Unlocking Electrolytic Hydrogen:

Why Rate Design Determines Project Viability

Joint Report by:
Renewable Hydrogen Alliance and Customized Energy Solutions

Introduction Page

About the Renewable Hydrogen Alliance: *RHA is a non-profit industry trade association enabling renewable hydrogen in the Pacific Northwest through education, networking and advocacy. RHA supports members across full value chain of the hydrogen ecosystem, including fuel users, technology and service providers, equipment manufacturers, project developers, public and private fleet operators, labor unions, utilities, and many others with an interest in the clean and renewable hydrogen sector.*

Renewable Hydrogen Alliance commissioned this analysis to quantify the impacts of electricity rate design on the economic viability and grid impacts of electrolytic hydrogen projects. This work reflects RHA's role as a neutral convener focused on aligning policy, markets, and stakeholders to support responsible hydrogen and energy infrastructure development. The analysis was developed in collaboration with technical and market experts and is based on operational modeling using representative project assumptions and regional electricity pricing structures.

Renewable Hydrogen Alliance does not sell hydrogen, develop projects, or promote specific technologies or commercial interests. The findings are intended to support informed decision-making and reduce uncertainty around project viability and grid integration.

To learn more about RHA, visit renewableh2.org or email info@renewableh2.org

About Customized Energy Solutions: *CES is a global energy services and technology company, founded in 1998 and headquartered in Philadelphia, USA. With over 400 professionals and offices in North America, India, and Japan, CES supports clients worldwide in navigating dynamic, deregulated electricity and energy markets. CES delivers expertise in market consulting, asset management, retail operations, and emerging technologies such as hydrogen.*

Interested in learning more about how integrating flexible operations into design can impact project revenues and inform investment decisions? ***To learn more about CES, visit ces-ltd.com or Contact:***

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Executive Summary

The Pacific Northwest (PNW) is facing unprecedented constraints on its energy system. The growth of new electric loads paired with a rapidly changing electric supply has stressed an already constrained transmission and generation system.[1] With a challenging forecast for the region's clean energy and climate goals,[2] there is increased value to capturing and using every clean electron.

Globally, electrolytic hydrogen production is an increasingly common tool to deliver renewable energy to end users without overreliance on the electric transmission system. A gaseous energy carrier, renewable hydrogen is used as a transportation fuel, industrial feedstock, or resilient power source that can be delivered by pipeline, truck, and rail.

This report by the Renewable Hydrogen Alliance and Customized Energy Solutions shows that electrolytic hydrogen can also help to balance the electric grid by ramping electrolyzer operations in alignment with grid needs. When paired with an energy source, like solar photovoltaics, new proton exchange membrane (PEM) electrolyzer technologies can ramp energy usage in response to grid signals and energy prices. When supported by smart utility rates that incentivize customer load management, electrolyzers can still meet production volume and price targets while providing grid services and increasing renewable energy capture.

More specifically, this report examines how electrolytic hydrogen projects perform when electricity pricing, grid conditions, and operational flexibility are treated as core design inputs rather than afterthoughts. As electric grids integrate more variable renewable generation and experience rising peak demand, large energy users face increasing exposure to volatile electricity prices and capacity constraints. Electrolyzers, particularly modern PEM systems, are uniquely capable of responding to these conditions by adjusting power consumption in real time. This flexibility creates both economic and grid-level value, but only when rate structures allow it to be used.

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[1]A new analysis of resource adequacy in the Pacific Northwest has projected a resource shortfall beginning in 2026 which could grow to the size of Oregon's entire energy load (9 GW) by 2030 -

https://www.utc.wa.gov/sites/default/files/2025 10/Revised%20V3%20E3%20Presentation%20RA%20Study%20September%2022%20WA%20RA%20Me eting.pdf

[2]https://www.opb.org/article/2025/10/24/oregon-greenhouse-gas-reduction-benchmark-environment data-centers-tighger-2/

This analysis evaluates a representative electrolytic hydrogen project operating under different capital, energy, and hydrogen pricing scenarios. The results demonstrate that rate design is a decisive factor in hydrogen project viability, regardless of other price considerations. Under favorable rate structures, flexible electrolyzers reduce energy and demand charges, improve net revenue, and support grid reliability by absorbing excess power and reducing load during peak conditions. Under inflexible tariffs, otherwise viable projects are unable to hit cost and IRR targets. Flexible operation under market-responsive or wholesale-style rates consistently outperforms constant operation under standard tariffs, even when total hydrogen production is lower.

This analysis is the latest evidence that electrolyzers are a grid-aligned resource whose value depends on how markets and policies are structured. With energy and environmental policymaking increasingly falling to states, it is essential that Oregon and Washington establish the policy foundations for electrolytic hydrogen and other clean fuels to proliferate, helping hydrogen customers and electric ratepayers alike.

The industry, policymaker, and research actions identified in this report outline near-term policies that can help the PNW and other regions to advance affordable and local fuel production. Targeted policy tools can improve the integration of electrolytic hydrogen into grid operations and system planning while improving the attractiveness of the PNW market for potential hydrogen investment.

