Guidehouse®

Remaking Our Energy System

What Enables a Successful Decarb Hub?

Learn which incentives, policies, and business structures best help this emerging energy system model compete with established commodities.

Governments across the globe are introducing robust incentives to accelerate the energy transition, with a particular focus on emerging low-carbon technologies such as carbon capture, ammonia, methanol, clean hydrogen, and sustainable aviation fuels.

In the U.S., a new presidential administration beginning in January 2025 could make changes to federal support for low-carbon programs. Currently, though, many supportive incentives exist. For example, the Inflation Reduction Act (IRA) of 2022 provides lucrative tax credits for carbon capture projects, offering up to $85 per metric ton (tonne) of CO_2 captured and stored and up to $180/tonne for Direct Air Capture (DAC)—making it one of the most generous incentive structures in the world. The IRA has also established production tax credits of up to $3 per kilogram of clean hydrogen produced.

Germany has introduced its National Hydrogen Strategy, which allocates $10 billion (€9 billion) to scale up green hydrogen projects that will help decarbonize key sectors such as steel and chemicals. The UK has announced it will spend up to $28.2 billion (£21.7 billion) on carbon capture and storage. With its $18 billion (¥2.8 trillion) budget, Japan's Green Innovation Fund is driving investments in hydrogen and carbon capture technologies to satisfy ambitious greenhouse gas emission reduction goals.

Enablers such as these are critically important to achieving early-term growth that supports wide-scale production of decarbonized commodities, whether they be energy or physical products. Because they cost four to eight times more than traditional alternatives, significant investment is needed to increase production and create a declining cost curve.

These government-led initiatives highlight growing recognition of the need to accelerate decarbonization within the energy, transportation, and industrial economies to create a competitive global landscape for clean energy innovation. They also provide a unique opportunity for companies to decarbonize, especially when they're paired with regulatory and policy decarbonization goals. Company leaders wanting to expand their ability to reach their net-zero goals should be exploring how those enablers can accelerate their decarbonization plans.

In our previous article, "Remaking Our Energy System: Decarbonization at Scale," we explored the concept of the decarb hub (short for decarbonization hub). This full-ecosystem approach to a decarbonized energy system consists of three components: A complete value chain, an orchestrator, and financial enablers and/or penalties. Together, they mitigate the significant risks associated with the relatively low commercial maturity of decarbonization ecosystems. Because hubs can't succeed without a firm financial foundation, a variety of incentives, policy structures, and emerging business models are needed to support decarb hub development.

