Memo

Date: October 11, 2018
To: State Building Code Council
From: David Mead
Subject: Greenhouse Gas Factors for Fuels
Distribution: PAE, Duane Jonlin – City of Seattle

Summary

The proposed carbon emission factors listed in Table C407.1 of the commercial provisions of the Washington State Energy Code are inconsistent in their emissions methodology. Electricity is taken as a source emission (needing corrections) while natural gas is a site emission (excluding venting and fugitive emissions). The following memo outlines a methodology to make these consistent for the emissions factors in the energy code.

TABLE C407.1 CALCULATION METHOD
Here is the table referenced for comments in this memo:

Table C407.1 . Carbon Emissions Factors

Type	CO2e (lb/unit)	Unit
Electricity	0.82	kWh
Natural Gas	11.70	Therm
Oil	22.50	Gallon
Propane	12.40	Gallon
Other*	195.00	mmBTU
On-site renewable energy	0.00	

*District energy systems may use alternative emission factors supported by calculations approved by the code official

In order to show how these fuels compare with the same units here is the conversion table:

Table C407.1 Carbon Emissions Factors - Normalized

Type	CO2e (lb/unit)	Unit	CO2e (lb/kWh)
Electricty	0.82	kWh	0.820
Nat Gas	11.7	Therm	0.399
Oil	22.5	Gallon	0.552
Propane	12.4	Gallon	0.463
Other	195	mmBTU	0.665
On-site renewable energy	0	-	0.000

Note how natural gas is the best performing fuel when normalized. This does not accurately calculate the emissions rate of natural gas however as it excludes fugitive and venting sources. NREL, the EPA and others have done research on this showing that venting and fugitive emissions from natural gas can be 60% and 40% of the total emissions[1] but none of this is included in the current code. By calculating natural gas

[1] https://www.nrel.gov/docs/fy16osti/62820.pdf

emissions the current way it penalizes electricity which is measured as a source emissions (from the point of generation) where natural gas is measured on a site basis (excluding emissions from generation).

In order to correct this the following table is proposed, increasing the natural gas emission rate by 50% to include fugitive and venting sources. This is actually conservative as many sources how these emissions are actually much higher due to fracking (30% to more than double) compared to conventional gas[2]. NASA has shown through measurements how much extra methane is in the atmosphere but it is being excluded by emissions factors in the current building codes[3].

Proposed GHG Rates

Table C407.1 Carbon Emissions Factors - Normalized

Type	CO2e (lb/unit)	Unit	CO2e (lb/kWh)
Electricty	0.55	kWh	0.55
Nat Gas	17.55	Therm	0.599
Oil	22.5	Gallon	0.552
Propane	12.4	Gallon	0.463
Other	195	mmBTU	0.665
On-site renewable energy	0		0.000

This table corrects the natural gas rate and uses the proposed electricity rate of 0.55 lb/kWh that reflects estimated rates for the 2026 Washington grid by the code council. The challenge with the electrical rate is that some of the sources are from natural gas electrical plants which should also use the same increased natural gas rate noted above. Future sources are increasingly renewable as well with the growth in renewable energy not currently included in the electrical emissions projections. These measures combined could balance each other out but a detailed analysis would be needed to estimate both.

Summary

In order to accurately calculate GHG emissions fugitive and venting emissions from natural gas should be included. Especially with 2/3 of natural gas[4] coming from fracking sources now. At a minimum, burning natural gas on-site for buildings should include the source emissions. These rates will be closer to reflecting the true emissions from natural gas.

[2] http://www.atkinson.cornell.edu/Assets/ACSF/docs/attachments/Howarth-EtAl-2011.pdf

[3] https://www.nasa.gov/feature/jpl/nasa-led-study-solves-a-methane-puzzle

[4] https://www.sightline.org/2017/10/30/is-your-natural-gas-actually-fracked/