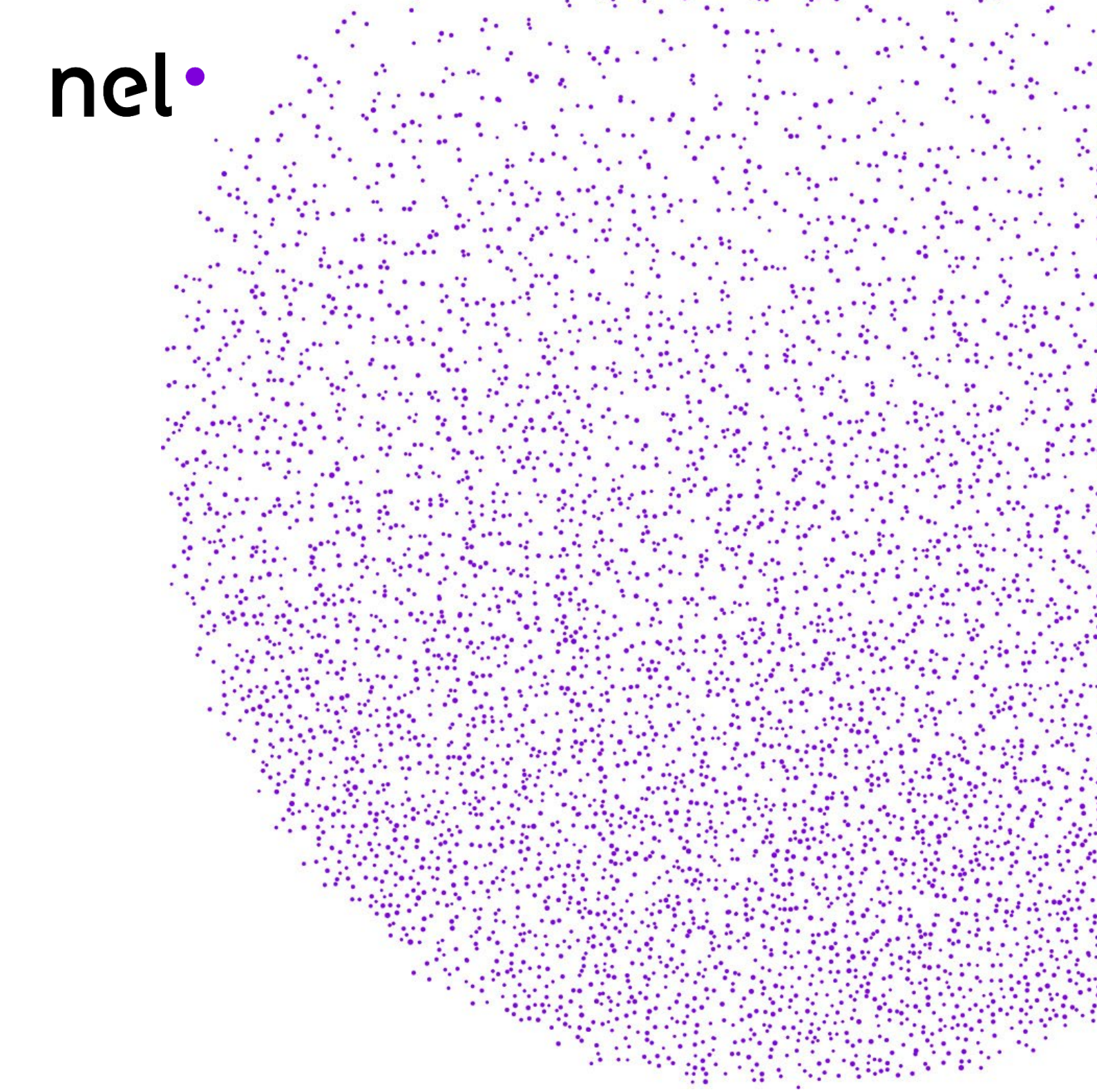

Nel recommendations on the development of US Inflation Reducation Act guidelines (45V) for clean hydrogen production

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Key Nel recommendations for 45V proposed rules

1. Grandfathering

Treasury should exempt either the first 10 GW of projects or projects that come online before December 31, 2030 - whichever comes first – from demonstrating incrementality and deliverability requirements for the duration of the tax credit period.

