Residents for Responsible Renewables

October 29, 2019

Mayor Mike Hurley and Members of Council
City of Burnaby
4949 Canada Way
Burnaby BC V5G 1M2

Dear Mayor & Members of Council

Re: 2019 UBCM session on Hydrogen and ongoing promotions by special interest groups

Our organization promotes the responsible use of renewables in addressing the climate crisis. We have no relationships or financial interests in any industry or academic institution and our only objective is to ensure that proposed climate crisis solutions are based on science and the evidence and that funds available to address the climate emergency are used as effectively as possible.

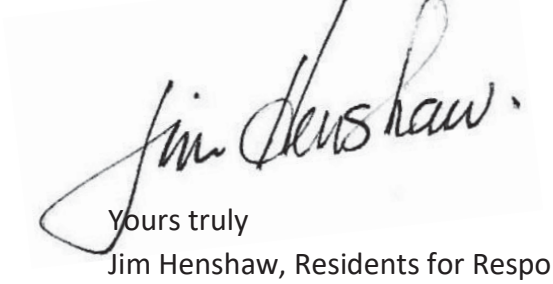
We note that at the 2019 UBCM session entitled "Hydrogen 101" and through other channels, there may remain a series of unsupported claims about the efficacy of hydrogen for roadway transportation purposes to reduce GHG emissions.

Attached please find 10 reasons why hydrogen fuel cell vehicles and infrastructure should not be considered as part of a municipal GHG reduction strategy. It is not a matter of hydrogen vehicles being "an option", but rather that hydrogen vehicles, fuel, and infrastructure continue to show no prospects of being commercially or environmentally viable.

We are confident (from the science and the math) that the result of a roadway hydrogen strategy would be the ultimate abandonment of such a direction. This would result in the stranding of any and all hydrogen assets constructed with taxpayer funding.

Regretfully, these assets would represent millions of dollars in taxpayer expenditures that could have been effectively used to address the climate crisis emergency.

We would urge all municipalities to be highly circumspect about hyperbolic claims about hydrogen for roadway transportation. Although hydrogen has many industrial and commercial applications and uses, roadway vehicles is not one of them.



Yours truly
Jim Henshaw, Residents for Responsible Renewables
cc Chris Gilmore, Exec Dir. of Climate Change Strategy Christopher.gilmore@gov.bc.ca

Referred to:
Environment and Social Planning Committee (2019.11.05)
Copied to:
City Manager, Dir. Corporate Services, Dir. Engineering

Residents for Responsible Renewables

Ten reasons why Hydrogen Fuel Cell Vehicles and Infrastructure should not be considered as part of a municipal GHG reduction strategy.

BACKGROUNDER, updated to September 18, 2019

1) Hydrogen fuel and fueling is dangerous (safety first)

Hydrogen is 10 times more flammable and 20 times more explosive than gasoline and cannot be odorized (like propane). In early 2018 there was an incident in California involving a hydrogen transport vehicle catching fire during which the fire chief imposed a one-mile evacuation zone around the burning hydrogen transporter. https://www.youtube.com/watch?v=amzs_xdiinM

More recent incidents in 2019 involved; an explosion at a hydrogen electrolysis facility that killed 2 and injured 6 http://koreajoongangdaily.joins.com/news/article/article.aspx?aid=3063503 ; an explosion and fire at a hydrogen transfer station in California https://tinyurl.com/yx9qtzdq and an explosion at a combined hydrogen production and dispensing station in Norway https://tinyurl.com/y6aoak2h Both of the latter incidents resulted in the interruption of hydrogen supplies for hydrogen vehicles. The latter explosion also resulted in a personal injury and a suspension of all hydrogen vehicle sales.

2) Hydrogen sourcing is either harmful to the environment or wasteful of resources.

There are two main commercial methods of producing hydrogen. “Blue” hydrogen is made by steam-reforming natural gas (methane) and results in the release of 5.5 kg of CO2 to the atmosphere per kg of hydrogen produced [1] [2]. The other method known as “green” hydrogen or clean hydrogen, is produced via electrolysis, and although emissions-free, there are CO2 and other emissions associated with delivering the hydrogen to the dispensing stations. However, the major issue with green hydrogen is the wasteful quantities of electricity (60 kWh per kg) and clean water (9 litres per kg) that are expended to make it. The electricity used to make enough hydrogen to propel a hydrogen vehicle for 100 km is enough electricity to power a BC home for 2 days. The water expended to produce the same one kg of hydrogen is 9 litres, or enough for the daily drinking water requirements of a family of four.

Moreover the same electrical energy used to make enough hydrogen to propel a hydrogen vehicle 100 km will propel an all-electric vehicle over 3 times farther.

Producing hydrogen from biogas or other fugitive methane sources is in most cases both impractical and wasteful. Such sources of methane should be used locally to replace conventional methane or other fossil fuels rather than expend additional CO2 emissions and energy inputs and costs to, in effect, convert one fuel (methane) to another (hydrogen). Other methods of producing hydrogen (and there are many) are either impractical, still in the lab, or unaffordable.

