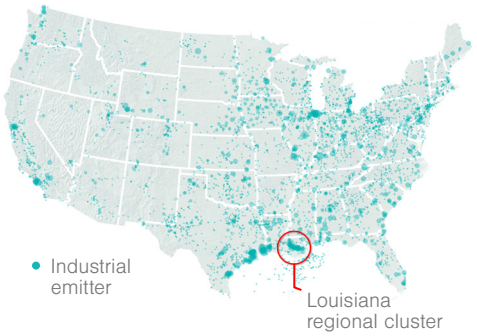
# Regional CCUS Opportunities in Louisiana

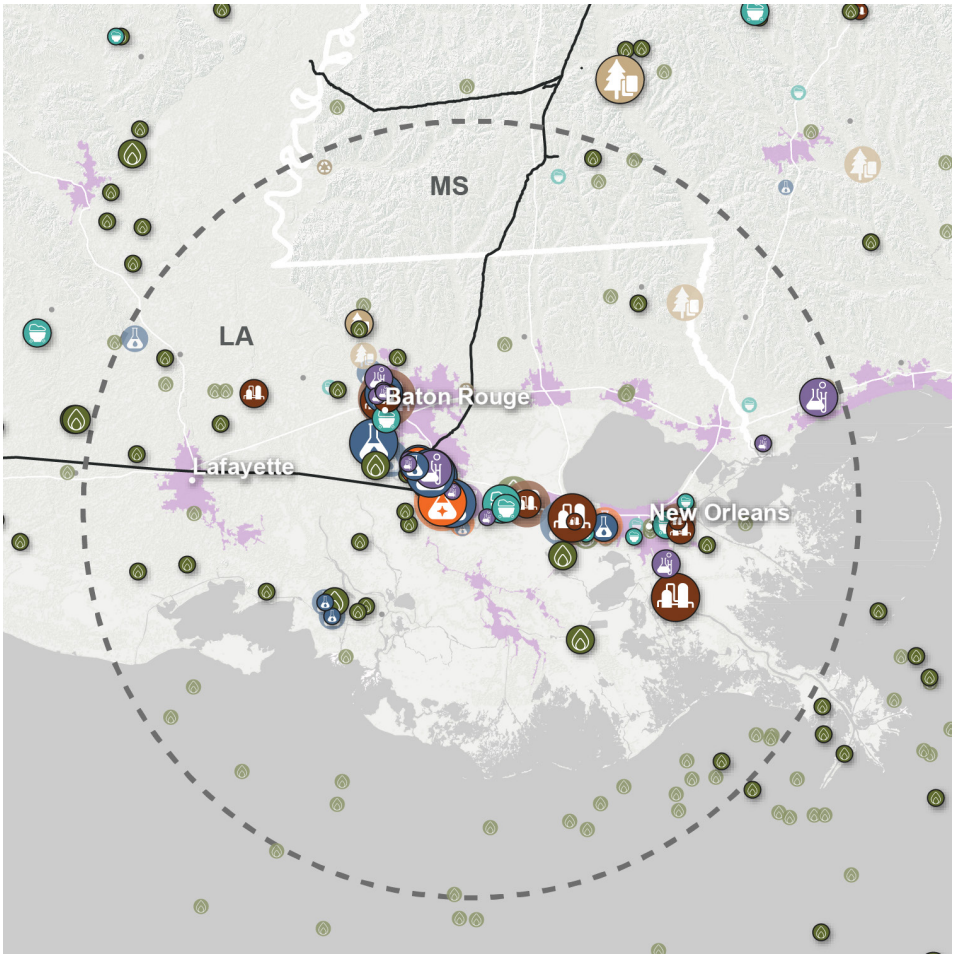
## Capture clusters of small-to-midsize industrial emitters




*Analysis by EFI Foundation and Horizon Climate Group identified regional clusters with high concentrations of small-to-midsize industrial (i.e., non-power plant) units, referred to as **capture targets**, that run frequently, are technically feasible for carbon capture retrofit, and have low $CO_2$ concentrations in their emissions that have not been a focus of prior study.*

With dense clustering of industrial activity, favorable geologic saline formations for $CO_2$ storage, existing $CO_2$ infrastructure, and supportive state policy, Louisiana has several important advantages for carbon capture, utilization, and storage (CCUS) hub formation. Capture targets in the Louisiana regional cluster are densely concentrated along the corridor between Baton Rouge and New Orleans. A variety of industries are interspersed along this corridor, including chemical and petrochemicals plants, refineries, and ammonia production sites (Figure 1). Numerous petroleum and natural gas (NG) system facilities are located throughout the cluster both on- and off-shore. An existing $CO_2$ pipeline running through the Louisiana cluster establishes a precedent for local $CO_2$ transport and storage.