- This ensures that first mover projects – those willing to take on the risk of early investment into a nascent, yet developing market – are built; this will support establishment of domestic production capacity and availability to meet requirements of early adopting end users.
- Grandfathering also provides enough baseload electrolyser manufacturing demand to stimulate US-based manufacturing and supply chains.
  - Establishing this level of baseload capacity creates the potential to realize the intent of Congress, and the Administration, to achieve the electrolyser manufacturing capacity needed for a long-term, self-sustaining clean hydrogen economy.
  - In addition, the development of a clean hydrogen industry will bring multiple benefits to the US economy and labor market, including new jobs, new workforce training, the promotion of new skills, and the transition into a clean energy future.

2. Set an ultra-clean grid de minimis standard

Given that certain regions of the US grid are rapidly decarbonizing, Treasury should also exempt projects that utilize power from a zero- or near-zero emissions grid. Treasury should designate zones of the grid, such as within a balancing authority, that it will exempt from meeting project-level incrementality and deliverability requirements. Data to support Treasury in making these exemptions is available from the Energy Information Administration's "Emissions by plant and by region" tables[1]. This action will reduce the compliance burden on innovative companies that are seeking to drive aggressive decarbonization technologies through grid-connected projects and also drive investment into regions with abundant low carbon electricity.

3. Resolve specific points of significant concern outlined in § 1.45V–4(d)(3)(ii)(A)

For all other projects, Treasury will advance the intent of the Administration and Congress to stimulate a domestic clean hydrogen industry through the following steps:

- Start with monthly matching, rather than hourly:
  - Projects that are installed on, or after, January 1, 2028 should begin temporal matching at a *monthly cadence, rather than hourly*, to give the industry time to develop the required tracking technology and continue building out the renewable energy assets that are currently in the interconnection queues around the country.
  - While some regions may have very nascent hourly matching capabilities, in the near term, this transition period ensures more equal access to local, clean hydrogen generation than

[1] Energy Information Administration, Emissions by plant and by region. 1 November, 2023. https://www.eia.gov/electricity/data/emissions/

the current guidelines provide, without compromising the carbon footprint of clean hydrogen projects.

- Add a market review step to evaluate readiness for more granular temporal matching:
  - Similar to the EU framework, beginning on January 1, 2030, Treasury should undertake a holistic market review to determine the effectiveness of temporal matching.
  - During this review Treasury will evaluate whether temporal matching is likely to achieve the objectives of the Administration and Congress, and whether technology and markets are available for more granular matching.
  - Specific metrics Treasury should apply include the carbon intensity of the grid regions, electricity prices and availability and accessibility of EACs, and the credibility of production matching products available in the marketplace. Treasury should also evaluate the uptake and cost impact of hourly matching on proposed projects.
- Phase in more granular temporal matching, if and only if, the markets are ready to transition:
  - Treasury should certify that that the market is capable of moving to an hourly temporal matching before requiring the industry to adhere to the requirement.

4. Resolve specific points of significant concern regarding clean hydrogen projects that utilize fossil gas feedstocks and/or carbon capture

- Clean hydrogen production from fossil gas-based production methods should only be eligible for facilities that were operational prior to the release of the final 45V guidance. No new fossil gas-based facilities should be eligible to receive a 45V tax credit.
- Treasury should not allow certificates for methane or other fossil gas-based feedstocks to be eligible to receive 45V.
- Require 3rd party verification for "actual carbon capture rates" of relevant facilities which must be included in the project's GREET models to verify 45V eligibility.
- The Department of Energy should evaluate actual methane leakage for existing pipelines and determine which, if any, meet the assumptions in the GREET model for methane leakage rates.
- Require 3rd party verification for "actual methane leakage" for well-to-gate which must be included in the project's GREET models to verify 45V eligibility rather than using an assumed value.

5. Modify the definition of 'qualified clean hydrogen production facility':

- Exclude from the definition of 'qualified clean hydrogen production facility', any facility utilizing electrolysers placed in service where the final electrolyser stack was assembled in or by a 'Covered Nation,' as defined by 10 USC § 4872(d)(2), or a 'Foreign Entity Of Concern,' as referenced under IIJA Section 40207.

