to resolve Negative Vote: - N/A

Voted Negative with Reason (ballot 1)

Drumheller, Craig

Although a 5,000 square foot home sounds large, the way it is being applied here could cause an average sized 2,501 square foot single story home with a full basement to meet the threshold for these additional requirements. In addition, the threshold is independent of the number of bedrooms. In order to resolve both of these issues, changing the 5,000 square feet of conditioned floor area to 5,000 square feet of above grade conditioned floor area would resolve both of these problems.

We ask that you vote NO on REPI-020 so it can be discussed as a committee. Below is a potential solution that should achieve the spirit of the goal for without causing unjustified increases in stringency.

Proposed revision:

R405.2 Performance-based compliance. Compliance based on total building performance requires that a proposed design meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The building thermal envelope shall be greater than or equal to levels of efficiency and solar heat gain coefficients in Table R402.1.1 or R402.1.3 of the 2009 International Energy Conservation Code.
3. An annual energy cost of the proposed design that is less than or equal to 90 percent of the annual energy cost of the standard reference design or the additional efficiency credits as required in Section R408.2 shall be installed without including such measures in the proposed design under Section R405. For dwelling units with greater than 5,000 square feet (465 m) of above grade conditioned floor area, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.

   Exception: The energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.

R408.2 Additional energy efficiency credit requirements. Two of the additional measures shall be selected from Table R408.2 that meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m) of above grade conditioned floor area. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as

indicated in the table for the specific climate zone. Interpolation of credits between measures shall not be permitted.

Heikkinen, Gary

Should clarify that this only applies to conditioned space. For example, an unconditioned basement should not be included in the square footage.

Johnson, Ric

Changing the language to read, 5,000 square feet above grade floor area.

To vote for approval, the proposal:

Change the proposal to read 5,000 square feet above grade floor area.

Koban, Mary

- AHRI notes that the wording is confusing and difficult to interpret. There are two options for energy savings (standard compared to building reference or use additional energy efficiency credits). If a builder takes the additional energy efficiency credit path, no annual energy cost calculation is needed. Therefore, there is no question whether to include or exclude such measures under section R405.
- The requirements for 5000 sq feet of conditioned floor appear to be overly restrictive and possibly include residential systems that have a finished basement. The code should clearly denote that the footage is above grade.
- AHRI notes that this code proposal may force builders and consumers to one type of technology without clear justification for the energy efficiency savings by using TableR408.2 provided in REPI-18-21.
- AHRI would like to better understand the magnitude of the credits used in bothREPI-18-21 and pulled into/referenced in REPI-20-21.
- Therefore, AHRI would like to defer the code changes until some of these issues can be resolved.

Kochkin, Vladimir

- 5,000 sq ft should be based on above-grade square footage.
- Cost effectiveness analysis must be conducted based on the new R408 which now requires 10 credits.

Martino, Amy

Change "conditioned floor area" to "living space" or create an exception for conditioned attics.

Reason:

Conditioned floor area can include non habitable conditioned attics and unfinished basements. Additional requirements are reasonable for areas intended to be habitable and living spaces, but a 2500 s.f single living floor home should not be penalized if it has a conditioned unfinished non- habitable attic.

Marston, Thomas

Do not support in current form. Language should declare conditioned square footage as stated at time of permit, finishing below-grade space after permit should not create a need to comply with a Large Building proposal. Alternately, below-grade, conditioned by design, space is excluded from the total area calculation.

Raymer, Robert

Although a 5,000 square foot home sounds large, the way it is being applied here could cause an average sized 2,501 square foot single story home with a full basement to meet these additional requirements. In addition, the requirement is independent of the number of bedrooms. To resolve both issues, changing the 5,000 square feet of conditioned floor area to 5,000 square feet of above grade conditioned floor area would resolve both problems.

We ask that you vote NO on REPI-020 so it can be discussed as a committee. Below is a potential solution that should achieve the spirit of the goal for without causing unnecessary increases in stringency.

Revise as follows:

R405.2 Performance-based compliance. Compliance based on total building performance requires that a proposed design meets all of the following:

3. An annual energy cost of the proposed design that is less than or equal to 90 percent of the annual energy cost of the standard reference design or the additional efficiency credits as required in Section R408.2 shall be installed without including such measures in the proposed design under Section R405. For dwelling units with greater than 5,000 square feet (465 m) of above grade conditioned floor area, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.

> **Exception:** The energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.

R408.2 Additional energy efficiency credit requirements. Two of the additional measures shall be selected from Table R408.2 that meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m) of above grade conditioned floor area. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as indicated in the table for the specific climate zone. Interpolation of credits between measures shall not be permitted.

Shanks, Brian

While I don't think this is necessary, I could vote in the affirmative with some revisions

Possible Remedy

As I suggested during the sub-committee meeting, if this included a below-grade exclusion I would reconsider my position

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Wright, Jeremy

1. 5,000 square feet shall be based on above grade finish heated square footage.

2. Cost effectiveness must be conducted based on the new R408 which requires 10 credits.

REPI-33-21

IECC®: TABLE R402.1.2, TABLE R402.1.3, R408.2, R408.2.1 (New)

Proponents:
Amanda Hickman, representing Leading Builders of America (LBA) (amanda@thehickmangroup.com)

2021 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2 (TABLE R1102.1.2) MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

	FENESTRATIONU-FACTORf	SKYLIGHTU-FACTOR	GLAZED FENESTRATION SHGCd, e	CEILINGU-FACTOR	WOOD FRAME WALLU-FACTORb	MASS WALLU-FACTORb	FLOORU-FACTOR	BASEMENT WALLU-FACTOR	CRAWL SPACE WALLU-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.0~~26~~30	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.0~~26~~30	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.0~~24~~26	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.40	0.0~~24~~26	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.0~~24~~26	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.0~~24~~26	0.045	0.057	0.028	0.050	0.055

For SI: 1 foot = 304.8 mm.

- a.

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

- b.

  Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zones 0 and 1, 0.14 in Climate

Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.

- c.

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

- d.

  The SHGC column applies to all glazed fenestration.

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

- e.

  There are no SHGC requirements in the Marine Zone.

- f.

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

  – 1.

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

  – 2.

    In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the *International Residential Code*.

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

	FENESTRATIONU-FACTORb, i	SKYLIGHTbU-FACTOR	GLAZED FENESTRATIONSHGCb, e	CEILINGR-VALUE	WOODFRAMEWALLR-VALUEg	MASSWALLR-VALUEh	FLOORR-VALUE	BASEMENTc,gWALLR-VALUE	SLABdR-VALUE& DEPTH	CRAWLSPACEc,gWALLR-VALUE
0	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0	3/4	13	0	0	0

					& 10ci					
2	0.40	0.65	0.25	~~49~~38	13 or 0 & 10ci	4/6	13	0	0	0
3	.30	0.55	0.25	~~49~~38		8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	.30	0.55	0.40	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	13/17	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
6	0.30[i]	0.55	NR	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	15/20	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
7 and 8	0.30[i]	0.55	NR	~~60~~49	30 or 20 & 5ci[h] or 13 &	19/21	38	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci

					10ci[h] or 0 & 20ci[h]					

For SI: 1 foot = 304.8 mm.
NR = Not Required.
ci = continuous insulation.

- a.

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

- b.

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

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

- c.

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

- d.

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

- e.

  There are no SHGC requirements in the Marine Zone.

- f.

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

- g.

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

- h.

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

- i.

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

  - 1.

    Above 4,000 feet in elevation, or

  - 2.

    In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the *International Residential Code*.

R408.2 (N1108.2) Additional efficiency credits ~~package options~~.

Two additional ~~Additional~~ efficiency ~~package options for compliance with Section R401.2.1 are set forth in Sections Table R408.2.1 through R408.2.5.~~ measures shall be selected from Table R408.2 that are cumulatively equal to or greater than ten credits. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table 408.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.

Add new text as follows:

R408.2.1 Opaque wall option.

For *buildings* in climate zones 4 and 5, the maximum U-factor of 0.060 shall be permitted to be used for wood frame walls for compliance with Table R402.1.2 where complying with one or more of the following:

- 1.

  A heat pump is installed for space heating.

- 2.

  All installed water heaters have a UEF equal to or greater than 2.0 or a COP of greater than 1.0.

- 3.

  In addition to the number of credits required by Section R408.2, three additional credits are achieved.

REPI-33-21 LBA cost effective proposal

Voted Affirmative with comment (ballot 3):

Koban, Mary

Based on information received and discussed by my membership, AHRI would like to change our position and remove our negative comments on REPI-33-21.

Voted Affirmative with comment (ballot 1):

Kochkin, Vladimir

- REPI-033 is package solution with REPI-018 which doubles the minimum number of credits required in Section R408 and requires a minimum of two additional practices for compliance. The overall impact is a significant increase in stringency for the next iteration of the code.
- Ceilings: insulation levels are realigned because of negligible energy savings of a few dollars per year that do not meet by a very large margin the cost-effectiveness criteria approved by the consensus committee. DOE's PNNL conducted an energy analysis that confirmed the very low energy savings. Summary of the ANNUAL energy savings from the proposed ceiling insulation for select cities is below from two sources. The results show insignificant amount of energy savings:

	Annual Energy Savings				
DOE PNNL	**New York**	**Albuquerque**	**Seattle**	**Denver**	**Buffalo**
	$6	$7	$6	$8	$11
Home Innovation	**Phoenix**	**Memphis**	**Baltimore**	**Chicago**	**Helena**
	$8	$11	$9	$12	$12

- Walls: insulation in CZ 4 and 5 does not meet by a large margin the cost-effectiveness criteria approved by the committee (energy savings are between $50 and $100 per year with construction costs of as high as $5,000). However, the proposal does not change the prescriptive wall insulation requirements. Instead, the proposal offers an energy-neutral option to allow wall design choices and it requires the energy savings to be fully offset by other measures in R408 for a minimum of additional 3 credits. As an alternative, electrification options are also included as a trade-off for design flexibility in response to requests from other stakeholders.
- Like all systems in the building, insulation needs to be right-sized such that the benefit it provides is commensurate with the financial and environmental costs of adding incremental quantity of insulation material on top of the already stringent insulation requirements. This change will help designers find the right balance.

Marston, Thomas

Support because it was developed in concert with REPI-18 and requires the thermal modifications that were deemed no longer cost effective based on life-cycle cost analysis are replaced with features that

support the energy offset. REPI-33 when combined with REPI-18 enables designers to strive for lowest operating cost solutions that have ROI's of 5% to 10%. Thermal features modified in REPI-33 were deemed to have ROI's of 1% to 2%. We must wait to 50 to 100 years to learn if these measures will offset carbon emissions. Rejecting REPI-33 means our primary concern is no longer focused on lowering operating costs.

Martino, Amy

Strongly support

Reason:

Insulation levels were increased in the 2021 IECC (particularly increasing R-60 in the ceiling) in the final CDPaccess vote despite being defeated in the Committee and Public Comments hearings. It was defeated because there was no cost justification or justifiable energy savings gained. This accepts the 2021 outcome but adjusts prescriptive insulation levels to be more flexible and cost-effective with alternative choices and conditions which will actually save energy.

Raymer, Robert

Recommend inclusion of this proposal into the Public Comment draft as it provides greater flexibility for meeting prescriptive insulation provisions with other provisions that are more cost effective and that are equal to or in many cases, save more energy.

Wright, Jeremy

1. REPI-033 is package solution with REPI-018 which doubles the minimum number of credits required in Section R408 and requires a minimum of two additional practices for compliance. The overall impact is a significant increase in stringency for the next iteration of the code.

2. Ceilings: insulation levels are realigned because of negligible energy savings of a few dollars per year that do not meet by a very large margin the cost-effectiveness criteria approved by the consensus committee.

3. Walls: insulation in climate zone 4 and 5 do not meet by a large margin the cost effectiveness criteria approved by the committee. However, the proposal does not change the prescriptive wall insulation requirements. Instead, the proposal offers an energy-neutral option to allow wall design choices and it requires the energy savings to be offset by other measures in R408 for a minimum of additional 3 credits. As an alternative, electrification options are also included as a trade-off for design flexibility in response to requests from other stakeholders.

4. As with all systems in the building, insulation needs to be correctly sized so that the benefit it provides is corresponds with the financial and environmental costs of adding incremental quantity of insulation

material on top of the already stringent insulation requirements. This proposed change will help designers find the correct balance.

Voted Negative with Reason (ballot 3):

Chawla, Patricia

While I support REPI-33, I am submitting a negative vote so that the "Omnibus" proposal (version 2) can be discussed at the September meeting.

Lyles, Mark

For the reasons stated in my previous ballot I do not support this proposal but I am supportive of the omnibus proposal that is being worked on by a number of committee members as a way to address my concerns with this proposal.

Rossmiller, Gil

I do like the "Omnibus" proposal that has been presented. Worth the discussion.

Salcido, Robert

This proposal rolls back ceiling insulation levels and would increase energy use in all buildings in climate zones 4-8. There has been no official analysis by proponents to show that these levels of insulation are not cost effective. There is also a stipulation to reduce wall insulation in CZ 4&5 if a federal minimum heat pump, a heat pump water heater or three additional energy credits. There has been no energy analysis conducted to show in CZ4&5 if the options chosen would be an overall gain or loss of efficiency. There was no cost effectiveness analysis proving this point. There needs to be an analysis conducted that explicitly shows if this is an overall efficiency gain or loss. Our position is that this will be a net loss in efficiency.

Williams, Jeremy

REPI-33 (re)introduces an inequitable tradeoff between building envelope systems and mechanical equipment, representing a net decrease in overall energy efficiency. Whole-building equipment tradeoffs should only be reconsidered in the IECC as part of a comprehensive decarbonization strategy.

Vijayakumar, Gayathri

While I support REPI-33 and 122, I am submitting a **negative** vote so that the attached modification ["Omnibus Version 2" proposal] can be discussed at the September meeting should REPI-33 fail to achieve 2/3rds. Presented initially in Ballot 2 as a mod to REPI-33, the first omnibus included unedited text from RECPI-6, RECPI-7, REPI-64, 68, 93, and 111. **Based on Ballot 2 results,** it now combines those REPI's with text from REPI-7, 20, 70, 122, and 115.

In addition, in the spirit of finding consensus, the following EDITS to individual REPI's are made in "Omnibus Version 2", based on modifications proposed in the Ballot 1 and 2 comments provided by voters. Where edited in the Omnibus, I used red font, but I also summarized the changes below.

REPI-7, 20, 111, RECPI-6: no change

REPI-70 & 115: compromised and moved from main body to R408

RECPI-7: compromised and reduced EV requirement to apply to just 75% of dwelling units, not 100%

REPI-64: compromised and edited to allow CZ 3 to maintain current 3 ACH50, and only lowers that value to 2.5 (not 2.0) for CZ 4-8

REPI-68: compromised and edited so that cool roofs are not required in CZ3 and an exception offered to humid climates in Chapter 5

REPI-93: compromised and edited to exempt CZ5, but still expands ERV/HRV requirement into CZ6

REPI-33: compromised and added a 4th option and now requires 2 of the 4 options to be selected. Also made edits to the 3 current options (HP and HPWH must meet the R408 efficiency levels, and edited the option for 3 additional credits, to be 5 instead.)

REPI-122: changed envelope backstop UA multiplier to 1.0 and 1.10 (instead of 1.15); this change is made to all code sections for consistency (R102, 405, 406, Appendix RC)

My goal is for these REPI's to ALL move forward, providing both progress and flexibility, and perhaps by combining them all into one proposal/motion, they can.

COMPROMISE /OMNIBUS PROPOSAL

Color Coding Key

RECPI-6 / RECPI-7 REPI-33 REPI-64 REPI-68 REPI-93 REPI-111

REPI-7 REPI-20 REPI-70 REPI-115 REPI-122

2021 International Energy Conservation Code

CHAPTER 2 [RE] DEFINITIONS

SECTION R202 GENERAL DEFINITIONS

Add new definitions as follows (RECPI-6…I think they are the same as RECPI-7):

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 (EVSE). Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the *electric vehicle* connectors, attached 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*.

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 electrical infrastructure, 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*.

Add new definitions as follows (REPI-70 & REPI-115):

DEMAND RESPONSE SIGNAL. A signal that indicates a price or a request to modify electricity consumption for a limited time period.

DEMAND RESPONSIVE CONTROL. A control capable of receiving and automatically responding to a *demand response signal.*

ENERGY STORAGE SYSTEM (ESS). One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time.

Add new definition as follows (REPI-68):

LOW-SLOPED ROOF. A roof slope less than 2 units vertical in 12 units horizontal (17 percent slope).
STEEP-SLOPED ROOF. A roof slope 2 units vertical in 12 units horizontal (17 percent slope) or greater.

Add new definition as follows (REPI-7):

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.

Add new text as follows:

CHAPTER 1 [RE] SCOPE AND ADMINISTRATION

SECTION R103 CONSTRUCTION DOCUMENTS

R103.2.2 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.

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 required, 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.

Add new text as follows:

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY
SECTION R401 GENERAL

R401.3 (N1101.14) 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, and dimensions.

Add new text as follows:

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY
SECTION R402 BUILDING THERMAL ENVELOPE

R402.6 Roof reflectance. Roofs in Climate Zones 0 through 23 shall comply with one or more of the options in Table R402.6.

Exceptions:

1. Roofs with a radiant barrier with an emittance of 0.05 or less.
2. Portions of the roof that include or are covered by one or more of the following:
    2.1. *On-site renewable energy* systems or components

2.2. Solar air or water heating systems or components

2.3. Vegetative roofs or landscaped roofs

2.4. Above roof decks or walkways

2.5. Skylights

2.6. HVAC systems and components, and other opaque objects mounted above the roof

3. Portions of roof shaded during the peak sun angle of the summer solstice by permanent features of the building or by permanent features of adjacent buildings.

4. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (74 kg/m^2) or 23 psf (117 kg/m^2) pavers.

5. Roofs where portions exempted by exceptions 2, 3, and 4 make up not less than 75 percent of the total roof area.

TABLE R402.6 (TABLE N1102.6) MINIMUM ROOF REFLECTANCE[a]

Roof Slope	Three-year aged solar reflectance index[b]
Low-slope	75[b,c]
Steep-slope	16

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year-aged solar reflectance in accordance with Section R402.6.1

b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

c. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft 2 × °F (12 W/m 2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

R402.6.1 (N1102.6.1) Aged solar reflectance. Where an aged solar reflectance required by Section R402.6 is not available, it shall be determined in accordance with Equation 4-1.

$$R_{aged}=[0.2+0.7(R_{initial}-0.2)] \quad \text{(Equation 4-1)}$$

where:
R_{aged}=The aged solar reflectance
$R_{initial}$=The initial solar reflectance determined in accordance with CRRC-S100

Revise as follows:

SECTION 405 TOTAL BUILDING PERFORMANCE

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION[a]	TITLE
Building Thermal Envelope	

R402.6	Roof reflectance
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.4	Renewable energy infrastructure
R404.4	Electric readiness
R404.4	Electric Vehicle Power Transfer Infrastructure

TABLE R405.4.2(1) (TABLE N1105.4.2(1)) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Roofs	Type: composition shingle on wood sheathing. *Low-sloped*: modified bitumen *Steep-sloped*: asphalt shingles	As proposed
	Gross area: same as proposed.	As proposed
	Low-sloped: (Aged) Solar absorptance reflectance = 0.63 in Climate Zones 0 to 2 and 0.25 in Climate Zones 3 to 80.75. *Steep-sloped*: (Aged) Solar reflectance = 0.2 in Climate Zones 0 to 2 and 0.25 in Climate Zones 3 to 8.	As proposed
	Thermal Emittance = 0.900.75.	As proposed

SECTION R406 ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

Revise as follows:

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
R402.6	Roof Reflectance
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
R404.2	Interior lighting controls
R404.4	Renewable energy infrastructure
R404.4	Electric readiness
R404.4	Electric Vehicle Power Transfer Infrastructure

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

SECTION R407 TROPICAL CLIMATE REGION COMPLIANCE PATH

R407.2 (N1107.2) Tropical climate region.

Compliance with this section requires the following:

1. Not more than one-half of the *occupied* space is air conditioned.

2. The *occupied* space is not heated.

3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.

4. Glazing in *conditioned spaces* has a *solar heat gain coefficient* (SHGC) of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.

5. Permanently installed lighting is in accordance with Section R404.

6. The exterior roof surface complies with one of the options in Table R402.6~~C402.3 of the *International Energy Conservation Code* Commercial Provisions~~ or the roof or ceiling has insulation with an *R-value* of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.

7. Roof surfaces have a slope of not less than 1/4 unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.

8. Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.

9. Bedrooms with *exterior walls* facing two different directions have operable fenestration on exterior walls facing two directions.

10. Interior doors to bedrooms are capable of being secured in the open position.

11. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

CHAPTER 5 [RE] EXISTING BUILDINGS

R503 ALTERATIONS

R503.1.1 (N1111.1.1) Building envelope. Building envelope assemblies that are part of the *alteration* shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.12, R402.3.1, R402.3.2, R402.4.3, R402.6 and R402.4.5.

Exception:

1. Storm windows installed over existing fenestration.

2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.

3. Construction where the existing roof, wall or floor cavity is not exposed.

4. Roof recover where the new roofing meets the reflectance requirements under R402.6.

5. Roof recover in buildings in Very Hot Humid, Hot Humid, and Warm Humid Climate Zones, as designated in Figure R301.1.

~~5~~6. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

~~6~~7. Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided that the code does not require the glazing or fenestration assembly to be replaced.

CHAPTER 6 [RE] REFERENCED STANDARDS

Add new standard(s) as follows:

ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM C1549-2016	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E903-2012	Standard Test Method for Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres (Withdrawn 2005)
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E1918-06(2016)	Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-sloped Surfaces in the Field
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E1980- 11	Standard Practice for Calculating Solar Reflectance of Horizontal and Low-sloped Opaque Surfaces
CRRC	Cool Roof Rating Council 2435 North Lombard Street Portland OR 97217
ANSI/CRRC-S100-2021	Standard Test Methods for Determining Radiative Properties of Materials

Revise as follows (REPI-33):

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R402 BUILDING THERMAL ENVELOPE

TABLE R402.1.2 (TABLE R1102.1.2) MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

	FENESTRATION U-FACTOR[f]	SKYLIGHT U-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING U-FACTOR	WOOD FRAME WALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.02~~6~~30	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.02~~6~~30	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.02~~4~~26	0.045	0.098	0.047	0.059	0.065
5 and	0.30	0.55	0.40	0.02~~4~~26	0.045	0.082	0.033	0.050	0.055

Marine 4									
6	0.30	0.55	NR	0.02~~4~~26	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.02~~4~~26	0.045	0.057	0.028	0.050	0.055

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

	FENESTRATION U-FACTOR[b, i]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[g]	MASS WALL R-VALUE[h]	FLOOR R-VALUE	BASEMENT[c,g] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c,g] WALL R-VALUE
0	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
2	0.40	0.65	0.25	~~49~~38	13 or 0 & 10ci	4/6	13	0	0	0
3	.30	0.55	0.25	~~49~~38		8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	.30	0.55	0.40	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	13/17	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
6	0.30[i]	0.55	NR	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	15/20	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
7 and 8	0.30[i]	0.55	NR	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or	19/21	38	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci

					0 & 20ci[h]					

Revise as follows (REPI-64):

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R402 BUILDING THERMAL ENVELOPE

R402.4.1.3 (N1102.4.1.3) Prescriptive air leakage ~~Leakage~~ rate.

When complying with Section R401.2.1, the building or dwelling unit shall have an air leakage rate not exceeding 5.0 air changes per hour in Climate Zones 0, 1 and 2, ~~3.0~~ air changes per hour in Climate Zone 3, and ~~2.0~~ ~~3.0~~2.5 air changes per hour in Climate Zones ~~3~~4 through 8, when tested in accordance with Section R402.4.1.2.

TABLE R405.4.2(1) (TABLE N1105.4.2(1)) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air exchange rate	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zone 3: 3.0 air changes per hour. Climate Zones ~~3~~4 through 8: ~~2.0~~ ~~3.0~~ 2.5 air changes per hour.	The measured air exchange rate.[a]
	The mechanical ventilation rate shall be in addition to the air leakage rate and shall be the same as in the proposed design, but not greater than 0.01 × CFA + 7.5 × (N + 1) where: CFA = conditioned floor area, ft^2. N = number of bedrooms. The mechanical ventilation system type shall be the same as in the proposed design. Energy recovery shall not be assumed for mechanical ventilation.	The mechanical ventilation rate[b] shall be in addition to the air leakage rate and shall be as proposed.

Revise as follows (REPI-93):

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R403 SYSTEMS

R403.6.1 Heat or energy recovery ventilation.

Dwelling units shall be provided with a heat recovery or energy recovery ventilation system ~~in Climate Zones 7 and 8~~. The system shall be balanced with a minimum sensible heat recovery efficiency of 65 percent at 32°F (0°C) at a flow greater than or equal to the design airflow.

Exceptions:

1. *Dwelling units* in single- and two-family dwellings and townhouses in Climate Zones 0-~~5~~4.

2. *Dwelling units* in Group R occupancies that comply with Section C403.7.4.1.

Add new text as follows (REPI-111):

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R404 ELECTRICAL POWER AND LIGHTING SYSTEMS

R404.4 (N1104.4) Electric readiness. Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.4.1 through R404.4.4. All water heating systems shall comply with the space requirements of Section R404.4.5.

R404.4.1 (N1104.4.1) Cooking products. An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.

Exception: Cooking products not installed in an individual *dwelling unit*.

R404.4.2 (N1104.4.2) Household Clothes Dryers .

An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.

Exception: Clothes dryers that serve more than one *dwelling unit* and are located outside of a *dwelling unit*.

R404.4.3 (N1104.4.3) Water heaters.

An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.

Exception: Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.

R404.4.4 (N1104.4.4) Electrification-ready circuits.

