April 26, 2021

House Energy & Environment Committee
Oregon State Capitol
Salem, OR 97301

RE: Senate Bill 333-A

Dear Chair Marsh, Vice-Chair Brock Smith, Vice-Chair Helm, and members of the committee:

I live in Portland and organize with the Metro Climate Action Team (sponsored by OLCV), which is a community of volunteers working to ensure Oregon is a leader in addressing the climate crisis. I also work with another community of volunteers (OCEAN) focused on the responsible development of offshore wind energy on Oregon's south coast.

I am writing you today in support of SB 333-A. Renewable hydrogen is a versatile energy carrier and a useful jack-of-all-trades for implementing a clean energy future. However, renewable energy (electricity) is needed to produce it. Fortunately, many regions around the world are accelerating their transition to renewable energy in order to mitigate the climate crisis and provide substantial new business opportunities for their economies. Wind and solar already provide roughly a third of Europe's electricity. In the U.S., 15 states (plus DC and Puerto Rico) have already committed by law or have set goals to achieve 100 percent carbon-free electricity by 2050 or earlier, and more plan to do the same.

Hydrogen is the most abundant element in the universe and is the fuel that powers the sun. It is currently produced from fossil fuels ("grey hydrogen") by the chemical industry and used in many products like fertilizer. In fact, 6% of global natural gas (methane) and 2% of coal currently goes into the production of grey hydrogen. However, hydrogen can also be produced with renewable energy (wind and solar) using electrolyzers that split water (H_2O) into its two constituent parts, hydrogen and oxygen. Made this way, it's referred to as renewable hydrogen or green hydrogen and it can play many vital roles in our transition to a low carbon energy future. These include use as a clean fuel where electricity and/or batteries are impractical, decarbonizing key segments of industry and utility-scale long term storage of renewable energy. It can be produced, stored, transported and used without toxic pollution or CO_2 emissions. It has three times the energy density per unit weight compared to fuels like gasoline or diesel and can be pumped at similar transfer rates. It burns at the same temperature as natural gas but its emissions are only water vapor and heat. However, using renewable hydrogen as a clean fuel or to store renewable energy is a recent development and still faces some hurdles before it can be adopted on a large scale. Cost is the primary challenge, but storage, distribution and safety issues will need to be addressed also.

<u>RENEWABLE HYDROGEN – COSTS NEED TO DECLINE FURTHER</u>

Many new technologies have a basic chicken-and-egg problem related to cost. Costs can come down with scale but getting to scale often requires costs coming down. At the current small project scale, the cost of renewable hydrogen is significantly more than hydrogen made from and with fossil fuels.

However recent global commitments are projected to significantly reduce costs and could bring green hydrogen to cost parity by as early as 2030 thanks to economies of scale and much cheaper renewable energy. In fact, the massive deployment targets in the European Commission's hydrogen plan alone could drive costs of electrolyzers by 2030 to levels below those previously projected for 2050 and beyond. The other key component, renewable energy, is also continuing its rapid cost declines. For example, IRNEA expects the cost of offshore wind could fall by another 50% by 2030.

RENEWABLE HYDROGEN – OPPORTUNITIES

A recent report by Goldman Sachs described green hydrogen as "the next transformational driver of the Utilities industry" and a once-in-a-generation opportunity that could give rise to a $10 trillion global market by 2050. The key component is access to abundant renewable energy such as the world-class offshore wind resource in Oregon. Here are some examples where green hydrogen can replace fossil fuels or provide new opportunities that will lead to a cleaner energy future:

- Manufacturing – producing steel, cement and many industrial chemicals
- Transportation – fuel for cars, airplanes, trains, heavy transports and ships
- Electric utilities – energy storage to fill gaps from intermittent wind and solar
- Electric utilities – create value from wasted renewable energy (curtailments)
- Electric utilities – fuel to repurposed stranded fossil fuel generating plants
- Gas utilities – use existing pipeline and other infrastructure, with some modifications, to storage and deliver zero carbon gas to customers

The European Union wants to build 40 gigawatts of electrolyzers by 2030 to produce 10 million tons of green hydrogen. In December 2020, seven of the world's biggest renewable hydrogen project developers launched the Green Hydrogen Catapult initiative with the aim of deploying 25 gigawatts of renewables-based hydrogen production capacity by 2026. Another consortium is exploring deployment of up to 10 gigawatts of offshore wind dedicated to renewable hydrogen. In Asia, Australia has taken first mover advantage with a renewable hydrogen export project expected to be in operation by 2025. This market is expected to be driven initially by Japan, but there is also increasing support from China, India, South Korea, Singapore and New Zealand. Most of these countries have included hydrogen into their policy agenda.

RENEWABLE HYDROGEN – NEW POTENTIAL MARKET FOR COASTAL OREGON

One promising market for green hydrogen that is well-suited for Oregon's south coast is zero carbon fuel for maritime shipping. Currently, around 90% of world trade is by sea and it accounts for 3% of global greenhouse gas emissions. In 2018, governments pledged to cut shipping greenhouse gas emissions in half by 2050 (compared to 2008 levels), with continuing efforts to phase them out entirely.

There are several ways hydrogen can be used to power ships and there are many projects underway around the world to determine their relative pros and cons. For example, storing hydrogen may be expensive and difficult onboard a ship, so one alternative is to go an additional step in the production process and convert green hydrogen into green ammonia. Ammonia can be burnt in an internal combustion engine or run through a fuel cell to drive an electric motor. This will enable global maritime fleets to use their existing propulsion systems till the end of their useful lives while planning for more efficient electric propulsion for their future fleets. Ammonia is a well-known commodity from industry and decades of experience with it give green ammonia an added safety advantage.

Finally, it's worth noting that promoting hydrogen as a component of a clean energy future could bring some unintended consequences. Fossil companies like it because they believe it will be derived from fossil fuels for the next decade or more enabling them to sell more product. It may be the only survival route for gas grid operators leading them to try and phase it into their product as slowly as possible. Both these developments would have adverse consequences for meeting necessary emissions reduction goals.

Thank you for your consideration of these comments

Sincerely,

Michael Mitton
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