❌ MYTH: All zero-emission vehicle needs can be met by battery electric vehicles.

✅ FACT: A diversified energy portfolio is essential because different jobs (and preferences) need different tools.

While most zero-emission vehicles (ZEVs) on the road today are battery electric vehicles (BEVs), they account for only a small fraction of all vehicles. Gasoline and diesel still account for 87% of light-duty vehicles on the road, and even higher shares in the medium- and heavy-duty vehicle classes. Ignoring the potential for fuel cell electric vehicles (FCEVs) to further accelerate ZEV market development leaves key communities and business sectors without an option that meets their needs, ultimately undermining California's climate and air goals.

Fuel cells excel where batteries face limitations:

- Fast refueling and higher energy density ensure high levels of utilization, which is a critical need for:
    - Heavy-duty trucks in goods movement with heavy loads, with long daily operating distances and/or multiple shifts.
    - Medium-duty commercial trucks with high duty cycles, including the construction, utility, and agricultural sectors.
    - Emergency response, including infrastructure (e.g., fire trucks, transit buses, boom trucks, and/or garbage trucks) with high-duty cycles.
    - Super commuters, anything between a soccer mom and a salesperson

- The hydrogen refueling experience is designed to feel familiar. Drivers refuel quickly at centralized stations, much like gasoline and diesel, making it well-suited for commercial fleets and customers who prefer or require centralized fueling.
    - Hydrogen vehicles are designed for fast fueling: light-duty cars typically refuel in about five minutes, while heavy-duty trucks in roughly twenty minutes, keeping vehicles on the road and operations moving with minimal downtime.

- FCEVs rely less on precious metals and mineral resources.
    - Battery supply chains face critical-mineral pressures today, with a heavy dependence on imported lithium, cobalt, and nickel, a risk already recognized by the International Energy Agency. By offering an electric drive option that relies less on these materials, fuel cell electric vehicles can help reduce stress on battery supply chains right now.
    - Hydrogen fuel cell systems rely on platinum group metals, for which recycling capabilities are well established in the U.S. A diversified approach to zero-emission transport (spanning both BEVs and FCEVs) strengthens supply chain resilience and reduces overdependence on any single technology or trade partner.

- At deployment scales, hydrogen systems benefit from stronger economies of scale, with costs falling more quickly as deployment grows. For large fleets like transit, building charging infrastructure to support a full battery-electric bus fleet costs significantly more than building the same capacity of hydrogen refueling infrastructure for fuel cell buses.

Rather than focusing on these two technologies competing against one another, remember that both present complementary pathways to fully displace gas and diesel.

Bottom line? California's air quality and climate targets demand a multifaceted approach, with each technology optimized for the unique needs of each transportation segment rather than competing for the same market.

❌ MYTH: Battery electric supply chains are already established, so hydrogen supply chains would only add unnecessary complexity.

✅ FACT: Hydrogen is among the most widely produced industrial gases, and scaling the infrastructure on the existing backbone, while also bringing in technology innovators and distributors, is achievable.

- Hydrogen is already produced and handled at a large scale, supported by decades of industrial experience, global supply chains, trained workforces, and established safety codes, providing a practical backbone for growth in the transportation market.

- As global energy markets gradually transition away from petroleum refining, existing hydrogen production, logistics, and handling assets can be repurposed, creating a cost-effective on-ramp for clean transportation applications rather than requiring an entirely new fuel system.

- New market entrants and technology innovators are accelerating pathways to lower-carbon hydrogen, including renewable electrolysis, carbon capture, and improved process efficiency, driving down carbon intensity while leveraging existing infrastructure.

- Decarbonizing hydrogen production is often more straightforward and economical than decarbonizing crude oil extraction and refining, particularly when comparing full-lifecycle emissions.

- Repurposing hydrogen currently used in petroleum refining for fuel cell applications delivers immediate emissions benefits by eliminating combustion at the point of use and reducing upstream impacts compared with producing and burning refined petroleum fuels.