The unused conductors required by Sections R404.4.1 through R404.4.3 shall be labeled with the word "spare." Space shall be reserved in the electrical panel in which the branch circuit originates for the installation of an overcurrent device. Capacity for the circuits required by Sections R404.4.1 through R404.4.3 shall be included in the load calculations of the original installation.

R404.4.5 (N1104.4.5) Water heater space.

An indoor space that is at least 3 feet (304 mm) by 3 feet (304 mm) wide by 7 feet (2133 mm) high shall be available surrounding or within 3 feet (304 mm) of the installed water heater.

Exceptions:

1. Installed heat pump, electric tankless, or fossil fuel tankless water heaters.

2. Water heaters in a centralized water heating system serving multiple *dwelling units* in a R-2 occupancy.

Add new text as follows (REPI-7):

R404.4 (N1104.4) Renewable energy infrastructure. The building shall comply with the requirements of R404.4.1 or R404.4.2.

R404.4.1 (N1104.4.1) 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 *dwelling unit* with a permanently installed on-site renewable energy system.
2. A *dwelling unit* with a solar-ready zone area that is less than 500 square feet (46 m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A *dwelling unit* with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
4. A *dwelling unit* with a *solar-ready zone* area that is shaded for more than 70 percent of daylight hours annually.
5. A *dwelling unit* that complies with Appendix RC.
6. A *dwelling unit* with a renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated whole-building electric use on an annual basis.

R404.4.1.1 (N1104.4.1.1) Solar-ready zone area. The total area of the *solar-ready zone* shall not be less than 250 square feet (23.2 m^2) and shall be composed of areas not less than 5.5 feet (1676 mm) in ~~i~~be one direction and not less than 80 square feet (7.4 m^2) exclusive of access or set back areas as required by the *International Residential Code*.

Exception: Dwelling units in 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 (N1104.4.1.2) Obstructions. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

R404.4.1.3 (N1104.4.1.3) Electrical service reserved space. The main electrical service panel shall have a reserved space for a dual pole circuit breaker and shall be labeled "For Future Solar Electric." The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.

R404.4.1.4 (N1104.4.1.4) 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 a minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".

R404.4.2 (N1104.4.2) Group R occupancies. Buildings in Group R-2, R-3 and R-4 shall comply with Section C405.13.

~~Add~~ **new text as follows (RECPI-6 & 7):**

R404.4 Electric Vehicle Power Transfer Infrastructure. New *automobile parking spaces* for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.4.1 through R404.4.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.4.1 through R404.4.5.

R404.4.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one *EV-capable, EV-ready, or EVSE installed space* per dwelling unit. R-2 occupancies or allocated parking for R-2 occupancies in mixed-use buildings shall be provided with an EV capable space, EV ready space, or EVSE space for 75% of ~~each~~ dwelling units or automobile parking spaces, whichever is less.

R404.4.2 EV Capable Spaces. Each *EV capable space* used to meet the requirements of Section R404.4.1 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 capable space* and a suitable panelboard or other onsite electrical distribution equipment.

2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.4.4

3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-pole circuit breaker or set of fuses.

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

R404.4.3 EV Ready Spaces. Each branch circuit serving *EV ready spaces* shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each *EV ready space* it serves.

2. Have a minimum circuit capacity in accordance with R404.4.4.

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)."

R404.4.4 Circuit Capacity. The capacity of electrical infrastructure serving each *EV capable space, EV ready space* and *EVSE space* shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each *EV capable space, EV ready space* or *EVSE* space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.

R404.4.4 Circuit Capacity. The capacity of electrical infrastructure serving each *EV capable space, EV ready space* and *EVSE* space shall comply with one of the following:

1. A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each *EV capable space, EV ready space* or *EVSE* space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.

2. The requirements of R404.4.4.4.1.

Exceptions:

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

2. For R-2 occupancies, where substantiation has been approved that meeting the requirements of Section R404.4.4.1 will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the builder or developer by more than $400.00 per dwelling unit.

R404.4.4.1 Circuit capacity management. The capacity of each branch circuit serving multiple *EVSE spaces, EV ready space* or *EV capable spaces* designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.

R404.4.5 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.

R404.4.5 EVSE installation. EVSE shall be installed in accordance with NFPA 70 and Section R404.4.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.

R404.4.5.1 EVSE minimum charging rate.

Each installed EVSE shall comply with one of the following:

1. Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).

2. Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.4.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.

CHAPTER 6 [RE] REFERENCED STANDARDS

Add new standard(s) as follows:

UL	UL LLC 333 Pfingsten Road Northbrook IL 60062
UL 2202-2009	Electric Vehicle (EV) Charging System - with revisions through February 2018
UL	UL LLC 333 Pfingsten Road Northbrook IL 60062
UL 2594-2016	Standard for Electric Vehicle Supply Equipment

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R408 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

Revise as follows (REPI-33) and correlated with REPI-18 and 20

R408.2 (N1108.2) Additional energy efficiency credit requirements ~~package options~~.

Two of the additional ~~Additional~~ efficiency ~~package options for compliance with Section R401.2.1 are set forth in Sections Table~~ R408.2.1 through R408.2.5. measures shall be selected from Table R408.2 that ~~are cumulatively equal to or greater than~~ meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of conditioned floor area. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table 408.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.

Add new text as follows:

R408.2.1 Opaque wall option.

For *buildings* in climate zones 4 and 5, the maximum U-factor of 0.060 shall be permitted to be used for wood frame walls for compliance with Table R402.1.2 where complying with two ~~one~~ or more of the following:

1. ~~A heat pump is installed for~~ Primary space heating is provided by a heat pump that meets one of the efficiencies in R408.2.3.

2. All installed water heaters are heat pumps that meet one of the efficiencies in R408.2.4~~have a UEF equal to or greater than 2.0 or a COP of greater than 1.0~~.

3. In addition to the number of credits required by Section R408.2, ~~three~~ five additional credits are achieved.

4. Renewable energy resources are installed to meet the requirements of R408.2.8.

TABLE R408.2
CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		CZ 0 & 1	CZ 2	CZ 3	CZ 4	CZ 4C	CZ 5	CZ 6	CZ 7	CZ 8
R408.2.9.1	Electrical energy storage	1	1	1	1	1	1	1	1	1
R408.2.9.2	Electrical energy storage ready	0	0	0	0	0	0	0	0	0
R408.2.9.3	Electrical energy storage (R-2, R-4)	1	1	1	1	1	1	1	1	1
R408.2.10	Demand Responsive Thermostat	1	1	1	1	1	1	1	1	1

R408.2.9 Electrical Energy Storage

One- and two-family dwellings, townhouse units, and Group R-3 occupancies shall either comply with R408.2.9.1 or R408.2.9.2. Buildings with Group R-2 and R-4 occupancies shall comply with R408.2.9.3.

R408.2.9.1 Electrical energy storage energy capacity. Each building shall have a ESS with a minimum rated energy capacity of 5 kWh with a minimum of four ESS supplied branch circuits.

R408.2.9.2 Electrical energy storage system ready. Each building shall be energy storage ready in accordance with Sections R408.2.9.2.1 through R408.2.9.2.4.

R408.2.9.2.1 Energy storage system space. Interior or exterior space with dimensions and locations in accordance with Section R328 of the *International Residential Code* and Section 110.26 of NFPA 70 shall be reserved to allow for the future installation of an *energy storage system*.

R408.2.9.2.2 System Isolation Equipment Space. Space shall be reserved to allow for the future installation of a transfer switch within 3 feet (305mm) of the main panelboard. Raceways shall be installed between the panelboard and the transfer switch location to allow the connection of an ESS.

R408.2.9.2.3 Panelboard with backed-up load circuits. A dedicated raceway from the main service to a panelboard that supplies the branch circuits served by the ESS. All branch circuits are permitted to be supplied by the main service panel prior to the installation of an ESS. The trade size of the raceway shall be not less than one inch. The panelboard that supplies the branch circuits shall be labeled "Subpanel reserved for future battery energy storage system to supply essential loads."

R408.2.9.2.4 Branch circuits served by ESS. A minimum of four branch circuits shall be identified and have their source of supply collocated at a single panelboard supplied by the ESS. The following end uses shall be served by the branch circuits:

1. A refrigerator.

2. One lighting circuit near the primary egress.

3. A sleeping room receptacle outlet.

R408.2.9.3 Electrical energy storage system. Buildings with Group R-2 and R-4 occupancies shall comply with C405.15.

R408.2.10 Demand Response

The thermostat controlling the primary heating or cooling system of each *dwelling unit* shall be provided with a *demand responsive control* capable of communicating with the Virtual End Node (VEN) using a wired or wireless bi-directional communication pathway that provides the occupant the ability to voluntarily participate in utility demand response programs, where available. The thermostat shall be capable of executing the following actions in response to a *demand response signal*:

1. Automatically increasing the zone operating cooling set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C), and 4°F (2°C).
2. Automatically decreasing the zone operating heating set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C), and 4°F (2°C).

Thermostats controlling single stage HVAC systems shall comply with Section R408.2.10.1. Thermostats controlling variable capacity systems shall comply with Section R408.2.10.2. Thermostats controlling multi-stage HVAC systems shall comply with either Section R408.2.10.1 or R408.2.10.2.

Where a *demand response signal* is not available the thermostat shall be capable of performing all other functions.

R408.2.10.1 Single stage HVAC system controls. Thermostats controlling single stage HVAC systems shall be provided with a *demand responsive control* that complies with one of the following:

1. Certified OpenADR 2.0a VEN, as specified under Clause 11, Conformance
2. Certified OpenADR 2.0b VEN, as specified under Clause 11, Conformance
3. Certified by the manufacturer as being capable of responding to a *demand response signal* from a certified OpenADR 2.0b VEN by automatically implementing the control functions requested by the VEN for the equipment it controls
4. IEC 62746-10-1
5. The communication protocol required by a controlling entity, such as a utility or service provider, to participate in an automated demand response program
6. The physical configuration and communication protocol of CTA 2045-A or CTA-2045-B

R408.2.10.2 Variable capacity and two stage HVAC system controls. Thermostats controlling variable capacity and two stage HVAC systems shall be provided with a *demand responsive control* that complies with the communication and performance requirements of AHRI 1380.

CHAPTER 6 [RE] REFERENCED STANDARDS

Add new standard(s) as follows:

CTA

Consumer Technology Association Technology & Standards Department

1919 S Eads Street

Arlington, VA 22202

CTA Consumer Technology Association Technology & Standards Department. ANSI/CTA-2045-B – 2018: Modular Communications

Interface for Energy Management

IEC

IEC Regional Centre for North America

446 Main Street 16th Floor

Worcester, MA 01608

IEC IEC Regional Centre for North America. IEC 62746-10-1 - 2018: Systems interface between customer energy management system and the power management system - Part 10-1: Open automated demand response

OpenADR

OpenADR Alliance

111 Deerwood Road, Suite 200

San Ramon, CA 94583

OpenADR OpenADR Alliance. OpenADR 2.0a and 2.0b – 2019: Profile Specification Distributed Energy Resources

AHRI

Air-Conditioning, Heating, & Refrigeration Institute

2111 Wilson Blvd, Suite 500

Arlington, VA 22201

AHRI 1380-2019 Demand Response through Variable Capacity HVAC Systems in Residential and Small Commercial

Applications

Add new text as follows:

CTA Consumer Technology Association Technology & Standards Department ANSI/CTA-2045-A – 2018:. Modular Communications

Interface for Energy Management

Revise as follows (REPI-122):

R102.1.1Above code programs. The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. *Buildings approved* in writing by such an energy-efficiency program shall be considered to be in compliance with this code where such buildings also meet the requirements identified in Table R405.2 and the proposed total *building thermal envelope* UA, which is the sum of *U*-factor times assembly area, shall be less ~~is greater~~ than or equal to the *building thermal envelope* UA using the prescriptive *U*-factors from Table R402.1.2 multiplied by ~~1.15~~1.00 in Climate Zones 0, 1, and 2, and by 1.10 in Climates Zones 3 through 8, in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3

shall be 0.30. ~~levels of efficiency and solar heat gain coefficients in Tables 402.1.1 and 402.1.3 of the 2009 *International Energy Conservation Code*.~~

For Climate Zones 0-2: $UA_{Proposed\ design} \leq 1.00 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)

For Climate Zones 3-8: $UA_{Proposed\ design} \leq 1.10 \times UA_{Prescriptive\ reference\ design}$

Revise as follows:

R401.2.5 Additional energy efficiency.

This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying with Section R401.2.1, one of the additional efficiency package options shall be installed according to Section R408.2.

~~2. For buildings complying under with Section R401.2.2 , the building shall meet one of the following:~~

~~2.1. One of the additional efficiency package Options in Section R408.2 shall be installed without including such measures in the proposed design under Section R405; or~~

~~2.2. The proposed design of the building under Section R405.3 shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design.~~

2~~3~~. For buildings complying with the Energy Rating Index alternative Section R401.2.3, the Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified in Table R406.5.

The option selected for compliance shall be identified in the certificate required by Section R401.3.

R405.2 (N1105.2) Performance-based compliance.

Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.

2. The proposed total *building thermal envelope* UA, which is the sum of the U-factor times assembly area, shall be less ~~greater~~ than or equal to the *building thermal envelope* UA using the prescriptive *U*-factors from Table R402.1.2 multiplied by ~~1.15~~1.00 in Climate Zones 0, 1 and 2, and 1.10 in Climates Zones 3 through 8, in accordance with Equation 4-1.~~levels of efficiency and solar heat gain coefficients in Table R402.1.1 or R402.1.3 of the 2009 *International Energy Conservation Code*.~~The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

~~Equation 4-1: $UA_{proposed\ design} <= 1.15 \times UA_{prescriptive\ reference}$ design.~~

For Climate Zones 0-2: $UA_{Proposed\ design} \leq 1.00 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)

For Climate Zones 3-8: $UA_{Proposed\ design} \leq 1.10 \times UA_{Prescriptive\ reference\ design}$

3. For buildings without a fuel burning appliance for space heating or water heating, ~~An~~ the annual energy cost of the *proposed design* that is less than or equal to 85 percent of the annual energy cost of the *standard reference design* or the additional efficiency credits as required in Section R408.2 shall be installed without including such measures in the proposed design under Section R405. For *dwelling units*

with greater than 5,000 square feet (465 m^2) of conditioned floor area, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the *proposed design* that is less than or equal to 80 percent of the annual energy cost of the *standard reference design.*

Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.

TABLE R405.4.2(1) (TABLE N1105.4.2(1)) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN		
Heating systems[d, e, j, k]		~~As proposed~~		
	Fuel Type/Capacity: Same as proposed design	As proposed		
	Product class: Same as proposed design	As proposed		
	Efficiencies:	As proposed		
	Heat pump: Complying with 10 CFR §430.32	As proposed		
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed		
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed		
Cooling systems[d, f, k]		~~As proposed~~		
	Fuel Type: Electric Capacity: Same as proposed design	As proposed		
	Efficiencies: Complying with 10 CFR §430.32	As proposed		
Service water heating[d, g, k]				
		Compactness ratio[i] factor		**HWDS**
		1 story	2 or more stories	
		> 60%	> 30%	0
		> 30% to ≤ 60%	> 15% to ≤	0.05

<table>
<tr><td></td><td></td><td></td><td>30%</td><td></td></tr>
<tr><td></td><td></td><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td></td><td></td><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
<tr><td></td><td>Fuel Type: Same as proposed design</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Draw Pattern: Same as proposed design</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td><td></td><td></td></tr>
<tr><td>Thermal distribution systems</td><td>Duct insulation: in accordance with Section R403.3.1.

Duct location: ~~same as proposed design~~

<table><tr><th>Foundation Type</th><th>Slab on grade</th><th>Unconditioned crawlspace</th><th>Basement or conditioned crawlspace</th></tr><tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

-

All other: 75% in unconditioned attic and 25% inside conditioned space

-</td><td>One-story building: 100% in unconditioned crawlspace

-

All other: 75% in unconditioned crawlspace and 25% inside conditioned space

-</td><td>50% inside conditioned space

-

50% unconditioned attic

-</td></tr></table>
Duct system leakage to outside:

For duct systems serving > 1,000ft² of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min)</td><td>Duct insulation: as proposed.

Duct location: as proposed.

Duct System Leakage to Outside:

The measured total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.

Exceptions:

1.. When duct system</td><td></td><td></td></tr>
</table>

	per 100 ft² (9.29 m²) of *conditioned floor area.* For duct systems serving ≤ 1,000ft² of *conditioned floor area*, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).	leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered. 2. When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of *conditioned floor area.*		
	~~For all systems other than tested duct systems. a~~ For hydronic systems and ductless systems.a ~~A~~ thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies. ~~for all systems other than tested duct systems.~~ **~~Exception:~~** ~~For nonducted heating and cooling systems that do not have a fan, the standard reference design thermal distribution system efficiency (DSE) shall be 1.~~ ~~For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of *conditioned floorarea* at a pressure of differential of 0.1 inch w.g. (25 Pa).~~	~~As tested or, where not tested,~~ For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).		

g. For a proposed design ~~with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design~~ without a proposed water heater, ~~a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed~~ the following assumptions shall be made for both the proposed design and standard reference design.
Fuel Type: Same as the predominant heating fuel type
Rated Storage Volume: 40 Gallons
Draw Pattern: Medium
Efficiency: Uniform Energy Factor complying with 10 CFR §130.32

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

k. For heating systems, cooling systems, or water heating systems not included in Table R405.4.2(1), the standard reference design shall be the same as proposed design.

TABLE R405.4.2(2) DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS[a]

Distribution system components located in unconditioned space	NA	0.95
~~Untested distribution~~ Distribution system ~~systems~~ components entirely located in conditioned space[c]	~~0.88~~NA	1
Ductless systems[d]	1	NA

a. Default values in this table are for untested distribution systems, which must still meet minimum requirements for duct system insulation.

b. Hydronic systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed-loop piping and that do not depend on ducted, forced airflow to maintain space temperatures.

c. Entire system in conditioned space shall mean that no component of the distribution system, including the air-handler unit, is located outside of the conditioned space.

d. Ductless systems shall be allowed to have forced airflow across a coil but shall not have any ducted airflow external to the manufacturer's air-handler enclosure.

Add new standard(s) as follows:

DOE	US Department of Energy c/o Superintendent of Documents 1000 Independence Avenue SW Washington DC 20585
10 CFR, Part 430-2021	Energy Conservation Program for Consumer Products: Energy and Water Conservation Standards and their compliance dates.

Add this section (revised per REPI-126) and further revise as follows as part of the Omnibus:

R406.3 Building thermal envelope. ~~Building and portions thereof shall comply with Section R406.3.1 or R406.3.2.~~

~~**R406.3.1 On-site renewables are not included.** Where on-site renewable energy is not included for compliance using the ERI analysis of Section R406.4, t~~The proposed total building thermal envelope UA, which is sum of *U*-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive *U*-factors from Table R402.1.2 multiplied by ~~1.15~~ 1.00 in Climate Zones 0, 1, and 2, and by 1.10 in Climates Zones 3 through 8, in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

~~$UA_{Proposed\ design} \leq 1.15 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)~~

For Climate Zones 0-2: $UA_{Proposed\ design} \leq 1.00 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)

For Climate Zones 3-8: $UA_{Proposed\ design} \leq 1.10 \times UA_{Prescriptive\ reference\ design}$

~~**R406.3.2 On-site renewables are included.** Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 *International Energy Conservation Code*.~~

Voted Negative with Reason (ballot 2):

Amann, Jennifer

This proposal reduces the efficiency of the code by rolling back prescriptive ceiling insulation requirements to 2012 IECC levels and, for climate zones 4 and 5, by reducing wall insulation requirements. Weakening of ceiling insulation requirements also reduces the stringency of UA-based compliance options and the performance path covered in section R405. The proposed offsets have not been shown to be equivalent to the efficiency losses resulting from the reduced ceiling and wall insulation requirements. ACEEE is opposed to the tradeoff of long-term envelope efficiency gains from the 2021 IECC for shorter-lived equipment measures including measures that are increasingly likely to be installed as more and more all-electric homes are constructed.

The 2024 IECC must achieve improvements in energy efficiency and decarbonization to support measurable progress toward zero emissions buildings. ACEEE could accept modifications to provide added flexibility as follows: 1) restore the ceiling insulation requirements in Tables R402.1.2 and R402.1.3 by modifying the tables in REPI-33 as shown below; and 2) allow a maximum wood frame wall U-factor of 0.060 and maximum ceiling U-factor of 0.026 in climate zones 4 and 5 only with the additional requirement that builders adopt two out of three options to install electric heat pumps, heat pump water heaters, and/or renewable energy generation. Any points associated with the options used for compliance with this section cannot be applied toward credits required for compliance with Section R408.2.

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.0~~30~~26	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.0~~30~~26	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.0~~26~~24	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.40	0.0~~26~~24	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.0~~26~~24	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.0~~26~~24	0.045	0.057	0.028	0.050	0.055

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

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
2	0.40	0.65	0.25	~~38~~49	13 or 0 & 10ci	4/6	13	0	0	0
3	.30	0.55	0.25	~~38~~49	20 or 13 & 5ci[h] or 0 & 15ci[h]	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	.30	0.55	0.40	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	13/17	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
6	0.30[i]	0.55	NR	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	15/20	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
7 and 8	0.30[i]	0.55	NR	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	19/21	38	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci

R408.2.1 Opaque ~~wall~~ envelope option. For *buildings* in climate zones 4 and 5, the maximum U-factor of 0.060 shall be permitted to be used for wood frame walls and the maximum U-factor of 0.026 shall be permitted to be used for ceilings for compliance with Table R402.1.2 where ~~complying with~~ ~~one~~ two ~~or more~~ of the following options are installed. The credits associated with the selected options for complying with this section shall not apply towards the credits required for complying with Section R408.2.

1. ~~A heat pump is installed for space heating.~~ Primary space heating is provided by a heat pump that meets the requirements of R408.2.3.
2. All installed water heaters are heat pump water heaters that meet the requirements of R408.2.4~~have a UEF equal to or greater than 2.0 or a COP of greater than 1.0.~~
3. Renewable energy resources are installed to meet the requirements of R408.2.8.

Gonzalez-Laders, Emma

My previous comment on ballot #1 included outdated efficiency metrics and testing standards that have been recently revised by the DOE and designed to more accurately reflect how heat pumps will perform after installation. The previous comment also contained an error.

Maintain the same modifications to Tables R402.1.2 and R402.1.3 from ballot #1 and modify efficiency values of Section R408.2.1 as follows:

R408.2.1 Opaque wall option. For buildings in climate zones 4 and 5, the maximum U-factor of 0.060 shall be permitted to be used for wood frame walls for compliance with Table R402.1.2 where complying with two ~~one~~ or more of the following:

1. A heat pump is installed for primary space heating with an efficiency greater than or equal to either ~~10 HSPF~~ 8.5 HSPF2/~~16 SEER~~ 16.9 SEER 2 or 3.5 COP.

2. All installed water heaters ~~have~~ are heat pump water heaters with a UEF equal to or greater than ~~2.0~~ ~~2.9~~ 3.3 ~~or a COP of greater than 1.0~~.

3. Renewable energy resources permanently installed that have the rated capacity to produce a minimum of 1.0 watt of on-site renewable energy per square foot of conditioned floor area.

4. In addition to the number of credits required by Section R408.2, three additional credits are achieved.

Reason: Update efficiency metrics and testing standards and correct an error

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Stone, Mike

Negative with comment (This appears to decrease efficiency and needs more consideration during the next round of comments).

Vijayakumar, Gayathri

While I support REPI-33, I am submitting a negative vote so that the attached modification [“Omnibus” proposal] can be discussed at the September meeting. Presented as a mod to REPI-33, it combines REPI-33 with text from RECPI-6, RECPI-7, REPI-64, 68, 93, and 111. My goal is for these REPI’s to ALL move forward and perhaps by combining them all into one proposal/motion, they can.

COMPROMISE /OMNIBUS PROPOSAL

Color Coding Key

RECPI-6 / RECPI-7 REPI-33 REPI-64 REPI-68 REPI-93 REPI-111

2021 International Energy Conservation Code

CHAPTER 2 [RE] DEFINITIONS

SECTION R202 GENERAL DEFINITIONS

Add new definitions as follows (RECPI-6…I think they are the same as RECPI-7):

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 (EVSE). Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the *electric vehicle* connectors, attached 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*.

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 electrical infrastructure, 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*.

Add new definition as follows (REPI-68):

LOW-SLOPED ROOF. A roof slope less than 2 units vertical in 12 units horizontal (17 percent slope).

STEEP-SLOPED ROOF. A roof slope 2 units vertical in 12 units horizontal (17 percent slope) or greater.

Add new text as follows:

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R402 BUILDING THERMAL ENVELOPE

R402.6 Roof reflectance. Roofs in Climate Zones 0 through 3 shall comply with one or more of the options in Table R402.6.

Exceptions:

1. Roofs with a radiant barrier with an emittance of 0.05 or less.

2. Portions of the roof that include or are covered by one or more of the following:

    2.1. *On-site renewable energy* systems or components

    2.2. Solar air or water heating systems or components

    2.3. Vegetative roofs or landscaped roofs

    2.4. Above roof decks or walkways

    2.5. Skylights

    2.6. HVAC systems and components, and other opaque objects mounted above the roof

3. Portions of roof shaded during the peak sun angle of the summer solstice by permanent features of the building or by permanent features of adjacent buildings.

4. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (74 kg/m^2) or 23 psf (117 kg/m^2) pavers.