Priority actions include:

- Adopting smart utility rates that are accessible for electrolyzer projects
- Including flexible electrolyzers in electric system planning and modeling
- Exploring opportunities for behind-the-meter electrolyzer deployment co-located with renewable electricity generation

As the global renewable hydrogen economy continues to grow, it is essential that the PNW and other US markets keep pace with policies to encourage affordable renewable hydrogen production. Updating utility rates, interconnection policies, and grid planning methodologies to incorporate the grid benefits of electrolytic hydrogen are no-regrets actions.

Together, these policy actions enable an essential next step for the hydrogen industry: moving from proof of concept to practical deployment that aligns electrolyzer flexibility with grid needs, market rules, and planning requirements. Establishing a common policy playbook allows utilities, developers, and regulators to work in concert on deploying electrolyzers to deliver grid value, enable continued renewable deployment, and enable cost-effective renewable hydrogen at scale.

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Electrolyzer Optimization and Project Economics

Prepared by Customized Energy Solutions and Renewable Hydrogen Alliance
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1. Background and Motivation

Hydrogen production in the U.S. is expected to grow rapidly over the next decade, with electrolysis being one of the main methods of production. While many commercial electrolyzer plants are paid based on volume of fuel delivered, strategic ramping of electrolyzer operations can significantly reduce electric power expenses to improve overall asset economics. In partnership with the Renewable Hydrogen Alliance (RHA), Customized Energy Solutions (CES) conducted a comprehensive modeling study to determine how flexible operations—responding to hourly electricity pricing and peak demand charges—could improve project economics.

The findings demonstrate that not only can assets incorporate flexible operations, but intelligent dispatch against grid pricing can also be a critical lever in unlocking project profitability.

The study centered on three key financial drivers that can amplify the benefits of flexible operations:

- **Electricity rate design**
- **Hydrogen market pricing**
- **Electrolyzer capital costs**

In each scenario and across all sensitivities, flexible operations resulted in superior economics over constant production. With an estimated system utilization between 79 percent and 95 percent, flexible operations succeeded in reducing costs, optimizing net revenue, and still meeting hydrogen production targets. Analysis further estimated the impact of each of three variables on project financial metrics and how the hydrogen industry could incentivize future growth.

This report summarizes electrolyzer performance under multiple scenarios and highlights how incentivizing flexible operations for large loads can not only benefit the project owner but also provide value to the local electric grid. Finally, this report suggests key policy actions that can be taken to support the growth of the hydrogen industry equitably for all parties.

2. CES Modeling Approach

CES utilized its proprietary **CoMETS (Comprehensive Market Evaluation Tools)** platform to simulate flexible operations for a 10 MW grid-connected electrolyzer system co-located with 10 MW solar photovoltaics (PV). The model optimized hourly dispatch to produce hydrogen using either onsite solar generation or grid electricity. If the cost of electricity plus other operation expenses exceeded the value of the hydrogen, the electrolyzer would ramp down to avoid operating at a loss.

CES interviewed multiple electrolyzer manufacturers and hydrogen developers to inform the modeling inputs. Specifications for proton exchange membrane (PEM) electrolyzers were used due to this technology's capabilities to quickly ramp up and down and operate at partial load, with minimal effect on the system's health – the exact features needed to effectively respond to variable electricity prices. These conversations provided the basis for assumptions about operational characteristics such as efficiency curves, ramp rates, and capital costs for state-of-the-art 10 MW PEM electrolyzer systems. For safety and performance purposes the minimum operational load was set to 10 percent of maximum capacity, per recommendations from Center for Hydrogen Safety panel experts.[3]

The project scenario also assumed eligibility for the 45V Clean Hydrogen Production Tax Credit, which provides $3/kg of hydrogen produced directly from renewable electricity — in this case, the co-located solar PV. To qualify, facilities must begin construction before 2028 and maintain hourly matching and emissions requirements. Additionally, to qualify as a clean hydrogen production facility, annual emissions must be less than 4 kg of CO_2e per 1 kg of hydrogen produced, even after 2030 when hourly accounting begins. In this analysis, the electrolyzer has an efficiency of 17.2 kg H_2/MWh, meaning the average carbon intensity of electricity used to produce hydrogen must be less than 69.0 kg CO_2e/MWh. In the West, several utilities have an average carbon intensity below this limit, but not all.

Table 1. Average Carbon Intensity for select western utilities.

Utility	Average Carbon Intensity (kg CO2e/MWh)
Pacific Gas & Electric Company (PG&E)[4]	7.3
Tacoma Power[5]	34.2
Seattle City Light[5]	45.3
PacifCorp[6]	540
Portland General Electric (PGE)[6]	320
Puget Sound Energy (PSE)[5]	367.5

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[3]https://www.aiche.org/chs

[4]https://www.pge.com/assets/pge/docs/account/billing-and-assistance/bill-inserts/1225-power-content-label.pdf

[5]https://apps.ecology.wa.gov/publications/documents/2514008.pdf

[6]https://www.cleanenergytransition.org/post/demystifying-electricity-resources-and-emissions-in-oregon-and washington#:~:text=Oregon%20Electric%20Utilities%20Emissions&text=Electricity%20consumption%20accounted%20for%20~28,%2C%20wind%2C%20and%20BPA%20resources

Since the electroyzer is also paired with solar PV, reducing the total grid power consumed and resulting carbon emissions, the allowable carbon intensity of the utility can actually be much higher than 69.0 kg CO2e/MWh.

