Building To Net-Zero:
A U.S. Policy Blueprint for Gigaton-Scale CO₂ Transport and Storage Infrastructure

June 30, 2021

Anne Canavati, Project Manager
Alex Kizer, SVP of Research & Analysis
Meeting the NDC target will take rapid, economywide decarbonization

<table>
<thead>
<tr>
<th>Sector</th>
<th>GHG Reduction 2005-2018 (GtCO₂e)</th>
<th>NDC Baseline Year</th>
<th>New NDC Target of ~50% reduction from 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>6,577</td>
<td>2005</td>
<td>3,223</td>
</tr>
<tr>
<td>Industry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buildings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LULUCF/CDR</td>
<td>-662</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EPA data; EFI Analysis
Creating a new focus on building the enabling CO$_2$ infrastructure

Overview of CO$_2$ Infrastructure

Major Existing U.S. CO$_2$ Facilities
Unlocking a gigaton of emissions reductions and removal economywide

**Support** near-term, economywide emissions reduction and removal of CO₂ from the atmosphere.

**Preserve** jobs in hard-to-decarbonize sectors that underpin the nation’s clean industrial development.

**Create** new industries and additional good-paying jobs for U.S. workers, often relying on the skillsets common to existing emissions-intensive industries.

**Decarbonize supply chains** for manufacturing, fuels, and power generation.
CO₂ hub development is key to moving the industry up the CCUS learning curve, capturing economies of scale for CO₂ sources, and supporting other clean energy systems.

Our report includes more than a dozen policy recommendations supporting CO₂ infrastructure hub development, with an emphasis on labor and equity issues.

Our modeling analysis shows that building CO₂ infrastructure hubs could unlock significant CO₂ capture potential across many subsectors in Industry and Electricity.
About *Building to Net-Zero*

- Collaborate with union partners to understand **labor impacts** of policies
- Conduct **regional case studies** for CCS hubs in the **Ohio River Valley**, the **Gulf Coast**, and **Wyoming**
- Identify **opportunities** and **challenges** of deploying CO$_2$ infrastructure
- Make **policy recommendations** to the Legislative and Executive Branches
Testimonials from Labor Unions Included in Blueprint

“Passage of the SCALE Act is very important because that will begin the process of developing the infrastructure to get carbon to the places where it will be injected in the ground.”

“In our view, CCUS technologies can help preserve good jobs and create new ones. And those technologies can do so while reducing carbon emissions from essential industries that ensure U.S. economic health and global competitiveness.”

“[Policymakers should] increase funding for the development of the technology as well as to increase the funding for the demonstration projects that were included in the Energy Act that was passed last year—that bill called for six demonstration projects, two industrial, two gas, and two coal, but no money was appropriated for these projects.”

“[Expanding 45Q tax credits] is only a small piece of the puzzle. What is needed is a rapid development and deployment of the infrastructure that will be needed to move CO₂ and deploy CCUS.”

“Already, our Canadian Boilermakers have built CCUS facilities at Shell Quest in Edmonton, Alberta, SaskPower’s Boundary Dam in Estevan, Saskatchewan, and the NWR Sturgeon Refinery—part of the Alberta Carbon Trunk Line.”

“CCUS will be key for maintaining good manufacturing jobs as the global economy decarbonizes. It will be particularly important for industries like steel, cement, chemicals, and refining where United Steelworker members work.”

“The Boilermakers are encouraged by the interest and support that many U.S. lawmakers have shown in this critical technology, including the expansion of tax incentives for CCUS projects. We hope to see that momentum continue with additional CCUS-focused legislation and increased funding for the Department of Energy’s CCUS research and development.”

“CCUS holds potential for energy, environmental and economic benefits. Deploying the technology at scale can protect and create high-paying jobs in energy production and other heavy industries while allowing us to meet our mid-century goals for mitigating carbon emissions across the economy.”

“As a craft that constructs and repairs electric power plants, refineries, pulp and paper mills, and steel mills, we see enormous opportunities for our members with widespread adoption of CCUS.”

