MEMORANDUM

Pacific Northwest NATIONAL LABORATORY

Date:	**January 19, 2024**	Memo No.:	[##########]
To:	**JC Hudgison**	Project No.:	[##########]
From:	**Tillou, Michael M**	Internal Distribution:	**File/LB**
Subject:	**Requested analysis of 2024 IECC**		

Summary: PNNL reviewed the proposed energy credits in the pending 2024 IECC Residential provisions, as requested by the ICC, and determined sufficient options are available for all building types to meet the energy credit requirements of Appendix RG without using equipment which exceeds federal minimum efficiency requirements.

Background: The ICC Board of Directors received a letter from the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) expressing concern that specific sections of the IECC and IRC Residential provisions may potentially be preempted under the Energy Policy and Conservation Act (EPCA). Specifically, AHRI asserted it would be impossible for all building types to meet the thresholds in Appendix RG using minimum efficiency equipment. The ICC Board of Directors, in turn, asked the IECC Residential Consensus Committee to address AHRI's assertion regarding Appendix RG.
ICC staff, on behalf of the ICC Residential Consensus Committee chair, requested that PNNL review the proposed requirements of the (pending) 2024 IECC Residential provisions, and assist in determining whether Appendix RG can be met without using *high efficiency equipment* (i.e., equipment which exceeds federally regulated minimum efficiency requirements for covered products). AHRI references 42 USC 6297 (f)(3) as the basis for their concerns with regard to federal preemption.

Discussion of Technical Issues:

Are sufficient credits available to meet Appendix RG without using equipment that exceeds federal minimum efficiency requirements?

PNNL's review and analysis of Appendix RG finds that sufficient energy credits are available to typical residential building types in each climate zone without requiring the use of equipment that exceeds federal minimums. The purpose of the energy credits is to provide building owners and designers with the flexibility to achieve the specified level of energy performance through a range of optional measures, as well as to make it easier for designers to incorporate new and advanced technologies and construction practices without having to undertake more complicated calculations or energy

modeling. It is anticipated that many designers will elect to incorporate high efficiency equipment into their building designs, as these options tend to be highly practical and cost effective. However, designers who elect not to utilize high efficiency equipment still have a variety of options, including the use of renewable energy systems or ground source heat pumps, which would meet the required threshold without the need to use equipment which exceeds federal minimum efficiency levels.

AHRI's letter does not assert that Appendix RG explicitly requires the use of high-efficiency equipment, rather they assert that Appendix RG cannot be met in certain applications unless high-efficiency equipment is selected (i.e., not enough credits are otherwise available), and that those cases are *only within climate zones 0 through 3*. PNNL's review finds that sufficient credits, in all climate zones, are indeed available under Appendix RG without needing to utilize high-efficiency equipment. At the same time, PNNL also notes that high-efficiency equipment is commonly preferred as one of the most cost-effective means of improving whole-building energy performance. It is anticipated that many designers and builders will voluntarily elect to utilize such credits, although in no way required to under Appendix RG. This was considered during committee deliberations and in establishing the provisions of both the base code and Appendix RG.

In addition, PNNL notes that the credit table referenced by AHRI was from the second public comment legislative draft and not the final credit table approved by the Residential Committee. This resulted in discrepancies in available measures, and some of the associated point values. More importantly, AHRI presents the two solar water heater energy credits (R408.2.3(7)(a) and R408.2.3(7)(b)) as unavailable options, suggesting that solar water heaters are an EPCA-covered product. However, DOE does not currently regulate solar water heaters, making these credits available. In addition, AHRI has based their concern on a specific scenario where ground source heat pumps (R408.2.2(1)) and on-site renewable energy systems (R408.2.7) are not feasible in climate zones 0 through 3. PNNL notes that such systems will generally be viable options and that sufficient credits remain available even under such a constrained scenario.

What other avenues are available for complying with Appendix RG?

