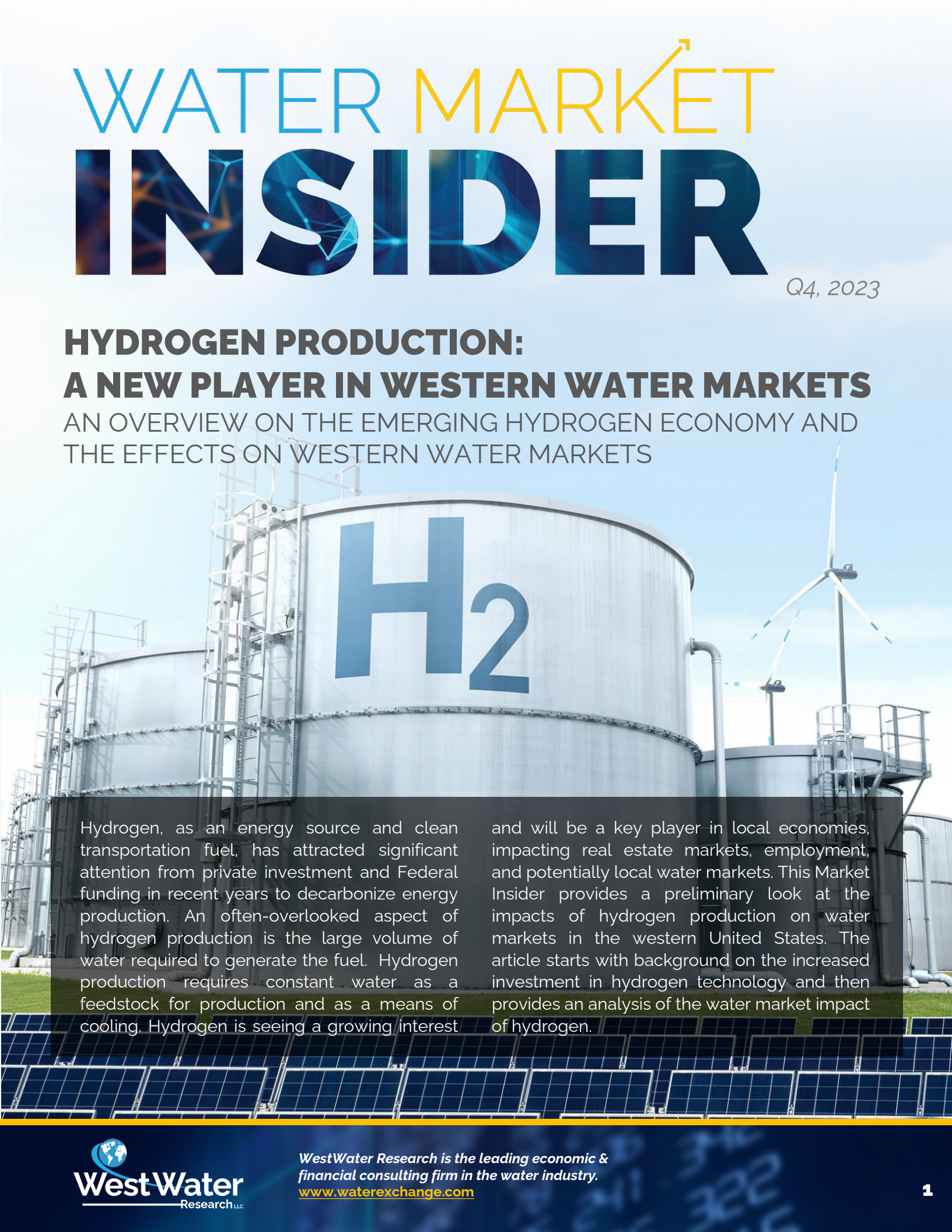


WATER MARKET INSIDER

Q4, 2023

HYDROGEN PRODUCTION: A NEW PLAYER IN WESTERN WATER MARKETS

AN OVERVIEW ON THE EMERGING HYDROGEN ECONOMY AND
THE EFFECTS ON WESTERN WATER MARKETS



Hydrogen, as an energy source and clean transportation fuel, has attracted significant attention from private investment and Federal funding in recent years to decarbonize energy production. An often-overlooked aspect of hydrogen production is the large volume of water required to generate the fuel. Hydrogen production requires constant water as a feedstock for production and as a means of cooling. Hydrogen is seeing a growing interest

