



Alliance for Renewable Clean
Hydrogen Energy Systems

February 26, 2024

The Honorable Janet Yellen
Secretary of the Treasury
U.S. Department of the Treasury
1500 Pennsylvania Avenue NW
Washington, DC 20220

Mr. John Podesta
Senior Advisor to the President for Clean
Energy Innovation and Implementation
The White House
1600 Pennsylvania Avenue NW
Washington, DC 20500

Subject: REG–117631–23: Feedback Regarding the Internal Revenue Service’s Proposed Regulations to Implement the Section 45V Credit for the Production of Clean Hydrogen

Dear Secretary Yellen and Senior Advisor Podesta:

The Alliance for Renewable Clean Hydrogen Energy Systems (also known as ARCHES H2 LLC or “ARCHES”) greatly appreciates the opportunity to comment on the draft proposed regulations that will implement the credit for production of clean hydrogen (clean hydrogen production credit), as established and amended by the Inflation Reduction Act of 2022. As the U.S. Department of Energy’s (“DOE”) selected “Renewable Hydrogen Hub” for California, with an award of up to \$1.2 billion from DOE and more than \$11 billion in additional cost-share funds committed by state, municipal, and private entities, *ARCHES’ core mission is the rapid establishment at scale of a safe, reliable, and cost-effective renewable, clean hydrogen ecosystem for the benefit of the people of California and ultimately the nation.* Renewable, clean hydrogen is vitally needed to enable deep decarbonization of the economy and to achieve our state’s and nation’s critical greenhouse gas reduction, energy security, and clean air goals. We at ARCHES are prioritizing the coordination, collaboration, innovation, and equity needed to reach DOE’s Hydrogen Shot goals and actualize the benefits they will bring to all of our communities. However, the proposed section 45V criteria threaten Hydrogen Hub success and put the DOE’s Hydrogen Shot goals out of reach in the very states that have led the way toward carbon neutrality, renewable energy integration, energy resilience, and the buildout of a robust American renewable hydrogen market.

We understand and agree with the aims of the section 45V criteria. We also agree that the energy used to make clean hydrogen must be renewable and that the Internal Revenue Service (“IRS”) must establish effective guardrails to ensure there is a reduction of overall emissions as we scale up electrolytic hydrogen production. Therefore, the energy mix supporting electrolysis must include increasing percentages of renewables over time, ultimately reaching 100% by 2050 to meet the federal government’s climate targets.¹ However, in order to achieve these aims, the clean hydrogen production tax credit must consider and incorporate the diverse characteristics of differing regions, especially those of clean-electricity-leading states, such as California, that have already instituted requirements and guardrails to meet stringent, economy-wide clean-air, climate-change, and renewable energy goals. Part I below lays out our

¹ Please note that the energy mix in California must be 100% carbon-free by 2045 to meet California’s legally binding requirements established for the electricity sector by Senate Bill 100 (2018) and economy-wide by Assembly Bill 1279 (2022).

concerns with the current draft 45V regulations and Part II lays out a proposed solution to address these concerns.

I. Concerns with the Current Draft Regulations

Our central concern is that, without key amendments, the proposed section 45V regulations will set in motion serious and harmful unintended consequences for California and peer clean electricity states. As written, the proposed section 45V criteria of incrementality, time matching, and deliverability will push projects out of California and possibly toward non-electrolytic fossil-fuel-derived hydrogen production, with significant adverse impacts for California, the ARCHES Hydrogen Hub and ecosystem, and its associated economic, environmental, and social benefits.

The ARCHES DOE Hydrogen Hub will bring over \$12 billion in hydrogen infrastructure deployment. The environmental benefits of ARCHES' DOE-approved Hydrogen Hub projects to the State of California are profound, and the economic value of the health-related benefits due to the clean air improvements alone are estimated to be nearly \$3 billion per year. The ARCHES DOE Hub is also anticipated to create over 200,000 family-sustaining jobs and to bring \$380 million in direct community benefits programs to California's disadvantaged and Tribal populations. All or many of those environmental and societal benefits are at risk because the current proposed section 45V regulations do not sufficiently account for the progress that states like California have already made toward 100% renewable electricity on their grids and the systems already in place to support them.

