

# Southern California Hub

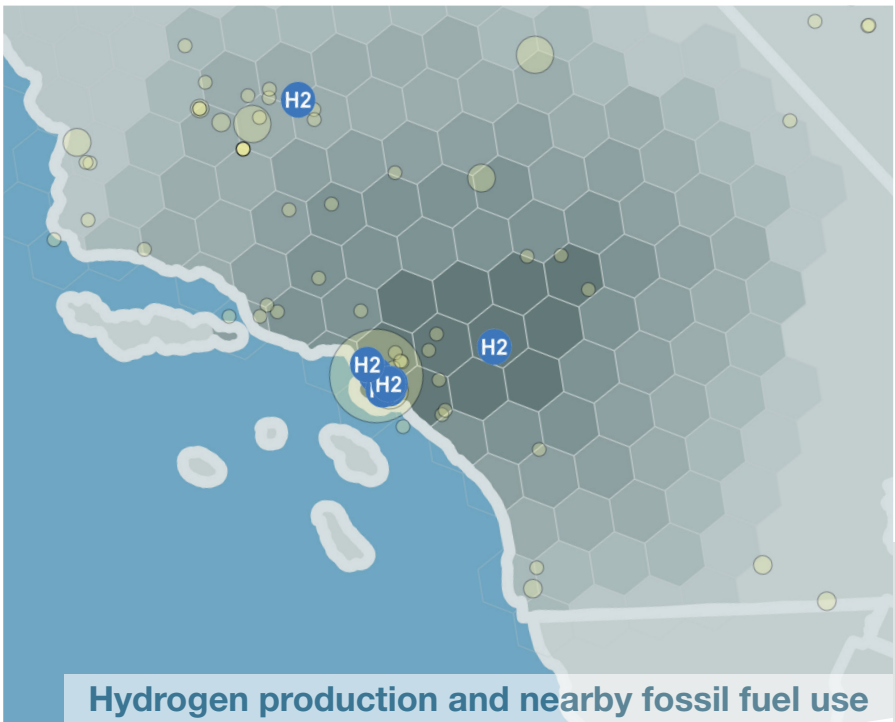
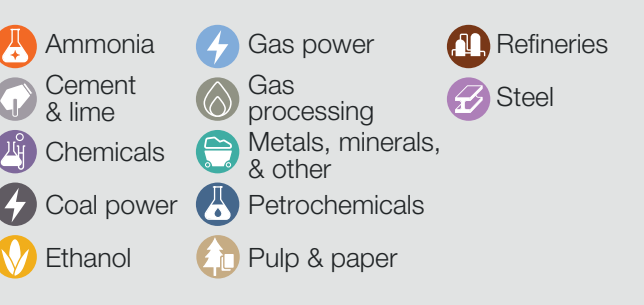
The existing landscape of industrial production, commodity transport infrastructure, and geologic carbon storage capacity make Southern California a potential launching point for investment in carbon capture and low-carbon hydrogen deployment.



## Industrial Emissions and Fossil Fuel Use

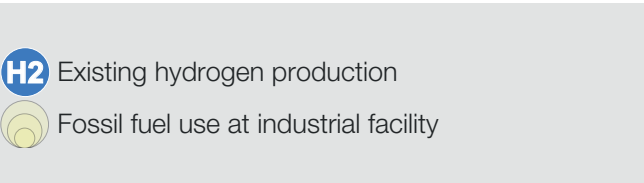


Southern California is home to a high number and concentration of diverse industries, including petroleum refining, natural gas processing, and cement and steel manufacturing. Facilities in the Southern California hub emit 31.7 million metric tons (Mt) of CO<sub>2</sub>e annually, including 11.3 Mt from stationary combustion and 12.7 Mt from process emissions. There are 18 facilities in this regional hub that are eligible for the 45Q tax credit based on their current emissions profile.



There are **nine hydrogen-producing facilities** in the Southern California hub already co-located with the central corridor of industrial activity and fossil fuel use. Industrial facilities in this regional hub use a total of 189 million MMBtu of fossil fuels per year.

Hydrogen can be used as a low- or zero-carbon alternative to fossil fuels at industrial facilities. Clusters of hydrogen production and fossil fuel demand can facilitate technology deployment and jumpstart the transition to hydrogen.



