Western Pennsylvania is home to a high number and concentration of diverse industries, including steel and steel products manufacturing and natural gas processing. Facilities in the Western Pennsylvania hub emit 115.7 million metric tons (Mt) of CO₂e annually, including 14.3 Mt from stationary combustion and 19.3 Mt from process emissions. There are 20 facilities in this regional hub that are eligible for the 45Q tax credit based on their current emissions profile.

The top industrial fuels consumed in the Western Pennsylvania hub include natural gas at 86 million MMBtu per year and coke oven gas at 31 million MMBtu per year. Steel and gas processing plants are the largest consumers of fossil fuels in this regional hub, consuming 72 million MMBtu and 23 million MMBtu of fossil fuels, respectively.

Industrial facility emissions

<table>
<thead>
<tr>
<th>Sector</th>
<th>Total # of Facilities</th>
<th>Total Emissions</th>
<th>Stationary Combustion Emissions</th>
<th>Process Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>1</td>
<td>0.2</td>
<td>&lt; 0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Chemicals</td>
<td>5</td>
<td>0.8</td>
<td>0.8</td>
<td>-</td>
</tr>
<tr>
<td>Coal power plants</td>
<td>18</td>
<td>75.8</td>
<td>2.5</td>
<td>-</td>
</tr>
<tr>
<td>Gas power plants</td>
<td>13</td>
<td>9.0</td>
<td>0.2</td>
<td>-</td>
</tr>
<tr>
<td>Gas processing</td>
<td>44</td>
<td>2.9</td>
<td>2.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Metals, minerals &amp; other</td>
<td>37</td>
<td>18.5</td>
<td>0.9</td>
<td>17.6</td>
</tr>
<tr>
<td>Petrochemicals</td>
<td>2</td>
<td>0.1</td>
<td>0.1</td>
<td>-</td>
</tr>
<tr>
<td>Pulp &amp; paper</td>
<td>2</td>
<td>0.1</td>
<td>0.1</td>
<td>-</td>
</tr>
<tr>
<td>Refineries</td>
<td>2</td>
<td>0.8</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Steel &amp; steel products</td>
<td>28</td>
<td>7.5</td>
<td>6.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Total</td>
<td>152</td>
<td>115.7</td>
<td>14.3</td>
<td>19.3</td>
</tr>
</tbody>
</table>

All emissions are in million metric tons CO₂e.

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

There is one hydrogen-producing facility in the Western Pennsylvania hub already co-located with the central cluster of industrial activity and fossil fuel use. Industrial facilities in this regional hub use a total of 138 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.
Western Pennsylvania 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$_2$ 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 20 industrial and power facilities in the Western Pennsylvania hub that meet emissions thresholds for Section 45Q eligibility, nine have been identified as near- to medium-term candidates for capture retrofit over the next 10 to 15 years.

**45Q-eligible facilities by industry**
- Coal power
- Gas power
- Refineries
- Cement & lime
- Steel

Western Pennsylvania has potential to act as a major carbon storage destination for capture facilities and carbon removal. The state of Pennsylvania has potential to store 18 billion metric tons of CO$_2$ in secure geologic saline formations, and also has extensive capacity for carbon storage in geologic fossil basins.

**Geologic storage opportunity**
- Assessed low-cost saline storage
- saline CO$_2$ storage formation
- Fossil CO$_2$ storage formation
- Existing petroleum production site

### Fossil storage formations by CO$_2$ storage capacity

- Brown-Lumberport: 4.0 Mt CO$_2$ per year
- Jarvisville: 3.0 Mt CO$_2$ per year
- Smithton-Flint-Sedalia: 3.0 Mt CO$_2$ per year
- Weston-Jane Lew: 3.0 Mt CO$_2$ per year
- Bridgeport-Pruntytown: 1.5 Mt CO$_2$ per year
- North Ellsworth: 1.2 Mt CO$_2$ per year
- Baltic: 0.8 Mt CO$_2$ per year
- Volant: 0.6 Mt CO$_2$ per year
- Salem-Wallace: 0.6 Mt CO$_2$ per year
- Ravenna-Best: 0.5 Mt CO$_2$ per year

### Saline storage formations by CO$_2$ storage capacity

- Mt Simon Basal: 1,693 Billion metric tons
- St. Peter Sandstone: 1,622 Billion metric tons
- Rose Run: 1,086 Billion metric tons
- Knox Group: 669 Billion metric tons
- Mt. Simon Sandst.: 641 Billion metric tons
- Medina/Clinton: 635 Billion metric tons
- Lockport Dolomite: 187 Billion metric tons
- Bass Island Dolomite: 72 Billion metric tons
- Sylvania Sandstone: 71 Billion metric tons
- Oriskany Sandstone: 71 Billion metric tons
Western Pennsylvania 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 CO₂ 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 Western Pennsylvania hub are located along major rail lines, facilitating connection to markets across the US.

Logistical challenges to carbon and hydrogen pipeline deployment can be reduced by following existing right-of-way of natural gas lines. The Western Pennsylvania hub currently has 5,323 miles of natural gas pipelines.

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas pipelines</td>
<td>5,323</td>
</tr>
<tr>
<td>Oil pipelines</td>
<td>1,406</td>
</tr>
</tbody>
</table>

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 on Lake Erie and access to shipping channels along the Ohio river, Western Pennsylvania is well-positioned to access global and international markets for carbon and hydrogen.

Collocating new CO₂ and hydrogen pipelines along existing pipeline routes can maximize efficiency and reduce surface impacts. New CO₂ and hydrogen pipelines could follow existing right-of-way established along the Western Pennsylvania hub’s 1,406 miles of oil pipelines to achieve efficient buildout.
GPI’s Atlas of Carbon and Hydrogen Hubs

An Atlas of Carbon and Hydrogen Hubs for United States Decarbonization

February 2022

Download the report at carboncaptureready.org

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