AHRI's concern is that all possible building types and configurations must be able to comply with the requirements of the IECC. The I-Codes have long recognized that certain building types and configurations may not be able to meet each individual code requirement,and provides opportunities to comply through a variety of prescriptive and performance based options, as well as through alternative means and methods.

<u>Appendix RG Compliance Paths</u>
It is worth noting that, Appendix RG provides three compliance options which can be selected for a given building. In addition to the Energy Credit pathway projects can also chose a simulated building performance path (based on 2024 IECC Section R405) or an

Energy Rating Index (ERI) compliance path (based on Section R406). All three pathways allow buildings to comply using a combination of energy efficiency measures and renewable energy systems. None of the compliance path explicitly requires the use of high efficiency equipment.

Alternative Means and Methods

Another option available to projects is the revised Section R104 which would allow projects to propose *alternative materials, design and methods of construction and equipment* to meet the requirements of the IECC. The purpose of this section is to underscore that the provisions of the IECC, consistent with the broader collection of I-Codes, are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by the code.

How can the ICC help ensure adopting state and local governments are aware of potential preemption issues and challenges?

The ICC Board's letter to the residential committee chair also requests guidance on how the Board might alert jurisdictions considering adopting the provisions of Appendix RE (All-Electric Residential Buildings) about the risk that an all-electric building solution could face a preemption challenge. If ICC decides it necessary and appropriate to provide such an alert, ICC could provide an advisory note indicating that challenges to similar solutions have been made, and advising that interested jurisdictions review recent legal decisions as part of their adoption proceedings.

As stated above, PNNL's analysis of Appendix RG indicates that the provisions can be met without being required to select high-efficiency equipment. However, if such a challenge was made, a similar note as suggest above could apply.

Review of Individual Concerns Expressed by AHRI:

PNNL has thoroughly reviewed AHRI's concerns and offers the below guidance to clarify the specific concern being raised and the proposed remedy.

AHRI Assertion	PNNL Analysis
Principal concern: Sufficient credits are not available to meet the Appendix RG requirements without using credits for equipment that increases efficiency beyond federal minimum requirements.	PNNL's review finds that the energy credit table[1] has sufficient credits in climate zone 0-3 for a project to earn 20 credits without utilizing equipment that exceeds federal minimums. AHRI bases their concern on a specific scenario where, only within climate zones 0-3, measures such as renewable energy systems and ground source heat pumps (GSHP) are not feasible. Even under such a scenario, where such credits are not available—onsite renewable energy (R408.2.7) and GSHP (R408.2.2(1))—there remain multiple pathways for earning the required 20 credits in climate zones 0-3. In its letter, AHRI suggests that solar service water heating products, which are referenced in energy credits (R408.2.3(7)(a) and R408.2.3(7)(b)), are regulated by DOE. However, solar water heaters are not currently regulated by DOE. Therefore, these two additional credit options are available to a building designer to achieve the credit threshold. Using either one of the solar service water heating credit options, in addition to the other options selected in AHRI's letter, provides more than the required minimum 20 credits to achieve the required threshold, without the need to use equipment that exceeds federal minimum efficiency requirements to achieve those credits.
Proposed Exception AHRI has proposed an exception to weaken Appendix RG requirements in certain cases.	AHRI has described a hypothetical "edge case" (i.e., difficulty installing solar and GSHPs) and proposed a weakening exception as the solution. The example they cite represents a typical real-world design challenge that building owners and designers frequently face with regard to the application of code requirements, not just energy code requirements. The current IECC Residential Provisions already allow a pathway for cases like this to comply without requiring exceptions that weaken code requirements. The IECC Residential committee and subcommittees discussed these types of scenarios and determined that Section R104 *Alternative Materials, Design and Methods of Construction and Equipment* allows building officials to work with project teams to resolve such cases. Section R104 allows for alternative mean and methods to be proposed and approved which alleviates the need to burden the code with narrowly crafted exceptions, such as the one proposed by AHRI, that reduce stringency requirements for specific building types in specific climate zones.

[1] The credit table AHRI shared in its letter reflects an earlier version of the table from the 2nd Legislative Draft and is not the final energy credit table approved by the RE Committee. The correct table has been included at the end of this memo.

