



LOW CARBON
VENTURES

CO₂ Transport Infrastructure 101, Economics, and Policy

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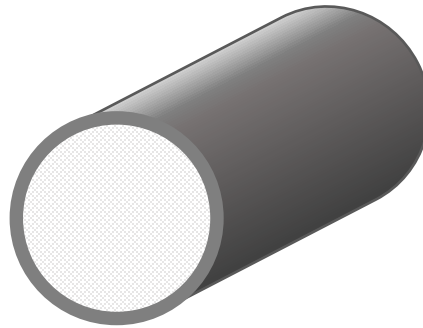
The Carbon Capture, Utilization, and Storage System



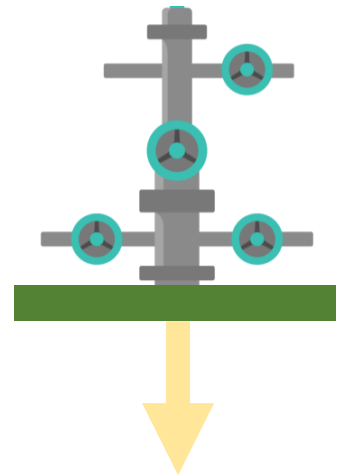
CO₂ Capture
(Industrial or
Atmospheric)



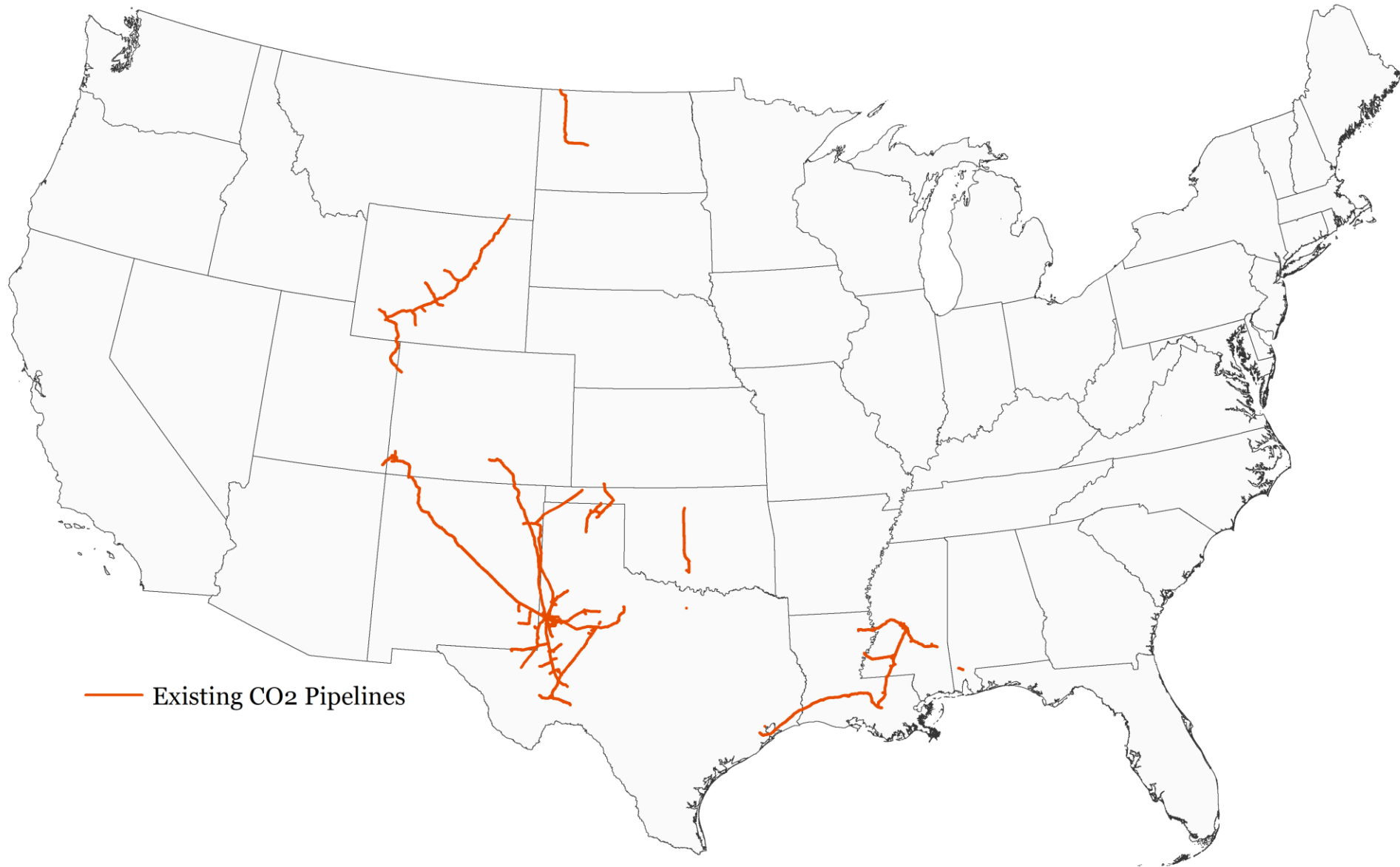
Transport



Storage
(or Utilization)