In this analysis, the electrolyzer is assumed to be located in a utility territory with sufficiently low carbon intensity to remain eligible for 45V credits. In determining the quantity of credits, the analysis only assigned tax credits for hydrogen produced directly from solar PV. While in practice project developers can purchase Energy Attribute Credits (EACs) to offset carbon emissions from grid power to increase the number of 45V credits they receive, this analysis considered a more conservative approach to not overstate the potential value of the tax credits. The model evaluated both technical constraints (electrolyzer ramp rates, efficiency, hourly solar production) and financial considerations (capital cost, operational costs, grid electricity costs, tax credits, and water costs). Two electricity rate plans were modeled:

- A **Standard Time-of-Use (ToU) rate plan** based on PG&E's Industrial/Gen. Service B-20.[7]
- A **Wholesale Pass-Through rate plan** with wholesale hourly energy prices and identical demand charges to the ToU rate. The energy price used was CAISO NP-15 to simulate wholesale energy prices in the PG&E territory. While PG&E does not currently offer a wholesale pass-through rate plan, several Pacific Northwest utilities offer market-based pricing, including Portland General Electric.[8]

[7]https://www.pge.com/tariffs/en/rate-information/electric-rates.html#accordion-a84c67dc1e-item-c2ddbc7fac

[8]https://portlandgeneral.com/about/info/pricing-plans/market-based-pricing

Table 2. Modeled Rate Plan Descriptions

Rate Plan	Standard Time-of-Use Rate Plan	Wholesale Pass-Through Rate Plan
Energy Charge	**Summer (Jun-Sep):** Peak: 17.965 ¢ / kWh Mid-Peak: 14.648 ¢ / kWh Off-Peak: 10.945 ¢ / kWh **Winter (Oct-May):** Peak: 17.075 ¢ / kWh Off-Peak: 10.380 ¢ / kWh Super Off-Peak: 3.902 ¢ / kWh	CAISO NP-15 hourly day-ahead LMP prices
Demand Charges	**Summer (Jun-Sep):** Peak: $ 30.09 / kW Mid-Peak: $ 7.17 / kW Off-Peak: n/a **Winter (Oct-May):** Peak: $ 4.02 / kW Off-Peak & Super Off-Peak: n/a	
Peak Period Definitions	**Summer (Jun-Sep):** Peak: 4pm-9pm Mon-Sun Mid-Peak: 2pm-4pm, 9pm-11pm Mon-Sun Off-Peak: All other hours **Winter (Oct-May):** Peak: 4pm-9pm Mon-Sun Off-Peak: All other hours Super Off-Peak: 9am-2pm Mon-Sun *Note: Peak Period definitions only apply for demand charges for Wholesale Pass-through rate plan.*	

CES uses the industry-leading fundamental production cost modeling software PLEXOS[9] for forecasting hourly power prices across various wholesale power markets. CES leverages a base reference case from PLEXOS and builds upon it by using inputs and assumptions from fundamental research on the current and expected states of the Western Interconnection power grid. The CES model of long-term CAISO NP-15 power prices was used for the analysis.

[9] https://www.energyexemplar.com/plexos

[10] https://escholarship.org/content/qt83p5k54m/qt83p5k54m_noSplash_8bb1326c13cfb9aa3d0d376ec26d3e06.pdf?t=s9oa2u

