October 10, 2023

The Honorable Christian Dorsey
Chair, Arlington County Board
2100 Clarendon Boulevard
Arlington, VA 22201

RE: **Proposed hydrogen fuel cell bus pilot raises cost and climate concerns**

Dear Chair Dorsey and Members of the Arlington County Board:

We appreciate the Board's commitment to moving beyond methane gas as a fuel for the ART Bus fleet. Methane is a potent greenhouse gas prone to leakage throughout its lifecycle, and bus emissions harm the communities served. With the new ART Operations and Maintenance Facility specifically designed for battery electric buses (BEBs), and the first BEBs on order, Arlington is in an ideal position to move forward with fleet electrification.

Arlington County staff have proposed buying 2 to 4 hydrogen fuel cell buses in the near future to test on Arlington roadways. This Hydrogen Fuel Cell Bus Pilot will cost millions of dollars but deliver little value to Arlington residents and taxpayers. The results of the pilot will be largely irrelevant because hydrogen will remain a poor choice for Arlington's bus fleet no matter how well pilot buses perform. The pilot cannot address the fundamental, documented reasons why hydrogen would be a serious fiscal and environmental mistake for Arlington. These reasons are outlined below.

1. **Hydrogen fuel cell buses and infrastructure are very expensive**

Each hydrogen bus costs approximately $250,000 more than a battery electric bus.[1] The cost for a pilot involving 4 buses and a simple fueling station would exceed $6 million. For the fleet, up-front fueling infrastructure costs are estimated by the ART Zero Emission Bus Study to be $10 to $15 million.[2] These up-front costs create a significant risk of stranded assets if hydrogen-based operations prove to be uneconomical compared to battery electric buses. Stranded assets remain a concern if costs are covered by grants, as grant funders typically require assets to be retained for their useful life.

2. **Green hydrogen is prohibitively expensive and availability is uncertain**

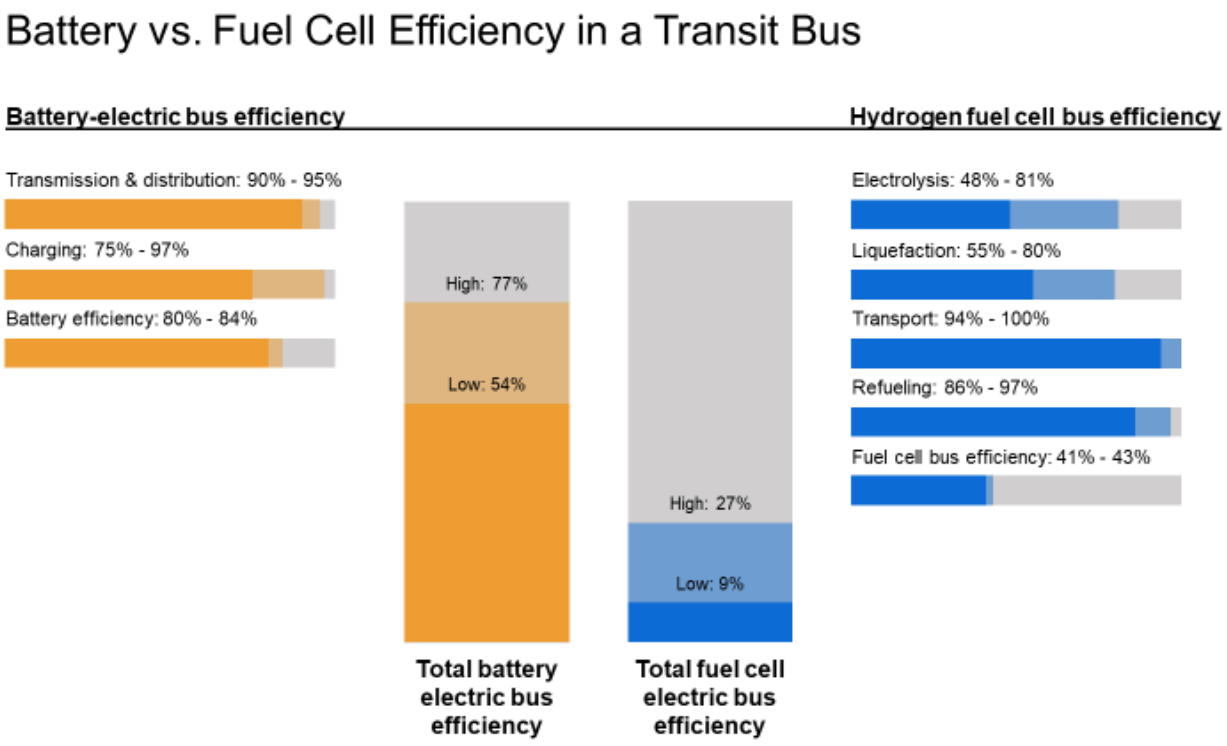
Fuel costs and supply risks are major considerations. To minimize climate harm and achieve Arlington's carbon reduction goals, only green hydrogen should be considered for use in Arlington.[3] Green hydrogen does not exist in our area and future production and cost is uncertain. Where it is available, the cost of green hydrogen is much higher than the more common gray hydrogen, which is created using natural gas. The hydrogen industry has recently backed away from predictions of dramatic declines in the cost of green hydrogen over the next few years.[4]

Cost estimates for all types of hydrogen are variable but are at least 4 times higher than electricity costs for a battery electric bus, according to the ART Zero Emissions Bus Study.[5] Hydrogen costs are subject to spikes. For example, it is now nearly 14 times more expensive to drive a hydrogen car in California than a comparable battery electric vehicle, according to a recent analysis.[6]

To manage fuel cost and supply risks, the County Board should not authorize hydrogen bus purchases before acceptable fuel delivery contracts are available for review. Provisions guaranteeing availability of certified green hydrogen, cost caps, and allocation of risk require careful scrutiny.