ARCHES has conducted detailed regulatory and empirical analysis and data-driven modeling of the effect of the proposed regulations relating to the clean hydrogen production credit and its key requirement of acquiring and retiring Energy Attribute Certificates ("EACs") to qualify for the tax credit. ARCHES' analysis of proposed hydrogen projects examined volume and cost of hydrogen production, associated greenhouse gas emissions, air quality impacts, and health outcomes. Three different scenarios within the proposed ARCHES system were modeled, with and without a production tax credit scheme. Absent the credit, the models yield a 2030 hydrogen cost roughly 50% greater than diesel and an associated production decrease of at least 33%. Critically, the PTC could (but only if revised as suggested herein) allow clean renewable hydrogen pricing to be on par with diesel, which is essential for widespread adoption of hydrogen technology and successful hydrogen market liftoff.

Therefore, as proposed, the section 45V criteria are particularly detrimental to clean hydrogen production in California (and in peer states with strict renewable-energy requirements for their grids), with the fundamental challenges as follows:

1. Incrementality (Incremental power generation) – § 1.45V–4(d)(3)(i)

New power sources for hydrogen production are defined in the proposed regulations as clean power generators that begin commercial operations within three years of a new electrolytic hydrogen facility being placed into service. The goal of incrementality is to ensure that clean hydrogen production does not displace another existing use for that renewable energy, resulting in the other use consuming non-renewable "dirty" energy, thus increasing air pollution and carbon emissions. There are at least four problems with this conceptual framework when applied to California and other states with 100% renewable and carbon-free mandates.

First, hydrogen production converts grid electricity to a different form and stores it for later use in multiple sectors, similar to charging a battery. The real use of that stored energy is the later consumption of the hydrogen in end-use applications that other clean resources (including batteries) cannot effectively support. In the case of the ARCHES' DOE Hub program, the end use will often be to displace diesel fuel. Thus, while hydrogen production using existing

renewable grid energy might *in the worst case* cause another user to draw from California's increasingly renewable grid, the green hydrogen will displace far-more-polluting fossil fuels (most often diesel) in ports, power, and heavy-duty transportation. ARCHES' systemwide modeling has shown that producing hydrogen with grid electricity results in significant reductions in both air pollution and carbon emissions. In other words, in California, as proposed, incrementality will *increase* air pollution and carbon emissions because it focuses only on electrolytic hydrogen production, while the end-use of clean renewable hydrogen is not taken into account.

Second, California produces more renewable energy than it can use at times, necessitating curtailment of renewable resources (e.g., of solar and wind production), pushing them below maximum output. This valuable, renewable energy is essentially wasted. Under the proposed section 45V regulations, hydrogen produced with curtailed energy would not qualify for the tax credit. A rational regulatory structure would encourage hydrogen production with curtailed energy, storing the excess energy for future use and making electrolyzers "good grid citizens", able to ramp up or down to absorb excess renewable energy or alleviate transmission congestion. For context, California could meet 22% of ARCHES' total planned electrolyzer hydrogen production demand in 2030 *just with the curtailed renewable energy from 2023*. As California installs more renewable resources to meet its legally binding Renewable Portfolio Standard ("RPS") goals, curtailment rates will increase considerably and even more renewable energy will be wasted, making grid-connected electrolyzers a key tool to increase renewable electricity penetration and utilization.

Third, California already requires that **all new power** added to the grid must be renewable, and our state has a greater-than-five-year interconnection queue for renewable projects. If the section 45V regulations were implemented as written, new renewable power generation facilities for hydrogen would be placed at the end of this queue and unable to interconnect in a timely fashion. The proposed 45V criteria effectively force grid-connected electrolyzers outside of the state RPS framework without a clear path for success. This is because the renewable generation projects already in the queue are being pursued to meet rapidly accelerating load growth coupled with legally mandated, renewable electricity (RPS) requirements, and falling short comes with steep financial penalties.²