Figure 1. Small-to-midsize industrial capture targets




**Regional cluster**
100-mile radius

**Capture targets**
*Sized by annual $CO_2$ emissions*
- Ammonia
- Chemicals
- Pet. & NG systems
- Misc. industry
- Petrochemicals
- Pulp & paper
- Refineries

**Other capture opportunities**
*Sized by annual $CO_2$ emissions*
- Ammonia
- Chemicals
- Pet. & NG systems
- Misc. industry
- Petrochemicals
- Pulp & paper
- Refineries
- Steel
- Waste

- All other industrial facilities

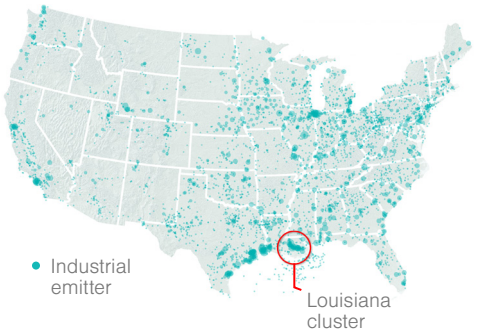
**Infrastructure**
- Urban area
- Interstate highway
- Existing $CO_2$ pipeline

Source: Elizabeth Abramson, Horizon Climate Group (2023), based on EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

# Regional CCUS Opportunities in Louisiana

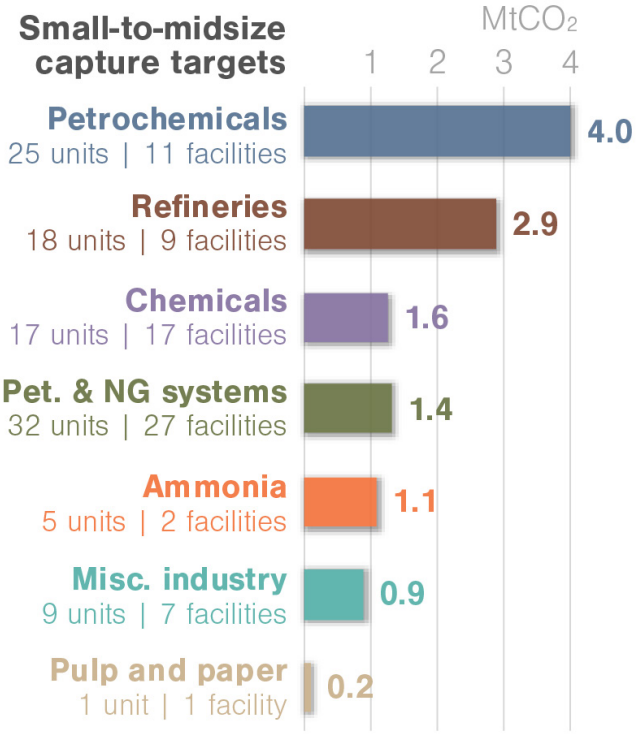
## Capture clusters of small-to-midsize industrial emitters

*Within the Louisiana cluster, this analysis identified 107 industrial units across 74 facilities as prime small-to-midsize capture targets.*




Petrochemical production, petroleum refining, and chemical production represent the greatest potential emissions reductions from capture targets in this cluster (Figure 2). Together, capture targets in this regional cluster account for 12 $MtCO_2$ per year, roughly 20% of the cluster's total $CO_2$ emissions from industrial facilities and 12% of the $CO_2$ emitted by industrial facilities across the state (Figure 3). Louisiana is in the latter stages of applying for primacy over $CO_2$ storage permitting, and has more planned Class VI storage wells than any other state.

Figure 2. Capture targets by sector and annual emissions



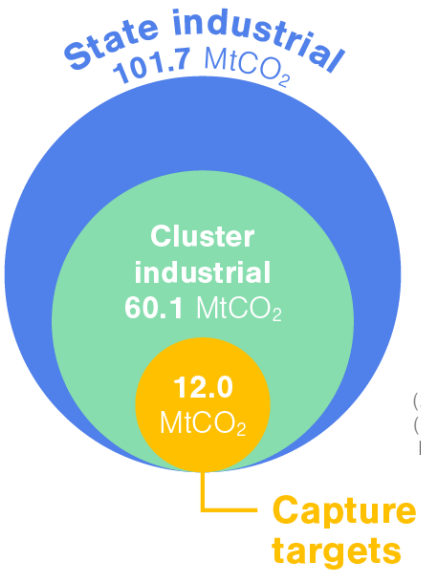

Source: Elizabeth Abramson, Horizon Climate Group (2023), based on EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

| **Louisiana regional cluster** At a glance | |
|---|---|
| Primary states involved | Louisiana |
| Statewide industrial emissions | 135.9 $MtCO_2e$ per year |
| Capture targets identified | 107 units<br>74 facilities<br>12.0 $MtCO_2$ per year |
| Top capture target industries | Petrochemicals<br>Refineries<br>Chemicals |
| Geologic saline storage | Present throughout |
| Existing $CO_2$ pipelines | Present |

Source: EPA GHG Inventory (2021), EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

$MtCO_2e$: million metric tons of $CO_2$-equivalent
$MtCO_2$: million metric tons of $CO_2$