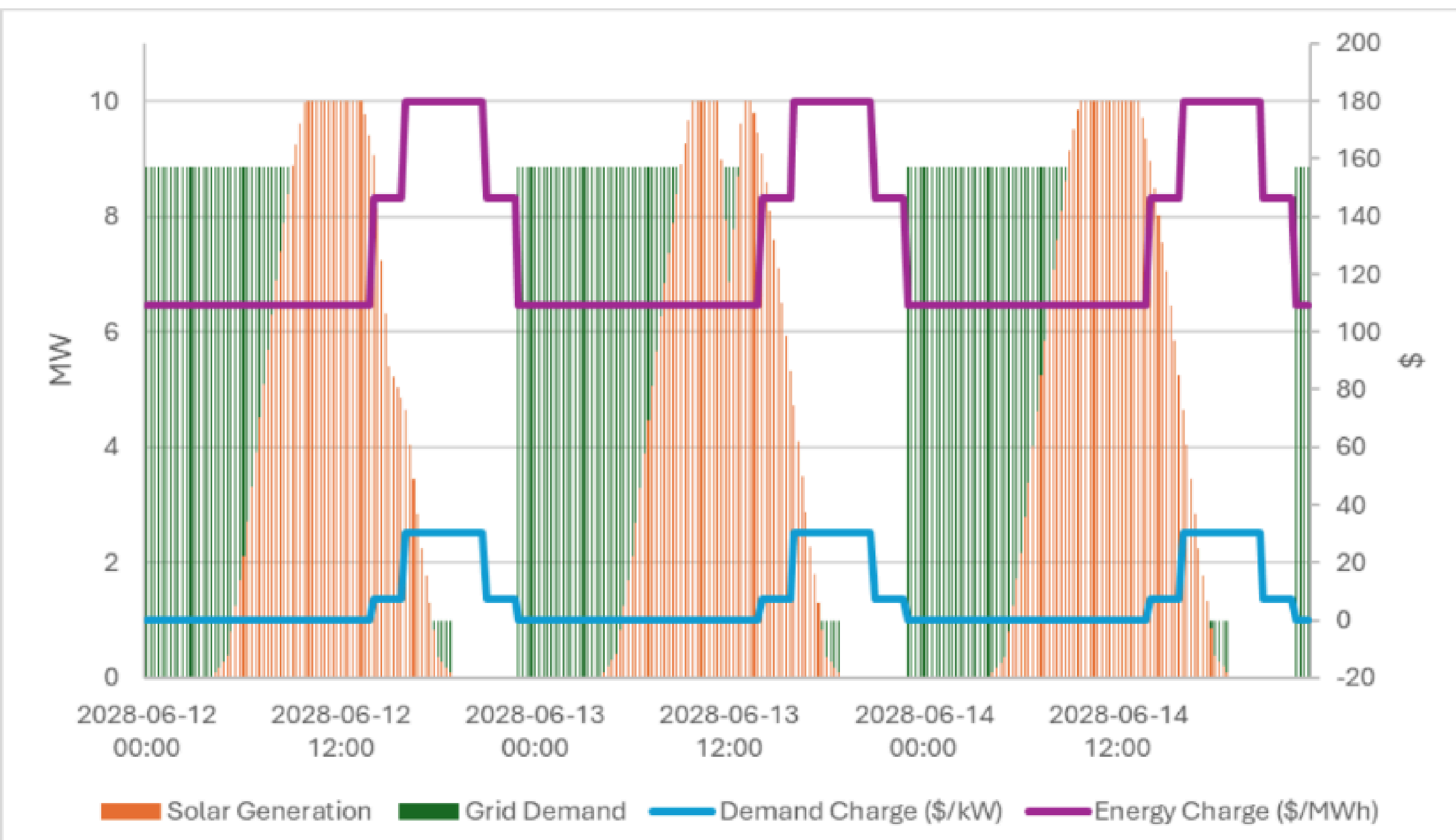
Each rate plan scenario was tested across three hydrogen price levels: **$5/kg, $7.50/kg,** and **$10/kg.** Under these scenarios, it is assumed that the electrolyzer developer secures a long-term, fixed-price contract for the offtake of hydrogen, without consideration of end use.

For capital costs, CES worked with multiple electrolyzer OEMs, developers, and other industry experts to create a range of scenarios for the cost of the electrolyzer and balance of plant. The base scenario was designated at **$1,900/kW,** with high and low scenarios at **$2,400/kW** and **$1,400/kW,** respectively, plus a replacement cost during the 15-year investment period equal to 40 percent of the capital cost. An additional $600,000 was assumed for a short-term 1,000 kg storage tank.[10] The solar PV system was assumed to have a capital cost of $1,400/kW.