Existing CO₂ Pipelines – 5,000 miles

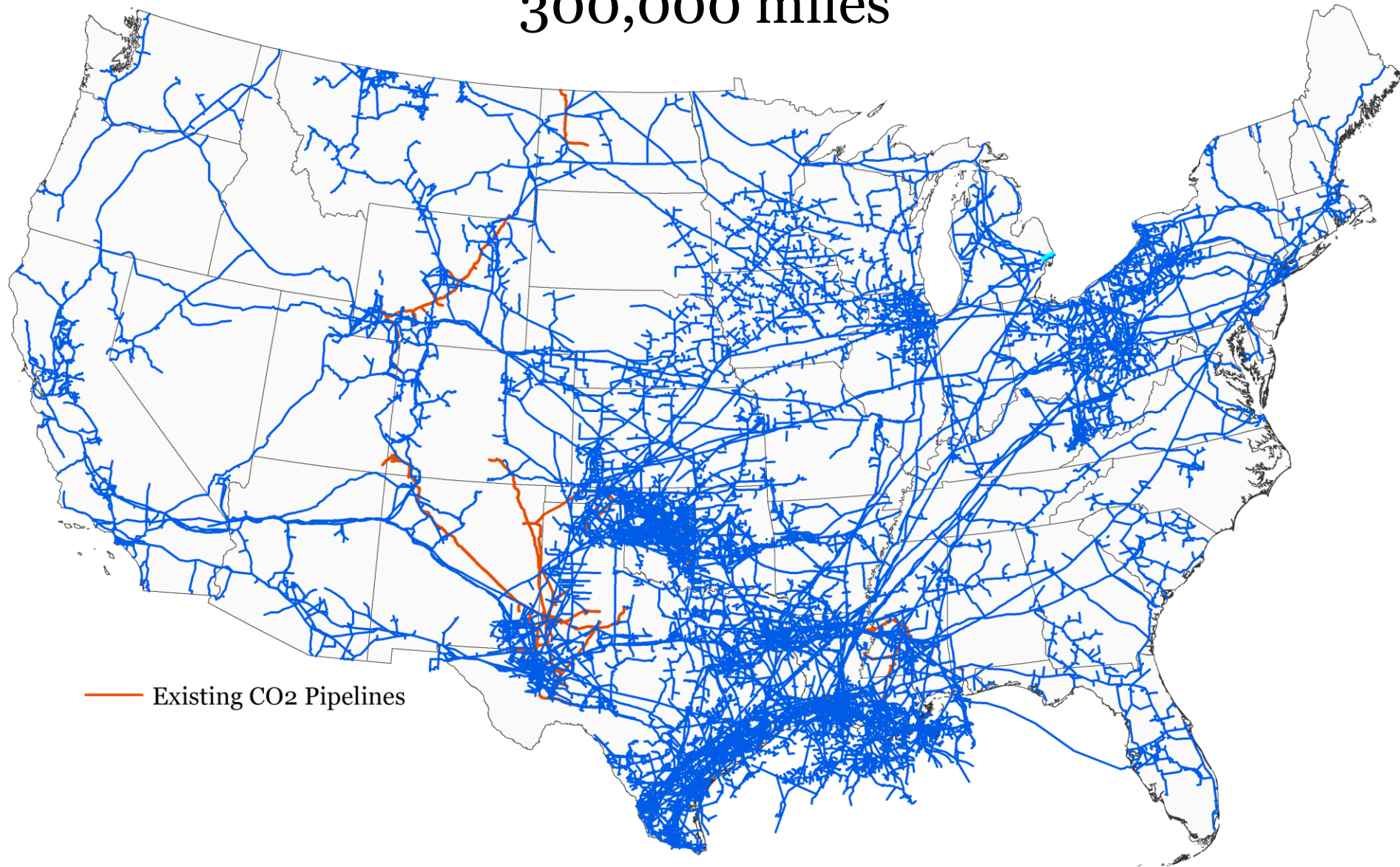


Existing CO₂ Pipelines

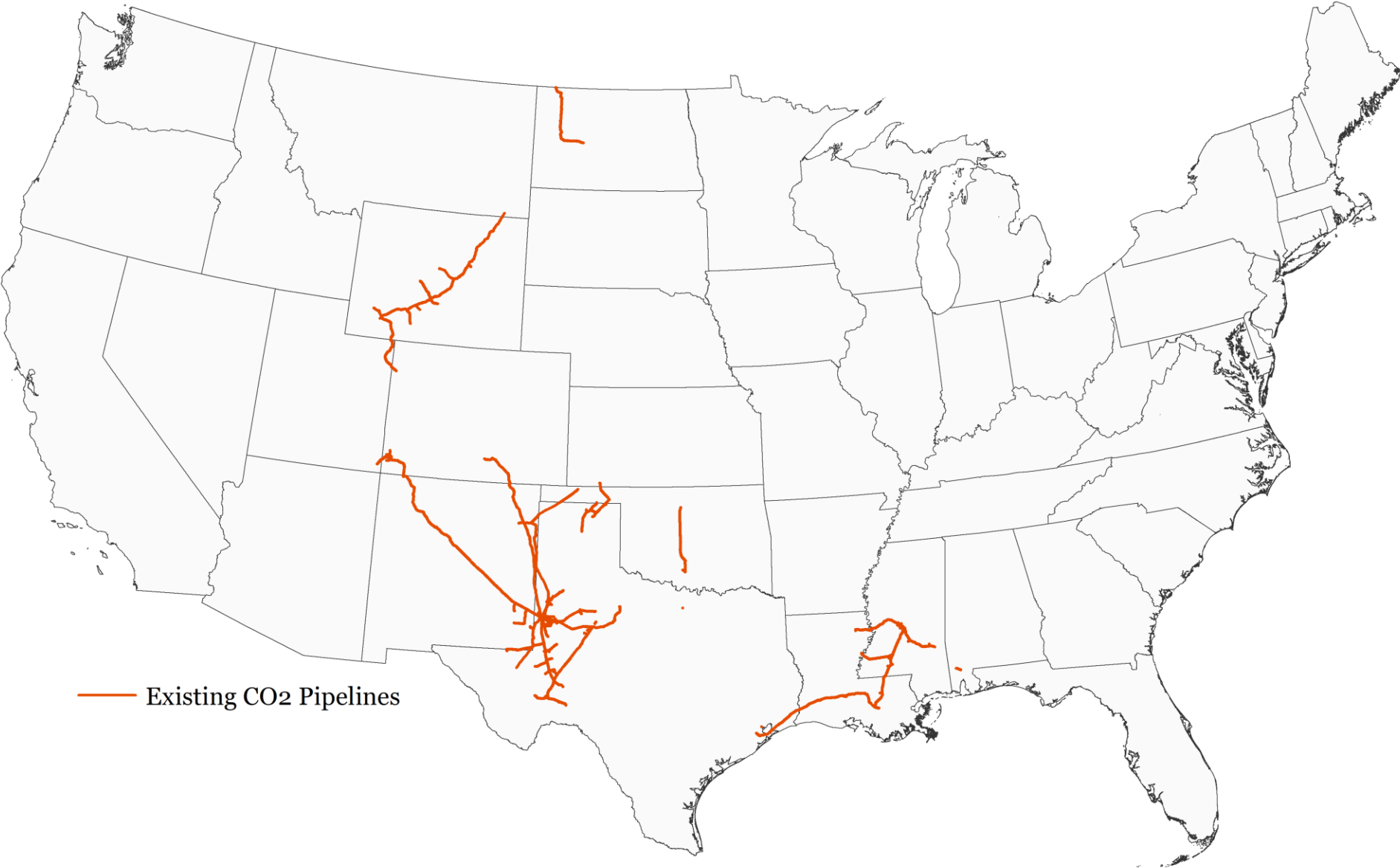
(Existing Natural Gas Interstate Pipelines)