- Fuel cell electric vehicles maximize the environmental benefits of hydrogen by converting fuel to electricity with high efficiency and zero tailpipe emissions, making cleaner hydrogen pathways increasingly valuable as the grid and production methods continue to decarbonize.

❌ MYTH: Hydrogen and fuel cell vehicles are an inefficient choice.

✅ FACT: Hydrogen can be more efficient than diesel and gasoline; more importantly, it reduces emissions. Performance and choice also matter, and hydrogen excels in applications where fast refueling and long range are essential.

Fuel cell systems extract more usable energy from fuel than gasoline or diesel engines, meaning less energy is wasted as heat. As hydrogen production becomes cleaner, emissions continue to fall, without requiring changes to the vehicle itself.

Hydrogen fuel cell vehicles refuel in under 10 minutes and deliver a range of 300 miles or more, matching the convenience of gasoline while producing zero emissions. This makes hydrogen the optimal choice for heavy-duty trucking, transit fleets, and high-mileage applications where charging downtime is costly. For passenger vehicles, hydrogen offers a zero-emission option for drivers who require quick refueling and extended range, thereby expanding consumer choice rather than limiting it. There are also non-transportation industrial-sector opportunities for reduced emissions.

- *Light-Duty*: Customer needs vary; some require 5-minute refueling, while others can charge overnight. Hydrogen offers significant efficiency gains over gasoline vehicles while delivering the same performance, range, and utility.
    - Hydrogen vehicles produce zero tailpipe emissions, eliminating harmful diesel exhaust that impacts air quality and public health, especially in freight-heavy communities.

- *Heavy-Duty*: For 500+ miles of driving range and fast fill times comparable to diesel, hydrogen fuel cell electric trucks (FCETs) offer the optimal one-to-one replacement for diesel trucks.
    - Fuel cell trucks use electric motors, which are more efficient and responsive than diesel engines, delivering smooth acceleration and strong performance without combustion.
    - Hydrogen fuel systems are relatively light and compact ZEV powertrains, helping preserve cargo capacity and avoid payload penalties, a critical advantage for commercial trucks.

- *Applications That Are Hard to Electrify*: 1) maritime vessels (on their own or in a hydrogen carrier), 2) industrial feedstock and high-temperature heat, 3) mining and off-road vehicles, 4) aviation, and 5) passenger and freight rail. Hydrogen's ability to decarbonize these applications also enables their synergistic use.

❌ MYTH: Hydrogen is "greenwashing" and extends fossil dependence.

✅ FACT: Hydrogen is transitioning from a well-established industrial commodity (used for decades in oil refining and fertilizer production) to a clean vehicle fuel that helps achieve our environmental goals.

Hydrogen's transition mirrors the early days of renewable electricity, when market mechanisms helped launch the industry, and now those same policies are delivering real, physical clean-energy projects. California's Low Carbon Fuel Standard (LCFS) was designed to evolve from credit-based incentives into tangible investments in renewable hydrogen production.

Today, purpose-built projects converting solar power, renewable waste, and biogenic resources into hydrogen are moving the market from accounting to reality, demonstrating that hydrogen for transportation is a genuine decarbonization pathway, not greenwashing.

Controlling leaks from hydrogen storage and distribution systems is crucial to ensuring safety and efficiency, as every lost molecule represents wasted potential energy and money. With technological advancements in system design, materials, and improved practices, leak rates are expected to fall further, thereby enhancing hydrogen's climate benefits.

❌ MYTH: Hydrogen, when released into the atmosphere, worsens climate change.

✅ FACT: Hydrogen is not a direct greenhouse gas. Methane is the climate pollutant of concern in these claims, as hydrogen can indirectly extend methane's atmospheric lifetime. This makes leak minimization an important supply chain priority, but it does not change the fundamental calculus: replacing fossil fuels with hydrogen reduces global warming impacts by up to 95%, even under high-leakage assumptions.

