The Future of the Hydrogen economy

Abstract: Hydrogen is emerging beyond its conventional role as an additive component for gasoline production, chemical and fertilizer manufacture, and food production to become a promising fuel for transportation and stationary power. Hydrogen offers a potentially unmatched ability to deliver a de-carbonized energy system, thereby addressing global climate change concerns, while simultaneously improving local air quality and reducing dependence on imported fossil fuels. This "trifecta" of potential benefits is sometimes missed by narrow "cost-effectiveness" analyses that examine any one of these benefits but ignore the others.

The emergence of a broader "hydrogen economy" can best be thought of as a transition that will take many years to unfold. Natural gas is a reasonable source of hydrogen in the near term, as it offers modest benefits and lower costs than most other sources. However, as the costs of hydrogen technologies such as fuel cells and electrolyzers decrease through mass production and technological learning, and costs of primary solar and wind power sources continue to slowly decrease, renewably-produced hydrogen will become more competitive. Moreover, hydrogen costs will be relatively stable due to a diversity of feedstock base, with far more stable prices than the volatile oil and natural gas markets can offer. These reasons, coupled with the environmental benefits that hydrogen can offer if produced renewably and cleanly, have led most environmental advocates and states that are working to commercialize clean energy technologies to envision one articulated long-term scenario—a clean energy future that relies on fuel cells powered by renewably produced hydrogen.

Many states, particularly New York, Massachusetts, Connecticut, Florida, Michigan, Ohio and California, are providing research and project deployment funds, tax breaks for new industry, and other measures to encourage hydrogen and fuel cell developments in their states. These program incentives are based on the assumption that fuel cells and related hydrogen infrastructure development are likely to be important to a long-term, sustainable energy future, and that these technologies hold out hope for increased economic development in American industry. In fact, while the belief is hardly unanimous, many analysts and advocates have become convinced that fuel cells are one of the few "emission-free" technologies capable of fully transforming our energy system in a way that is urgently needed to stabilize greenhouse gas emissions and address climate change in the decades ahead.