300,000 miles

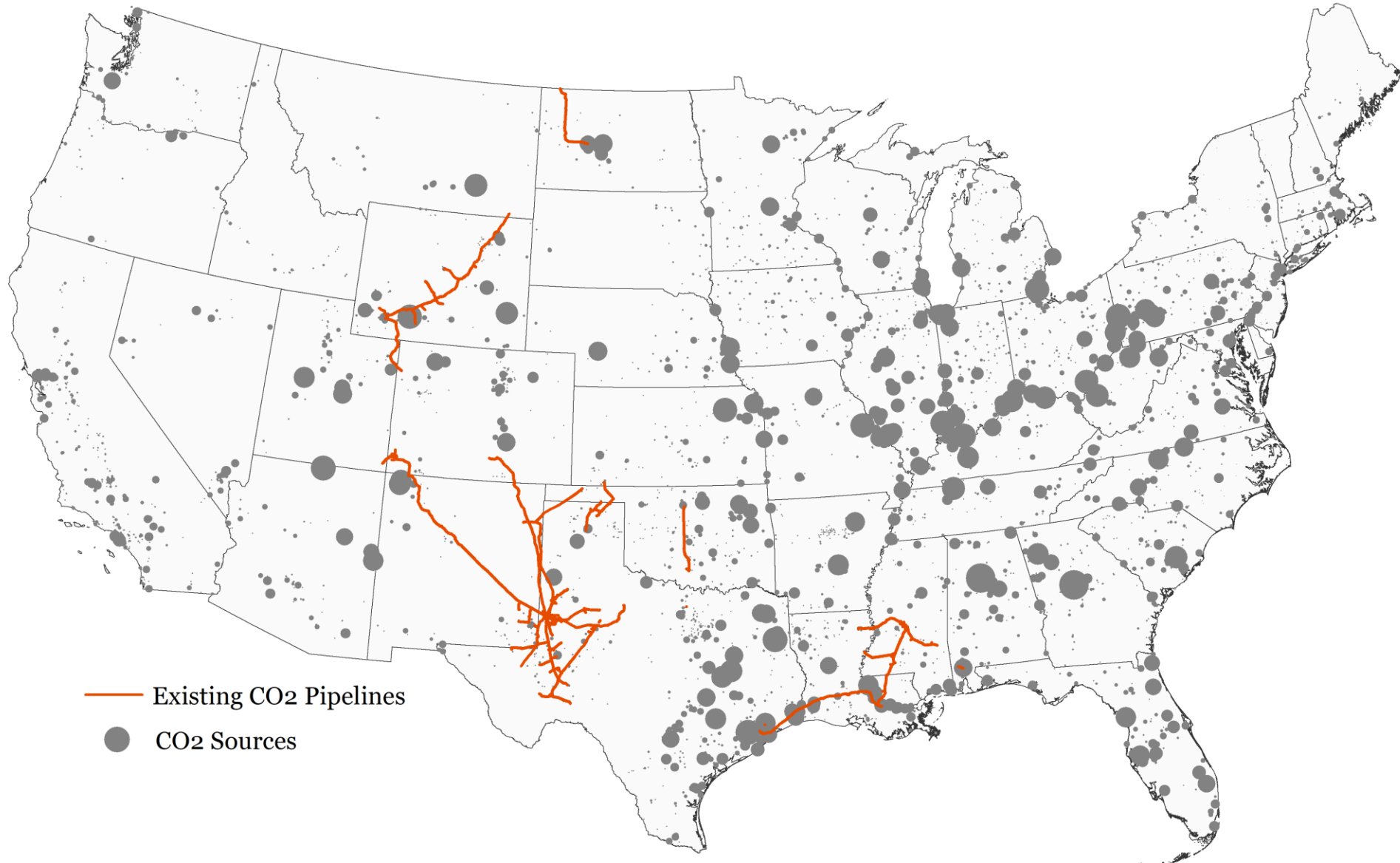


— Existing CO2 Pipelines



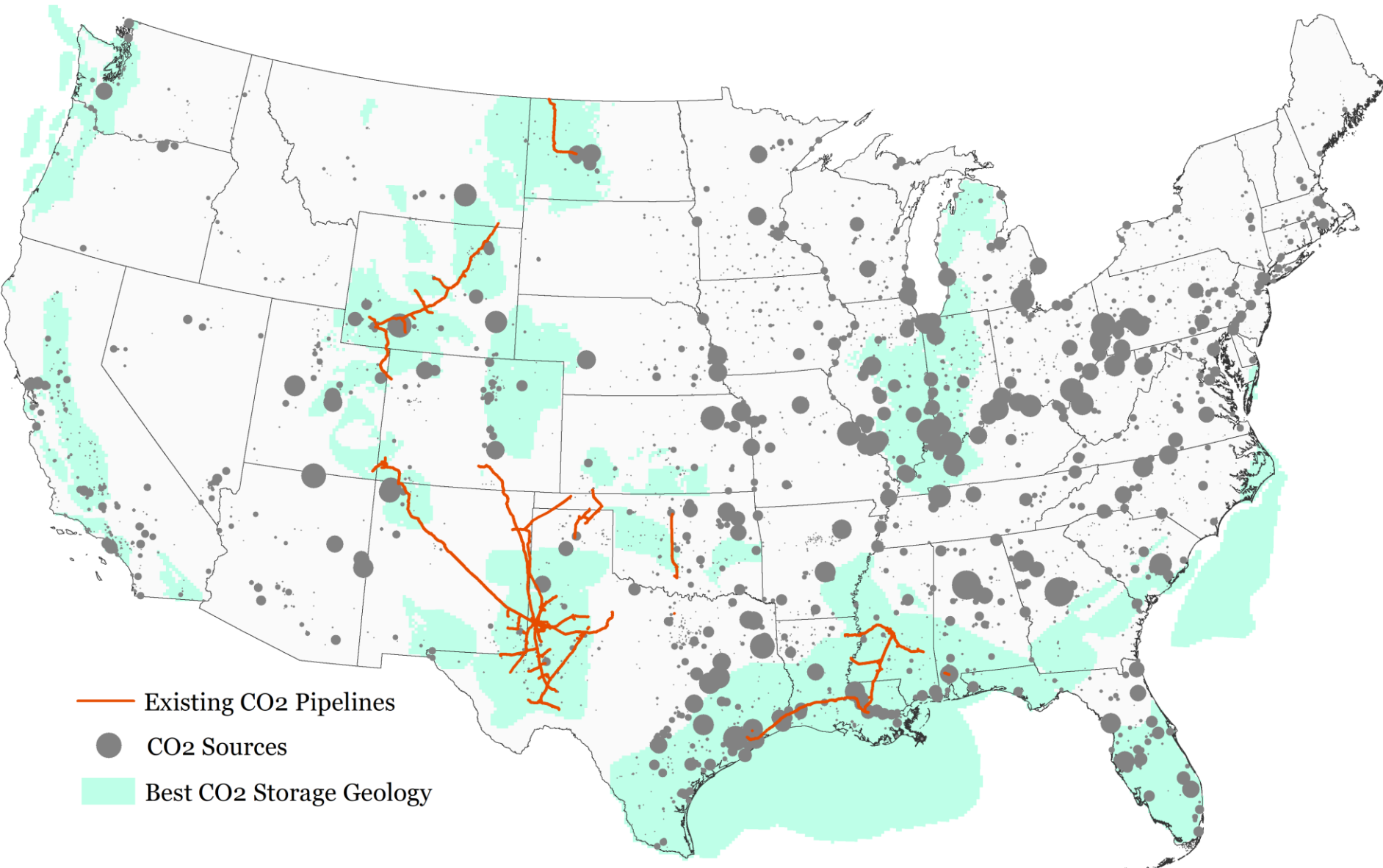
Existing CO2 Pipelines

CO₂ Sources



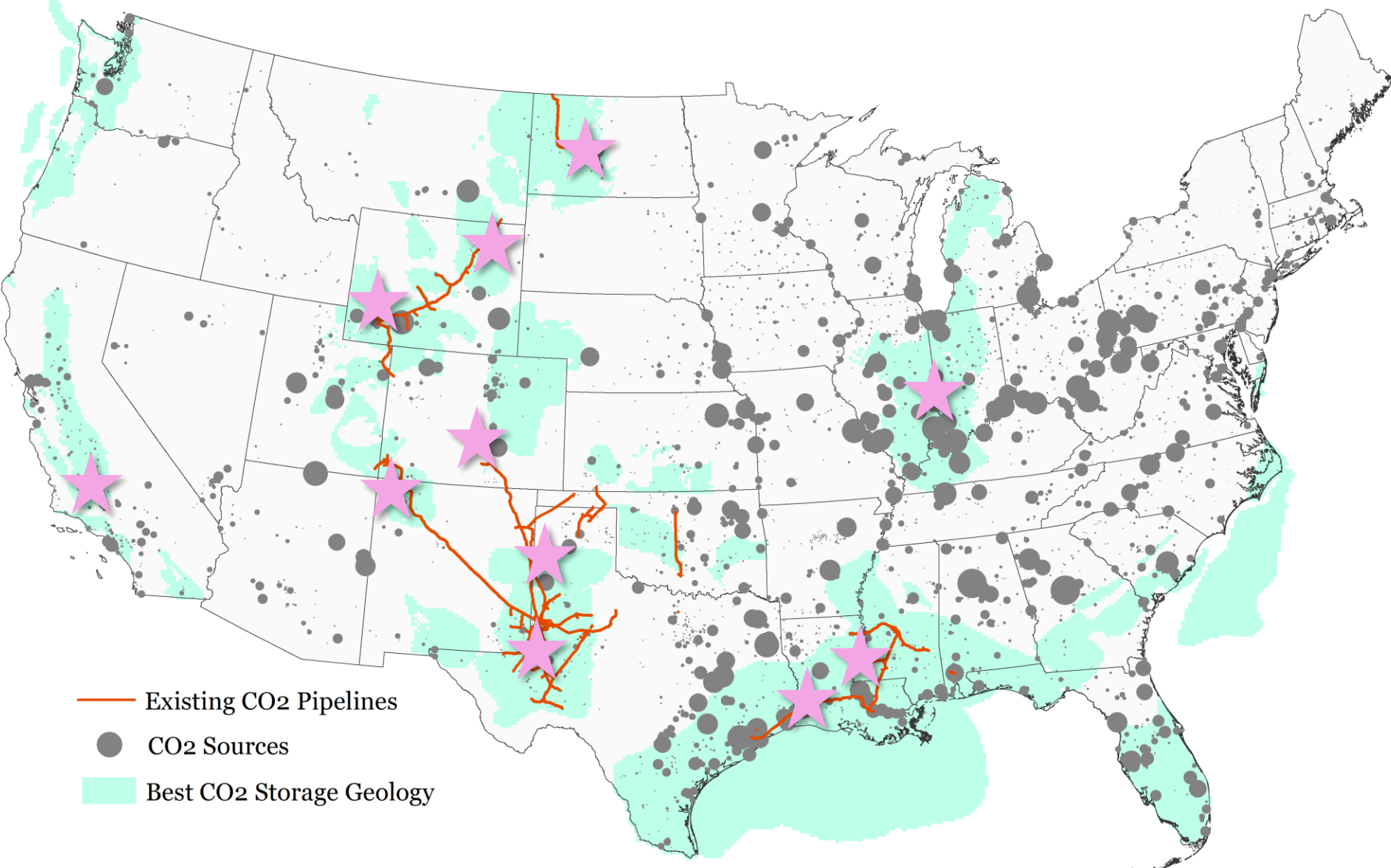
- Existing CO2 Pipelines
- CO2 Sources

Best CO₂ Storage Geology



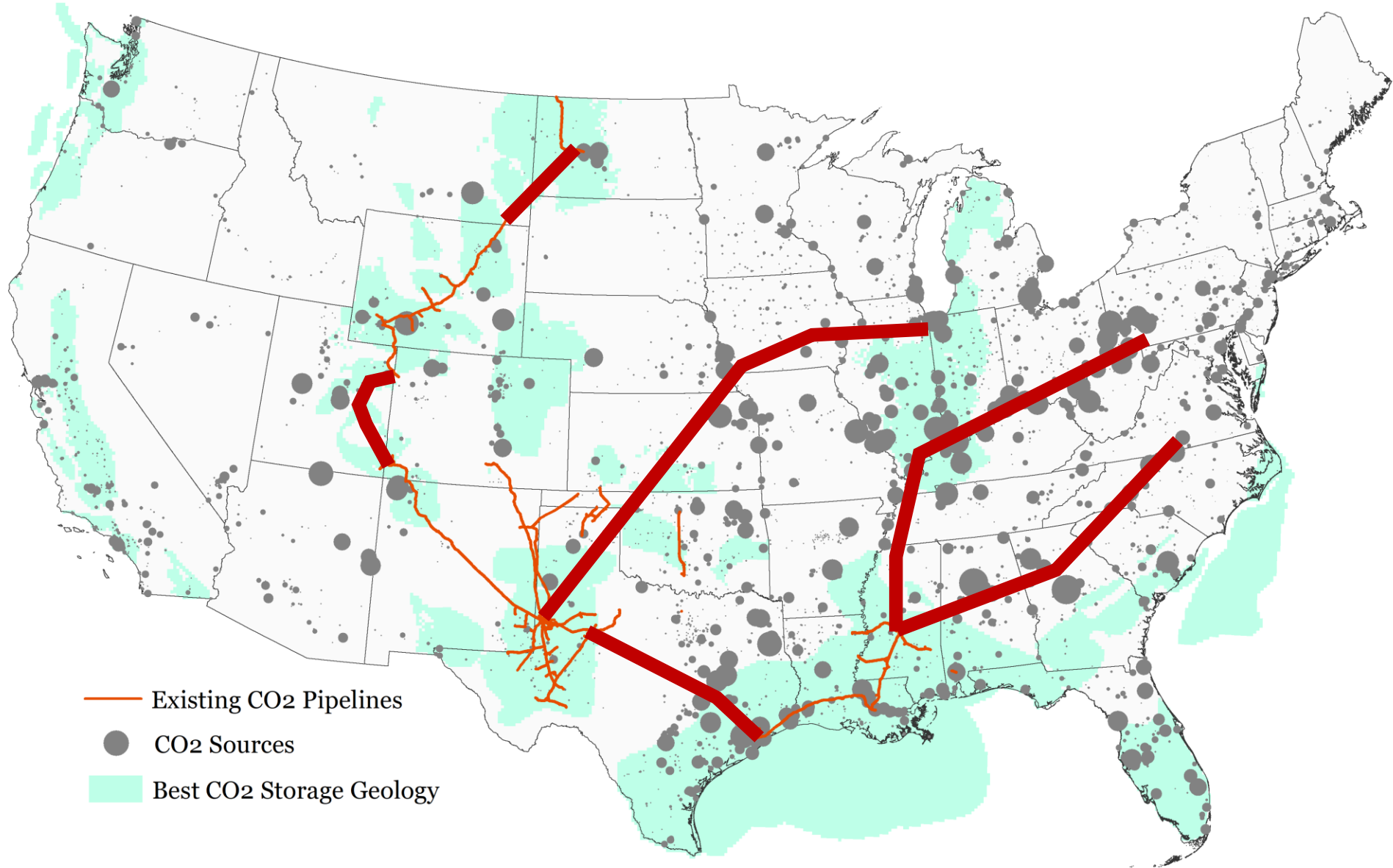
- Existing CO₂ Pipelines
- CO₂ Sources
- Best CO₂ Storage Geology

Announced Potential 45Q Projects



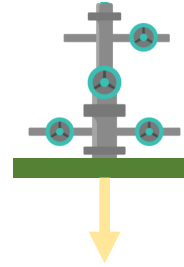
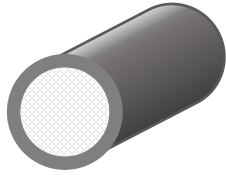
- Existing CO2 Pipelines
- CO2 Sources
- Best CO2 Storage Geology

Potential Interstate CO₂ Trunk Pipelines



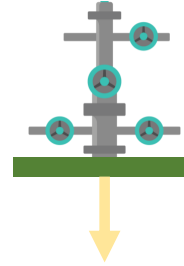
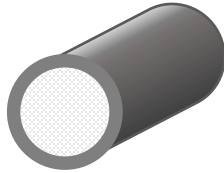
- Existing CO₂ Pipelines
- CO₂ Sources