5. Roofs where portions exempted by exceptions 2, 3, and 4 make up not less than 75 percent of the total roof area.

TABLE R402.6 (TABLE N1102.6) MINIMUM ROOF REFLECTANCE[a]

Roof Slope	Three-year aged solar reflectance index[b]
Low-slope	75[b,c]
Steep-slope	16

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year-aged solar reflectance in accordance with Section R402.6.1

b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

c. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft 2 × °F (12 W/m 2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

R402.6.1 (N1102.6.1) Aged solar reflectance. Where an aged solar reflectance required by Section R402.6 is not available, it shall be determined in accordance with Equation 4-1.

$$R_{aged}=[0.2+0.7(R_{initial}-0.2)] \quad \text{(Equation 4-1)}$$

where:

R_{aged}=The aged solar reflectance

$R_{initial}$=The initial solar reflectance determined in accordance with CRRC-S100

Revise as follows:

SECTION 405 TOTAL BUILDING PERFORMANCE

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION[a]	TITLE
Building Thermal Envelope	
R402.6	Roof reflectance
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.4	Electric readiness
R404.4	Electric Vehicle Power Transfer Infrastructure

TABLE R405.4.2(1) (TABLE N1105.4.2(1)) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Roofs	Type: ~~composition shingle on wood sheathing.~~ *Low-sloped*: modified bitumen *Steep-sloped*: asphalt shingles	As proposed
	Gross area: same as proposed.	As proposed
	Low-sloped: (Aged) Solar ~~absorptance~~ reflectance = 0.63~~0.75~~. *Steep-sloped*: (Aged) Solar reflectance = 0.2	As proposed
	Thermal Emittance = ~~0.90~~0.75.	As proposed

SECTION R406 ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

Revise as follows:

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
R402.6	Roof Reflectance
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
R404.2	Interior lighting controls
R404.4	Electric readiness
R404.4	Electric Vehicle Power Transfer Infrastructure

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

SECTION R407 TROPICAL CLIMATE REGION COMPLIANCE PATH

R407.2 (N1107.2) Tropical climate region.

Compliance with this section requires the following:

1. Not more than one-half of the *occupied* space is air conditioned.

2. The *occupied* space is not heated.

3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.

4. Glazing in *conditioned spaces* has a *solar heat gain coefficient* (SHGC) of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.

5. Permanently installed lighting is in accordance with Section R404.

6. The exterior roof surface complies with one of the options in Table R402.6~~C402.3 of the *International Energy Conservation Code* Commercial Provisions~~ or the roof or ceiling has insulation with an *R-value* of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.

7. Roof surfaces have a slope of not less than 1/4 unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.

8. Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.

9. Bedrooms with *exterior walls* facing two different directions have operable fenestration on exterior walls facing two directions.

10. Interior doors to bedrooms are capable of being secured in the open position.

11. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

CHAPTER 5 [RE] EXISTING BUILDINGS

R503 ALTERATIONS

R503.1.1 (N1111.1.1) Building envelope. Building envelope assemblies that are part of the *alteration* shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.12, R402.3.1, R402.3.2, R402.4.3, R402.6 and R402.4.5.

Exception:

1. Storm windows installed over existing fenestration.

2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.

3. Construction where the existing roof, wall or floor cavity is not exposed.

4. Roof recover where the new roofing meets the reflectance requirements under R402.6.

5. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

6. Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided that the code does not require the glazing or fenestration assembly to be replaced.

CHAPTER 6 [RE] REFERENCED STANDARDS

Add new standard(s) as follows:

ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM C1549-2016	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E903-2012	Standard Test Method for Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres (Withdrawn 2005)
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E1918-06(2016)	Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-sloped Surfaces in the Field
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E1980- 11	Standard Practice for Calculating Solar Reflectance of Horizontal and Low-sloped Opaque Surfaces
CRRC	Cool Roof Rating Council 2435 North Lombard Street Portland OR 97217
ANSI/CRRC-S100-2021	Standard Test Methods for Determining Radiative Properties of Materials

Revise as follows (REPI-33):

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R402 BUILDING THERMAL ENVELOPE

TABLE R402.1.2 (TABLE R1102.1.2) MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

	FENESTRATION U-	SKYLIGHT U-	GLAZED FENESTRATION	CEILING U-FACTO	WOOD FRAME WALL	MASS WALL U-	FLOOR U-FACTO	BASEMENT WALL	CRAWL SPACE

	FACTOR[f]	FACTOR	SHGC[d, e]	R	U-FACTOR	FACTOR[b]	R	U-FACTOR	WALL U-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.02~~6~~30	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.02~~6~~30	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.02~~4~~26	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.40	0.02~~4~~26	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.02~~4~~26	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.02~~4~~26	0.045	0.057	0.028	0.050	0.055

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

	FENESTRATION U-FACTOR[b, i]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[g]	MASS WALL R-VALUE[h]	FLOOR R-VALUE	BASEMENT[c,g] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c,g] WALL R-VALUE
0	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
2	0.40	0.65	0.25	~~49~~38	13 or 0 & 10ci	4/6	13	0	0	0
3	.30	0.55	0.25	~~49~~38		8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	.30	0.55	0.40	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	~~60~~49	30 or 20 & 5ci[h] or 13 & 10ci[h] or	13/17	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci

					0 & 20ci[h]					
6	0.30[i]	0.55	NR	~~6049~~	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	15/20	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
7 and 8	0.30[i]	0.55	NR	~~6049~~	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	19/21	38	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci

Revise as follows (REPI-64):

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R402 BUILDING THERMAL ENVELOPE

R402.4.1.3 (N1102.4.1.3) Prescriptive air leakage ~~Leakage~~ rate.

When complying with Section R401.2.1, the building or dwelling unit shall have an air leakage rate not exceeding 5.0 air changes per hour in Climate Zones 0, 1 and 2, and 2.0 ~~3.0~~ air changes per hour in Climate Zones 3 through 8, when tested in accordance with Section R402.4.1.2.

TABLE R405.4.2(1) (TABLE N1105.4.2(1)) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air exchange rate	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 through 8: 2.0 ~~3.0~~ air changes per hour.	The measured air exchange rate.[a]
	The mechanical ventilation rate shall be in addition to the air leakage rate and shall be the same as in the proposed design, but not greater than 0.01 × CFA + 7.5 × (N + 1)	The mechanical ventilation rate[b] shall be in addition to the air leakage rate and shall be as proposed.

	where: CFA = conditioned floor area, ft^2. N = number of bedrooms. The mechanical ventilation system type shall be the same as in the proposed design. Energy recovery shall not be assumed for mechanical ventilation.	

Revise as follows (REPI-93):

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R403 SYSTEMS

R403.6.1 Heat or energy recovery ventilation.

Dwelling units shall be provided with a heat recovery or energy recovery ventilation system ~~in Climate Zones 7 and 8~~. The system shall be balanced with a minimum sensible heat recovery efficiency of 65 percent at 32°F (0°C) at a flow greater than or equal to the design airflow.

Exceptions:

1. *Dwelling units* in single- and two-family dwellings and townhouses in Climate Zones 0-4.

2. *Dwelling units* in Group R occupancies that comply with Section C403.7.4.1.

Add new text as follows (REPI-111):

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R404 ELECTRICAL POWER AND LIGHTING SYSTEMS

R404.4 (N1104.4) Electric readiness. Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.4.1 through R404.4.4. All water heating systems shall comply with the space requirements of Section R404.4.5.

R404.4.1 (N1104.4.1) Cooking products. An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.

Exception: Cooking products not installed in an individual *dwelling unit.*

R404.4.2 (N1104.4.2) Household Clothes Dryers .

An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.

Exception: Clothes dryers that serve more than one *dwelling unit* and are located outside of a *dwelling unit.*

R404.4.3 (N1104.4.3) Water heaters.

An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.

Exception: Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.

R404.4.4 (N1104.4.4) Electrification-ready circuits.

The unused conductors required by Sections R404.4.1 through R404.4.3 shall be labeled with the word "spare." Space shall be reserved in the electrical panel in which the branch circuit originates for the installation of an overcurrent device. Capacity for the circuits required by Sections R404.4.1 through R404.4.3 shall be included in the load calculations of the original installation.

R404.4.5 (N1104.4.5) Water heater space.

An indoor space that is at least 3 feet (304 mm) by 3 feet (304 mm) wide by 7 feet (2133 mm) high shall be available surrounding or within 3 feet (304 mm) of the installed water heater.

Exceptions:

1. Installed heat pump, electric tankless, or fossil fuel tankless water heaters.

2. Water heaters in a centralized water heating system serving multiple *dwelling units* in a R-2 occupancy.

Add new text as follows (RECPI-6 & 7):

R404.4 Electric Vehicle Power Transfer Infrastructure. New *automobile parking spaces* for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.4.1 through R404.4.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.4.1 through R404.4.5

R404.4.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one *EV-capable, EV-ready, or EVSE installed space* per dwelling unit. R-2 occupancies or allocated parking for R-2 occupancies in mixed-use buildings shall be provided with an EV capable space, EV ready space, or EVSE space for each dwelling unit or automobile parking space, whichever is less.

R404.4.2 EV Capable Spaces. Each *EV capable space* used to meet the requirements of Section R404.4.1 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 capable space* and a suitable panelboard or other onsite electrical distribution equipment.

2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.4.4

3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-pole circuit breaker or set of fuses.

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

R404.4.3 EV Ready Spaces. Each branch circuit serving *EV ready spaces* shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each *EV ready space* it serves.

2. Have a minimum circuit capacity in accordance with R404.4.4.

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)."

R404.4.4 Circuit Capacity. The capacity of electrical infrastructure serving each *EV capable space, EV ready space* and *EVSE space* shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each *EV capable space, EV ready space* or *EVSE* space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.

R404.4.4 Circuit Capacity. The capacity of electrical infrastructure serving each *EV capable space, EV ready space* and *EVSE* space shall comply with one of the following:

1. A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each *EV capable space, EV ready space* or *EVSE* space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.

2. The requirements of R404.4.4.4.1.

Exceptions:

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

2. For R-2 occupancies, where substantiation has been approved that meeting the requirements of Section R404.4.4.1 will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the builder or developer by more than $400.00 per dwelling unit.

R404.4.4.1 Circuit capacity management. The capacity of each branch circuit serving multiple *EVSE spaces, EV ready space* or *EV capable spaces* designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.

R404.4.5 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.

R404.4.5 EVSE installation. EVSE shall be installed in accordance with NFPA 70 and Section R404.4.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.

R404.4.5.1 EVSE minimum charging rate.

Each installed EVSE shall comply with one of the following:

1. Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).

2. Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.4.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.

CHAPTER 6 [RE] REFERENCED STANDARDS

Add new standard(s) as follows:

UL	UL LLC 333 Pfingsten Road Northbrook IL 60062
UL 2202-2009	Electric Vehicle (EV) Charging System - with revisions through February 2018
UL	UL LLC 333 Pfingsten Road Northbrook IL 60062
UL 2594-2016	Standard for Electric Vehicle Supply Equipment

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R408 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

Revise as follows (REPI-33)

R408.2 (N1108.2) Additional efficiency credits ~~package options~~.

Two additional ~~Additional~~ efficiency ~~package options for compliance with Section R401.2.1 are set forth in Sections Table~~ R408.2.1 through R408.2.5. measures shall be selected from Table R408.2 that are cumulatively equal to or greater than ten credits. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table 408.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.

Add new text as follows:

R408.2.1 Opaque wall option.

For *buildings* in climate zones 4 and 5, the maximum U-factor of 0.060 shall be permitted to be used for wood frame walls for compliance with Table R402.1.2 where complying with one or more of the following:

1. A heat pump is installed for space heating.

2. All installed water heaters have a UEF equal to or greater than 2.0 or a COP of greater than 1.0.

3. In addition to the number of credits required by Section R408.2, three additional credits are achieved.

Voted Negative with Reason (ballot 1):

Boyce, Amy

EECC is voting no on this proposal for the following reasons:

- It reduces baseline efficiency by setting prescriptive ceiling insulation requirements back to the levels of the 2012 IECC, a code now over a decade old, also reducing the stringency of UA-based compliance options and the Performance Path (R405).
- The proposed offsets for reducing wall insulation have not been shown to sufficiently counter the long term efficiency losses. HVAC and water heating equipment, as well as many of the additional efficiency credits, have a much shorter lifespan than envelope measures, making the trade-offs unbalanced.
- Credit may be given for items that would have been installed anyway, such as electric heat pumps, resulting in a reduction in efficiency with no actual gains.

We do not support any direct reductions in efficiency with respect to a prior code, and do not believe trade-offs should be offered for elements already to be included, or without justification of adequate energy savings.

Edminster, Ann

The proposal's rollback of wall insulation is not justified from a cost perspective; the costs for wall insulation given in NAHB's report are seven times those used in the 2016 California CASE report on this topic (and vetted by the California Building Industries Association). An insulation reduction that affects energy consumption for the life of the building should not be traded for adding a couple of electric circuits on the off-chance that it will result in reduction or elimination of fossil fuel usage. Further, heat pumps that might underperform in cold climates (e.g., CZ5) and thus drive use of electric resistance heating should be precluded to avoid unintended increases in energy use and emissions. To address these shortcomings, I recommend the following language:

R408.2.1 Opaque ~~wall~~ envelope insulation option. For buildings in climate zones 4 and 5, a maximum U-factor of 0.060 shall be allowed for wood frame walls and a maximum U-factor of 0.026 shall be allowed for ceilings for compliance with Table R402.1.2 where ~~one or more~~ all of the following options are installed. The points associated with the selected options for complying with this section shall not apply towards the ten points required for complying with Section R408.2:

1. Space heating shall be provided by a heat pump that meets the requirements of R408.2.3. If the heat pump is an air source heat pump, it shall have a variable speed compressor with at least three speeds and a COP of 1.75 measured at 5□F and maximum capacity operation.

2. All installed water heaters shall be heat pump water heaters that meet the requirements of R408.2.4. ~~2.0 or a COP of greater than 1.0~~

Finlayson, Ian

The requirements of REPI-33 that apply to R408.2 allow the envelope to be weakened in climate zones 4 and 5 while creating a tradeoff for mechanical equipment that lacks the durability and long term benefit associated with a better thermal envelope. In order to support this proposal these tradeoff options would have to be strengthened by making the following modifications to REPI-33:

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.0~~30~~26	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.0~~30~~26	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.0~~26~~24	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.40	0.0~~26~~24	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.0~~26~~24	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.0~~26~~24	0.045	0.057	0.028	0.050	0.055

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

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
2	0.40	0.65	0.25	~~38~~49	13 or 0 & 10ci	4/6	13	0	0	0
3	.30	0.55	0.25	~~38~~49	20 or 13 & 5ci[h] or 0 & 15ci[h]	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	.30	0.55	0.40	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13

5 and Marine 4	0.30[i]	0.55	0.40	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	13/17	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
6	0.30[i]	0.55	NR	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	15/20	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
7 and 8	0.30[i]	0.55	NR	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	19/21	38	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci

R408.2.1 Opaque ~~wall~~ envelope option. For buildings in climate zones 4 and 5, the maximum U-factor of 0.060 shall be permitted to be used for wood frame walls and the maximum U-factor of 0.026 shall be permitted to be used for ceilings for compliance with Table R402.1.2 where three additional credits are achieved in addition to the number of credits required by Section R408.2 and ~~complying with one~~two ~~or more~~ of the following options are installed. The credits associated with the selected options for complying with this section shall not apply towards the credits required for complying with Section R408.2.

1. ~~A heat pump is installed for space heating.~~ Primary space heating is provided by a heat pump that meets the requirements of R408.2.3.

2. All installed water heaters meet the requirements of R408.2.4.~~have a UEF equal to or greater than 2.0 or a COP of greater than 1.0~~

3. Renewable energy resources are installed to meet the requirements of R408.2.8.

Reason: Requiring builders to pick two options from a list of three choices: electric space conditioning, water heating, renewable energy generation, in addition to choosing a measure worth three additional credits, would sufficiently reduce a buildings carbon emissions to compensate for the long-term impact of weakening the building envelope. This proposal also ensures that the total number of credits from these measures exceed the ten required credits per REPI-18.

Statement from EECC: EECC opposes this proposal on the following grounds:

- It reduces baseline efficiency by setting prescriptive ceiling insulation requirements back to the levels of the 2012 IECC, a code now over a decade old, also reducing the stringency of UA-based compliance options and the Performance Path (R405).

- The proposed offsets for reducing wall insulation have not been shown to sufficiently counter the long term efficiency losses. HVAC and water heating equipment, as well as many of the additional efficiency credits, have a much shorter lifespan than envelope measures, making the trade-offs unbalanced.

- Credit may be given for items that would have been installed anyway, such as electric heat pumps, resulting in a reduction in efficiency with no actual gains.

We object to any straight reductions in efficiency with respect to a prior code, and do not believe trade-offs should be offered for elements already to be included, or without justification of adequate energy savings.

Gonzalez-Laders, Emma

this proposal reverses the efficiency in Climate Zones 4 and 5 by reducing the efficiency of the long-service-life building envelope by allowing short-service-life equipment trade-offs for “opaque walls ” without providing any technical analysis demonstrating that the trade-offs will result in comparable levels of efficiency. The proposal also reduces the efficiency of ceiling assemblies for Climate Zones 2-8 in Tables R402.1.2 and Table R402.1.3 to 2018 levels without providing any mitigating factors.

Revise as follows:

TABLE R402.1.2 (TABLE R1102.1.2) MAXIMUM ASSEMBLY U-FACTORS AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d,e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.026	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.026	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.024	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	NR	0.024	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.024	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.024	0.045	0.057	0.028	0.050	0.055

For SI: 1 foot = 304.8 mm.

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

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

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

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

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

f. A maximum *U*-factor of 0.32 shall apply in Marine Climate Zone 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:
1. Above 4,000 feet in elevation above sea level, or
2. In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the *International Residential Code*.

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

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b,i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b,e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0 + 10	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0 + 10	3/4	13	0	0	0
2	0.40	0.65	0.25	49	13 or 0 + 10	4/6	13	0	0	0
3	.30	0.55	0.25	49	20 or 13 + 5ci or 0 + 15	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	.30	0.55	0.40	60	20 + 5 or 13 + 10ci or 0 + 15	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	60	20 + 5 or 13 + 10ci or 0 + 15	13/17	30	15ci or 19 or 13 + 5ci	10ci, 4 ft	15ci or 19 or 13 + 5ci
6	0.30[i]	0.55	NR	60	20 + 5ci or 13 + 10ci or 0 + 20	15/20	30	15ci or 19 or 13 + 5ci	10ci, 4 ft	15ci or 19 or 13 + 5ci
7 and 8	0.30[i]	0.55	NR	60	20 + 5ci or 13 + 10ci or 0 + 20	19/21	38	15ci or 19 or 13 + 5ci	10ci, 4 ft	15ci or 19 or 13 + 5ci

For SI: 1 foot = 304.8 mm.
NR = Not Required.

ci = continuous insulation.

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

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
Exception: In Climate Zones 0 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

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

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

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

f. Basement wall insulation is not required in Warm Humid locations as defined by Figure R301.1 and Table R301.1.

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

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

i. A maximum *U*-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:
1. Above 4,000 feet in elevation, or
2. In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the *International Residential Code*.

R408.2.1 Opaque wall option. For buildings in climate zones 4 and 5, the maximum U-factor of 0.060 shall be permitted to be used for wood frame walls for compliance with Table R402.1.2 where complying with two ~~one~~ or more of the following:

1. A heat pump is installed for primary space heating with an efficiency greater than or equal to either 10 HSPF/16 SEER or 3.5 COP.

2. All installed water heaters ~~have~~ are heat pump water heaters with a UEF equal to or greater than ~~2.0~~ 2.9 ~~or a COP of greater than 1.0~~.

3. Renewable energy resources permanently installed that have the rated capacity to produce a minimum of 1.0 watt of on-site renewable energy per square foot of conditioned floor area.

4. In addition to the number of credits required by Section R408.2, three additional credits are achieved.

Herring, Bridget

Opposed to the reduction in building envelope values. Support flexibility for compliance depending on location however, I oppose the options provided in the proposed R408.2.1 opaque wall section for two reasons:

1. There has been no persuasive analysis that the level of performance in R408.2.1 is equivalent to the reduction in envelope values

2. The options in R408.2.1, as written, would consider National Appliance Energy Conservation Act (NAECA) equipment as additional efficiency. In addition, without further specification this would promote equipment that has been demonstrated in my jurisdiction to exacerbate peak demand which also occurs additional cost.

Koban, Mary

- For buildings in climate zones 4 and 5, the maximum U-factor of 0.060 shall be permitted to be used for wood frame walls for compliance with Table R402.1.2 where complying with one or more of the following:
- As the proponent states, the proposal lowers the prescriptive envelope requirements by requiring higher prescriptive HVAC and water heater requirements. However, AHRI notes that the house envelope will have a longer life than the HVAC or water heater equipment, and as such should have more prescriptive requirements than HVAC and water heaters. Otherwise, the energy savings are not fully guaranteed over the life of the building.
- AHRI recommends that at a minimum this code proposal list other tradeoff options than only the HVAC and water heater equipment, such as the windows, insulation, etc., alternatively, this portion of the code could be deleted.

Lindburg, Alison

- The requirements of REPI-33 that apply to R408.2 allow the envelope to be weakened while creating a tradeoff for mechanical equipment that lacks the durability and long-term benefit associated with a better thermal envelope.
- It reduces baseline efficiency by setting prescriptive ceiling insulation requirements back to the levels of the 2012 IECC, a code now over a decade old, also reducing the stringency of UA-based compliance options and the Performance Path (R405).
- The proposed offsets for reducing wall insulation have not been shown to sufficiently counter the long term efficiency losses. HVAC and water heating equipment, as well as many of the additional efficiency credits, have a much shorter lifespan than envelope measures, making the trade-offs unbalanced.

- Credit may be given for items that would have been installed anyway, such as electric heat pumps, resulting in a reduction in efficiency with no actual gains.

Suggested modification: Strengthen the Ceiling U-factors and R-values in CZ 2 through CZ 8.

Lyles, Mark

The requirements of REPI-33 that apply to R408.2 allow the envelope to be weakened in climate zones 4 and 5 while creating a tradeoff for mechanical equipment that lacks the durability and long term benefit associated with a better thermal envelope. In order to support this proposal these tradeoff options would have to be strengthened by making the following modifications to REPI-33:

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.03~~30~~26	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.03~~30~~26	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.0~~26~~24	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.40	0.0~~26~~24	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.0~~26~~24	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.0~~26~~24	0.045	0.057	0.028	0.050	0.055

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

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
2	0.40	0.65	0.25	~~38~~49	13 or 0 & 10ci	4/6	13	0	0	0

3	.30	0.55	0.25	~~38~~49	20 or 13 & 5ci[h] or 0 & 15ci[h]	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	.30	0.55	0.40	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	13/17	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
6	0.30[i]	0.55	NR	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	15/20	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
7 and 8	0.30[i]	0.55	NR	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	19/21	38	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci

R408.2.1 Opaque ~~wall~~ envelope option. For buildings in climate zones 4 and 5, the maximum U-factor of 0.060 shall be permitted to be used for wood frame walls and the maximum U-factor of 0.026 shall be permitted to be used for ceilings for compliance with Table R402.1.2 where three additional credits are achieved in addition to the number of credits required by Section R408.2 and ~~complying with one~~ two ~~or more~~ of the following options are installed. The credits associated with the selected options for complying with this section shall not apply towards the credits required for complying with Section R408.2.

1. ~~A heat pump is installed for space heating.~~ Primary space heating is provided by a heat pump that meets the requirements of R408.2.3.

2. All installed water heaters meet the requirements of R408.2.4~~.have a UEF equal to or greater than 2.0 or a COP of greater than 1.0~~

3. Renewable energy resources are installed to meet the requirements of R408.2.8.

Reason: Requiring builders to pick two options from a list of three choices: electric space conditioning, water heating, and renewable energy generation, in addition to choosing a measure worth three additional credits, would sufficiently reduce a buildings carbon emissions to compensate for the long-term impact of weakening the building envelope. This proposal also ensures that the total number of credits from these measures exceed the ten required credits per REPI-18.

Meyers, Jim

If real energy savings, improvements, to the code are to happen for new residential construction there needs to be an improvement to fenestration in hot climates. Any new proposal that has a focus on the envelope systems should also address the important of heat gain in buildings through windows. Although I don't agree with some sections of the amended tables – window improvements should be included. And these improvements are typically no cost improvements.

CLIMATE ZONE	FENESTRATION *U*-Factor[d]	Skylight *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]
0	NR	0.75	0.20
1	NR	0.75	0.20
2	0.40	0.65	0.20

Reason: Low SHGC windows are readily available in the hot climate markets. This was a missed opportunity during proposal development. Builders are currently installing better than 2021 IECC windows in climate zone 2 in the southwest. Reducing the SHGC values will benefit efficiency in all IECC compliance paths.

Noble, Michael

Fresh Energy cannot support rollback of higher insulation levels in attics and wall in zones 4 and 5 as a tradeoff for higher mechanical efficiencies. With a goal of net zero carbon in the built environment, it is especially egregious to consider a tradeoff that would lower building thermal envelope efficiency. Reaching the national goal of greater than 50% carbon reduction by 2030 and net zero by 2050 requires we increase ambition, not reduce it. Especially considering the goal of increased electrification, high thermal efficiency becomes an even higher priority, not a lower one. Mechanical systems are updated and changed but building wall sections last the life of the structure, so it is not reasonable to trade off a high efficiency wall system for a lower efficiency one that would endure for the life of the structure.

In addition, recent federal legislation would require jurisdictions to adopt a code at least as efficient as the 2021 IECC to qualify for certain federal funding. Would rollback of envelope thermal efficiencies to 2012 levels make states ineligible for certain federal funds?

Fresh Energy is open to compromises that would advance electrification, decarbonization and the increased reliance on renewable energy, but not higher efficiency fossil fuel combustion as a tradeoff for envelope efficiency.

