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August 31, 2020

Honorable Eric Lipman
Administrative Law Judge
Minnesota Office of Administrative Hearings
600 North Robert Street
St. Paul, MN 55101

RE: OAH Docket # 8-9001-36776 – Rebuttal Comments
Possible Amendments to Rules Governing the Minnesota Residential Energy Code

Dear Judge Lipman:

Thank you for the opportunity to submit rebuttal comments on possible amendments to Rules Governing the Minnesota Residential Energy Code. The Midwest Energy Efficiency Alliance (MEEA) is a regional non-profit membership organization which serves as the Midwest's key proponent and resource for energy efficiency. In particular, MEEA has staff with extensive expertise in building energy codes. We have been heavily involved in assisting the state with the adoption, enforcement of, and compliance with building energy code policy since 2009.

MEEA supports amending the existing Minnesota Building Codes to include the 2018 IECC residential provisions. Upon a positive determination by the US Department of Energy, the state is required by statute to review the 2018 IECC for adoption as the statewide energy code. As noted in the comments provided by the Department of Labor and Industry, that process has not yet been completed for the residential provisions. In order to properly discuss the merits of the provisions to be included in the code, the state must go through the rulemaking process for the residential 2018 IECC.

While not directly relevant to the administrative law determination, MEEA believes it is important to clarify some points made on how the residential 2018 IECC will impact Minnesota if adopted. First, adopting the unamended 2018 IECC residential provisions would be cost effective for residents in the state. As noted in previous comments, an analysis by the Pacific Northwest National Laboratory[1], the nationally recognized experts on energy code analysis, found the unamended 2018 IECC to be cost-effective and 6% more efficient than the current Minnesota Energy Code (an amended version of the 2012 IECC). Additionally, the new code would save residents $151 annually on their utility bills, with a simple payback period of 3.6 years.[2]

Affordability is rightfully a concern when considering making changes to code requirements, especially during an affordability crisis that is currently occurring in the

[1] To see the methodology used for all of the U.S. Department of Energy's Cost Effectiveness Analyses, visit: https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-23923.pdf
[2] See attached PNNL's full results and analysis

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state. However, despite being the only building code that improves long term affordability for homeowners and occupants, updated energy code requirements have been accused of being too expensive to implement. Depending on the homebuilder there may be some modest increased cost to construction with the adoption of the 2018 IECC[3]. However, the energy savings and associated monetary benefits significantly outweigh the initial costs and will help keep homes more affordable throughout the lifetime of the building. Changes to any building code have the potential for increasing the first cost of construction; energy codes are the only codes that provide monetary savings over time.

Secondly, the feasibility of meeting code requirements, particularly for out of state builders with fewer utility incentives, was raised as a concern. The 2018 IECC has incorporated even more flexibility for builders than previous versions of the code. With the adoption of the 2018 IECC, builders would be able to use the Energy Rating Index pathway, a HERS rating- like system, to comply with the energy code. This is a simple, flexible way for builders to comply with energy code requirements and trade off higher efficiency in certain components for lesser efficiency in others, while maintaining the same overall building efficiency. For areas of the state with limited capacity to hire professionals to conduct these types of analyses, the US Department of Energy (DOE) offers a free web-based analysis software called REScheck[4], where builders can perform an energy analysis for energy code compliance, and similarly trade off certain components while maintaining the same level of efficiency in the building.

Thirdly, it was noted in several comments that, on average, Minnesota builders are already surpassing the requirements in the 2018 IECC in terms of energy efficiency. This directly contradicts other testimony that it would be difficult and costly for buildings in the state to comply with updated energy code requirements. While it is impressive to see that Minnesota homebuilders are achieving an average Home Energy Rating Score of 50, the statewide energy code is intended to be a minimum standard for all builders in the state. The energy code prescribes the least efficient house that can legally be built, and by updating the requirements in the energy code for residential buildings, Minnesota would be assuring the benefits of improved efficiency for *all* occupants of new homes in the state.

The adoption of the residential provisions of the 2018 IECC would have significant benefits for the state. Updating Minnesota's residential energy code now would keep the state on track with the adoption cycle it put in place and would help better prepare the construction industry for the advanced building efficiency technologies continually entering the marketplace. Improving the energy efficiency of residential buildings is also essential for the state to meet its established climate and energy goals.