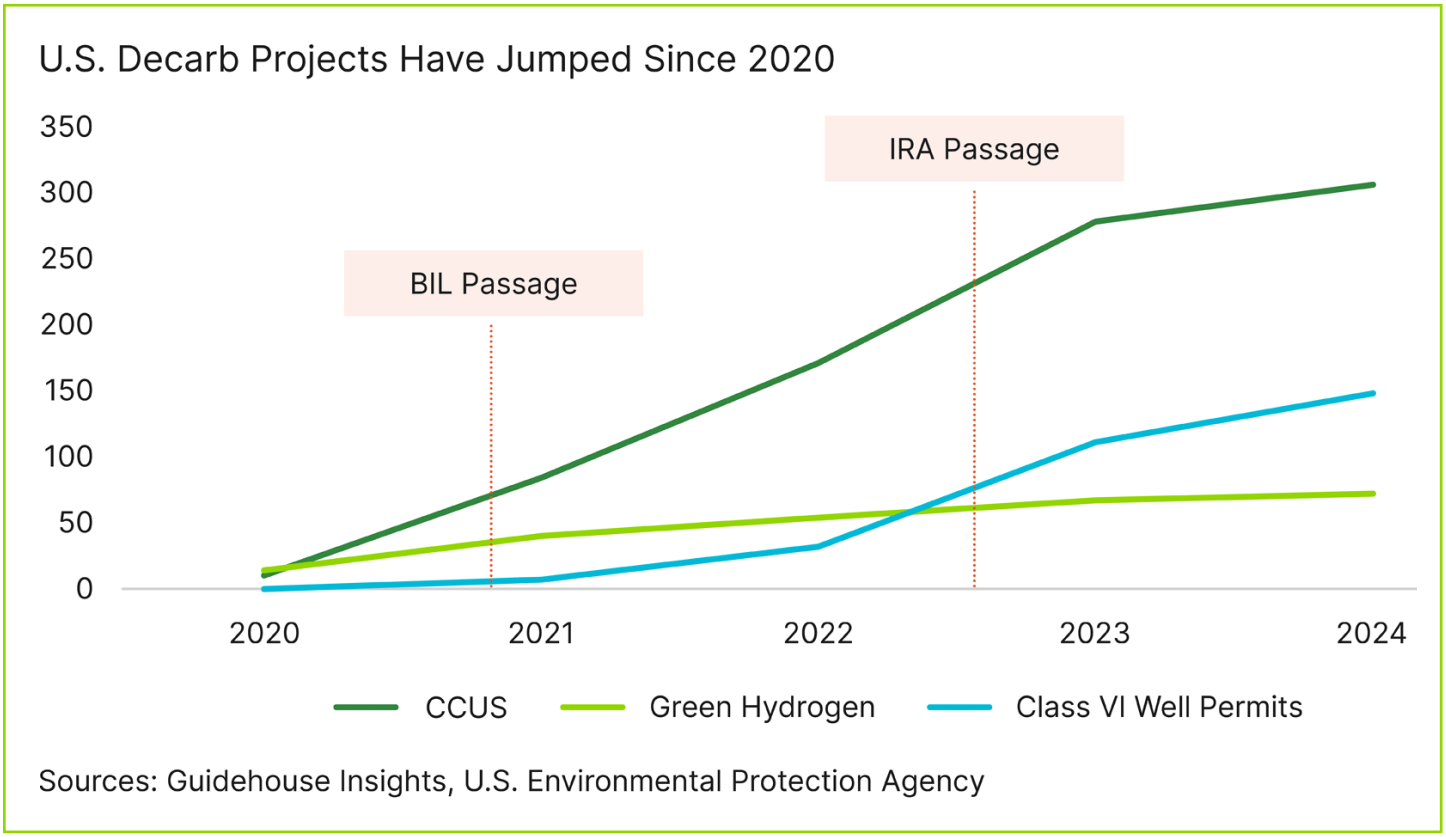
How Incentives and Subsidies Propel Success

Two primary incentive pathways exist to spur clean energy development:

One-time capital incentives. These can take the form of grants, cooperative agreements, low-interest loans, or investment tax credits. Although a new U.S. administration casts questions about the future of federal decarbonization programs, the IRA and the Bipartisan Infrastructure Law of 2021 both provide numerous financial incentives to accelerate the deployment of decarbonization infrastructure. This includes hydrogen and DAC hubs—networks of projects comprised of one or more complete value chains. The U.S. Department of Energy (DOE) is implementing these programs with requirements and design constraints that apply to the entire value chain. Such incentives and frameworks are intended to address the need for these ecosystems and networks where they don't exist or are underdeveloped.

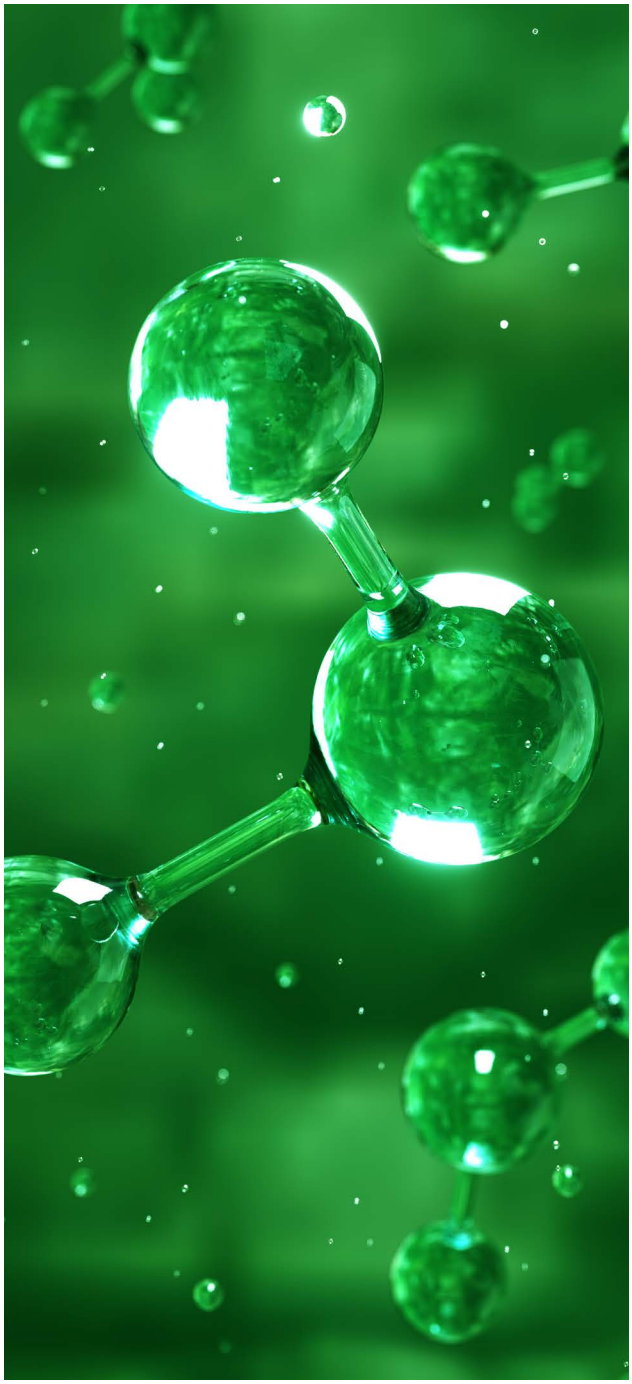
Ongoing incentives. This includes production tax credits and other ways to encourage permanent sequestration of CO_2. These incentives create a financial driver for industries struggling to create decarbonization-related products and services at competitive prices. For instance, the recently enhanced U.S. Section 45Q tax credit of up to $85/tonne for carbon capture and storage and $180/tonne for DAC makes these efforts more economically feasible for a variety of use cases, including power generation, industrial heating, and DAC projects.

