Rhodium Group

The Economic Benefits of Industrial Carbon Capture

Investment and Employment Opportunities for Eastern and Western States

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John Larsen
Director
jwlarsen@rhg.com

Whitney Herndon
Associate Director
wjherndon@rhg.com

Galen Hiltbrand
Research Analyst
ghiltbrand@rhg.com

Ben King
Senior Analyst
bking@rhg.com

About this analysis

The Great Plains Institute (GPI) commissioned Rhodium Group to assess and quantify the economic benefits associated with carbon capture retrofit opportunities in specific states. The research was performed independently. The results presented in this report reflect the views of the authors, and not necessarily GPI's.

About Rhodium Group

Rhodium Group is an independent research provider combining economic data and policy insight to analyze global trends. Rhodium's Energy & Climate team analyzes the market impact of energy and climate policy and the economic risks of global climate change. This interdisciplinary group of policy experts, economic analysts, energy modelers, data engineers, and climate scientists supports decision-makers in the public, financial services, corporate, philanthropic and non-profit sectors. More information is available at www.rhg.com.

John Larsen is a Director at Rhodium Group and leads the firm's US power sector and energy systems research. John specializes in analysis of national and state clean energy policy and market trends. Previously, John worked for the US Department of Energy's Office of Energy Policy and Systems Analysis where he served as an electric power policy advisor.

Whitney Herndon is an Associate Director at Rhodium Group and manages the firm's US energy research. Whitney manages a team of analysts that use a range of energy and economic models to analyze the impact of policy proposals and market shifts on the US energy system and macroeconomy. Her expertise includes carbon capture, energy and electric power systems modeling, and economy-wide decarbonization.

Galen Hiltbrand is a Research Analyst at Rhodium Group, focusing on US energy policy and carbon management. She uses quantitative tools to assess the role that carbon capture and carbon removal technologies can play in decarbonizing the US energy system.

Ben King is a Senior Analyst at Rhodium Group, focusing on US energy policy and markets. Previously, Ben was an analyst in the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE), where he worked on demand-side efficiency analysis and electricity market policy.

Contents

SECTION 1

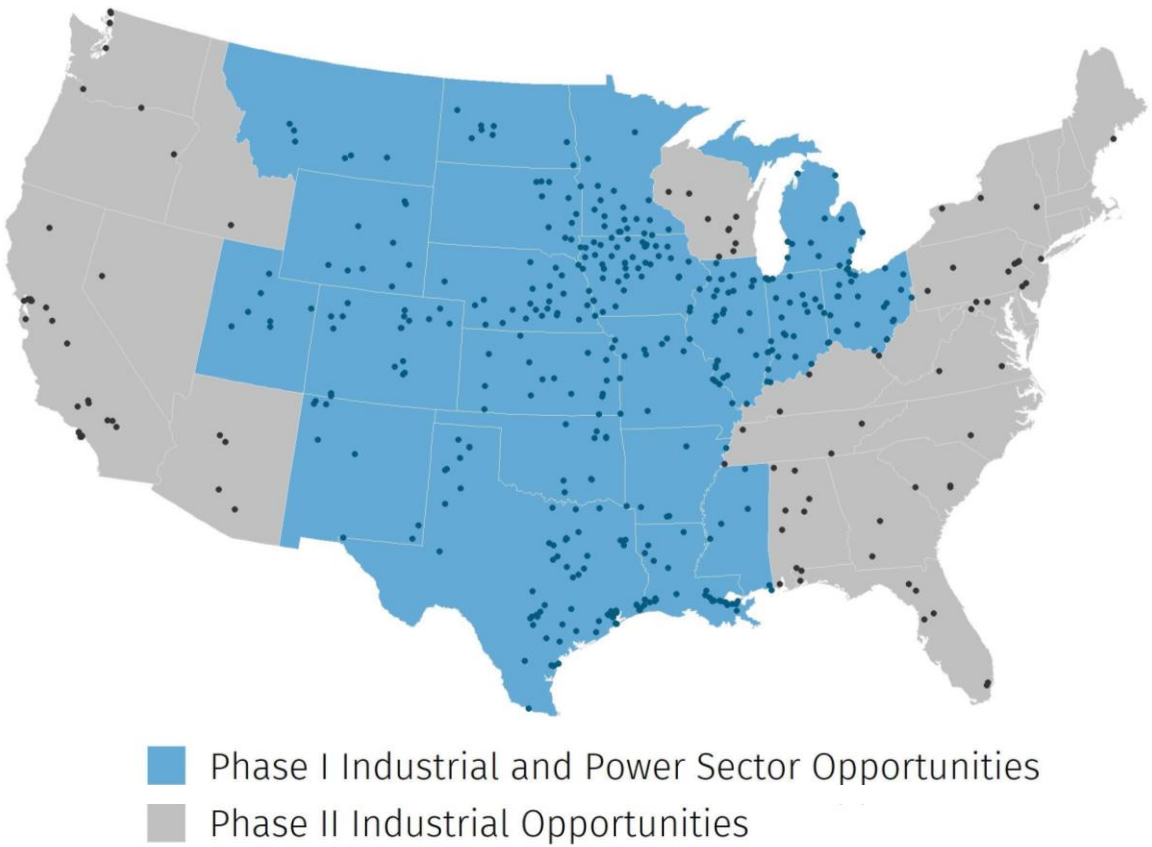
Study Objectives, Methodology, and Assumptions

Study Objectives

This study is Phase II of a state-by-state analysis exploring the economic benefits associated with carbon capture retrofit opportunities at existing industrial facilities as well as the expansion of CO_2 transport infrastructure. The direct economic benefits considered include private sector investment and employment opportunities associated with the construction and operation of carbon capture retrofits. In this phase, Rhodium Group identified and explored the economic benefits of near- to intermediate-term industrial carbon capture retrofits in Eastern & Western states (highlighted in gray).

In our previous Phase I analysis, we explored industrial and power sector opportunities in 21 of the states participating in the Regional Carbon Capture Deployment Initiative. GPI identified the facilities examined in Phase I as carbon capture projects with near- to intermediate-term feasibility.

Examined Carbon Capture Opportunities by State
Facilities with carbon capture opportunities pinpointed in dark blue and gray



Source: Rhodium Group analysis, The Great Plains Institute

Methodology and Assumptions

Employment Analysis

- We assume the carbon capture retrofits and corresponding transport infrastructure will be built over a 15-year time period from 2021 to 2035.
- This assumption does not represent Rhodium Group's view on carbon capture infrastructure deployment.
- We use the economic model IMPLAN's state level tools for this analysis.
- Results only include jobs associated with transport infrastructure and retrofitting of facilities.
- We estimate in-state jobs associated with the investment for carbon capture within each state.
- Jobs associated with capital investments are the average annual jobs over 15 years spurred by retrofitting facilities with carbon capture.
- Annual operation jobs represent the on-site and off-site jobs associated with operating the carbon capture retrofit equipment at each facility each year.
- Employment per industrial output is assumed to stay constant over time.

Facility Identification

- Facilities analyzed in this study were identified by Rhodium Group to be at or below a $100/ton cost of capture, transport, and storage cut-off.
- For purposes of analysis, it is assumed that any identified facilities remain operational through the study period regardless of their current or future economic viability
- Transport infrastructure buildout scenarios and CO_2 transport networks were devised from the Regional Carbon Capture Deployment Initiative's use of SimCCS modeling.

Cost Characterization

- Capital and operations & maintenance costs are independently assessed by Rhodium.
- Carbon capture at each plant is determined as part of the cost analysis.
- Transport infrastructure costs are from the National Energy Technology Laboratory (NETL) model.

Methodology

Employment Analysis

Step 1: Apply Costs

- Identify near to intermediate industrial facility opportunities
- Apply Rhodium's own capital and operations and maintenance (O&M) costs to each facility
  - Apply capacity decisions
  - High and low capital and O&M costs
- Aggregate costs in each study region state by present industries
  - Ammonia, cement, ethanol, gas processing, hydrogen, refineries, and steel

Step 2: IMPLAN Inputs

- Conduct in-depth research on how distribution of costs for carbon capture vary by industry
  - Each facility type requires different equipment, materials, maintenance, and energy inputs which lead to different costs
- Apply cost breakdowns for each industry and sort into appropriate IMPLAN sectors
- Run state-specific IMPLAN analysis with a high and low scenario for each present industry

Step 3: Aggregate Jobs

- Jobs Associated with Capital Investment: include jobs associated with retrofitting the facility with carbon capture
  - Equipment, materials, construction, engineering
- Operation Jobs: include the increase in jobs associated with operating the retrofit facility
  - Can include maintenance, labor, chemicals, water treatment, and energy
  - Includes both on-site and off-site jobs necessary for retrofit operations. On-site jobs are approximately 5-15% of total operation jobs depending on the industry.

Section 2

Key Takeaways

Key Takeaways

Industrial carbon capture is a multi-billion dollar investment opportunity

Pursuing all industrial carbon capture opportunities across the Phase II states will require $8.2-$12.3 billion in capital investment over the next 15 years.

Carbon capture investment will lead to good jobs

Jobs associated with industrial carbon capture retrofits in these states total 5,000-7,300 on average per year over the next 15 years.*

A diverse array of opportunities is available

Jobs can be created in a variety of industries from steel to cement, ethanol and refining. The top 5 states in Phase II for industrial carbon capture potential are California, Pennsylvania, Florida, Alabama & Tennessee.

Carbon capture can play to each states' strengths

Economic opportunities associated with carbon capture are available across the United States. While states in Phase I with heavy manufacturing see the most potential, there are substantial industrial carbon capture opportunities in Phase II states that should not be ignored.

*These total jobs figures include the jobs associated with capital investment plus the annual operation jobs. Capital investment jobs are the average jobs over the 15-year study period from 2021-2035. The annual operation jobs last for as long as the plant is in operation, which for this analysis we assume will be at least 15 years.

Section 3

Study Region States

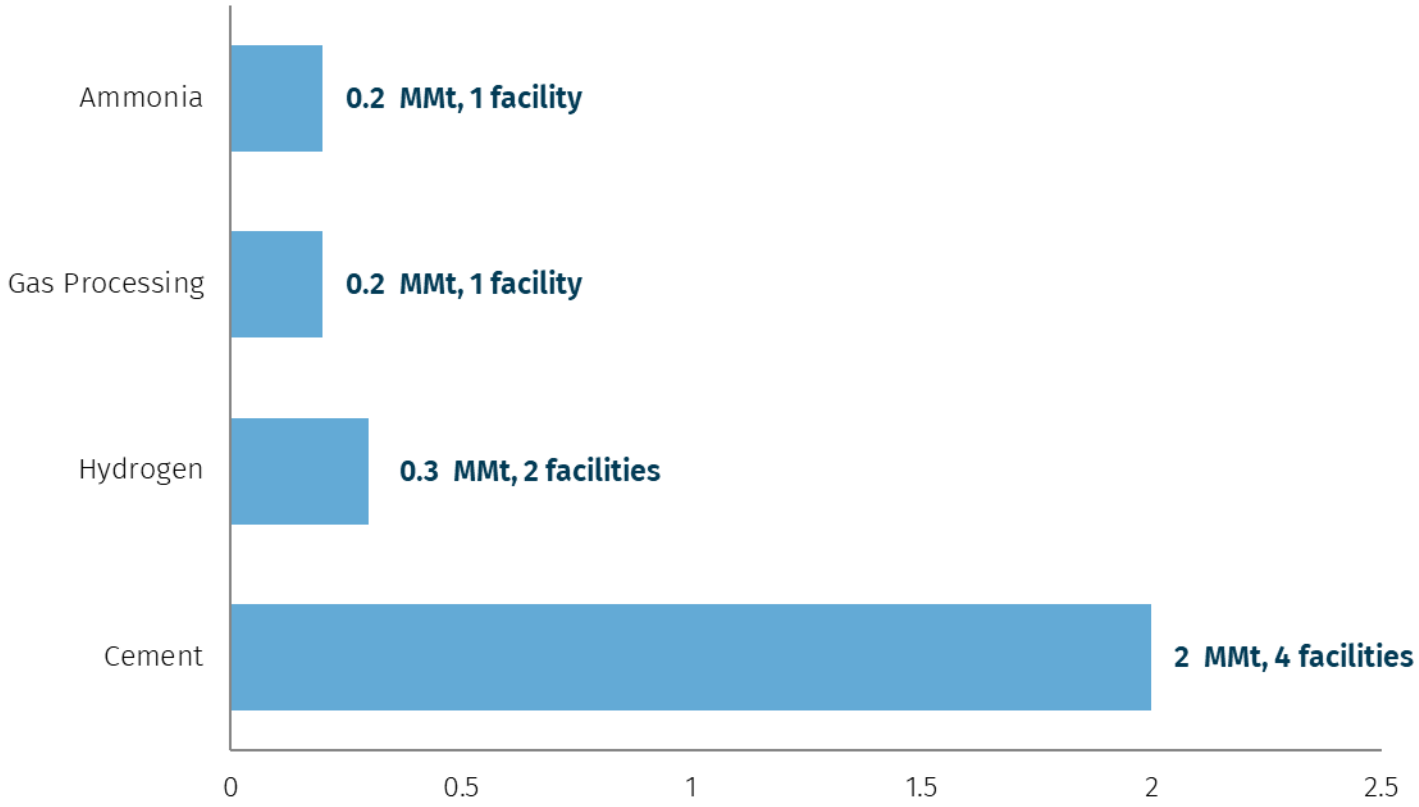
1. Alabama
2. Arizona
3. California
4. Florida
5. Georgia
6. Idaho
7. Kentucky
8. Maine
9. Maryland
10. Nevada
11. New Jersey
12. New York
13. North Carolina
14. Oregon
15. Pennsylvania
16. South Carolina
17. Tennessee
18. Virginia
19. Washington
20. West Virginia
21. Wisconsin

Alabama: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

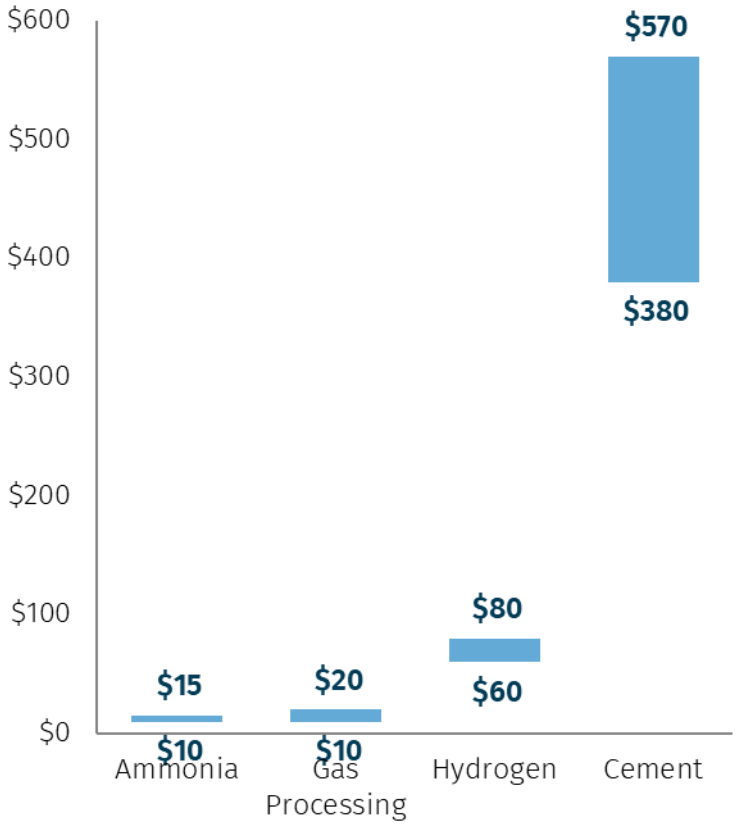
- If all near to intermediate term opportunities in Alabama are pursued, $460 to $685 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Alabama total 150 to 215 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 130 to 190 ongoing jobs.
- In addition, $588 million in transport infrastructure will be required to support these projects. This investment will create 350 jobs on average each year over a 15-year deployment period.

Alabama: Industrial Facilities

Carbon capture opportunities

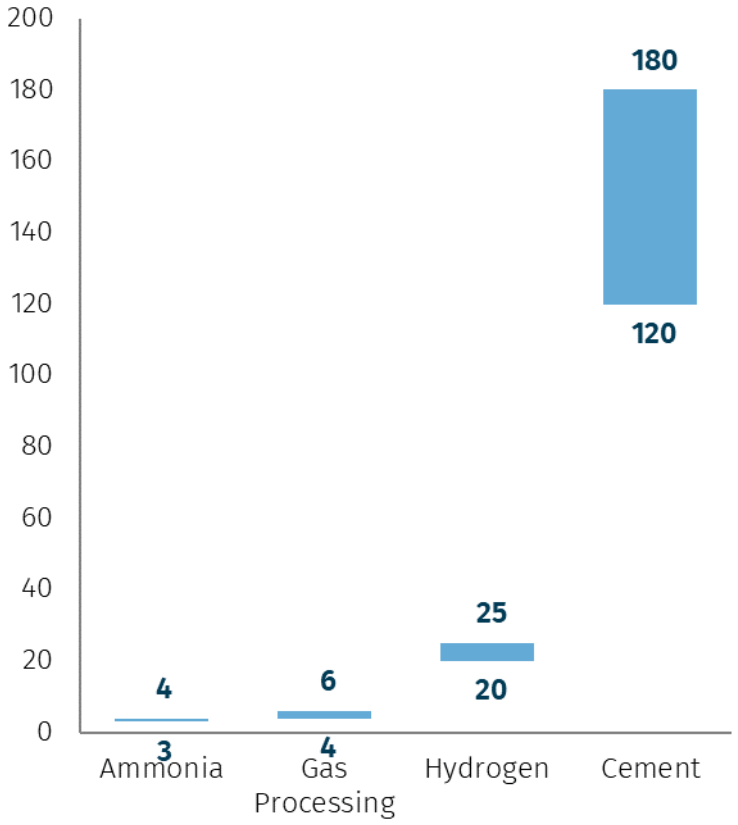
Capital Investment Requirement

Million $ USD



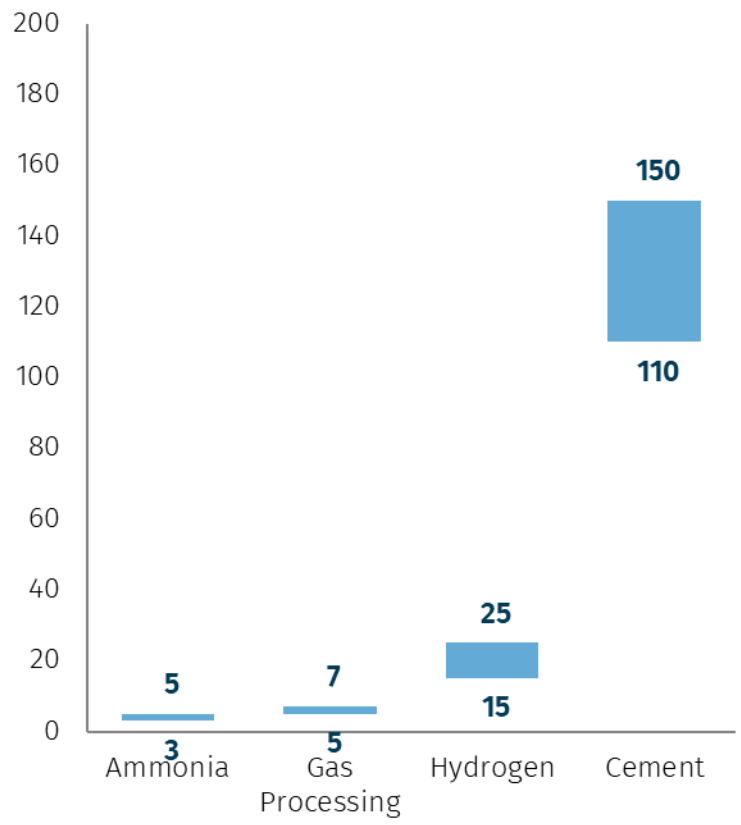
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