and will be a key player in local economies, impacting real estate markets, employment, and potentially local water markets. This Market Insider provides a preliminary look at the impacts of hydrogen production on water markets in the western United States. The article starts with background on the increased investment in hydrogen technology and then provides an analysis of the water market impact of hydrogen.

FOLLOW THE MONEY

Figure 1: Private and Public Investment in the Hydrogen Economy

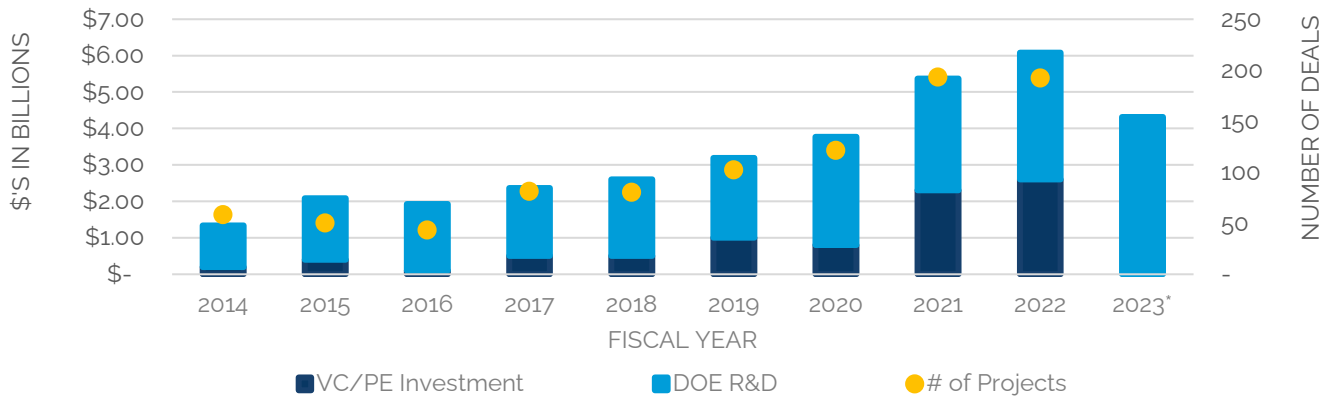


Figure 1 shows the relationship between VC/PE investment and Federal investment in the hydrogen economy. 2023 is noted with an asterisk as not having complete data on VC/PE investment.

The influx of capital, both public and private, into the hydrogen economy is significant. Many economic sectors and national policies are shifting toward renewable, carbon-free energy sources, and hydrogen is promoted as a component of a carbon-free energy system and as a cost-effective alternative fuel with an abundant and readily available supply.

To incentivize the transition to carbon-free energy, there has been a large push to finance the transition

with public funding as well as venture capital (VC) and private equity (PE) capital. The Department of Energy (DOE) provides the majority of public funding for Research and Development (R&D) into hydrogen, and DOE spending on hydrogen R&D has been steadily increasing for over a decade. Recently, with new legislation backing increased hydrogen production, a shared interest has coalesced between public and private markets in hydrogen development..

REGIONAL HYDROGEN HUBS

Federal investment policies are promoting a regionalization of hydrogen infrastructure. The Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act (IRA) have funded and incentivized Regional Clean Hydrogen Hubs (H2Hubs). Regional hydrogen hubs are networks of hydrogen producers, consumers, and infrastructure to accelerate the use and lower the cost of hydrogen as a clean energy resource. The Biden Administration announced federal funding recipients for regional hydrogen hubs on October 13th, 2023. Recipients of the federal funding in the western United States are Washington, Oregon, Montana, California, and Texas. In addition, the DOE has made a Demand-Side Request for Proposals (RFP) to fund market formation and lower the cost of hydrogen. The application process is ongoing, with funding between \$500 million and \$1 billion. Recipients are likely to be near H2Hub funding recipients..