3. How do Flexible Operations Improve Cost-Effectiveness?

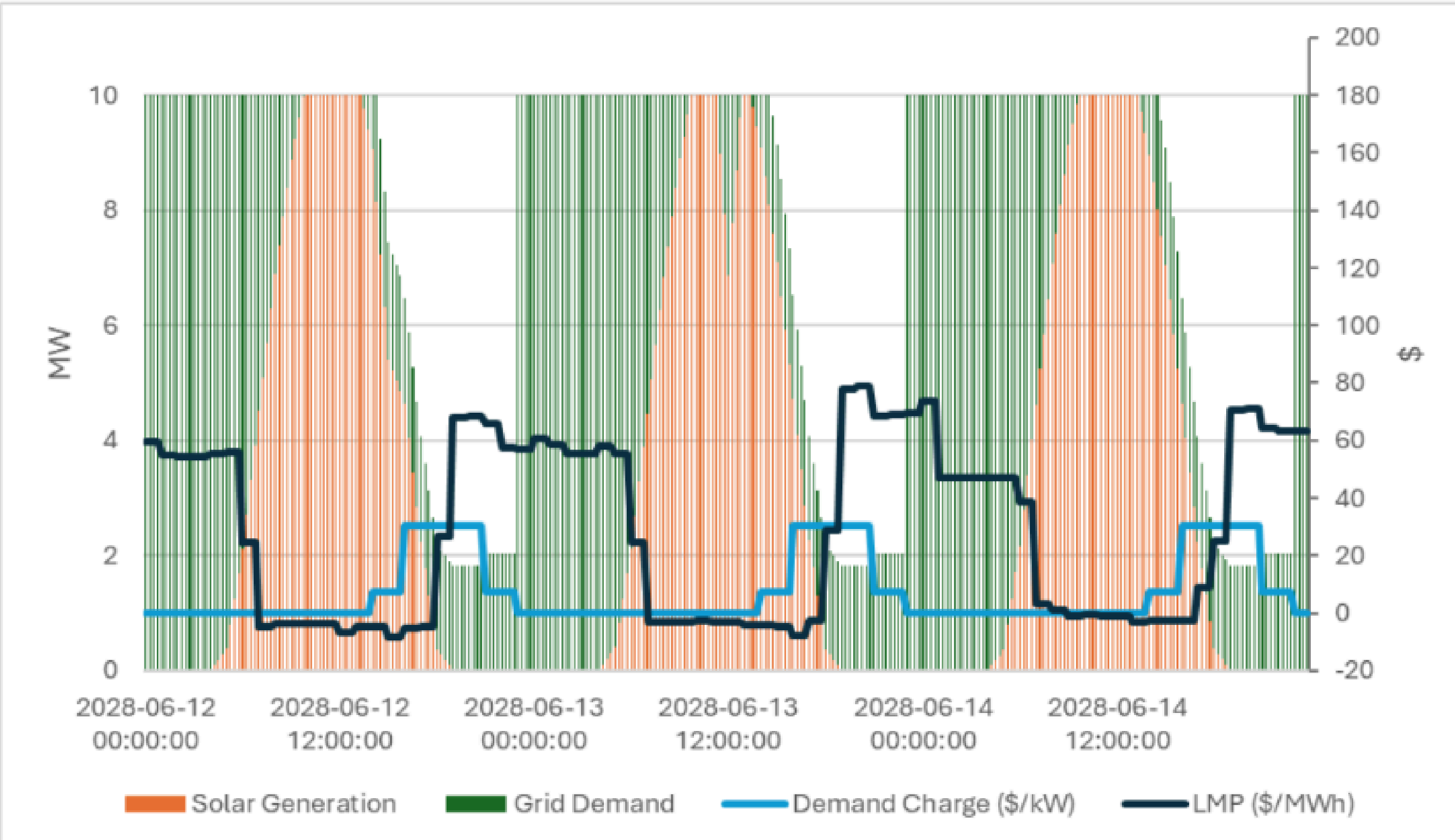
CoMETS optimizes production considering the cost of electricity against the potential revenue from hydrogen. In Figure 1, electrolyzer electricity consumption under the ToU rate plan for three June days is shown. During off-peak hours, the electrolyzer draws maximum power from the grid, but once the higher energy prices of mid-peak and peak periods begin, along with the demand charges, the electrolyzer relies almost entirely on the solar generation to produce hydrogen. As the available solar energy declines, some grid power is used to maintain the minimum 10 percent production requirement.

Figure 1. ToU Rate Plan: Electrolyzer hourly electricity consumption vs. energy and demand prices



Optimal operations under the Wholesale Pass-Through rate plan also show how grid electricity consumption reduces dramatically during high price hours. However, because this rate plan ties energy rates to wholesale locational marginal prices (LMP) prices, the flexibility of PEM electrolyzers becomes even more valuable and higher production is achieved throughout the day.

Figure 2. Wholesale Pass-Through Rate Plan: Electrolyzer hourly electricity consumption vs. energy and demand prices