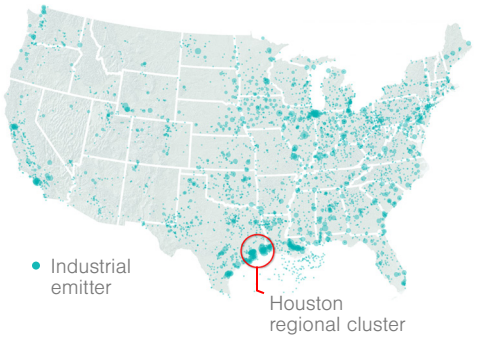
Figure 3. Annual emissions in context




Source: Elizabeth Abramson, Horizon Climate Group (2023), based on EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

# Regional CCUS Opportunities in the Greater Houston Area

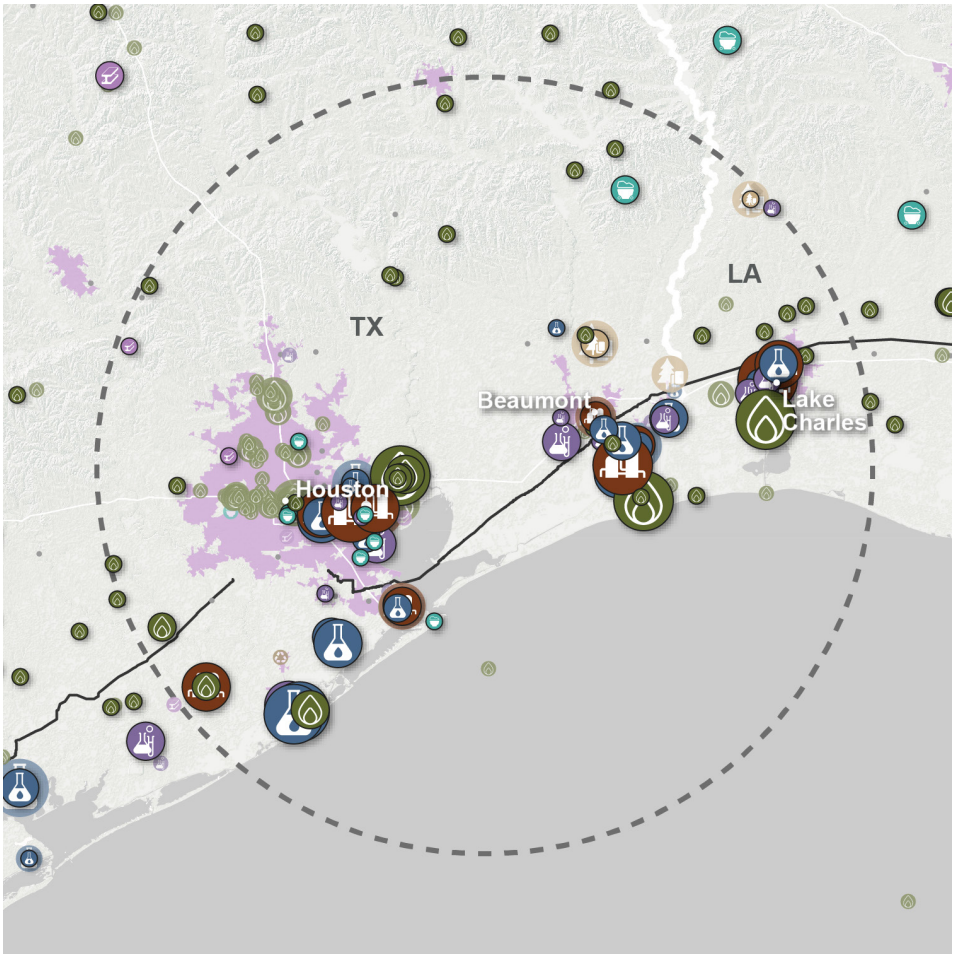
## Capture clusters of small-to-midsize industrial emitters




*Analysis by EFI Foundation and Horizon Climate Group identified regional clusters with high concentrations of small-to-midsize industrial (i.e., non-power plant) units, referred to as **capture targets**, that run frequently, are technically feasible for carbon capture retrofit, and have low $CO_2$ concentrations in their emissions that have not been a focus of prior study.*

The Texas Gulf Coast near the Houston metropolitan area is home to a high concentration of industrial operations in the refining, natural gas processing, chemicals and petrochemicals sectors. Its proximity to existing $CO_2$ pipelines and potential $CO_2$ storage in geologic saline formations give the Houston area a head start in forming an industrial ecosystem of $CO_2$ capture, utilization, and storage (CCUS). Capture targets in the Houston regional cluster are grouped around the cities of Houston, Beaumont, and Lake Charles, and include activites such as refining, gas processing, and chemical and petrochemical production, among others (Figure 1). An existing $CO_2$ pipeline runs along the route between these clusters, establishing a precedent of local $CO_2$ transport and storage.

