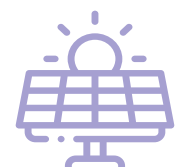
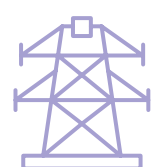
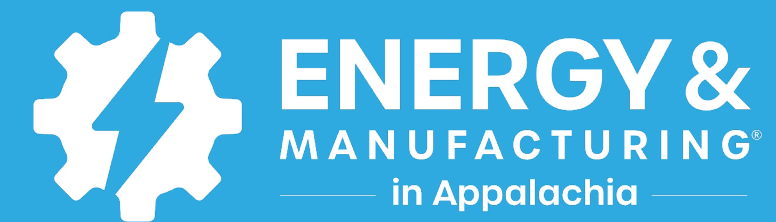




BLUE HYDROGEN



**INDUSTRY
OVERVIEW
SEGMENTS**



INDUSTRY OVERVIEW SEGMENT – BLUE HYDROGEN

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Executive Summary

For small and medium-sized manufacturers (SMMs) in Appalachia, the "Hydrogen Economy" is no longer a futuristic concept—it is an immediate purchase order opportunity. As of late 2025, the demand for blue hydrogen production is accelerating, driven by the region's geological advantages and industrial legacy.

However, the landscape is shifting. While federal seed money kick-started this conversation, recent political changes have placed about **\$1.7 billion** in federal funding for regional hydrogen projects at risk. This volatility creates a divergence in the market: projects reliant solely on government funding face headwinds, while blue hydrogen projects backed by private capital and natural gas assets remain robust.

The opportunity for SMMs is not in the chemical science, but in the hardware: the tanks, pipes, compressors and pressure vessels required to build these massive facilities. This report maps the **supply chain for Steam-Methane Reforming (SMR) with Carbon Capture**, providing the data and NAICS codes you need to identify your place in the chain and how to vet potential customers in a volatile funding environment.





Industry Overview

WHAT IS BLUE HYDROGEN?

To a manufacturer, a blue hydrogen facility is essentially a chemical refinery that requires familiar heavy industrial equipment.

The process (Steam-Methane Reforming):

- 1. Steam-Methane Reforming (SMR):** High-pressure natural gas is mixed with steam and heated in a furnace (reformer) to ~1500°F. This breaks the methane (CH₄) apart, creating hydrogen (H₂) and carbon monoxide (CO).
- 2. Shift reaction:** The gas moves to a second vessel where more steam is added to convert the carbon monoxide into carbon dioxide (CO₂) and more hydrogen.
- 3. The blue factor (carbon capture):** In a traditional plant, the CO₂ is vented into the air. In a blue plant, a capture unit—typically an amine scrubber or cryogenic unit—isolates the CO₂ for storage.
- 4. Result:** You produce clean hydrogen gas for fuel/industry, and the CO₂ is compressed and injected deep underground or used in other industrial processes.

Why Appalachia? We sit atop the Marcellus and Utica shale plays, providing the cheapest natural gas feedstock in the industrialized world. Furthermore, our region has the geological formations necessary to store the captured CO₂ safely. We are the only region that can produce low-carbon hydrogen at scale today without waiting for massive new renewable power grids to be built.

MARKET SIZE & GROWTH FORECASTS (2025–2035)

The market for blue hydrogen equipment in Appalachia is entering a hyper-growth phase driven by the compressed timeline of federal incentives.

- **Regional investment:** The ARCH2 Hub alone represents a **\$925 million** federal investment, unlocking an estimated **\$6 billion** in private capital from partners like EQT, Air Liquide and Enbridge.
- **Market growth:** The North American blue hydrogen market is projected to grow from **\$2.5 billion in 2025** to potentially over **\$86 billion by 2035**.
- **Production capacity:** Appalachia is targeted to produce over **1,500 metric tons of hydrogen per day** by 2030.

Key takeaway: The majority of this capital expenditure will be spent in the next three to five years to meet federal deadlines.

MARKET DRIVERS

Policy: The One Big Beautiful Bill Act & the IRA The legislative landscape shifted dramatically in mid-2025. The OBBBA shortened the window for the Section 45V (clean hydrogen production) tax credit, moving the expiration to **December 2027**.

- **Impact:** This favors **blue hydrogen** over green. Blue projects can be deployed more quickly because they use existing gas infrastructure. Green projects, which require building new wind/solar farms, may miss the 2027 deadline.
- **Section 45Q:** The tax credit for sequestering carbon (carbon capture) remains robust (\$85/ton), making the economics of adding capture units to SMR plants highly profitable.

Possible regional hubs: These hubs are not a single plant but a network of connected infrastructure across PA, WV and OH. It creates a guaranteed ecosystem of buyers and sellers.