Rationale for these measures

These recommendations support both the Administration's and Congressional policy objectives to incubate a successful, thriving clean hydrogen ecosystem in order to meet economic and environment goals. With revisions, Nel remains strongly optimistic that the U.S. can achieve important policy goals, including:

- Driving large scale emissions reductions in hard to abate sectors – ammonia, iron & steel production, medium- and heavy-duty transportation.
- Develop U.S. based supply chains: ensure first movers are building new projects because *where projects are deployed is where supply chains will be built.*
  - Because of the natural clustering of supply chains around deployed projects, it's in the U.S.'s best interest to have a similar 45V framework with the E.U. market to prevent significant market fragmentation.
- Establish a globally competitive U.S. hydrogen economy. Driving down the cost of clean hydrogen production establishes the basis for U.S.-based manufacturers across the supply chain to provide technology and services to the burgeoning low carbon economy.

These goals can be achieved with the proposed 45V revisions by:

- Supporting first movers. 45V is a key component of the U.S. policy agenda to create the financial basis upon which major investment decisions can be made, leading to the development of hydrogen infrastructure and a variety of low-carbon hydrogen use cases. The provisions above provide critical incentives for first movers, those willing to take on additional risk, to re-capture U.S. competitiveness in a global hydrogen economy.
- Enabling scaled electrolyser production. By enabling the viability of green hydrogen use cases, these recommendations can enable Nel and other electrolyser developers to achieve domestic manufacturing scale. As with any industry, production scale is essential to our ability to provide the market with low-cost, high reliability electrolysers that can both compete with emerging international competition and support the requisite production economics of emerging low carbon industries.

Market effects if the current draft rule is left intact

As written, the 45V guidance will severely diminish the viability of clean green hydrogen projects in the U.S. It will cede green hydrogen production and manufacturing to other countries and prevent the U.S. from achieving the scale or supply chains needed to reach any 2030 decarbonization goal reliant on low cost, clean hydrogen.

1. Competitive field will tilt toward unregulated, carbon-intensive industries

Decarbonizing 'hard to abate' industries requires rapid scaling and use of clean hydrogen to provide proof that a transition to producing clean hydrogen is technically and economically feasible, while creating competitive advantages for U.S. heavy industry. We note that key industries which hydrogen can decarbonize – medium- and heavy-duty transportation, iron and steel production, and ammonia production – all remain fossil dependent with no corresponding obligation to reduce their own carbon footprint. Similarly, grey hydrogen also has no similar obligation. Once this new capacity is in place, there is zero incentive to modify or upgrade given their capital intensity and their decades long lifetimes.

2. Competitive field will tilt toward foreign competitors, including China

In a global economy, major transitions also require sufficient capital and industry buy-in to create new domestic supply chains that will enable the build out of nascent markets. Through the IRA and IIJA, Congress has dedicated tens of billions of dollars (and possibly more due to uncapped tax credits), of taxpayer funds to do just this. As seen in solar power, wind power, and now batteries, achieving volume manufacturing is the most important enabling lever to drive down production costs which is the essential gateway to achieving project viability. The hydrogen industry is on a trajectory to unlock these cost reductions through automation and production volume, in part due to DOE investments in large scale hydrogen production. However, mobilizing industry's investment in manufacturing requires clear signals that the market can absorb the scaled electrolyser production. The 45V implementation pathway that the Treasury dictates can either build upon this ambitious legislation or relinquish this once-in-a-generation opportunity.

3. Chilling of the investment climate in the U.S.

The U.S. hydrogen industry had been slowly growing (~5% CAGR domestic hydrogen production)[2] which sped up more in response to the historic $9.5B investment by congress (Dec 2021) directly for building domestic hydrogen infrastructure.

- This momentum further increased after the passage of the IRA (Aug 2022) with the 45V production tax credit – in anticipation of a favorable policy environment for the next decade in the U.S.
- Projects across the country scrambled to secure their electrolyser capacity reservations due to a perceived manufacturing capacity shortage relative to the exponential demand.