Figure 1. Small-to-midsize industrial capture targets




**Regional cluster**
100-mile radius

**Capture targets**
*Sized by annual $CO_2$ emissions*
- Chemicals
- Pulp & paper
- Pet. & NG systems
- Refineries
- Misc. industry
- Steel
- Petrochemicals

**Other capture opportunities**
*Sized by annual $CO_2$ emissions*
- Chemicals
- Pulp & paper
- Pet. & NG systems
- Refineries
- Misc. industry
- Steel
- Petrochemicals
- Waste

- All other industrial facilities

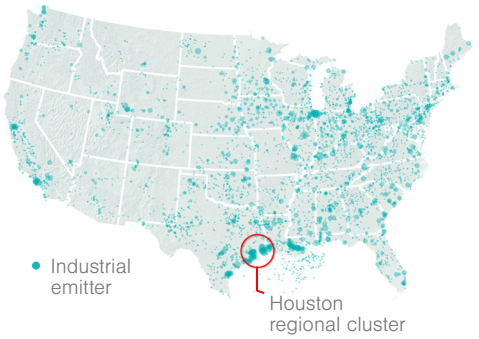
**Infrastructure**
- Urban area
- Interstate highway
- Existing $CO_2$ pipeline

Source: Elizabeth Abramson, Horizon Climate Group (2023), based on EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

# Regional CCUS Opportunities in the Greater Houston Area

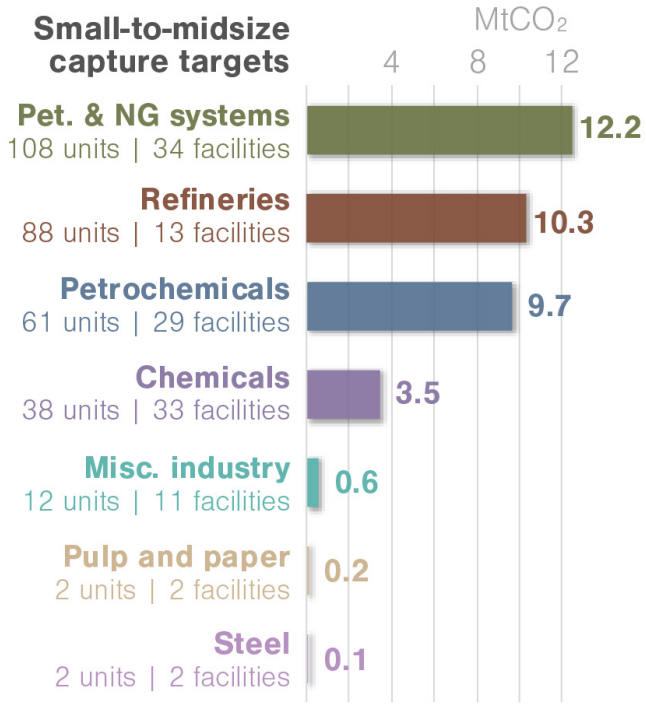
## Capture clusters of small-to-midsize industrial emitters

*Within the Houston cluster, this analysis identified 311 industrial units across 124 facilities as prime small-to-midsize capture targets.*




Petroleum and natural gas (NG) systems, petroleum refining, and petrochemcial production represent the greatest potential emissions reductions from capture targets in this cluster (Figure 2). Together, capture targets in this regional cluster emit 36.6 $MtCO_2$ per year, accounting for roughly 25% of the cluster's total $CO_2$ emissions from industrial facilities and equivalent to 15% of the total $CO_2$ emitted by industrial facilities in the state of Texas (Figure 3). Texas has fairly well-developed CCUS policy (pipeline permitting, liability provisions, etc.) and is applying for Class VI primacy.

Figure 2. Capture targets by sector and annual emissions



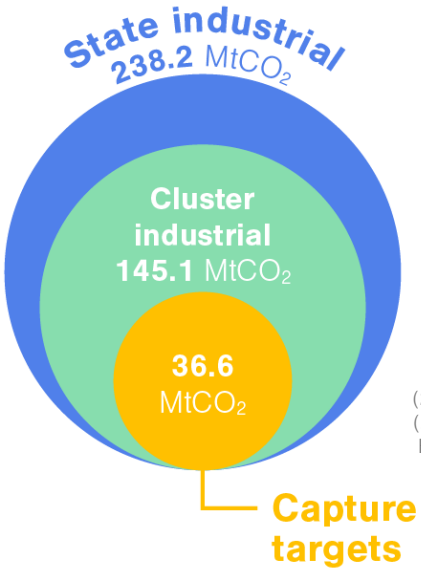

Source: Elizabeth Abramson, Horizon Climate Group (2023), based on EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

| **Houston regional cluster** At a glance | |
|---|---|
| Primary states involved | Texas and Louisiana |
| Statewide industrial emissions | 364.2 $MtCO_2e$ per year |
| Capture targets identified | 311 units<br>124 facilities<br>36.6 $MtCO_2$ per year |
| Top capture target industries | Petroleum and NG systems<br>Refineries<br>Petrochemicals |
| Geologic saline storage | Present throughout |
| Existing $CO_2$ pipelines | Present |