### Industrial facility emissions

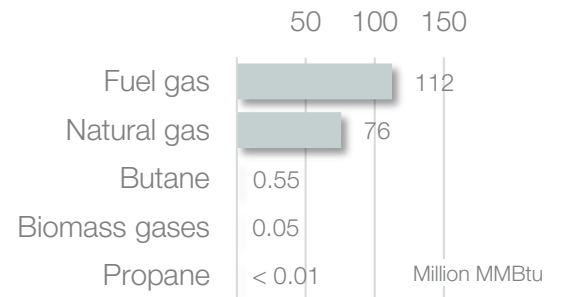
| Sector                   | Total # of Facilities | Total Emissions | Stationary Combustion Emissions | Process Emissions |
|--------------------------|-----------------------|-----------------|---------------------------------|-------------------|
| Cement                   | 3                     | 4.2             | < 0.1                           | 4.2               |
| Chemicals                | 2                     | 0.1             | 0.1                             | -                 |
| Gas power plants         | 23                    | 7.9             | 0.3                             | -                 |
| Gas processing           | 6                     | 2.3             | 0.1                             | 2.2               |
| Metals, minerals & other | 14                    | 0.8             | 0.7                             | 0.1               |
| Pulp & paper             | 2                     | 0.3             | 0.3                             | -                 |
| Refineries               | 8                     | 15.9            | 9.7                             | 6.2               |
| Steel & steel products   | 3                     | 0.2             | 0.2                             | < 0.1             |
| <b>Total</b>             | <b>61</b>             | <b>31.7</b>     | <b>11.3</b>                     | <b>12.7</b>       |

All emissions are in million metric tons CO<sub>2</sub>e.

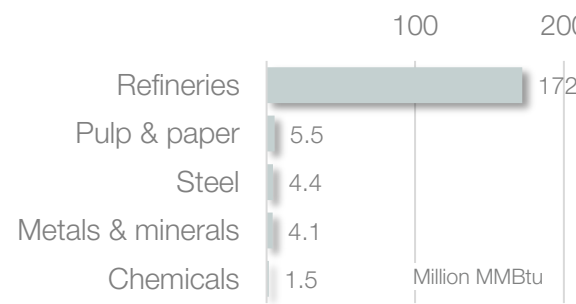
The top industrial fuels consumed in the Southern California hub include fuel gas at 112 million MMBtu per year and natural gas at 76 million MMBtu per year. Refineries are the largest consumers of fossil fuels in this regional hub, consuming 172 million MMBtu of fossil fuels per year.

Using hydrogen as a medium- and high-intensity energy source to displace conventional fossil fuels can reduce combustion emissions alongside other solutions like electrification and renewable energy. Process emissions from product manufacture are another major source of GHGs at industrial facilities. These production processes may not involve fuel combustion and would require other solutions such as carbon capture to fully decarbonize.