Lifecycle studies (e.g., from the International Council on Clean Transportation and the National Laboratory of the Rockies) consistently show that hydrogen-powered systems deliver large net emissions reductions compared to diesel and gasoline. Hydrogen produced from natural gas with carbon capture and sequestration can reduce global warming impacts by approximately 65% over the first decade, while renewable hydrogen can reduce impacts by more than 95%, even with conservative leakage assumptions.

As with natural gas, refrigerants, or other industrial gases, leak prevention and system design matter, and hydrogen infrastructure is being engineered to minimize losses. When deployed responsibly, hydrogen remains a powerful tool for deep decarbonization, particularly in applications where few other zero-emission options can deliver comparable performance.

❌ MYTH: Renewable hydrogen production requires too much water.

✅ FACT: Hydrogen production uses modest amounts of water, and the real consideration is where that water comes from, not how much is required.

Producing 1 kg of hydrogen (through electrolysis) requires 2.4 gallons of water. Put another way, an average bathtub of water could produce enough hydrogen to power a hydrogen fuel-cell truck for 150 miles, compared with roughly 90 miles for a diesel-powered truck. Concerns about water use are therefore not driven by hydrogen's inherent water intensity, but by the importance of ensuring that hydrogen production is sited and managed responsibly, particularly in regions that already face water stress.

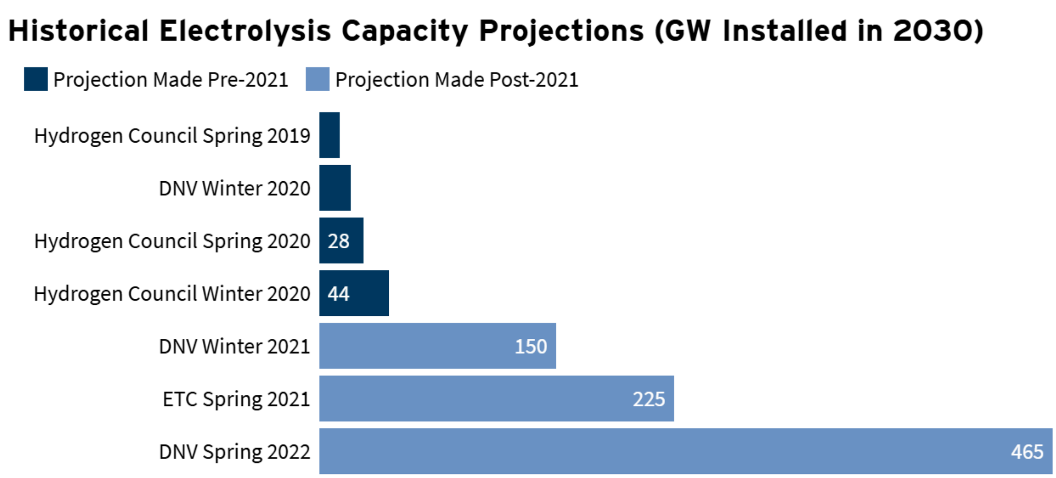
In California, renewable hydrogen can be produced using a wide range of water sources, including recycled water, brackish water, non-potable water, and seawater, enabling projects to be designed to minimize impacts on local freshwater supplies.

Additionally, electrolysis of water is only one pathway for renewable hydrogen. Hydrogen can be produced from landfill gas, agricultural waste, municipal waste, and forestry residues, often using water already present in those waste streams. When viewed in context, hydrogen's water requirements are comparable to, or lower than, those of conventional fuel production, reinforcing that water use is a planning and governance challenge, not a technological limitation.

❌ MYTH: Green hydrogen is still decades away.

✅ FACT: Green hydrogen is ready to play a significant role in global emissions reductions by 2030.

