Submitted electronically on January 31, 2024

To: Department of Energy, Office of Clean Energy Demonstrations, MACH2 Hydrogen Hub

We, the undersigned organizations and individuals, are writing to express our grave concern regarding President Biden's announcement in Philadelphia that the proposed Mid-Atlantic Clean Hydrogen Hub ("MACH2") has been slated to receive $750 million as part of the Administration's $7 Billion hydrogen hub campaign.[1] The October announcement rocked the communities of the Delaware River Watershed and prompted a multitude of questions about a little known federal initiative that will have indelible impacts on our communities and the environment.

MACH2 misdirects funding that is urgently needed to support and produce truly clean, efficient, renewable and affordable greenhouse gas-free energy sources and systems that are critically needed to reduce greenhouse gas emissions by 2030. President Biden has set a goal of reducing the nation's greenhouse gas emissions by 50-52% below 2005 levels by 2030.[2] Meeting this goal requires immediately deploying truly renewable energy sources to replace fossil fuels. But these ready to implement renewables – strategies such as wind, solar, increased efficiency, to name a few – are being displaced in order to chase hydrogen. Unlike renewable energy strategies, hydrogen is unproven at scale, extraordinarily expensive, and imposes new environmental and community burdens.

MACH2 includes all of Delaware, southeastern Pennsylvania, and southern New Jersey, including the Delaware River area up to Trenton. The hub reportedly would produce hydrogen using primarily nuclear energy ("pink hydrogen"), wind energy ("green hydrogen"), and biogas or biomethane in steam methane reforming with carbon capture or some other form of methane harvesting ("orange hydrogen"). Even though the MACH2 application included fracked gas as an energy source, some of its developers deny its planned use today. However, the public has no alternative to the original official documents used to garner selection by DOE, so we cannot eliminate the use of "blue hydrogen", which uses fossil gas. And notably, some leaders in the effort have asserted natural gas is an essential component of the hub. We know that "blue hydrogen" is a disaster at all levels, as explained by energy experts.[3]

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[1] https://www.energy.gov/articles/biden-harris-administration-announces-7-billion-americas-first-clean-hydrogen-hubs-driving

[2] https://www.whitehouse.gov/climate/

[3] Howarth, et al. (2021). How green is blue hydrogen? *Energy Sci Eng.* 2021;9:1676–1687.

Precisely how much of each energy source would be used is debatable, depending on many unknowns. For instance, since the MACH2 announcement, a key MACH2 anchor partner, New Jersey's Orsted wind energy project has been cancelled.[4] There is no verified wind partner to replace Orsted's 11,000 megawatts of offshore wind energy, the "green" energy source that was a foundation of the MACH2 application to the Department of Energy. Where will this huge volume of "green" hydrogen come from, especially at the beginning of the project? Or will it be replaced by more "pink hydrogen" which requires more nuclear power construction and/or the continuation of the existing Salem Nuclear Generating Station that, because of its dependence on old technology, inflicts devastating consequences for our region's Delaware River every year. Or perhaps natural gas will continue, or become again, a major component of the hub?

The public has been shut out of the secretive hydrogen hub process despite lofty pronouncements about the requirement "to develop and ultimately implement a comprehensive Community Benefits Plan (CBP)—which will be informed by early and meaningful community and labor engagements in each region."[5] Yet the industry and government selection of production sites, infrastructure such as pipelines, storage depots and transmission lines, and where and how the hydrogen would be used for MACH2 has rushed ahead behind locked doors without the public's knowledge or involvement. Many of the key decisions have already been made, ***without*** the public. The lack of transparency has been confounding and offensive to those who would be on the frontlines of the project's components.

Basic facts about MACH2 are not available and even Freedom of Information Act requests have not produced details that are required for the public to understand the potential impacts of building out the enormous footprint of MACH2. Claims of community engagement and the implementation of President Biden's Justice40 Initiative are ringing hollow. Frontline communities are once again being told what is good for them rather than being asked what they want.

Our concerns about detrimental community impacts are heightened when we hear the MACH2 developers state they will "reuse and revitalize significant existing pipeline infrastructure" and that this was "a key component of the MACH2 Hub and was a driving influence in the selection of site locations."[6] In truth, MACH2's enormous environmental footprint threatens communities in one of the most densely populated regions of the nation, already overburdened by environmental degradation and public health damage.

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[4] https://apnews.com/article/orsted-offshore-wind-new-jersey-guarantee-forfeit-2512e3bdfc2be70c137084fd2bdad02f

[5] https://www.energy.gov/articles/biden-harris-administration-announces-7-billion-americas-first-clean-hydrogen-hubs-driving

[6] Mach2 Hydrogen Hub Application, WWW.MACH-2.COM

How will an overburdened community benefit from even greater environmental intrusions?