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[3] According to the analysis completed by PNNL, the increased costs associated with the adoption of the 2018 IECC are an average of $543

[4] To view the software, visit: https://www.energycodes.gov/rescheck

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Starting the rulemaking process is necessary to appropriately discuss the merits and appropriateness of the residential provisions of the 2018 IECC for Minnesota.

Thank you for considering our views on this very important decision. If you have any questions about this testimony, please feel free to contact me.

Sincerely,

Nicole Westfall
Senior Building Policy Associate
Midwest Energy Efficiency Alliance (MEEA)
nwestfall@mwalliance.org

MEMORANDUM

Pacific Northwest NATIONAL LABORATORY

Date: **4/3/2019**

To: **Don Sivigny**

From: **Z. Todd Taylor**

Information Release # **PNNL-SA-142461**

Subject: **Preliminary Cost-Effectiveness of the Residential 2018 IECC for the State of Minnesota**

Moving from Minnesota's residential energy code, which is based on the 2012 IECC with amendments, to the 2018 IECC, is expected to be cost-effective. This assessment of cost-effectiveness is based on expected changes in construction cost related to energy savings analyzed for the two IECC climate zones that occur in Minnesota (6 and 7). The analysis is based on DOE's established methodology for analyzing IEEC-based codes.[1]

The current Minnesota code's foundation tradeoff that allows a reduction of foundation wall insulation from R15 to R10 if the tested envelope leakage rate is equal to (or less than) 2.6 air changes per hour at 50 pascals (ach50) results in a modest net energy savings in the affected buildings (those with heated basements). The tradeoff was not assumed in the cost-effectiveness analysis presented here.

DOE's methodology evaluates 32 residential prototypes comprising two building types, four foundation types, and four HVAC types, in each of the two Minnesota climate zones by simulating with TMY3 weather data. For Minnesota, climate zone 6 is based on Minneapolis-St. Paul data and climate zone 7 on Duluth data.

Minnesota's residential code amends the 2012 IECC as follows:

- **Wood-frame wall insulation R-values:** The 2012 IECC requires R20+5[2] or R13+10 in climate zones 6 and 7. The MN code amends that to R20 or R13+5 for climate zone 6, and to R21 for climate zone 7.
- **Basement and crawlspace wall insulation R-values:** The 2012 IECC requires R15/19[3] in climate zones 6 and 7, with insulation extending to the finished floor or 8 feet for basements. The MN code eliminates the R19 cavity option and, for the R15 continuous requirement, adds a requirement to put at least R10 (of the R15 total) on the exterior of the foundation wall and not more than R11 on the interior. There is a trade-off option allowing R10 exterior with no interior insulation if the home's tested air leakage is

[1] https://www.energycodes.gov/development/residential/methodology

[2] The first number represents cavity insulation between framing members; the second number represents additional continuous insulation (e.g., insulating sheathing).

[3] The first number represents continuous insulation (e.g., a blanket or board); the second number represents the alternative if insulation is in a cavity between framing members (e.g., furred-in on the foundation wall). Both are assumed to be applied on the inside of a crawlspace wall.

less than or equal to 2.6 ACH50. The MN code requires basement insulation to extend to the depth of the footing or 10 feet. *For basement walls, the DOE methodology and prototypes do not accommodate a split of insulation between interior and exterior, so it will be simulated as a single R15 layer. Conditioned crawlspaces are not part of typical residential construction as represented in the DOE analysis methodology and prototypes and are not simulated in the present analysis.*