Capital incentives are most useful for capital expenditure-dominated cost structures, while production tax credits promote increased production for assets with expensive operating costs and expected high utilization.



Other types of incentives exist but are often geared toward technology R&D or early-stage commercialization rather than more commercially mature solutions.

As helpful as these national incentives are, they often are not compelling enough to attract all potential participants in a decarb hub. An important part of the coordinator's role is to uncover as many other sources of financial support as possible, sometimes in a creative and innovative fashion. This may well involve state, local, and private sources. A resourceful coordinator will often find ways to incorporate seemingly disparate economic resources into the proposed hub's overall financial viability. For example, it might be possible to support offtakers of clean fuels with lesser-known incentives such as the IRA's Section 48E tax credit for new clean power generation facilities. By helping offtakers afford low-carbon fuels, the decarb hub also supports the upstream portions of the value chain.



Regulatory and Policy Enablers

While incentives can encourage participation, regulations, policies, and penalties can similarly motivate stakeholders to act. For example, the European Union Emissions Trading System (EU ETS) has implemented a declining cap on total GHG emissions from factories, power plants, and other installations. Emission allowances are allocated to companies by the EU, and the companies can buy more from a market if needed.

In the U.S., California and Washington have implemented similar cap-and-trade systems, where companies hold permits for their emissions and can buy or sell them as needed. The U.S. federal government has also introduced Clean Air Act regulations that impose limits on carbon emissions for power plants and other major sources.

The EU ETS is expanding its coverage to include imports of certain energy-intensive goods through the introduction of a carbon border adjustment mechanism. This will gradually replace free allowance allocations for European manufacturers with a charge on imported goods based on total GHG emissions during production. The mechanism, which is based on the price per tonne of CO_2 set by the EU ETS or UK ETS, creates an incentive to reduce emissions for European industries by removing free allocations and for importers by levying a new charge based on the embedded emissions of imported goods.

Under the Biden administration, the DOE is developing ways to support hydrogen demand. While initial efforts have focused on offtakers within hydrogen hubs, the chosen mechanisms may be replicable across other decarb hubs. DOE involvement with these efforts is also not always necessary for them to move forward.

Beyond federal and state policies, some sectors are developing their own policies to stimulate decarbonization—resulting in stated emissions and/or technology development targets across the production of power, cement, glass, metals, chemicals, and other areas. To meet these targets, some producers are banding together to provide assurances of adequate demand for clean fuels, feedstocks, or products using such mechanisms as advance market commitments.

Effective Hydrogen Infrastructure Financing

In our work analyzing infrastructure viability for the European Hydrogen Backbone, we identified upfront financing as a major hurdle. Developers struggle to secure capital due to high infrastructure costs and market uncertainty—with early revenues unable to cover costs and traditional regulatory tariffs unavailable.

