

Green Hydrogen Deployment Brief

Annual matching through 2032 provides a pathway to commercialization and maturation of the industry with limited emissions risk.

Clean hydrogen is in its infancy but has significant potential to decarbonize high-emitting sectors that are difficult to directly electrify, such as heavy industry and long-distance transportation. According to the Department of Energy's June 2023 *National Clean Hydrogen Strategy and Roadmap*, hydrogen can reduce U.S. emissions approximately 10 percent by 2050 relative to 2005 emissions levels. That future is far from certain with the rules determining eligibility for the highest tier of the clean hydrogen production tax credit playing a major role in the outlook for green hydrogen.

The following is based on surveying ACP member companies with planned green hydrogen projects. This feedback from industry reaffirms earlier estimates of market size under the two matching regimes (hourly and annually). Specifically, the companies answered three key questions:

1. How much green hydrogen production do you plan to place in service by 2032 under annual matching?
2. What is your anticipated market share of green hydrogen production by 2032?
3. Assuming your projects started construction before 2029, if hourly matching is imposed earlier than 2032 or grandfathering is not allowed for those projects, how much green hydrogen production do you anticipate delivering by 2032?

Hourly matching fails to deliver the deployment levels necessary to achieve scale

The implementation of an hourly matching requirement before 2032 (for projects that start construction before 2029) will result in minimal deployment. The market will be forced to focus on niche applications where customers have a high willingness-to-pay or mandates require the purchase of the fuel. This is especially true given recent price increases. Industry estimates point to an 80-120% increase in the levelized cost of hydrogen over the last year due to higher equipment costs and higher expected electricity costs.

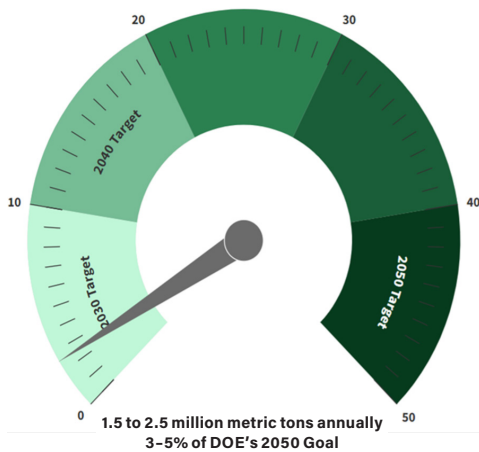
Most ACP members indicated they would not move projects forward under an hourly matching regime. They point to a 20-150% price premium for hourly matched hydrogen production, depending on the region, that makes the fuel uneconomic for most applications. As a result, ACP estimates the potential market size under hourly matching to be minimal. The few ACP members pursuing projects under hourly matching indicate they will need to rely on customers with a high willingness-to-pay or access export markets.

ACP estimates the size of the green hydrogen market by 2032 under hourly matching to be less than 0.7 million tons per annum (mtpa).

Annual matching through 2032 delivers enough projects to achieve economies of scale

Green hydrogen production is expected to reach 1.5-2.5 mtpa under an annual matching regime, with most of those projects delivered between 2028 and 2032. This equates to 10-16 GW of electrolyzers, which at an average size of 400 MW, suggests the industry will deploy 25-40 projects by 2032 under this regime. Either by project count or green hydrogen production volume, the scale of deployment delivers enough activity to establish the industry while alleviating concerns that too many projects will qualify under this regime.

Industry expectation of green hydrogen production by 2032 under an annual matching regime



This activity represents 3-5% of DOE's 2050 clean hydrogen target. These initial projects, enabled under more flexible rules, provide the building blocks to achieve the other 95% of DOE's target and deliver 10% emissions reductions to the US economy. The industry believes this modest market size is sufficient to achieve economies of scale and motivate continued investment.

This level of anticipated deployment presumes first-mover companies are grandfathered for the life of the tax credit under an annual matching system if they are placed in service by 2032. An obligation to switch to a more stringent hourly regime midstream during the 10-year credit window will result in deployment levels consistent with an hourly matching regime. This deployment projection further assumes the imposition of an additionality requirement, consistent with the ACP proposal from June 15, 2023, which requires "new" clean energy sources to be used to power green hydrogen facilities.

At this estimated production volume of green hydrogen under annual matching, the risk of emissions impacts is minimal

The relatively low volume of green hydrogen production estimated to proceed under an annual matching regime limits the risk of emissions impact. Even under the high emissions-case scenario of green hydrogen producing 18 kg CO₂ per kg of H₂, the maximum estimated impact is 45 million metric tons of emissions per year. This is more than offset by the ~750 million metric tons of emissions reduction per year that a green hydrogen industry can deliver by 2050.

Challenges remain even with flexible guidance

Annual matching does not guarantee green hydrogen projects will move forward. A host of challenges will also need to be addressed:

Demand remains a primary concern as the lack of mandates, access to export markets, and limited infrastructure means green hydrogen will need to compete on merit, delivering a cost-competitive feedstock.

The supply chain is still in its infancy. Scaling to deliver facilities approaching 400 MW or larger in size will require a tremendous ramping effort, putting pressure on supply chains, logistics, construction, and the workforce.

Electrolyzers will need to compete for limited renewable resources. Permitting delays and a lack of transmission combine with increasing demand to likely create a competitive market for renewable power.

It takes time to build green hydrogen projects. Projects could require 52 to 78 months to develop. Estimates of project stage timelines include:

- Project configuration: 6-12 months
- Engineering and design: 12 months
- Equipment procurement: 6-12 months
- Construction: 24-36 months
- Site commissioning: Up to 6 months

In sum, this means only streamlined projects can reach commercialization by 2028. As projects await 45V guidance, timelines are being elongated until the rules are final.

Annual matching is imperative. It provides a pathway to commercialization and maturation of the industry with limited emissions risk given realistic projected green hydrogen deployment in the near term.