- **Duct insulation R-values:** The 2012 IECC requires R8 on supply ducts located in vented attics, and R6 on all other ducts. The MN code requires various R-values ranging from R3.3 to R8, and adds requirements for a vapor retarder and/or weather protection, depending on duct location. *The presence/absence of vapor retarders or weather protection has no effect on energy consumption in DOE's methodology.* The MN code's duct R-values are:
    - Ducts outside the building, and outdoor air intakes and exhaust ducts within conditioned spaces: R3.3. *Because DOE's methodology and prototypes do not consider these ducts, this will have no effect on the comparison.*
    - Within cement slab or within ground: R3.5. *Because DOE's methodology and prototypes do not consider these ducts, this will have no effect on the comparison.*
    - Attics, garages, and ventilated crawlspaces: R8. This is the same as the 2012 IECC's supply-in-attic requirement and higher than the 2012's requirement for return ducts and supply ducts in ventilated crawlspaces. *DOE's methodology and prototypes do not consider ducts in garages.*
    - Inside conditioned space: None required. This is the same as in the 2012 IECC.
- **Mechanical ventilation:** The 2012 IECC defers to the IRC or IMC for ventilation requirements. The 2012 IRC, which is used in the DOE methodology and prototypes, requires the equivalent of a continuous 60 CMF in DOE's 2376-ft^2, 3-bedroom single-family prototype, and 45 CFM per dwelling unit in DOE's 1200-ft^2 multifamily prototype with 2 bedrooms per unit. The MN code gives two options for identifying required continuous ventilation rates (DOE's methodology analyzes ventilation only on a continuous basis):
    - By an equation involving a dwelling unit's conditioned floor area (CFA) and number of bedrooms: $CFM_{continuous} = \{0.02 * CFA + [15 * (N_{bedrooms} + 1)]\} / 2$

      For DOE's residential prototypes, this equation gives 54 CFM for the single-family home and 35 CFM per dwelling unit for the multifamily home.
    - In accordance with Table R403.5.2 in the MN code, which for DOE's single- and multifamily prototypes, gives continuous ventilation requirements of 55 and 45 CFM, respectively.

      The present analysis will assume the lower of the rates required by the equation and the table, in this case 54 CFM for single-family and 35 CFM for multifamily.

      Minnesota requires that the ventilation system be balanced. Because DOE's established methodology simulates ventilation as a simple, continuous exhaust fan, the balance provision can be evaluated by simply doubling the fan energy.

The MN code also adds some specific requirements for HRV/ERV installations where installed as part of a balanced system. *Because neither the 2012 IECC nor the Minnesota code requires H/ERVs, this will have no effect on the comparison.*

Costs associated with bringing the Minnesota code up to the 2018 IECC stem from all the differences between the 2012 and 2018 editions of the IECC plus the Minnesota amendments to the 2012 IECC listed above. For this analysis, the cost differences between the 2012 and 2018 IECCs were taken from extant and in-progress DOE/PNNL reports on the cost effectiveness of new code editions. Specifically, Minnesota-specific changes in first cost (∆FC) between various versions of the IECC were taken from the Minnesota-specific 2015 IECC analysis[4] and the (in-progress) national 2018 IECC analysis (after applying an appropriate state cost multiplier).

Life Cycle Cost (LCC) savings is the primary measure DOE uses to assess the economic impact of building energy codes. LCC is the calculation of the present value of costs over a 30-year period including initial equipment and construction costs, energy savings, maintenance and replacement costs, and residual value of components at the end of the 30-year period. When the LCC of the updated code (2018 IECC) is lower than that of the previous code (Minnesota's residential energy code), the updated code is considered cost-effective.

The energy prices used in the analysis are:

- Electricity price: \$0.1338/kWh (\$0.0392/kBtu)
- Natural gas price: \$8.290/ft^3 (\$0.00793/kBtu)
- Heating oil price: \$2.658/gal (\$0.01919/kBtu)

These prices are the state average residential energy costs for the most recently available year or heating season as appropriate. The prices and sales data are from the United States Energy Information Administration.[5,6,7] Heat content of fossil fuels is taken from EIA sources: 1045 Btu/ft^3 for gas,[8] and 138,500 Btu/gal for fuel oil.[9] Fuel prices are escalated over the analysis period based on EIA's year-by-year projections in the 2018 Annual Energy Outlook,[10] Reference Case Table 3.[11] Table 1 below shows the key economic parameters used in the analysis.