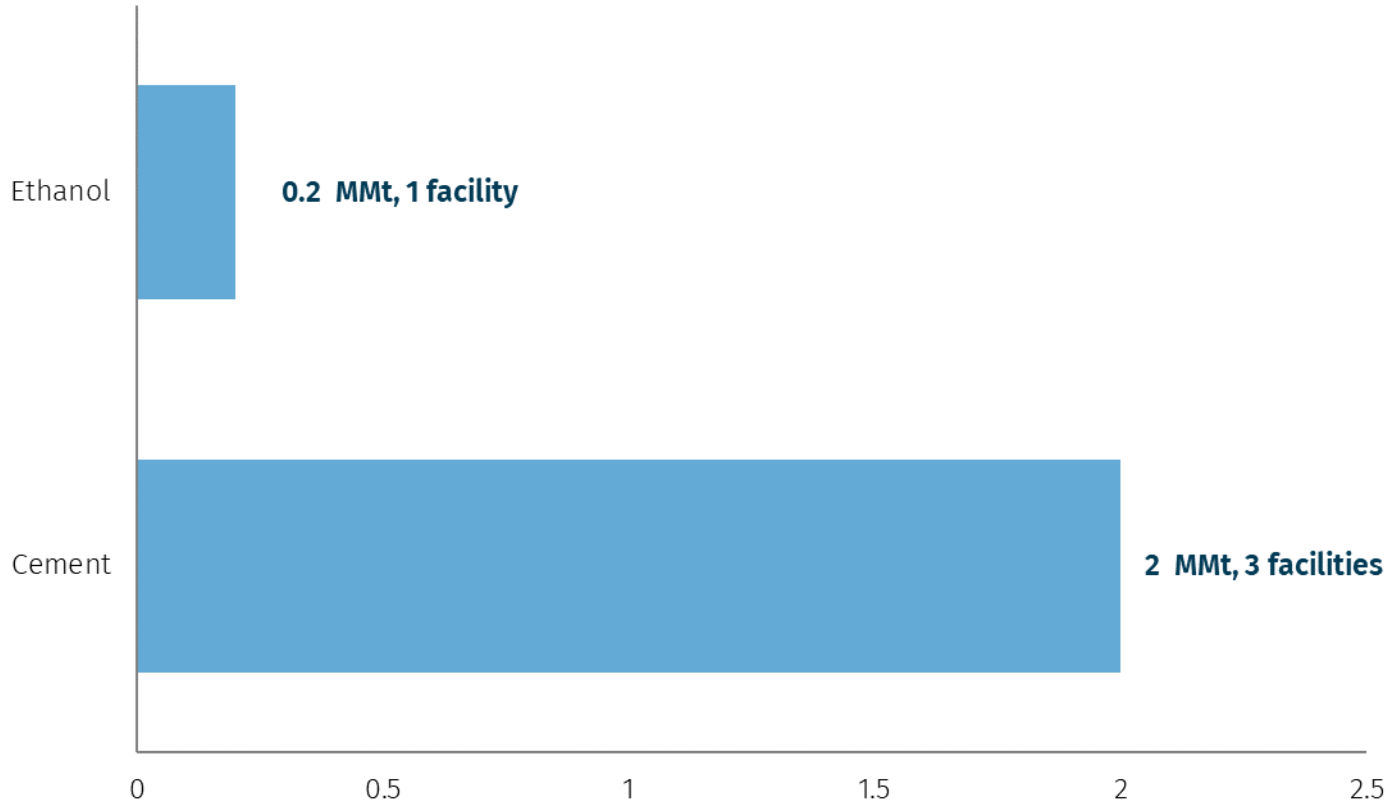
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Arizona: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

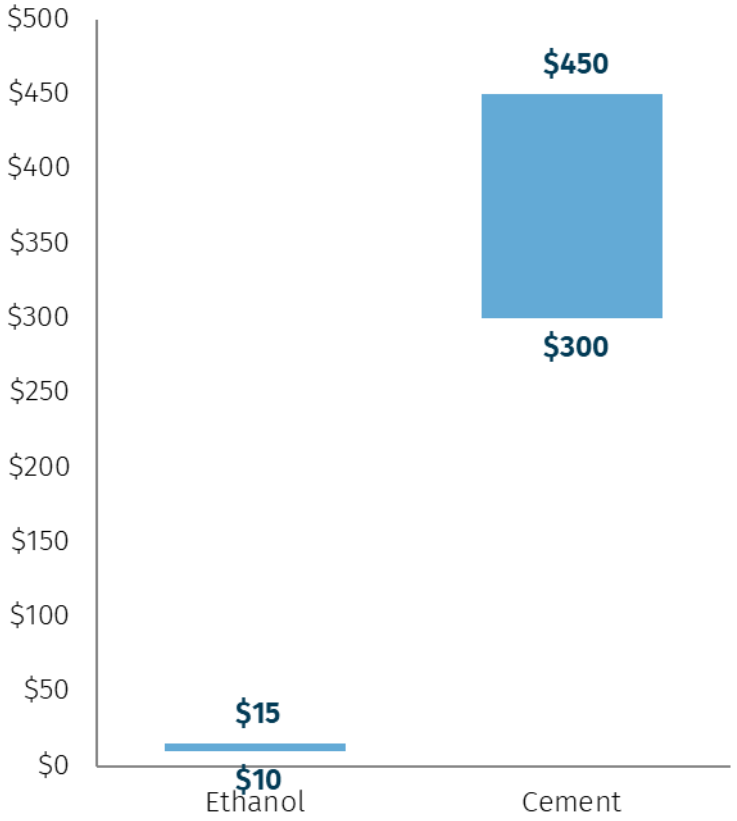
- If all near to intermediate term opportunities in Arizona are pursued, $310 to $465 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Arizona total 100 to 145 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 95 to 130 ongoing jobs.
- In addition, $1 billion in transport infrastructure will be required to support these projects. This investment will create 570 jobs on average each year over a 15-year deployment period.

Arizona: Industrial Facilities

Carbon capture opportunities

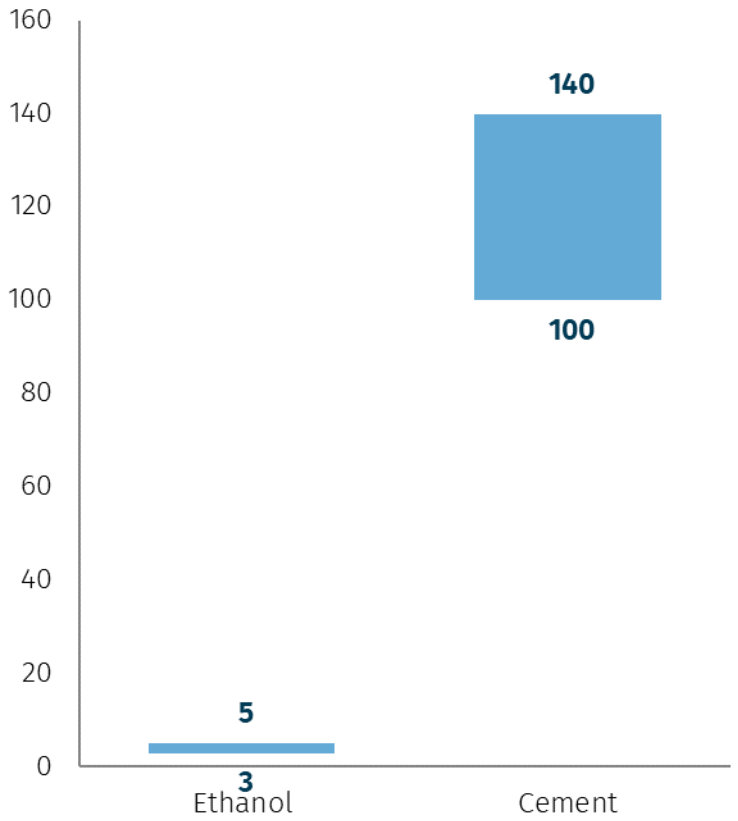
Capital Investment Requirement

Million $ USD



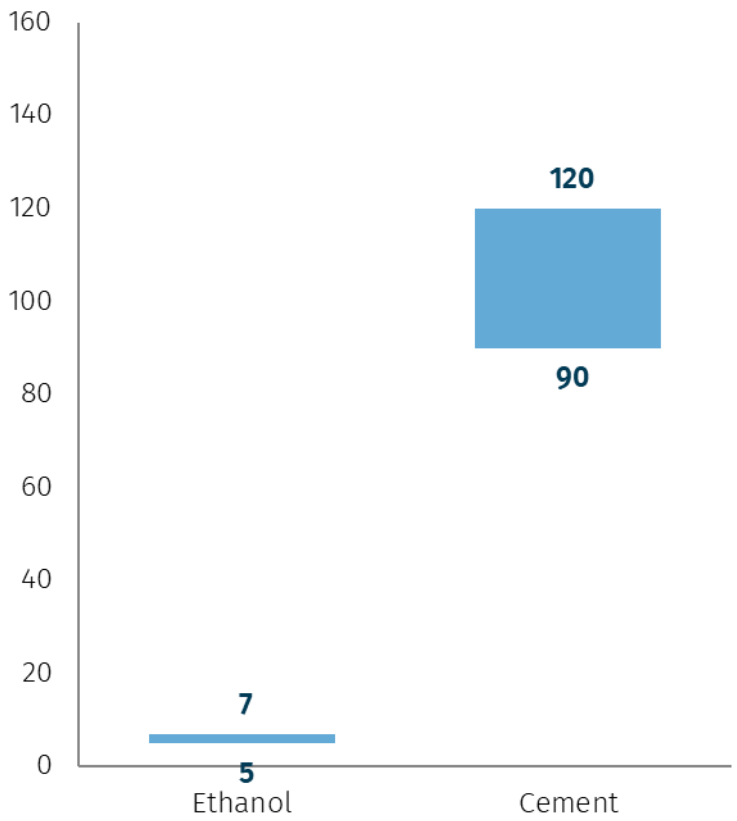
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



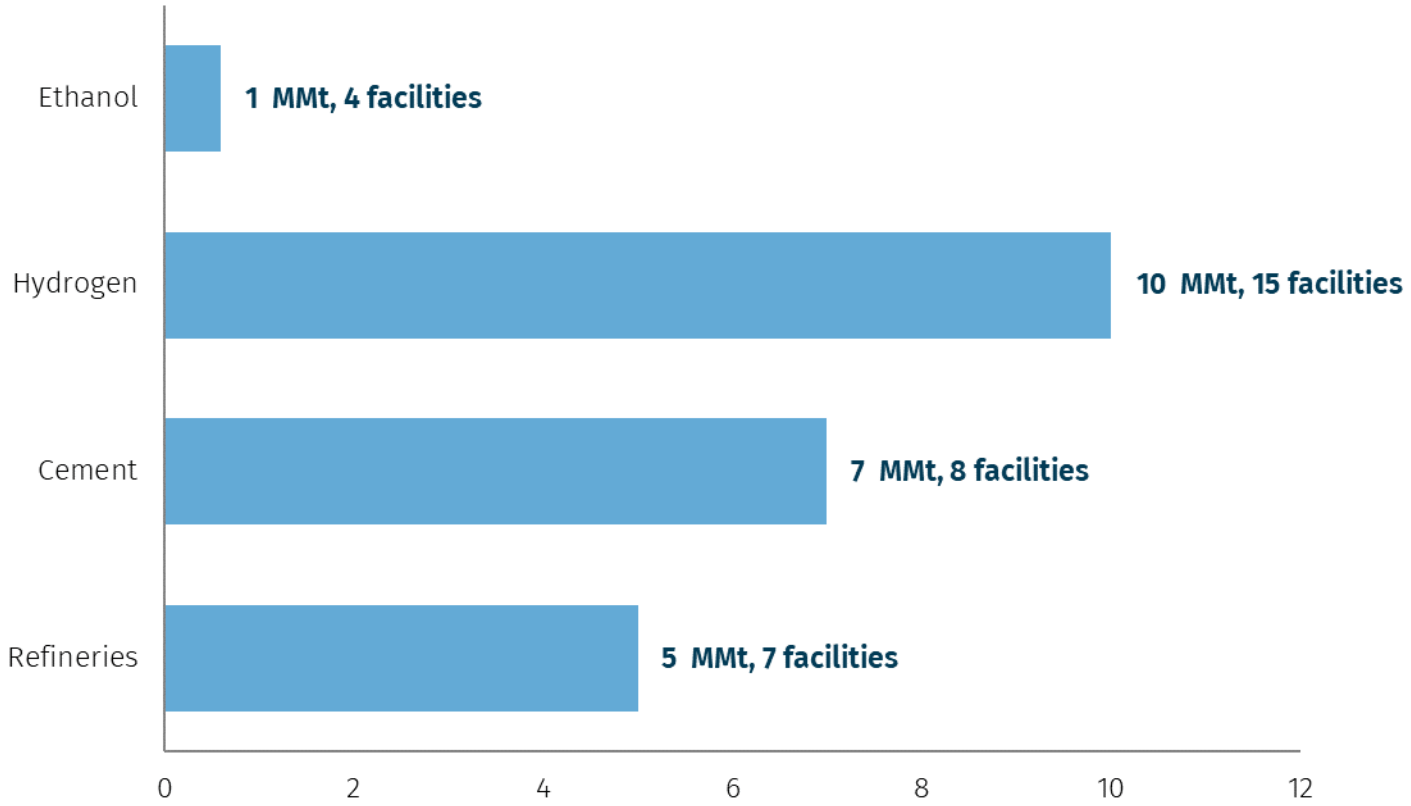
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

California: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

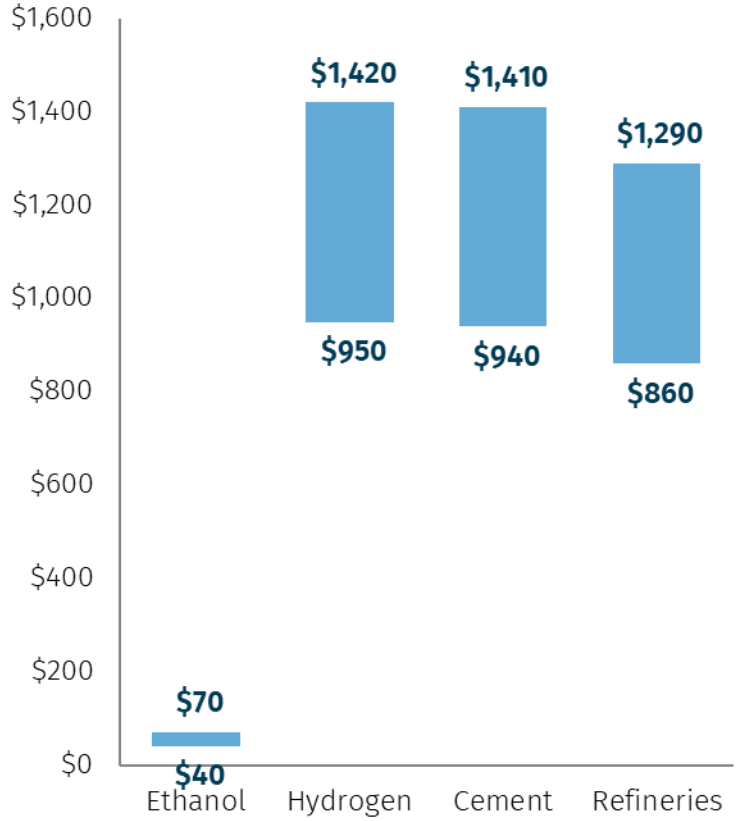
- If all near to intermediate term opportunities in California are pursued, $2.8 to $4.2 billion in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in California total 890 to 1,340 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 880 to 1,200 ongoing jobs.
- In addition, $1.2 billion in transport infrastructure will be required to support these projects. This investment will create 540 jobs on average each year over a 15-year deployment period.

California: Industrial Facilities

Carbon capture opportunities

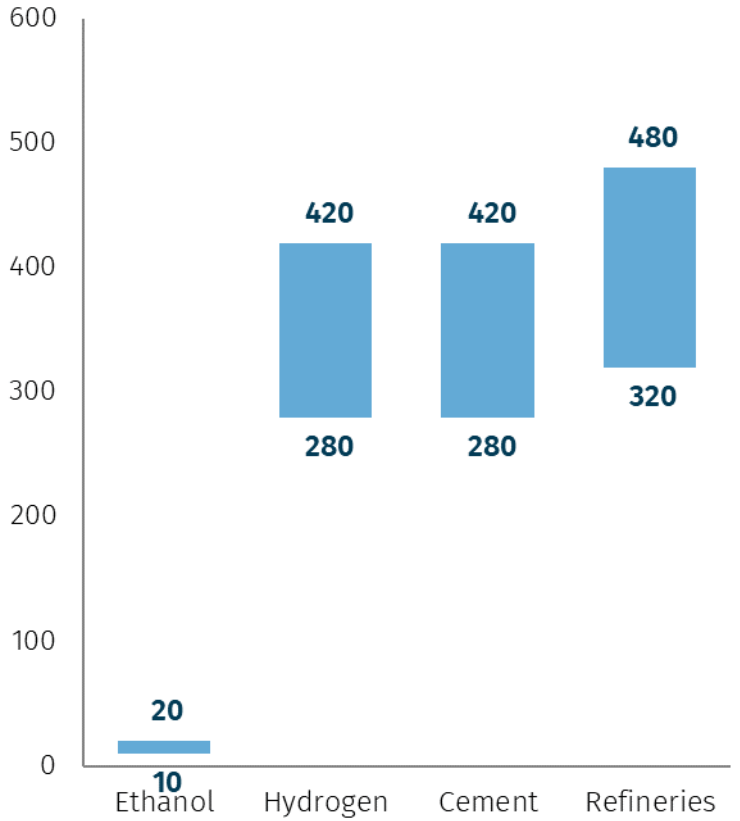
Capital Investment Requirement

Million $ USD



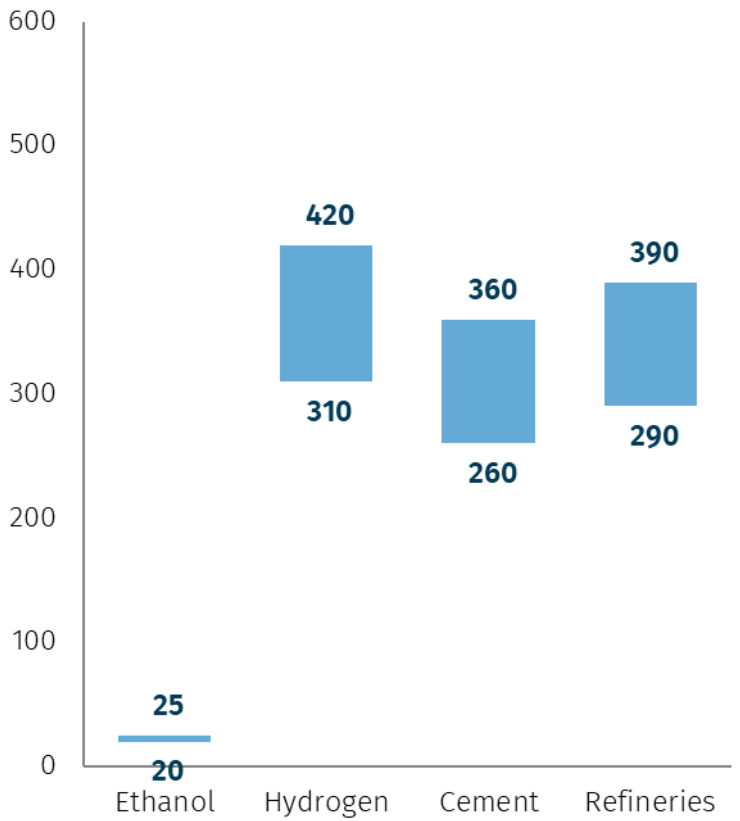
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