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CCUS System Economics

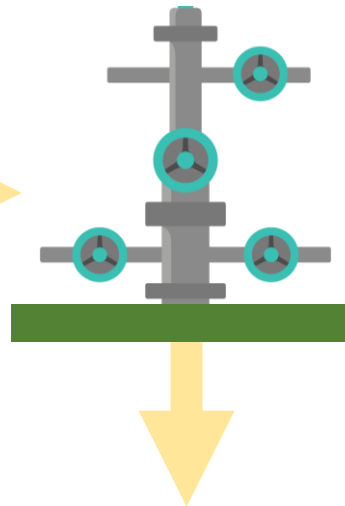
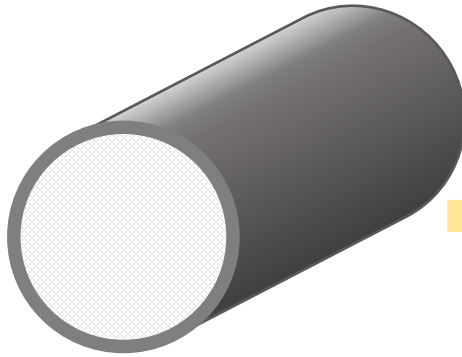
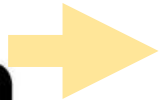
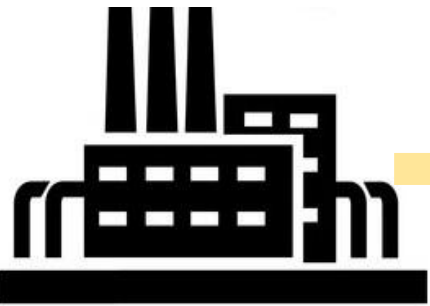


\$
per ton

CCUS System Economics: Economy of Scale



\$
per ton



\$
per ton



The Importance of CO₂ Transport Infrastructure

1. Enable capture of more CO₂ from more regions



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2. Realizing economies of scale



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Trunk CO₂ pipeline infrastructure will lower system costs and risks, enabling more CCUS deployment, more learning, innovation, and cost reduction, and therefore even more deployment and scale-up in a virtuous cycle.