### Top industrial fuels consumed



### Largest fuel-consuming industries

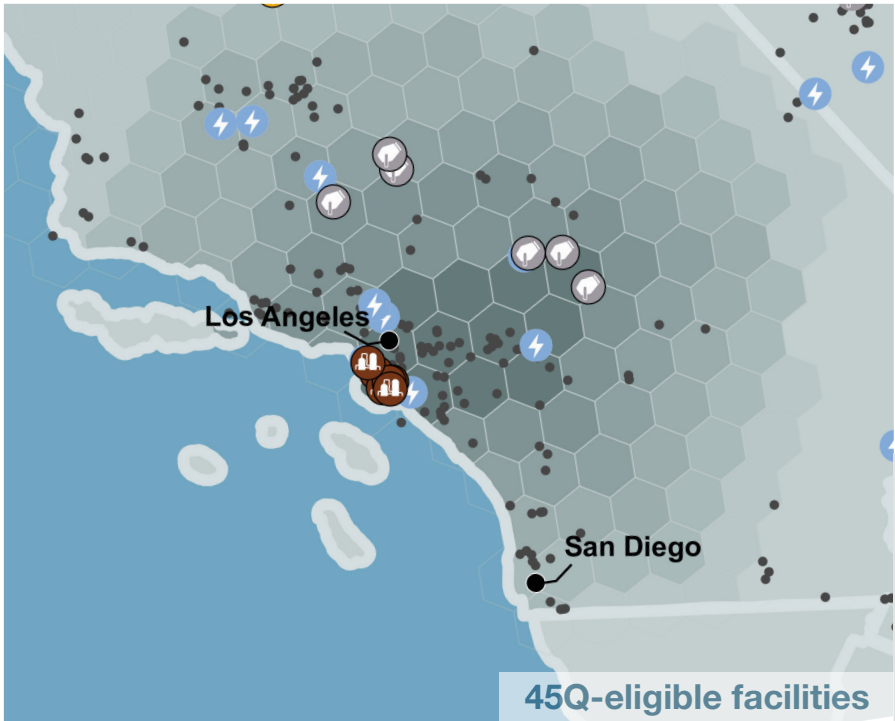


# Southern California Hub

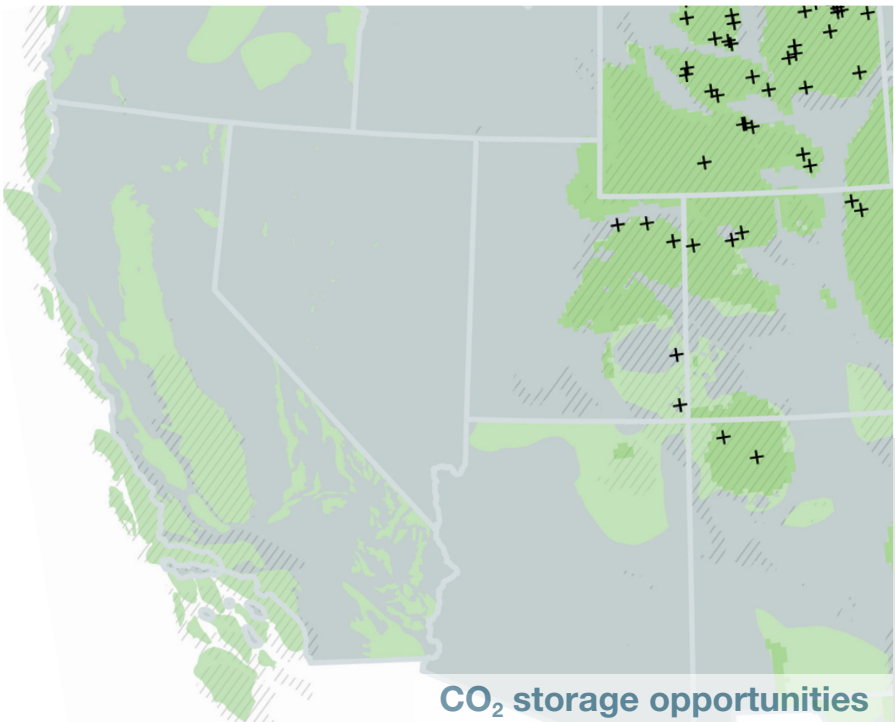
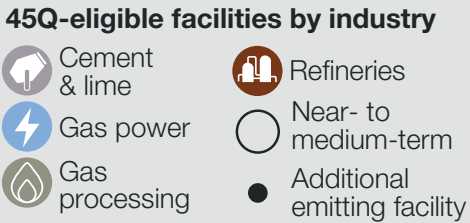
Carbon capture and storage is an essential tool for achieving midcentury climate goals, maintaining the competitiveness of US industry, and protecting and creating high-wage jobs. Carbon capture is crucial in decarbonizing key carbon-intensive industries where CO<sub>2</sub> emissions are inherent to the chemistry of production processes and cannot be eliminated solely by switching to low-carbon electricity. The US has capacity to safely and permanently store thousands of years of carbon emissions in geologic saline formations.