The flip side of MACH2 developers' selection of an "operating or formerly operating industrial or chemical site with access to existing pipelines", taking advantage of a "historically strong industrial presence", is that the same communities that have borne the burden of prior industrial pollution will now be targeted for more. This backwards thinking is a hallmark of the hydrogen hub rollout and helps to explain why the public has not been consulted on site selection.

MACH2 plans to use hydrogen "for industrial, transportation, electric power generation, and residential & commercial end-uses". Several of these uses require the combustion of hydrogen. When hydrogen is burned, it emits oxides of nitrogen (NOx). In fact, the combustion of hydrogen emits six times as much NOx as burning methane.[7] Nitrogen dioxide (NO2) and NOx are harmful gasses that negatively impact peoples' lungs and heart,[8] and impair neurological development.[9] A recent report found that premature death associated with exposure to nitrogen dioxide (NO2) is more likely to occur with people of color.[10] Many Delaware River communities located where MACH2 plans to build hydrogen plants already are populated by people of color and low income (environmental justice communities) who are overburdened with NOx pollution from fossil fuel combustion engines and industrial sources. NOx also reacts with volatile organic compounds (VOC) in the atmosphere that produce ozone (smog), which imposes additional serious health damage[11] to proximate communities and worsens climate impacts. The Delaware River Valley fails to meet federal clean air standards for ozone[12]; our region cannot tolerate any more NOx.

MACH2 plans the use of nuclear energy to make "pink" hydrogen. The nuclear power plants in our region are already nearing the end of their targeted life; extending operations of these facilities, including the Salem Nuclear Generating Station that inflicts significant environmental and ecosystem harm, would be devastating for the Delaware

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[7] Cellek Mehmet Salih & Ali Pınarbaşı, *Investigations on Performance and Emission Characteristics of an Industrial Low Swirl Burner While Burning Natural Gas, Methane, Hydrogen- Enriched Natural Gas and Hydrogen as Fuels*, 43 Int'l J. of Hydrogen Energy 1994, 1205 (Jan. 11, 2018), https://www.sciencedirect.com/science/article/abs/pii/S0360319917319791. file:///C:/Users/tracy/Downloads/cellek_pinarbasi.pdf. PDF p. 3.

[8] ToxFAQs for Nitrogen Oxides at https://wwwn.cdc.gov/TSP/ToxFAQs/ToxFAQsDetails.aspx?faqid=396&toxid=69

[9] Morgan, Z.E.M., Bailey, M.J., Trifonova, D.I. *et al.* Prenatal exposure to ambient air pollution is associated with neurodevelopmental outcomes at 2 years of age. *Environ Health* **22**, 11 (2023). Published January 24, 2023. https://doi.org/10.1186/s12940-022-00951-y

[10] *Environ. Sci. Technol. Lett.* 2023, 10, 12, 1159–1164. Publication Date: November 7, 2023. https://doi.org/10.1021/acs.estlett.3c00500

[11] https://scienceexchange.caltech.edu/topics/sustainability/what-causes-smog

[12] https://www.dvrpc.org/airquality/

River. Building new modular nuclear units as proposed by anchor partner Holtec adds to the current Salem and Hope Creek nuclear waste problem and will increase pollution and environmental degradation. “Pink” hydrogen is not green and cannot be developed without grave harm to this region.

No matter what “color” energy source is used to produce hydrogen, hydrogen is a tiny molecule, lighter and smaller than methane, with a greater potential for leaking.[13] A National Renewable Energy Laboratory (NREL) study of a prototype proton exchange membrane (PEM) electrolyzer found that most hydrogen losses (estimated at 3.4%) occur in the dryer, resulting in a total loss of about 4 percent.[14] This leakage contributes to global warming. The molecules not only leak out but also become lodged within steel pipes and fittings, causing dangerous embrittlement of the metal. Natural gas pipelines have not been proven safe for hydrogen nor for hydrogen blending.[15]

Hydrogen is not an efficient energy storage medium (batteries are superior) and does not perform efficiently in use (electric motors are superior).[16] The hydrogen production process consumes enormous amounts of water[17], uses so much energy to make that it is actually a net loss[18], and is very expensive[19]. Handling and using hydrogen poses safety risks due its flammability and explosive properties, especially in populated regions. The wide use of hydrogen would require expensive and time consuming infrastructure build out.[20]

Another problem with all hydrogen forms is that it has an indirect global warming effect by extending the lifetime of methane and other greenhouse gasses (GHGs).[21] Hydrogen cannot be considered climate friendly. Despite the potential to reduce carbon emissions for specific niche industrial uses, it cannot be denied that the overall impact of prioritizing hydrogen over development and direct use of clean renewables is the wrong