Finally, over the next decade, ARCHES DOE Hydrogen Hub projects will add an average of approximately 400 megawatts ("MW") per year for electrolytic hydrogen production, only about 12% of which will be supplied by grid power. In other words, ARCHES projects would *only* add about **50 MW per year** of grid load for a *total* of approximately 500 MW by 2033. Over that same time period, California plans to add **7,000 MW of renewable electricity generation per year**, with recently approved plans by the California Public Utilities Commission ("CPUC") to add a *total* of **86,000 MW by 2035**.³ Therefore, the energy required for ARCHES' electrolytic hydrogen production—which isn't an end-use in and of itself, but merely energy storage for later clean-energy use—would be more than accounted for within California's existing renewable electricity procurement plans. That would not be the case if such energy must be on top of (*i.e.*, incremental to) California's already extremely aggressive 100% clean renewable electricity plans and mandates.

The incrementality requirements as written will delay hydrogen production, prolong the use of fossil fuel technologies that could be replaced by renewable clean hydrogen, and reduce the

²California Public Utilities Commission (CPUC) *RPS Compliance and Reporting*.
<https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/rps/rps-compliance-rules-and-process/rps-compliance-and-reporting>

³CPUC *Proposed Decision Ordering Supplemental Mid-Term Reliability Procurement (2026-2027) and Transmitting Electric Resource Portfolios to California Independent System Operator for 2023-2024 Transmission Planning* (2024).
<https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M502/K651/502651263.PDF>

number of family-sustaining jobs, with a corollary diminution of environmental, health, economic, and social benefits for frontline, disadvantaged, and tribal communities.

2. Temporal Matching – § 1.45V–4(d)(3)(ii). This criterion calls for annual matching through 2027, and hourly matching in subsequent years. In RPS states like California, with significant renewable resources, hourly matching imposes substantial added expense, reduced flexibility, and uncertainty for project financing, without corresponding emission benefits. According to independent analysis by Energy and Environmental Economics, Inc. (“E3”), a firm that has done foundational work for California, hourly matching delivers no meaningful emissions benefits in comparison to annual matching in an RPS state like California that has significant amounts of renewable resources. E3’s analysis further shows that hourly matching requirements can more than double the cost for the same renewable generation portfolio, negatively impacting renewable, clean hydrogen project costs and the fundamental viability of securing financing for such projects.⁴

Accordingly, section 45V accounting should require clean hydrogen production facilities in California (and other similarly situated states) to apply the same temporal matching system that those states apply to other carbon-free technologies (*e.g.*, batteries).

3. Deliverability – § 1.45V–4(d)(3)(iii) The proposed deliverability criteria would require qualifying EACs to use electricity produced by a renewable electricity generating facility that is in the same “region” as the relevant hydrogen production facility. Most importantly, it imposes arbitrary physical boundaries that do not correlate with how power actually flows,⁵ inhibiting the expansion of the seven DOE Hydrogen Hubs into regional networks and eventually a national system.

The geographical boundaries of the proposed guidelines (US DOE, National Transmission Needs Study, Oct. 2023⁶) differ markedly from the operational realities of the balancing areas within the broader Western Energy Interconnect and the successful Energy Imbalance Market, which spans 11 states and covers 83% of the Greater West.⁷ California imports and exports electricity daily to balance its grid. Existing regional tracking systems, such as the Western Renewable Energy Generation Information System, can be used to generate RECs for broader balancing areas. Limiting EACs and the production credit to single-state regions will disadvantage hydrogen producers planning to use renewable energy generated in an appropriate balancing area and will hinder the DOE’s goal of interconnecting its regional hydrogen hubs to build a national hydrogen network. At a minimum, the definition of “region” must account for the reality of geographical power flows and the ability to *physically* deliver the energy from production to actual consumption.

4. Impact on Sectoral End Uses⁸:

ARCHES’ electrolytic hydrogen is targeted for use in key industrial sectors heavily reliant on fossil fuels: power plants, diesel trucks, buses, diesel port equipment, shipping, aviation, heavy industry, etc., that cannot be fully and effectively decarbonized by other sources.