Final Energy Credit Table approved by RE Committee for publication in IECC 2024.

R408.2 Table										
Measure	**Measure**	**Credit Value**								
Number	**Description**	**CZ0 & 1**	**CZ2**	**CZ3**	**CZ4**	**CZ4C**	**CZ5**	**CZ6**	**CZ7**	**CZ8**
R408.2.1.1(1)	2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	5% Reduction in total UA	0	1	1	2	1	2	2	2	2
R408.2.1.1(3)	7.5% Reduction in total UA	0	1	2	2	2	2	3	3	3
R408.2.1.1(4)	10% Reduction in total UA	1	1	2	3	3	4	4	5	5
R408.2.1.1(5)	15% Reduction in total UA	1	2	2	4	4	5	6	7	8
R408.2.1.1(6)	20% Reduction in total UA	2	4	4	5	6	7	8	9	11
R408.2.1.1(7)	30% Reduction in total UA	3	6	6	8	8	11	12	13	16
R408.2.1.2(1)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	2	1	1	1	1	1
R408.2.1.3(1)	Roof reflectance 0.75 (roof is part of thermal envelope directly above conditioned space)	1	0	0	0	0	0	0	0	0
R408.2.1.3(2)	Roof reflectance 0.75 (roof is above an unconditioned space that contains ductwork)	1	1	0	0	0	0	0	0	0
R408.2.1.4	Reduced Air Leakage (2.5 ACH50 for SF and 0.24 CFM50/sq ft for MF)	1	1	1	2	1	3	NA	NA	NA
R408.2.2(1)	Ground source heat pump 16.1 EER/3.1 COP	14	14	14	15	10	15	17	18	21
R408.2.2(2)	High Performance Cooling (Option 1) 15.2 SEER2/12.0 EER2	5	4	3	2	1	1	1	1	1
R408.2.2(3)	High Performance Cooling (Option 2) 16.0 SEER2/12.0 EER2	6	4	3	2	1	1	1	1	1
R408.2.2(4)	High Performance Gas Furnace (Option 1) 97 AFUE	0	1	2	5	3	6	7	7	9
R408.2.2(5)	High Performance Gas Furnace (Option 2) 95 AFUE	0	1	2	4	3	5	6	7	8
R408.2.2(6)	High Performance Gas Furnace (Option 3) 90 AFUE	0	1	1	NA	NA	NA	NA	NA	NA
R408.2.2(7)	High Performance Gas Furnace and Cooling (Option 1) 90 AFUE + 15.2 SEER2 and 10.0 EER2	5	5	4	NA	NA	NA	NA	NA	NA
R408.2.2(8)	High Performance Gas Furnace and Cooling (Option 2) 95 AFUE + 16.0 SEER2 and 10.0 EER2	6	5	5	NA	NA	NA	NA	NA	NA
R408.2.2(9)	High Performance HP with gas furnace backup (Option 1) 90 AFUE + 7.8 HSPF2/15.2 SEER2/10.0 EER2	15	13	11	NA	NA	NA	NA	NA	NA
R408.2.2(10)	High Performance HP with electric resistance backup (Option 1) 7.8 HSPF2/15.2 SEER2/11.7 EER2	13	12	11	NA	NA	NA	NA	NA	NA
R408.2.2(11)	High Performance Gas Furnace and Cooling (Option 3) 95 AFUE + 15.2 SEER2/12.0 EER2	NA	NA	NA	5	4	6	7	7	9
R408.2.2(12)	High Performance Gas Furnace and Cooling (Option 4) 97 AFUE + 16.0 SEER2/12.0 EER2	NA	NA	NA	6	5	7	8	8	10
R408.2.2(13)	High Performance HP with gas furnace backup (Option 2) 95 AFUE + 8.1 HSPF2/15.2 SEER2 (cold climate heat pump)	NA	NA	NA	12	8	11	11	12	12
R408.2.2(14)	High Performance HP with electric resistance backup (Option 2) 8.1 HSPF2/15.2 SEER2 (cold climate heat pump)	NA	NA	NA	12	8	12	13	14	16
R408.2.3(1)(a)	Gas-Fired Storage Water Heater (option 1) All Volumes and DPs: UEF = 0.81	8	7	7	5	6	4	4	3	2
R408.2.3(1)(b)	Gas-Fired Storage Water Heater (option 2) UEF = 0.86	9	8	8	6	7	5	4	4	3
R408.2.3(2)(a)	Gas-Fired Instanteneous Water Heater (option 1) - All volumes, Medium or High DP: UEF = 0.92	10	9	9	6	7	5	5	4	3
R408.2.3(2)(b)	Gas-Fired Instanteneous Water Heater (option 2) - All volumes, Medium or High DP: UEF = 0.95	11	10	9	6	7	6	5	4	3
R408.2.3(3)	Electric Water Heaters (option 1) - Integrated HPWH: All Volumes: Low, Medium or High DP: UEF = 3.30	10	9	9	7	6	4	3	3	2
R408.2.3(4)	Electric Water Heaters (option 2) - Integrated HPWH, 120 Volt/15 amp Circuit: UEF = 2.20	8	8	8	6	5	4	3	3	2