End users: Who is buying this hydrogen?

- **Steel: Cleveland-Cliffs** (Middletown Works, OH) and **U.S. Steel** (Mon Valley, PA) are transitioning to hydrogen-based Direct Reduced Iron (DRI) to decarbonize steelmaking.
- **Heavy transport:** Fuel cell heavy-duty trucks (e.g., via **Plug Power**) moving freight along I-70 and I-79.
- **Data centers:** New interest from tech giants to use hydrogen fuel cells for backup power at regional data centers.



Industry Overview

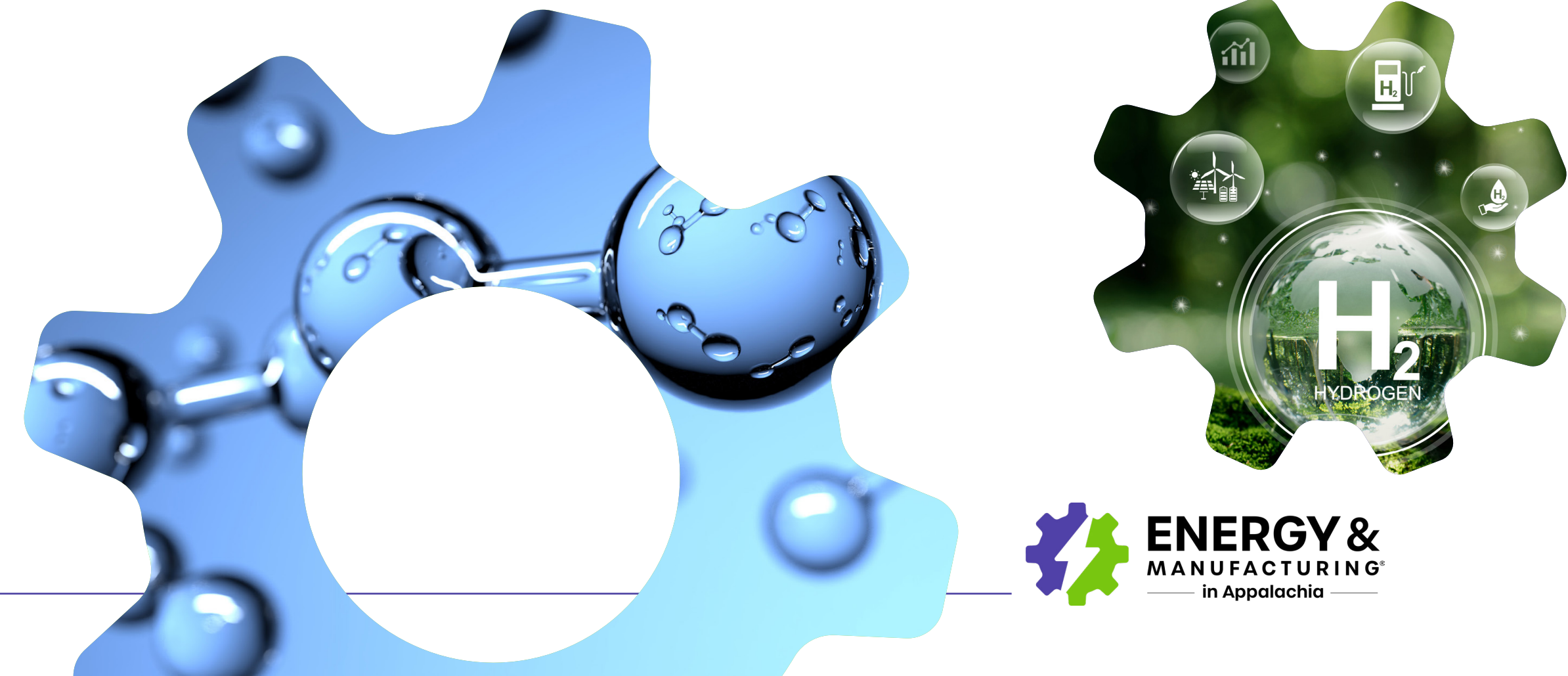
CHALLENGES & CONCERNS

While the outlook is bright, manufacturers must be aware of friction points:

- **Federal funding volatility:** In October 2025, news broke that over **\$1.7 billion** in federal funding earmarked for Pennsylvania’s hydrogen hubs—specifically ARCH2 and MACH2—is at **risk of being rescinded or delayed by federal review**. Manufacturers must understand the nuance here to avoid bad debt:
 - **ARCH2 (Appalachian Hub - blue hydrogen):** While under review, this hub is considered lower risk. It relies on natural gas (SMR), aligning with the current administration’s “energy dominance” goals and enjoying strong bipartisan support from PA and WV legislators.
 - **MACH2 (Mid-Atlantic Hub - green/pink hydrogen):** Considered higher risk. This hub focuses on renewable and nuclear electrolysis. Without the fossil fuel component, it faces steeper political skepticism regarding its federal subsidies.
 - **Strategic advice:** Prioritize contracts with prime contractors who have **private balance sheets**, such as major energy companies, rather than startups whose existence depends entirely on a Department of Energy grant.
- **Regulatory limbo (Section 45V):** The tax credits for hydrogen production are being rewritten. Until the Treasury Department finalizes the rules on carbon intensity, many private investors are pausing final investment decisions. This may delay the start of fabrication contracts by six to twelve months.
- **Infrastructure bottlenecks:** We can produce the hydrogen, but moving it requires new pipelines. Permitting delays for pipelines remain the **single biggest risk** to project timelines.
- **The “methane leak” penalty:** To qualify for the highest tax credits, producers must prove their natural gas feedstock has near-zero methane leaks. This creates a sub-market for **high-integrity valves and leak-detection sensors**.
- **Cost of carbon capture:** Adding a carbon capture unit (CCUS) **increases the cost of an SMR plant by 30%-50%**. Manufacturers who can find ways to lower the cost of pressure vessels or absorption towers will have a competitive edge.

HIGH-LEVEL OVERVIEW OF THE SYSTEM

- 1. Feedstock handling – the front end:** This stage uses heavy-gauge piping and desulfurization vessels to draw in natural gas and remove impurities like sulfur. It relies on standard pressure vessels, industrial compressors and filtration hardware to condition the gas for downstream processing.
- 2. Reforming & shift – the hot zone:** The facility’s core features a massive furnace, or reformer, containing high-alloy tubes and a train of reactor vessels. Here, gas is heated to over 1500°F to strip hydrogen from methane, requiring specialized alloy components capable of withstanding extreme thermal stress.
- 3. Separation – purification:** Purification utilizes pressure swing adsorption units—skids of tall vertical columns and complex valve manifolds—that act as molecular filters. This system separates pure hydrogen from the gas stream while trapping byproducts for recycling or capture.
- 4. Carbon capture & compression – the blue machinery:** This defining stage employs absorber towers to isolate carbon dioxide from the exhaust. Once captured, massive multi-stage compressors pressurize the CO₂ into a dense, supercritical fluid, preparing it for pipeline injection and permanent underground storage.



Supply Chain Component Map

This table connects each process step to specific equipment, materials, design parameters, and NAICS codes. Use it to identify manufacturing opportunities aligned with your capabilities.

PROCESS STEP	EQUIPMENT/COMPONENT	CRITICAL MATERIALS	KEY PARAMETERS	NAICS Codes
1. Feedstock Pretreatment	Desulfurization Reactor/Adsorber	Steel pressure vessel; ZnO catalyst (consumable)	20–40 bar; ASME BPVC Section VIII	332420, 325180
	Water Purification System	RO membranes; DI resin tanks; filters; pumps	High-purity demineralized water output	333318
2. Reforming	SMR Furnace	Box-type housing; refractory lining (Al ₂ O ₃); gas burners	800–1000°C; requires temperature uniformity	333994
	Reformer Catalyst Tubes	Superalloys: INCOLOY 800H/HT, Inconel 601/617, Hastelloy X; Ni catalyst	800–1000°C; 20–40 bar; 100,000+ hr life; centrifugal casting	331210, 325180
	Pre-Reformer (Optional)	Steel pressure vessel; Ni catalyst	400–600°C; converts heavier hydrocarbons	332410, 325180
	Steam System & Heat Recovery	Steam drum; waste heat boilers, heat exchangers	20–25 bar; 400–600°C; ASME compliant	332410
3. Shift Conversion	High-Temperature Shift Reactor	Packed-bed pressure vessel; Fe–Cr oxide catalyst	350–500°C; 20–40 bar; ASME BPVC VIII	332410, 325180
	Low-Temperature Shift Reactor	Packed-bed pressure vessel; Cu–Zn–Al catalyst	200–250°C; 20–40 bar; sulfur-sensitive	332410, 325180
4. Purification	PSA Skid	4+ adsorber vessels; high-cycle valve skid; process controls	Ambient temp; 10–40 bar adsorption; 99.9–99.9999% H₂	333249, 333998
	Adsorbent Materials (Consumable)	Activated carbon (AC); zeolite molecular sieves (5A, 13X)	20+ year design life; selective adsorption	325998, 325180
5. Compression & Storage	Hydrogen Compressor	Reciprocating compressor (preferred); H₂-compatible materials	34–100 bar discharge; embrittlement mitigation	333912
	Stationary Storage Vessels	Type I: All-metal (steel/aluminum); Type II: Metal + composite wrap	200–500 bar; ASME BPVC VIII Div 3 (KD-10)	332420
Cross-Cutting	Piping, Valves, Fittings	Hot sections: high-temp alloys; H ₂ sections: 316L SS, Cr–Mo steel	ASME B31.12 for H ₂ piping; embrittlement prevention	332919, 332999