We recommended that development take place in three phases:

- **Market ramp-up**, where tariffs must remain high to cover early costs
- **Start mature market**, where tariffs decrease as usage grows
- **Steady mature market**, where tariffs stabilize with consistent capacity use

We concluded that securing government support and external financial assistance is critical to bridge these gaps and enable financially viable hydrogen infrastructure across Europe.

Levers to Drive Value

For any decarb hub project, a fundamental component is a business model that provides value potential to all participants. Innovative business model development can enable decarb hubs to create new revenue streams, drive economic growth, and ensure long-term viability of efforts to transition to a low-carbon future. Many business models focus on the following key value streams:

Tax credit monetization. Tax credits can play a significant role in making decarbonization projects financially viable. For example, companies applying the IRA's hydrogen production tax credit in its current form can offset some production costs and reduce the offering price to make it more competitive with alternative fuels and feedstocks.

New end uses. Innovative applications for clean products are creating new potential revenue streams for decarb hubs. Hydrogen can be used to make direct-reduced iron, rendering the process nearly carbon-free. CO_2 can be used to produce concrete, resulting in improved concrete properties and a lower carbon footprint. By adopting new uses for hydrogen and CO_2 such as producing electrofuels like e-methane, e-methanol, and sustainable aviation fuels, decarb hubs can help drive economic growth and sustainability.

Regulatory mechanisms. Two forms include regulatory credit systems and traditional regulatory recovery. Market-based regulatory credit trading systems such as cap-and-trade programs encourage continuous emissions reduction improvements, support decarb hub financial viability, and let companies earn revenue by staying within their emission allowances and selling excess credits to other companies. New business models can also be supported by traditional utilities if they're able to recover investment costs through regulatory recovery rates. For instance, a company may add new pipelines, new production units, or other key decarbonization assets that create an incentive for them to build and deliver energy using those assets. The challenge is that regulators can be slow to approve new or innovative assets without sufficient proof that they're needed for utilities to service their territory. Decarb hubs can validate the need for and support of these new assets.

Five Steps for Planning a Decarb Hub

Here are the key steps needed to take when planning for and building a successful decarb hub:

1.) Identify regional accelerants. Analyze your region's unique drivers and accelerants. Regions with strong industrial bases, heavy carbon-emitting industries, or existing infrastructure for energy production may benefit from targeted decarbonization efforts. Look at local policies, tax incentives, and partnerships that can expedite clean energy transitions such as California's Low-Carbon Fuel Standard program, which offers significant compensation for low-carbon transportation fuels.

2.) Engage early and often with policy and regulatory bodies. Successful decarb hubs are built in close alignment with national and local regulatory frameworks. Early engagement with regulators is crucial to developing strong relationships and providing sufficient time for planning, project preparation, permitting, and compliance efforts. Decarb hub leaders should also engage early with policymakers to ensure that proposed projects can take full advantage of emerging regulatory mechanisms such as cap-and-trade systems, carbon pricing, or sector-specific emissions reduction targets.

3.) Plan for long-term sustainability. Early investment in decarb hubs often requires inventive business models to mitigate financial risk. Hub development should also be structured to take advantage of long-term revenue streams, including ongoing financial incentives such as tax credits for hydrogen production or CO_2 sequestration. Don't assume incentives will be renewed at the program's end, but also be ready to take full advantage of the benefits if the programs get continued. Extra revenue might be used to expand production or improve infrastructure. Regulatory recovery mechanisms can support the financial viability of new infrastructure investments over the long term by providing market certainty through tariffs extending over decades.

4.) Take advantage of financial incentives and subsidies. Financial incentives are critical enablers in the decarbonization space. Take full advantage of the diverse forms of capital available for decarbonization projects, including grants, loans, and tax credits that will increase cost competitiveness between decarbonized and non-decarbonized commodities. These funding streams might not last forever, but understanding them and accessing them while they are still available will be key to ensuring your hub's long-term financial sustainability.

5.) Use market mechanisms. Regulatory credit trading systems, like cap-and-trade programs, can provide a powerful market-driven approach to generating revenue for your decarb hub. By selling excess credits or allowances earned by staying under emissions targets, your hub can create additional funding streams. Similarly, innovative market mechanisms for low-carbon products (e.g., sustainable steel or concrete), such as advance market commitments, can provide early opportunities for growth and scale.

Following these steps will help solidify your decarb hub's development timeline, support its long-term success, and advance its role in driving regional and global decarbonization efforts.

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