Schmidt, Amy

1. Inconsistent with the intent and scope of the “additional efficiency” measures to put in trade-off

2. Especially troubling that we would include trade-offs for thermal envelope efficiency for HVAC with a shorter service life

3. Also counter intuitive to trade off the efficiency of the envelope which will create a greater HVAC load

Urbanek, Lauren

This proposal as written rolls back energy efficiency in climate zones 4 and 5, by reducing ceiling insulation requirements back to the requirements approximately equivalent to the 2012 IECC. The proposal also reduces wall insulation requirements in section R408.2. It is unclear whether the proposed tradeoffs would be – at a minimum - equivalent to the reduction in efficiency from reducing the wall insulation requirements, let alone resulting in a building that is more efficient and reduces carbon emissions compared to the 2021 IECC. In order to meet the nation's scientifically-driven climate goals of reducing emissions at least 50 percent by 2030, with a net zero emissions economy by 2050, new buildings play an important role. New buildings must be put on a glide path to achieve net zero emissions no later than the 2030 code cycle. If passed, this proposal heads in entirely the wrong direction and makes it significantly more difficult to meet that goal.

Contrary to the claims that increased wall insulation has a 100 year payback, research from California Title 24 demonstrates that high-performance walls are cost-effective (research found here: https://title24stakeholders.com/wp-content/uploads/2017/10/2016_CASE-Report_Residential-High-Performance-Walls.pdf).

NRDC understands the need for flexibility, but we cannot agree to a proposal that would reduce the efficiency of the code – or even to keep it at a static efficiency level. We must have a 2024 code that demonstrates progress toward decarbonized buildings. However, understand the need for compromise, and outline a reasonable solution in the strikethrough text below. This would allow for the maximum ceiling U-factor of 0.026 and a maximum wood frame wall U-factor of 0.060 in climate zones 4 and 5, while requiring builders to adopt two of three options to install heat pumps for space heating, heat pump water heaters, and/or renewable energy.

Furthermore, recent federal legislation would require jurisdictions to adopt a code at least as efficient as the 2021 IECC to qualify for certain federal funding. If this proposal passed into the 2024 IECC, there is a significant risk that jurisdictions would not be able to access federal funding for code adoption, making the 2024 IECC irrelevant.

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.0~~30~~26	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.0~~30~~26	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.0~~26~~24	0.045	0.098	0.047	0.059	0.065

5 and Marine 4	0.30	0.55	0.40	0.0~~26~~24	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.0~~26~~24	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.0~~26~~24	0.045	0.057	0.028	0.050	0.055

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

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0 & 10ci	3/4	13	0	0	0
2	0.40	0.65	0.25	~~38~~49	13 or 0 & 10ci	4/6	13	0	0	0
3	.30	0.55	0.25	~~38~~49	20 or 13 & 5ci[h] or 0 & 15ci[h]	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	.30	0.55	0.40	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	13/17	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
6	0.30[i]	0.55	NR	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	15/20	30	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci
7 and 8	0.30[i]	0.55	NR	~~49~~60	30 or 20 & 5ci[h] or 13 & 10ci[h] or 0 & 20ci[h]	19/21	38	15ci or 19 or 13 & 5ci	10ci, 4 ft	15ci or 19 or 13 & 5ci

R408.3 ~~2.1 Opaque wall~~ Reduced envelope insulation option. For *buildings* in climate zones 4 and 5, the maximum U-factor of 0.060 shall be permitted to be used for wood frame walls and the maximum U-factor of 0.026 shall be permitted to be used for ceilings for compliance with Table R402.1.2 where ~~complying with one~~ two or more of the of the following are installed. The points associated with the selected options for complying with this section shall not apply toward the ten points required for complying with Section R408.2.

4. ~~A heat pump is installed for space heating.~~ Space heating is provided by a heat pump that meets the requirements of R408.2.3. If the heat pump is an air source heat pump, it shall have a variable speed compressor with at least three speeds and a COP of 1.75 measured at 5 degrees Fahrenheit and at maximum capacity operation.

5. All installed water heaters shall be heat pump water heaters that meet the requirements of R408.2.4. ~~have a UEF equal to or greater than 2.0 or a COP of greater than 1.0.~~

6. Renewable energy resources shall be installed that meet the requirements of R408.2.8.

Wiley, Seth

- Energy efficiency of the 2021 Code is understood to be the baseline for consensus development and including the REPI-33 strikeouts would seem to allow the Code to be less energy efficient that the 2021 Code; however, given that GHG emissions reduction is now part of the IECC development purview, this proposed text change below to REPI-33 is intended to recognize the benefits of flexibility in the Code while achieving decreased GHG emission.

Proposed Text to resolve Negative Vote:

- Remove REPI-33 strikeouts from Table R402.1.2 and create a new Table Footnote for the Ceiling U-Factor column enumerated footnote “g”; the Footnote “g” should indicate that use of Ceiling U-Factors as proposed in REPI-33 is allowed provided that there is no on-site fossil fuel burning equipment for purposes other than emergency back-up power generation.

- Remove strikeouts from Table R402.1.3 and create a new Table Footnote for the Ceiling R-Value column enumerated footnote “j”; the Footnote “j” should indicate that use of Ceiling R-Values as proposed in REPI-33 is allowed provided that there is no on-site fossil fuel burning equipment for purposes other than emergency back-up power generation.

REPI-64-21

IECC®: R402.4.1.2, R402.4.1.3, TABLE R405.4.2(1), R408.2.5

Proponents:
William Fay, representing Energy Efficient Codes Coalition; Amy Boyce, representing Energy Efficient Codes Coalition (amy.boyce@imt.org); Amber Wood, representing Energy Efficient Codes Coalition (awood@aceee.org); Jason Reott, representing Energy Efficient Codes Coalition

2021 International Energy Conservation Code

Revise as follows:

R402.4.1.2 (N1102.4.1.2) Testing and maximum air leakage rate.

The *building* or *dwelling unit* shall be tested for air leakage. 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 $m^3/(s \times m^2)$] of 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 *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope* have been sealed.

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, 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, where installed at the time of the test, shall be open.

- 4.

  Exterior or interior terminations for continuous ventilation systems shall be sealed.

- 5.

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

- 6.

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

Exception:

1. Attached single-family 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.

R402.4.1.3 (N1102.4.1.3) Prescriptive air leakage ~~Leakage~~ rate.

When complying with Section R401.2.1, the building or dwelling unit shall have an air leakage rate not exceeding 5.0 air changes per hour in Climate Zones 0, 1 and 2, and 2.0 ~~3.0~~ air changes per hour in Climate Zones 3 through 8, when tested in accordance with Section R402.4.1.2.

TABLE R405.4.2(1) (TABLE N1105.4.2(1)) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

BUILDING COMPONENT		
Air exchange rate		The measured air exchange rate.[a]
		The mechanical ventilation rate[b] shall be in addition to the air leakage rate and shall be as proposed.

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

- a.

  Where required by the code official, testing shall be conducted by an approved party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals,* or the equivalent, shall be used to determine the energy loads resulting from infiltration.

- b.

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

- c.

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

- d.

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

- e.

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

- f.

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

- g.

  For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.

- h.

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

  – .

    $AF = A_s \times FA \times F$

  – .

    where:

  – .

    AF = Total glazing area.

  – .

    A_s = Standard reference design total glazing area.

  – .

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

  – .

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

  – .

    and where:

– .

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.

– .

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

– .

Below-grade boundary wall is any thermal boundary wall in soil contact.

– .

Common wall area is the area of walls shared with an adjoining dwelling unit.

- i.

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

– 1.

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

– 2.

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

– 3.

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

– 4.

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

– 5.

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

– 6.

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

R408.2.5 (N1108.2.5) Improved air sealing and efficient ventilation system option.

The measured air leakage rate shall be less than or equal to 2.0 ~~3.0~~ ACH50, with either an Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV) installed. Minimum HRV and ERV requirements, measured at the lowest tested net supply airflow, shall be greater than or equal to 75 percent Sensible Recovery Efficiency (SRE), less than or equal to 1.1 cubic feet per minute per watt (0.03 m^3/min/watt) and shall not use recirculation as a defrost strategy. In addition, the ERV shall be greater than or equal to 50 percent Latent Recovery/Moisture Transfer (LRMT).

REPI-64-21 Air tightness improvements

Voted Affirmative with comment (ballot 3):

Salcido, Robert

Proposal: Sets air leakage testing requirements for CZ 3-8 to 2.0 ACH50

Comment: The prescriptive envelope air tightness requirement of ≤3.0 ACH50 for climate zones 3-8 has not changed since the mandatory air leakage test requirement was first incorporated into the 2012 IECC. We agree with the proponent that reducing the infiltration from 3.0 ACH50 to 2.0 ACH50 will not substantially increase construction costs but save a significant amount of energy. Tighter envelopes mixed with mechanical ventilation and heat recovery provide better indoor air quality for homeowners. We applaud the envelope subcommittee and residential consensus committee to approve this proposal and move it forward as part of the 2024 IECC public comment.

Voted Affirmative with comment (ballot 2):

Allen, Charles

pursuing ongoing recommendations in the working group.

Dent, Stephen

Overlapping content of these REPI'S can be clarified and simplified by combining them in the proposed new section 402.4.1.2.

Voted Negative with Reason (ballot 2):

Davis, Clifford

not cost effective in most locations

Demers, Paul

REPI 18 currently addresses added savings thru air sealing in an optional format. Approval of the mandatory maximum air leakage rate adversely impacts REPI 18.

Gobble, Kevin

This should be moved to R408 and will be difficult to achieve while not cost effective in many areas.

Mabe, Gavin

I agree with concerns expressed in the ballot comments on the following proposed changes.

Parks, Robert

Move to R408, no substantiation for cost has been provided, very difficult to achieve, not cost effective in most locations

My negative vote on these proposals is because I agree with the concerns and reasons statements already expressed in ballot comments on this proposed change

---

Potts, Richard

2.0 ACH 50 is difficult to achieve and the cost effectiveness would be debatable considering the labor hours spent chasing air leakage at a level this low.

Voted Negative with Reason (ballot 1):

Drumheller, Craig

The 2.0 ACH 50 is too tight and difficult to achieve. I do not believe the cost values were appropriately applied. Disapprove

---

Heikkinen, Gary

- Measure is not cost-effective.
- Recommend keeping 3 ACH50 in the main body and move 2ACH50 to section R408.

Hensley, John

This proposal is already listed as an option in REPI-018. The proposal is not cost affective. Just not ready! Disapprove

---

Johnson, Ric

This proposal is unnecessary as the provision are provide for in RECI-18-21, which offers designers choices. As currently presented, it is not cost affective, as in order to meet the criteria, a $200.00 cost does not cover the necessary cost that changes to current building practices, and materials are not included. The energy savings presented by the proponent do not cover the additional costs at $20-$30 savings per year or addresses the indoor air quality and mold/humidity issues found in southern states

and in areas in Ohio near the river in climate zone 4 and Lake Erie in climate Zone 5. These issues are better handled in R408 as presented in RECI-18-12.

Kochkin, Vladimir

- The cost-effectiveness spreadsheet provided with the proposal does not accurately address compliance costs for achieving building tightness of below 2ACH50. There was no substantiation provided by the proponent to justify the very low construction cost numbers used in the analysis. Significant changes to building practices and construction methods/materials would be required and must be evaluated before such a significant change can be proposed.
- We learned from interviews with builders that even homes that use 100% spray foam for air insulation and air sealing DO NOT consistently achieve air tightness below 2ACH50 (more typical range for testing is between 2.5 and 2.0 ACH50). But spray foam costs thousands of dollars more to install -- not the $200 per house suggested by the proponent.
- As another reference point for cost: spray aerosol applications cost $1-2 per square foot (Center for Energy and Environment, MN, Prepared for U.S. Department of Energy, Aerosol Envelope Sealing of New Residences, December 2020), similarly would be adding thousands to the cost of a house.
- This measure is already included in REPI-018 (Section R408 – Additional Practices with a Points System). This is the appropriate location for this measure to offer designers choice and it works well with the glidepath strategy.
- California Title 24 2022 does not have near this stringent level of building tightness. Their default value for modeling is set at 5 ACH50.
- Energy savings are climate dependent and the new target is particularly unreasonable in warmer climate zones (CZ 3 and 4). The energy savings reported by the proponent for CZ 3 are about $30 per year ($2.60 per month). If there is a strong desire from the committee to change building tightness criteria in the baseline provisions, a more reasonable approach will be to leave CZ 3 and 4 at 3ACH50 and change to 2.5 ACH50 for CZ 5-8. The more aggressive targets should remain in R408.
- The cost-effectiveness spreadsheet approved by the consensus committee and used to substantiate this proposal has two significant issues:
    - The lower bound for the real discount rate was set at near 1.5% - this is a significant deviation from the direction from ICC to use the OMB rates at 3% and 7% and was never justified.
    - Measures justified based on social cost of carbon must be placed into an appendix to be consistent with the 2024 IECC Intent statement that directs greenhouse gas reduction measures to be included in non-mandatory appendices.

Madrid, Ricardo

I do not agree with the cost effectiveness numbers. From consensus discussions it might be more applicable in the northern climates only.

Marston, Thomas

Do not support additional requirement. This measure is not proven to be cost-effective in small buildings where it is most problematic. I can support this measure when it is assigned to R408 because it allows the energy designer to consider the merits of a tighter building shell.

Martino, Amy

Reject proposal. It already is being proposed in section 408 where it belongs.

Reason:

Cost effectiveness statement states average increase in construction costs of $198 per dwelling unit and is beyond underestimated. Estimates would far exceed $1000 and account for increased sealing of 'holes" smaller than 1/2". Although this is attainable, it requires special sealing which according to a manufacturer and a DOE prepared report, spray aerosol applications cost are $1 to $2 per square foot.

Raymer, Robert

This level of air-change-per-hour is far too difficult and costly to achieve and is not appropriate as a mandatory minimum provision in the IECC. Significant changes to standard building practice would be required. The energy savings reported by the proponent fall into a range of $20-$30 per year which seems extremely small given the limited gains in efficiency.

And, as pointed out by NAHB, specific technologies such as spray foam would need to be used for certain house configurations which would significantly increase construction compliance costs above those cited by the proponents. For example, the Center for Energy & Environment report a cost of $1-$2 per square foot for spray aerosol applications. That is why California allows 2.0 ACH 50 as a compliance option instead of listing it as a minimum prescriptive requirement.

Regarding the 2024 IECC, it should be noted that this is included as a compliance option in REPI 18 via Section R408.

Request Disapproval of this item and approval of REPI 18.

Shanks, Brian

REPI-60-21. REPI-61-21, REPI-63-21 & REPI-64-21 all R402.4.1.2 and difficult for me to interpret on their own

Possible Remedy

If ICC staff could provide a merged clean file it would be easier for me to consider the changes represented in each similar proposal

---

Truitt, Richard

REPI 18 addresses additional energy savings for reduced air infiltration in an optional format. Reducing the mandatory maximum air leakage rate in climate zones 3 through 8 to 2 takes aways from the optional provisions of REPI-18. Home construction targeting to a reduced level should be awarded in this fashion and not made as a mandatory level of compliance.

Wright, Jeremy

1. The cost effectiveness spread sheet is inaccurate. There is not information by the propionate to justify the extremely low construction cost numbers used. There will be major changes in building practices required for compliance. This needs to be evaluated prior to making such a significant change to the code.

2. Changing from typical insulation such as fiberglass or cellulose to spray foam is significantly more expensive that the proposed $200 per house by the proponent. Generally, spray foam is two to three times more than typical insulation materials.

3. Homes with 100% foam for air insulation and sealing do not consistently achieve 2ACH50. Depending on size the typical range is 3 and 2.0 ACH50. To achieve 2 ACH50 other measures beyond spray foam are typically needed.

4. The proposal is unreasonable in warmer climate zones 3 and 4. The saving proposed by the proponent in climate zone 3 is about $30 per year. If the wishes of the committee is to change building tightness provisions, a more reasonable methods would be leaving climate zones 3 and 4 at 3ACH50 and change to 2.5 ACH50 for zones 5-8. The more aggressive target should remain in R408.

REPI-68-21

IECC®: SECTION 202 (New), R402.6 (New), TABLE R402.6 (TABLE N1102.6) (New), R402.6.1 (N1102.6.1) (New), TABLE R405.4.2(1), R407.2, R503.1.1, ASTM Chapter 06 (New), CRRC Chapter 06 (New), TABLE R406.2

Proponents:
Elizabeth McCollum, representing on behalf of the California Statewide Utility Codes and Standards Team (iecc-cool-roof@2050partners.com); Mark Lyles, representing New Buildings Institute (markl@newbuildings.org)

2021 International Energy Conservation Code

Add new definition as follows:

R202 **LOW-SLOPED ROOF.** A roof slope less than 2 units vertical in 12 units horizontal (17 percent slope).

R202 **STEEP-SLOPED ROOF.**

A roof slope 2 units vertical in 12 units horizontal (17 percent slope) or greater.

Add new text as follows:

R402.6 Roof reflectance.

Roofs in Climate Zones 0 through 3 shall comply with one or more of the options in Table R402.6.

Exceptions:

1. Roofs with a radiant barrier with an emittance of 0.05 or less.

2. Portions of the roof that include or are covered by one or more of the following:

2.1. systems or componentsOn-site renewable energy

2.2. Solar air or water heating systems or components

2.3. Vegetative roofs or landscaped roofs

2.4. Above roof decks or walkways

2.5. Skylights

2.6. HVAC systems and components, and other opaque objects mounted above the roof

3. Portions of roof shaded during the peak sun angle of the summer soltice by permanent features of the building or by permanent features of adjacent buildings.

4. ^{2}) or 23 psf (117 kg/m^{2}) pavers.Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (74 kg/m

5. Roofs where portions exempted by exceptions 2, 3, and 4 make up not less than 75 percent of the total roof area.

TABLE R402.6 (TABLE N1102.6) MINIMUM ROOF REFLECTANCE[a]

Roof Slope	Three-year aged solar reflectance index[b]
Low-slope	75[b,c]
Steep-slope	16

- a.

The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year-aged solar reflectance in accordance with Section R402.6.1

- b.

  Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

- c.

  Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft 2 × °F (12 W/m 2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

R402.6.1 (N1102.6.1) Aged solar reflectance .

Where an aged solar reflectance required by Section R402.6 is not available, it shall be determined in accordance with Equation 4-1.

$R_{aged}=[0.2+0.7(R_{initial}-0.2)]$

(Equation 4-1)

where:

R_{aged}=The aged solar reflectance

$R_{initial}$=The initial solar reflectance determined in accordance with CRRC-S100

Revise as follows:

TABLE R405.4.2(1) (TABLE N1105.4.2(1)) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT		
Roofs	Type: ~~composition shingle on wood sheathing.~~ *Low-sloped*: modified bitumen *Steep-sloped*: asphalt shingles	As proposed
	Gross area: same as proposed.	As proposed
	Low-sloped: (Aged) Solar ~~absorptance~~reflectance = 0.63~~0.75~~. *Steep-sloped*: (Aged) Solar reflectance = 0.2	As proposed
	Thermal Emittance = ~~0.90~~0.75.	As proposed

R407.2 (N1107.2) Tropical climate region.

Compliance with this section requires the following:

- 1.

  Not more than one-half of the *occupied* space is air conditioned.

- 2.

  The *occupied* space is not heated.

- 3.

Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.

- 4.

  Glazing in *conditioned spaces* has a *solar heat gain coefficient* (SHGC) of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.

- 5.

  Permanently installed lighting is in accordance with Section R404.

- 6.

  The exterior roof surface complies with one of the options in Table R402.6~~C402.3 of the *International Energy Conservation Code*–Commercial Provisions~~ or the roof or ceiling has insulation with an *R-value* of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.

- 7.

  Roof surfaces have a slope of not less than $^1/_4$ unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.

- 8.

  Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.

- 9.

  Bedrooms with *exterior walls* facing two different directions have operable fenestration on exterior walls facing two directions.

- 10.

  Interior doors to bedrooms are capable of being secured in the open position.

- 11.

  A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

R503.1.1 (N1111.1.1) Building envelope.

Building envelope assemblies that are part of the *alteration* shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.12, R402.3.1, R402.3.2, R402.4.3,R402.6 and R402.4.5.

Exception:

1. Storm windows installed over existing fenestration.

2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.

3. Construction where the existing roof, wall or floor cavity is not exposed.

4. Roof recover where the new roofing meets the reflectance requirements under R402.6.

5. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

6. Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided that the code does not require the glazing or fenestration assembly to be replaced.

Add new standard(s) as follows:

ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM C1549-2016	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E903-2012	Standard Test Method for Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres (Withdrawn 2005)
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E1918-06(2016)	Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-sloped Surfaces in the Field
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E1980- 11	Standard Practice for Calculating Solar Reflectance of Horizontal and Low-sloped Opaque Surfaces
CRRC	Cool Roof Rating Council 2435 North Lombard Street Portland OR 97217
ANSI/CRRC-S100-2021	Standard Test Methods for Determining Radiative Properties of Materials

Revise as follows:

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
R402.6	Roof Reflectance
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
R404.2	Interior lighting controls
R406.3	Building thermal envelope

- a.

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

REPI-68-21 Cool roofs

Voted Affirmative with comment (ballot 2):

Allen, Charles

pursuing ongoing recommendations in the working group.

Voted Negative with reason (ballot 3):

Lyles, Mark

Comment: Based on feedback from the consensus committee, the proponent is recommending the following modifications to REPI-68:

R402.6 Roof reflectance. Roofs in Climate Zones 0 through ~~3~~2 shall comply with one or more of the options in Table R402.6.

Exceptions:

1. Roofs with a radiant barrier with an emittance of 0.05 or less.

2. Portions of the roof that include or are covered by one or more of the following:

    2.1. *On-site renewable energy* systems or components

    2.2. Solar air or water heating systems or components

    2.3. Vegetative roofs or landscaped roofs

    2.4. Above roof decks or walkways

    2.5. Skylights

    2.6. HVAC systems and components, and other opaque objects mounted above the roof

3. Portions of roof shaded during the peak sun angle of the summer solstice by permanent features of the building or by permanent features of adjacent buildings.

4. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (74 kg/m^2) or 23 psf (117 kg/m^2) pavers.

5. Roofs where portions exempted by exceptions 2, 3, and 4 make up not less than 75 percent of the total roof area.

TABLE R402.6 (TABLE N1102.6) MINIMUM ROOF REFLECTANCE[a]

Roof Slope	Three-year aged solar reflectance index[b]
Low-slope	75[b,c]
Steep-slope	16

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year-aged solar reflectance in accordance with Section R402.6.1

b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

c. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft 2 × °F (12 W/m 2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

R402.6.1 (N1102.6.1) Aged solar reflectance. Where an aged solar reflectance required by Section R402.6 is not available, it shall be determined in accordance with Equation 4-1.

$R_{aged}=[0.2+0.7(R_{initial}-0.2)]$ (Equation 4-1)

where:

R_{aged}=The aged solar reflectance

$R_{initial}$=The initial solar reflectance determined in accordance with CRRC-S100

Revise as follows:

SECTION 405 TOTAL BUILDING PERFORMANCE

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION[a]	TITLE
Building Thermal Envelope	
R402.6	Roof reflectance
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls

TABLE R405.4.2(1) (TABLE N1105.4.2(1)) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Roofs	Type: ~~composition shingle on wood sheathing.~~ *Low-sloped*: modified bitumen *Steep-sloped*: asphalt shingles	As proposed
	Gross area: same as proposed.	As proposed
	Low-sloped: (Aged) Solar ~~absorptance~~ reflectance = ~~0.75~~0.63 in Climate Zones 0 to 2 and 0.25 in Climate Zones 3 to 8. *Steep-sloped*: (Aged) Solar reflectance = 0.2 in Climate Zones 0 to 2 and 0.25 in Climate Zones 3 to 8.	As proposed
	Thermal Emittance = ~~0.90~~0.75.	As proposed

SECTION R406 ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

Revise as follows:

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
R402.6	Roof Reflectance
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
R404.2	Interior lighting controls

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

SECTION R407 TROPICAL CLIMATE REGION COMPLIANCE PATH

R407.2 (N1107.2) Tropical climate region.

Compliance with this section requires the following:

1. Not more than one-half of the *occupied* space is air conditioned.

2. The *occupied* space is not heated.

3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.

4. Glazing in *conditioned spaces* has a *solar heat gain coefficient* (SHGC) of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.

5. Permanently installed lighting is in accordance with Section R404.

6. The exterior roof surface complies with one of the options in Table R402.6~~C402.3 of the *International Energy Conservation Code*–Commercial Provisions~~ or the roof or ceiling has insulation with an *R-value* of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.

7. Roof surfaces have a slope of not less than $^1/_4$ unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.

8. Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.

9. Bedrooms with *exterior walls* facing two different directions have operable fenestration on exterior walls facing two directions.

10. Interior doors to bedrooms are capable of being secured in the open position.

11. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

CHAPTER 5 [RE] EXISTING BUILDINGS

R503 ALTERATIONS

R503.1.1 (N1111.1.1) Building envelope. Building envelope assemblies that are part of the *alteration* shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.12, R402.3.1, R402.3.2, R402.4.3, R402.6 and R402.4.5.

Exception:

1. Storm windows installed over existing fenestration.

2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.

3. Construction where the existing roof, wall or floor cavity is not exposed.

4. Roof recover where the new roofing meets the reflectance requirements under R402.6.

5. Roof recover in buildings in Very Hot Humid, Hot Humid, and Warm Humid Climate Zones, as designated in Section R301.

~~5~~6. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

~~6~~7. Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided that the code does not require the glazing or fenestration assembly to be replaced.

CHAPTER 6 [RE] REFERENCED STANDARDS

Add new standard(s) as follows:

ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM C1549-2016	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken PA 19428-2959
ASTM E903-2012	Standard Test Method for Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres (Withdrawn 2005)
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ASTM E1980- 11	Standard Practice for Calculating Solar Reflectance of Horizontal and Low-sloped Opaque Surfaces
CRRC	Cool Roof Rating Council 2435 North Lombard Street Portland OR 97217
ANSI/CRRC-S100-2021	Standard Test Methods for Determining Radiative Properties of Materials

Voted Negative with Reason (ballot 2):

Davis, Clifford

not cost effective, remove CZ3

Gobble, Kevin

I do not agree with including Climate Zone 3 in this code change. It is not cost effective and will be difficult to enforce. Change the wording in R402.6 to Climate Zones 0 through 2.