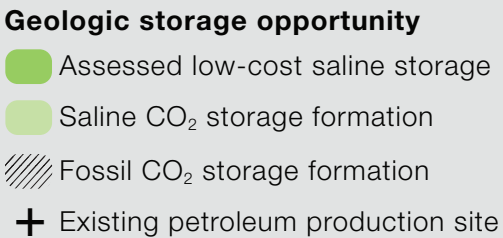
## Carbon Capture and Storage



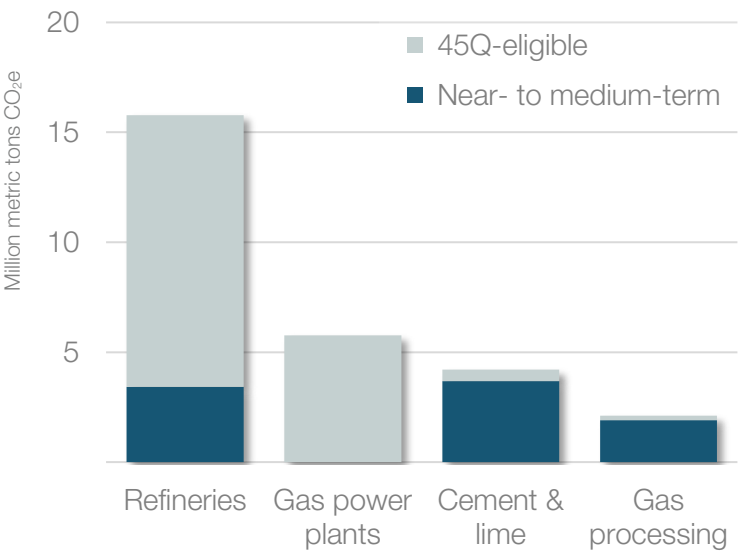
The Section 45Q tax credit lowers cost barriers to carbon capture and storage. Among the 18 industrial and power facilities in the Southern California hub that meet emissions thresholds for Section 45Q eligibility, 12 have been identified as near- to medium-term candidates for capture retrofit over the next 10 to 15 years.



Southern California has potential to act as a carbon storage destination for capture facilities and carbon removal. The state of California has potential to store 148 billion metric tons of CO<sub>2</sub> in secure geologic saline formations, and also has extensive capacity for carbon storage in geologic fossil basins.

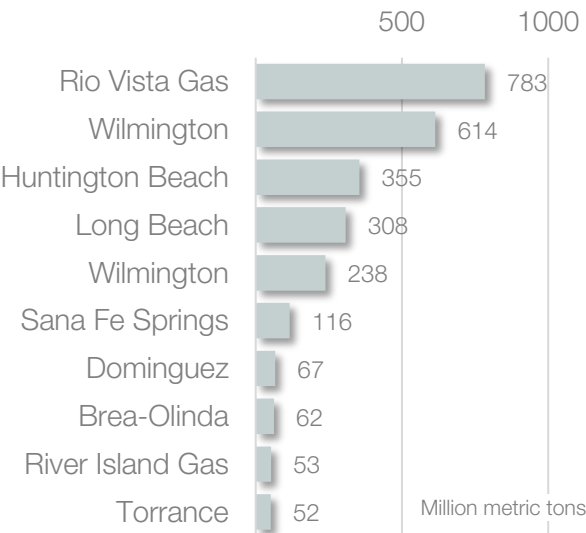


## Carbon capture opportunities

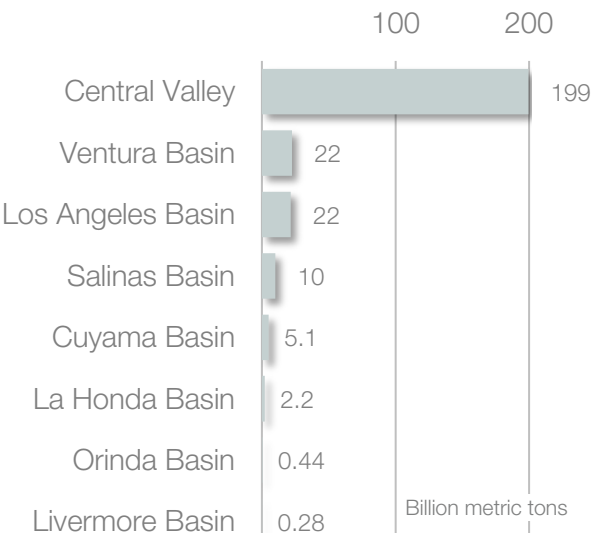


- Industrial and power facilities emit **31.7 Mt CO<sub>2</sub>e per year**
- 45Q-eligible** facilities emit **28.0 Mt CO<sub>2</sub>e per year**
- 9.0 Mt CO<sub>2</sub> per year** are **capturable** in the **near- to medium-term**

## Fossil storage formations by CO<sub>2</sub> storage capacity



## Saline storage formations by CO<sub>2</sub> storage capacity





# Southern California Hub

Industrial hubs can offer existing transportation infrastructure, delivery routes, and distribution networks needed for the efficient supply of feedstocks and delivery of products. Hydrogen may be blended into existing natural gas pipelines for co-firing, and both carbon and hydrogen could be transported by rail, freight trucking, or barge. Existing pipeline rights-of-way may be crucial for efficient and equitable routing of new CO<sub>2</sub> pipelines for utilization and permanent storage.