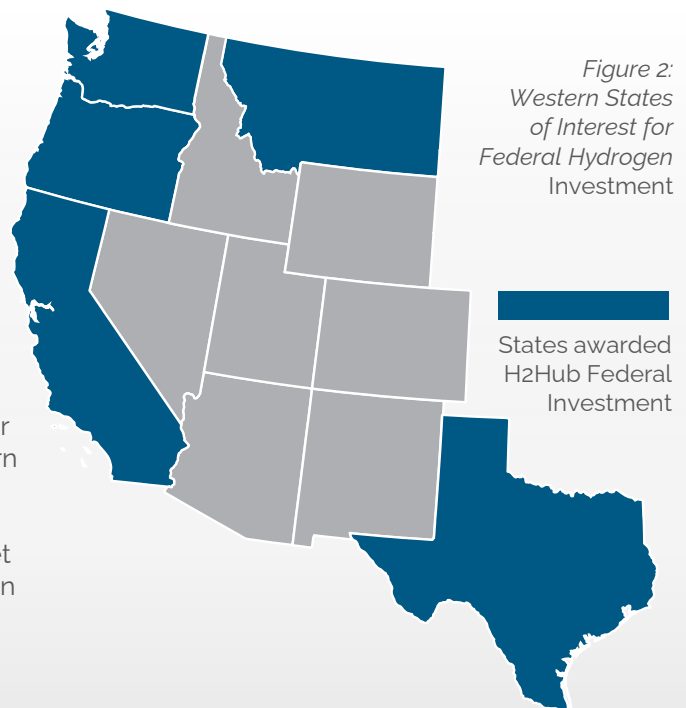


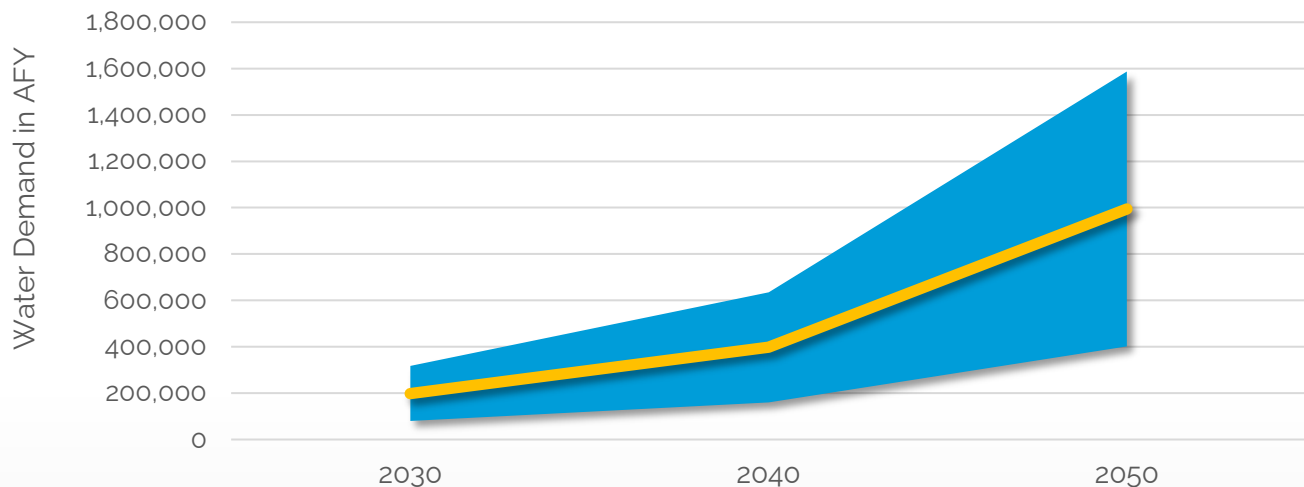
Figure 2: Western States of Interest for Federal Hydrogen Investment

States awarded H2Hub Federal Investment

HOW MUCH WATER WILL BE NEEDED?