Although claims continue to be made that carbon capture and storage (CCS), will be used to eliminate CO2 emissions from blue hydrogen, this technology is still prohibitively expensive and/or not

commercially viable. Billions of dollars have been spent world-wide on CCS attempts over several decades without commercial success. Claims of viable CCS via injecting CO2 into oil wells are significantly overstated and result in additional oil production.

3) Hydrogen fuel is unaffordable

Hydrogen fuel, depending on the source of hydrogen, costs from 27% more (for methane-based hydrogen) to 98% more (for clean hydrogen) than the equivalent cost of gasoline [3][4]. There is no objective data that indicates that mainstream vehicle owners are prepared to pay more than the price of gasoline to fuel a hydrogen vehicle. Some vehicle manufacturers are offering up to three years of free hydrogen fuel with the purchase of their vehicles in attempts to mitigate this issue, but this essentially highlights the problem of higher fueling costs and the extra costs that would be incurred after three years.

4) Hydrogen fueling is impractical

Only 18 vehicles can be fueled per day at a 100 kg hydrogen dispensing station. There is a further constraint that a maximum of 3 or 4 vehicles can receive a full tank of hydrogen before there has to be a significant pause in refueling for re-pressurizing the hydrogen dispensing tank back up to 10,000 psi and rechilling the hydrogen before dispensing. Continuing to fuel another vehicle at lower pressure (5,000 psi) would result in the vehicle receiving only half a tank of hydrogen (half the range).

5) Hydrogen infrastructure is not scalable

Unlike gasoline stations that can refuel about 600 vehicles per day, a 100 kg hydrogen station can only practically refuel about 18 vehicles per day. It would take 4 FCEV stations (8 pumps per station) to fuel 600 FCEVs per day - a four-fold increase that is constrained by station footprint requirements as hydrogen cannot be safely stored below ground.

With the high capital and operating costs for hydrogen infrastructure, there is no known business model that results in a positive rate of return for a hydrogen fueling - even with subsidized hydrogen fueling costs. Worse, hydrogen station installations would represent a sub-optimal use of scarce and valuable real estate assets. Producing hydrogen at dispensing locations is impractical and represents a high degree of risk (the Norway incident).

6) Hydrogen infrastructure is not sustainable

Hydrogen production and dispensing is energy-intensive compared to other options. Sixty (60) kWh of electricity is required to produce each kilogram of green hydrogen – enough to propel a hydrogen vehicle 100 km but a fully-electric vehicle at least 3 times further. Using such quantities of electricity to produce hydrogen would not only be wasteful of a renewable resource but would compete for the electricity and grid capacity needed for other and more cost-effective purposes such as converting oil-heated homes to electric heating. Worse, electrolyzing hydrogen in quantities would seriously impact the grid as electrolysis would occur during the daytime peak periods as opposed to when most electric vehicles would be charged at night (off peak).

7) The Lack of a market for hydrogen fuel cell vehicles

There is no known demand for FCEVs in British Columbia. Hydrogen vehicles that used to have advantages in terms of range and refueling times have seen these advantages disappear as pure electric vehicles are now available with equivalent range at lower cost and with faster charging speeds. There is no hydrogen refueling time advantage under most circumstances as electric vehicles are usually (80%-90%) charged unattended at home overnight whereas hydrogen vehicles must be driven to and from a hydrogen station and be attended by the vehicle operator while refueling.

8) Regulatory issues

Currently there are no hydrogen fueling dispensers approved by Measurement Canada for the retail sale of hydrogen to the general public in Canada.

9) Hydrogen vehicles are expensive

The current entry level purchase cost of a hydrogen vehicle is in the order of $73,000 compared to an equivalent-range electric vehicle at $45,000 or 38% less

The high cost of hydrogen vehicles combined with their complexity, means that hydrogen vehicle prices are not expected to be substantially reduced with increased volumes or technology.

10) Hydrogen infrastructure is socially inequitable

A capital investment of $3,200,000 CDN for a 100 kg/day hydrogen hydrolysis production facility ($2,920,000) and dispensing equipment ($400,000) would be required to support just 200 hydrogen vehicles travelling an average of 50 km per day. The same funding would provide infrastructure for 10 times as many (2,000) new or used electric vehicles. These factors make investments in hydrogen infrastructure an order-of-magnitude less effective at increasing the adoption rates of zero well-to-wheel emission vehicles. Due to the high cost of hydrogen vehicles and hydrogen infrastructure, fuel cell vehicles would be accessible to high-end consumers only.

[1] Ulf Bossel "Does a Hydrogen Economy Make Sense" Vol. 94, No. 10, October 2006 | Proceedings of the IEEE Page 1835 – Figure 9

[2] Although claims continue to be made about carbon capture and storage there are no viable operations to date that either do not result in additional CO2 emissions and/or result in additional production of oil to be burned in the atmosphere.

[3] Based on current average cost of hydrogen in California ($13.99USD/kg) and BC gasoline cost of $1.40 per litre and Joint Agency Staff Report – Cost to Attain 100 Hydrogen Refueling Stations – California Energy Commission- California Air Resources Board, January 2017, Page F-5 adjusted for the lower cost of BC electricity

[4] Subsidies for hydrogen fuel costs should not be eligible for funding from the BC Low Carbon Fuel Standard if the hydrogen is sourced from steam-reformed methane as this method, in effect, expends additional energy to convert one fuel into another.