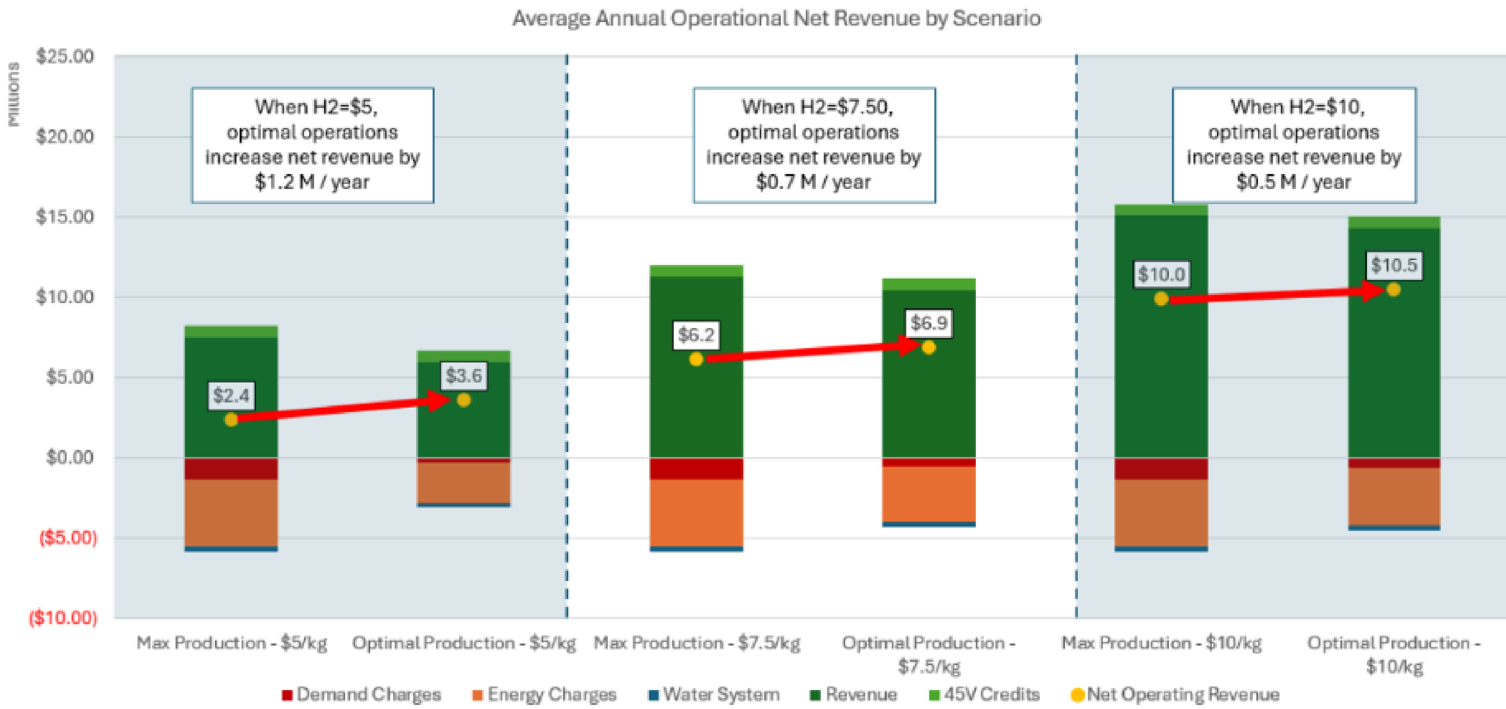


Under both rate plans, CES found that optimal operations (flexible ramping) provided higher net revenues than maximum production (flat 24/7 operation) in every hydrogen price scenario. However, two key differences arose when comparing operations between the rate plans. First, the significantly higher energy prices of the ToU plan result in grid energy never exceeding 8.5 MW despite the maximum electrolyzer capacity of 10 MW, even during off-peak hours. Second, under the Wholesale Pass-Through rate plan, the electrolyzer maintains some grid production during peak and mid-peak hours, while production stops entirely during certain hours under the ToU plan due to unfavorable economics.

Looking specifically at optimal operations under the Wholesale Pass-Through rate plan, operational net revenue increased[11] by between $0.5 million and 1.2 million per year, as shown in Figure 3:

[11]Operational net revenue is defined as Hydrogen revenue plus 45V tax credits, less energy changes, demand charges, and water costs.

Figure 3. Operational Net Revenue comparison between Maximum and Optimal Production for three price scenarios



In the three hydrogen price scenarios under the Wholesale Pass-Through rate plan, the electrolyzer capacity factor of the plants was reduced to between 79-95 percent, leading to a slight reduction in hydrogen revenue. However, this was far outweighed by the avoided energy and demand charges during expensive hours. Under the ToU rate plan, while capacity factor remained high for the $7.50/kg and $10/kg scenarios, it dropped dramatically to 27 percent at $5/kg, highlighting the impact of commodity price on profitable production hours.

Table 3. Electrolyzer Capacity Factor under rate plan and commodity price scenarios.

Commodity Price	Electroyzer Capacity Factor	
	Standard Time-of-Use	Wholesale Pass-Through Rate Plan
$5 / kg H2	27%	79%
$7.50 / kg H2	81%	93%
$10 / kg H2	85%	95%

4. How do the Three Key Levers Impact Profitability?

While optimal flexible operations have a clear benefit for operational net revenue, investment decisions and project profitability must consider capital costs and other financial factors.

Electricity Rate Plans Make or Break the Business Case

The ability to respond to hourly energy prices dramatically influences profitability. Under the Standard ToU rate, the electrolyzer follows a consistent pattern of ramping down during peak hours, but the flat rate during that peak means there is no opportunity to ramp up and increase production. Further, while using a Wholesale energy price exposes the electrolyzer to market risk, on average wholesale prices are significantly lower than retail energy rates. And because PEM electrolyzers can rapidly shift production when energy prices rise, the risk can be minimized through optimal operations.