Figure 3: Nationwide Water Demand Estimates (AFY) to Meet Hydrogen Production Goals



The figure above projects anticipated water demands for hydrogen production nationwide over the coming decades. Estimated water demands follow the goals set forth by the Biden Administration for hydrogen production in terms of million metric tons (MMT). By 2030 the goal is to produce 10 MMT of hydrogen domestically, 20 MMT by 2040, and 50 MMT by 2050.

The rate of water consumption for hydrogen production varies widely by production type (electrolysis or natural gas), cooling method (evaporative or dry), and form of end-product (hydrogen gas, ammonia, or other).

Consequently, industry and academic estimates of

water use for a fully scaled hydrogen economy vary widely. A review of 12 recent water demand studies provides a range of 80,000 to 320,000 acre-feet required annually to meet the 2030 hydrogen production goal. By 2050, a median estimate is 1,000,000 acre-feet of water will be consumptively used in hydrogen production.

While such volumes are locally significant, they pale to other, existing uses. Assuming one-half of new hydrogen production will occur in the Western U.S., approximately 18,000 acre-feet of water must be reallocated annually from existing uses to hydrogen production by 2050 to meet the stated production goals.

WATER MARKET EFFECTS OF THE HYDROGEN INDUSTRY HYDROGEN ECONOMY AND THE WESTERN WATER MARKETS

Hydrogen production is likely to require reallocation of water resources from existing users. This is expected to result in localized water price appreciation and increased market activity due to the entrance of a new demand sector. Hydrogen facilities have the potential to create new demand for water in predominantly rural areas of the Western US that have not previously experienced water market pressures from municipal and industrial growth. The following points summarize the anticipated impact of hydrogen on Western water markets:

1. MARKET EFFECTS WILL BE LOCALIZED The water market effects of hydrogen will be localized around production facilities. Like other water demands, the focus of water transfer will be near the facility location. Regional market activity will only be influenced to the extent that local water sources are not available.

2. RELIABLE SUPPLIES WILL BE TARGETED Similar to other high-value industrial and municipal water uses; reliable water supplies are required to support the hydrogen industry. Water source reliability may come in the form of senior-priority water rights, reservoir storage, or stable groundwater aquifers. Reliable water supplies will likely see price appreciation and market interest from the hydrogen sector while unreliable water supplies are unlikely to be affected.

3. PRICE APPRECIATION MAY OCCUR The magnitude of price appreciation will follow basic supply and demand dynamics.

4. PRICE RESPONSE LIKELY TO BE TEMPORARY Any pricing effects in the local water market are expected to be temporary during a period of hydrogen facility development. Following the acquisition of needed supplies, many areas are expected to see a return to historic market prices dominated by the agricultural economy.

5. SALES AND MULTI-YEAR CONTRACTS WILL BE PRIORITIZED Hydrogen facilities are expected to purchase most of their needed water supplies. Multi-year leasing contracts and dry-year option contracts as part of a water supply portfolio may be an attractive option in some locations to access water supply sources that are not obtainable through permanent sales. 🌐



WestWater would like to thank Riley Birkeland for his research efforts on the hydrogen industry and potential water market impacts during his 2023 summer internship with us. Riley is currently working on his undergraduate degree in Agricultural Business, with a minor in Economics, at Colorado State University.

ABOUT WESTWATER RESEARCH

WestWater Research is the leading economic consulting firm in pricing, valuation, and transaction advisory services for water rights and water resource development. Our clients rely on our expertise to make sound water resource management and financial decisions when water demands increasingly outpace available supplies.

We work across the country with five regional offices to provide market intelligence, valuation, transaction advisory, strategic planning, and asset management services relating to water rights and water resources. We are known for our rigorous analysis, and information-driven water rights investment strategy formulation and execution

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