

To: Washington State Building Code Council
From: Gary Heikkinen, PE; Member of Energy Code TAG
Date: July 12, 2019
Subj: Comments on Washington State Energy Code Proposals

These comments are in regards to 2 code change proposals to the Washington State Energy Code-Commercial:

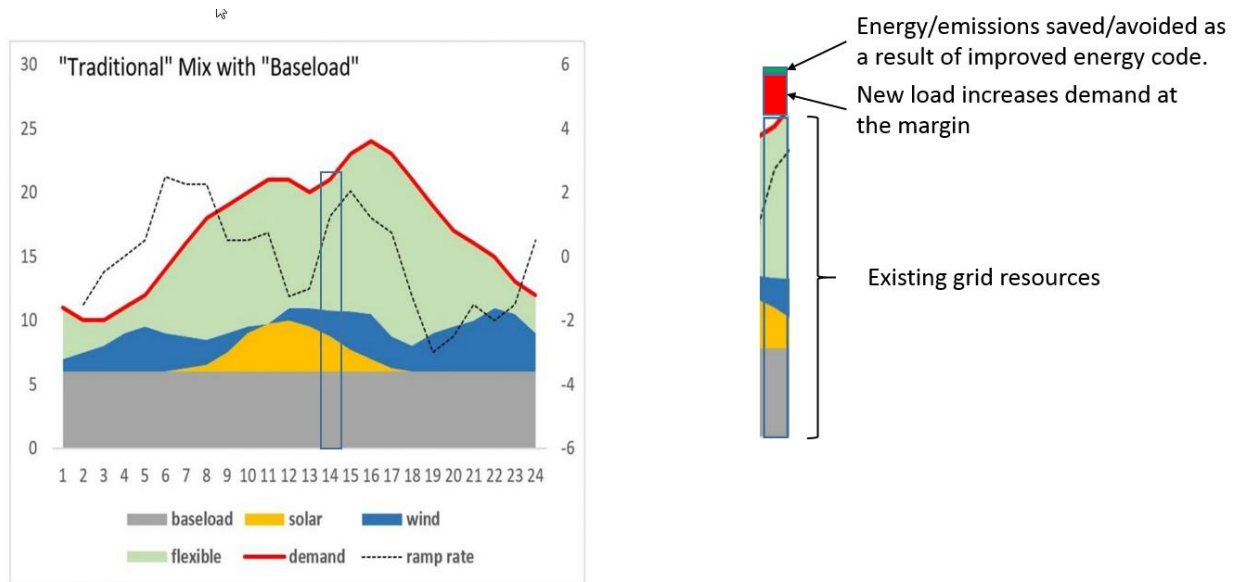
- Proposal 050-2018, HVAC Total System Performance Ratio which would add a requirement to the Prescriptive Path compliance option for systems serving occupancies subject to section C403.3.5 and would use carbon emissions to generate a HVAC Total System Performance Ratio (TSPR) to determine compliance.
- Proposal 141-2018, Total Building Performance which would replace the existing Performance Path in section C407.1 with the method from ASHRAE Std. 90.1, Appendix G, but using carbon emissions rather than energy cost as the metric.

Both of the above-mentioned proposals will, for the first time, use carbon emissions rather than energy cost or energy use as the basis for measuring performance and for compliance with the code. Using carbon emissions can certainly work, but only if the correct emissions factors are used. Wrong emissions factors will result in wrong decisions made with regard to building systems, especially for HVAC and water heating systems.

The reasoning and logic behind my comments and recommendations are based on 4 assertions:

1. A factor for marginal emissions rather than average emissions is the best metric to use when evaluating the effects of energy efficiency (in this case, energy codes) and renewable energy. This is supported by such organizations as the EPA, ASHRAE Std. 105 and the NW Power and Conservation Council.

All of the organizations mentioned above (EPA, ASHRAE, NWPCC) agree that marginal emissions rather than average emissions are the correct metric to use when evaluating the effect of energy efficiency or energy codes. The illustration below shows a typical 24 hour load shape for grid electricity. You can see that any new building adds to the demand and only affects the amount of energy that needs to be provided by those “flexible” or “marginal” resources. The new load does not affect the amount of energy that is provided by the base-loaded resources or renewables. Therefore, the only emissions affected come from those marginal resources and not the base-loaded or renewable resources.



The emissions factor for natural gas is fairly straightforward and has really not changed over time. However, future additions of renewable natural gas and/or hydrogen to the pipeline will reduce the carbon intensity and emissions factor. This has not been taken into account in the future emissions factor for natural gas.

The emissions factor for electricity is not as straightforward since electricity can come from multiple different sources, including coal, natural gas, hydro, nuclear, wind and solar. Each of these has a different emissions factor, with renewables and nuclear being zero.

2. The “Avoided Carbon Dioxide Production Rates in the Northwest Power System” study by the NWPCC dated March 13, 2018 is the best study available today for projecting future emissions rates (factors) for the Northwest.