But, There Are Critical Barriers to Deployment





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1. Cost / capital intensity

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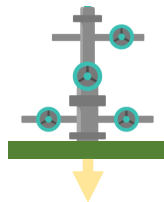
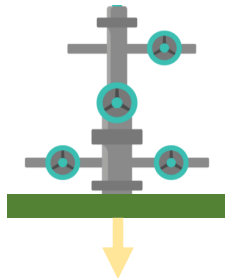
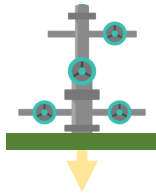
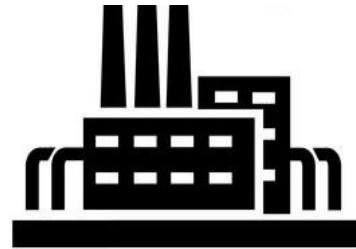
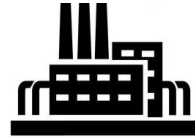
1. Cost / capital intensity
2. Chicken-and-egg

But, There Are Critical Barriers to Deployment

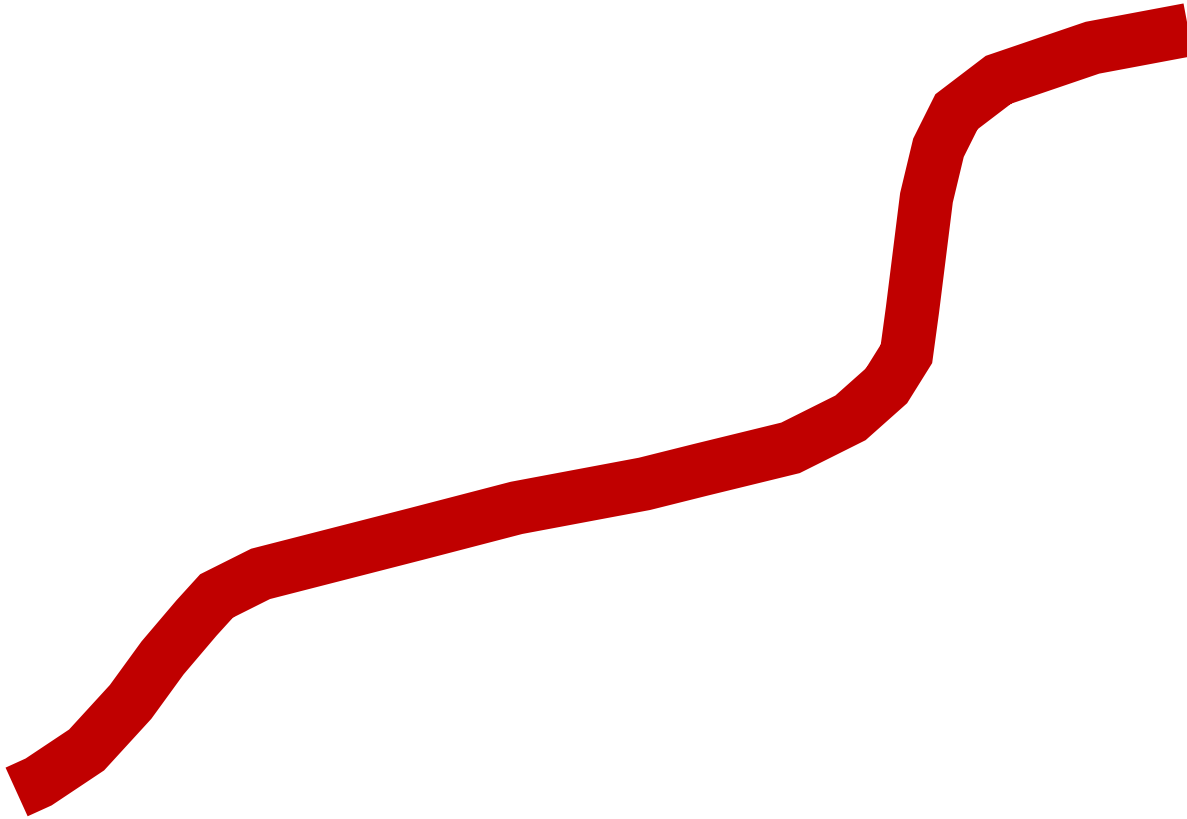


1. Cost / capital intensity
2. Chicken-and-egg
3. Economy of scale / first-mover disadvantage

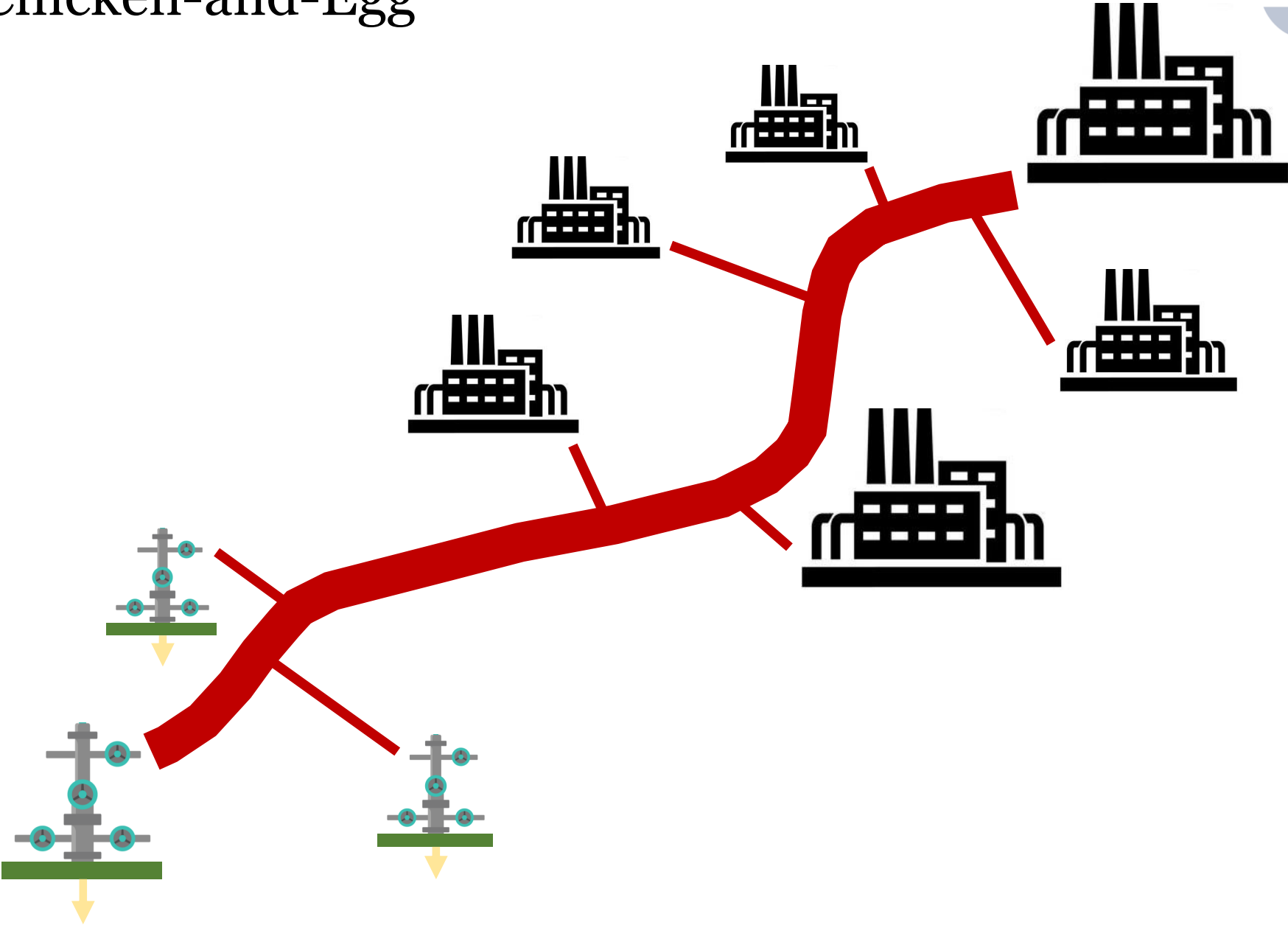
Chicken-and-Egg



Chicken-and-Egg

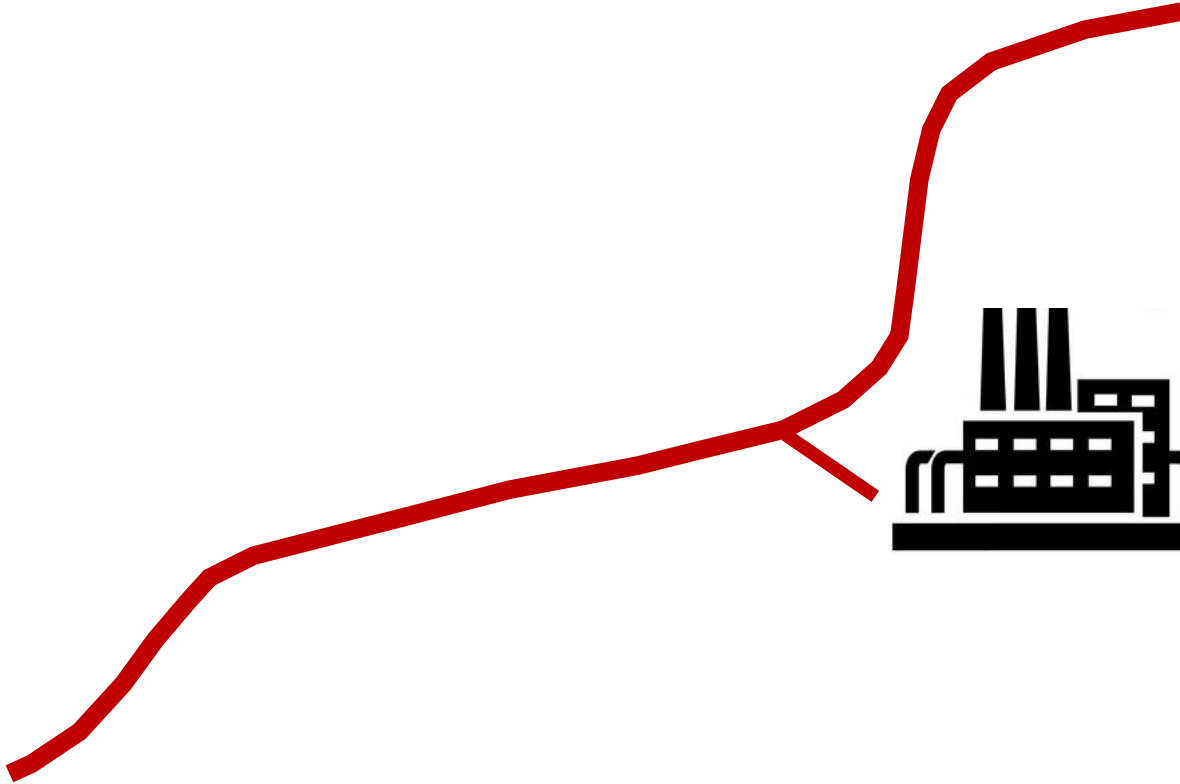
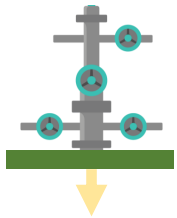