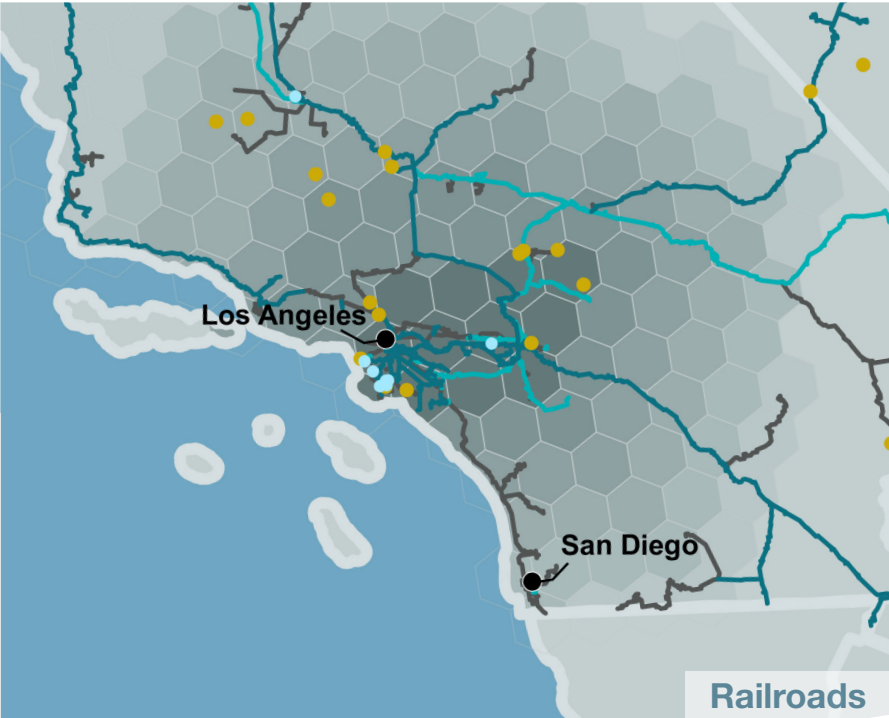


## Transport Infrastructure

Many industrial facilities are located along rail lines and often use rail transport to import and export goods. Railroads can also play a role in transporting captured carbon and hydrogen. Many of the facilities in the Southern California hub are located along major rail lines, facilitating connection to markets across the US.

### Railroad networks

- Union Pacific Railroad
- BNSF Railway
- CSX Transportation
- Norfolk Southern Railway
- All others



Railroads



Barge waterways and freight highways

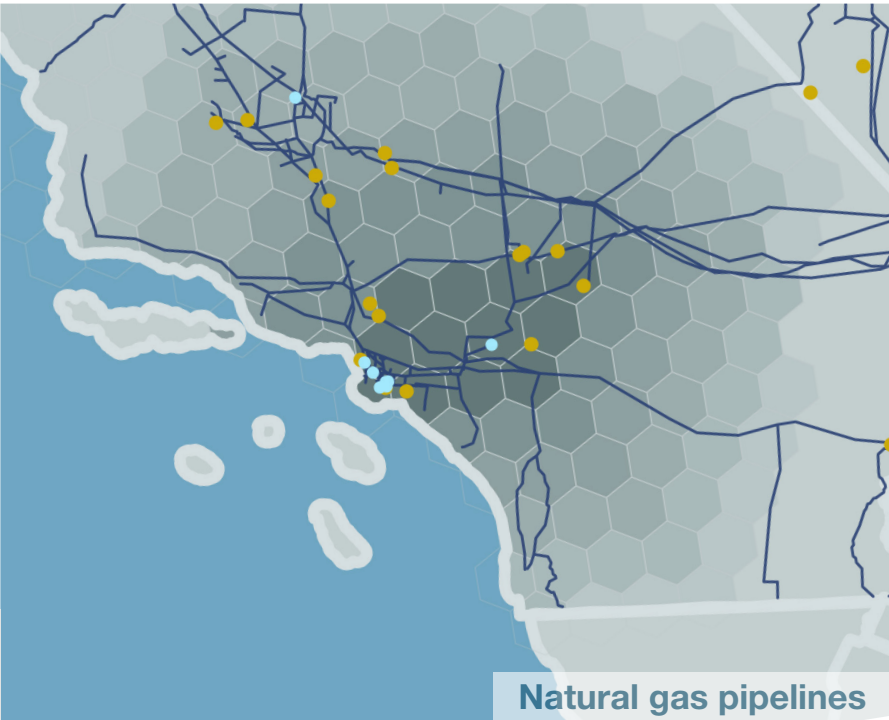
Freight trucks and barges can each play a role in the development of carbon and hydrogen transport networks. Both transport options are flexible, enabling routes to evolve over time and the frequency of transport to adapt in line with the volume of material being transported. With several major ports and extensive access to shipping channels, Southern California has unique access to global and domestic markets for carbon and hydrogen.

