PEAK Coalition Hydrogen Statement

The need for decisive climate action grows more apparent with every passing day, and we are grateful for the steps New York has initiated toward decarbonizing our state’s power sector. However, as environmental justice leaders and community members in New York State, we are seriously concerned about the fulsome consideration of hydrogen, particularly hydrogen combustion, as a decarbonization tool as announced in recent statements by New York State Energy Research and Development Authority (NYSERDA) and other state or federal entities.

In that regard, appointed and elected officials have contacted us for our views on the use of hydrogen in various sectors of the economy in the state. We thought it best to summarize our concerns in writing now so that you have a full picture of the issues and concerns we have for the use of hydrogen, especially the combustion of hydrogen in electricity and other sectors.

In general, we have the following general concerns, with more specific details to follow:

1. We are opposed to the production and use of blue hydrogen in all forms, as the science clearly shows that production of hydrogen derived from fossil fuels, even when combined with carbon capture and storage (CCS), will result in higher greenhouse gas emissions – particularly of methane – than burning gas or coal.

2. We are concerned with green hydrogen when used for combustion in power plants or other industrial processes, as that combustion process results in dangerous levels of nitrogen oxide (NOx) emissions in environmental justice communities in New York.

3. We are also concerned generally with green hydrogen – in addition to the NOx impacts – if the production of hydrogen from renewable power results in the diversion of renewable output from direct power sector emissions reductions; this would not only distract from the climate goals of New York legislation but could well delay the retirement of fossil-fuel power plants.

4. We are similarly concerned with green hydrogen as the production processes require environmentally damaging levels of water consumption and transportation of hydrogen that requires expensive upgrades and continued use of fossil-fuel infrastructure.

5. To the extent there might be productive uses of green hydrogen – assuming these other concerns are addressed – its use should be limited to non-combustion purposes through fuel cells, the only non-emissions form of energy production from hydrogen.

6. And finally, we must state that we would be opposed to any such uses of hydrogen in any form until and unless the state develops a consensus regulatory framework to regulate the uses and production of hydrogen that addresses the air emissions, safety, water use, renewable diversion, cost, and related issues to such a transformation in our energy sector.

As public demand for carbon-free power has increased, the fossil fuel industry has responded through a public relations blitz on so-called “clean” hydrogen as the way forward. Over the past four years, oil and gas companies, along with other fossil fuel-heavy industries, have
formed at least six trade associations to advocate for policies supporting greater hydrogen production and use in the United States. The industry’s motivation is clear: to use hydrogen to gain a new lease on life for their existing dirty assets.

We urge state regulators to follow a more reasoned path. The state should develop an independent investigation of hydrogen production and use before any real projects are reviewed or approved. This should include independent peer-reviewed science on all emissions and other public health and environmental impacts of hydrogen production and use in any sector of the state’s economy.

We urge NYSERDA to look past the hype when considering potential uses for hydrogen, particularly as there is a growing body of research that outlines several reasons why the production of hydrogen, and its use in the power sector, are concerning.

A growing body of scientific literature supports the many concerns we have about reliance on hydrogen for a clean energy future. These concerns and supporting materials are detailed below.

1. The only “clean,” carbon-free hydrogen is green hydrogen
   - 95% of global hydrogen is gray hydrogen. Most of that is produced via steam methane reformation (SMR) of natural gas, a carbon-intensive process.
   - Green hydrogen, produced via electrolyzers powered by renewable energy, is carbon-free. However, the current global installed electrolyzer capacity is at 200 MW.
   - While capacity is expected to increase, it will be at least a decade before there is enough green hydrogen commercially available to power large-scale commercial projects.
   - This leaves blue hydrogen, in which the SMR process is paired with carbon capture and storage (CCS) technology. CCS technology does not capture all carbon emissions from the blue hydrogen lifecycle. In SMR, about 55 percent of the total CO2 emissions are a byproduct of the reforming and water-shift reactions; the remaining 45 percent result from combustion for heating (source).
   - A recent lifecycle analysis of blue hydrogen found that generating blue hydrogen would result in more greenhouse gas emissions than directly burning gas for heat (source).
   - Furthermore, most uses of captured CO2 would result in higher emissions than they would avoid. Permanent storage of CO2 has yet to be proven, with concerns that leakage could negate many of the purported climate benefits of the process (source).

