ERM Report: Assessment of Grid-Connected Hydrogen Production Impacts

Summary & Key Findings

The Inflation Reduction Act Section 45V established a new clean hydrogen production tax credit that will pay an incentive per kilogram of clean hydrogen produced over the first 10 years of a facility's production, with different incentive tiers based on greenhouse gas intensity. The Secretary of the Treasury is now charged with issuing a final rule for determining lifecycle GHG emissions, which will govern treatment of the upstream electricity supply for hydrogen production.

EDF contracted Environmental Resources Management to assess the importance and potential design of "3 pillars" of electricity emissions accounting: incrementality (new clean energy supply), temporality (hourly-matched) and deliverability (located nearby). This report is presented in two parts. Part I includes a literature review, which summarizes key findings from approximately 30 reports on the 3 pillars and outlines areas of consensus, as well as key differences in assumptions and methodologies. Part II assesses key aspects of the 3 pillars from a regional context and explores key implementation considerations and policy design options.

Key Findings

- **This analysis indicates that a 3-pillar framework will provide protection against emissions increases while enabling sustainable long-term industry growth:** In the absence of the 3 pillars, electrolysis would lead to notable net increases in grid emissions, placing the industry on unstable footing and contravening the spirit of the IRA.
- **The 3 pillars will enable robust low-carbon value chains that endure past the tax credit's expiration:** Specifically, the 3 pillars will incentivize domestic market solutions to complement variable renewables (e.g., long-duration storage, batteries and transmission lines), the build-out of hydrogen storage, and the deployment of more flexible electrolyzers capable of producing competitively-priced hydrogen after the tax credit expires. Strong requirements will also support global value chains, including by aligning with or exceeding international market requirements such as those in the EU. Moreover, the guidelines for 45V will serve as an important precedent for future low-carbon tax credits, policies or regulations – both H2-related and beyond.
- **The 3 pillars can spur regional low-carbon hydrogen economies**: Requiring low-carbon electricity to be local and time-matched will help establish regional low-carbon hydrogen economies, supporting DOE's strategic goals.
- **Compliance with the 3 pillars can be demonstrated in several ways**: This can include direct connection; power purchase agreements with bundled environmental attribute certificates or an equivalent utility program; or matched hourly EACs. However, unbundled certificates are insufficient – in most markets, they fail to provide sufficient financial backing on their own as a guaranteed revenue source to underpin new clean generation investments.

- **Multiple studies underscore that incrementality requirements are vital:** There is consensus across the literature that incrementality requirements are essential to avoiding a net increase in emissions from the deployment of grid-based hydrogen production. In this report, incrementality is defined as new clean generation, as well as generation which would otherwise not have existed but was enabled by demand from hydrogen production, such as nuclear capacity under threat of retirement or curtailed renewable generation.
- **Hourly matching of low-carbon electricity to hydrogen production avoids emissions and cost increases:** Hourly matching drives alignment of clean supply and demand and avoids consequential emissions increases on the grid. Advanced grid modeling suggests that the 3 pillars will only negligibly affect production costs. At the same time, weak production rules could increase consumer electricity prices significantly by pushing markets to find less efficient solutions for balancing hydrogen demand and supply, including a net increased call on more expensive generators. They would also encourage the deployment of cheap, inflexible electrolyzers with high stranded asset risk.
- **The 3 pillars reinforce and enhance the efficacy of each other:** For example, without incrementality measures, temporality and deliverability measures alone will struggle to prevent emissions increases. And without an hourly matching requirement, only requiring generation of new supply will have little effect. This speaks to synergy within the framework and the necessity of all 3 pillars supporting each other.

Policy Design

The following text box in the report lays out an example of a strong pillar-based framework, with underlined elements representing new ideas presented in this report while the rest represents Treasury's proposed guidance.

1. **Incrementality:** Clean energy source placed in service no more than 36 months before the electrolyzer claiming the generated clean electricity.
    - Can include direct connection, power purchase agreements or equivalent utility program, or hourly matched environmental attribute certificates from generators that meet the same requirements
    - Can apply the 80/20 rule for renewable facility repowering
    - Can include uprates and resources that would otherwise be curtailed
    - Consider including resources that would otherwise be retired (e.g., nuclear) subject to demonstrated need beyond existing subsidies
    - Consider exemptions for deliverability regions with high renewables penetration (e.g., >90 percent), low grid carbon intensity and/or states with emissions caps
2. **Temporality**: Clean electricity supply matched on an hourly basis by 2028
    - No legacy (a.k.a. grandfathering) of facilities
    - Consider potential buffer approaches to provide reasonable operational flexibility (e.g., small buffer volume for non-hourly-aligned unbundled certificates)
3. **Deliverability**: Clean energy source procured from same region as defined by either eGRID boundaries or the National Transmission Needs Study
    - Ability to wheel from adjacent regions (e.g., based on transmission capacity rights or LMP differential)
    - Consider periodic updates to boundaries to reflect changing transmission constraints
4. **Calculation Methodology:** The calculation methodology should be Scope 2 attribute-based with electricity supply volumes accounting for transmission / distribution system losses

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