- Interstate highway
- Navigable waterway
- Major port

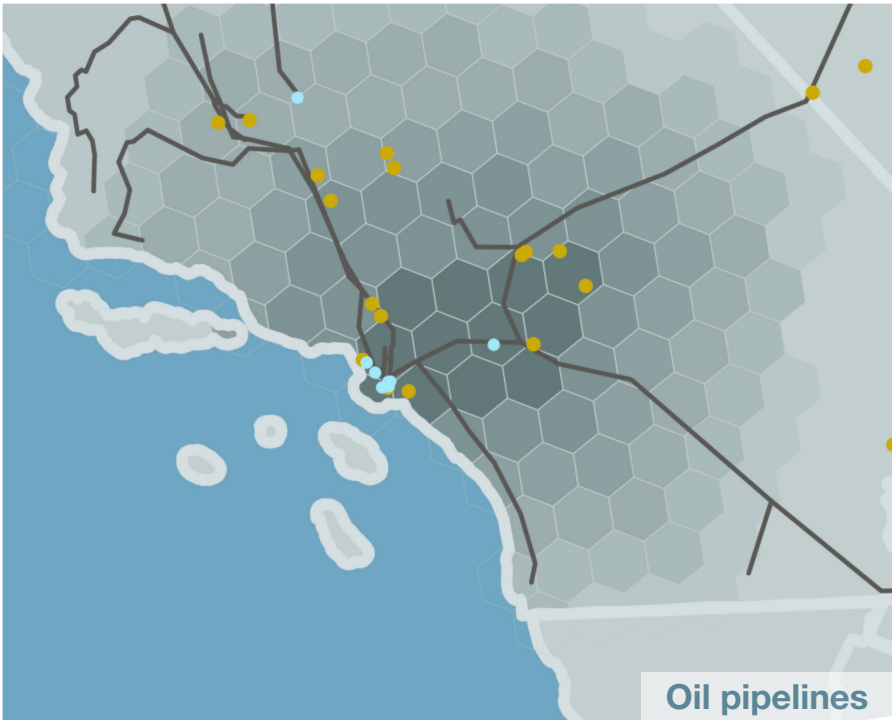
Logistical challenges to carbon and hydrogen pipeline deployment can be reduced by following existing right-of-way of natural gas lines. The Southern California hub currently has 750 miles of natural gas pipelines.

| Infrastructure        | Miles |
|-----------------------|-------|
| Natural gas pipelines | 750   |
| Oil pipelines         | 1,596 |