⁴ Kahn, M. (2023, April 25). *E3 and ACORE Publish New Report Comparing Hourly and Annual GHG Emissions Accounting and Associated Costs for Clean Hydrogen - E3*.

<https://www.ethree.com/e3-and-acore-publish-new-report-comparing-hourly-and-annual-ghg-emissions-accounting-and-associated-costs-for-clean-hydrogen/>

⁵ Concerns about this exact scenario have already caused one production project to express that, without meaningful changes to 45V they intend to withdraw from ARCHES.

⁶ U.S. Department of Energy (2023, October). *National Transmission Needs Study*.

<https://www.energy.gov/sites/default/files/2023-12/National%20Transmission%20Needs%20Study%20-%20Final%202023.12.1.pdf>

⁷ <http://westerneim.com>

⁸ Calculated using proprietary data and the models used in ARCHES’ hydrogen hub proposal, based on expected ARCHES hydrogen hub performance across its 39 projects.

ARCHES' clean hydrogen power, transportation, and port sector projects are estimated to avert a total of 2.6M metric tons of fossil fuel CO₂eq emissions, which translates into the equivalent of avoiding the combustion of 130 million gallons of diesel per year. That includes reduced emissions of nearly 7,000 metric tons per year of NO_x, 326 metric tons per year of PM_{2.5} & PM₁₀, and 240 metric tons per year of SO₂, which equates to dramatically improved quality of life for California's frontline communities and nearly **\$3 billion per year** in health-related cost savings and associated benefits.

As California's grid isn't yet perpetually 100% carbon-free, without ARCHES grid-connected hydrogen production projects, there would be modest near-term emissions benefits on the production side. However, this would cause a disproportionately high increase on the end-use side. With grid-powered electrolysis, the average emissions of the ARCHES DOE Hub system would increase by 0.3 metric tons of CO₂eq per metric ton of hydrogen produced.⁹ In those applications where hydrogen displaces diesel, such as in the ports and heavy duty transportation sectors, every metric ton of hydrogen used prevents 18 metric tons of CO₂eq from being emitted. Thus, the draft section 45V criteria would result in an ***emissions savings of 0.3 metric ton CO₂eq per metric ton of avoided grid-connected hydrogen production, but cause a net increase of 17.7 metric tons CO₂eq per metric ton due to the continued use of diesel instead of hydrogen at the ports and in heavy-duty transportation.***

To translate this into the proposed ARCHES DOE Hub 2030 system, under the draft section 45V criteria, the three California ports could lose access to approximately 30 metric tons of hydrogen per day. This is equivalent to continuing to emit 530 metric tons of avoidable CO₂ emissions *daily*—the carbon equivalent of burning over 52,000 gallons of diesel every day—just at the ports.¹⁰ Put another way, the system could save 9 metric tons CO₂eq per day on production (a number that would get smaller each year as our grid becomes increasingly clean¹¹), but emit 530 metric tons CO₂eq per day from existing diesel end uses.

In summary, in California, the draft section 45V criteria could result in an *increase of 521 metric tons of CO₂eq emissions per day—the equivalent of burning 18.7 million gallons of diesel every year—just from the three ports in the ARCHES DOE Hub proposal.*

II. Proposed Approach

For California, an alternative compliance pathway is ARCHES' preferred option.

California has a long history of adopting more stringent and all-encompassing state environmental regulations than the federal government. Examples include our overall mobile zero-emission vehicle requirements, energy efficiency Title 24 standards, and 100% renewable and carbon-free energy mandates, just to name a few. We believe that the alternative compliance pathway outlined below would both more effectively reduce overall harmful emissions AND incentivize clean hydrogen production in California.

Specifically, and in alignment with State of California energy and air resources regulatory agencies, we propose the establishment of an alternative compliance pathway designed to enable grid-connected projects to come online in states with a firm commitment to 100% clean electricity by a date certain, thus meeting the overall intent behind requiring Energy Attribute Certificates without disadvantaging clean energy frontrunner states already well on the way to meeting 100% carbon-free grid targets. The concept behind this proposal is to leverage a given state's existing electric system planning processes and clean electricity mandates to count toward meeting section 45V criteria goals for clean renewable hydrogen production.