“Policymakers will need to ensure that our nation builds out the infrastructure and incentives to reduce the costs and ensure widespread deployment of carbon capture technology.”
## Case Studies of Potential CO₂ Hubs in the United States

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Emissions Reduction</th>
<th>Hub Facilities</th>
</tr>
</thead>
</table>
| Ohio River Valley           | 123 MtCO₂                 | Sources: 29 power generation, 19 iron and steel/aluminum, 5 chemicals manufacturing & production, 2 refinery, and 1 mineral plant  
Sink: 8 geologic storage sites, 855 miles of CO₂ pipelines |
| Wyoming                     | 43 MtCO₂                  | Sources: 10 power generation, 4 refinery, 2 chemicals manufacturing and production, and 1 mineral plant  
Sink: 4 geologic storage sites, 443 miles of CO₂ pipelines |
| Texas and Louisiana Gulf Coast | 171 MtCO₂               | Sources: 47 chemicals manufacturing and production, 31 power generation, 25 refinery, 23 gas processing, 21 hydrogen and ammonia production, 3 iron and steel/aluminum production, and 2 paper and pulp production plants  
Sinks: 5 geologic storage sites, 1,462 miles of CO₂ pipelines |
Challenges for Gigaton-Scale CO2 Infrastructure

**Inadequate Federal Policy Guidance**
- Unclear Role in Achieving Climate Targets
- Limited Existing Policy Designs
- New Policy Needed to Reach Gigaton-Scale

**Challenging Permitting Environment**
- Numerous Federal, State, and Local Jurisdictions Involved
- Uncertain Permitting Timelines
- Variability in CO2 Transport and Storage Regulation Among States

**Insufficient Revenues and Uncertain Costs**
- Limitations of the Section 45Q Tax Credit
- Challenge Aligning Players, Permitting, and Financing
- Lack of a Long-term Liability Framework

**Lack of Public Awareness and Varying Support**
- Low Public Awareness and Varied Opinions of CO2 Infrastructure
- Historic Inequities in Infrastructure Siting
- Concern of Continued Fossil Fuel Use
Policy Blueprint for Gigaton-Scale CO₂ Infrastructure Development

- Achieve gigaton scale CO₂ infrastructure by 2050
- Establish national target for carbon dioxide removal for 2030 and 2050
- Prioritize regional CO₂ hubs serving multiple users
- Enable scalable CO₂ storage business models
- Create opportunities to transition conventional fossil energy jobs to CO₂ management jobs
- Extend economic development funding to communities building CO₂ hubs
- Conduct public education and outreach to address environmental justice concerns of frontline communities
- Enhance federal capabilities to coordinate regulation and permitting of CO₂ infrastructure projects
- Strengthen implementation of UIC Class VI permitting process
- Establish an effective regulatory framework for siting interstate CO₂ pipelines
- Extend and expand provisions for tax credits for CO₂ capture and storage
- Expand federal funding for CO₂ storage and pipeline infrastructures
- Expand RFS eligibility for CCUS projects
- Establish a Federal scheme for managing long-term liability risk of stored CO₂
Define a National Strategy

• Set a national target for implementing one Gt per year of CO\textsubscript{2} infrastructure capacity
• Direct agencies to promote clean U.S. supply chains
• With Congress, support scalable business models for CO\textsubscript{2} storage
• Set a national CDR target (separate and distinct from NDC)

• Target funding for CO\textsubscript{2} infrastructure to offer equitable transitions for workers and communities
• Require federal agencies to designate CO\textsubscript{2} transport infrastructure corridors on federal lands
• Encourage deploying high-capacity CO\textsubscript{2} infrastructure for hub formation

• Coordinate the planning and development of hydrogen and CO\textsubscript{2} infrastructures

• With BLM, offer long-term leases for geologic storage of CO\textsubscript{2} on federal lands (BLM)
• With BOEM, provide a comprehensive regulatory framework for sub-seabed CO\textsubscript{2} storage in the Outer Continental Shelf
## Possible Ownership and Management Structures for CO2 Storage Business Models

