From: KEN GARBER <kengarber@prodigy.net>
Sent: Thursday, December 01, 2022 11:35 AM
To: Planning <Planning@a2gov.org>
Subject: climate impact of electric vs. gas

To the planning commission:

When it comes to climate impact, is electric better than gas? That's a question planning staff and Commission posed at the November 15 meeting. What is the emissions advantage, if any, of an Ann Arbor building that uses an all-electric heating system versus one that burns gas in a furnace?

Because DTE Energy generates most of its electricity from burning fossil fuels, mainly coal, this is a legitimate question. Does going electric really help the climate, at the present moment, given how dirty our electricity is?

To answer this important question, I crunched the numbers. Let's consider a hypothetical Ann Arbor household that consumes 103 million BTUs a year, which is close to the state average. That's translates to 1,000 therms. The electricity calculation is straightforward. A high efficiency heat pump rated at 10 HSPF (Heating Seasonal Performance Factor)—good, but not exceptional-- will produce 10,000 BTU of heat per kWh. So those 103 million annual household BTUs require 10,300 kWh of electricity. The 2021 conversion factor for DTE's energy mix is 0.0005956 metric tons CO2 equivalent emissions per kWh. This figure was provided by Thea Yagerlener in the city's Office of Sustainability and Innovations, and was determined from DTE's reported values. (The emissions factor for carbon dioxide is multiplied by the fraction of fossil fuel energy sources in DTE's fuel mix. A weighted average is determined, taking into account the amount DTE purchases from the regional grid.) Applying this conversion factor results in an electric heat pump producing 6.14 metric tons CO2 equivalent emissions per kWh per year in our theoretical Ann Arbor household.

The gas calculation is more nuanced, because the choice of emissions conversion factor is more subjective. Our theoretical household's same annual 103 million BTUs or 1,000 therms are equivalent to 100,000 cubic feet of gas. At 13 kg CO2 equivalent emissions per therm, a conversion factor that takes into account upstream emissions (see below), that comes to 13 metric tons CO2 emissions per household per year, just from burning gas.

That conversion factor is on the high end of published figures, but it's based on good science. It's the figure recommended by NASA climate scientist Peter Kalmus in his book, "Being the change," page 150. Kalmus considered upstream CO2 emissions from the fracking process, which generates half of the country's natural gas, and methane leakage over the natural gas life cycle. He also factored in methane's global warming potential over a 100-year time frame, which is 33 times greater than that of CO2. Some analyses only take direct CO2 emissions from furnace gas combustion into account, which leads to a gross underestimation of the climate impact of natural gas. That was the error made by consultant D.R. Nelson in exhibit F of Robertson Brothers' August 29 letter to Planning Commission about the Village development.

So the 13.0 metric tons annual emissions from burning gas in this hypothetical house's gas furnace are more than double the emissions from an electric heat pump. Conclusion: electric heat is twice as clean as gas heat right now. And of course as the grid gets cleaner, and/or the city sources clean electricity from non-DTE sources, that advantage will grow.

Ken Garber
28 Haverhill Ct
(734) 741-0134 phone