Table 4. Financial metrics for Standard ToU rate to Wholesale Pass-Through Rate under various hydrogen price scenarios. Financial metrics do not consider debt

Rate Plan	Price Scenario	IRR (Unlevered)	NPV (Unlevered)	Annual H2 Production	Capacity Factor
Standard ToU Rate	If H_2 is $5…	-6.6%	-$20.9 M	401 ton/yr	27%
	If H_2 is $7.50…	3.5%	-$6.2 M	1,229 ton/yr	81%
	If H_2 is $10…	12.7%	$15.8 M	1,286 ton/yr	85%
Wholesale Pass-Through Rate	If H_2 is $5…	-1.8%	-$14.7 M	1,194 ton/yr	79%
	If H_2 is $7.50…	10.3%	$8.7 M	1,398 ton/yr	93%
	If H_2 is $10…	19.2%	$33.6 M	1,432 ton/yr	95%

At each hydrogen price scenario, the Wholesale Pass-Through rate plan results in more hydrogen production than the ToU rate plan, leading to a significant uplift in IRR and NPV. While electrolyzers can be profitable under both rate plans, the Wholesale Pass-Through plan provides more opportunity for successful investment.

Hydrogen Price is the Ultimate Driver for Profitability

Despite the gains from flexible operations, a key insight emerged: if hydrogen prices fall too low, even optimal operations may not generate positive returns on the modeled rate plans. As shown in Table 3, the "go-ahead" investment point is around $10/kg under this particular ToU plan, assuming current capital costs. This improves under the Wholesale Pass-Through Plan, with a hydrogen price around $7.50/kg - $8/kg leading to a successful investment. Under both of those hydrogen price points under the respective rate plans, the electrolyzer investment will not pencil with the modeled rates and capital costs. However, if a project developer can access similarly structured rate plans in lower electricity cost states (e.g., Washington and Oregon with abundant low-cost hydro power), the project may be able to reach profitability at lower hydrogen prices.

Capital Costs Matter — But Less Than Operational Costs and Revenue

Capital cost reductions can be a valuable lever for improving project returns; however, in this analysis it rarely changed a "go/no-go" decision. Looking at the ToU rate plan at both $5/kg and $7.50/kg for hydrogen, all capital cost scenarios resulted in an unprofitable investment. At the same time, at $10/kg, the base and low capital cost scenarios were both strong investments, while the high capital cost scenario still presented a moderate investment.

Table 5. Impact of Capital Cost on IRR and NPV under ToU and Wholesale Pass-Through rate plan for differant hydrogen price scenarios.

		Standard ToU Rate		Wholesale Pass-Through Rate	
Scenario	Total Capital Cost	IRR	NPV	IRR	NPV
If H_2 is $5...	-Low - $14.6 M	-3.1%	-$14.1 M	1.5%	-$8.1 M
	Base - $19.6 M	-6.6%	-$20.9 M	-1.8%	-$14.7 M
	High - $24.6 M	-9.8%	-$27.6 M	-4.8%	-$21.4 M
If H_2 is $7.50...	Low - $14.6 M	6.3%	-$0.2 M	13.5%	$14.4 M
	Base - $19.6 M	3.5%	-$6.2 M	10.3%	$8.7 M
	High - $24.6 M	1.1%	-$12.3 M	7.6%	$2.9 M
If H_2 is $10...	Low - $14.6 M	15.9%	$21.5 M	22.9%	$39.3 M
	Base - $19.6 M	12.7%	$15.8 M	19.2%	$33.6 M
	High - $24.6 M	10.1%	$10.0 M	16.1%	$27.8 M

Capital cost has a larger impact on margins with the Wholesale Pass-Through rate. While low capital costs still can't overcome the $5/kg scenario, a low capex can turn the $7.50/kg scenario from a moderate investment into a strong one, while a high capex can have the opposite effect. And if hydrogen is priced at $10/kg, then all projects are profitable regardless of capex.

This underscores that low electricity prices and supportive rate structures are often more impactful than capital cost reductions alone. Given the urgency that many developers face to begin construction before 45V credits expire, these findings are encouraging that projects can be successful even at today's capital costs.

[12] https://nicholasinstitute.duke.edu/sites/default/files/publications/rethinking-load-growth.pdf

5. Benefits for Utilities

While there are clear financial benefits for electrolyzers to adjust operations based on electricity price, the case for electric utilities is equally apparent. As large electricity consumers, electrolyzers can significantly increase electric grid utilization, with many projects needing dedicated substations and other rate base projects. Further, the flexibility of electrolyzers can allow utilities to increase system utilization during non-peak hours, while avoiding peak hour demand increases – a feature that large loads like data centers typically cannot provide.

The ramping flexibility of PEM electroyzers provides significant value to the utility for system stability, assuming the correct rate plans are in place to incentivize responses to price signals. As many utilities are facing affordability pressures, use of interruptible load tariffs and other tools can bring electrolyzers into a utility's portfolio of low-cost dispatchable assets that improve grid responsiveness during peak demand hours. By offering rate plans designed to disincentivize consumption during peak hours, utilities can avoid massive generation and transmission investments that would otherwise be necessary, while continuing to improve system utilization. Creating pathways for electrolyzer operators to offer and monetize grid services can help to attract new loads while improving overall system flexibility.