The report that I have been using as the basis for my recommendations is the “Avoided Carbon Dioxide Production Rates in the Northwest Power System” by the NWPCC dated March 13, 2018.

3. The emissions factor for the regional grid (either the Northwest Power Pool or the Western Electric Coordinating Council) is more accurate than using a Washington state-only emissions factor. This is supported in the NWPCC report.

The “avoided” rates referenced in the report are from the marginal resources in the WECC, not just Washington, since Washington is not a standalone grid and what happens in Washington affects the regional grid.



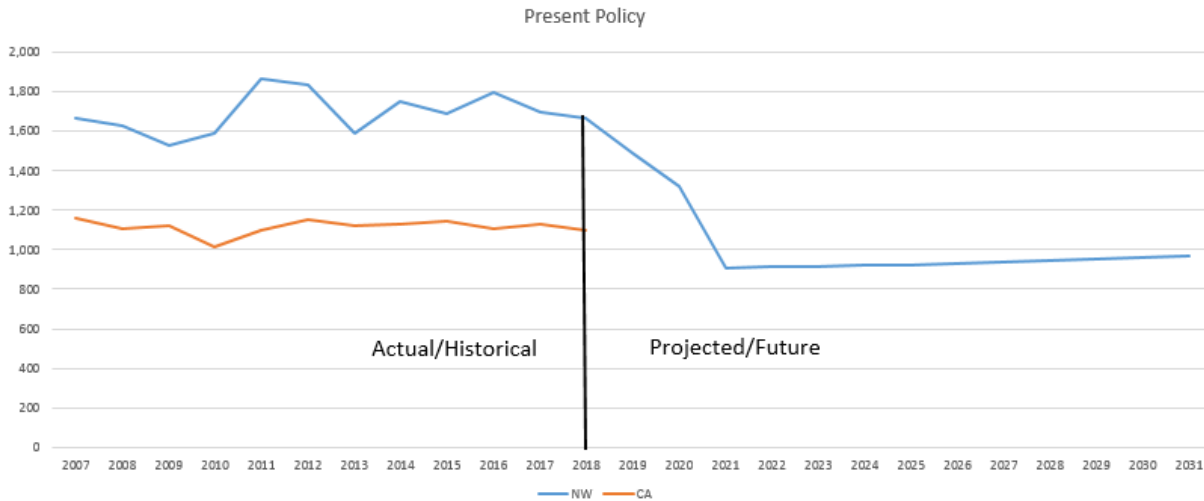
4. The Annual Average Avoided Emissions Rate of .97 lbs/kwh projected for 2031 as shown in the “Present Policy” scenario in the NWPPCC study is the best and most defensible factor to use in the code if carbon emissions are to be used.

Table 1: Annual Average Avoided CO₂ Emissions Rate

Scenario	Annual Average Avoided Emissions Rate (lbs. of CO ₂ per kWh)
2016	1.83
2021	0.91
2026	0.93
2031	0.97

I want to point out in particular that the actual emissions rate in 2016 was 1.83 lbs/kwh. The projected rates in 2021 and beyond are based on scheduled and assumed coal plant retirements and also include a cost of carbon ranging from \$11/ton in 2016 to \$23/ton in 2035, even though there is no actual cost of carbon yet in the WECC outside of CA. To further illustrate, the graph below shows 2007-2018 actual carbon emissions from electricity for the NW Power Pool (blue) and California (orange) just for comparison purposes. You can see that emissions factors have been relatively flat during that time frame. I have graphed future years

using the NWPCC projected emissions rates shown in the table above. It shows a precipitous drop in emissions rates between 2018 and 2021. Given the historical trend, it is questionable whether these future emissions rates will drop to those much lower levels in such a short period of time.



The emissions factor for electricity currently under consideration in these proposals is 0.7 lbs/kwh. It should be noted that this is a future, estimated emissions factor and not the current factor (1.83 lbs/kwh in 2016). The 0.7 lbs/kwh factor does correspond with a scenario in the NWPCC report for 2026, but only when including a cost of carbon equal to the Social Cost of Carbon, ranging from \$45/ton in 2016 to \$66/ton in 2031. I would submit that this is a highly speculative scenario and one that should not be used to establish a factor for code purposes.

Therefore, the following recommendations are made regarding these 2 proposals:

- Disapprove proposal 050-2018, HVAC Total System Performance Ratio based on the fact that it adds a requirement for a computer simulation to the Prescriptive Path, rendering that simplified path no longer prescriptive. It will also add time, complexity and cost to that process.
- If the SBCC chooses to retain this proposal and use carbon emissions as the metric for compliance, use a factor of .97 lbs/kwh which is based on the 2031 projected emissions rate from the NWPCC report.
- Retain proposal 141-2018, Total Building Performance, but use a factor of .97 lbs/kwh.