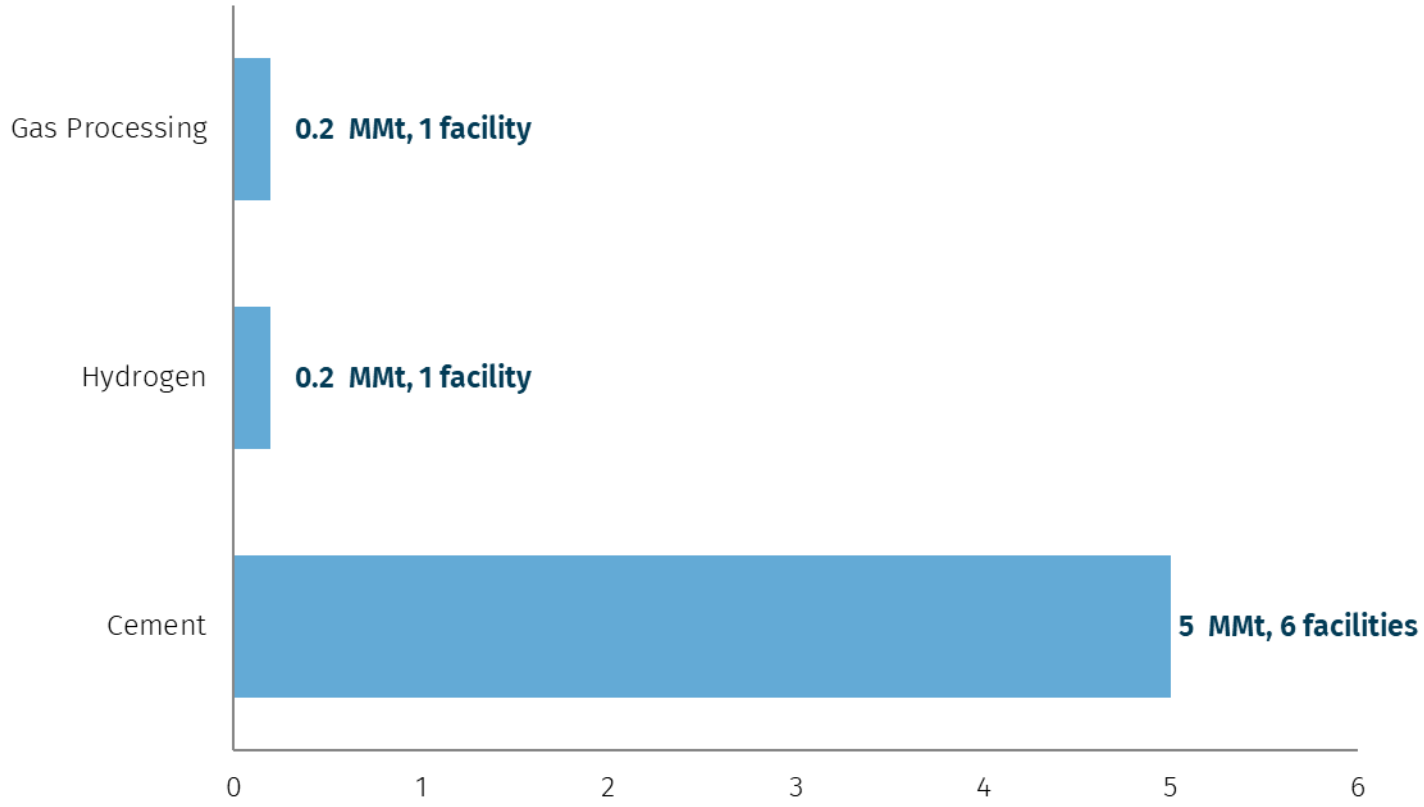
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Florida: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

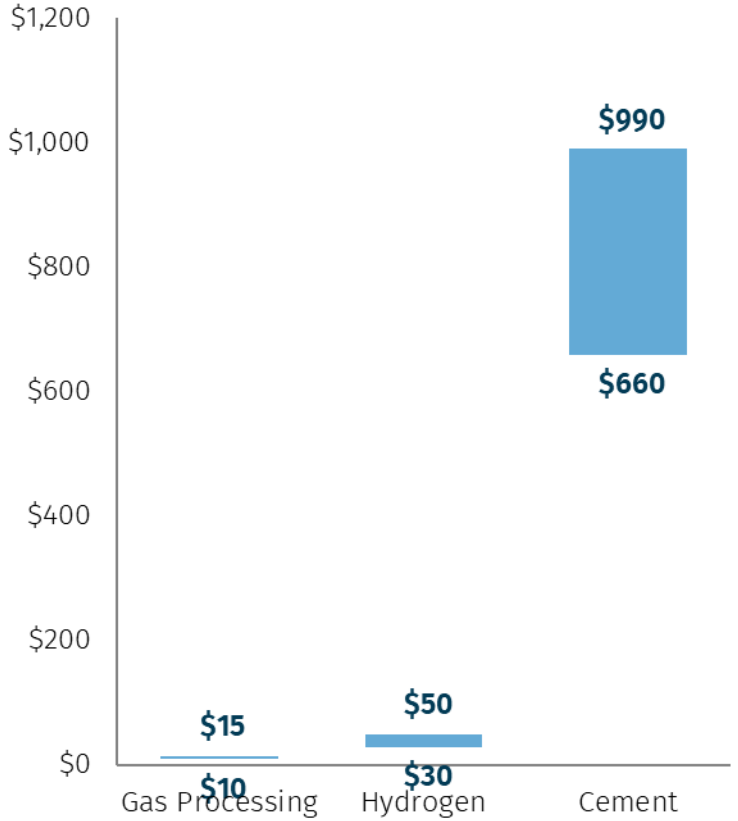
- If all near to intermediate term opportunities in Florida are pursued, $0.7 to $1.1 billion in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Florida total 225 to 340 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 200 to 270 ongoing jobs.
- In addition, $430 million in transport infrastructure will be required to support these projects. This investment will create 220 jobs on average each year over a 15-year deployment period.

Florida: Industrial Facilities

Carbon capture opportunities

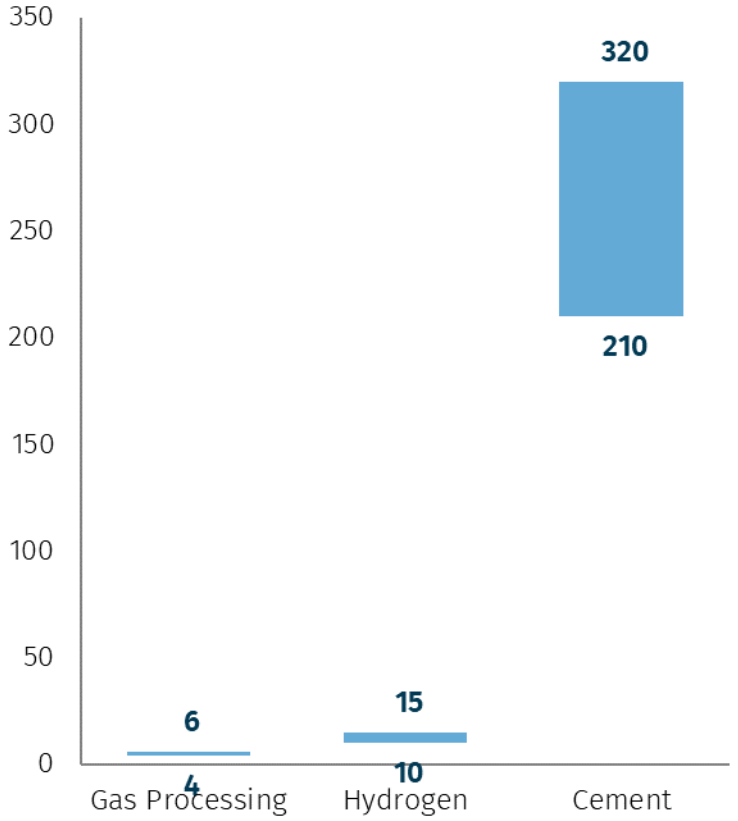
Capital Investment Requirement

Million $ USD



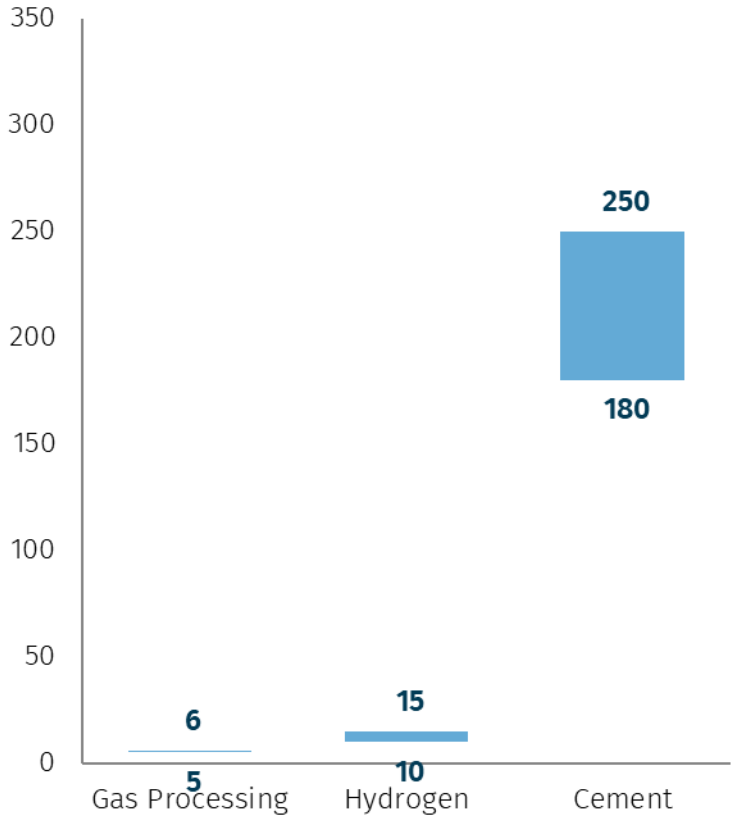
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



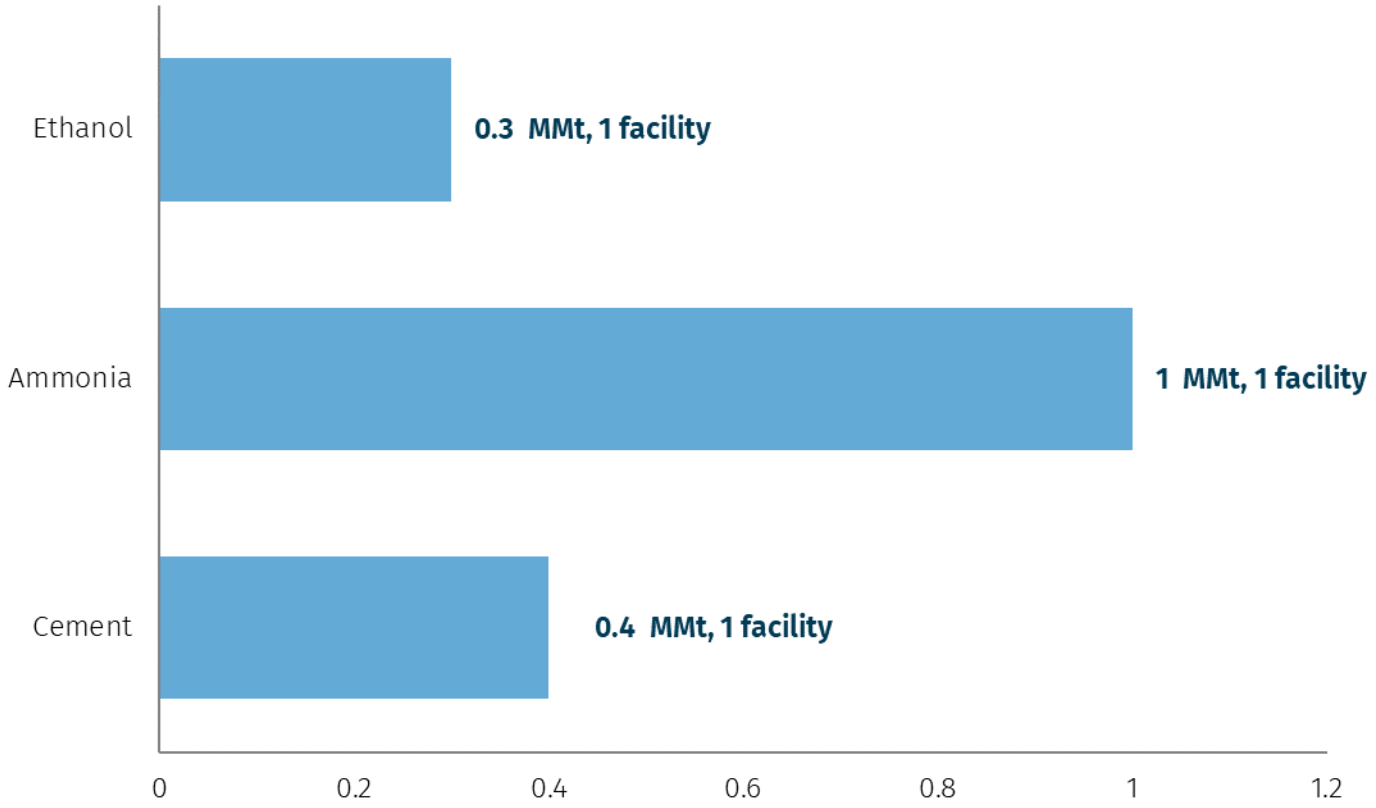
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Georgia: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

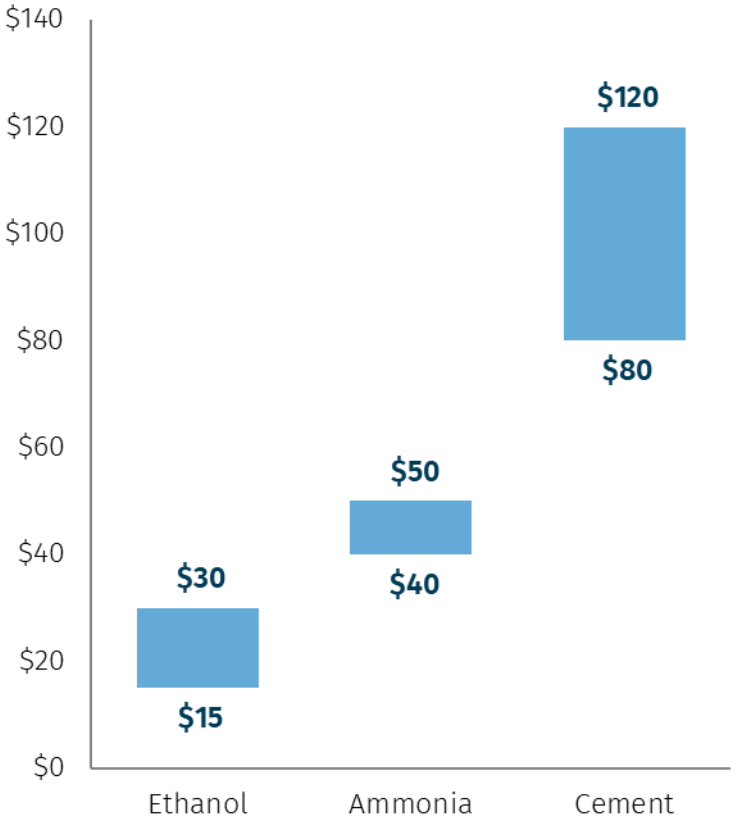
- If all near to intermediate term opportunities in Georgia are pursued, $135 to $200 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Georgia total 40 to 60 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 50 to 60 ongoing jobs.
- In addition, $252 million in transport infrastructure will be required to support these projects. This investment will create 120 jobs on average each year over a 15-year deployment period.

Georgia: Industrial Facilities

Carbon capture opportunities

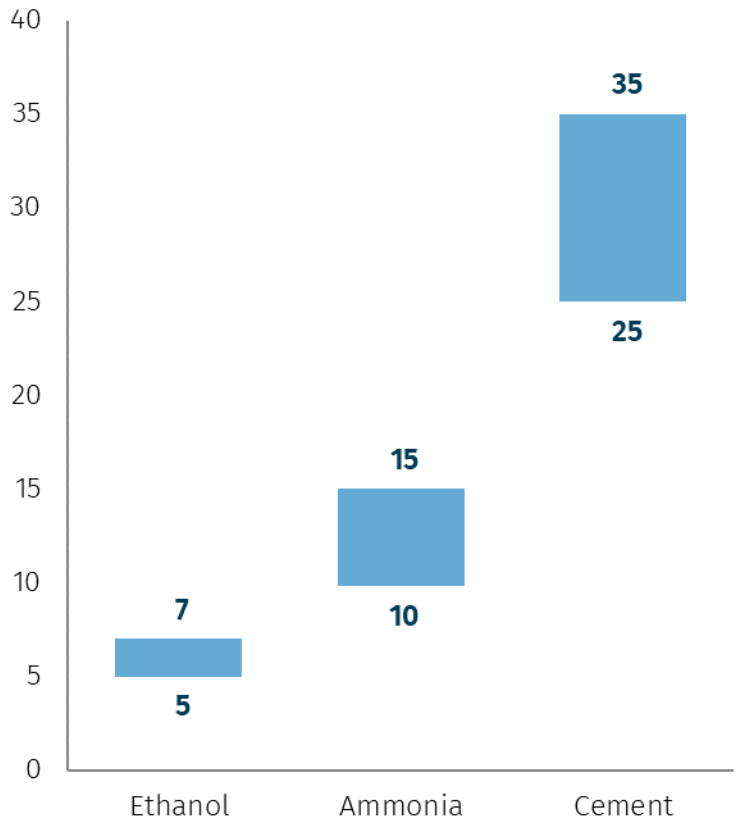
Capital Investment Requirement

Million $ USD



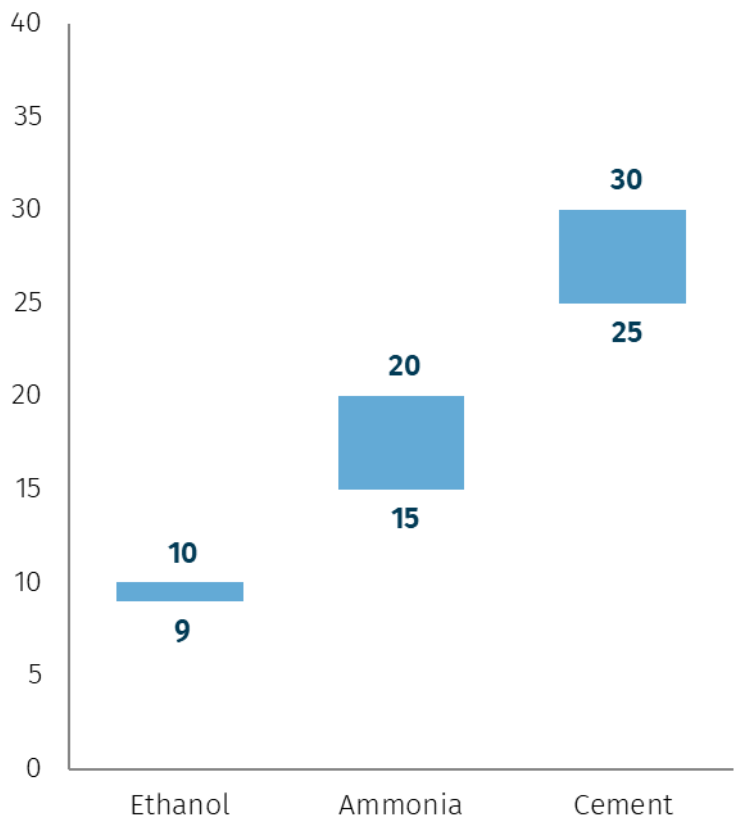
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