Supply Chain Component Map

COMPLETE NAICS CODE LIST

- **331110** – Iron and Steel Mills
- **331210** – Iron and Steel Pipe and Tube Manufacturing from Purchased Steel
- **325180** – Other Basic Inorganic Chemical Manufacturing
- **325998** – All Other Miscellaneous Chemical Product Manufacturing
- **332410** – Power Boiler and Heat Exchanger Manufacturing
- **332420** – Metal Tank (Heavy Gauge) Manufacturing
- **332919** – Other Metal Valve and Pipe Fitting Manufacturing
- **332999** – All Other Miscellaneous Fabricated Metal Product Manufacturing
- **333249** – Other Industrial Machinery Manufacturing
- **333318** – Other Commercial and Service Industry Machinery Manufacturing
- **333414** – Heating Equipment Manufacturing
- **333912** – Air and Gas Compressor Manufacturing
- **333994** – Industrial Process Furnace and Oven Manufacturing
- **333998** – All Other Miscellaneous General Purpose Machinery Manufacturing



<https://energyindustryreview.com/power/air-liquides-next-generation-smr-x-hydrogen-plant-start-up/>



Resources for Manufacturers

If you want to pivot your shop to serve this industry, start here:

- **Appalachian Regional Clean Hydrogen Hub (ARCH2):** The official program office. Monitor their procurement and community benefits pages for diverse supplier opportunities.
- **PA Manufacturing Extension Partnership (PA MEP):** Can help with ISO certifications and ASME stamps required for pressure vessel work.
- **WVU Industrial Extension (WV MEP):** Based in Morgantown, it is deeply integrated with the ARCH2 leadership and can advise on supplier readiness.
- **MAGNET (Ohio MEP):** Located in Cleveland, it offers specific programs for automotive suppliers pivoting to energy/hydrogen.
- **DOE Office of Clean Energy Demonstrations (OCED):** The federal office overseeing the funding. It has hosted vendor days for H2Hubs in the past.
- **Fuel Cell & Hydrogen Energy Association (FCHEA):** The leading national trade association; its Supply Chain Working Group helps component suppliers connect directly with major OEMs like Air Products and Plug Power.
- **Center for Hydrogen Safety (CHS):** A global nonprofit that provides safety training and certifications, giving manufacturers a competitive advantage when bidding on safety-critical contracts.

- **Carbon Capture Coalition:** A nonpartisan group focused on the policies and tax incentives (Section 45Q) that drive the carbon capture market, offering critical intelligence on project viability.
- **American Society of Mechanical Engineers (ASME):** The governing body for the Boiler and Pressure Vessel Code. It offers specific courses and standards for “Hydrogen Piping and Pipelines” essential for compliance.



<https://www.hydrogeninsight.com/production/exxonmobil-threatens-to-scrap-worlds-largest-blue-hydrogen-project-over-us-emissions-criteria-for-tax-credits/2-1-1603061>



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Energy & Manufacturing in Appalachia Program

BLUE HYDROGEN: OVERVIEW

The Blue Hydrogen Overview was drafted by Adam Pope. Adam is a Senior Director with Bravo Group. Bravo Group specializes in navigating the complexities of highly regulated energy and infrastructure projects. To date, we have managed energy projects with a combined \$15 billion in capital investment and facilitated over 2,600 miles of critical infrastructure development.

Adam brings more than two decades of experience in public relations, corporate and marketing communications, and advocacy within highly regulated industries, delivering strategic solutions for clients across sectors, including many Fortune 500 companies. He has extensive experience in the energy and infrastructure space and has become a respected and well-versed member of the industry in Pennsylvania and beyond. His expertise has allowed energy and infrastructure clients to develop complex projects in a highly regulated environment. He has developed and implemented large-scale integrated communications and public relations campaigns that routinely deliver the results clients need. With a background in the public and private sectors, Adam provides a comprehensive understanding of Pennsylvania’s political landscape. He offers a hybrid expertise in public relations tactics and government relations strategies. Before joining the firm, Adam served as the community liaison officer, managing government and public relations for EXCO Resources and BG Group, a joint venture natural gas and oil exploration and production company. Adam previously served as director of development for U.S. Sen. Arlen Specter. He secured more than \$1.2 billion in direct funding and managed appropriations for 15 counties. Adam graduated from the University of Pittsburgh with a Bachelor of Arts in political science.