<table>
<thead>
<tr>
<th>MODEL TYPE</th>
<th>OWNERSHIP</th>
<th>OPERATION</th>
<th>FINANCING</th>
<th>LIABILITY</th>
<th>PERMITTING</th>
<th>SITING</th>
<th>ANALOGS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRIVATE SECTOR MODEL</strong></td>
<td>Private</td>
<td>Private</td>
<td>Private with government subsidy</td>
<td>Private</td>
<td>Works with Governments</td>
<td>Works with Governments</td>
<td>Current CCUS Projects (e.g., ADM*, Petra Nova)</td>
</tr>
<tr>
<td><strong>UTILITY MODEL</strong></td>
<td>Government chartered, Private</td>
<td>Private</td>
<td>Private with government subsidy, Government regulated</td>
<td>Private, Government insurance model, Obligation to serve</td>
<td>Works with governments</td>
<td>Works with governments</td>
<td>Investor-owned interstate utilities in electricity, gas, telecoms, etc.</td>
</tr>
<tr>
<td><strong>PUBLIC AUTHORITY MODEL</strong></td>
<td>State/local government, Interstate compact</td>
<td>Private, Government</td>
<td>Government, Private partners</td>
<td>Government, Obligation to serve</td>
<td>Eminent domain authority, Works with governments</td>
<td>Eminent domain authority, Works with governments</td>
<td>Public utilities for electricity, etc.; interstate or intermunicipal agencies (e.g., DC WASA*, Port Authority); federal quasi-corporations (e.g., Amtrak, USPS)</td>
</tr>
<tr>
<td><strong>QUASI-FEDERAL GOVERNMENT MODEL</strong></td>
<td>Federal Government</td>
<td>Government, Contractors</td>
<td>Government, Private partners</td>
<td>Government, Regional or national jurisdiction</td>
<td>Eminent domain authority, Works with governments</td>
<td>Eminent domain authority, Works with governments</td>
<td>TVA, Power Marketing Administrations (e.g., BPA, WAPA, SWPA*)</td>
</tr>
</tbody>
</table>

*ADM=ARCHER DANIELS MIDLAND; DC WASA = DISTRICT OF COLUMBIA WATER AND SEWER AUTHORITY; TVA = TENNESSEE VALEY AUTHORITY; BPA = BONNEVILLE POWER ADMINISTRATION; WAPA = WESTERN AREA POWER ADMINISTRATION; SWPA = SOUTHWESTERN POWER ADMINISTRATION*
Establish an Effective and Efficient Regulatory Framework

- Create a Clean Energy Permitting Facilitation Office (CEPFO) to assist with timely and efficient CO₂ infrastructure permitting
- Convene an Interagency Working Group to develop an action plan for CO₂ hubs
- Explore and support the use of existing rights-of-way
- Explore and support the use of existing infrastructure for CO₂ pipelines

- Implement a government-wide assessment and solicit improvements for CO₂ infrastructure regulations (CEQ)

- Increase the funding to EPA for permitting Class VI storage wells

- Engage technical experts to inform its Class VI injection permitting review process
- Seek Congressional appropriations to increase the funding for permitting Class VI storage wells
**Enhance Policy Support and Strengthen Financial Incentives**

- With the Treasury Department, develop a federal liability framework for CO₂ storage
- Seek Congressional appropriations of $4 billion for cost-shared infrastructure investments over the next five years
- Consider the local benefits when evaluating grants for regional demonstration projects

- Increase funding to the Carbon Storage Program to develop sites for commercial-scale storage
- Appropriate $4 billion for cost-shared infrastructure investments over the next five years
- Modify the 45Q tax credit
- Reinstate and expand the 48C tax credit
- Update the Section 48A Advanced Coal tax credit

- Allow CCUS as a lifecycle GHG emission reduction technology pathway in the Renewable Fuel Standard (RFS)
### Create Workforce and Community Development Strategy

- Expand apprenticeship and pre-apprenticeship programs that train skills relevant to CO₂ transport and storage

- **With USDA and DOT, engage communities with displaced energy workers**
- Direct project developers to allocate a portion of funds for community engagement
- **Expand and standardize local outreach programs**

- Fund the Dislocated Worker Grant program and prioritize grants that translate skills
- Require projects receiving tax credits to pay prevailing wages consistent with Davis-Bacon

- Direct project developers to allocate a portion of funds for community engagement
- **Expand and standardize local outreach programs**
- Increase funding requests for existing EJ programs
- Improve EJScreen

- Extend abandoned mine reclamation funding to support economic development communities that are developing CO₂ transport and storage hubs

- Provide Economic Development Administration Assistance to Coal Communities program to fund infrastructure projects, brownfields redevelopment, and technical assistance and financing for non-infrastructure projects with an "economic development” focus