[2] https://www.precedenceresearch.com/hydrogen-generation-market#:~:text=North%20America%20hydrogen%20generation%20market,4.84%25%20from%202021%20to%202030

- In parallel, electrolyser manufacturers made multiple announcements to invest in new electrolyser manufacturing capacity with the intent to build gigafactories capable of servicing all of this new demand.
- However, once the leaked 45V guidance started circulating and industry saw the extremely strict proposed eligibility rules to access the 45V PTC, this momentum quickly softened.
  - Major projects, including hydrogen hub projects, have been paused.
  - FID for projects have been delayed, sometimes indefinitely.

Example scenario if current draft rule is left intact

- Electricity Pricing: It is well known that electricity prices make up the majority of the levelized cost of hydrogen production. The U.S. Department of Energy's U.S. National Clean Hydrogen Strategy and Roadmap states 'the levelized cost of hydrogen production is highly sensitive to the cost of electricity. Access to low-cost energy with a high-capacity factor (e.g., through integration with existing clean baseload assets such as hydroelectric and nuclear power plants) can facilitate much lower levelized costs.'[3]
  - As written, 45V nearly eliminates this pathway to accessing low cost, high-capacity factory electricity – reducing the number of levers available to make green hydrogen projects financially attractive when cost of capital is high.
- Foreign Subsidized Manufacturing: China has been aggressively building electrolyser manufacturing capacity, flooding the markets with very low cost electrolysers that are attractive where capex is more sensitive than opex.
  - As written, 45V's incrementality and deliverability/EAC requirements will likely drive up the overall capex of projects, making ultra-low cost electrolysers that do not meet the reliability nor durability standards that the U.S. has come to expect from its infrastructure even more attractive than they are today.
    - This single handedly cedes manufacturing of electrolysers to other countries who are likely to use less responsible supply chains and foreign labor. Once this occurs, there's little incentive for domestic manufacturers to invest in manufacturing capacity and further innovation in electrolysers, ensuring a perpetual lack of U.S. competition in the market without major government intervention.
- Finally, with hourly matching, projects will need to either add in storage to access renewable power when it's unavailable or severely reduce the utilization rate of the electrolyser if RECs aren't available in the right region.[4] In this scenario, the latter option makes more economic sense and would require overbuilding the electrolyser (e.g. buy a higher capacity electrolyser) to compensate for the reduced number of operational hours.[5] This further adds to the upfront capex[6] of a project and drives home how extremely low-cost Chinese electrolysers will become the top choice.

[3] https://www.hydrogen.energy.gov/library/roadmaps-vision/clean-hydrogen-strategy-roadmap

[4] "Forcing a disconnect between the times in which hydrogen can be produced — i.e., hourly match's restriction of hydrogen production to only the hours intermittent solar or wind power is generated — with the round-the-clock consistency required of hydrogen supply will result in added system costs and complexity. For an hourly matched system to supply 24/7 hydrogen to an end user, it must rely on expensive batteries, greatly oversized renewables and electrolyzer capacity, and/or hydrogen storage, adding both cost and heightened infrastructure needs to the project. In contrast, monthly or annual systems have the added option of drawing power across more periods of the day to produce hydrogen more consistently, allowing for greater ease in meeting the required consistencies of supply." https://rmi.org/insight/calibrating-us-tax-credits-for-grid-connected-hydrogen-production/ Weiss, et al. Calibrating US Tax Credits for Grid-Connected Hydrogen Production : A Recommendation, A Flexibility, and a Red Line. 2023.

[5] "A key observation [...] is that in nearly all cases, when disregarding the attribution of a PTC, the LCOH is higher under hourly versus annual time-matching requirements. This finding relates to Figure 2, which shows that significantly more resources need to be built to meet hourly versus annual time-matching requirements." Cybulsky, et al. Producing hydrogen from electricity: How modeling additionality drives the emissions impact of time-matching requirements. MIT Energy Initiative. April 2023.

[6] 68% to 170% increase in LCOH in 2030 in an hourly matching vs annual matching scenario under 45V. https://go.woodmac.com/l/131501/2023-03-15/2yx541/131501/16788910281oysDzSz/Wood_Mackenzie_H2_CI_Timing_Requirements_1003.pdf Hydrogen Carbon Intensity Temporal Matching Analysis. Pages 12-16. March 2023