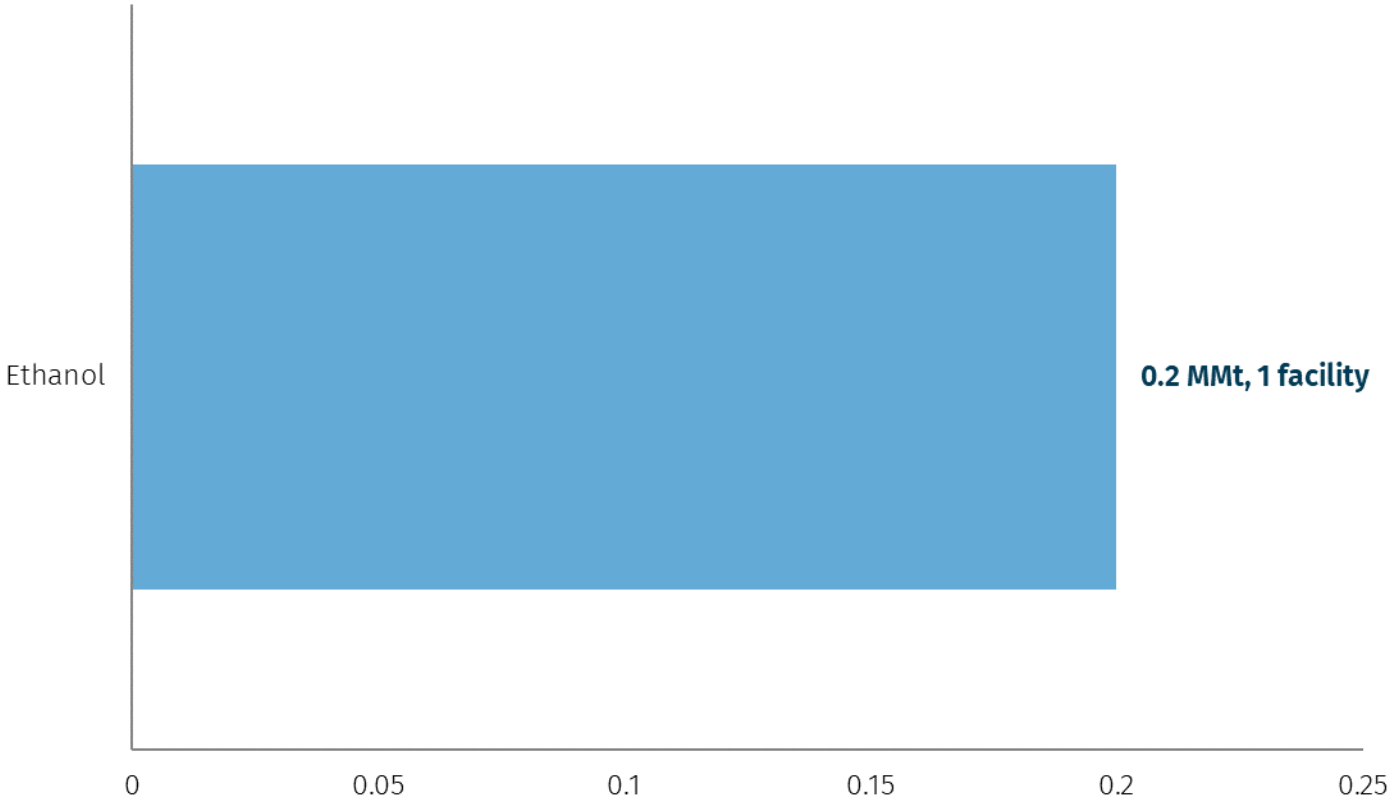
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Idaho: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

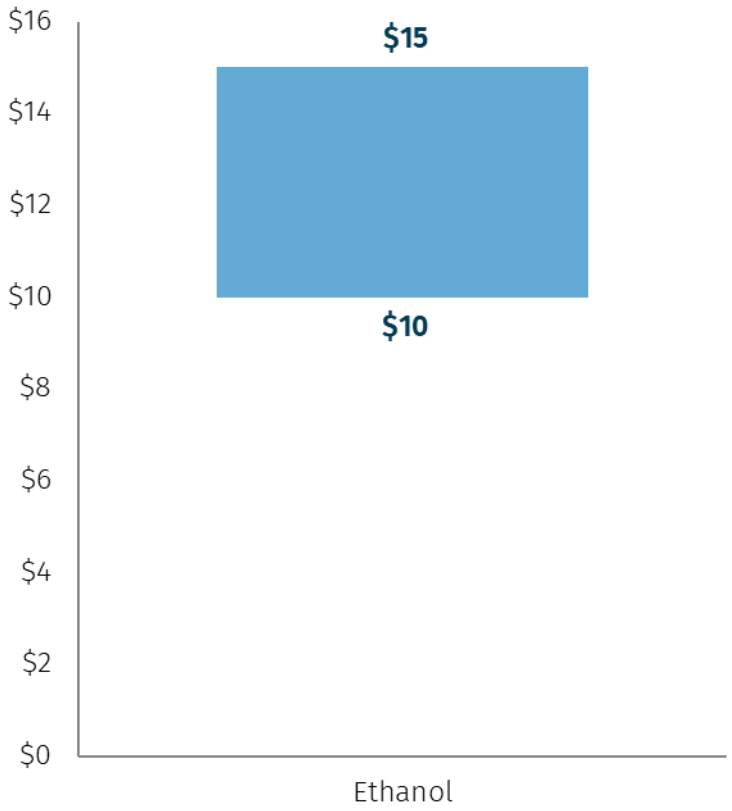
- If all near to intermediate term opportunities in Idaho are pursued, $10 to $15 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Idaho total 4 to 5 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 6 to 8 ongoing jobs.
- In addition, $190 million in transport infrastructure will be required to support these projects. This investment will create 90 jobs on average each year over a 15-year deployment period.

Idaho: Industrial Facilities

Carbon capture opportunities

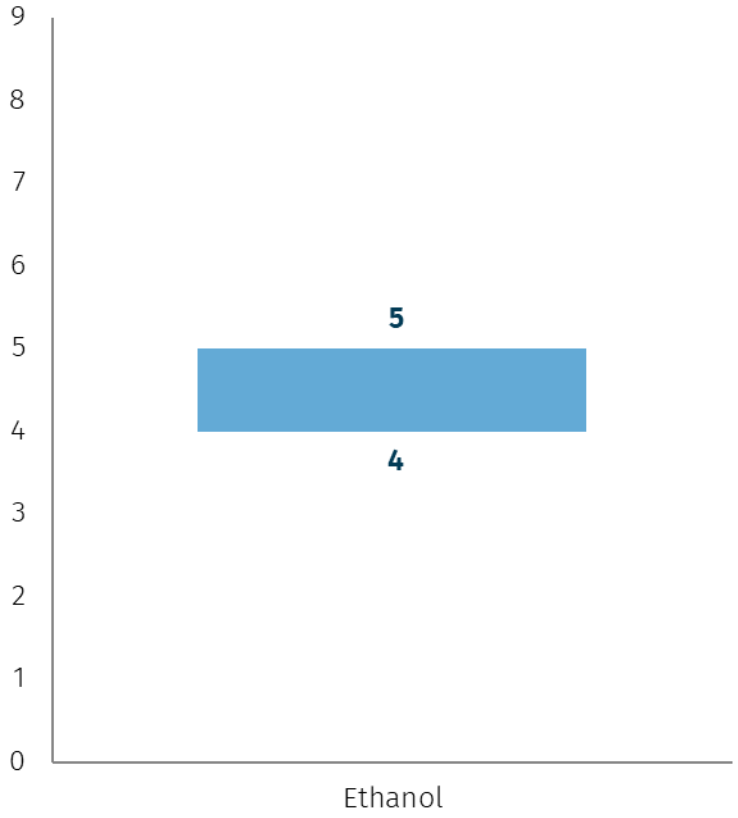
Capital Investment Requirement

Million $ USD



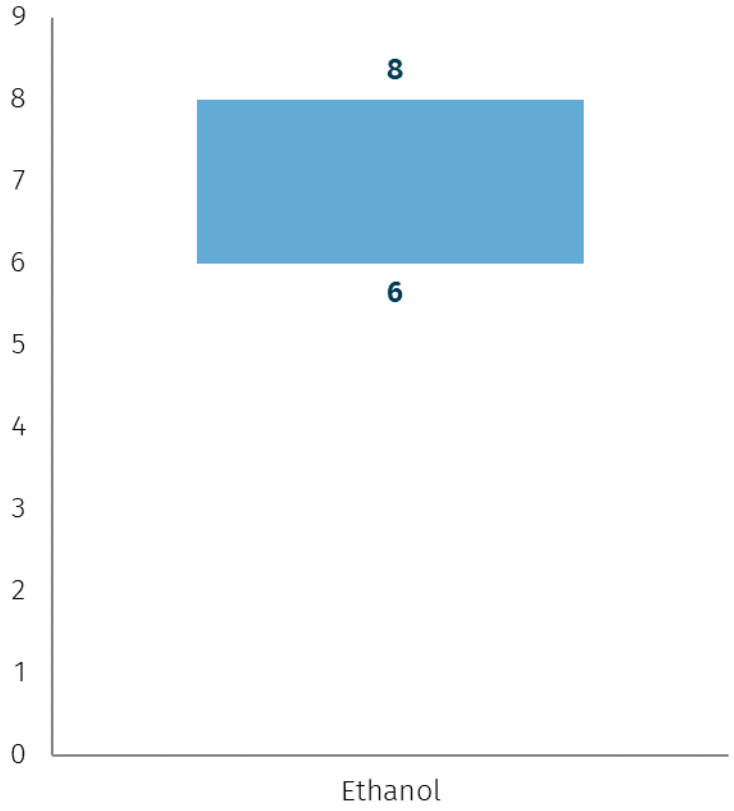
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



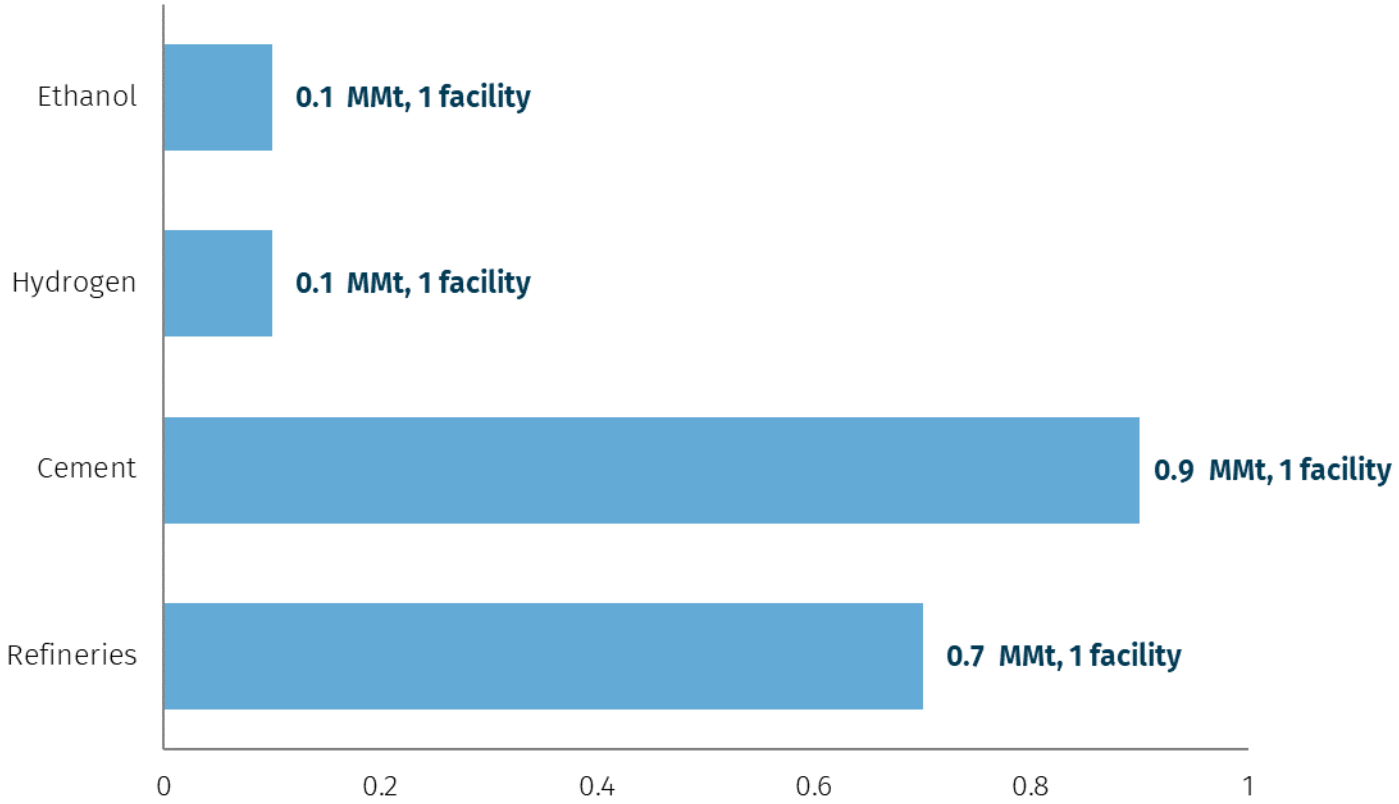
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Kentucky: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

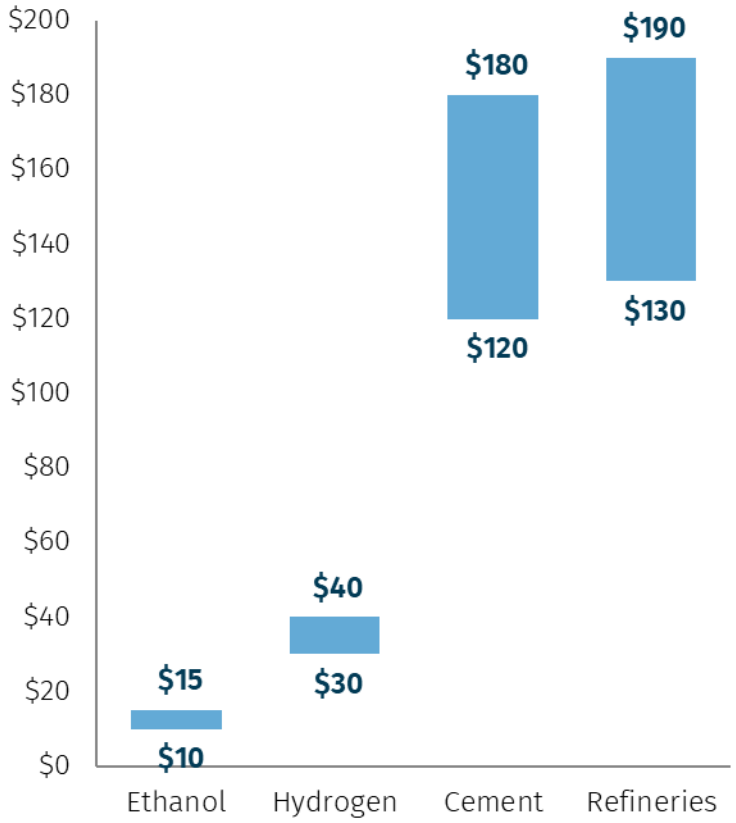
- If all near to intermediate term opportunities in Kentucky are pursued, $290 to $425 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Kentucky total 100 to 160 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 80 to 120 ongoing jobs.
- In addition, $754 million in transport infrastructure will be required to support these projects. This investment will create 390 jobs on average each year over a 15-year deployment period.

Kentucky: Industrial Facilities

Carbon capture opportunities

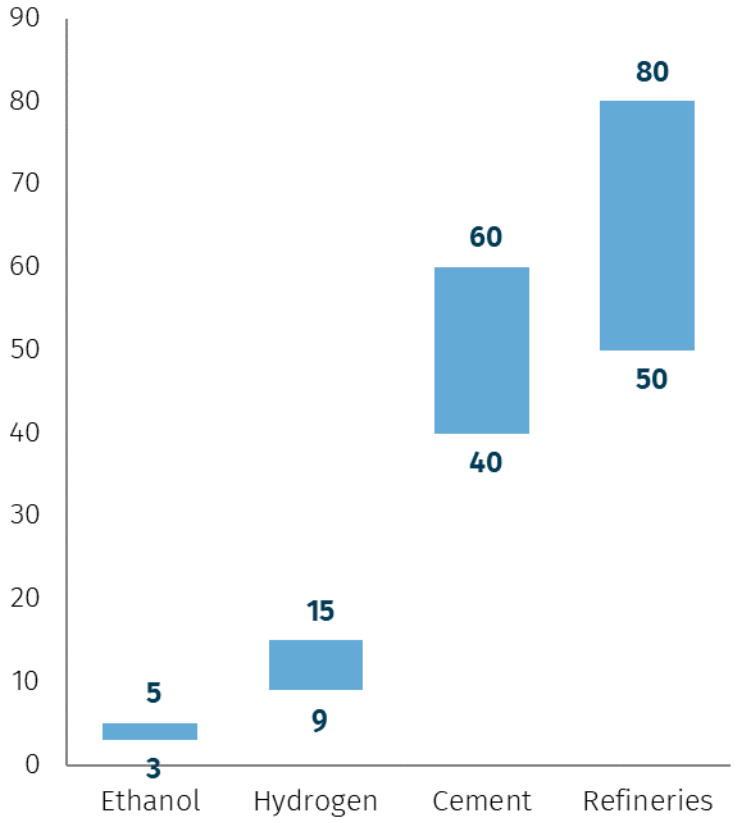
Capital Investment Requirement

Million $ USD



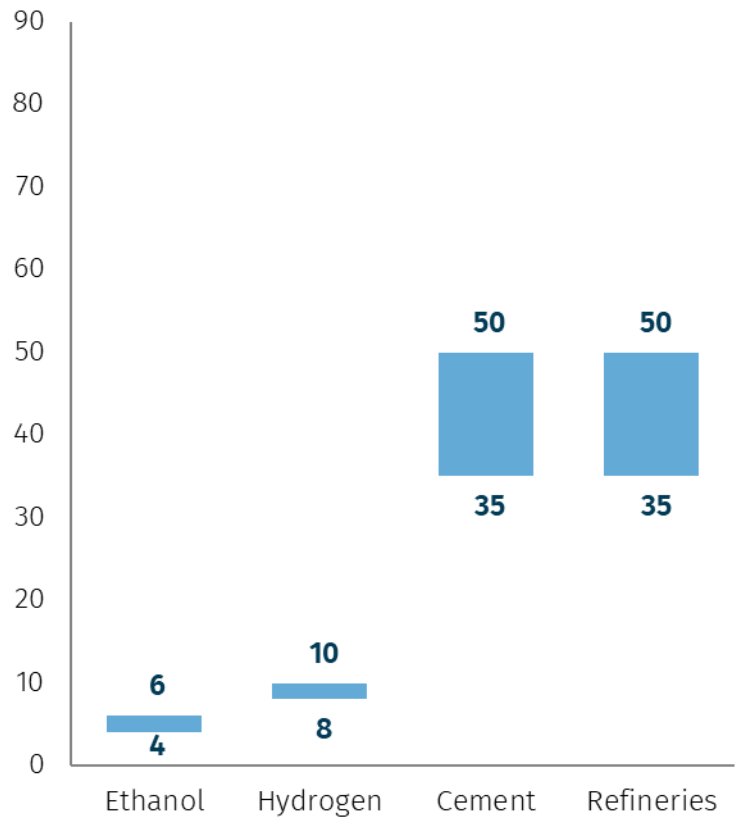
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



