From: Murray, Chuck (COM)
Sent: Thursday, October 11, 2018 3:04 PM
Subject: Carbon Emissions from Electric Generation Discussion.docx

Please make this document available to State Building Code Council members for the meeting October 12, 2018.

I have developed the attached document to summarize the variations in approach to measuring carbon emissions from electricity. I hope this will be helpful in the upcoming decisions on energy code changes EM050-2018 Total system performance ratio and EP141-2018 Adopt App G in place of C407. Both include carbon emissions as the unit of measure when comparing outcomes from different fuel sources.

Last Friday, the energy code tag unanimously affirmed the carbon emissions is a good unit of measure for comparing systems from a range of energy sources. There is not unanimous consent on the value to include in the code for electricity. The SBCC will need to make a choice. I hope the attached document will be useful.

Given the range of possible futures, Commerce will be recommending the SBCC select a median case, while taking into consideration the social impact of carbon emissions. At this juncture our recommendation for electricity is 0.70 lb. per kWh. This will push code compliance to more efficient systems. It will encourage the use of high efficiency gas and electric heat pumps over other equipment and fuel choices. This value will not have a significant impact on the choice between high efficiency gas and heat pump systems.

A good number of state policies direct agencies to pursue carbon emissions reductions, including direction to the SBCC in the following section of the RCW.

19.27a.020
(2) The council shall follow the legislature's standards set forth in this section to adopt rules to be known as the Washington state energy code. The Washington state energy code shall be designed to:
(a) Construct increasingly energy efficient homes and buildings that help achieve the broader goal of building zero fossil-fuel greenhouse gas emission homes and buildings by the year 2031;

Please keep in mind, these code changes provide many benefits as described by the proponents statements. Review this information in the context of the code changes being considered.

Thank you,

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Carbon Emissions from Electric Generation Discussion

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Average carbon emissions from electric generation delivered to Washington Customers

RCW 19.29A.060 Fuel mix disclosure requires electric utilities to report energy generating resource delivered to meet loads. This includes both in-state and out of state resources. This provides specific emissions from specific generators used to meet loads.

Emissions vary from year to year. The Fuel mix disclosure program has been tracking electric energy fuel sources since 2007. The average carbon emissions 2007 to 2016 were **0.46 lb. per kWh**.[1] Current emissions are primarily driven by coal, followed by natural gas.

Average carbon emissions from generating resources are scheduled to go down substantially in the coming years. By 2025, most of the regions coal plants are scheduled for retirement. The region is expected to substitute the lost generation with energy conservation, demand response, renewables (as required by law) and gas generation.

Marginal carbon emissions from electric generation

Power planners typically use a marginal resource factor when comparing different resource alternatives. The marginal resource is change in carbon emissions associated with a unit change in quantity of electricity supplied or produced.

The Department of Commerce has used a simple marginal resource factor. The marginal resource is based on the addition of a high efficiency combined cycle gas generator. The value used is **0.82 lb. per kWh**. This is the value used in the OFM life cycle cost tool adopted by the SBCC.

The NW Power and Conservation Council recently published a draft analysis describing marginal carbon emissions.[2] Using an economic dispatch model which includes all available generators in the Western Electricity Coordinating Council, the analyst determined which resources would operate if an additional 100 megawatts of electricity capacity were required and the northwest were either buying more power or selling less power during each hour of each of 80 historical water years.

The table below combines two alternatives presented in the analysis. Because the method of analysis uses an economic dispatch to select resources, it is sensitive to variations in carbon policies. When there is a price on carbon, the selection of carbon-based resources is reduced. In the table below we present both the existing policy results and the results with the social cost of carbon.

	Existing Policy	With Social cost of Carbon
	(lbs. of CO2 per kWh)	(lbs. of CO2 per kWh)
2016	1.83	1.40
2021, Plan DR	0.91	0.58
2026	**0.93**	**0.70**
2031	**0.97**	**0.55**

[1] Washington State Department of Commerce, Aggregate Fuel Mix Time Series 2017 (xlsx) http://www.commerce.wa.gov/wp-content/uploads/2018/01/Energy-Fuel-Mix-Aggregate-Time-Series-2017-vers-B.xlsx

[2] AVOIDED CARBON DIOXIDE PRODUCTION RATES IN THE NORTHWEST POWER SYSTEM
DRAFT – January 2018, https://www.nwcouncil.org/sites/default/files/avoided-co2-rate-report-draft-for-comment-2018-01.pdf