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TITLE
Electrification is important; then we must add hydrogen

ABSTRACT
Many countries and states have significantly decarbonized and depolluted their electric grids and have policies for completely decarbonizing and depolluting electric grids by date-certain (e.g., 2045 in California). The technologies used to accomplish this feat include solar, wind, nuclear, geothermal, wave, battery energy storage and other technologies. As a result, it is extremely important that more and more end-uses connect to the electric grid and attempt to use this clean electricity when it is produced, or include energy storage to match supply with demand. In addition, certain electric technologies like heat pumps and batteries are much more efficient than their fueled alternatives so that their adoption should become widespread throughout society. Shifting as much of societal energy demands to the electric grid is the most important strategy for decarbonization and depollution throughout the world. But, since we only deliver about 20% of primary energy by electricity today it is impossible to expect that all of the 80% of current energy that is delivered via molecules today will be able to convert to electric operation. In addition, some of the 80% of energy demands require features, such as light weight, reducing gas, high temperature heat, the hydrogen chemical, long duration and/or massive storage, etc. that cannot be delivered or that cannot be easily or cost-effectively delivered by electricity directly. As a result, we must electrify everything that we can possibly electrify and then we should invest heavily in hydrogen to get the rest of society decarbonized and depolluted. Most of the hydrogen will be produced by electrolysis of water with zero emissions electricity, essentially becoming the new electrification vector that could enable decarbonization and depollution of everything for everyone.