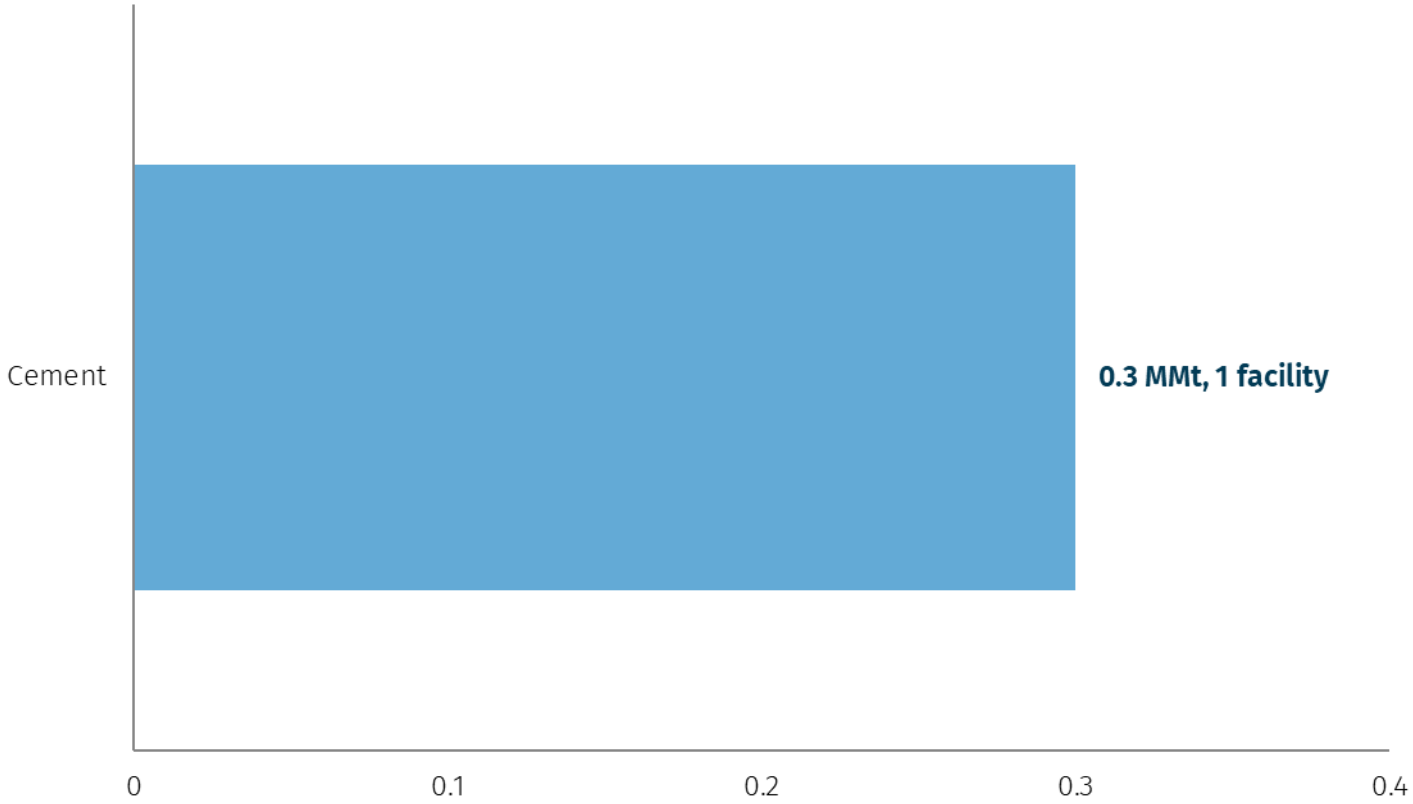
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Maine: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

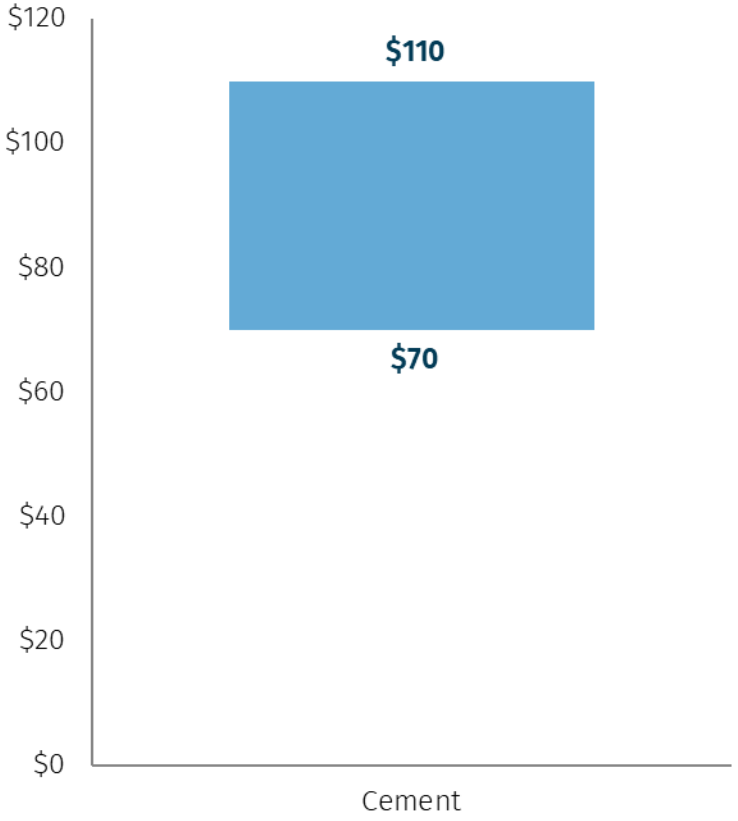
- If all near to intermediate term opportunities in Maine are pursued, $70 to $110 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Maine total 25 to 40 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 20 to 30 ongoing jobs.
- In addition, $28 million in transport infrastructure will be required to support these projects. This investment will create 20 jobs on average each year over a 15-year deployment period.

Maine: Industrial Facilities

Carbon capture opportunities

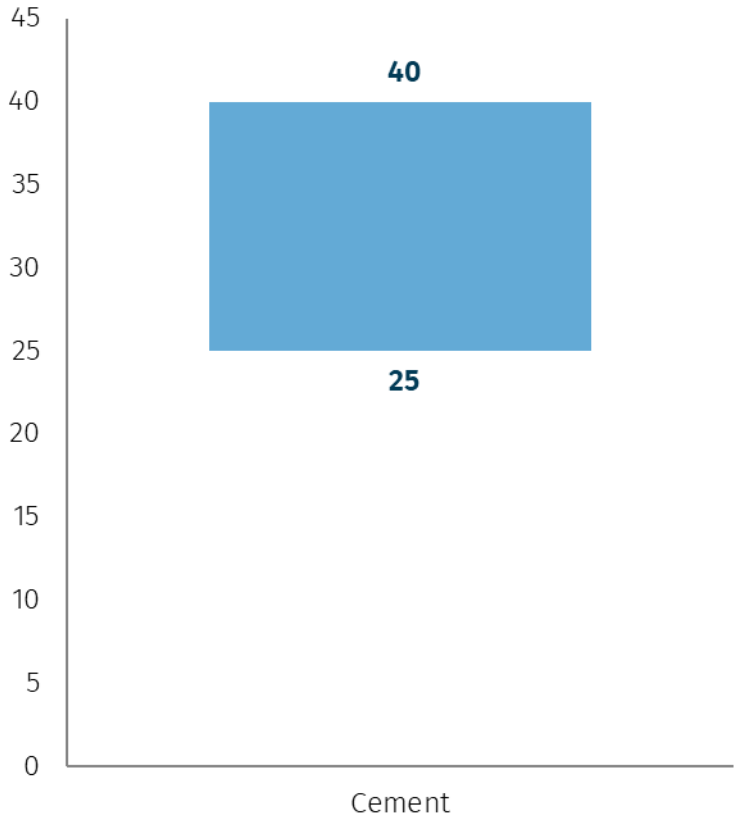
Capital Investment Requirement

Million $ USD



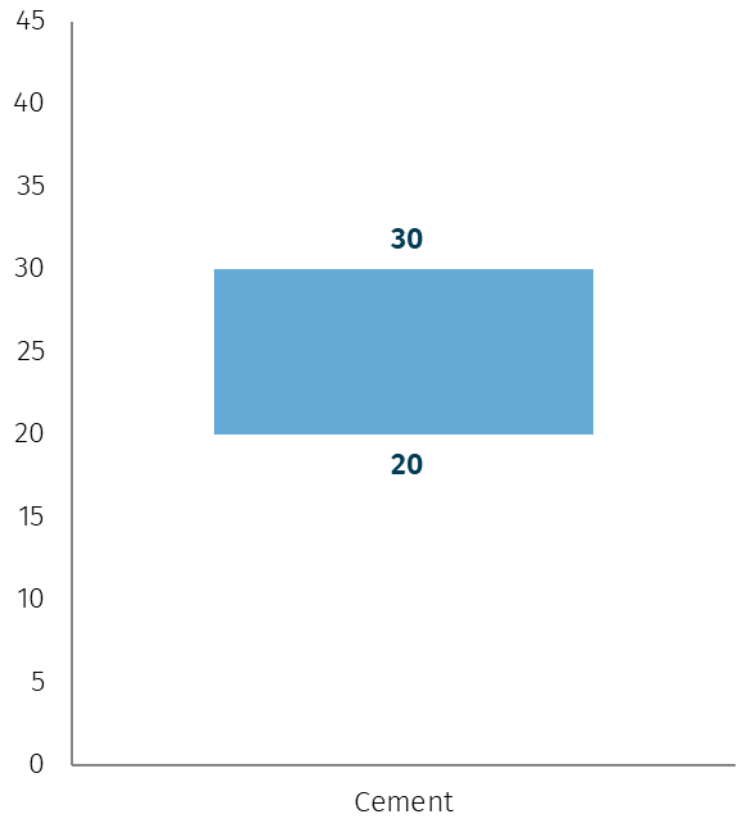
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



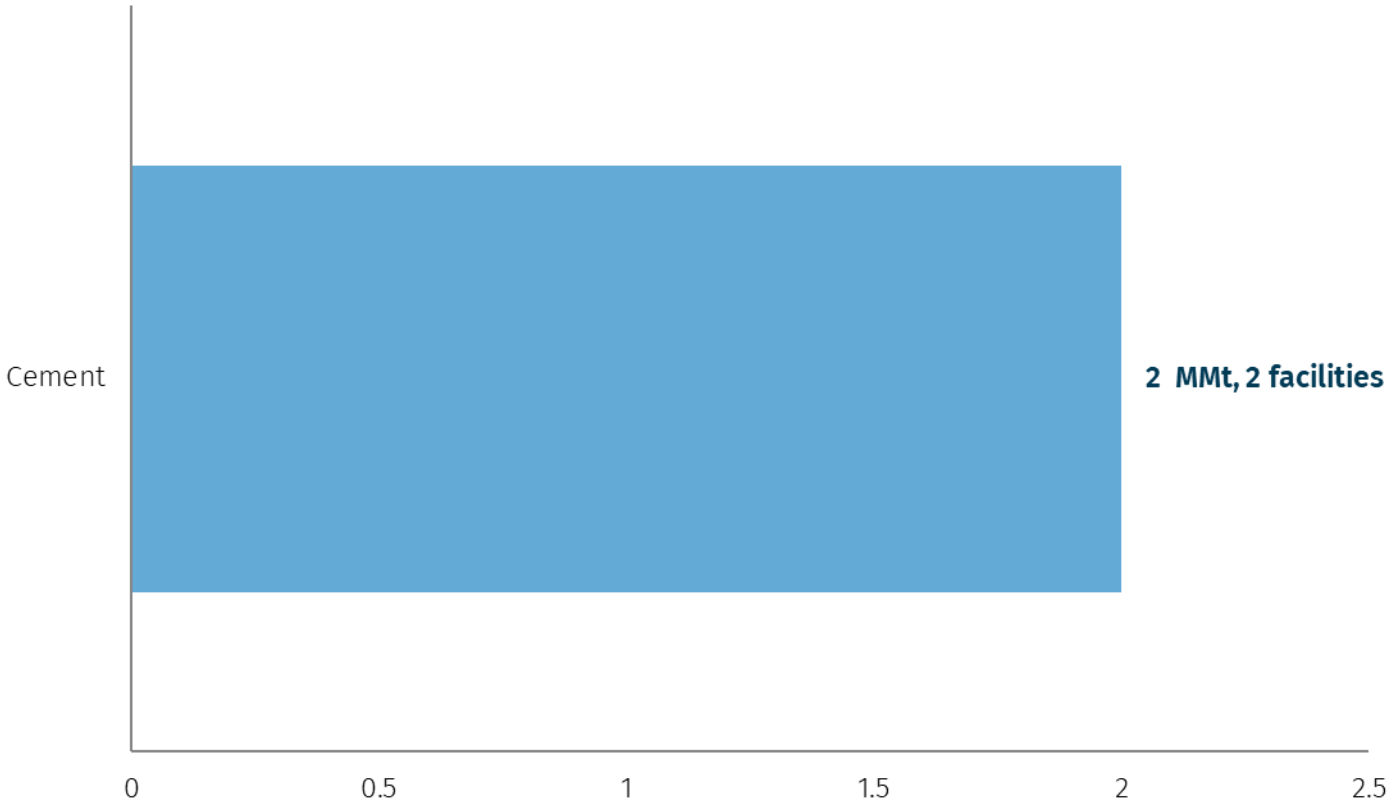
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Maryland: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

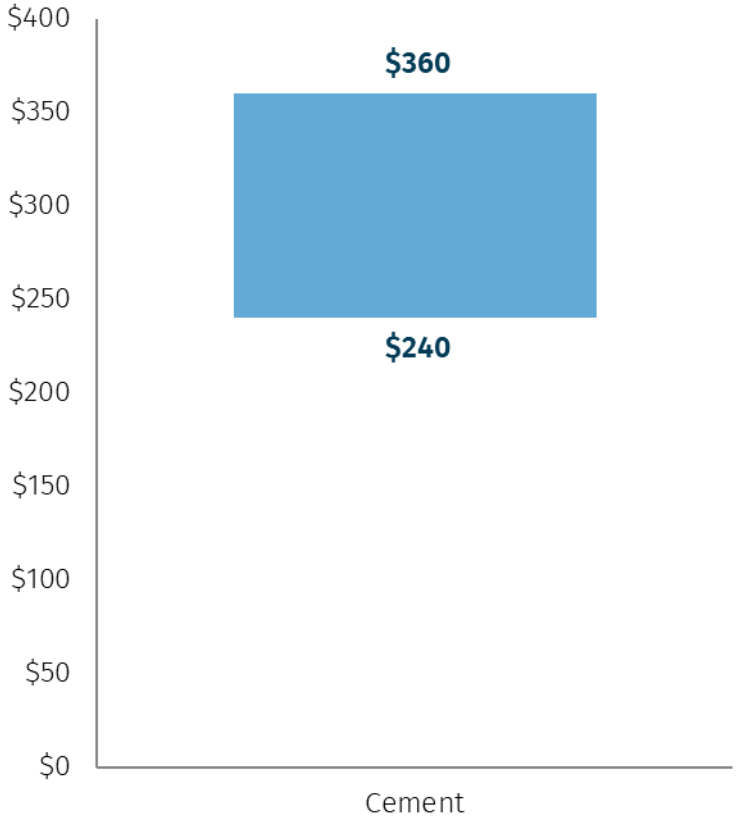
- If all near to intermediate term opportunities in Maryland are pursued, $240 to $360 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Maryland total 70 to 110 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 60 to 90 ongoing jobs.
- In addition, $67 million in transport infrastructure will be required to support these projects. This investment will create 30 jobs on average each year over a 15-year deployment period.

Maryland: Industrial Facilities

Carbon capture opportunities

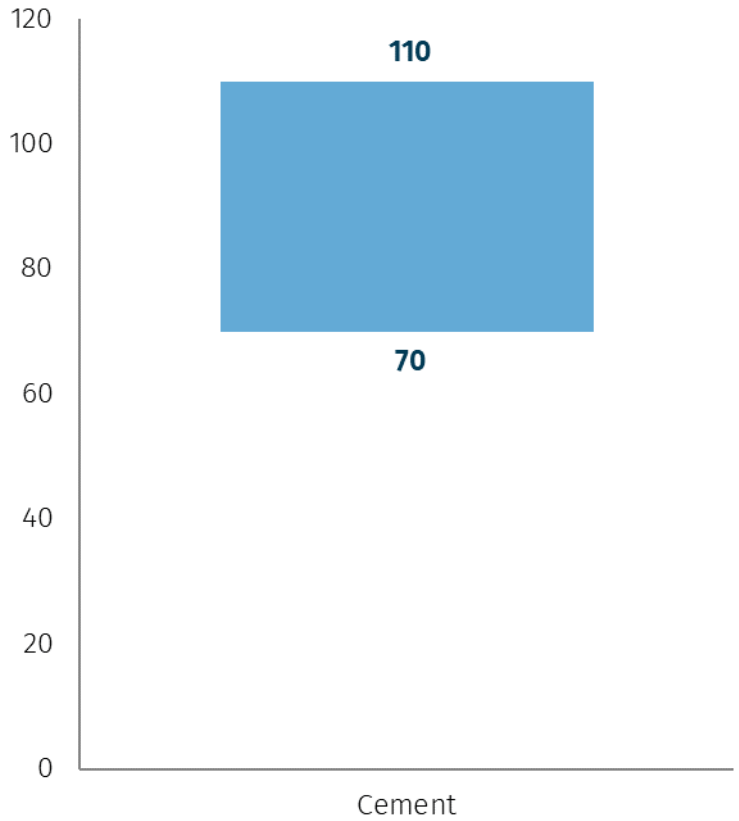
Capital Investment Requirement

Million $ USD



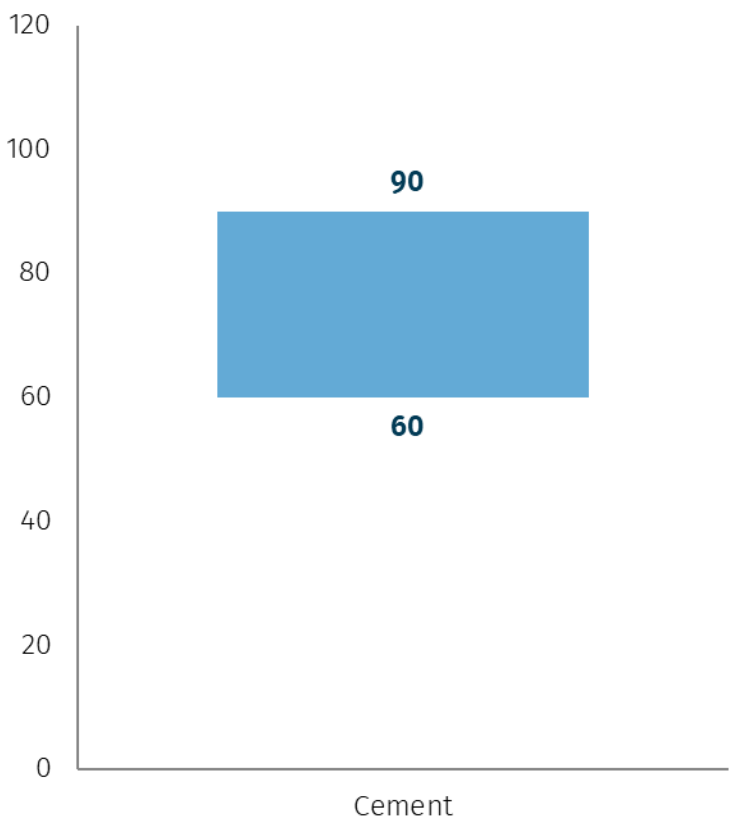
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



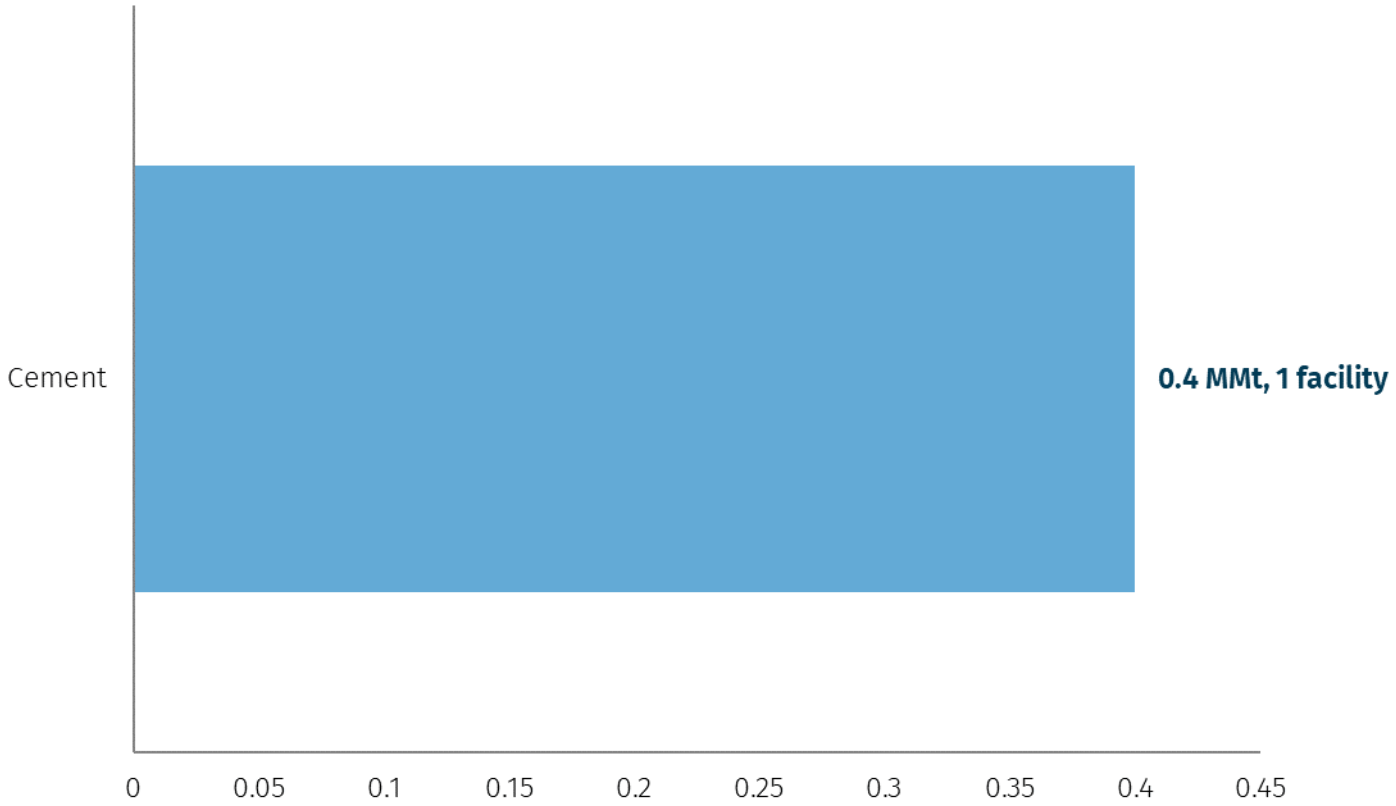
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Nevada: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