- Existing CO<sub>2</sub> pipelines
- Natural gas pipelines



Natural gas pipelines



Oil pipelines

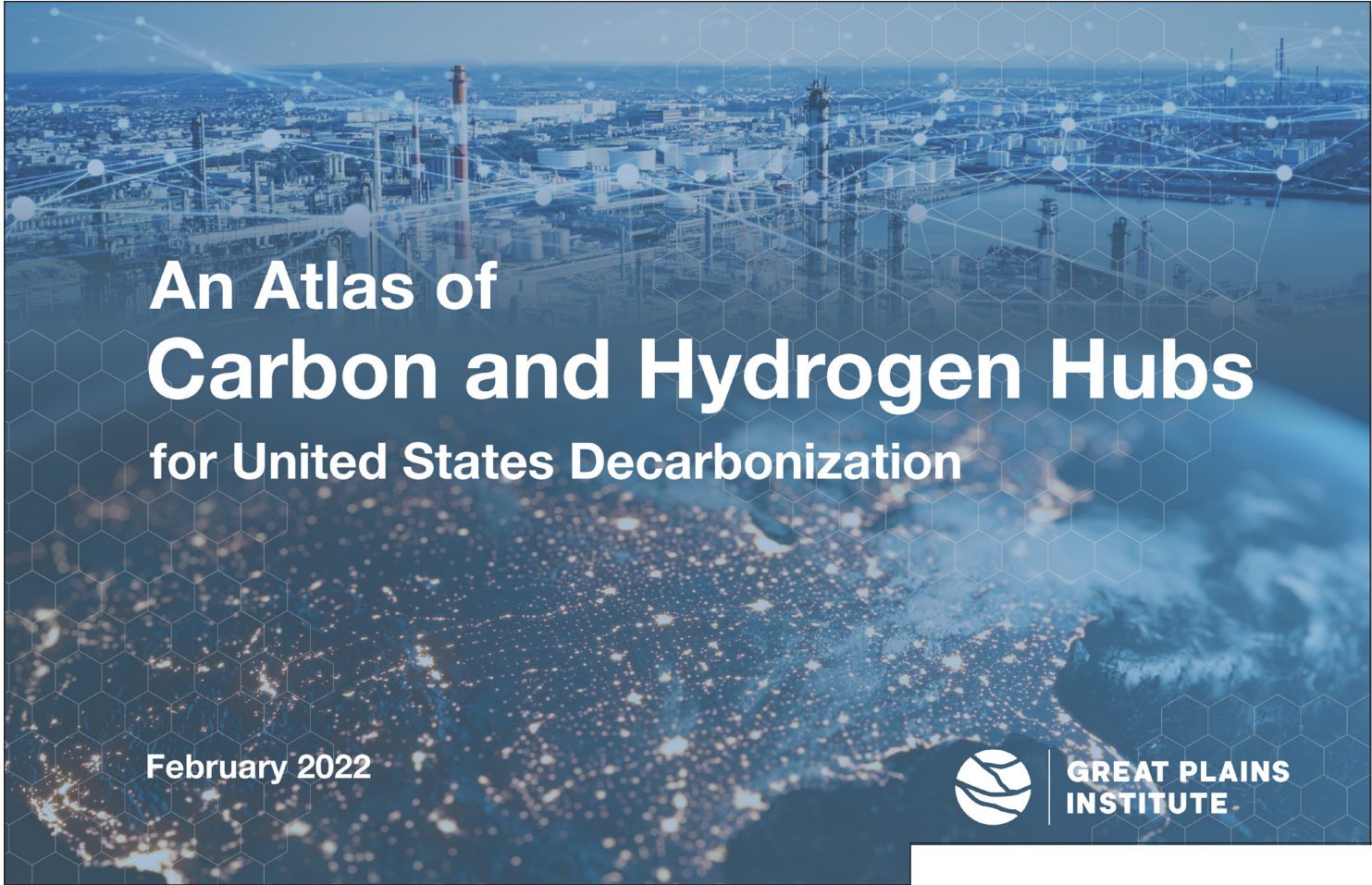
Collocating new CO<sub>2</sub> and hydrogen pipelines along existing pipeline routes can maximize efficiency and reduce surface impacts. New CO<sub>2</sub> and hydrogen pipelines could follow existing right-of-way established along the Southern California hub's 1,596 miles of oil pipelines to achieve efficient buildout.

- 45Q-eligible facility
- Existing hydrogen production

- Existing CO<sub>2</sub> pipelines
- Hydrocarbon gas liquids pipelines
- Petroleum pipelines



# GPI's Atlas of Carbon and Hydrogen Hubs



## About the Great Plains Institute

A nonpartisan, nonprofit organization, the Great Plains Institute (GPI) is transforming the energy system to benefit the economy and environment. Working across the US, we combine a unique consensus-building approach, expert knowledge, research and analysis, and local action to find and implement lasting solutions. Our work strengthens communities and provides greater economic opportunity through creation of higher paying jobs, expansion of the nation’s industrial base, and greater domestic energy independence while eliminating carbon emissions.

Learn more: [www.betterenergy.org](http://www.betterenergy.org)

Download the report at [carboncaptureready.org](http://carboncaptureready.org)