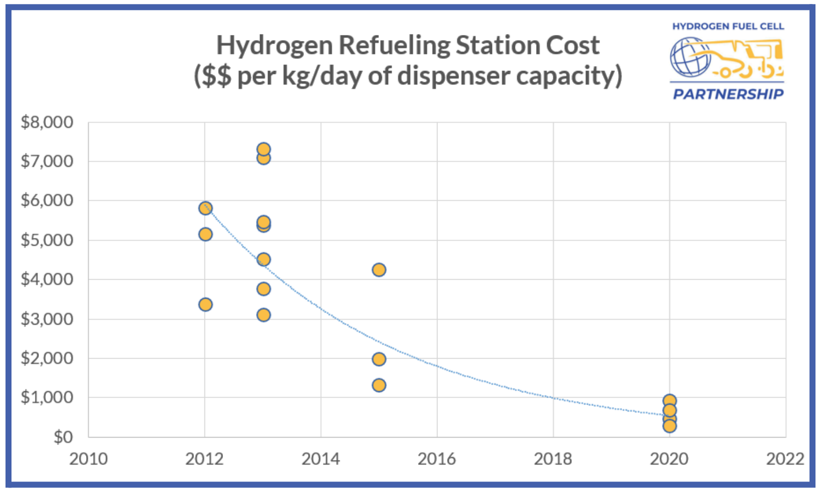
Global electrolysis capacity projections for 2030 continue to increase year over year, demonstrating growing confidence in hydrogen production infrastructure. The International Energy Agency (IEA) projected an installed electrolyzer capacity range of 250 to 520 GW by 2030 in early 2025.



❌ MYTH: Hydrogen fuel and stations cost too much money.

✅ FACT: Costs are falling rapidly as the technology matures.

Costs are falling rapidly as the technology matures, and comparing hydrogen stations to electric chargers is an apples-to-oranges comparison.



A hydrogen station is a complete multi-dispenser fueling facility designed to deliver 1,000 kg of hydrogen (equivalent to 33,000+ kWh) per day at capacity. At the same time, a single DC fast-charging port provides an average of 15-33 kWh per day.

The normalized cost of hydrogen stations (per dispenser) has decreased by 77-88% since 2012, with station capital costs declining from over $16,000 per kilogram per day capacity in 2011-2012 to $1,200-$3,000 per kilogram per day by 2020. When properly normalized across full infrastructure networks serving equivalent vehicle populations, analysis by the then-National Renewable Energy Laboratory (NREL) found that hydrogen and electric charging infrastructure have "essentially indistinguishable" levelized costs per vehicle-mile.

❌ MYTH: Hydrogen can only succeed with public subsidies.

✅ FACT: Strategic public support accelerates market development; long-term success depends on scale and private investment.

Like all clean technologies, hydrogen needs targeted, early-stage public investment to overcome first-mover costs and enable infrastructure buildout. As hydrogen station and vehicle deployments grow in tandem, costs decline through industry learning, operational optimization, and economies of scale.

California's hydrogen infrastructure is already transitioning toward greater private-sector leadership, with energy companies, equipment providers, and fuel suppliers increasingly leading development. Experience from market modeling and early deployment indicates that with sustained, coordinated growth in stations and vehicles over a multi-year period, the hydrogen fueling industry can reach a point where private revenue supports ongoing operations and expansion, reducing reliance on public subsidies.

This trajectory mirrors the evolution of other energy and transportation markets: public investment accelerates early deployment, while market fundamentals ultimately sustain long-term growth.

❌ MYTH: Hydrogen mobility is unsafe.

✅ FACT: Hydrogen vehicles meet U.S. and global standards and are already operating safely around the world.

The National Highway Traffic Safety Administration established Federal Motor Vehicle Safety Standards that specify performance requirements for hydrogen fuel systems and storage tanks under both normal operating conditions and crash conditions. As with all motor vehicles, these standards must be met to operate legally on U.S. roads.

Hydrogen storage cylinders used in vehicles are constructed and rigorously tested to industry standards, including impact, penetration, and fire exposure tests. These systems are designed with multiple layers of protection and incorporate safety devices that isolate or intentionally vent hydrogen in extreme conditions, such as an engulfing fire.

While hydrogen has distinct physical properties that require specific safety measures—including high flame temperatures and flames that may be difficult to see—vehicle and fueling systems are engineered to manage these risks through robust tank design, pressure relief devices, sensors, and operating protocols.