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[13] https://www.powereng.com/library/6-things-to-remember-about-hydrogen-vs-natural-gas
[14] Fan et al. (2022). Hydrogen Leakage: A Potential Risk for the Hydrogen Economy. Columbia Center on Global Energy Policy.
[15] Miroslav Penchev et. al., Hydrogen Blending Impacts Study Final Report. Agreement Number: 19NS1662 (2022)(prepared for the California Public Utilities Commission)[hereinafter Hydrogen Blending Impacts Study Final Report]; Zhiyuan Fan et. al, *Hydrogen Leakage: A Potential Risk for the Hydrogen Economy*, Colum. U. Ctr. on Global Energy Pol’y 1 (July 2022).
[16] https://about.bnef.com/blog/liebreich-separating-hype-from-hydrogen-part-two-the-demand-side/
[17] Center for International Environmental Law, “FOSSILS, FERTILIZERS, AND FALSE SOLUTIONS”, October 2022. Page 31. Available online at *https://www.ciel.org/reports/fossil-fertilizers*
[18] https://www.eia.gov/energyexplained/hydrogen/
[19] https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/electric-power/112020-green-hydrogen-costs-need-to-fall-over-50-to-be-viable-sampp-global-ratings
[20] Saadat, S., & Gersen, S. (2021). Reclaiming Hydrogen for a Renewable Future. Earthjustice Right to Zero Campaign.
[21] https://www.rechargenews.com/energy-transition/-hydrogen-unlikely-to-play-major-role-in-road-transport-even-for-heavy-trucks-fraunhofer/2-1-1162055

investment at the wrong time and, if the hubs are built out as projected, will increase atmospheric warming and work counter to our shared climate goals.

As a source of heat, hydrogen costs four times as much as natural gas.[22] In fact, without the $7B in government grants and the additional $100B in subsidies that the Administration is preparing to dole out, large scale hydrogen development would not be cost-effective or sustainable. Economic analyses show that green hydrogen can be expected to be four to five times more expensive than hydrogen made from natural gas[23] and that fuel cell-run vehicles, both cars and trucks, are not competitive with the battery technology now being used for transportation.[24] The timeline for MACH2 and the other hydrogen hubs stretch out over several years, according to OCED, with operational systems projected beyond 2030. This is too long a delay to achieve the required dramatic reductions of climate pollution that is needed in the hard-to-decarbonize industrial sectors that have other decarbonization options.[25] To reduce greenhouse gas emissions now on the scale and timeline required, the direct use of renewable and clean electricity and battery storage is far more efficient, affordable, and it's immediately available.[26]

In closing, fossil fuel combustion accounts for most of the anthropogenic greenhouse gas emissions.[27] We know that 80% of total annual U.S. electricity demand can be met with wind and/or solar power generation[28], replacing most sources of climate changing greenhouse gas emissions with truly clean renewables. We can't waste time or energy by chasing hydrogen, particularly when the climate crisis is compelling us to invest first and directly in reliable solutions that will slash the bulk of greenhouse gas emissions on urgent footing.

Signed and respectfully submitted by:

Organizations:
350.org
American Infrastructure Solutions

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[22] https://about.bnef.com/blog/liebreich-separating-hype-from-hydrogen-part-two-the-demand-side/
[23] https://www.energypolicy.columbia.edu/publications/low-carbon-heat-solutions-heavy-industry-sources-options-and-costs-today/
[24] https://www.rechargenews.com/energy-transition/-hydrogen-unlikely-to-play-major-role-in-road-transport-even-for-heavy-trucks-fraunhofer/2-1-1162055
[25] Saadat, S., & Gersen, S. (2021). Reclaiming Hydrogen for a Renewable Future. Earthjustice Right to Zero Campaign.
[26] https://about.bnef.com/blog/liebreich-separating-hype-from-hydrogen-part-two-the-demand-side/
[27] https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gases-come-from.php
[28] Matthew R. Shaner, et al, Geophysical constraints on the reliability of solar and wind power in the United States, Energy and Environmental Science, Issue 4, 2018. https://pubs.rsc.org/en/content/articlelanding/2018/ee/c7ee03029k#!divAbstract

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Better Path Coalition
Between the Waters
Bucks Environmental Action
Clarke For Senate
Clean Water Action
Climate Reality Project: Susquehanna Valley PA Chapter
Concerned Health Professionals of Pennsylvania
Damascus Citizens for Sustainability
Delaware River Pachamama Alliance
Delaware Riverkeeper Network
Divest NJ
Don't Gas the Meadowlands Coalition
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