Source: EPA GHG Inventory (2021), EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

$MtCO_2e$: million metric tons of $CO_2$-equivalent
$MtCO_2$: million metric tons of $CO_2$

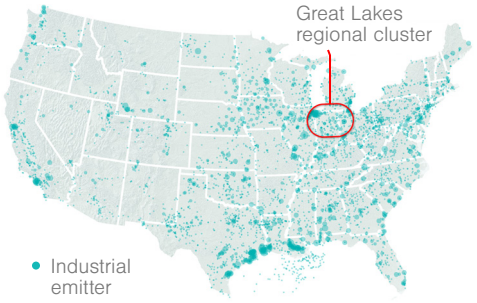
Figure 3. Annual emissions in context




Source: Elizabeth Abramson, Horizon Climate Group (2023), based on EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

# CCUS Opportunities in the Great Lakes Region

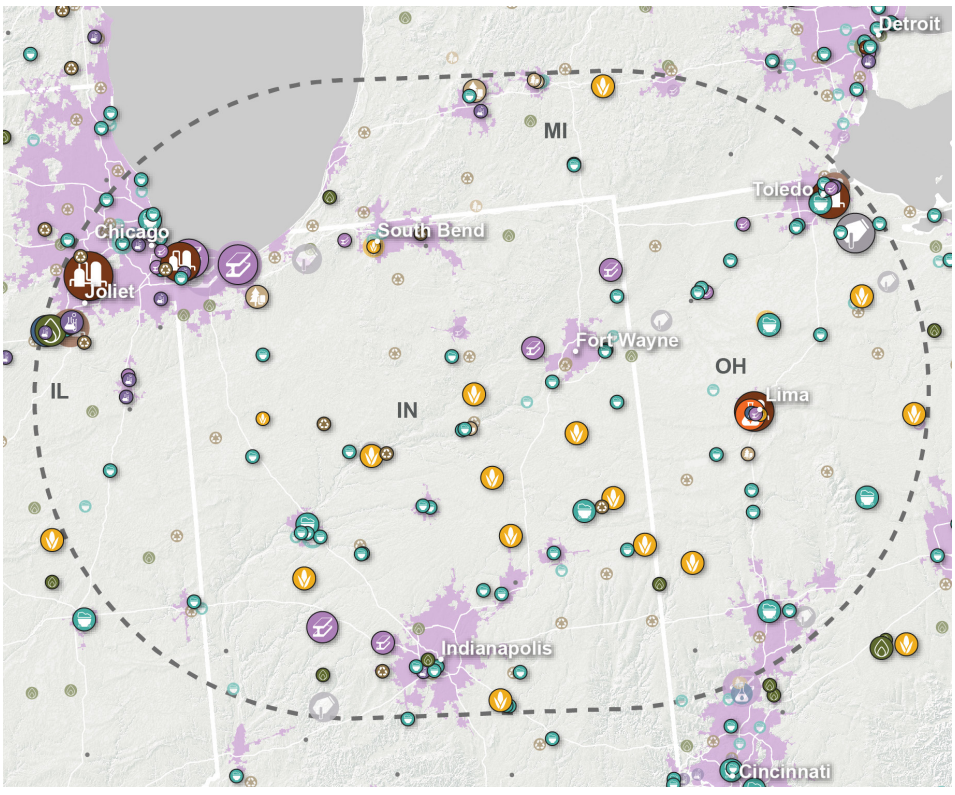
## Capture clusters of small-to-midsize industrial emitters




*Analysis by EFI Foundation and Horizon Climate Group identified regional clusters with high concentrations of small-to-midsize industrial (i.e., non-power plant) units, referred to as **capture targets**, that run frequently, are technically feasible for carbon capture retrofit, and have low $CO_2$ concentrations in their emissions that have not been a focus of prior study.*

The Great Lakes is home to numerous facilities that refine petroleum and produce steel, ethanol, and cement. These sectors present a good opportunity for the creation of a carbon capture, storage, and utilization (CCUS) hub or hubs when considered alongside the nearby potential $CO_2$ storage in geologic saline formations in Illinois, Indiana, and Michigan. Capture targets in the Great Lakes regional cluster are dispersed throughout the region, with ethanol production and miscellaneous industry sites dotted throughout the region's more rural areas. Several refineries, iron and steel plants, and cement plants are clustered around urban areas such as Chicago, Illinois, and Toledo and Lima, Ohio (Figure 1). Capture targets in the miscellaneous industry in the Great Lakes regional cluster include glass manufacturing, food processing, and auto manufacturing sites.