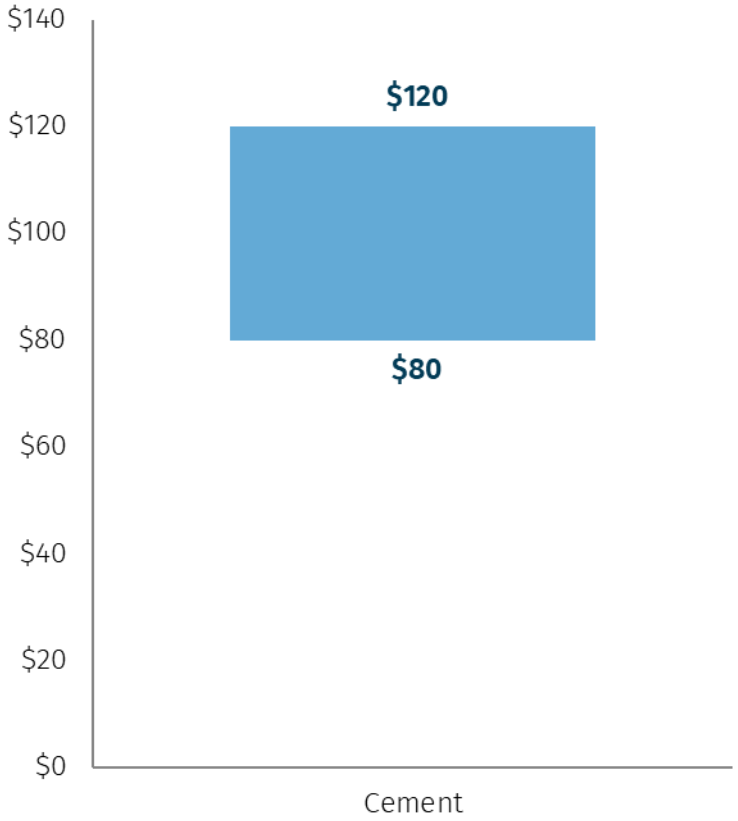
- If all near to intermediate term opportunities in Nevada are pursued, $80 to $120 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Nevada total 25 to 35 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 20 to 30 ongoing jobs.
- In addition, $11 million in transport infrastructure will be required to support these projects. This investment will create 10 jobs on average each year over a 15-year deployment period.

Nevada: Industrial Facilities

Carbon capture opportunities

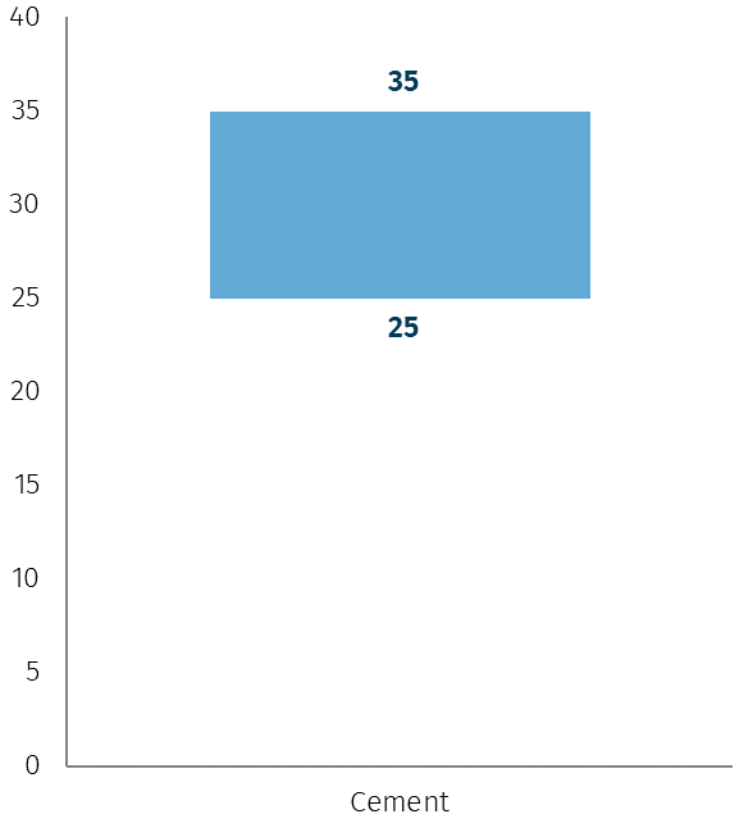
Capital Investment Requirement

Million $ USD



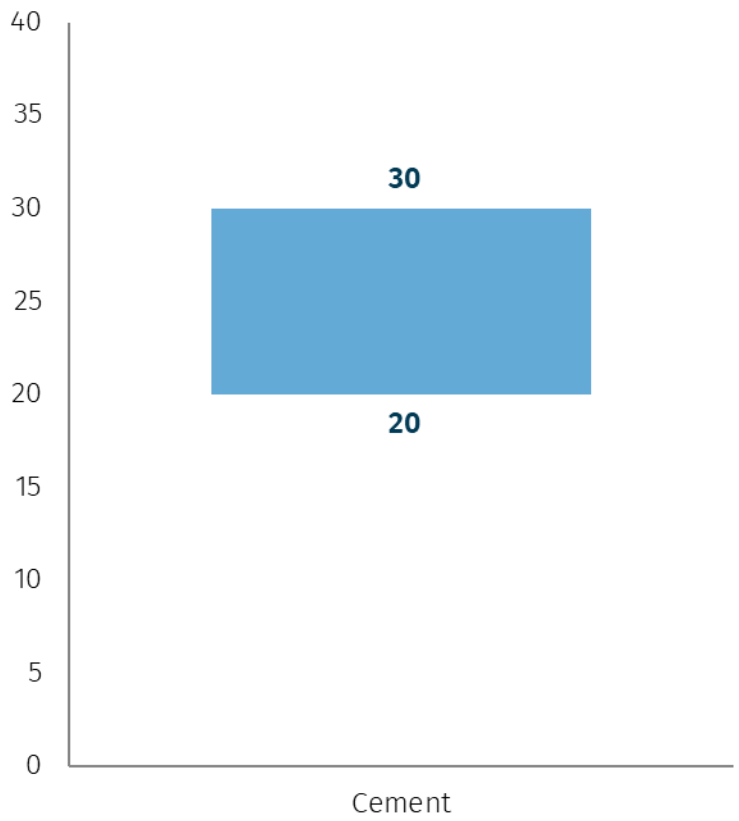
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



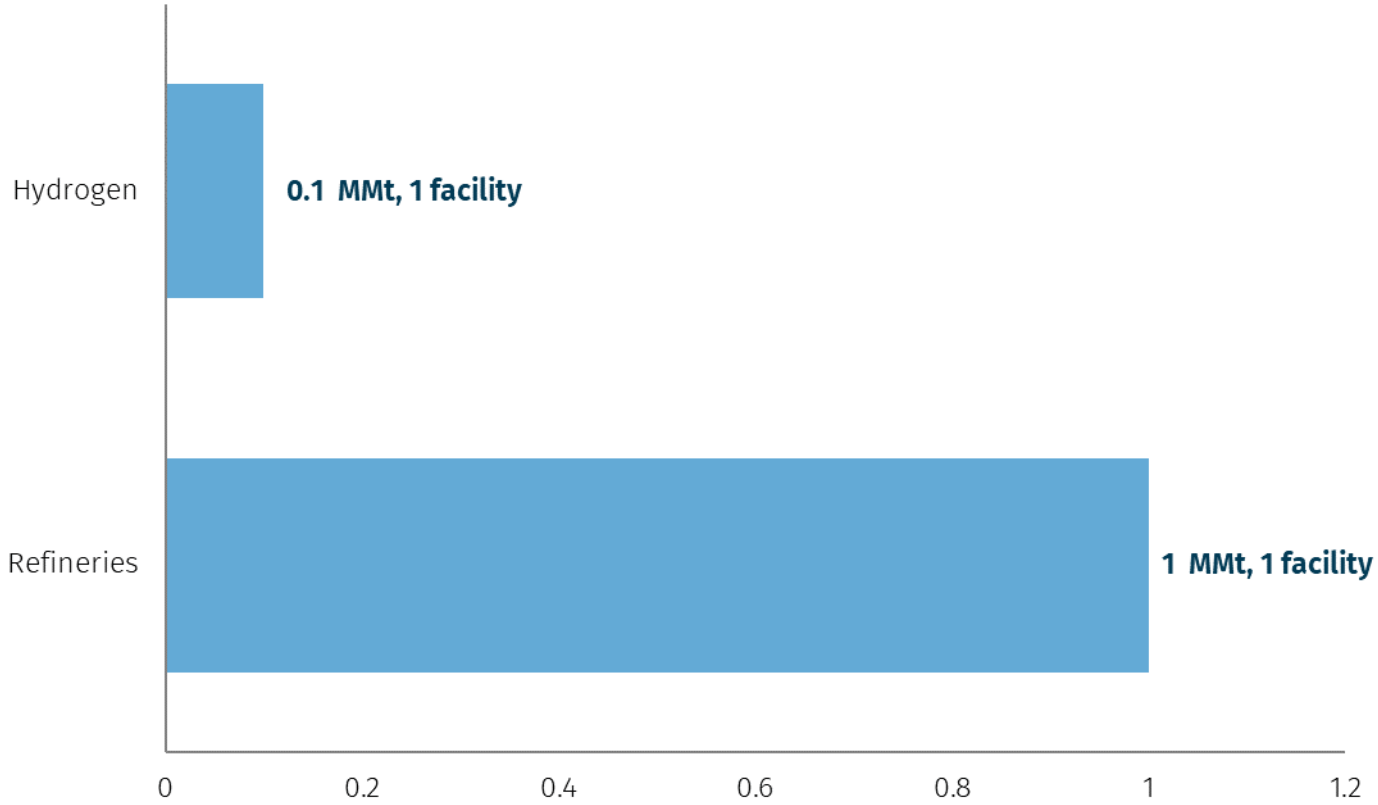
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

New Jersey: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

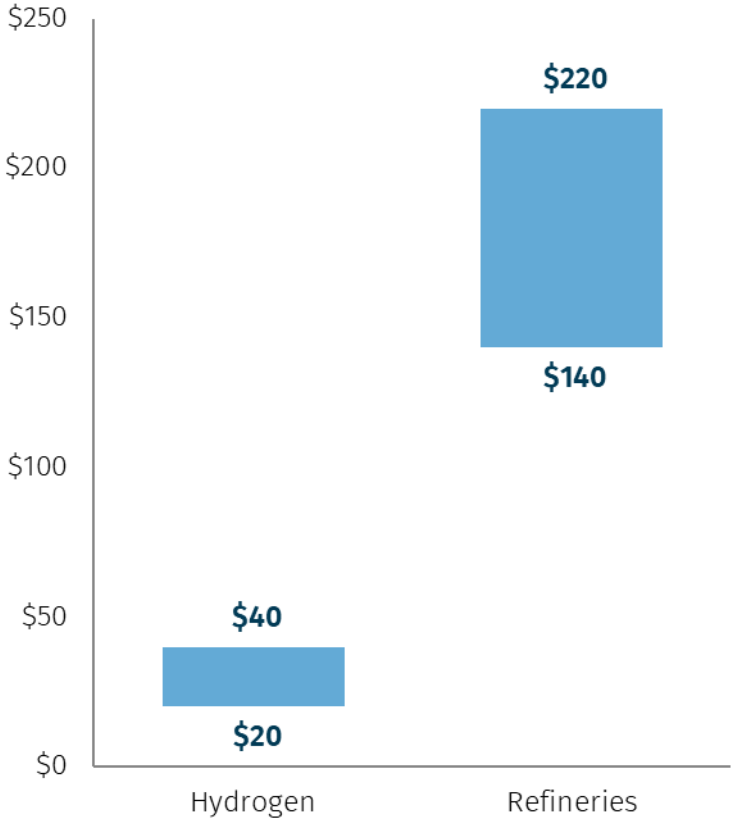
- If all near to intermediate term opportunities in New Jersey are pursued, $160 to $260 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in New Jersey total 60 to 90 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 40 to 55 ongoing jobs.
- In addition, $58 million in transport infrastructure will be required to support these projects. This investment will create 30 jobs on average each year over a 15-year deployment period.

New Jersey: Industrial Facilities

Carbon Capture Opportunities

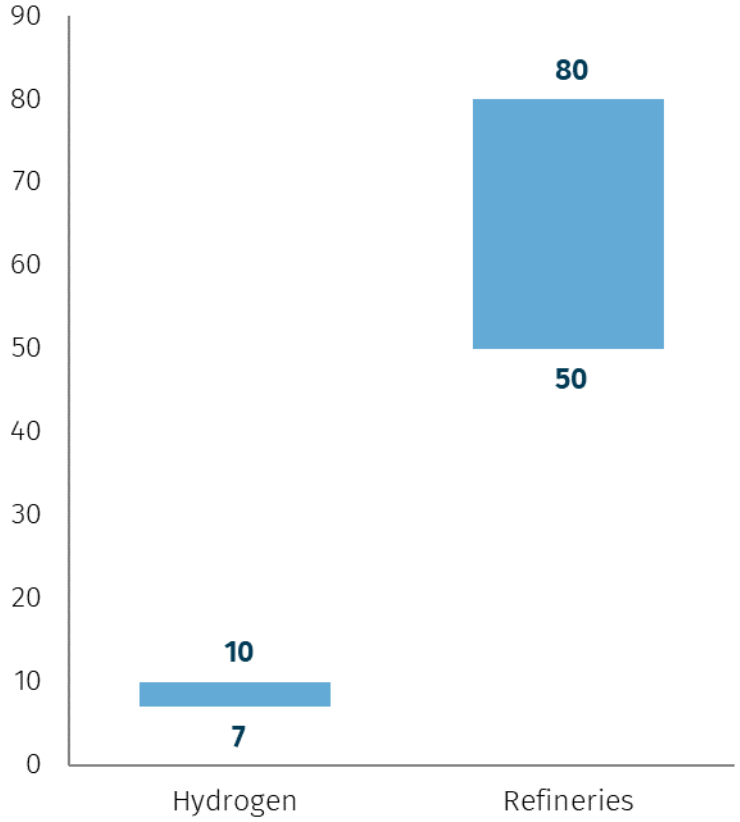
Capital Investment Requirement

Million $ USD



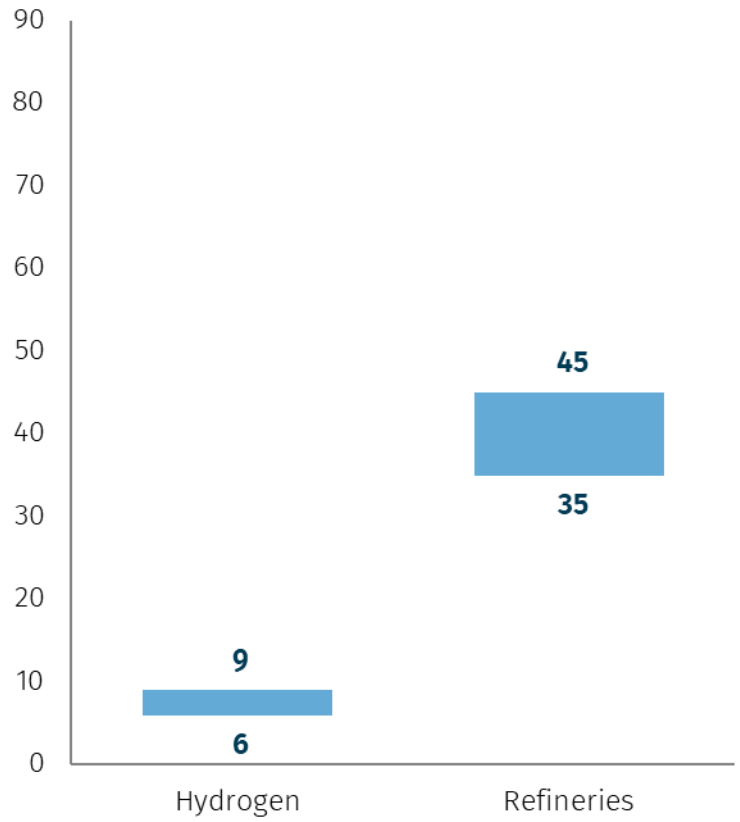
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



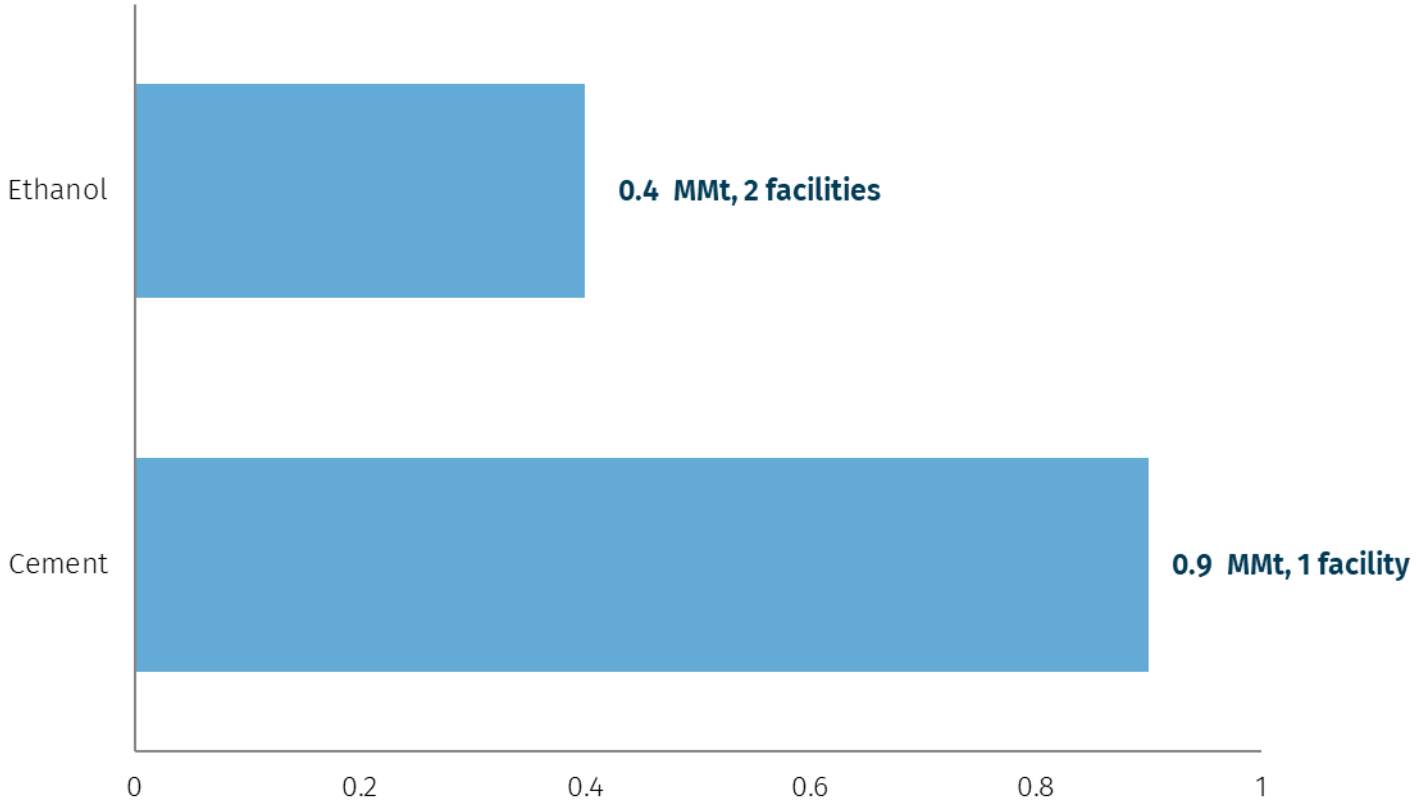
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