Chicken-and-Egg



Economy of Scale

First-Mover Disadvantage

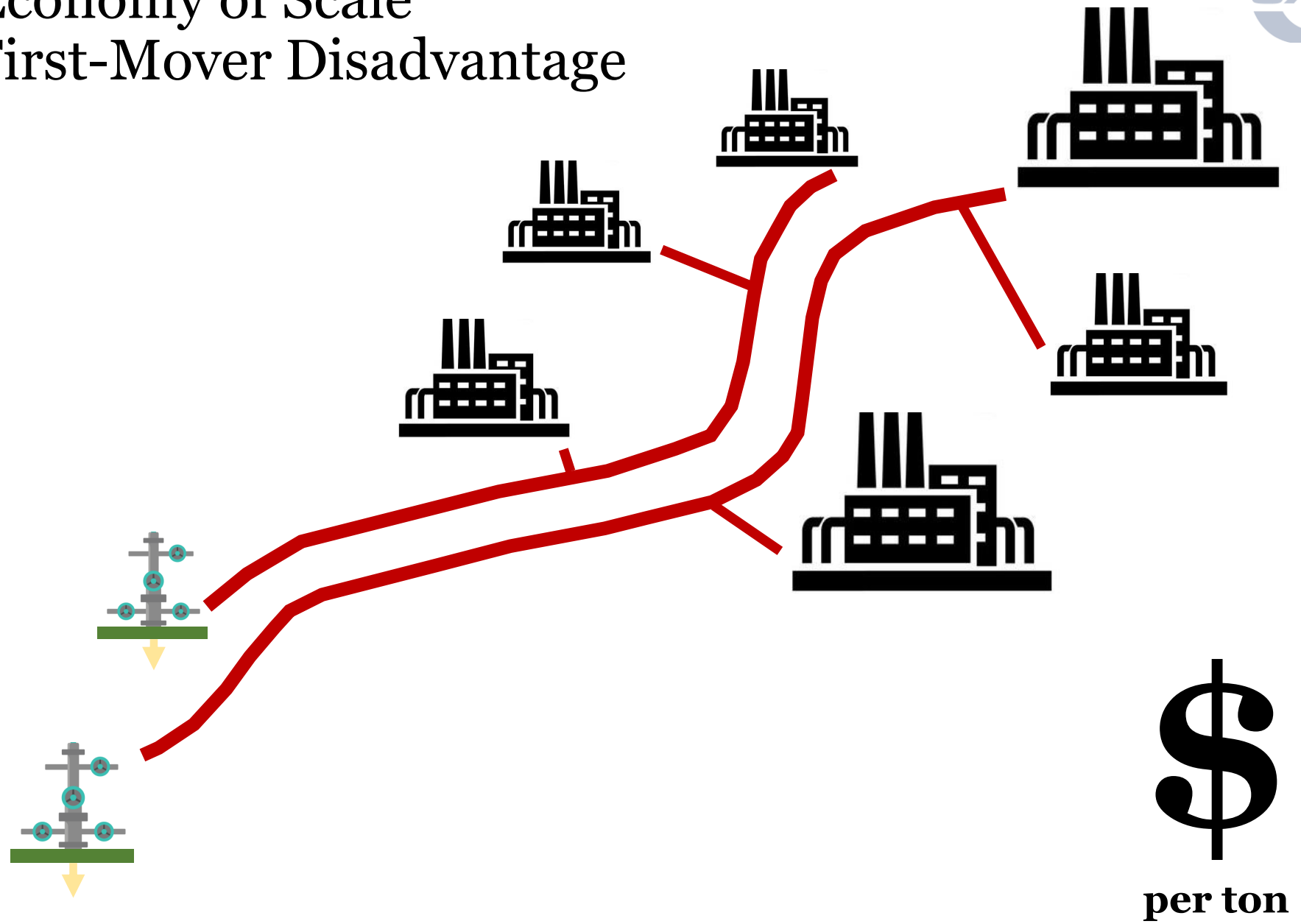


\$

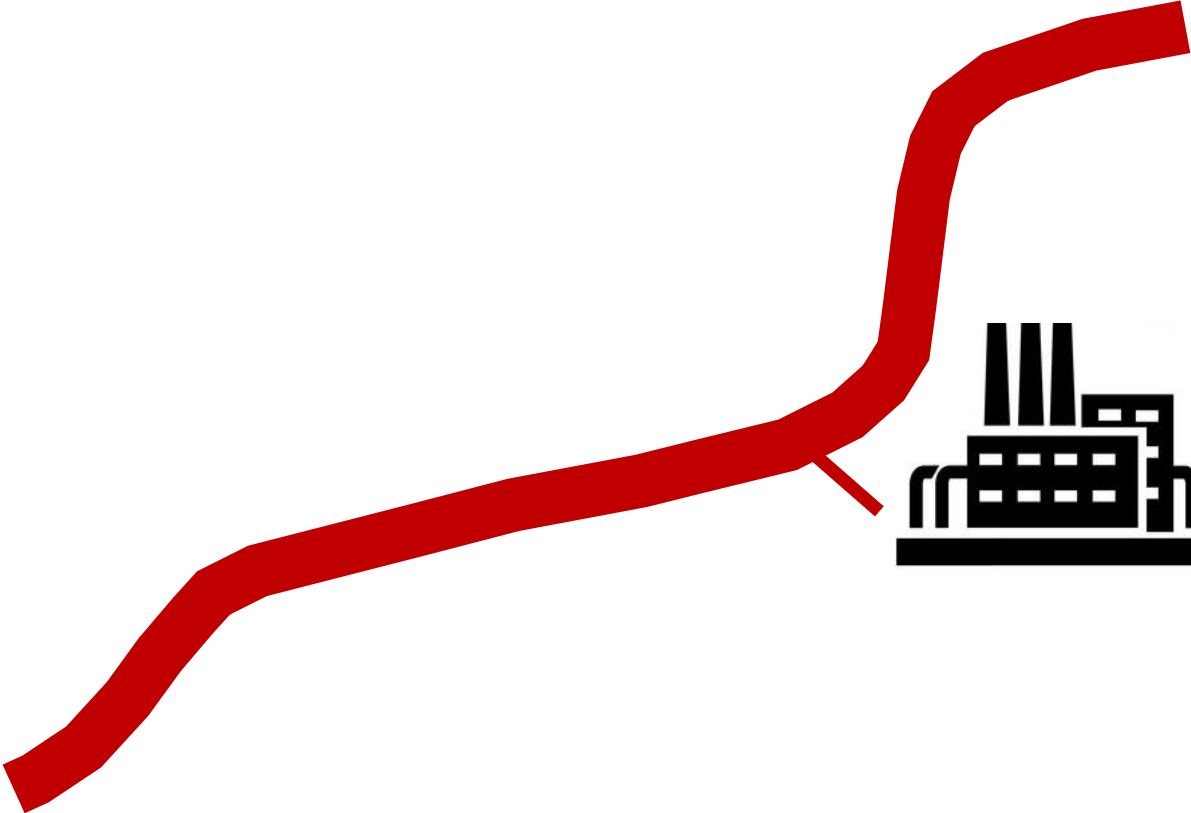
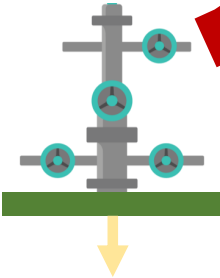
per ton