Mabe, Gavin

I agree with concerns expressed in the ballot comments on the following proposed changes.

Rossmiller, Gil

Does not appear to be as cost effective in climate zone 3. Revise from climate zone 0-3 to 0-2.

Voted Negative with Reason (ballot 1):

Drumheller, Craig

Mandatory Cool Roofs- Proponents stated not cost effective. Cost effectiveness is a requirement of the IECC as dictated in the framework document dictated by the ICC Board when creating these committees. Climate zone 3 should be removed.

Gobble, Kevin

I do not agree with including Climate Zone 3 in this code change. It is not cost effective and will be difficult to enforce. Change the wording in R402.6 to Climate Zones 0 through 2.

Heikkinen, Gary

Not cost-effective in CZ 3. Should be removed for that CZ.

Hensley, Edwin

Clarity is required on the cost versus the benefit in order to communicate the rationale to our constituency. Regional and urban/rural variations in cost are significant. We cannot contribute language to the proposals that would change our vote.

Johnson, Ric

The proponent's documentation and testimony state that the proposal in Climate Zone 3 is not cost effective. The standard should not include proposals that are not cost effective.

To vote for approval, modify the proposal as follows:

R402.6 Roof Reflectance – Roofs in Climate Zones 0 through 2 shall comply with one or more pf the options in Table E402.6. Remainder of text is unchanged.

Kochkin, Vladimir

- During their own testimony, the proponent stated that this proposal is not cost-effective in Climate Zone 3. Therefore, this proposal should not advance in its current form.
- The benefit of cool roof in buildings insulated to the levels required in the IECC is diminished.
- There are unintended consequences caused by cool roofs that can lead to moisture issues in attics in humid climates (this is caused by reduced drying and increased RH levels). Therefore, this proposed practice must be placed in R408 where it is a design choice or an exception for humid climates should be added.
- A similar proposal was disapproved by the commercial committee.
- Cost-effectiveness of this proposal for multifamily buildings was not analyzed – low rise MF is in the scope of the IECC residential and must be analyzed separately.
- Cost-effectiveness of steep-slope roofs was not analyzed.
- Cost-effectiveness of the configuration where ducts are not in the attic was not analyzed.
- Cool roofs result in elevated air temperatures above the surface of the roof. This will impact the efficiency of rooftop HVAC equipment and PV panels.
- Reflective roofs become less reflective through time. The cost effectiveness analysis doesn't include maintenance of the reflective characteristic of the roof.
- As noted by roofing manufacturers during the committee meeting, steep-slope roofing products that meet these specifications are primarily sourced from the west coast and would be burdened with the environmental impact of transportation to the east coast. Furthermore, the manufacturing process for the reflective granules used in these roofing products can be more energy intensive.
- Further testimony offered during the committee meeting indicated that the suggested benefits of cool roofs on the heat island effect are unclear and need further evaluation across various building densities and climatic conditions.

To address these issues, two mutually exclusive options are offered as a resolution:

Revise REPI-068 as follows:

Option 1 – Move to R408:

~~R402.6~~ R408.2.9 Roof reflectance. Roofs ~~in Climate Zones 0 through 3~~ shall comply with one or more of the options in Table ~~R402.6~~ R408.2.9.

~~Exceptions:~~

TABLE ~~R402.6~~ R408.2.9 MINIMUM ROOF REFLECTANCE

The remainder of the table and its footnotes are unchanged.

The remainder of the proposal starting at TABLE R405.4.2(1) is deleted and a new line is added to Table R402.8 as follows:

___ TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

		Credit Value

Measure Number	Measure Description	CZ 0 &1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8
….	….	..	..	..	..	..	..	..	..
R408.2.9	Roof reflectance	TDB by PNNL	TDB by PNNL	TDB by PNNL	TDB by PNNL	TDB by PNNL	TDB by PNNL	TDB by PNNL	TDB by PNNL

Option 2 – Remove CZ3 and add an exception:

R402.6 Roof reflectance. Roofs in Climate Zones 0 through 23 shall comply with one or more of the options in Table R402.6.

Exceptions:

1. Buildings in Very Hot Humid, Hot Humid, and Warm Humid Climate Zones as designated in Section R301.

Madrid, Ricardo

More consideration should be taken for Humid climates.

Marston, Thomas

Do not support this measure. I can support this when it is added to R408 or it is contained in an appendix that focuses on societal and social benefits of carbon reduction.

Martino, Amy

Remove Climate zone 3- Possibly located in new Section 409: Optional Jurisdictional Provisions

Reason:

Cool roofs by the proponent's testimony is not cost effective. It limits consumer choice and products may be limited in availability.

Parks, Robert

REPI-68-21 requires roofs in Climate Zone 3 to meet 'cool roof' requirements even though the proponent's supporting documentation, "Residential Cool Roof: REPI-068-21 Supporting Documentation" and subcommittee testimony said that portion of the proposal was not cost justified. Proposals that are not cost justified should not advance.

Raymer, Robert

REPI-68-21 requires roofs in Climate Zone 0, 1, 2, and 3 to meet 'cool roof' requirements. However, the proponents indicated that this proposal is not cost-justified in Climate Zone 3. Efficiency measures

should be cost-effective. Those measures that are not, should be voluntary and appear in either the Appendix or be provided with compliance credit in R408. Also, builders have experienced moisture and durability issues with cool roofs in humid regions of the country.

Revise as Follows:

Modify the proposal by deleting reference to Climate Zone 3:

R402.6 Roof reflectance. Roofs in Climate Zones 0 through 2~~3~~ shall comply with one or more of the options in Table R402.6.

1. *Buildings in Very Hot Humid, Hot Humid, and Warm Humid Climate Zones as designated in Section R301.*

Schmidt, Amy

1. Not opposed to adding roof reflectance in CZ 0-3; the issue is with the addition of the radiant barrier exception that does not have or have not demonstrated equivalent energy savings and therefore unnecessarily weaken the code. Radiant barriers have very little benefit if insulation levels are at R-30 or above per ORNL study.

2. It was also mentioned that it was added here so as not to create a condensation issue by installing both a cool roof and radiant barrier. This does not fix it. The exception does not prohibit this condition. There should rather be a sentence added to the charging paragraph stating that when installing a cool roof radiant barriers are not permitted.

Shanks, Brian

Disapprove based on proponents' statement during presentation that the proposal is not cost-effective in CZ3

Possible remedy

Amend to exclude CZ3

Wright, Jeremy

1. The proponent stated that the proposal is not cost-effective in climate zone 3. Therefore, the proposal should move forward in its current form.

2. Cool roofs pose moisture and durability issues in humid climates. This method should be placed in R408 where it is a choice or it should include an exception for warm humid climates.

3. Steep slope roofs were not analyzed and analysis for low slope roofs was assumed.

4. A similar proposal was disapproved in the commercial code.

REPI-69-21

IECC®: SECTION 202 (New), R403.1 (N1103.1) (New), R403.1, R403.6.1, R403.8, R404.2 (N1104.2) (New), R404.2, R404.3 (N1104.3) (New), R404.3, R404.4 (N1104.4) (New)

Proponents:
Kimberly Newcomer, representing NBI (kim@newbuildings.org)

2021 International Energy Conservation Code

Add new definition as follows:

R202 COMMON AREA.

All portions of *Group R occupancies* that are not *dwelling units* or *sleeping units*.

Add new text as follows:

R403.1 (N1103.1) General.

Systems serving individual *dwelling units* shall comply with Section R403. Systems serving *common areas or* two or more*dwelling units* shall comply with Sections C403 and C404 of the International Energy Conservation Code – Commercial Provisions instead of Section R403.

Revise as follows:

~~R403.1~~ R403.2 (N1103.2) Controls.

Not less than one thermostat shall be provided for each separate heating and cooling system.

R403.6.1 (N1103.6.1) Heat or energy recovery ventilation.

***Dwelling units* shall be provided with a heat recovery or energy recovery ventilation system ~~in Climate Zones 7 and 8~~. The system shall be balanced with a minimum sensible heat recovery efficiency of 65 percent at 32°F (0°C) at a flow greater than or equal to the design airflow.**

Exceptions:

1. Dwelling units in single and two-family buildings in Climate Zones 0-6.

2. Dwelling units in Group-R occupancies that comply with Section C403.7.4.1.

Delete without substitution:

~~R403.8 Systems serving multiple dwelling units~~ .

~~Systems serving multiple *dwelling units* shall comply with Sections C403 and C404 of the *International Energy Conservation Code*—Commercial Provisions instead of Section R403.~~

Add new text as follows:

R404.2 (N1104.2) Interior lighting controls..

Lighting serving individual *dwelling units* shall comply with Section R404.2.1. Lighting serving *common areas* shall comply with Sections C405.2 of the International Energy Conservation Code – Commercial Provisions instead of Section R404.2.1.

Revise as follows:

~~R404.2~~ R404.2.1 (N1104.2.1) ~~Interior lighting controls~~Controls for individual dwelling units.

Permanently installed lighting fixtures shall be controlled with either a dimmer, an occupant sensor control or other control that is installed or built into the fixture.

Exception:

1. Bathrooms.

2. Hallways.

3. ~~Exterior lighting fixtures.~~

4 . 3Lighting designed for safety or security.

Add new text as follows:

R404.3 (N1104.3) Exterior lighting controls.

Exterior lighting controlled from within individual *dwelling units* shall comply with Section R404.3.1. Controls for all other exterior lighting shall comply with Sections C405.2.7 of the International Energy Conservation Code – Commercial Provisions instead of Section R404.3.1.

Revise as follows:

~~R404.3~~ R404.3.1 (N1104.3.1) ~~Exterior lighting controls~~ Controls for individual dwelling units.

Where the total permanently installed exterior lighting power is greater than 30 watts, the permanently installed exterior lighting shall comply with the following:

- 1.

  Lighting shall be controlled by a manual on and off switch which permits automatic shut-off actions.

  ~~**Exception:** Lighting serving multiple *dwelling units.*~~

- 2.

  Lighting shall be automatically shut off when daylight is present and satisfies the lighting needs.

- 3.

  Controls that override automatic shut-off actions shall not be allowed unless the override automatically returns automatic control to its normal operation within 24 hours.

Add new text as follows:

R404.4 (N1104.4) Electrical Power Systems.

Group R occupancies shall comply with Sections C405.6 through C405.12.

REPI-69-21 Multi-family alignment

Voted Affirmative with comment (ballot 3):

Lyles, Mark

Comment: I support REPI-069, but where REPI-093 overlaps REPI-069 with respect to Climate Zones that are exempt from ERV/HRV requirements, I support REPI-093.

Voted Negative with Reason (ballot 3):

Heikkinen, Gary

- Including a pointer to the Commercial Code will cause confusion and make compliance more difficult.
- Inadequate cost justification in the proposal.
- Residential code should be self-contained.

Wright, Jeremy

Based on my review of ballot comments from other committee members.

Voted Negative with Reason (ballot 2):

Davis, Clifford

IECC-residential should not refer to commercial chapter

Demers, Paul

Opposed to the provisions in the Commercial provisions of the IECC. If the common area lighting efficiencies can be specified to address energy savings in Residential occupancies it could be supported.

Gobble, Kevin

IECC should be a standalone code and not referred to commercial spaces.

Mabe, Gavin

I agree with concerns expressed in the ballot comments on the following proposed changes.

Voted Negative with Reason (ballot 1):

Drumheller, Craig

Common Area Multifamily- This proposal would require slightly different window/wall/door requirements than the dwellings- not necessary or properly cost justified. Disapprove or somehow make it clear that the common areas must meet the adjacent dwelling wall/window performance

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Johnson, Ric

This proposal imposes the Commercial Standard provisions on common spaces of residential occupancies with proper substantiation. In jurisdictions such as Ohio, where the residential code is adopted by a Residential body, the IECC Residential Standard would not include the referenced Commercial Standard language. Additionally, the proponent does not try to provide any costs, just stating that the Commercial group deemed it to be cost effective, while not taking into account the differences between commercial costs and residential costs. This proposal is not ready and needs more work. The proponent should rework this proposal so that all the proposed language is included in the proposal, which will also allow for the proponent to reference the true costs of these mandates. As written, currently, it violates the ICC commitment to have the IRC as a complete self-contained document. The IECC Residential standard should also reflect this commitment.

Koban, Mary

- AHRI has concerns that this code proposal brings in the ICC Commercial section into the residential section of the code, which may not always be applicable, nor cost effective for residential construction.
- As noted, this would require HRV or ERV for residential occupancies.
- AHRI suggests modifying the code proposal to provide options for R occupancies outside of C403.7.4.1.

Kochkin, Vladimir

- ICC made a commitment to stakeholders that the residential IECC be a standalone code. Referring the user of the residential IECC to the commercial energy provisions breaks with the long-standing convention for delineation between the two codes within the IECC.
- Many jurisdictions adopt ASHRAE 90.1 as their commercial energy code and adopt only the residential chapters of the IECC.
- Any provision proposed to be added to the residential code must be evaluated individually and specifically for low-rise multifamily buildings, including the cost-effectiveness analysis. General statements that, if a provision is already in the commercial code, it should be required by the residential code are inadequate as a reason for proposing a change.
- The revision to R403.6.1 moves the primary requirement into the exception. This change makes it appear as if the default configuration is to install HRV or ERV is all climate zones in all

residential buildings. This is not the case. This is bad form for code writing and counterproductive to those users attempting to understand the intent of the code.

- The only pointer that existed in the 2021 IECC that sends the user of the residential code to find a set of provisions in the commercial side of the code was for exterior lighting. The consensus committee already approved a proposal to remove the pointer and add the appropriate exterior lighting provisions directly to the residential provisions (REPI-105).

Madrid, Ricardo

The codes should remain as two separate codes. References from a residential to a commercial code and vice versa create cumbersome and confusion application.

Marston, Thomas

Do not support this measure. Appling provisions of the commercial code into the residential code is not valid because building costs are not consistent between the two building types. The proponent assigned cost justification based on commercial values.

Martino, Amy

IECC- residential should be a stand-alone code which does not refer to IECC commercial provisions. Multifamily buildings' common spaces vary considerably in size, configuration and have individual requirements depending on the design of the building

Reason:

In multifamily 3 stories and less, the common area may be limited and require only electric baseboard heating and minimal air circulation. Some are even unconditioned. Others contain long corridors which require more HVAC considerations. These designs vary considerably from multifamily building 4 stories or greater which the commercial code addresses.

Parks, Robert

REPI-69-21 tries to align the IECC-R and IECC-C provisions of the code by just referencing the commercial code's parallel sections instead of justifying specific benefits for the IECC-R. These is a reason why there are two code systems and just because it is in the commercial section is not good reasoning for it to be in the residentials section. It violates the commitment to industry that the ICC made to have the IRC as a complete, self-contained document.

Raymer, Robert

REPI-69-21 seeks to impose commercial energy code requirements on common-use areas in low-rise multifamily projects by just referencing the commercial code's sections (IECC-C) instead of crafting provisions specifically for the IECC-R. This is not consistent with ICC's commitment to provide industry with a self-contained document for residential construction. Also, what happens in a jurisdiction that adopts the IECC-R for residential but adopts the ASHRAE 90.1 code for their commercial energy code? Lastly, where is the cost-effectiveness analysis?

Suggested Response:

REPI-69-21 should be disapproved until the proponent re-formats the content so that everything being proposed will be in the residential code. It is more work, but it needs to be done to maintain the commitment for producing a stand-alone code.

Shanks, Brian

This proposal doesn't clearly demonstrate a need to include commercial mechanical requirements for three-story multi-family projects. Market confusion and enforcement inconsistencies being a concern, an education campaign in those markets seems like a better way to address the difference between code requirements.

Truitt, Richard

Not in favor of proposal refencing provisions contained within the commercial provisions of the IECC. If the committee intends to address lighting loads for the purpose of energy savings, specific residential provisions should be reviewed and established.

REPI-70-21

IECC®: SECTION 202 (New), R403.1, R403.1.1, R403.1.2 (New), R403.1.2.1 (New), R403.1.2.2 (New), R407.2, CTA (New), IEC (New), OpenADR (New), AHRI Chapter 06 (New), CTA Consumer Technology Association Technology & Standards Department (New)

Proponents:
Jeremy Williams, representing U.S. Department of Energy (jeremy.williams@ee.doe.gov)

2021 International Energy Conservation Code

Add new definition as follows:

DEMAND RESPONSE SIGNAL. A signal that indicates a price or a request to modify electricity consumption for a limited time period.

R202 DEMAND RESPONSIVE CONTROL. A control capable of receiving and automatically responding to a *demand response signal.*

Revise as follows:

R403.1 Controls.

Not less than one thermostat shall be provided for each separate heating and cooling system. The primary heating or cooling system serving the *dwelling unit* shall comply with Sections R403.1.1 and R403.1.2.

R403.1.1 Programmable thermostat.

The thermostat controlling the primary heating or cooling system of the *dwelling unit* shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day and different days of the week. This thermostat shall include the capability to set back or temporarily operate the system to maintain *zone* temperatures of not less than 55°F (13°C) to not greater than 85°F (29°C). The thermostat shall be programmed initially by the manufacturer with a heating temperature setpoint of not greater than 70°F (21°C) and a cooling temperature setpoint of not less than 78°F (26°C).

Add new text as follows:

R403.1.2 Demand responsive thermostat.

The thermostat shall be provided with a *demand responsive control* capable of communicating with the Virtual End Node (VEN) using a wired or wireless bi-directional communication pathway that provides the homeowner the ability to voluntarily participate in utility demand response programs, where available. The thermostat shall be capable of executing the following actions in response to a *demand response signal*:

- 1.

  Automatically increasing the zone operating cooling set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C), and 4°F (2°C).

- 2.

  Automatically decreasing the zone operating heating set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C), and 4°F (2°C).

Thermostats controlling single stage HVAC systems shall comply with Section R403.1.2.1. Thermostats controlling variable capacity systems shall comply with Section R403.1.2.2. Thermostats controlling multi-stage HVAC systems shall comply with either Section R403.1.2.1 or R403.1.2.2. Where a *demand response signal* is not available the thermostat shall be capable of performing all other functions.

Exception: Assisted living facilities.

R403.1.2.1 Single stage HVAC system controls.

Thermostats controlling single stage HVAC systems shall be provided with a *demand responsive control* that complies with one of the following:

- 1.

  Certified OpenADR 2.0a VEN, as specified under Clause 11, Conformance

- 2.

  Certified OpenADR 2.0b VEN, as specified under Clause 11, Conformance

- 3.

  demand response signal from a certified OpenADR 2.0b VEN by automatically implementing the control functions requested by the VEN for the equipment it controls

  Certified by the manufacturer as being capable of responding to a

- 4.

  IEC 62746-10-1

- 5.

  The communication protocol required by a controlling entity, such as a utility or service provider, to participate in an automated demand response program

- 6.

  The physical configuration and communication protocol of CTA 2045-A or CTA-2045-B

R403.1.2.2 Variable capacity and two stage HVAC system controls.
Thermostats controlling variable capacity and two stage HVAC systems shall be provided with a *demand responsive control* that complies with the communication and performance requirements of AHRI 1380.

Revise as follows:

R407.2 Tropical climate region.

Compliance with this section requires the following:

- 1.

  Not more than one-half of the *occupied* space is air conditioned and is controlled by a thermostat in accordance with Sections R403.1.1 and R403.1.2.

- 2.

  The *occupied* space is not heated.

- 3.

  Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.

- 4.

  Glazing in *conditioned spaces* has a *solar heat gain coefficient* (SHGC) of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.

- 5.

  Permanently installed lighting is in accordance with Section R404.

- 6.

  The exterior roof surface complies with one of the options in Table C402.3 of the *International Energy Conservation Code*–Commercial Provisionsor the roof or ceiling has insulation with an *R-value* of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.

- 7.

  Roof surfaces have a slope of not less than $^1/_4$ unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.

- 8.

  Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.

- 9.

  Bedrooms with *exterior walls* facing two different directions have operable fenestration on exterior walls facing two directions.

- 10.

  Interior doors to bedrooms are capable of being secured in the open position.

- 11.

  A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

Add new standard(s) as follows:

CTA	Consumer Technology Association Technology & Standards Department 1919 S Eads Street Arlington VA 22202

CTA Consumer Technology Association Technology & Standards Department.

ANSI/CTA-2045-B – 2018: Modular Communications Interface for Energy Management

IEC	IEC Regional Centre for North America 446 Main Street 16th Floor Worcester MA 01608

IEC IEC Regional Centre for North America.

IEC 62746-10-1 - 2018: Systems interface between customer energy management system and the power management system - Part 10-1: Open automated demand response

OpenADR	OpenADR Alliance 111 Deerwood Road, Suite 200

	San Ramon CA 94583

OpenADR OpenADR Alliance.

OpenADR 2.0a and 2.0b – 2019: Profile Specification Distributed Energy Resources

AHRI	Air-Conditioning, Heating, & Refrigeration Institute 2111 Wilson Blvd, Suite 500 Arlington VA 22201
AHRI 1380-2019	Demand Response through Variable Capacity HVAC Systems in Residential and Small Commercial Applications

Add new text as follows:

CTA Consumer Technology Association Technology & Standards Department ANSI/CTA-2045-A – 2018:. Modular Communications Interface for Energy Management

REPI-70-21 Demand response

Voted Affirmative with comment (ballot 1):

Rodriguez, Mark

The reason statement fails to describe what happens when a utility demand response program does not exist or if a homeowner is willing to opt in. There are too many future variables to predict which equipment may be compatible with future demand programs.

Voted Negative with Reason (ballot 2):

Davis, Clifford

Should be addressed through utility programs

Demers, Paul

This program should be entirely voluntary as it provides to much control to the utility which should not be included in the energy code. This is a potentially costly requirement that could cause some specialized equipment to be needed which should not a specific code mandate in areas where such a system is not present. If a supplier wishes to impliment such a system, they should participate in the implimentation subject to the rate payers approval, and not an energy code requirement.

Mabe, Gavin

I agree with concerns expressed in the ballot comments on the following proposed changes.

Parks, Robert

Should be addressed through utility programs

I believe it is irresponsible to require “every home” to have a component for an “optional program”! If it is an optional program, then the components needed to “opt in”, should be provided or purchased at that time. This code would not provide a payback of any kind, for every home that has this thermostat… and yet to prove a payback in the limited areas where they are utilized.

Voted Negative with Reason (ballot 1):

Drumheller, Craig

Demand Response Thermostat- Should not be a mandatory item (would be OK with 408 credit). Not clear that programs exist everywhere, not clear if thermostats are compatible with complex HVAC systems, not clear if thermostats are universally compatible with local programs. Disapprove

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Gobble, Kevin

This code requires homeowners to enable utility demand response programs and opens up the possibility of cyber security issues. I do not believe this should be in the Energy code. I would strike through R403.1.2, R403.1.2.1, R403.1.2.2, and remove the additional language to R407.2. This also adds additional costs without the benefit of possibility obtaining the benefits. The connectivity to the Virtual End Node is a major issue in this code change.

Heikkinen, Gary

- Similar to "Ready" proposals, this only adds cost and does not guarantee any energy savings.
- Should not burden ALL homes with this cost.
- Not all utilities offer demand response programs.
- Potential future technical compatibility problems.

Johnson, Ric

This proposal from the DOE is not about improving the building efficiency, but about some future proposed grid management and pricing scheme between utilities and end users. The added cost stated of $100-$300 is for a device that may or may not be used sometime in the future. This provision is unnecessary and provide no energy savings to justify the added costs. These thermostats can be easily installed in the future, if and when an end-user and utility customer decides they want the device.

Koban, Mary

- While AHRI worked with the proponent regarding DR thermostats, we do note that many stakeholders during the IECC residential meeting had concerns over the mandatory nature of Section R403.1. The language requires DR by making the control comply with R403.1.1 and R403.1.2, while section R403.1.2 appears to be optional. AHRI notes that there may be code confusion regarding these two sections and how they are integrated.
- In further looking at this code proposal, AHRI members note that as the code proposal is currently written, it may negatively impact mini-splits and/or VRFs. Therefore, AHRI members are reviewing how to update this proposal to equally support all HVAC technology.
- AHRI notes that industry stakeholders stated that this code proposal to use the thermostat should be optional, otherwise there may be stranded assets for implementation. Many industry

stakeholders also noted security concerns that were expressed by many other members if the language is clearly optional.
- Alternatively, AHRI suggest to make this code proposal optional or part of SectionR408 which would alleviate these concerns.

Kochkin, Vladimir

- This measure should be addressed through utility programs to ensure that the thermostats are fully compatible with the programs' requirements at the time of program implementation.
- Replacing a thermostat is a straightforward task and it can be done in the future when the homeowner is ready to enroll in a utility program.
- Demand response programs are not available universally and not all homeowners will want to opt in to participate – in these cases the more expensive thermostat will become a "stranded asset."
- This measure can be included in R408 as an option for those homes that are ready to participate in a utility program at the beginning of occupancy.

Mabe, Gavin

I do not support including this in the code and forcing locals to amend it out. This should fall back on builders to install thermostats with demand response capability in areas this is applicable or utilities can provide compatible thermostats to customers that want to opt in. Thermostat manufacturers can decide if they choose to make this a standard capability through their own business plans. I don't feel this should be mandated by code.

If I understand the options correctly, then perhaps this could go in an Appendix section. I could support something like that.

Madrid, Ricardo

This should be left up to the industry to control and not a function of a code enforcement agency.

Marston, Thomas

Do not support this measure. I can support this when it is contained in an appendix that focuses on societal and social benefits of carbon reduction. I would support this measure when it is assigned to a new section like R408 and requires all parties to opt-in. In this case a utility would agree to provide specific hardware that the builder agrees to install at no charge. The utility would agree to promote the demand-control switching to the future occupant when they take possession of the property.

Martino, Amy

Reject proposal. With changing technology, requiring a specific thermostat which most likely will be obsolete and incompatible with a utility program in the future, should not be in IECC. Nothing precludes its installation where and when a resident chooses to opt. in to a utility program and accepts and understands the repercussions.