Figure 1. Small-to-midsize industrial capture targets




**Regional cluster**

**Capture targets**
*Sized by annual $CO_2$ emissions*

- Ammonia
- Cement
- Chemicals
- Ethanol
- Pet. & NG systems
- Misc. industry
- Petrochemicals
- Pulp & paper
- Refineries
- Steel
- Waste

**Other capture opportunities**
*Sized by annual $CO_2$ emissions*

- Ammonia
- Cement
- Chemicals
- Ethanol
- Pet. & NG systems
- Misc. industry
- Petrochemicals
- Pulp & paper
- Refineries
- Steel
- Waste

- All other industrial facilities

**Infrastructure**

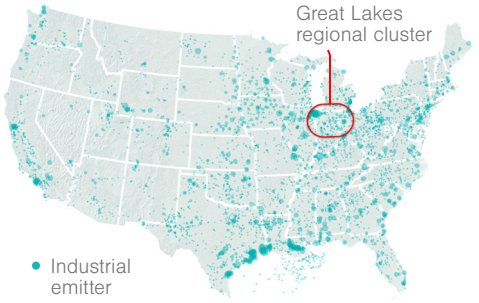
- Urban area
- Interstate highway

Source: Elizabeth Abramson, Horizon Climate Group (2023), based on EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

# CCUS Opportunities in the Great Lakes Region

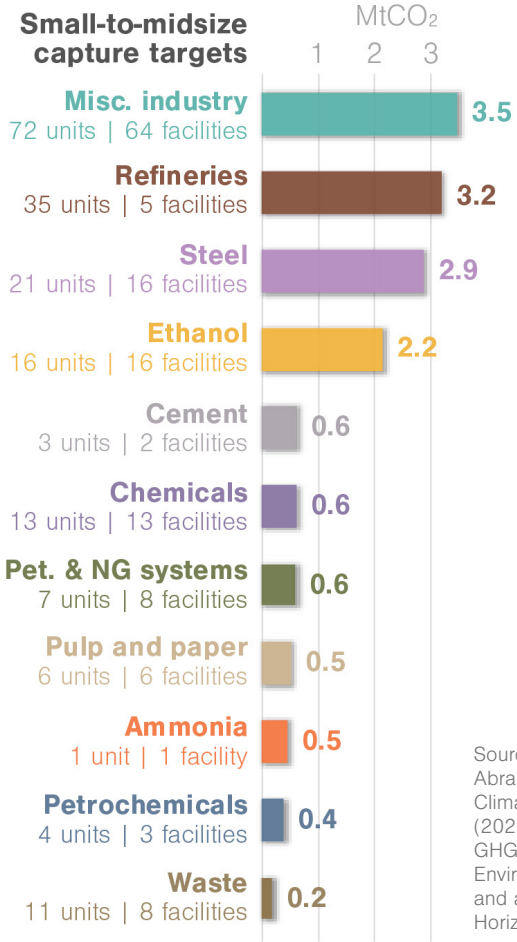
## Capture clusters of small-to-midsize industrial emitters

*Within the Great Lakes cluster, this analysis identified 189 industrial units across 140 facilities as prime small-to-midsize capture targets.*




Miscellaneous industry, petroleum refining, and iron and steel production represent the greatest potential emissions reductions from capture targets in this cluster (Figure 2). Together, capture targets in this cluster account for 15 $MtCO_2$ per year, roughly 24% of the cluster's total $CO_2$ emissions from industrial facilities and 11% of the total $CO_2$ emitted by industrial facilities in Illinois, Indiana, Ohio, and Michigan (Figure 3). None of the states in the Great Lakes cluster have applied for Class VI primacy, though this region has the first fully EPA-permitted Class VI wells. These states have relatively robust regulations for $CO_2$ infrastructure and some incentives for CCUS deployment.

Figure 2. Capture targets by sector and annual emissions



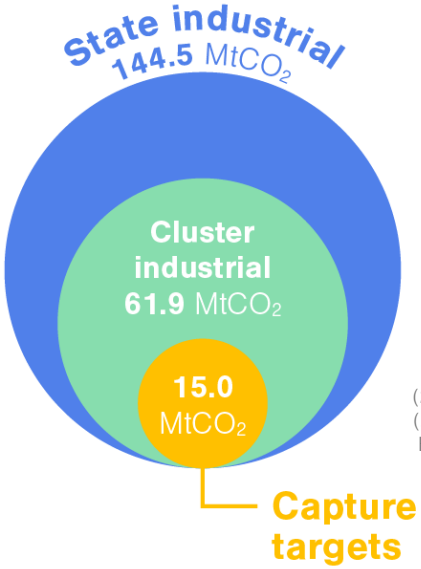

Source: Elizabeth Abramson, Horizon Climate Group (2023), based on EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

| **Great Lakes regional cluster** At a glance | |
|---|---|
| Primary states involved | Illinois, Indiana, Ohio, and Michigan |
| Statewide industrial emissions | 169.8 $MtCO_2e$ per year |
| Capture targets identified | 189 units<br>140 facilities<br>15.0 $MtCO_2$ per year |
| Top capture target industries | Misc. Industry<br>Refineries<br>Steel |
| Geologic saline storage | Present in some areas |
| Existing $CO_2$ pipelines | None |

Source: EPA GHG Inventory (2021), EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

$MtCO_2e$: million metric tons of $CO_2$-equivalent
$MtCO_2$: million metric tons of $CO_2$