This approach has been well corroborated, including recent analysis from the Nicholas Institute for Energy, Environment and Sustainability at Duke University, which found that if new load can be curtailed in 1 percent of hours, an additional 126 GW of peak load could be supported by existing infrastructure across the United States.[12] In the Pacific Northwest, the Bonneville Power Authority (BPA) could afford an additional 2.3 GW of peak load while PGE could add 1.1 GW on their current system if curtailed just under 90 hours per year. Given the higher curtailment rates between 80-100 percent during peak hours shown by optimal operations of electrolyzers in this study, those utilities could likely support even more load growth in the hydrogen sector.

6. Model Findings

The CES modeling analysis confirms what many in the clean hydrogen space have long suspected: **flexible electrolyzer operation is not only technically feasible but economically necessary.** As hydrogen developers and policymakers consider the future of this industry, several insights stand out:

- **Flexible operations > Maximum production**, especially when hydrogen prices are low, will lead to significant improvements in operational net revenue by reducing energy and demand charges.

- **Rate design enhancements are critical for incentivizing hydrogen development.** Policy makers, regulators, and utilities must offer electricity pricing structures that reward flexible demand, such as Time-of-Use and Wholesale Pass-Through rates for large industrial customers.

- **Capital cost declines will help, but the effect may be limited** without the right electricity and hydrogen pricing environment.

- **The early sunset of 45V credits means the industry must move quickly.** The economics of electrolyzer development are much clearer when tax credits are available. Even if 45V credits are available, the additionality exemption will make a significant difference. In California and Washington, cheaper power can be secured with existing renewables. In states like Oregon, new renewables must be built to secure 45V credits. Rising PPA prices and renewable capital costs will be passed on to the electrolyzer, making the economics more difficult.

Conclusions and Recommendations

Modeling findings from Customized Energy Solutions have shown that flexible electrolyzer operations have the potential to deliver value to both the grid and asset owners, but this will only be possible if project developers are able to deploy this technology as a grid resource. Based on these findings, RHA recommends that industry, policymakers, and electric planners consider the following actions to maximize the potential value of flexible electrolyzers such as PEM electrolyzers as a grid resource.

Industry Recommendations

1. **Utilities should establish rates to incentivize industrial customers to reduce demand when the grid is constrained.** Smart rate structures such as Time-of-Use and Wholesale Pass-Through are two approaches that effectively represent the value of curtailed power and incentitvize customer action through dynamic demand and energy charges.

2. **Smart rate structures must allow hybrid assets of electrolyzer load co-located with renewable generation.** Utilities must ensure that hybridized electrolyzer and renewable projects are eligible for smart tariffs and create streamlined pathways for participation. Co-location allows electrolyzers to be even more responsive to grid constraints because they can switch production to behind-the-meter generation when grid costs are high. Restricting co-located generation will either strain the grid with inflexible load or push industrial customers away altogether.

3. **Implementation of rate plans during 2026 is essential to support project financing decisions ahead of the 2027 "under-construction" cutoff for 45V.** Without tax credits, the margins will become even tighter for project developers, limiting growth for the hydrogen industry. Electric utilities, unable to leverage electrolyzer grid services, will face higher costs, which will be passed on to customers, impacting regional fuel costs and affordability.

Policy Recommendations

1. **Utility regulators should establish and maintain a database of smart tariff offerings.** Centralizing information from utilities across the state can help to facilitate developer evaluation of project sites in Oregon and Washington

2. **Regional electric planning entities should incorporate electrolytic hydrogen production as a flexible load in electric planning exercises.** The Northwest Power and Conservation Council's upcoming 9th Northwest Regional Power Plan, which has already developed a dedicated hydrogen load forecast; an approach that should be adopted by other planning organizations.[13] These planning exercises should also be used to understand the extent that flexible load resources can help to offset peak capacity needs and new peaking turbines.

[13] https://nwcouncil.app.box.com/s/ap0w9rfz6iajqfl47mhbbwia2k99zfiq

3. **Policymakers should encourage co-location of electrolyzers with electric generation facilities.** Co-location improves grid resilience and minimizes strain on the transmission system. State policy action on permitting, zoning, and other land use considerations can help to streamline project development and improve the attractiveness of Oregon and Washington for new projects.

Areas of Additional Research

The analysis in this report demonstrates that electrolyzers can be paired with variable renewable resources to deliver both grid value and cost-effective renewable hydrogen. Additional research and analysis can help to demonstrate the value of flexible electrolyzers in new and more complex applications:

1. **Where can renewable projects with limited transmission access leverage electrolyzers to improve project economics and grid value?** What utility tariffs or programs would be required to monetize this value?

2. **Where can electrolyzers provide balancing services on generation assets with constrained operations?** All turbine based clean resources (hydropower, geothermal, nuclear) have minimum operating constraints that can limit their ability to provide grid balancing services. How can electrolyzers enable these assets to provide grid services while improving impacting asset efficiency and maintenance costs?

3. **Where can electrolyzers provide solutions to electric system peak capacity needs and transmission constraints?** What performance guarantees or dispatchability requirements are needed for flexible electrolyzers dispatch to meet planning entity qualifying capacity requirements? Given the short deployment timelines for electrolyzers (12-18 months), where can electrolytic load facilitate continued deployment of renewable resources despite transmission constraints?

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