New York: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

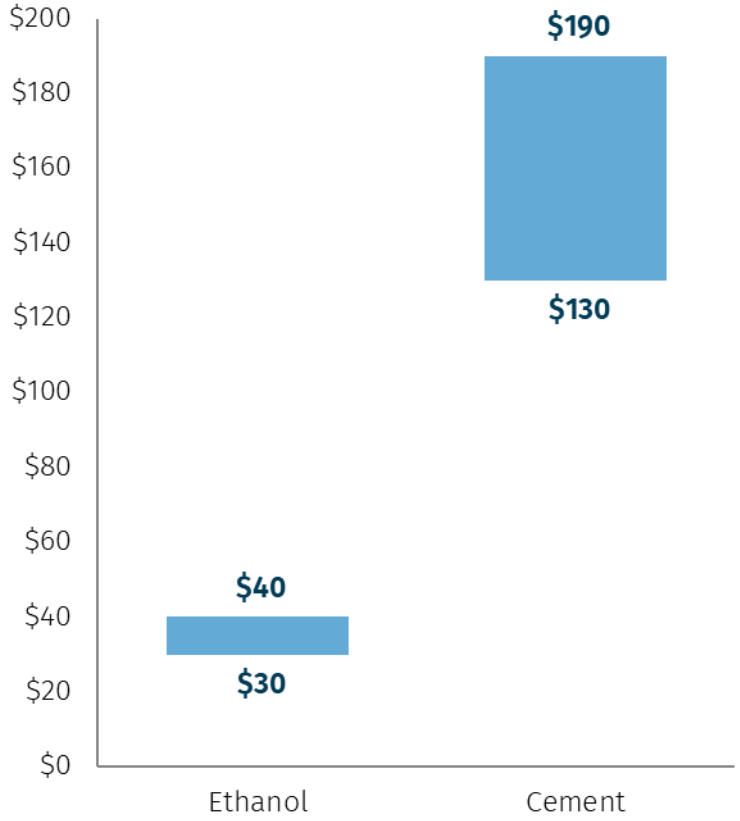
- If all near to intermediate term opportunities in New York are pursued, $160 to $230 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in New York total 40 to 70 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 45 to 60 ongoing jobs.
- In addition, $173 million in transport infrastructure will be required to support these projects. This investment will create 90 jobs on average each year over a 15-year deployment period.

New York: Industrial Facilities

Carbon capture opportunities

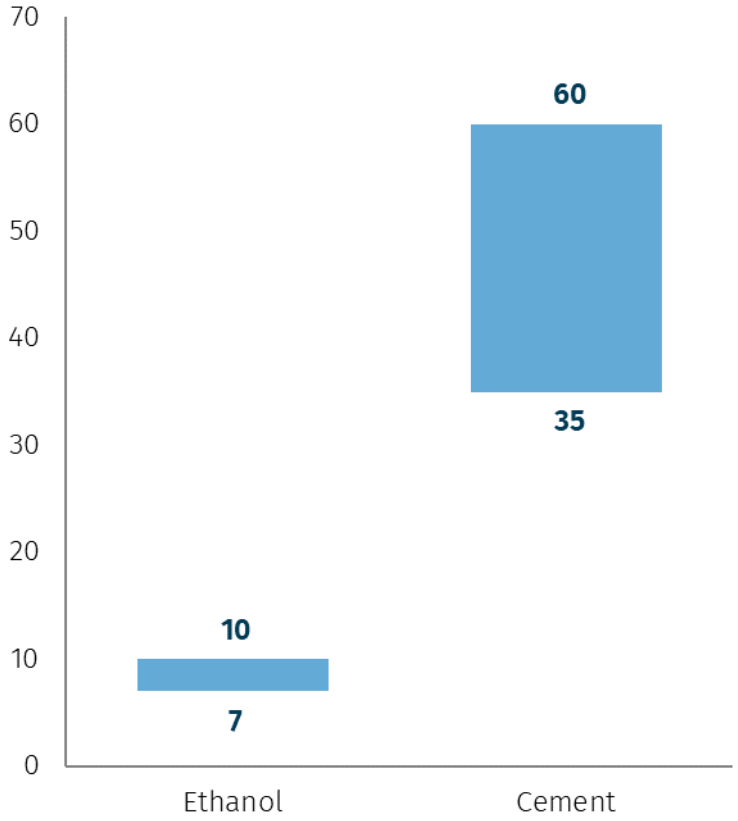
Capital Investment Requirement

Million $ USD



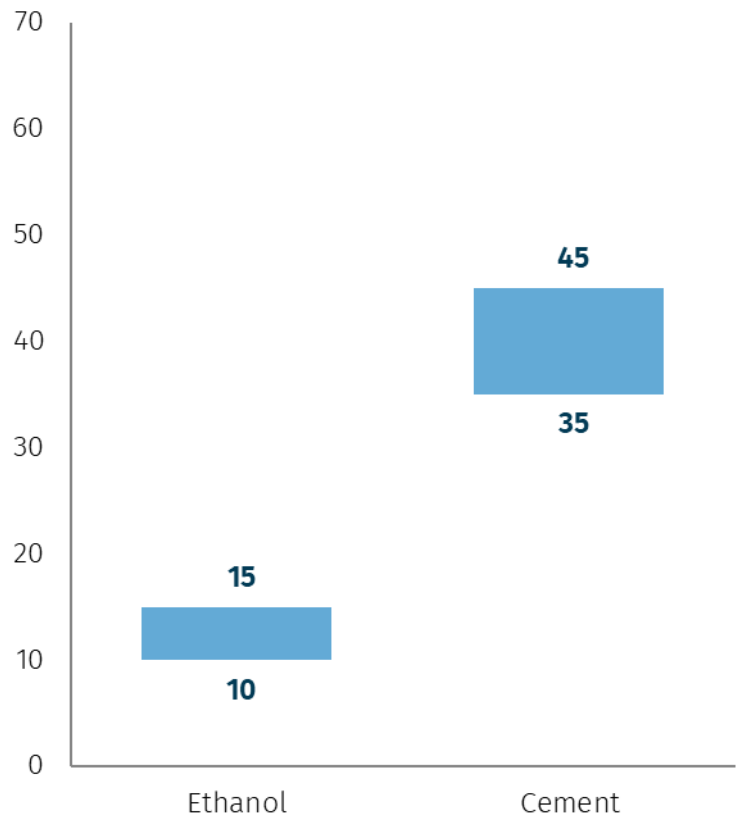
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



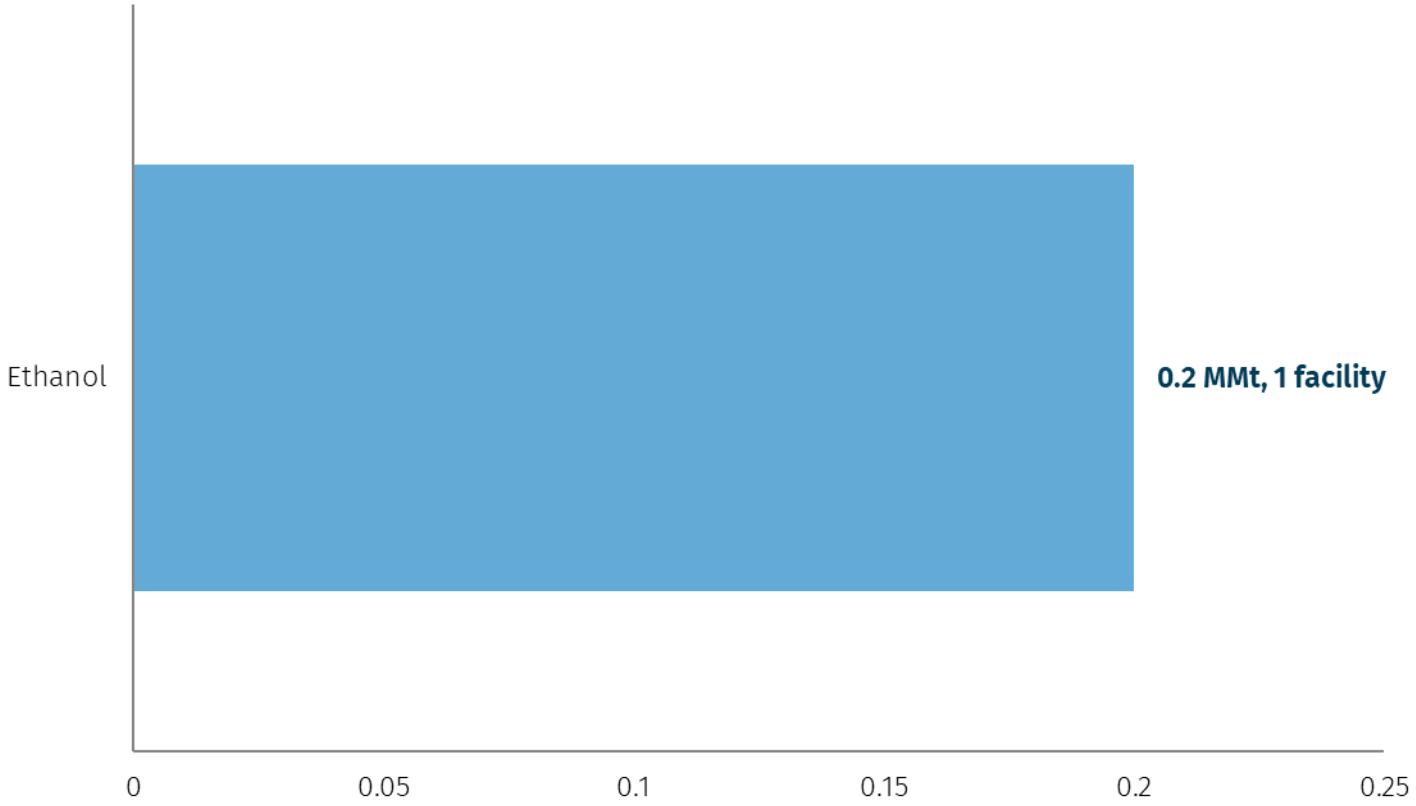
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

North Carolina: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

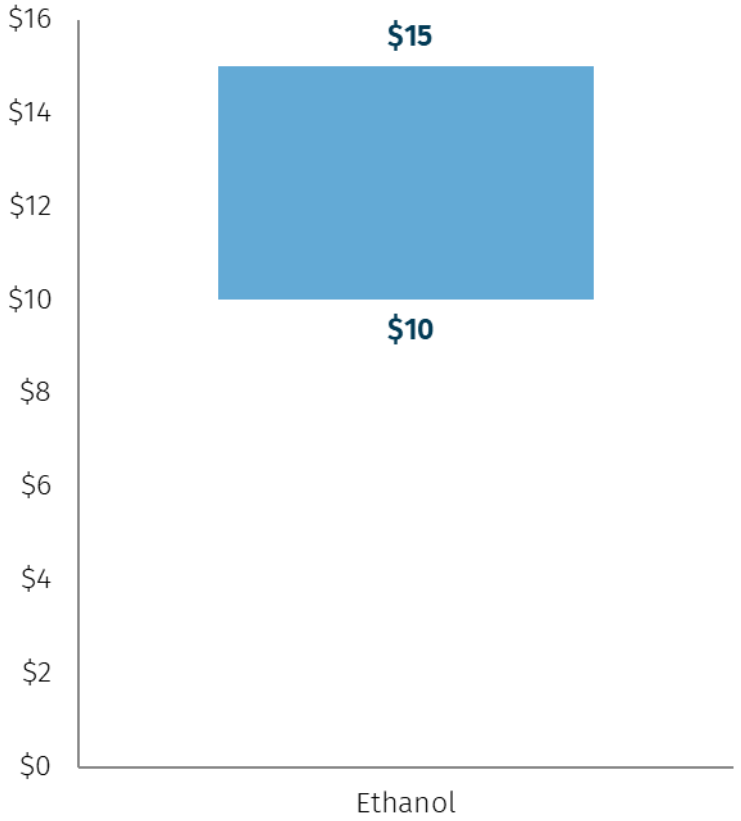
- If all near to intermediate term opportunities in North Carolina are pursued, $10 to $15 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in North Carolina total 3 to 5 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 5 to 7 ongoing jobs.
- In addition, $4 million in transport infrastructure will be required to support these projects. This investment will create 3 jobs on average each year over a 15-year deployment period.

North Carolina: Industrial Facilities

Carbon capture opportunities

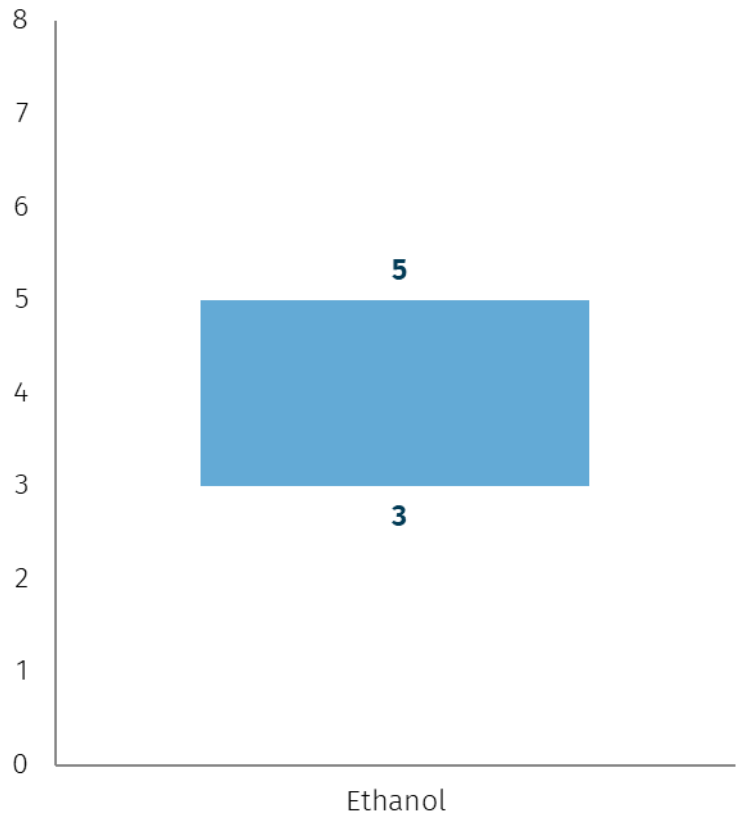
Capital Investment Requirement

Million $ USD



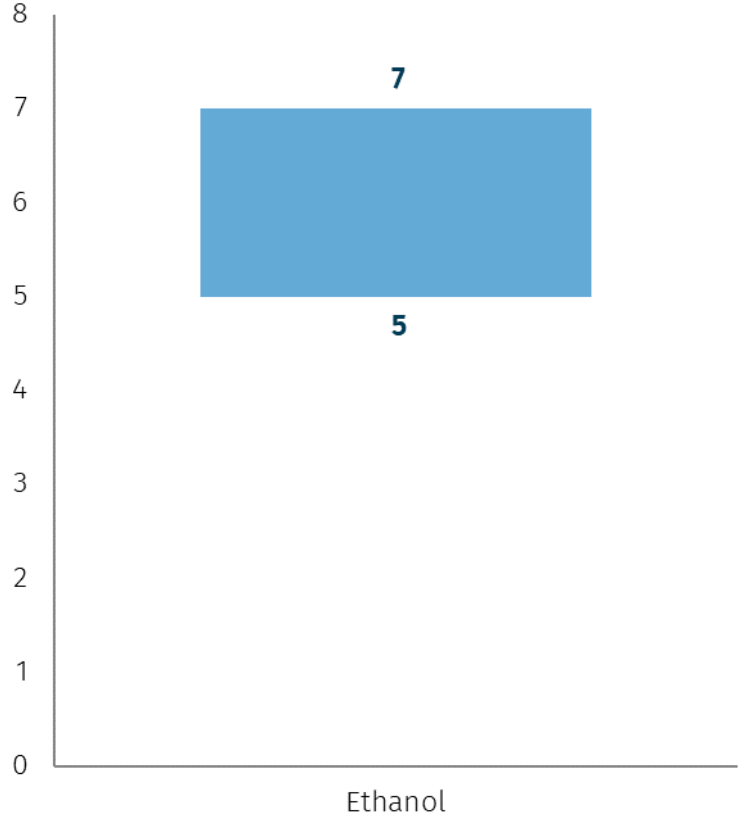
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



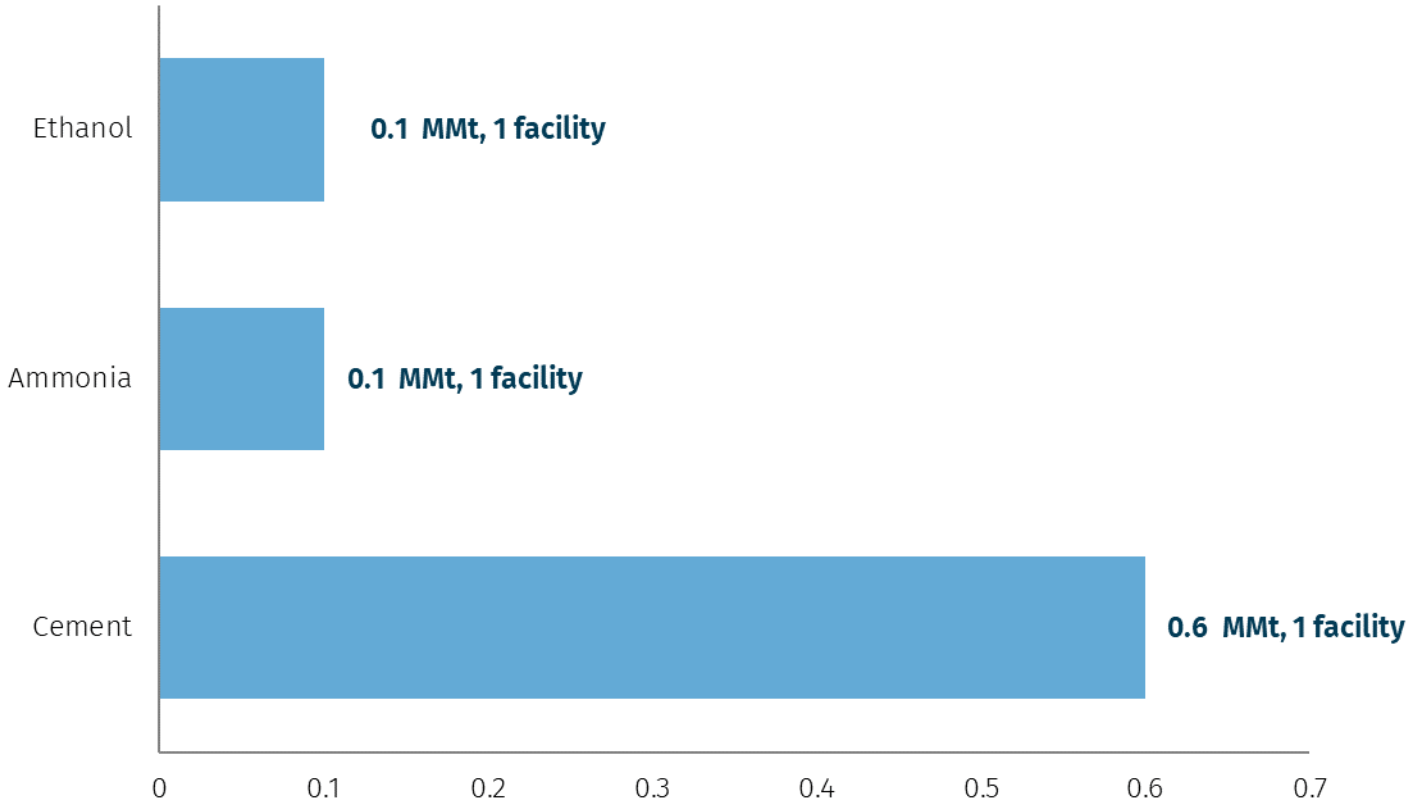
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Oregon: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

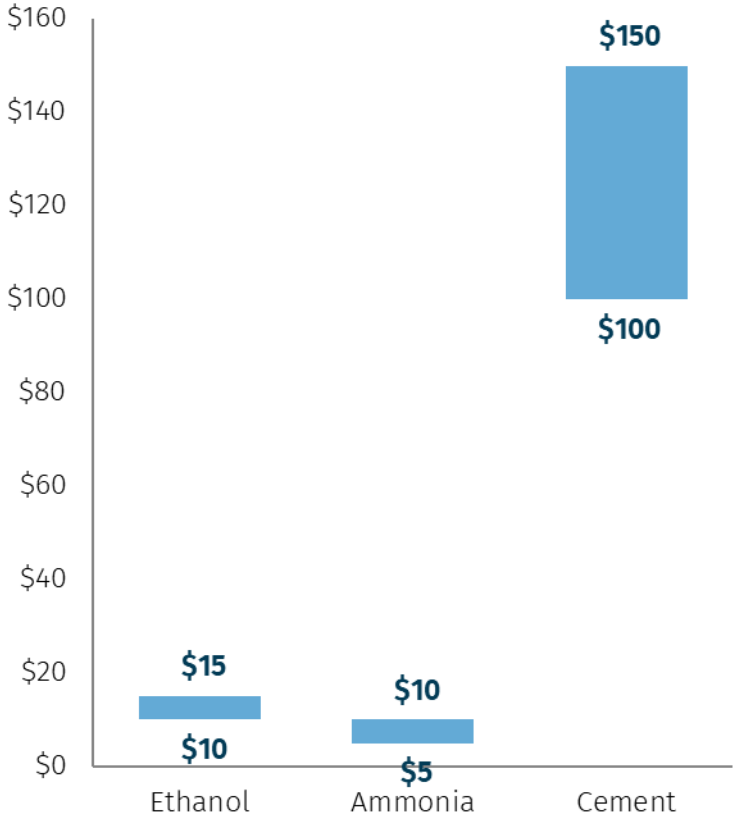
- If all near to intermediate term opportunities in Oregon are pursued, $115 to $175 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Oregon total 35 to 60 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 35 to 50 ongoing jobs.
- In addition, $90 million in transport infrastructure will be required to support these projects. This investment will create 60 jobs on average each year over a 15-year deployment period.