2. Green hydrogen is energy- and water-intensive to produce
   - With current electrolyzers, green hydrogen's efficiency, from production back to energy through combustion, is around 30%, which means 70% of the renewable energy put into producing green hydrogen is lost across the full cycle of production and use (source).
   - Next-generation electrolyzers could have an efficiency cycle of 80% -- which will only bring green hydrogen's total efficiency to around 45% (source).
   - To replace all current industrial consumption of gray hydrogen -- produced by fossil fuels without carbon capture -- with green hydrogen would require 3,500 TWh of renewable energy, the amount of renewable energy currently produced by the entire European Union (source).
For green hydrogen to be a viable source of energy, its production must be paired with a massive build-out of new renewable energy resources or a surplus from existing renewable energy. Without this, creating a market for green hydrogen runs the risk of diverting renewable energy sources from their best and most productive use, which is displacing fossil fuels. This scenario is already occurring globally around the export and sale of green ammonia (source).

Electrolysis is also a water-intensive process. Every kilogram of green hydrogen produced requires between 9 and 11 liters of water (source).

Because electrolysis breaks down water into constituent elements, this water needs to be purified. Most industrial water purification processes require, at minimum, a ratio of 2:1 wastewater to pure water, effectively doubling the amount of water required. This means each ton of green hydrogen could require up to 18 tons of water total (source).

This analysis also excludes the additional water used as a cooling fluid in most power plants. Most combined-cycle natural gas plants currently use up to 300 gallons of water per megawatt-hour of electricity produced (source).

3. Combusting green hydrogen in power plants jeopardizes public health and delays climate action

While producing green hydrogen can be a carbon-free process, if that gas is combusted, it is not emissions-free.

Burning hydrogen can lead to nitrogen oxide (NOx) emissions up to six times that of methane (source 1, source 2).

NOx does significant damage to the respiratory system over time. In areas affected by smog, symptoms including coughing, increased rates of asthma, and comorbidities with other respiratory illnesses develop. (source). This impact is readily apparent in many frontline communities dealing with heavy NOx emissions emitted by nearby high-polluting peaker power plants. These communities have developed historical health disparities and vulnerabilities because of constant NOx exposure.

To comply with Clean Air Act regulations, most power plants limit their NOx emissions either through a catalytic reaction, dilution of the fuel mix with water or steam, or using newer low-NOx technology such as a dry low NOx (DLN) combustion system. None of these systems have been proven to work with a significant hydrogen blend or 100% hydrogen fuel. Due to the fundamental differences between hydrogen and methane, existing NOx reduction methods are only effective at controlling NOx at very low levels of hydrogen blending.

Blending hydrogen at safe levels also does not lead to a significant decrease in CO2 emissions. Because of the lower energy density of H2, a blend of 30% H2 and 70% methane by volume would result in merely a 13% decrease in CO2 (source).

The world’s first dry low NOx, 100% H2 power generation system was developed in July 2020. However, even with dry low NOx technology, this pilot project still produces NOx levels similar to that of a newer natural gas plant (source).

Because of the significant upgrades to emissions control technologies required for most existing gas plants to handle a larger hydrogen blend, there is no glide path of blending that will eventually get a power plant up to 100% hydrogen. Allowing plants to repower based on the promise that they will eventually get to 100% hydrogen will only extend the suffering of frontline communities and increase the lifetime of polluting fossil fuels.
4. Building out hydrogen infrastructure – or upgrading existing infrastructure – will cost ratepayers hundreds and endanger lives