3. **The abysmal energy efficiency of hydrogen harms the climate**

Massive use of renewable energy is required to create green hydrogen, compress or liquefy it, transport it on trucks, conduct refueling operations, and then convert it back to electricity through a fuel cell process. In all, using a hydrogen fuel cell bus requires 2 to 9 times more renewable energy than using a battery electric bus.[7] Because renewable energy is a scarce resource, choosing an inefficient hydrogen system over an efficient battery electric system means less renewable energy is available to displace fossil fuels on the grid.[8] Choosing hydrogen over battery electric buses, therefore, would result in significant climate harm even though a fuel cell bus itself has no direct emissions. Marketing materials and studies that focus only on bus emissions or fuel economy once the hydrogen is on board the bus do not address the major energy losses that occur throughout the hydrogen lifecycle.



Source: Environmental Defense Fund, "Rule # 1 of Hydrogen Deployment: Electrify First," January 31, 2023. All underlying data, assumptions, and citations are available here.

4. **Arlington is ideal for battery electric buses**

Arlington's low-speed, stop-and-go routes, small geographic area, short distances, easy terrain, and modest miles driven per bus—combined with its new state-of-the-art maintenance facility—make it one of the best-suited counties in the nation for battery electric buses. The range of current-generation BEBs is sufficient to serve all or almost all Arlington routes,[9] and is growing at an impressive rate year-by-year. The knowledge base for BEBs is robust with thousands in service across the nation, including in Alexandria, Washington, D.C., Fairfax County, Prince George's County, and at WMATA. All these jurisdictions and WMATA have studied bus technology, and all are moving forward with BEBs while taking a wait-and-see approach to hydrogen buses. Montgomery County is transitioning to battery electric buses for close-in routes like those in Arlington. It is experimenting with hydrogen buses for longer rural and highway routes, which do not exist in Arlington.

5. **Need for careful review and due diligence**

The Board has an important role in ensuring that questions about the timing, costs, climate impacts, risks, purpose, and value of a hydrogen pilot are fully considered. Given the many advantages of battery electric buses, and serious questions about the cost and availability of green hydrogen and hydrogen infrastructure in our region, why not keep an eye on hydrogen technology while proceeding with the planned transition to battery electric buses? That is the way peer transit systems are approaching this issue after careful study. It is also the approach recommended by the environmental community.[10]

We urge you not to commit to other approaches without first discussing these issues with experts in the community. We would be happy to discuss these issues with you in greater detail at any time.

Sincerely,

Elenor Hodges
Executive Director, EcoAction Arlington

Julie Rosenberg
Leader, Faith Alliance for Climate Solutions, Arlington Hub

John Bloom
Chair, Sierra Club, Potomac River Group

cc: Mark Schwartz, Arlington County Manager
Bill Eger, Chief Climate Policy and Coordination Officer
Greg Emanuel, Director, Department of Environmental Services
Mike Moon, Chief Operating Officer, Department of Environmental Services
Hui Wang, Deputy Director of Transportation
Demetra McBride, Chief, Office of Sustainability and Environmental Management

[1] ART Zero Emission Bus Study, Appendix D, p. 20, estimates that a hydrogen fuel cell bus ($1.26 million) costs approximately 30% more than an electric bus ($955,000). The ART Bus Study Appendix data are out of date, but the cost differential likely remains similar.
[2] ART Zero Emission Bus Study, Appendix D, p. 10.
[3] The precise definition of green hydrogen under the Inflation Reduction Act may be released by the Treasury Department at any time and will govern projects eligible for substantial federal support. For explanation of the underlying issues see "The Great Green Hydrogen Battle," Canary Media, March 28, 2023.
[4] See, e.g., Hydrogen Insight, September 25, 2023, "Cost of green hydrogen unlikely to fall 'dramatically' in coming years, admit developers."
[5] ART Zero Emission Bus Study, Appendix D, p. 22, estimates that the cost per mile of fuel for a hydrogen bus ($1.80) is four times greater than the cost for a battery electric bus ($0.45). This estimate does not specify green hydrogen and is not based on local electricity rates or time-of-use charging rates.
[6] Hydrogen Insight, "Analysis: It is now almost 14 times more expensive to drive a Toyota hydrogen car in California than a comparable Tesla," September 18, 2023.
[7] Environmental Defense Fund, "Rule # 1 of Hydrogen Deployment: Electrify First," January 31, 2023.
[8] Hydrogen Insight, April 12, 2023, "Allowing US green hydrogen projects to use existing renewables 'could increase emissions by a factor of five.'"
[9] The first 4 BEBs ordered by Arlington are 3 Gillig 588 kWh buses and one Gillig 686 kWh bus. These buses have estimated ranges of 205 and 239 miles per charge, respectively, according to the Canadian Public Transit Discussion Board Wiki. Arlington has not released route modeling data for these models, but the average miles per day driven by an ART bus is just over 100 miles, suggesting that these BEBs will be able to serve all or almost all Arlington routes without difficulty.
[10] See, e.g., Sierra Club, "Hydrogen: Future of Clean Energy or False Solution?" Jan. 4, 2022; Environmental Defense Fund, "Rule # 1 of Hydrogen Deployment: Electrify First," January 31, 2023.