Reason:

Prior consensus committee voting disapproved a similarproposal due to many considerations including concerns for cyber security as expressed by representatives from Edison Electric in a separate forum. This is always an option by jurisdictions and utility companies which often include incentives to "opt- in" to a program. Although it may conserve energy for the utility companies, it places too much control in the hands of utility companies which may impact residents security, personal choice and residents activities particularly ifnot working a normal day shift.

Pousson, Jr., William

I do not believe it makes sense to require all new construction to install a Demand Response Thermostat when there are areas of the country where the utility provider doesn't offer a program to connect the thermostat. This increases the cost of construction for no benefit. Furthermore, the replacement of a thermostat is something that a homeowner can do themselves at a later date. There is an entire industry built around selling smart thermostats to customers who install it themselves with an app from the thermostat manufacturer. Finally, as someone who lives in the deep south, I cannot begin to explain the hesitance that homeowners will have if you tell them that someone outside of their home will be able to control their thermostats during the peak of summer. I cannot support this proposal and no modifications will make it acceptable.

Raymer, Robert

This measure should be addressed through local utility programs to ensure that the thermostats are fully compatible with the utilities' program requirements at the time of installation. While some utilities have successfully implemented this technology, with the full consent of the ratepayer, this proposal is not ready for inclusion in the IECC as a mandatory minimum feature. It should however be available in the code as a compliance option or for local consideration. This will allow more time for compatibility and security issues to be worked out before moving to a national mandate.

Revise as Follows:

Provide compliance credit in R408 or relocate in a new section R409 for jurisdictional consideration.

Shanks, Brian

The proponent, during testimony, indicated demand response controls were necessary in part due to an unstable grid. Also, it was stated that installing a demand response capable control at a delta cost of ~$200 would make it easier for those that wanted to voluntarily participate in utility demand response programs, where available. Just considering voluntarily participate and where available, it reinforced my

position that this is an unnecessary inclusion in code. Those that want to voluntarily participate in a utility demand response program are likely those that would do so no matter the 1st cost. The proponent didn't share how many utilities offered demand response programs so there was no way to know how many dwelling units would benefit from this requirement (or wouldn't) nor did they consider incremental cost where more than one HVAC system was utilized. Currently I am not aware of any homebuilder that would want to offer and manage the myriad of connected controls available. Discerning consumers, those that want to participate in the utility programs, should be able install their device of choice. There is no current justification to include demand response controls in every home.

Possible Remedy

I am unable to come up with any modification that would satisfy my concern with this proposal.

Truitt, Richard

The requirement of demand response capability does not ensure that the actual unit will be compatible with the utility program when the homeowner has a desire to voluntarily enter into such program. This may cause thermostats installed at initial construction to have to be removed and new compatible unit installed. This will cause additional cost in the future to comply. Additionally, this provision will not ensure that a homeowner will not change out the thermostat for a multitude of reasons that will not be demand response compatible. The code should not address this as a mandatory provision.

Wright, Jeremy

1. This should be addressed through utility programs to ensure thermostats are compatible with the program.

2. This can be upgraded in the future when a homeowner chooses to enroll in a program.

3. These thermostats are not currently compatible with all mechanical equipment.

4. This should remain a consumer choice. A consumer should not be required to bare the cost of the upgraded thermostat.

REPI-93-21

IECC®: R403.6.1

Proponents:
Marian Goebes, representing n behalf of the California Statewide Utility Codes and Standards Team (iecc-sf-hrv-erv@2050partners.com); Mark Lyles, representing New Buildings Institute (markl@newbuildings.org)

2021 International Energy Conservation Code

Revise as follows:

R403.6.1 Heat or energy recovery ventilation.

Dwelling units **shall be provided with a heat recovery or energy recovery ventilation system ~~in Climate Zones 7 and 8~~. The system shall be balanced with a minimum sensible heat recovery efficiency of 65 percent at 32°F (0°C) at a flow greater than or equal to the design airflow.**

Exceptions:

- 1. *Dwelling units* in single- and two-family dwellings and townhouses in Climate Zones 0-4.
- 2. Dwelling units in Group R occupancies that comply with Section C403.7.4.1.

REPI-93-21 HRV and ERV

Abstention with reason (ballot 3):

Salcido, Robert

This proposal pertains to covered products regulated through Federal rulemaking. As a matter of policy, PNNL abstains on such items which could impact rulemaking activities or result in a perceived conflict of interest.

Abstentions with comment (ballot 1):

Williams, Jeremy

This proposal pertains to covered products regulated through Federal rulemaking. As a matter of policy, DOE abstains on such items which could impact rulemaking activities or result in a perceived conflict of interest.

Voted Affirmative with comment (ballot 3):

Lyles, Mark

Comment: The proponent took feedback from voting members and updated the cost-effectiveness calculations. Based on their updated results, CZ5 is not passing cost-effectiveness thresholds, except when the social cost of carbon is included. I still support REPI-093, but as modified to expand the Exception #1 to include CZ0-4, as well as CZ5. CZ 6 is still showing as cost-effective.

Proposed modifications to REPI-93 to consider:

403.6.1 Heat or energy recovery ventilation

Dwelling units shall be provided with a heat recovery or energy recovery ventilation system ~~in Climate Zones 7 and 8~~. The system shall be balanced with a minimum sensible heat recovery efficiency of 65 percent at 32°F (0°C) at a flow greater than or equal to the design airflow.

Exceptions:

1. Dwelling units in single and two-family buildings in Climate Zones 0~~-4~~ 5.

2. Dwelling units in Group-R occupancies that comply with Section C403.7.4.1.

Reason: The current 2021 IECC ERV/HRV requirement applies to homes in CZ 7 & 8. In the version in the CAR, it expanded the requirement to include CZ 5 & 6.

Using feedback from NAHB, the proponent revised the analysis for cost effectiveness in the following ways:

- Increased the HRV's incremental cost to $1377, which is 25% more than our original analysis. This assumes an HRV that's independently ducted, instead of ducted through the furnace

ductwork, so should not penalize mini split heating and cooling systems (AHRI's concern). It assumes 9 hrs of total labor.
- Reduced energy savings for the HRV by 30%, to account for superposition – the fact that a balanced ventilation system will bring in more outdoor air (60 cfm, if the supply and exhaust fans are set for 60 cfm) than an unbalanced ventilation system (e.g., 42 cfm if an exhaust fan is set for 60 cfm) due to the pressure created by the building envelope if unbalanced. This means less heating and cooling in the base case (primarily exhaust-only), so energy savings dropped.

Because of the increase in HRV cost and reduction in HRV savings, climate zone 5B was no longer cost effective. 5A was cost effective if the social cost of carbon (SCC) was included but not cost effective if the SCC was ignored. Climate zones 6A and 6B continue to be cost effective, even when SCC is ignored. The revised analysis supports a modification to also exclude single-family homes in CZ 5.

Voted Negative with Reason (ballot 2):

Davis, Clifford

Not cost effective

Demers, Paul

The proposal does not reflect sufficient cost effectiveness.

Gobble, Kevin

This is not cost effective and saving may be overvalued.

Mabe, Gavin

I agree with concerns expressed in the ballot comments on the following proposed changes.

Parks, Robert

Not cost effective, will add $2,000 plus cost to maintain, energy savings are significantly overestimated

Energy savings are significantly overestimated, especially in the lower climate zones. Even in the upper climate zones, the smallest of ERV/HVR are often overkill and end up costing more rather than providing any savings at all.

Pousson, Jr, William

After reading the comments from the other committee members, I am not convinced that the cost effectiveness that was presented by the proponent is accurate. Unless they can provide documentation to the contrary I cannot support this proposal.

Shanks, Brian

After review of the proposed remedies I am updating my negative vote with reason for this proposal

Possible Remedy: Distill the recommendations provided and modify the proposal to include the resulting recommendations, most pointing to inclusion in R408 with compliance credit

Voted Negative with Reason (ballot 1):

Drumheller, Craig

HRV/ERV- Proponent did not demonstrate cost effectiveness. Would be resolved if included as a R408 credit.

Heikkinen, Gary

Savings are overestimated and first cost is underestimated, therefore making this proposal not cost-effective.

Hensley, Edwin

Clarity is required on the cost versus the benefit in order to communicate the rationale to our constituency. Regional and urban/rural variations in cost are significant. We cannot contribute language to the proposals that would change our vote.

Hensley, John

With lots of discussion of this proposal the actual cost was never truly explained. Consider adding to R408 for credit. Disapprove or provide actual cost that savings is not over-stated.

Johnson, Ric

The proposal uses outdate costs from 2018 and is not cost effective in Climate Zone 0 to 6. The proponent uses the social cost of carbon as a best case assumption but cannot justify the added costs. Current ERV costs are averaging between $1,500 - $2,000 and HRV's are averaging between $950 - $750.00. Inaccurate cost justification, inappropriate reference to a nonexistent section of the commercial standard this proposal should be disapproved.

Koban, Mary

- AHRI appreciated the work done by the proponent. However, as in REPI-69-21, AHRI has concerns that this code proposal brings commercial requirements into the residential code.
- AHRI further notes that this code proposal expands the climate zones to now includec limate zones 5 and 6. AHRI does not believe that cost justification and energy savings are clear. As noted during the committee meetings, it appears that some of the cost savings may be significantly overestimated relative to 2021 IECC with the estimated construction costs and maintenance costs are significantly underestimated.
- Therefore, AHRI suggests that this code proposal should be in section R408 for creditor modified.

Kochkin, Vladimir

- The cost-effectiveness analysis presented by the proponent is inaccurate at least on three key aspects:
    - The energy savings are significantly overestimated. This is apparently due to several assumptions made as part of energy modeling to favor HRV/ERV such as:
        - The analysis uses balanced ventilation as the base case for determining energy savings. The code does not require balanced ventilation. This is an incorrect assumption that leads to significantly overestimating energy savings.
        - The analysis does not include an interlock with the central system – this is the most typical design configuration for installing these systems in the field and should be analyzed at least as one of the options.
    - The construction costs are significantly underestimated: cost of duct, labor, integration with other building systems (e.g., cost of penetrations in the exterior wall), mark-ups, etc. A more representative cost estimate for adding an ERV/HRV is closer to $2,000.
    - The cost of filter replacement in ERV/HRV is ignored. Filters must be replaced at least every 6 months and the additional costs will change the life-cycle cost-effectiveness calculation.

The proposal becomes not cost-effective if evaluation is done using the corrected assumptions.

- The proposal does not address HVAC solutions with mini-splits or other ductless systems. These types of systems are becoming more popular and cannot be ignored.
- The cost-effectiveness spreadsheet approved by the consensus committee and used to substantiate this proposal has two significant issues:
    - The lower bound for the real discount rate was set at near 1.5% - this is a significant deviation from the direction from ICC to use the OMB rates at 3% and 7% and was never justified.
- Measures justified based on social cost of carbon must be placed into an appendix to be consistent with the Intent statement for the 2024 IECC which directs greenhouse gas reduction measures to be included in non-mandatory appendices.

Madrid, Ricardo

During consensus talks, many issues remained questionable and highly debatable. More review of this REPI is needed.

Marston, Thomas

Do not support this measure. ERV & HRV should be applied when operating costs and building costs are better understood and clearly stated. I can support this measure when it is part of R408, as currently shown in REPI-18, table 408.2

Martino, Amy

Relocate to Section 408 or new Section 409: Optional Jurisdictional Provisions

Reason:

Although I am concerned with indoor air quality, HRV's and ERV's are not as I understand required for balanced ventillation. The cost effectiveness statement overestimates the energy savings and underestimates the costs.

Raymer, Robert

The proponent did not demonstrate cost-effectiveness as the energy savings were significantly overestimated when compared to the 2021 IECC while the construction and maintenance costs were underestimated. However, as an emerging technology, this should be available for compliance credit.

Revise as Follows:

Relocate in R408 to allow for compliance credit.

Truitt, Richard

The proponent has failed to provide relative cost effectiveness documentation for this proposal.

Wright, Jeremy

1. The cost effectiveness by the proponent is inaccurate. The energy savings are considerably over estimated, the construction cost are under estimated, and cost to replace the filter is not included.

2. The proposal doesn’t address ductless mechanical systems.

REPI-111-21

IECC®: R404.4 (N1104.4) (New), R404.4.1 (N1104.4.1) (New), R404.4.2 (N1104.4.2) (New), R404.4.3 (N1104.4.3) (New), R404.4.4 (N1104.4.4) (New), R404.4.5 (N1104.4.5) (New)

Proponents:
Jeremy Williams, representing U.S. Department of Energy (jeremy.williams@ee.doe.gov)

2021 International Energy Conservation Code

Add new text as follows:

R404.4 (N1104.4) Electric readiness.

Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.4.1 through R404.4.4. All water heating systems shall comply with the space requirements of Section R404.4.5.

R404.4.1 (N1104.4.1) Cooking products.

An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.

Exception: Cooking products not installed in an individual *dwelling unit*.

R404.4.2 (N1104.4.2) Household Clothes Dryers .

An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.

Exception: Clothes dryers that serve more than one *dwelling unit* and are located outside of a *dwelling unit*.

R404.4.3 (N1104.4.3) Water heaters.

An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.

Exception: Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.

R404.4.4 (N1104.4.4) Electrification-ready circuits.

The unused conductors required by Sections R404.4.1 through R404.4.3 shall be labeled with the word "spare." Space shall be reserved in the electrical panel in which the branch circuit originates for the installation of an overcurrent device. Capacity for the circuits required by Sections R404.4.1 through R404.4.3 shall be included in the load calculations of the original installation.

R404.4.5 (N1104.4.5) Water heater space.

An indoor space that is at least 3 feet (304 mm) by 3 feet (304 mm) wide by 7 feet (2133 mm) high shall be available surrounding or within 3 feet (304 mm) of the installed water heater.

Exceptions:

1. Installed heat pump, electric tankless, or fossil fuel tankless water heaters.

2. *dwelling units* in a R-2 occupancy.Water heaters in a centralized water heating system serving multiple

REPI-111-21 Electrification

Voted Affirmative with comment (ballot 3):

Vijayakumar, Gayathri

While I fully support REPI-111, I am submitting a comment with my Affirmative vote in Ballot 3 in case it fails to achieve 2/3. Presented in Ballot 2 as a mod to REPI-33, the first omnibus included unedited text from RECPI-6, RECPI-7, REPI-64, 68, 93, and 111. **Based on Ballot 2 results,** it now combines those REPI's with text from REPI-7, 20, 70, 122, and 115 and is presented here as a MOD to REPI-111.

In addition, in the spirit of finding consensus, the following EDITS to individual REPI's are made in "Omnibus Version 2", based on modifications proposed in the Ballot 1 and 2 comments provided by voters. Where edited in the Omnibus, I used red font, but I also summarized the changes below.

REPI-7, 20, 111, RECPI-6: no change

REPI-70 & 115: compromised and moved from main body to R408

RECPI-7: compromised and reduced EV requirement to apply to just 75% of dwelling units, not 100%

REPI-64: compromised and edited to allow CZ 3 to maintain current 3 ACH50, and only lowers that value to 2.5 (not 2.0) for CZ 4-8

REPI-68: compromised and edited so that cool roofs are not required in CZ3 and an exception offered to humid climates in Chapter 5

REPI-93: compromised and edited to exempt CZ5, but still expands ERV/HRV requirement into CZ6

REPI-33: compromised and added a 4th option and now requires 2 of the 4 options to be selected. Also made edits to the 3 current options (HP and HPWH must meet the R408 efficiency levels and meet ENERGY STAR "connected" criteria, and edited the option for 3 additional credits, to be 5 instead.)

REPI-122: changed envelope backstop UA multiplier to 1.0 and 1.10 (instead of 1.15); this change is made to all code sections for consistency (R102, 405, 406, Appendix RC)

Voted Negative with Reason (ballot 2)

Davis, Clifford

Should be in an appendix

Demers, Paul

This proposal would result in a cost increase and similarly penalize a homeowner that may choose gas appliances over electric appliances

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Mabe, Gavin

I agree with concerns expressed in the ballot comments on the following proposed changes.

Parks, Robert

Move to appendix or jurisdictional option; feasibility concerns if a mandate; needs a glidepath

My negative vote on these proposals is because I agree with the concerns and reasons statements already expressed in ballot comments on this proposed change

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Rossmiller, Gil

Needs to be an option rather than a requirement. As an appendix would allow jurisdictions the opportunity to adopt and provide guidance.

Voted Negative with Reason (ballot 1):

Drumheller, Craig

Electric Ready – Does not belong in the base energy code. Should be an appendix that can be implemented at the state and local level when it is identified as a practical solution.

Gobble, Kevin

Remove the requirements for Electrification-ready circuits and do not include in load calculations. Strike through R404.4.4.

Heikkinen, Gary

- This proposal adds cost without any energy savings and by definition, is not cost effective.
- The reason statement states, “This proposal enhances customer choice by making it easy for homeowners to choose either electric or gas appliances.” If customer choice were truly one of the main reasons for this proposal, it would require that both electric and gas connections be installed at these locations.
- There will be stranded costs and assets if a home never installs electric appliances.
- This proposal presumes that electrification is imminent and the only method to decarbonize homes. It ignores future advancements in technologies, like gas heat pumps and carbon capture, and dismisses developments in renewable gas and hydrogen. It would be much more effective to be open to using all the tools in the bag rather than putting all the eggs in one basket.
- This is a “back-door” electrification proposal since some (or many) home builders will choose to only install electric appliances.

Hensley, John

I agree with preventing costly modifications later when you can install the infrastructure at rough is the best path. I do not think this is cost effective. The grid across the country is unreliable and stressed to the max and current plans of updating the grid are vague at best. Disapprove

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Johnson, Ric

This provision belongs in the Appendix as this should be an option for the 2024 IECC Standard. In many jurisdictions, legislation has been passed against mandatory electrification.

To vote for approval, this proposal:

Remain in an appendix allowing for a glidepath, not an expensive mandate that does not improve the energy efficiency of the dwelling.

Koban, Mary

- AHRI notes that this code proposal does not meet the guidelines for energy efficiency. This code is "electric readiness" and is about preparing future homes all elective appliances or heating units. If the electric grid cannot handle this increase in required capacity, the associated construction costs will never be recouped. (The submitter notes that this will increase the cost of construction.)
- AHRI notes that the exception listed in section R404.4.2 is not technology neutral, and that preference appears to be given to a particular type of tankless water heater. Energy efficiency can be achieved with all water heaters.
- AHRI further notes that the space requirements of section R4040.4.5 will definitely result in higher construction codes without a clear energy savings.
- AHRI further notes that stranded asset and installed costs are never recovered if all-electric appliances are not utilized. The provided cost justification is based on avoided future costs, which is an incorrect assumption and speculative at best.
- AHRI recommends that this code proposal be an optional prescriptive requirement or in appendix.

Kochkin, Vladimir

- These provisions should be located in an appendix – this is a better format for serving the wide range of jurisdictions around the country. There are many areas of the country which are not ready for electrification policies or have passed legislation against mandatory electrification.
- There are large regions of the country where the utility grid will need significant upgrades and maintenance before a substantial increase in load can be accommodated safely and dependably.
- There are climate considerations and building site considerations (e.g., rural areas, remote areas) that can make full electrification a less practical choice.
- The Intent statement for the 2024 IECC directs greenhouse gas reduction measures to be included in non-mandatory appendices. The Intent statement was an integral part of the ICC'

transition to the new standards development process and ICC's call for committee members. ICC staff's interpretation of the Intent statement in the February 15th, 2022 memo contradicts the plain language of R101.3.

Madrid, Ricardo

Allow for the jurisdiction to take local control of when the industry, state entities and power supply is prepared to move forward. Currently addresses rolling blackouts is more in line to address.

Marston, Thomas

Do not support this measure. I can support this when it is contained in an appendix that focuses on societal and social benefits of carbon reduction. I would support this measure if it were part of a new section like R408. This section recognizes measures in the table that do not save energy until acted upon at some time in the future. All parties must agree to opt-in to the selected measure(s) and costs are shared by all stakeholders. In this case, electric-ready will require hardware inside the building. It may also require the electric service, transformer, or primary cable upgrade. The builder would not be required to incur costs to upgrade the service if the jurisdiction is requiring electric ready buildings.

Martino, Amy

Move entire section to new Section 409: Optional Jurisdictional Provisions or in an appendix

Reason:

This proposal does not save or conserve energy, but addresses the broader subject of decarbonization. With concerns for burden on our electrical grid and infrastructure, inadequate electrical power infrastructure which will require major upgrades, increased electrical utility rates, an existing natural gas infrastructure in place, future reliance on only electricity particularly in emergencies, installing duplicative power which may never be utilized and consumer choice, I can only support this in the 2024 IECC if it is a juridictional option which is adopted where it can be implemented effectively and be cost effective. It does not take in consideration future technology and cleaner burning fuels.

Pousson, Jr., William

I feel that cooking equipment should not be required to install the future electric circuit. Many people prefer to cook with natural gas. I also question the space requirements for the water heater. In the south it is common for water heaters to be installed in a closet outside. This requires the space for the water heater to be indoors. Would an outdoor closet qualify?

Raymer, Robert

While there are jurisdictions throughout the country that either have or are considering going all-electric to promote decarbonization of the new building sector, there are still many areas of the country which are not ready to make this leap or have taken specific steps not to go all-electric. Also, there are large regions of the country where the utility grid is fragile and will need significant upgrades and maintenance before a substantial increase in load can be accommodated safely and dependably.

Builders and designers are still trying to get a handle on the impact on the electrical panel from going all-electric, having two EVs in the garage, solar on the roof, and batteries in the garage. While this can certainly be accomplished, the industry needs time to sort this out and learn how to incorporate load-management technology into the mix.

Lastly, the price of electricity can vary significantly from one utility provider to the next. In addition, many utilities have implemented time-of-use rates for electricity that can be 2-3 times higher during peak load periods than the rest of the day. It is still unclear how this will affect the consumer's pocketbook, but there will be an increase in monthly electric bills, possibly without an equal offsetting reduction in the gas bill. This should be a decision left to the builder and the local jurisdiction for the short term.

Revise as Follows:

The building industry suggests taking the proposal as written and provide compliance credit in R408 or as a jurisdictional option in a new R409 or the Appendix.

Shanks, Brian

There is not enough supporting documentation regarding the cost of including the design capacity (R404.4.4) in the initial load calculations. Best I can tell the proponent only addresses the installed cost to accommodate those circuits behind the load center and does not factor in the cost in front. It is also unclear if the proponent has considered land backlog where the utility backbone already in place likely wasn't designed to handle the increased electrical load.

Possible Remedy

1. An exception like when the infrastructure cannot support the inclusion of additional electrical load…

2. Move to appendix where a municipality can adopt if the electric infrastructure can support

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Truitt, Richard

This proposal increases cost of construction with no pay back on investment unless the homeowner changes out the gas equipment for electric appliance. This proposal is penalizing the homeowner who chooses to install gas appliance by choice by adding additional cost. I would support placing in an appendix for jurisdictions to adopt as desired.

Wright, Jeremy

1. There are areas in the country where the utility gird is not ready for electrification policies.

2. There are areas in the county that have passed legislation against electrification policies.

3. In northern climates electric heat is more expensive and less efficient than other clean fuel alternatives.

4. The provision should be placed in an appendix.

REPI-115-21

IECC®: SECTION 202 (New), R103.2.4 (New), R105.2.5 (New), R404.4 (New), R404.4.1 (New), R404.4.2 (New), R404.4.2.1 (New), R404.4.2.2 (New), R404.4.2.3 (New), R404.4.2.4 (New), TABLE R405.2, TABLE R406.2

Proponents:
Joseph Cain, representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2021 International Energy Conservation Code

Add new definition as follows:

ENERGY STORAGE SYSTEM (ESS) . One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time.

Add new text as follows:

R103.2.4 Energy storage-ready system.

The construction documents shall provide the location of pathways for routing of raceways or cable from the *energy storage system* to the electrical service panel, from the panelboard to dedicated branch circuits, the location and layout of a designated area for electrical *energy storage system* and system isolation equipment.

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 energy storage system area is not in the same space as the electrical panel, inspections shall verify conduit or pre-wiring from the energy storage ready zone to the electrical panel.

R404.4 Electrical energy storage system.

One- and two-family dwellings, townhouse units, and Group R-3 occupancies shall either comply with R404.4.1 or R404.4.2. Buildings with Group R-2 and R-4 occupancies shall comply with C405.15.

R404.4.1 Electrical energy storage energy capacity.

Each building shall have a ESS with a minimum rated energy capacity of 5 kWh with a minimum of four ESS supplied branch circuits.

R404.4.2 Electrical energy storage system ready.

Each building shall be energy storage ready area in accordance with Sections R404.4.2.1 through R404.2.2.4.

R404.4.2.1 Energy storage system space.

Interior or exterior space with dimensions and locations in accordance with Section R328 of the *International Residential Code* and Section 110.26 of NFPA 70 shall be reserved to allow for the future installation of an *energy storage system.*

R404.4.2.2 System Isolation Equipment Space.

Space shall be reserved to allow for the future installation of a transfer switch within 3 feet (305 mm) of the main panelboard. Raceways shall be installed between the panelboard and the transfer switch location to allow the connection of an *ESS.*

R404.4.2.3 Panelboard with backed-up load circuits.

A dedicated raceway from the main service to a panelboard that supplies the branch circuits served by the *ESS.* All branch circuits are permitted to be supplied by the main service panel prior to the installation of an *ESS.* The trade size of the raceway shall be not less than one inch. The panelboard that supplies the branch circuits shall be labeled "Subpanel reserved for future battery energy storage system to supply essential loads."

R404.4.2.4 Branch circuits served by ESS.

A minimum of four branch circuits shall be identified and have their source of supply collocated at a single panelboard supplied by the *ESS*. The following end uses shall be served by the branch circuits:

- 1.

  A refrigerator.

- 2.

One lighting circuit near the primary egress.

- 3.

  A sleeping room receptacle outlet.