- If steel is exposed to hydrogen at high temperatures, hydrogen will diffuse into the alloy and combine with carbon to form tiny pockets of methane. This methane does not diffuse out of the metal and cracks the steel. This process, called “hydrogen embrittlement,” means that hydrogen cannot simply be stored and transported with existing infrastructure (source).
- Steel makes up more than a quarter-million miles of natural gas transmission systems in the U.S. Because of the embrittlement issue, any plans to use existing natural gas assets with hydrogen would require the replacement of these pipelines.
- Pipeline replacement is not cheap. Plans currently underway in Chicago to replace all its natural gas pipes will cost each utility customer $750 per year by 2040 (source).
- There are only about 1,600 miles of dedicated hydrogen pipeline in the U.S. today. Because of hydrogen’s size and energy density, these pipelines need additional considerations beyond that of natural gas pipelines. Building a hydrogen pipeline is 68% more expensive than building a natural gas pipeline (source).
- Hydrogen embrittlement can also make storage a serious issue. The tiny cracks caused by embrittlement can lead to leaks and an increased likelihood of explosion (source).
- This makes storage a major concern for hydrogen. While methods such as using salt caverns have been proposed, these do not make sense in dense urban areas, and preparing the salt caverns for storage is also a water-intensive process (source).
- If natural gas was to be replaced with hydrogen, all end-user appliances would have to be replaced as well. Appliances currently built to run on natural gas, such as heaters and stoves, would not be able to run on hydrogen (source).
- Using hydrogen in the home instead of natural gas would lead to four times as many domestic explosions and subsequent injuries (source).

5. Despite hydrogen’s potential impacts on public health, the environment, and energy costs, it is currently being used with no regulatory oversight

- No commercial-scale hydrogen power plants exist in the United States today. This fuel, and the accompanying infrastructure needed to use it safely, have not been tested at a commercial scale.
- Despite this, more and more utilities are implementing plans to begin blending hydrogen in their existing fuel mix (source).
- Few of these blending proposals have addressed the serious environmental and public health concerns aroundcombusting hydrogen listed above, including the NRG repowering proposal in Astoria, Queens (source) and the Danskammer River-Road plant (source).
- Until there can be an independent review of the impacts of hydrogen production and combustion, no hydrogen blending proposals in power plants should be approved. As stated earlier, they only serve to extend the life of polluting fossil fuel assets and compound harm to frontline communities.
6. Uses of hydrogen as a decarbonization tool should be vetted using environmental justice principles to minimize harm to frontline communities

- Several environmental justice organizations have come out with principles of use that should be considered when vetting any hydrogen project, particularly given the lack of formal regulatory guidance.
- Earthjustice released a set of criteria for deploying green hydrogen in least-regret uses, stating that green hydrogen should only be considered when:
  - There are no low-cost decarbonization strategies available;
  - There are no electric technologies being developed that could take advantage of zero-emission technology directly;
  - The logistics and costs of infrastructure for hydrogen transportation and storage can be contained;
  - Technologies for using hydrogen fuel in the sector are or will be available; and
  - Transitioning to green hydrogen could reduce air pollution (source)
- Nearly three dozen environmental justice groups wrote a letter to New Mexico lawmakers against making the state a hydrogen hub. In the letter, the groups outlined seven guiding principles to determine whether and how hydrogen should be deployed as part of the climate transition, including:
  - [The state] must first put in place a comprehensive, durable, and enforceable climate policy framework before assessing whether hydrogen should be an element of the state's climate and energy transition
  - Equity and justice must shape and underpin hydrogen policy decisions
  - Hydrogen must neither divert nor delay [a] transition to a renewable energy future
  - Hydrogen must avoid adverse climate, environmental, public health, and community impacts
  - Policymakers must rigorously scrutinize the financial and economic prospects of hydrogen as a climate and energy transition tool, in particular, fossil-fuel derived hydrogen which, given negative market expectations, risks wasted capital and stranded assets
  - [The state] must provide a clear-eyed assessment of water availability, efficiency challenges, and constrained end-use markets for renewables powered green hydrogen
  - [The state] must carefully consider hydrogen transport and storage safety challenges and risks (source)

Green hydrogen can potentially play a role in decarbonizing truly hard-to-reach sectors such as steelmaking or industrial heat (although many of these uses can be replaced with existing solar technology as well [source]). However, its use should not be directed by fossil fuel industry players who stand to benefit from extending the life of assets that have already done significant harm to low-income and Black and Brown communities. We urge NYSERDA to prioritize the health and safety of the residents of New York, as well as New York's climate goals, over the demands of the industry.