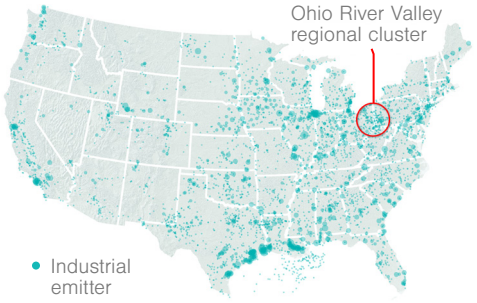
Figure 3. Annual emissions in context




Source: Elizabeth Abramson, Horizon Climate Group (2023), based on EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

# Regional CCUS Opportunities in the Ohio River Valley

## Capture clusters of small-to-midsize industrial emitters

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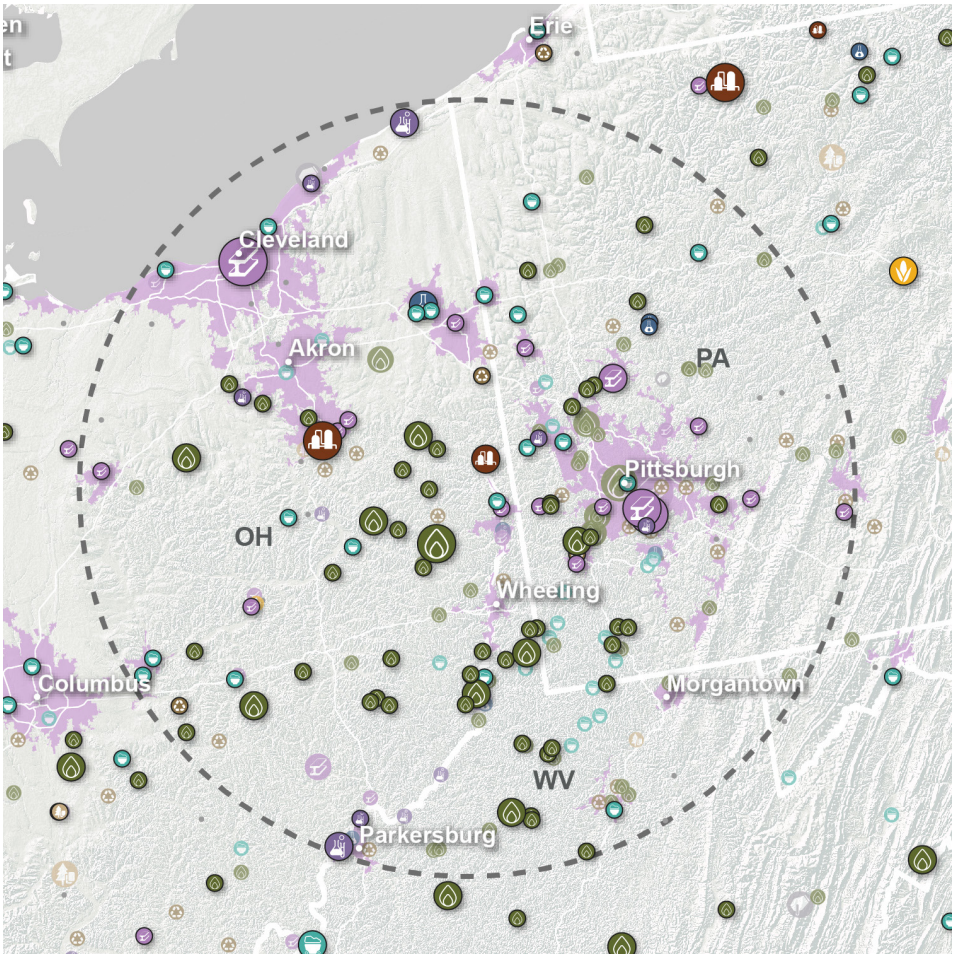
The tri-state area of Pennsylvania, Ohio, and West Virginia is home to a rich history of steel production and a variety of other industrial activity. A heavy presence of petroleum and natural gas systems and iron and steel production, as well as promising geologic storage formations to the west, anchor this region's potential to form a carbon capture, utilization, and storage (CCUS) hub or hubs. Capture targets are dispersed throughout the Ohio River Valley regional cluster, with numerous petroleum and natural gas (NG) system capture targets centered on the intersection of the three states in the cluster. Miscellaneous industry capture targets in this cluster include metal production, glass production, food processing, and minerals production sites. Capture targets in the iron and steel sector are visible around Pittsburgh and in Cleveland. (Figure 1).