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
R404.2	Interior lighting controls
R404.4	Electrical energy storage system

- 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
R404.2	Interior lighting controls
R404.4	Electrical energy storage
R406.3	Building thermal envelope

- a.

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

REPI-115-21 Energy storage ready required

Voted Affirmative with comment:

Voted Negative with Reason (ballot 2):

Davis, Clifford

Should be in an appendix

Demers, Paul

Requiring homes to be energy storage ready is unfairly imposing a requirement that limits a homeowners or jurisdictions right to choose and this proposal may be better suited within an Appendix rather than in the body of the code.

Mabe, Gavin

I agree with concerns expressed in the ballot comments on the following proposed changes.

Rossmiller, Gil

Needs to be an option rather than a requirement. As an appendix would allow jurisdictions the opportunity to adopt and provide guidance.

Voted Negative with Reason (ballot 1):

Drumheller, Craig

Battery Ready – It is not clear that this is the most practical solution for energy storage. The economies of scale clearly point toward utility based solutions rather than making each home an energy storage warehouse. Disapprove

---

Gobble, Kevin

I do not agree with requiring ESS on construction documents or space when they may never be installed in the home and will increase costs. Most, if not all of the systems we are seeing install in our jurisdiction is tied to the power grid. I would strike through R103.2.4, R105.2.5, R404.4, R404.4.1, R404.4.2, R404.4.2.1, R404.4.2.2, R404.4.2.3, and R404.4.2.4.

Heikkinen, Gary

- This proposal adds cost without any energy savings and by definition, is not cost effective.
- The proposal would burden ALL homes with this requirement and added cost, even though the infrastructure may never be used.
- Home owners who wish to install batteries should bear the incremental cost and take advantage of available incentives and tax credits to help offset.
- Doesn't not adequately address changing technology.

Hensley, Edwin

Clarity is required on the cost versus the benefit in order to communicate the rationale to our constituency. Regional and urban/rural variations in cost are significant. We cannot contribute language to the proposals that would change our vote.

Hensley, John

Doesn't not adequately address changing technology. Disapprove

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Johnson, Ric

This provision belong is an appendix. For energy savings, this proposal should be pair with onsite solar. If on-site solar is not going to be installed, this proposal provides no energy efficiency or savings. The proposal does not include costs for additional fire protection, nor damage protection that require specific design criteria to accommodate the added weight and support of future energy storage installation. The proposal provides no actual costs, only future cost savings.

To vote for approval, this proposal:

To be placed in an appendix for the 2024 IECC Residential Standard.

Koban, Mary

- AHRI again notes that this code proposal does not meet the guidelines for energy efficiency. This code is "electric storage systems" and is about preparing for a possible future requiring electrical energy storage systems. If the electric grid cannot handle this increase in required capacity, the associated construction costs will never be recouped. (The submitter notes that this will increase the cost of construction.)
- AHRI notes no cost analysis was done on installing these systems. Therefore, there may be stranded asset/costs never recovered if ESS not utilized.
- AHRI notes that this is listed as requirement, but we highly recommend this code proposal be optional or in appendix.

Kochkin, Vladimir

- These provisions should be in an appendix.
- The proposal presents onsite energy storage systems as an extension of the grid and serving as a resource to the grid rather the building, its occupant, or its owner. A portion of the justification focuses on the benefits to the grid and on resilience. These types of measures should be addressed through utility programs with opt-in strategies or other policies instead of energy code mandates. These considerations are outside of the scope of the IECC.
- From the energy savings standpoint, onsite battery storage should be paired with onsite solar. Where onsite solar is not going to be installed, these requirements will not serve an energy saving function. This is going to be an issue for jurisdictions that will prioritize community-scale and utility-scale renewable energy over the more expensive and less practical onsite generation.
- The proposal refers to the commercial code for low-rise multifamily provisions. IECC Residential is a standalone code and all provisions must be justified specifically for low-rise multifamily buildings and should be places in the residential code. Many jurisdictions adopt ASHRAE 90.1 as commercial code (not IECC). Referring the user of the residential IECC to the commercial energy provisions breaks with the long-standing convention for delineation between the two codes within the IECC.
- The cost statement does not account for the existing code requirements for impact protection of energy storage systems and for fire protection of the building. Both the impact protection measures and the fire protection measures require specific design choices to be able to accommodate future battery installation and will have additional cost implications for many design scenarios.
- The cost impact statement provided with the proposal refers to an aspirational goal for lowering costs in the future rather than an actual cost estimate.

Madrid, Ricardo

This would work good with solar provisions only.

Marston, Thomas

Do not support this measure. I can support this when it is contained in an appendix that focuses on societal and social benefits of carbon reduction. I can support this when the battery storage ready provision is provided with a benefit that offsets the cost to develop. Developers may choose to install community Solar, and homeowners should want greater resiliency by connecting battery backup systems to the grid, which is partially served with renewable energy.

Martino, Amy

Move entire section to new Section 409: Optional Jurisdictional Provisions or in an appendix

Reason:

This proposal does not save or conserve energy. It should only be paired with the instalation of on site solar PV and sized and designed accordingly. I am deeply concerned with the potential fire hazards that battery storage may cause and especially the effect on the construction and costs in order to ensure fire safety for residents. Technology will advance and this is a proposal which places infrastructure which may never be utilized especially if on site solar PV is not installed.

Section 409: Optional Jurisdictional Provisions

The section can provide a true glidepath from 2024 to 2027 to 2030 IECC and give jurisdictions reasonable time to facilitate, transition and plan due to their own local capacity to implement needed changes, upgrades, agreements and incentives which are responsive to community needs and restrictions. The alternate choice for a jurisdiction may simply be to not adopt them in any form or to modify them substantially. This gives jurisdictions the ability to set their own thresholds and to lean forward into advanced energy saving concepts. Points applied to section 408 may be a consideration.

This new section would be provisions in the IECC which may address the following:

- Provisions which technically do not save building energy
- Provisions which are based on increased costs for future retrofit which may not be required or utilized in the future (stranded technology)
- Provisions with significant uncertainty regarding their cost-justification
- Provisions which require a larger community consensus to implement including utility grid capacity, required upgrades and expansion plans, jurisdictional financial incentives (affordable housing, etc.), community land acquisition, agreements and maintenance plans.
- Provisions which may increase electrical utility rates
- Provisions which benefit the local community but would require coordination and agreements specific to the jurisdiction to implement. (Example: Community and utility scale renewables, REC's, etc.)
- Provisions addressing credits for upgrades to existing homes which are not likely to be required to be improved. (Points for increased insulation, replacing windows and doors, improving thermal envelope, increased energy efficiency for replacing equipment and lighting (HVAC, Hot water heating, appliances, etc.)
- Provisions which due to geographical and climatic reasons have marginal benefits for every jurisdiction adopting the IECC
- Provisions addressing decarbonization and climate change which affect more than the jurisdiction or community.

Examples which are optimal for Section 409 include

- Community and Utility scale renewables
- EV charging
- Electrical readiness
- All electrification
- PV solar readiness

- Battery energy storage readiness
- Above code programs
- Zero net energy
- Cool roofs
- Additional existing building (non-mandatory) upgrades

The following is an example section from ASHRAE 189.1 which utilizes Jurisdictional options.

4.2 Jurisdictional Options. The jurisdictional options listed in Table 4.2 provide jurisdictions the flexibility to adopt the code in a manner that is best suited to meet their unique environmental and regional goals and needs. The informative symbol "[JO]" after the section number indicates jurisdictional option provisions.

Table 4.2 may be used for the code adoption ordinance:

a. Where "No" boxes are provided, the jurisdiction checks the box to indicate where that section is not to be enforced as a requirement in the jurisdiction. Where the "No" box is not checked, that section is adopted.

b. Where a numerical value is listed to specify the level of performance, the jurisdiction shall indicate the required value to be adopted. Where a numerical value is not indicated, the value in the text is adopted without change

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Parks, Robert

The reason given to approve REPI-115-21 implies these requirements will be mandatory in the 2022 edition of California's title 24. Beyond requiring ESS to serve an onsite renewable energy system, REPI-115-21 wants building owners to assume the cost of providing real estate, and possibly equipment, for ESS to bolster the effectiveness of the grid. The REPI-115-21 reason states: "As deployment of distributed energy resources such as solar photovoltaic systems increases, so does the need for distributed energy storage resources to minimize grid impacts."

This is simply not feasible given the current technology and availability Vs cost.

Pousson, Jr., William

I am unconvinced that this should be required for every home. The code is a minimum code, and this does not strike me as a something that should be standard. I question the accuracy of the costs

estimate. I am also unconvinced that the equipment that is required to be installed will be necessary with future advances in battery technology.

Raymer, Robert

Battery storage is intended to be paired with an on-site photovoltaic energy system. While on-site solar may be mandated at some point in the future, rooftop PV will not be among the prescriptive mandates that appear in the 2024 IECC. In California, the mandate for battery-ready provision was not required until three years after the rooftop PV mandate took effect. As part of the glide path to 2030, the industry feels a mandate for on-site battery storage should either come with or after a mandate for on-site photovoltaic energy systems is in place. There is also the concern that this proposal does not adequately address changing technology.

Revise as Follows:

The industry suggests taking the proposal as written and provide compliance credit in R408 or as a jurisdictional option in a new R409 or the Appendix.

Shanks, Brian

This proposal belongs in an appendix where jurisdictions' that benefit from favorable solar conditions can adopt at will

Possible Remedy

Move to an Appendix

Truitt, Richard

This proposal does not fit within the Intent statement for inclusion into the body of the Code within Section R101.3 and N1101.3 as issued by the ICC Board. The insertion of energy storage ready provisions has no relevancy to energy efficiency for buildings. Within the Intent statement contains the following language. "The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others." This language provides for clear direction that the Board is open to such provisions, but they must be placed in an appendix for use and adoption by Jurisdictions.

Wright, Jeremy

1. Onsite battery storage only works when paired with solar. Otherwise, this requirement doesn’t serve as an energy savings function. This will be an issue where utility-scale renewable energy is used over less practical onsite generation.

2. This proposal should be in an appendix.

3. This proposal is based on potential future energy saving instead of actual cost savings.

4. The proposal is proposed to benefit the grid and not the homeowner. This should be addressed in utility programs and not the code.

REPI-122-21

IECC®: R401.2.5, R405.2, TABLE R405.4.2(1), TABLE R405.4.2(2), DOE Chapter 06 (New)

Proponents:
Vladimir Kochkin, NAHB, representing NAHB (vkochkin@nahb.org)

2021 International Energy Conservation Code

Revise as follows:

R401.2.5 Additional energy efficiency.

This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

- 1.

  For buildings complying with Section R401.2.1, one of the additional efficiency package options shall be installed according to Section R408.2.

- 2.

  ~~For buildings complying under with Section R401.2.2 , the building shall meet one of the following:~~

  - 2.1.

    ~~One of the additional efficiency package Options in Section R408.2 shall be installed without including such measures in the proposed design under Section R405; or~~

  - 2.2.

    ~~The proposed design of the building under Section R405.3 shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design.~~

- 2.

  3.

  For buildings complying with the Energy Rating Index alternative Section R401.2.3, the Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified in Table R406.5.

The option selected for compliance shall be identified in the certificate required by Section R401.3.

R405.2 (N1105.2) Performance-based compliance.

Compliance based on total building performance requires that a *proposed design* meets all of the following:

- 1.

  The requirements of the sections indicated within Table R405.2.

- 2.

  The proposed total *building thermal envelope* UA, which is the sum of the U-factor times assembly area, shall be less ~~greater~~ than or equal to the *building thermal envelope* UA using the prescriptive U-factors from Table R402.1.2 multiplied by 1.15 in accordance with Equation 4-1.~~levels of~~

~~efficiency and solar heat gain coefficients in Table R402.1.1 or R402.1.3 of the 2009 *International Energy Conservation Code*.~~The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

Equation 4-1: $UA_{proposed\ design} <= 1.15 \times UA_{prescriptive\ reference}$ design.

- 3.

  For buildings without a fuel burning appliance for space heating or water heating, ~~An~~ the annual energy cost of the *proposed design* that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the *proposed design* that is less than or equal to 80 percent of the annual energy cost of the *standard reference design.*

  Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.

TABLE R405.4.2(1) (TABLE N1105.4.2(1)) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT				
Heating systems[d, e, j, k]		~~As proposed~~		
	Fuel Type/Capacity: Same as proposed design	As proposed		
	Product class: Same as proposed design	As proposed		
	Efficiencies:	As proposed		
	Heat pump: Complying with 10 CFR §430.32	As proposed		
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed		
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed		
Cooling systems[d, f, k]		~~As proposed~~		
	Fuel Type: Electric Capacity: Same as proposed design	As proposed		
	Efficiencies: Complying with 10 CFR §430.32	As proposed		
Service water heating[d, g, k]				
		Compactness ratio[i] factor		**HWDS**
		1 story	2 or more	

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<tr><td></td><td></td><td></td><td>storie s</td><td></td></tr>
<tr><td></td><td></td><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td></td><td></td><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td></td><td></td><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td></td><td></td><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
<tr><td></td><td>Fuel Type: Same as proposed design</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Draw Pattern: Same as proposed design</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td><td></td><td></td></tr>
<tr><td>Thermal distribution systems</td><td>Duct insulation: in accordance with Section R403.3.1.

Duct location: ~~same as proposed design~~

<table><tr><th>Foundation Type</th><th>Slab on grade</th><th>Unconditioned crawlspace</th><th>Basement or conditioned crawlspace</th></tr><tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25%</td><td>50% inside conditioned space

50% unconditioned attic

</td></tr></table></td><td>Duct insulation: as proposed.

Duct location: as proposed.

Duct System Leakage to Outside:

The measured total duct system leakage rate shall be entered into the software as the duct system</td><td></td><td></td></tr>
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<tr><td></td><td>conditioned space

-</td><td>inside conditioned space

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Duct system leakage to outside:

For duct systems serving > 1,000ft² of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of conditioned floor area.

For duct systems serving ≤ 1,000ft² of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).
</td>
<td>leakage to outside rate.

Exceptions:

1.. When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.

2. When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of conditioned floor area.</td>
<td></td>
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<td></td>
<td>~~For all systems other than tested duct systems. a~~ For hydronic systems and ductless systems.a ~~A~~ thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies. ~~for all systems other than tested duct systems.~~
~~Exception: For nonducted heating and cooling systems that do not have a fan, the standard reference design thermal distribution system efficiency (DSE) shall be 1.~~</td>
<td>~~As tested or, where not tested,~~ For hydronic systems and ductless systems, DSE shall be as specified in</td>
<td></td>
<td></td>
</tr>
</table>

	~~For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of *conditioned floorarea* at a pressure of differential of 0.1 inch w.g. (25 Pa).~~	Table R405.4.2(2).		

- g.

  For a proposed design ~~with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design~~ without a proposed water heater, ~~a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed~~ the following assumptions shall be made for both the proposed design and standard reference design.
  Fuel Type: Same as the predominant heating fuel type
  Rated Storage Volume: 40 Gallons
  Draw Pattern: Medium
  Efficiency: Uniform Energy Factor complying with 10 CFR §130.32

- j.

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

- k.

  For heating systems, cooling systems, or water heating systems not included in Table R405.4.2(1), the standard reference design shall be the same as proposed design.

TABLE R405.4.2(2) DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS[a]

Distribution system components located in unconditioned space	NA	0.95
~~Untested distribution~~ Distribution system ~~systems~~ components entirely located in conditioned space[c]	~~0.88~~NA	1
Ductless systems[d]	1	NA

- a.

  Default values in this table are for untested distribution systems, which must still meet minimum requirements for duct system insulation.

- b.

  Hydronic systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed-loop piping and that do not depend on ducted, forced airflow to maintain space temperatures.

- c.

  Entire system in conditioned space shall mean that no component of the distribution system, including the air-handler unit, is located outside of the conditioned space.

- d.

  Ductless systems shall be allowed to have forced airflow across a coil but shall not have any ducted airflow external to the manufacturer's air-handler enclosure.

Add new standard(s) as follows:

DOE	US Department of Energy c/o Superintendent of Documents 1000 Independence Avenue SW Washington DC 20585
10 CFR, Part 430-2021	Energy Conservation Program for Consumer Products: Energy and Water Conservation Standards and their compliance dates.

REPI-122-21 Performance path

Voted Affirmative with comment (ballot 3):

Mabe, Gavin

After further consideration, I would like to revert back to my original YES vote.

Voted Affirmative with comment (ballot 2):

Allen, Charles

pursuing ongoing recommendations in the working group.

Voted Affirmative with comment (ballot 1):

Kochkin, Vladimir

- This change addresses a problem with the 2021 IECC – the current code has only a hybrid performance/prescriptive compliance path that requires the user to conduct partial performance analysis (R405) and then follow-up with prescriptive design (R408) for equipment or other measures.
- REPI-122 revises Section R405 to provide a standalone, energy-neutral performance compliance path.
- The envelope backstop approved by the consensus committee will apply to the revised Section R405.
- The performance target is set at a very aggressive level of 80% of the reference design house energy (the new R408 point system requires only 90%). For all-electric buildings, a more achievable 85% target is set because it is more difficult to achieve these targets with an electric-only design. PNNL did a preliminary analysis of REPI-122 and did not identify any reason to further reduce the multipliers.
- The proposal considered input from a wide range of stakeholders and was approved by a 2/3 margin vote at the consensus committee meeting.

Marston, Thomas

Support because the Simulated Performance Path, R405, is including many of the energy consuming devices that create energy costs, which allow designers to present an estimated operating cost to owners that will occupy the building. REPI-122 correctly aligns the advantage of moving ducts within the building envelope.

Martino, Amy

Strongly support

Reason:

This improves the 2021 IECC and creates a functioning performance path which is needed.

Raymer, Robert

Support inclusion of this proposal into the Public Comment draft as it simplifies the code by restoring a standalone performance path. R408 (additional prescriptive measures) are not needed as everything is in one place in Section R405. It also provides improved parity between the prescriptive path and the performance path. To make progress on a glide path towards net zero it is critical that we have a fully optimized performance path. Increases to insulation stringency will only increase cost and not provide the meaningful energy savings that is needed.

Wright, Jeremy

1. This change addresses a problem with the 2021 IECC, the current code just a hybrid performance/ prescriptive compliance path which requires the user to conduct performance analysis and the follow with prescriptive design for equipment or other measures.

2. The proposed changes provide a standalone, energy neutral performance compliance path.

3. The proposal included input from numerous stakeholders and was approved by the consensus committee.

Voted Negative with Reason (ballot 3):

Chawla, Patricia

While I mostly support REPI-122, I am submitting a negative vote so that the “Omnibus” proposal (version 2) can be discussed at the September meeting.

Salcido, Robert

This proposal makes two dangerous adjustments to the R405 reference standard design. First, HVAC and SWH equipment is set to the current federal minimum efficiency which differs from the current platform that HVAC/SWH equipment is the same as the proposed home efficiencies. This gives extensive credit to homes that install high efficiency equipment that is now considered standard practice in many climate zones. A second change is duct location is set in the reference home where in the past it was in the same location as the proposed home. These locations are in various unconditioned spaces in the home based on foundation type. As a result, ducts in conditioned space for the proposed home can receive extensive credit since the reference home will have ducts in

unconditioned spaces. To compensate for this, compliance metrics have been put in place that homes with heat pumps must meet 85% or better of the standard reference home annual costs. Homes with gas furnaces must meet 80% or better of the standard reference home annual costs.

This proposal allows large increases in energy allowed in the R405 reference home which makes it much easier to comply with the total building performance path even with the added efficiency metrics of 80% and 85% based on heating type. There was no analysis performed to determine if the added efficiency metrics would cover the loss of efficiency in the R405 standard reference design. In order to support such a proposal, we would need to see an analysis of this proposal showing that the 80% and 85% compliance metrics would cover the increased energy consumption in the reference home design. Another option would be to set the duct location in the reference home to conditioned space. This way there would be no credit for a good duct location but any ducts in unconditioned space would need to make up the energy with other efficiency.

Williams, Jeremy

DOE is concerned that a 1.15 multiplier for envelope backstop this could represent a net decrease in energy efficiency in section R405.2, the performance-based compliance path. Additional analysis is needed to understand the impact of this approach versus other options, such as a 1.10 or 1.05 backstop. DOE suggests considering a 1.10 multiplier as an initial step, but this should be supported by a more detailed analysis.

Voted Negative with Reason (ballot 2):

Amann, Jennifer

ACEEE opposes this proposal because it would allow new homes that are less efficient than the 2021 IECC to comply with the 2024 version of the code. Any weakening of the code relative to the 2021 version is unacceptable if we are to make progress toward zero emissions building goals and address the climate crisis. There has been no data provided to support the proposed credits and tradeoffs. Specific concerns with the proposal include: 1) credits for heating, cooling, water heating equipment that is already common in new construction; 2) credits for locating ducts in conditioned areas, already a common practice in moderate to cool climates; and 3) tradeoffs of long-lived envelope measures for shorter-term HVAC and water heating equipment which will be replaced multiple times over the life of the building.

Mabe, Gavin

I agree with concerns expressed in the ballot comments on the following proposed changes.

Rossmiller, Gil

More discussion is needed for the backstop. Many comments on the 1.15 multiplier should be 1.10.

Stone, Mike

Negative with comment (This appears to decrease efficiency and needs more consideration during the next round of comments).

Vijayakumar, Gayathri

While I support REPI-122, I am submitting a negative vote because I think there is a good compromise solution being proposed with the UA backstop and I would like it discussed at the September meeting. At the meeting, I could support REPI-122 with or without the attached modification to UA. Note: I have expanded the UA edit to include R406 since the Committee has expressed some interest in the backstops all being consistent.

REPI-122-21

IECC®: R401.2.5, R405.2, TABLE R405.4.2(1), TABLE R405.4.2(2), DOE Chapter 06 (New)

Proponents:

Vladimir Kochkin, NAHB, representing NAHB (vkochkin@nahb.org)

2021 International Energy Conservation Code

Revise as follows:

R102.1.1Above code programs. The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. *Buildings approved* in writing by such an energy-efficiency program shall be considered to be in compliance with this code where such buildings also meet the requirements identified in Table R405.2 and the proposed total *building thermal envelope* UA, which is the sum of *U*-factor times assembly area, shall be less ~~is greater~~ than or equal to the *building thermal envelope* UA using the prescriptive *U*-factors from Table R402.1.2 multiplied by 1.00 in Climate Zones 0, 1, and 2, and by 1.10 in Climates Zones 3 through 8, in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30. ~~levels of efficiency and solar heat gain coefficients in Tables 402.1.1 and 402.1.3 of the 2009 *International Energy Conservation Code*.~~

For Climate Zones 0-2: $UA_{Proposed\ design} \leq 1.00 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)

For Climate Zones 3-8: $UA_{Proposed\ design} \leq 1.10 \times UA_{Prescriptive\ reference\ design}$

Revise as follows:

R401.2.5 Additional energy efficiency.

This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying with Section R401.2.1, one of the additional efficiency package options shall be installed according to Section R408.2.

~~2. For buildings complying under with Section R401.2.2 , the building shall meet one of the following:~~

~~2.1. One of the additional efficiency package Options in Section R408.2 shall be installed without including such measures in the proposed design under Section R405; or~~

~~2.2. The proposed design of the building under Section R405.3 shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design.~~

2~~3~~. For buildings complying with the Energy Rating Index alternative Section R401.2.3, the Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified in Table R406.5.

The option selected for compliance shall be identified in the certificate required by Section R401.3.

R405.2 (N1105.2) Performance-based compliance.

Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.

2. The proposed total *building thermal envelope* UA, which is the sum of the U-factor times assembly area, shall be less ~~greater~~ than or equal to the *building thermal envelope* UA using the prescriptive *U*-factors from Table R402.1.2 multiplied by 1.00 in Climate Zones 0, 1 and 2, and 1.10 in Climates Zones 3 through 8, in accordance with Equation 4-1.~~levels of efficiency and solar heat gain coefficients in Table R402.1.1 or R402.1.3 of the 2009 *International Energy Conservation Code*.~~The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

For Climate Zones 0-2: $UA_{Proposed\ design} \leq 1.00 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)

For Climate Zones 3-8: $UA_{Proposed\ design} \leq 1.10 \times UA_{Prescriptive\ reference\ design}$

3. For buildings without a fuel burning appliance for space heating or water heating, ~~An~~ the annual energy cost of the *proposed design* that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the *proposed design* that is less than or equal to 80 percent of the annual energy cost of the *standard reference design.*

Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.

TABLE R405.4.2(1) (TABLE N1105.4.2(1)) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN		
Heating systems[d, e, j, k]		~~As proposed~~		
	Fuel Type/Capacity: Same as proposed design	As proposed		
	Product class: Same as proposed design	As proposed		
	Efficiencies:	As proposed		
	Heat pump: Complying with 10 CFR §430.32	As proposed		
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed		
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed		
Cooling systems[d, f, k]		~~As proposed~~		
	Fuel Type: Electric Capacity: Same as proposed design	As proposed		

<table>
<tr><td></td><td>Efficiencies: Complying with 10 CFR §430.32</td><td>As proposed</td><td></td><td></td></tr>
<tr><td>Service water heating[d, g, k]</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>Compactness ratio[i] factor</td><td></td><td>HWDS</td></tr>
<tr><td></td><td></td><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td></td><td></td><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td></td><td></td><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td></td><td></td><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td></td><td></td><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
<tr><td></td><td>Fuel Type: Same as proposed design</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Draw Pattern: Same as proposed design</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td><td></td><td></td></tr>
<tr><td></td><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td><td></td><td></td></tr>
<tr><td>Thermal distribution systems</td><td>Duct insulation: in accordance with Section R403.3.1.

Duct location: ~~same as proposed design~~

<table><tr><th>Foundation Type</th><th>Slab on grade</th><th>Unconditioned crawlspace</th><th>Basement or conditioned crawlspace</th></tr><tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic</td><td>One-story building: 100% in unconditioned crawlspace</td><td>50% inside conditioned space

-</td></tr></table></td><td>Duct insulation: as proposed.

