The Michigan and Ohio hub is home to a high number and concentration of diverse industries, including steel and steel products manufacturing, ethanol production, and cement production. Facilities in this regional hub emit 47.0 million metric tons (Mt) of CO$_2$e annually, including 12.7 Mt from stationary combustion and 9.2 Mt from process emissions. There are 28 facilities in this regional hub that are eligible for the 45Q tax credit based on their current emissions profile.

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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.

Industrial activity and fuel use is distributed throughout Michigan, Ohio, and Indiana, and includes hydrogen five production facilities. Local infrastructure and geologic carbon storage capacity provide opportunities for investment in carbon capture and low-carbon hydrogen deployment.
Michigan & Ohio 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 CO₂ 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.

The Section 45Q tax credit lowers cost barriers to carbon capture and storage. Among the 28 industrial and power facilities in the Michigan and Ohio hub that meet emissions thresholds for Section 45Q eligibility, 13 have been identified as near- to medium-term candidates for capture retrofit over the next 10 to 15 years.

Michigan and Ohio have potential to act as a major carbon storage destinations for capture facilities and carbon removal. The states of Michigan and Ohio have the combined potential to store 57 billion metric tons of CO₂ in secure geologic saline formations, and also have extensive capacity for carbon storage in geologic fossil basins.

**Carbon capture opportunities**

- **Industrial and power facilities emit 47.0 Mt CO₂ per year**
- **45Q-eligible facilities emit 43.0 Mt CO₂ per year**
- **13.2 Mt CO₂ per year are capturable in the near- to medium-term**

**Fossil storage formations**

- Brown-Lumberport
- Jarvisville
- Smithton-Flint-Sedalia
- Weston-Jane Lew
- Bridgeport-Pruntytown
- North Ellsworth
- Baltic
- Volant
- Salem-Wallace
- Ravenna-Best

**Saline storage formations**

- Mt Simon Basal
- St. Peter Sandstone
- Rose Run
- Knox Group
- Mt. Simon Sandst.
- Medina/Clinton
- Lockport Dolomite
- Bass Island Dolomite
- Sylvania Sandstone
- Oriskany Sandstone

**Geologic storage opportunity**

- Assessed low-cost saline storage
- Saline CO₂ storage formation
- Fossil CO₂ storage formation
- Existing petroleum production site

**CO₂ storage opportunities**
Michigan & Ohio 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 Michigan and Ohio 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 Michigan and Ohio hub currently has 2,148 miles of natural gas pipelines. Northern Michigan is already home to proven CO₂ utilization and storage, with existing transport infrastructure.

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 major ports on Lake Erie, the Michigan and Ohio hub is well-positioned to access domestic 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 Michigan and Ohio hub’s 4,128 miles of oil pipelines to achieve efficient buildout.

### Transport Infrastructure

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas pipelines</td>
<td>2,146</td>
</tr>
<tr>
<td>Oil pipelines</td>
<td>4,128</td>
</tr>
</tbody>
</table>

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

**45Q-eligible facility**

**Major port**

**45Q-eligible facility**

**Existing hydrogen production**

**Existing CO₂ pipelines**

**Hydrocarbon gas liquids pipelines**

**Petroleum pipelines**
GPI’s Atlas of Carbon and Hydrogen Hubs

An Atlas of Carbon and Hydrogen Hubs for United States Decarbonization
February 2022

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

Download the report at carboncaptureready.org