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[4] https://www.energycodes.gov/sites/default/files/documents/MinnesotaResidentialCostEffectiveness_2015.pdf
[5] https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_06_b
[6] https://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_m.htm
[7] https://www.eia.gov/dnav/pet/PET_PRI_WFR_A_EPD2F_PRS_DPGAL_W.htm
[8] https://www.eia.gov/dnav/ng/ng_cons_heat_a_EPG0_VGTH_btucf_a.htm
[9] https://www.eia.gov/energyexplained/index.php?page=about_energy_units
[10] https://www.eia.gov/outlooks/archive/aeo18/
[11] https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2018&cases=ref2018&sourcekey=0

Table 1. Economic Parameters

Economic Parameter	Value	Notes
Study period	30 years	
Life of efficiency measures	60 years	
Discount rate (nominal)	5%	Equal to loan interest rate
Loan interest rate	5%	
Loan term	30 years	
Loan down payment	10%	
Private mortgage insurance rate	0.5% of loan balance	Eliminated after loan balance is less than 80% of home value
Loan fee rate	0.7% of loan amount	
Inflation rate	2.52%	Home value assumed to escalate with general inflation
Income Tax Rate	12%	12% federal, 7.05% state[12]
Property Tax Rate	0.5%	

Table 2 shows the economic impact of upgrading the Minnesota residential energy code to the 2018 IECC by building type and climate zone in terms of life-cycle cost savings in dollars per dwelling unit. Table 3 shows the annual energy cost savings (dollars per dwelling unit) and Table 4 shows incremental construction costs (dollars per dwelling unit).

Table 2. Life-Cycle Cost Savings ($/dwelling unit)

<table>
<tr><th>Climate Zone</th><th>Single-Family Prototype (~2400 ft²)</th><th>Multifamily Prototype (1200 ft² Dwelling Unit)</th></tr>
<tr><td>6</td><td>$2,653</td><td>$719</td></tr>
<tr><td>7</td><td>$3,259</td><td>$750</td></tr>
<tr><td rowspan="2">State</td><td>$2,792</td><td>$721</td></tr>
<tr><td colspan="2">$2,341</td></tr>
</table>

[12] http://www.tax-rates.org/minnesota/income-tax

Table 3. Annual Energy Cost Savings ($/dwelling unit)

<table>
<tr><th>Climate Zone</th><th>Single-Family Prototype (~2400 ft^2)</th><th>Multifamily Prototype (1200 ft^2 Dwelling Unit)</th></tr>
<tr><td>6</td><td>$146</td><td>$57</td></tr>
<tr><td>7</td><td>$169</td><td>$65</td></tr>
<tr><td rowspan="2">State</td><td>$151</td><td>$57</td></tr>
<tr><td colspan="2">$131</td></tr>
</table>

Table 4. Incremental Construction Costs ($/dwelling unit)

<table>
<tr><th>Climate Zone</th><th>Single-Family Prototype (~2400 ft^2)</th><th>Multifamily Prototype (1200 ft^2 Dwelling Unit)</th></tr>
<tr><td>6</td><td>$556</td><td>$506</td></tr>
<tr><td>7</td><td>$499</td><td>$600</td></tr>
<tr><td rowspan="2">State</td><td>$543</td><td>$512</td></tr>
<tr><td colspan="2">$536</td></tr>
</table>

To aid in understanding how the climate zone-level results affect Minnesota's single-family market as a whole, Table 5 shows the weight (as a percentage) of each zone-prototype combination that would be applied by DOE's methodology to aggregate results to the state level. The weights are based on housing starts. The state-level aggregate life-cycle cost savings is $2,772 per single-family home and $703 per multifamily dwelling unit, for an overall state life-cycle savings of $2,322 per dwelling unit.

Table 5. Weights for Overall State Aggregations (percent)

<table>
<tr><th>Climate Zone</th><th>Single-Family Prototype (~2400 ft^2)</th><th>Multifamily Prototype (1200 ft^2 Dwelling Unit)</th></tr>
<tr><td>6</td><td>60.4%</td><td>20.4%</td></tr>
<tr><td>7</td><td>17.9%</td><td>1.3%</td></tr>
<tr><td rowspan="2">State</td><td>78.3%</td><td>21.7%</td></tr>
<tr><td colspan="2">100%</td></tr>
</table>

An assessment of the energy impact of the current Minnesota code's foundation wall tradeoff is shown in Table 6, which shows the annual energy cost savings when the tradeoff is taken in homes with heated basements.

Table 6. Annual Energy Cost Savings Due to Minnesota's Foundation Tradeoff in Homes with Heated Basements

Climate Zone	**Single-Family Prototype (~2400 ft^2)**	**Multifamily Prototype (1200 ft^2 Dwelling Unit)**
6	$8.40	$12.40
7	$4.84	$13.85
State	$7.59	$12.49
	$8.65	