Duct location: as proposed.

Duct System Leakage to Outside:

The</td><td></td><td></td></tr>
</table>

	All other: 75% in unconditioned attic and 25% inside *conditioned space*	All other: 75% in unconditioned crawlspace and 25% inside *conditioned space*	50% unconditioned attic

Duct system leakage to outside:

For duct systems serving > 1,000ft² of *conditioned floor area*, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of *conditioned floor area.*

For duct systems serving ≤ 1,000ft² of *conditioned floor area*, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).

measured total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.

Exceptions:

1.. When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.

2. When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of

		conditioned floor area.		
	~~For all systems other than tested duct systems. a~~ For hydronic systems and ductless systems.a ~~A~~ thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies. ~~for all systems other than tested duct systems.~~ ~~**Exception:** For nonducted heating and cooling systems that do not have a fan, the standard reference design thermal distribution system efficiency (DSE) shall be 1.~~ ~~For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of *conditioned floorarea* at a pressure of differential of 0.1 inch w.g. (25 Pa).~~	~~As tested or, where not tested,~~ For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).		

g. For a proposed design ~~with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design~~ without a proposed water heater, ~~a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed~~ the following assumptions shall be made for both the proposed design and standard reference design.
Fuel Type: Same as the predominant heating fuel type
Rated Storage Volume: 40 Gallons
Draw Pattern: Medium
Efficiency: Uniform Energy Factor complying with 10 CFR §130.32

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

k. For heating systems, cooling systems, or water heating systems not included in Table R405.4.2(1), the standard reference design shall be the same as proposed design.

TABLE R405.4.2(2) DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS[a]

Distribution system components located in unconditioned space	NA	0.95
~~Untested distribution~~ Distribution system ~~systems~~ components entirely located in conditioned space[c]	~~0.88~~NA	1
Ductless systems[d]	1	NA

a. Default values in this table are for untested distribution systems, which must still meet minimum requirements for duct system insulation.

b. Hydronic systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed-loop piping and that do not depend on ducted, forced airflow to maintain space temperatures.

c. Entire system in conditioned space shall mean that no component of the distribution system, including the air-handler unit, is located outside of the conditioned space.

d. Ductless systems shall be allowed to have forced airflow across a coil but shall not have any ducted airflow external to the manufacturer's air-handler enclosure.

Add new standard(s) as follows:

DOE	US Department of Energy c/o Superintendent of Documents 1000 Independence Avenue SW Washington DC 20585
10 CFR, Part 430-2021	Energy Conservation Program for Consumer Products: Energy and Water Conservation Standards and their compliance dates.

Add this section (revised per REPI-126) and further revise as follows as part of the modification:

R406.3 Building thermal envelope. ~~Building and portions thereof shall comply with Section R406.3.1 or R406.3.2.~~

~~R406.3.1 On-site renewables are not included.~~ ~~Where on-site renewable energy is not included for compliance using the ERI analysis of Section R406.4, t~~The proposed total building thermal envelope UA, which is sum of *U*-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive *U*-factors from Table R402.1.2 multiplied by 1.00 in Climate Zones 0, 1, and 2, and by 1.10 in Climates Zones 3 through 8, in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

For Climate Zones 0-2: $UA_{Proposed\ design} \leq 1.00 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)

For Climate Zones 3-8: $UA_{Proposed\ design} \leq 1.10 \times UA_{Prescriptive\ reference\ design}$

~~R406.3.2 On-site renewables are included.~~ ~~Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 *International Energy Conservation Code*.~~

Voted Negative with Reason (ballot 1):

Boyce, Amy

EECC is voting no on this proposal for the following reasons:

- This proposal provides trade-off credits for heating, cooling, water heating equipment already commonly being installed.
- It provides credit for locating ducts in conditioned areas, which is often already done in moderate to cool climates.
- Trading off envelope measures will likely reduce the efficiency of the envelope for the life of the building, whereas HVAC elements will need to be replaced and will likely increase in efficiency as technology improves.
- Credits can already be earned for appliance and equipment efficiency via the additional credits proposal.
- As with REPI-33, no justification has been provided to indicate that the additional measures will provide adequate energy savings to offset the trade-offs.
-

Edminster, Ann

Setting the appropriate multiplier for the envelope backstop in R405.2 is critical to support of REPI-122; no data have been provided to support the proposed multiplier of 1.15. Additionally, when this proposal was heard by the Modeling Subcommittee a modification was made that changed the “and” between fuel burning appliance for space heating and water heating to “or,” significantly weakening the proposal. Analysis conducted by 2050 Partners (attached) shows that a 1.10 UA multiplier does not decrease the efficiency of the envelope beyond the 2018 IECC for Climate Zones 3-8, while providing the flexibility to leverage different efficiency measures to achieve compliance. For climate zones 1 and 2, code envelope values have not changed enough since the 2015 IECC to provide this flexibility, so this option should not apply to those climate zones. Thus, based on 2050 Partners’ analysis (corroborated by PNNL), and to address the action taken at the modeling subcommittee, REPI-122 should be modified as follows:

R405.2 (N1105.2) Performance-based compliance. Compliance based on total building performance requires that a proposed design meets all of the following:

1. The requirements of the sections indicated within Table R405.2.

2. The proposed total building thermal envelope UA, which is the sum of the U-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.2 multiplied by ~~1.15~~ 1.10 in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

Equation 4-1: UA proposed design <=~~1.15~~ 1.10 x UA prescriptive reference design.

Exception: In Climate zones 1 and 2 the propose total building thermal envelope UA shall be less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.2

3.For buildings without a fuel burning appliance for space heating ~~or~~ and water heating, ~~An~~ the annual energy cost of the proposed design that is less than or equal to 85% of the annual energy cost of the standard reference design. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80% of the annual energy cost of the standard reference design.

Analysis of IECC Total Building Thermal Envelope UA

Analysis completed by TRC based on a commission by 2050 Partners on behalf of the California Investor-Owned Utilities

Introduction

On behalf of the California Utility Codes and Standards Team, and in response to the REPI-122-21 proposal, TRC and 2050 Partners performed an analysis of the total building thermal envelope UA. REPI-122-21 states the following:

> "The proposed total building thermal envelope UA, which is the sum of U-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.2 multiplied by 1.15 in accordance with Equation 4-1.
>
> $UA_{Proposed\ design} \leq 1.15 \times UA_{Prescriptive\ reference\ design}$ (Equation 4-1)"

This analysis investigates whether the 1.15 multiplier is an appropriate target for all climate zones, using the 2015 IECC requirements as a benchmark for the minimum allowed envelope performance.

Methodology

The team evaluated UA for one single-family prototype house in different climate zones. The building geometry was consistent with PNNL's 2021 IECC determination (Salcido, Chen, Xie, & Taylor, 2021a), also reflected in DOE's prototype building files (US Department of Energy, 2021). Assumptions for these models, which utilized the most common foundation types for each climate zone, are summarized in Table 1.

Table 1. Representative Models by Climate Zone

CZ	Representative City	Foundation Type
1A	Miami, FL	Slab on grade
2A	Houston, TX	Slab on grade
3A	Atlanta, GA	Slab on grade
4A	New York, NY	Crawlspace
5B	Denver, CO	Heated basement
6A	Rochester, MN	Heated basement
7	International Falls, MN	Heated basement
8	Fairbanks, AK	Crawlspace

To recommend multipliers for each climate zone, the team compared proposed 2024 prescriptive U-factor requirements to the 2015 prescriptive envelope requirements, using the Ekotrope[2] software to calculate total UA. The proposed 2024 prescriptive U-factor requirements are identical to the 2021 requirements in Table R402.1.2, except for proposed changes to the fenestration U-factor for climate zones 5-8 (REPI-28-21).[3] The U-factor reference design properties for 2021 IECC, 2015 IECC, and the proposed 2024 IECC are summarized in Table 2. Changes between code years are highlighted for emphasis.

*Table 2. Summary of U-factor Reference Design Properties**

CZ	Fenestration U-Factor			Ceiling U-Factor		Wood Frame Wall U-factor	
	2024 (Proposed)	**2021**	**2015**	**2021**	**2015**	**2021**	**2015**
1A	0.50	0.50	0.50	0.035	0.035	0.084	0.084
2A	0.40	0.40	0.40	0.026	0.030	0.084	0.084
3A	0.30	0.30	0.35	0.026	0.030	0.060	0.060
4A	0.30	0.30	0.35	0.024	0.026	0.045	0.060
5B	0.28	0.30	0.32	0.024	0.026	0.045	0.060
6A	0.28	0.30	0.32	0.024	0.026	0.045	0.045

[2] https://www.ekotrope.com/

[3] Note that REPI-28-21 also proposes changes to skylight requirements, but there are no skylights in the residential prototype buildings.

7	0.27	0.30	0.32	0.024	0.026	0.045	0.045
8	0.27	0.30	0.32	0.024	0.026	0.045	0.045

*There are no U-factor changes from 2015 to 2021 in floor, basement wall, or crawlspace requirements

The UA results for the 2015, 2021, and 2024 reference designs (designated as 2015 RD, 2021 RD and 2024 RD), are summarized in Table 3.

Table 3. UA Results by Climate Zone and Code Year

CZ	UA		
	2015 RD	**2021 RD**	**2024 RD**
1A	498.3	498.3	498.3
2A	452.7	448.0	448.0
3A	383.7	339.9	339.9
4A	350.0	297.0	297.0
5B	368.9	327.8	316.6
6A	338.1	327.8	316.6
7	338.1	327.8	313.0
8	284.8	274.5	263.8

Results and Recommendations

Using the UA results above, TRC recommends climate zone-specific multipliers that would allow for envelope performance equivalent to the 2015 IECC envelope requirements. These results are summarized in Table 4.

Table 4. UA Multiplier Results by Climate Zone

CZ	Multiplier		
	2015/2024	**With adjustment***	**Recommended Multiplier**
1A	1.00	1.00	**1.00**
2A	1.01	1.01	**1.00**
3A	1.13	1.13	**1.10**
4A	1.18	1.18	**1.10**

5B	1.17	1.18	**1.10**
6A	1.07	1.08	**1.10**
7	1.08	1.09	**1.10**
8	1.08	1.08	**1.10**

* Due to an inconsistency in the modeling software, we were not able to create representative models to exactly match the reference design UA for models with basements (climate zones 5, 6, and 7). An adjustment was made based on the discrepancy between the 2021 reference design UA and modeled UA.

Therefore, we recommend that Equation 4.1 in REPI-122-21 be updated as follows.

$UA_{Proposed\ design} \leq M_{CZ} \times UA_{Prescriptive\ reference\ design}$, where M_{CZ} is defined by:

Climate Zone	M_{CZ}
1, 2	1.00
3, 4, 5, 6, 7, 8	1.10

References

Salcido, R., Chen, Y., Xie, Y., & Taylor, T. (2021a, June). *National Cost Effectiveness of the Residential Provisions of the 2021 IECC.* Retrieved from www.energycodes.gov: https://www.energycodes.gov/sites/default/files/2021-07/2021IECC_CostEffectiveness_Final_Residential.pdf

US Department of Energy. (2021). *Prototype Building Models*. Retrieved from Prototype Building Materials: https://www.energycodes.gov/prototype-building-models

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Finlayson, Ian and Lyles, Mark (Also referencing Analysis of IECC Total Building Thermal Envelope UA shown in Ann Edminster's comments)

Setting the appropriate multiplier for the envelope backstop that appears in item 2 of R405.2 is a critical component to supporting REPI-122. At no point has data been provided that supports the 1.15 multiplier that is being proposed. Additionally, when this proposal was heard by the Modeling Subcommittee a modification was enacted that changed the AND between fuel burning appliance for space heating and water heating to an OR which significantly weakens the intent of having the two values for buildings with and without fuel burning appliances. Based on analysis described in the following memo provided

by 2050 Partners, and corroborated by PNNL, and to address the action taken at the modeling subcommittee, the following modifications to REPI-122 should be made:

R405.2 (N1105.2) Performance-based compliance. Compliance based on total building performance requires that a proposed design meets all of the following:

1. The requirements of the sections indicated within Table R405.2.

2. The proposed total building thermal envelope UA, which is the sum of the U-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.2 multiplied by ~~1.15~~ 1.10 in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

Equation 4-1: UA proposed design <=~~1.15~~ 1.10 x UA prescriptive reference design.

Exception: In Climate zones 1 and 2 the propose total building thermal envelope UA shall be less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.2

3. For buildings without a fuel burning appliance for space heating ~~or~~ and water heating, ~~An~~ the annual energy cost of the proposed design that is less than or equal to 85% of the annual energy cost of the standard reference design. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80% of the annual energy cost of the standard reference design.

Reason: There is value in going to a singular envelope backstop for the R405 and R406 compliance paths based on the prescriptive values in the most recently published version of the code in that it provides better alignment across the different compliance paths within that code. Based on the analysis conducted by 2050 Partners described in the following memo we have determined that the 1.10 UA multiplier does not decrease the efficiency of the envelope beyond the 2018 IECC for Climate Zones 3-8 and provides the flexibility to leverage different efficiency measures to meet compliance. For climate zone 1 and 2 the envelope has not changed significantly enough since the 2015 IECC to provide this flexibility so should be exempted from this option.

Statement from EECC: EECC opposes this proposal on the following grounds:

- This proposal provides trade-off credits for heating, cooling, water heating equipment already commonly being installed.

- It provides credit for locating ducts in conditioned areas, which is often already done in moderate to cool climates.

- Trading off envelope measures will likely reduce the efficiency of the envelope for the life of the building, whereas HVAC elements will need to be replaced and will likely increase in efficiency as technology improves.

- Credits can already be earned for appliance and equipment efficiency via the additional credits proposal.

- As with REPI-33, no justification has been provided to indicate that the additional measures will provide adequate energy savings to offset the trade-offs.

Gonzalez-Laders, Emma

this proposal reduces the efficiency of the building envelope over the life of the building without providing any analysis or justification demonstrating that the proposed reductions are appropriate across climate zones. Analysis has been conducted by 2050 Partners demonstrating that a 1.10 UA multiplier results in reasonable efficiency reductions, but no similar analysis has been conducted to justify a 1.15 UA multiplier.

Revise as follows:

(reproducing here only the portions of the proposal being changed. all other portions remain unchanged)

R405.2 (N1105.2) Performance-based compliance. Compliance based on total building performance requires that a proposed design meets all of the following:

1. The requirements of the sections indicated within Table R405.2.

2. The proposed total building thermal envelope UA, which is the sum of the U-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.2 multiplied by ~~1.15~~ 1.10 in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

Equation 4-1: UA <=~~1.15~~ 1.10 x UA design.

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85% of the annual energy cost of the standard reference design. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80% of the annual energy cost of the standard reference design.

Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.

Herring, Bridget

Opposed to exempting a single compliance path from the additional efficiency requirement. Opposed to introducing NAECA equipment as the standard reference design, a code change that the voting membership has rejected consistently over the past five code cycles due to concerns with a reduction in efficiency.

Lindburg, Alison

Setting the appropriate multiplier for the envelope backstop that appears in item 2 of R405.2 is a critical component to supporting REPI-122. At no point has data been provided that supports the 1.15 multiplier that is being proposed. Additionally, when this proposal was heard by the Modeling Subcommittee a modification was enacted that changed the AND between fuel burning appliance for space heating and water heating to an OR which significantly weakens the intent of having the two values for buildings with and without fuel burning appliances.

This proposal provides trade-off credits for heating, cooling, water heating equipment already commonly being installed. It provides credit for locating ducts in conditioned areas, which is often already done in moderate to cool climates. Trading off envelope measures will likely reduce the efficiency of the envelope for the life of the building, whereas HVAC elements will need to be replaced and will likely increase in efficiency as technology improves. Credits can already be earned for appliance and equipment efficiency via the additional credits proposal. No justification has been provided to indicate that the additional measures will provide adequate energy savings to offset the trade-offs.

Suggested modification:

Do not allow trade-offs for measures that do not last the life of the measure being traded (the envelope).

Meyers, Jim

The backstop multiplier is another highly contested discussion point in the IECC. Should it be a set value tied to a version of the IECC or be set as a numeric multiplier. There has been some modeling by 2050 Partners and reviewed by PNNL to suggest the multiplier should be lower than proposed.

R405.2 (N1105.2) Performance-based compliance. Compliance based on total building performance requires that a proposed design meets all of the following:

1. The requirements of the sections indicated within Table R405.2.

2. The proposed total building thermal envelope UA, which is the sum of the U-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.2 multiplied by ~~1.15~~ 1.10 in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

Equation 4-1: UA proposed design <=~~1.15~~ 1.10 x UA prescriptive reference design

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Reason: Based on the analysis conducted by 2050 Partners the 1.10 UA multiplier doesn't weaken the efficiency of the envelope beyond the 2018 IECC and provides the flexibility to leverage various efficiency measures to meet the IECC.

Noble, Michael

Fresh Energy opposes this provision. Again, we do not support tradeoffs that would enable reducing envelope thermal efficiency below the t the 2021 IECC. Briefly speaking, tradeoffs that allow the building envelope to be less efficient are tradeoffs that last would typically last the life of the building, whereas heating, cooling, and domestic water appliances are changed out every one or two decades. Building energy code envelope requirements must be thought of as standards that will be right for the life of the building.

With the momentum growing that the Conference of the Parties has secured an international consensus that expects all of the economy of the world to achieve a net carbon neutral status by mid-century, we have to be building new buildings today that will be able to reach that bar. In other words, building envelopes matter a great deal now, if we do not want to impose exorbitant expense and expectations on building owner later. The highest performance envelopes

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Schmidt, Amy

1. Inconsistent and not coordinated with REPI-20
2. A percent adjustment on the performance path would be needed for this to be viable (5-10%)
3. Inconsistent and not coordinated with REPI-81

Urbanek, Lauren

NRDC is opposed to this proposal for a number of reasons, primarily that it creates a compliance pathway that would be less efficient than the 2021 IECC. If this proposal were to pass, builders could get credit for efficient heating, cooling, and water heating equipment, which are already widely installed in new homes. This is a concept that was rejected multiple times by governmental voting members in previous code cycles. In order to meet the nation's scientifically-driven climate goals of reducing emissions at least 50 percent by 2030, achieving a net zero emissions economy by 2050, new buildings play an important role. New buildings must be put on a glide path to achieve net zero emissions no later than the 2030 code cycle. If passed, this proposal heads in entirely the wrong direction and makes it significantly more difficult to meet that goal.

Heating, cooling, and water heating equipment has a significantly shorter lifespan (in the range of 12-15 years), compared with the building envelope, which is often unchanged through the life of the building. In order to avoid the worst effects of climate change, homes must be constructed to be efficient from the start, so that they will not need to be subject to costly retrofits at a later date. HVAC and water heating equipment will be replaced upon failure, at which point the efficiency will likely improve due to improvements in the federal minimum standards. It is far less likely that a homeowner will invest in additional insulation and air sealing in their home. Getting the envelope right the first time results in lower utility bills and lower carbon emissions over the life of the building.

It is unclear the impact of giving credit for locating ducts in conditioned areas. This is already done as a matter of course in many climates, so it could end up being a significant tradeoff in those areas.

Furthermore, recent federal legislation would require jurisdictions to adopt a code at least as efficient as the 2021 IECC to qualify for certain federal funding. If this proposal passed into the 2024 IECC, there is a significant risk that jurisdictions would not be able to access federal funding for code adoption, making the 2024 IECC irrelevant. As written, NRDC cannot accept this proposal.

Wiley, Seth

- Energy efficiency of the 2021 Code is understood as the baseline for consensus development; including REPI-122 proposed strikeout of Items #2 would seem to allow the Code to be less energy efficient than the 2021 Code as written; given that less energy efficiency typically translates to increased GHG emissions, REPI-122 seems to contravene the glidepath and GHG emissions reduction goals of this development process.

- Citing a Code backstop rather than UA backstop seems simpler for Code users, and simplifying Code across the Code is a good thing.

Proposed Text to resolve Negative Vote:

- Change REPI-122 Section R401.2.5 Item 2 to preserve current Code Section Items 2, 2.1, and 2.2.

- Change REPI-122 Section R405.2 Item 2 to read “The building thermal envelope shall be greater than or equal to levels of efficiency and solar heat gain coefficients in Table R402.1.1 or R402.1.3 of the 2009 2018 International Energy Conservation Code.”

REPI-129-21

IECC®: R406.3.2

Proponents:
William Fay, representing Energy Efficient Codes Coalition; Amy Boyce, representing Energy Efficient Codes Coalition (amy.boyce@imt.org); Amber Wood, representing Energy Efficient Codes Coalition (awood@aceee.org); Jason Reott, representing Energy Efficient Codes Coalition

2021 International Energy Conservation Code

Revise as follows:

R406.3.2 (N1106.3.2) On-site renewables are included.

Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the proposed total *building thermal envelope* UA, which is the sum of *U*-factor times assembly area, shall be ~~greater~~ less than or equal to the ~~levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2018 *International Energy Conservation Code*~~ building thermal envelope UA using the prescriptive *U*-factors from Table R402.1.2. The area-weighted maximum fenestration SHGC permitted shall be 0.25 in Climate Zones 0 through 3 and 0.40 in Climate Zones 4 through 5.

REPI-129-21 ERI On-site renewable backstop

Voted Affirmative with comment (ballot 1):

Rodriguez, Mark

REPI-126 effectively establishes a single thermal envelope for compliance and addresses on-site renewable energy targets. As a relatively low bar to hit, this would incentivize contractors to design with renewable sources on site. The table allows for an easy place to mark the glide path to Net Zero Energy. Based on committee action, I would suggest this proposal be disapproved.

Voted Negative with Reason (ballot 2):

Davis, Clifford

Should be a single-back stop in the code

Demers, Paul

The proposal does not provide sufficient backstop justification.

Noble, Michael

A single envelope backstop for R405 and R406 compliance paths should be based upon the prescriptive values in the most recent version of the code. The credit for onsite renewable energy generation should be considered as part of the ERI score as proposed in REPI-126.

Voted Negative with Reason (ballot 1):

Drumheller, Craig

ERI Solar Backstop- I believe it is appropriate to have a 15% Thermal Backstop for solar, this proposal eliminates any compliance credit in the ERI path – a disincentive to install solar which would likely exceed the 15% tradeoff. Change backstop to “UA proposed design<= 1.15 x UA prescriptive reference design” and allow unlimited solar tradeoffs after that.

Edminster, Ann

There should be a consistent envelope backstop for the R405 and R406 compliance paths, based on the prescriptive values in the most recently published version of the code. Further, the credit given for

onsite renewable energy generation should be considered as part of the total ERI score as proposed in REPI-126.

Finlayson, Ian and Lyles, Mark

REPI-126 which sets a single envelope backstop for the ERI compliance path and adjusts the ERI score for cases when solar in included, is a better method of instituting an envelope backstop.

Reason: There is value in going to a singular envelope backstop for the R405 and R406 compliance paths that is based on the prescriptive values in the most recently published version of the code in that it provides better alignment across the different compliance paths within that code and that the credit given for onsite renewable energy generation should be considered as part of the total ERI score as proposed in REPI-126.

Heikkinen, Gary

A single envelope back stop should be used throughout the code.

Johnson, Ric

The standard should have a single envelope backstop used throughout the standard. PV panel has longer lifespans that HVAC equipment, so it is wrong to use allow equipment tradeoff and not allow PV the same allowances. Should be voted down.

Kochkin, Vladimir

- A single envelope backstop should be used throughout the code.
- PV panels typically have longer lifespan that heating and cooling equipment – it's arbitrary to allow equipment trade-offs for envelope, but not allow the same trade-offs for onsite PV systems.
- Designer should have the option to determine an energy-neutral package of measures based on the balance of envelope, equipment, and generation.

Lindburg, Alison

There is value in going to a singular envelope backstop for the R405 and R406 compliance paths that is based on the prescriptive values in the most recently published version of the code in that it provides better alignment across the different compliance paths within that code and that the credit given for onsite renewable energy generation should be considered as part of the total ERI score as proposed in

REPI-126. REPI-126 which sets a single envelope backstop for the ERI compliance path and adjusts the ERI score for cases when solar is included, is a better method of instituting an envelope backstop.

Suggested modification:

Adjust ERI score for cases when solar is included.

Madrid, Ricardo

A builder should have more options. The code should stick to a single backstop.

Marston, Thomas

Do not support this measure. The insulation industry does not need a guarantee built into the code when we are racing to NZE. Insulation will never have the same ROI as solar when insulation requirements exceed 2018 IECC. If Carbon reducing solutions are needed, move all ducts inside the pressure boundary.

Martino, Amy

Reject proposal

Reason:

Renewable energy should be encouraged and not penalized

Raymer, Robert

A single envelope backstop should be used throughout the IECC. Just as important, there is no justification for limiting compliance credit for PV installation. California provided a robust PV compliance credit for several years leading up to the statewide mandate. In terms of a similar glidepath, the IECC should be strongly encouraging PV installation instead of creating an inadvertent penalty on solar.

Request Disapproval of this item

Shanks, Brian

I am reticent to admit that the different UA backstop proposals have me at a loss regarding which iteration to support. There should only be one way of calculating the UA no matter what section of code it applies to. I cannot vote affirmative for this iteration that introduces yet another variation associated with renewables.

Possible Remedy

Reconcile to a broadly accepted UA calculation

Truitt, Richard

The proponent failed to provide justification of proposed backstop levels compared to other proposals.

Vijayakumar, Gayathri

I am submitting a negative vote on REPI-129. I disagree with the proposed edit to the envelope backstop where on-site renewables are included. The current 2021 IECC backstop text is sufficient if 2 backstops are needed, but the better approach is the singular envelope backstop proposed in REPI-126. If a compromise is needed, an edit to the backstop in REPI-126 could be considered (1.10 x UA)

Wright, Jeremy

1. A single envelope backstop should be used throughout the code.

2. The designer should have the option to determine an energy neutral package basedon the balance of equipment, envelope, and power generation.