Figure 1. Small-to-midsize industrial capture targets




**Regional cluster**
100-mile radius

**Capture targets**
*Sized by annual $CO_2$ emissions*
- Chemicals
- Refineries
- Pet. & NG systems
- Steel
- Misc. industry
- Waste
- Petrochemicals

**Other capture opportunities**
*Sized by annual $CO_2$ emissions*
- Cement
- Petrochemicals
- Chemicals
- Pulp & paper
- Ethanol
- Refineries
- Pet. & NG systems
- Steel
- Misc. industry
- Waste

- All other industrial facilities

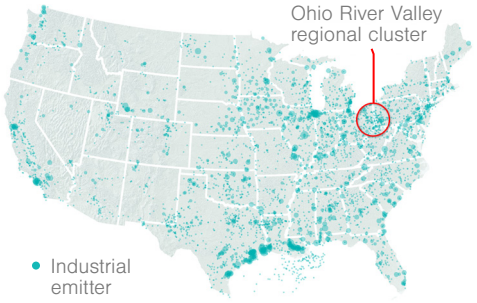
**Infrastructure**
- Urban area
- Interstate highway
- Existing $CO_2$ pipeline

Source: Elizabeth Abramson, Horizon Climate Group (2023), based on EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

# Regional CCUS Opportunities in the Ohio River Valley

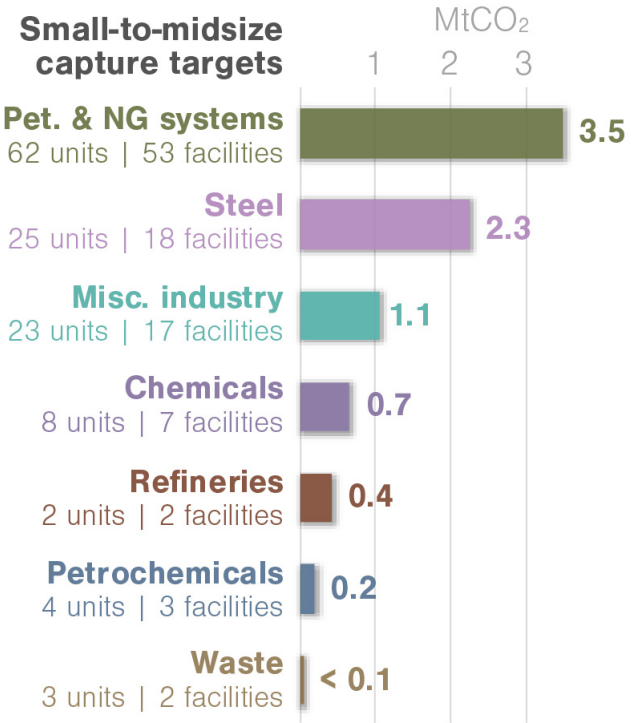
## Capture clusters of small-to-midsize industrial emitters

*Within the Ohio River Valley cluster, this analysis identified 127 industrial units across 112 facilities as prime small-to-midsize capture targets.*




Petroleum and natural gas systems, iron and steel production, and miscellaneous industry represent the greatest potential emissions reductions from capture targets in this cluster (Figure 2). Together, capture targets in this regional cluster account for 8.3 $MtCO_2$ per year, roughly 31% of the cluster's total $CO_2$ emissions from industrial facilities and 12% of the total $CO_2$ emitted by industrial facilities in Pennsylvania, Ohio, and West Virgina (Figure 3). West Virginia is in the early stages of applying for Class VI primacy, while Pennsylvania and Ohio have not applied. The states in this region have not established regulations for permitting $CO_2$ pipelines and have several other policy and regulatory gaps that could limit development.

Figure 2. Capture targets by sector and annual emissions



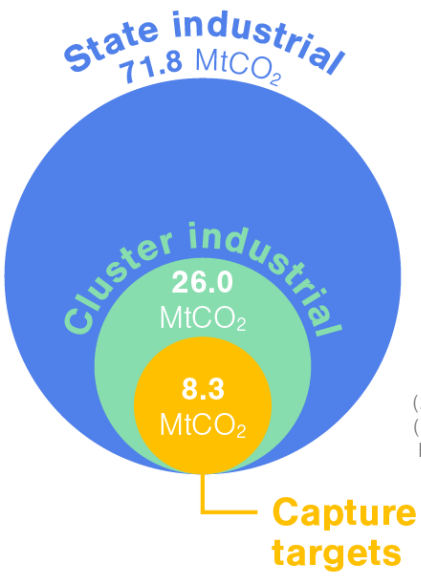

Source: Elizabeth Abramson, Horizon Climate Group (2023), based on EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

| **Ohio River Valley regional cluster** At a glance | |
|---|---|
| Primary states involved | Ohio, Pennsylvania, and West Virginia |
| Statewide industrial emissions | 173.1 $MtCO_2e$ per year |
| Capture targets identified | 127 units<br>112 facilities<br>8.3 $MtCO_2$ per year |
| Top capture target industries | Petroleum and NG systems<br>Steel<br>Misc. Industry |
| Geologic saline storage | None |
| Existing $CO_2$ pipelines | None |

Source: EPA GHG Inventory (2021), EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.

$MtCO_2e$: million metric tons of $CO_2$-equivalent
$MtCO_2$: million metric tons of $CO_2$

Figure 3. Annual emissions in context




Source: Elizabeth Abramson, Horizon Climate Group (2023), based on EPA GHGRP (2022), EPA Envirofacts (2023), and analysis by Horizon Climate Group.