R408.2.3(5)(a)	Electric Water Heaters (option 3) - Split System HPWH: UEF = 2.20 (compressor outdoors)	7	8	8	6	7	5	4	3	3
R408.2.3(5)(b)	Electric Water Heaters (option 4) - Split System HPWH: UEF = 3.75 (compressor outdoors)	8	9	10	7	8	5	5	4	3
R408.2.3(6)	Electric Water Heaters (option 5) - Rated input capacity > 12 kW: COP = 3.0	10	9	9	7	6	4	3	3	2
R408.2.3(7)(a)	Solar Water Heaters (option 1) - All Volumes and DPs, Electric Backup: SUEF = 3.00	13	13	13	9	8	5	4	4	3
R408.2.3(7)(b)	Solar Water Heaters (option 2) - All Volumes and DPs, Gas Backup: SUEF = 1.80	10	9	9	6	7	6	5	4	3
R408.2.3(8)	Compact Hot Water Distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More Efficient Distribution System - Ductless	3	4	5	7	8	10	10	10	14
R408.2.4(2)	100% of Ducts in Conditioned Space	2	3	4	6	7	9	9	9	13
R408.2.4(3)	>= 80% of ductwork inside conditioned space	2	3	3	5	6	7	7	7	9
R408.2.4(4)	Reduced Total Duct Leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	ERV or HRV installed - more stringent SRE values	0	0	0	0	1	3	2	2	2
R408.2.5(2)	2.0 ACH50 with ERV or HRV Installed	0	0	0	4	4	8	5	5	5
R408.2.5(3)	2.0 ACH50 with a Balanced Ventilation System	0	0	0	0	0	0	4	4	4
R408.2.5(4)	1.5 ACH50 with ERV or HRV Installed	0	0	0	6	5	10	9	9	9
R408.2.5(5)	1.0 ACH50 with ERV or HRV Installed	0	0	1	7	6	12	12	12	12
R408.2.6	Energy Efficient Appliances	1	1	1	1	1	1	0	0	0
R408.2.7	On-Site Renewable Energy Measure	17	16	17	11	11	9	8	7	4
R408.2.8	Demand Responsive Thermostat	1	1	1	1	1	1	1	1	1
R408.2.9	Whole Home Lighting Control	1	1	1	0	0	0	0	0	0
R408.2.10	Higher Efficacy Lighting	0	0	0	0	0	0	0	0	0
Includes solar SWH, GSHP and Renewable Energy Systems that are not covered products under EPCA		**56**	**58**	**60**	**46**	**41**	**50**	**50**	**51**	**57**
Appendix RG credits can also be met without using equipment that exceeds federal minimums or solar PV (@2kW) or GSHP		**25**	**28**	**29**						