⁹ Specifically, without our planned grid connected projects, the ARCHES hub would go from -0.87 kg CO₂eq/kg H₂ to -1.17 kg CO₂eq/kg H₂. This is an improvement of 0.3 kg CO₂eq/kg H₂ assuming a conservative 2033 grid mix.

¹⁰ <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

¹¹ These savings would get smaller each year as our grid moves to 100% carbon-free and renewable generation sources.

Recommendation 1: Amendment to §1.45V-4: Procedures for determining lifecycle greenhouse gas emissions rates for qualified clean hydrogen.

We propose minimally invasive revisions to the draft regulations through the addition of the following italicized and underlined text in section 1.45V-4(d):

...The requirements of this paragraph (d)(1) apply regardless of whether the electricity generating facility is grid connected, directly connected, or co-located with the hydrogen production facility. However, the requirements of this paragraph shall not apply, and a taxpayer shall not be required to acquire and retire qualifying EACs, for hydrogen production facilities where all of the following conditions exist and are verified in accordance with section 45V-5(g)(6):

(i) The hydrogen production facility is located in a state with mandatory requirements that clean electricity supply 100 percent of all retail sales to end-use customers by a date certain and in no circumstances later than December 31, 2050;

(ii) Any hydrogen production facility relying on grid power has the capability to increase or decrease electricity consumption on demand to follow grid needs; and

(iii) The hydrogen production facility's electricity demand is fully accounted for in the state's energy planning system, including applicable system-level, state-mandated time-matching and deliverability requirements.

Recommendation 2: Amendment to §1.45V-5: Procedures for verification of qualified clean hydrogen production and sale or use.

We propose that the aforementioned alternative compliance pathway can be verified by adding the following new subsection to section 1.45V-5(g):

... (6) If the taxpayer claims an exemption from acquiring and retiring EACs pursuant to section 45V-5(d)(1), a statement that the hydrogen production facility meets the three conditions described in sections 45V-5(d)(1)(i)-(iii).

In the absence of an alternative compliance pathway as described above, ARCHES believes that—based on feedback from our project partners and evidence provided by the potential rescission of one project already—many planned clean hydrogen projects in California are unlikely to be completed successfully. Moreover, for the reasons elaborated above, we believe these changes to be fully consistent with the intent and objectives of the original section 45V criteria: they will decrease pollutant and carbon emissions and accelerate progress toward a successful hydrogen economy and carbon-free future.

In summary, the draft section 45V incrementality, temporal matching, and deliverability criteria have irreconcilable problems when applied to aggressive clean-energy states like California with 100% renewable and carbon-free mandates and which already operate predominantly renewable power grids.¹² Rather than incentivizing hydrogen production and the growth of a hydrogen economy, as intended, the current section 45V language will inhibit clean hydrogen production and the growth of a hydrogen economy in California and similarly situated states. Our proposed alternative compliance pathway meets the spirit and intent of the section 45V framework and empowers California and like-minded states to accelerate renewable energy integration and the establishment of a robust, globally competitive, renewable clean hydrogen ecosystem. This proposed alternative compliance framework will enable decarbonization of all sectors of the economy in a reliable, resilient, and cost-effective way that benefits communities,

¹²California Energy Commission, Estimated Annual Clean Energy.
<https://www.energy.ca.gov/programs-and-topics/topics/renewable-energy/clean-energy-serving-california/estimated-annual-clean>

curbs climate change, and tangibly improves our environment, the economy, and our society.

Therefore, we strongly urge you to revise the proposed section 45V criteria for the clean hydrogen production credit by incorporating the two amendments above, which will enable renewable clean hydrogen projects in states leading the way toward a carbon-free future without impacting the regulatory compliance obligations of projects in other non-100%-clean-electricity states. ARCHES, as California's Hydrogen Hub, stands united with the State of California in this proposal and in further stimulating the energy transition toward decarbonization and its environmental, social, and economic benefits.

Respectfully yours,



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cc:

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