Economy of Scale

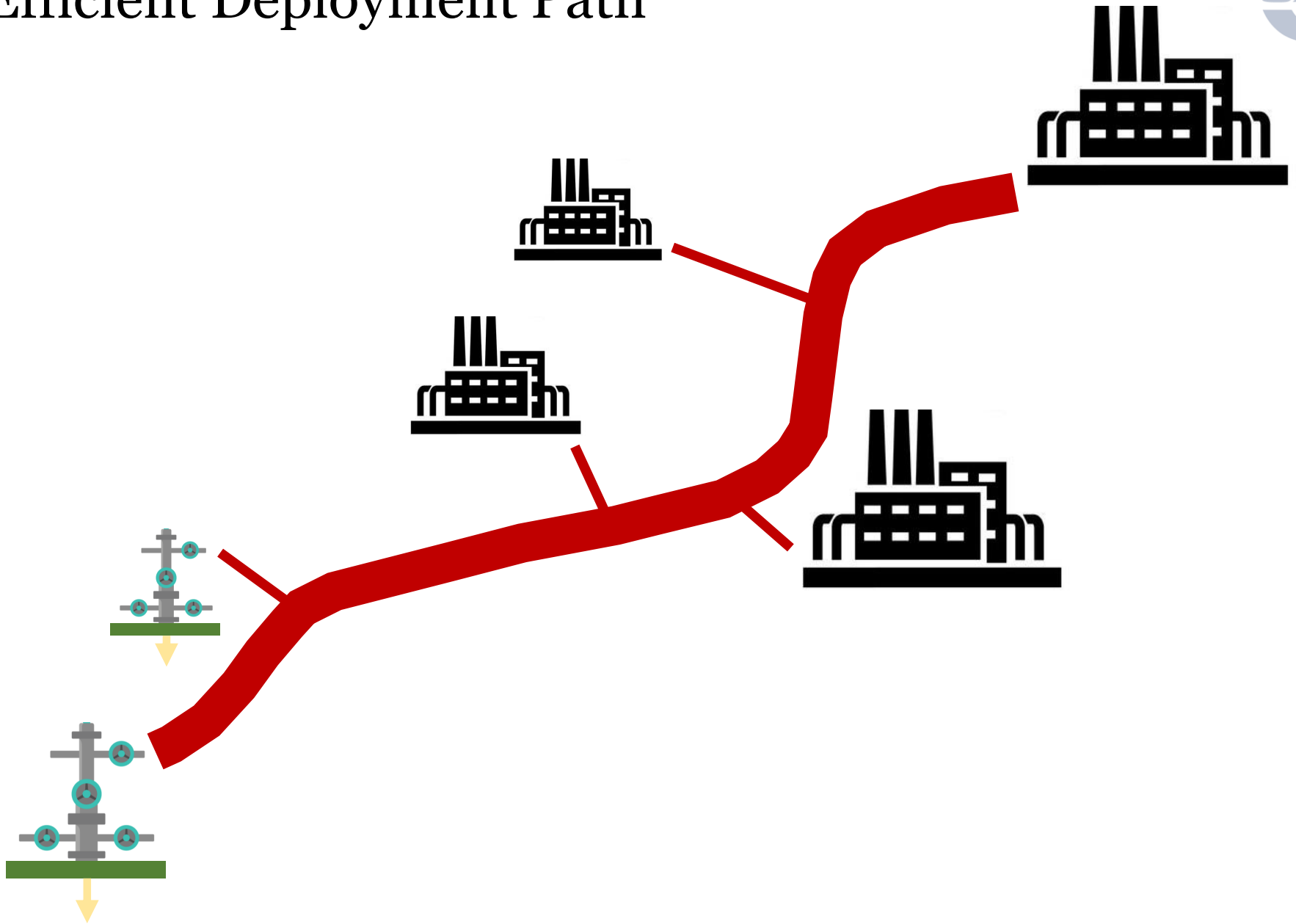
First-Mover Disadvantage



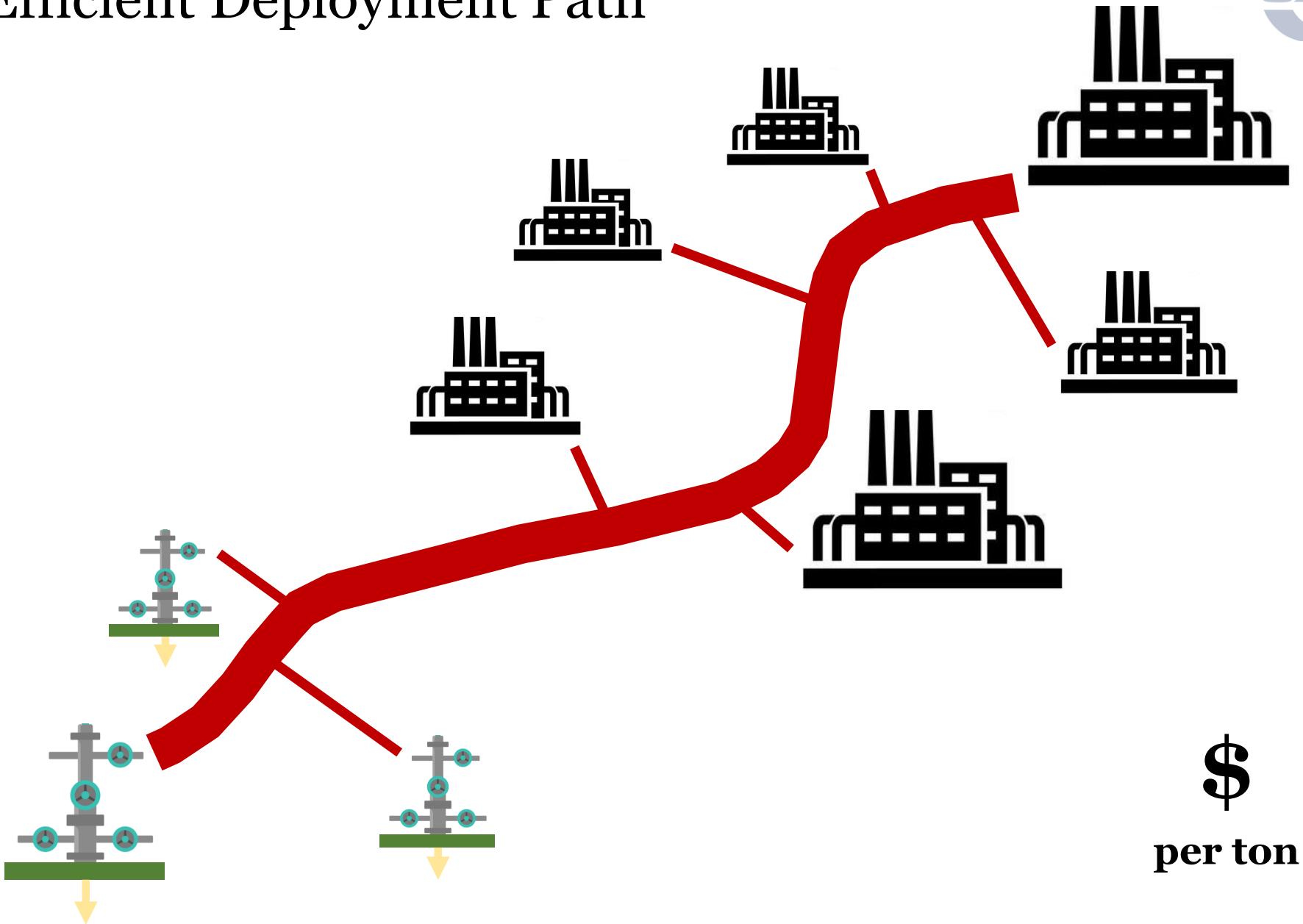
Efficient Deployment Path



Efficient Deployment Path



Efficient Deployment Path



\$
per ton

Essential Role for Government Policy





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1. Reduce financing cost

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1. Reduce financing cost
2. Overcome Chicken-and-Egg

Essential Role for Government Policy

1. Reduce financing cost
2. Overcome Chicken-and-Egg
3. Ensure sufficient scale

Past Example: First Transcontinental Railroad

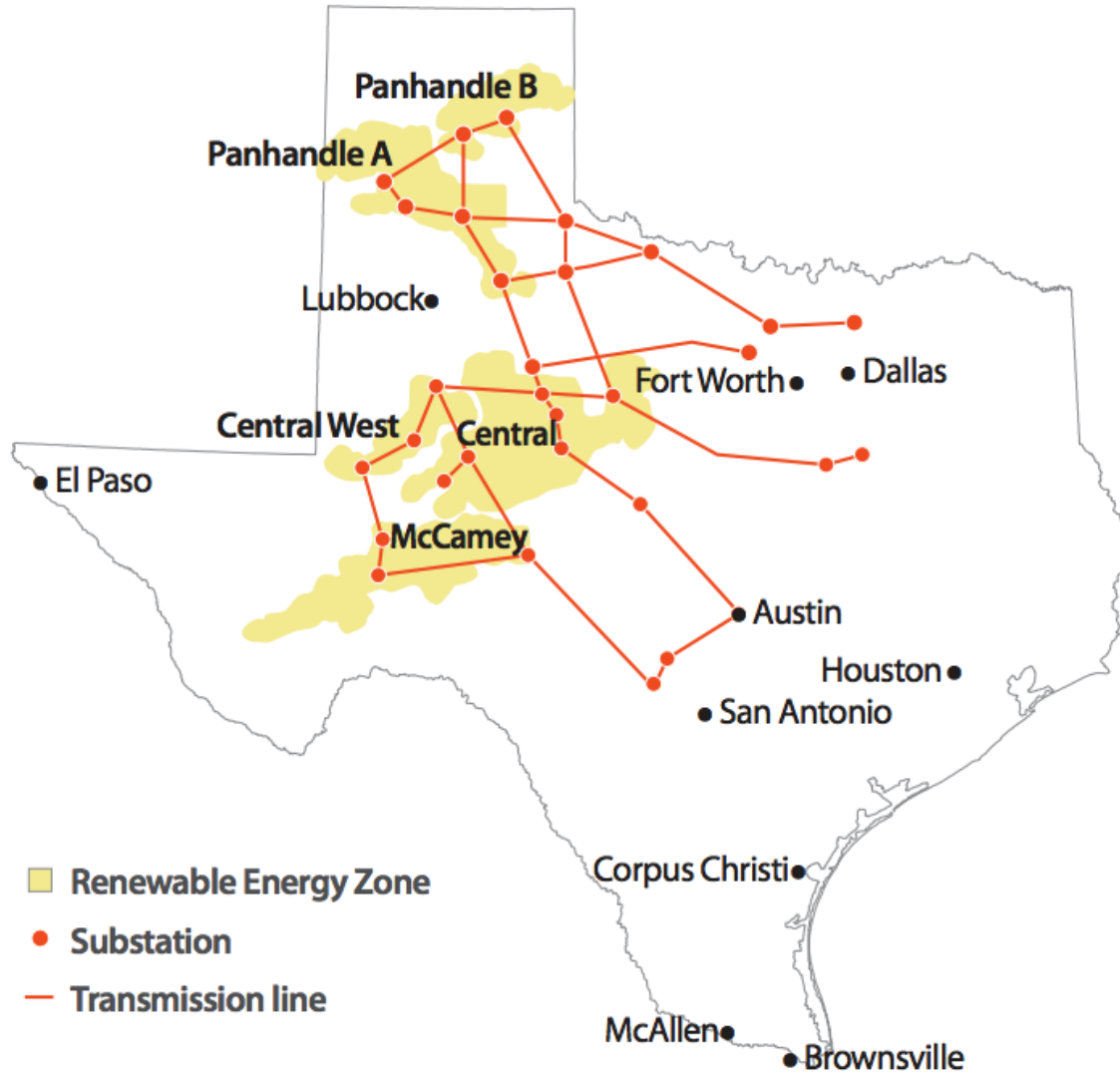
Avoid the Cocks, Snags, and "Lays of the Panama Route" Secure Speed, Comfort and Safety by taking the Union and Central Pacific Lines, which cross the Miller Pass and the Westinghouse Pass (a route which gives the Engineer instant control of the Train and is the most perfect protection against accidents ever invented).



Orders for Tickets between Eastern Cities and all Points reached via the Union and Central Pacific Lines can be purchased at the Co.'s offices in Ogden and Omaha, and in Omaha, New York and London for all Trans-Pacific Ports, and for the entire trip around the World

- Completed in 1869; opened up the west
- Enabled by federal government loans and grants (land grants)

Past Example: Texas Wind Energy



- Texas: wind resource in west; population in east
- Wind PTC (45Q analogue) mid-2000s
- Chicken-and-egg problem
- Texas state government mandated, planned, guaranteed financing for new transmission network

Government Policy Support for CO₂ Infrastructure



Government Policy Support for CO₂ Infrastructure

- European Union
 - Five Projects of Common Interest

Government Policy Support for CO₂ Infrastructure



- European Union
 - Five Projects of Common Interest

- Canada
 - Alberta CO₂ Trunk Line under construction with substantial government funding

Government Policy Support for CO₂ Infrastructure



- European Union
 - Five Projects of Common Interest
- Canada
 - Alberta CO₂ Trunk Line under construction with substantial government funding
- Australia
 - Government is leading development of a CO₂ trunk pipeline and storage system