Oregon: Industrial Facilities

Carbon capture opportunities

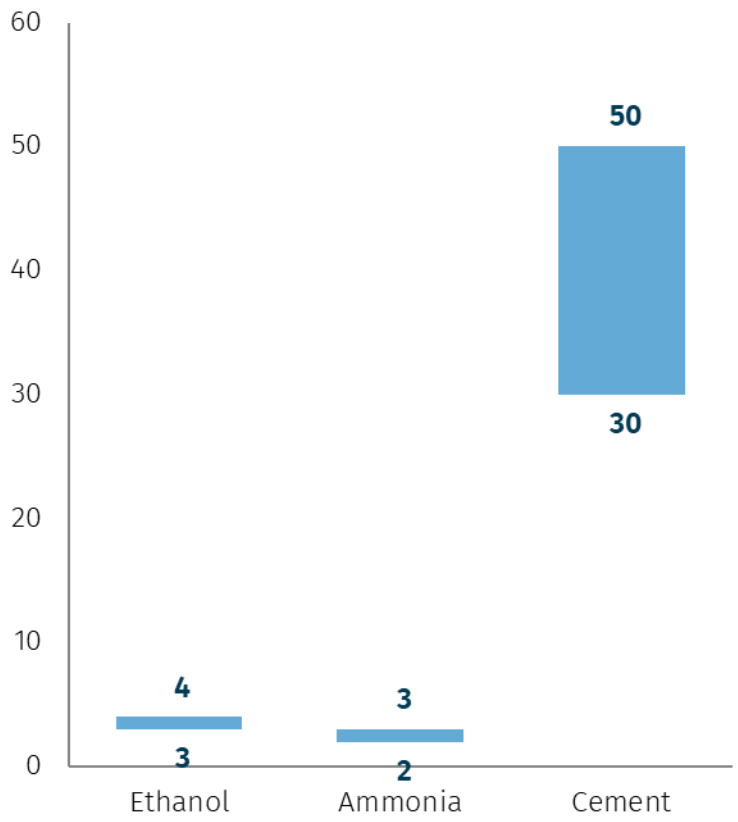
Capital Investment Requirement

Million $ USD



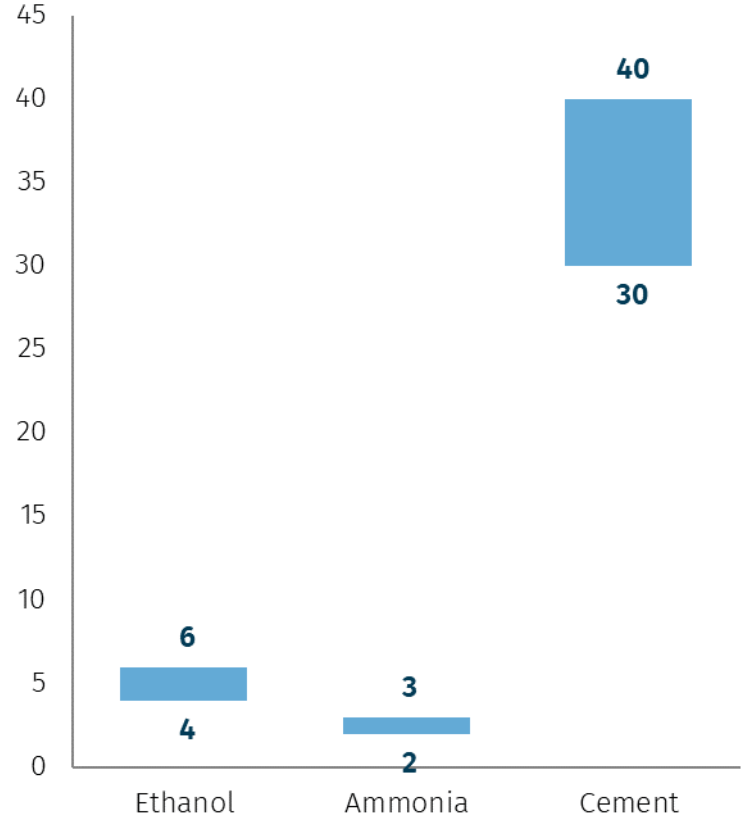
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



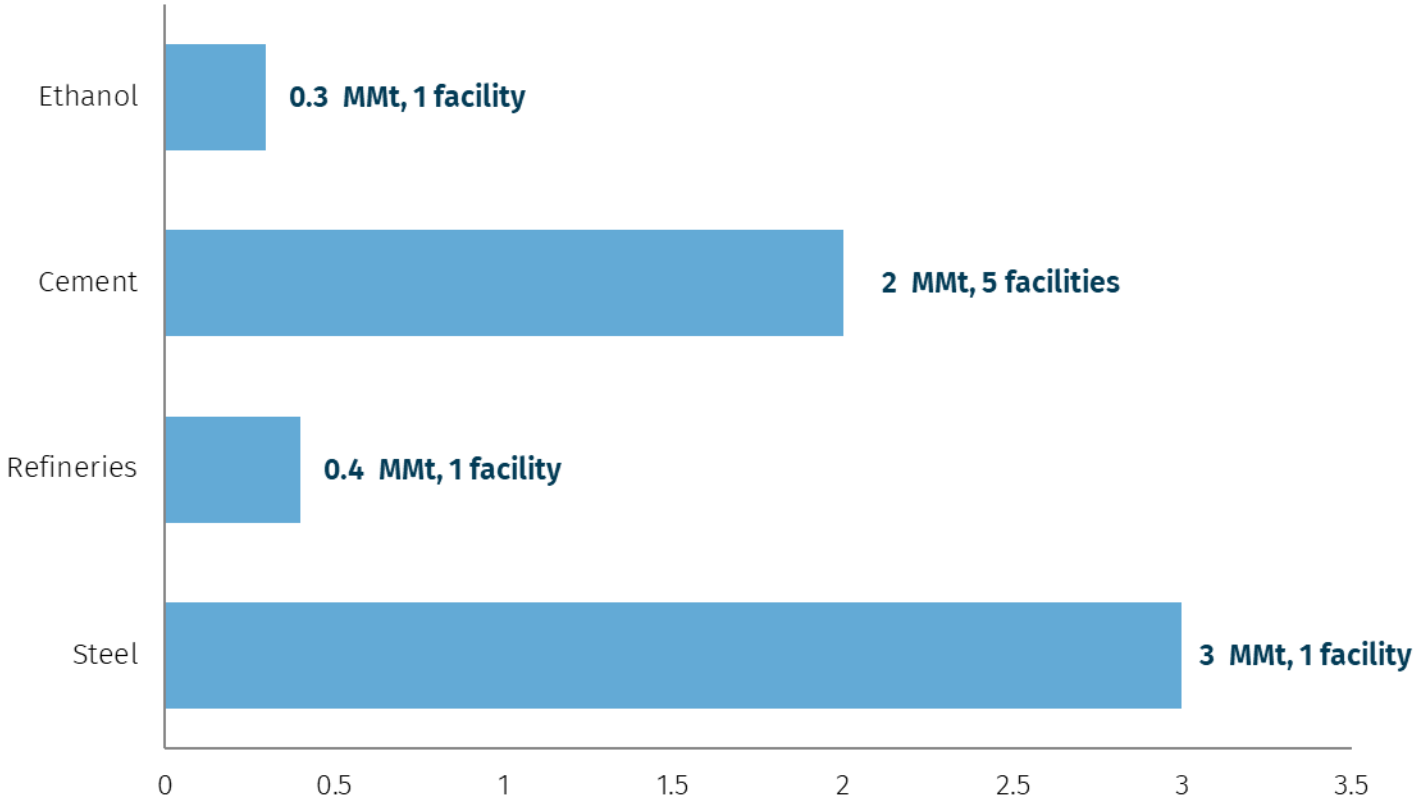
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Pennsylvania: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

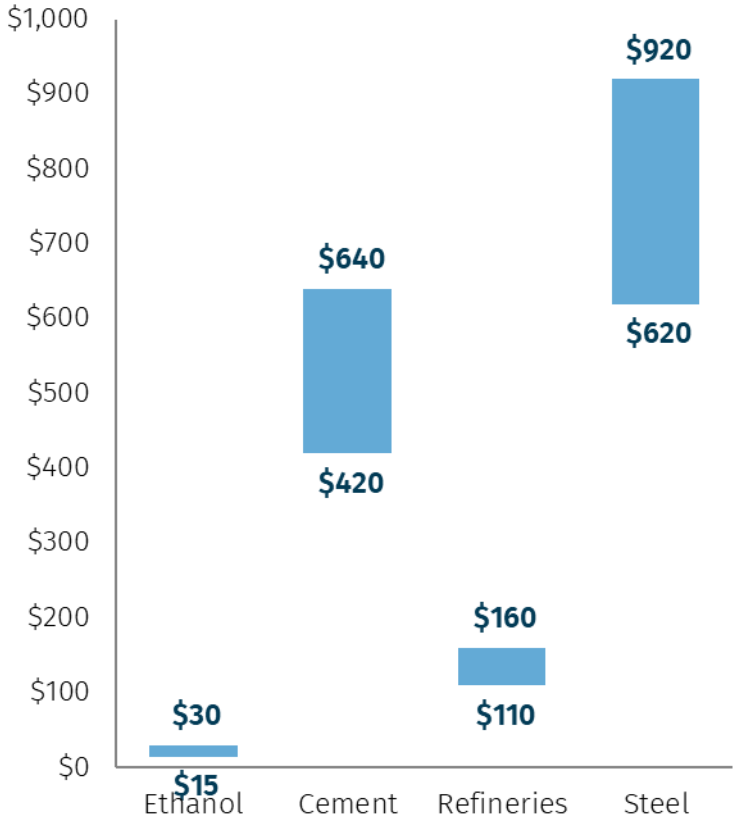
- If all near to intermediate term opportunities in Pennsylvania are pursued, $1.2 to $1.8 billion in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Pennsylvania total 355 to 540 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 300 to 435 ongoing jobs.
- In addition, $356 million in transport infrastructure will be required to support these projects. This investment will create 150 jobs on average each year over a 15-year deployment period.

Pennsylvania: Industrial Facilities

Carbon capture opportunities

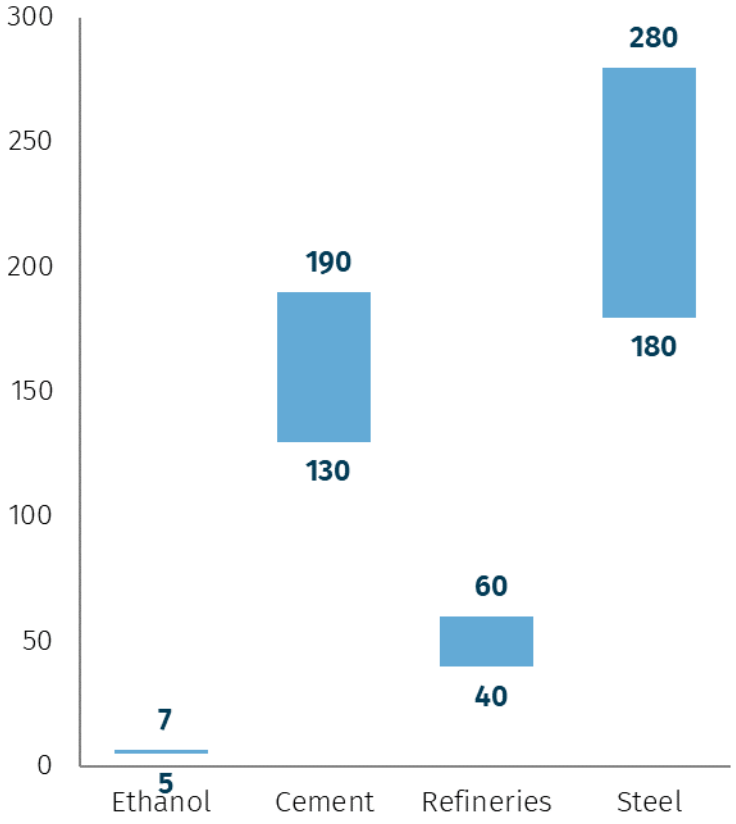
Capital Investment Requirement

Million $ USD



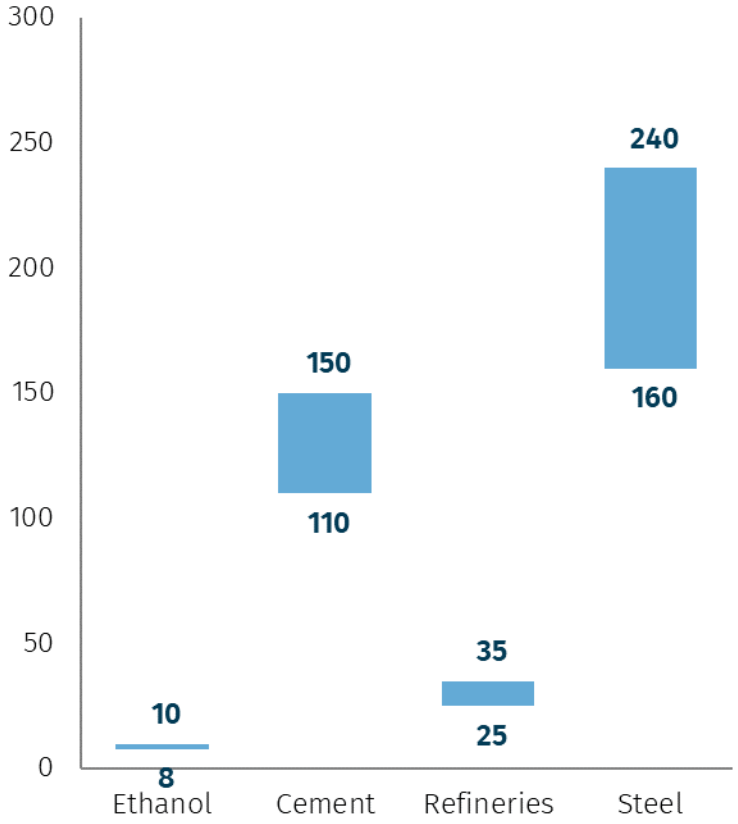
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



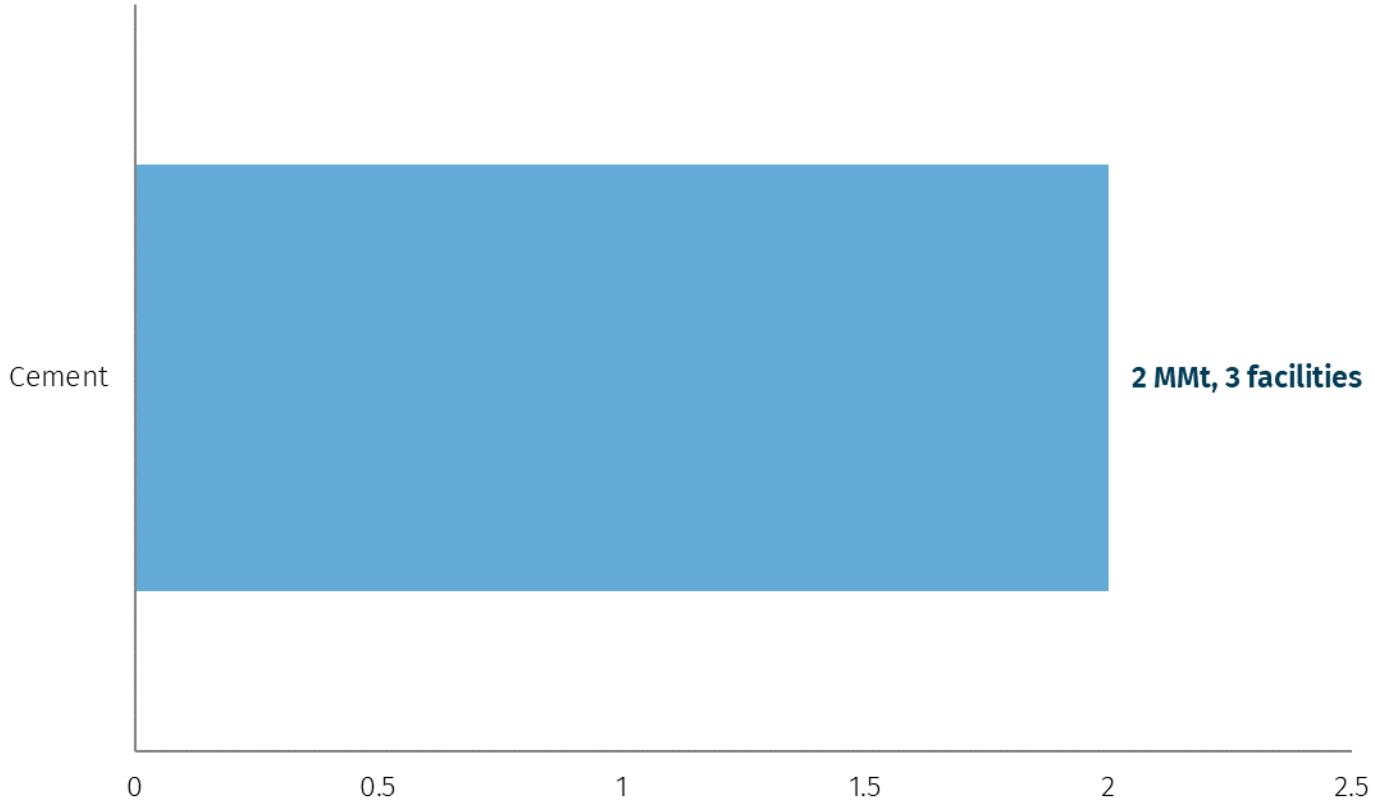
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

South Carolina: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

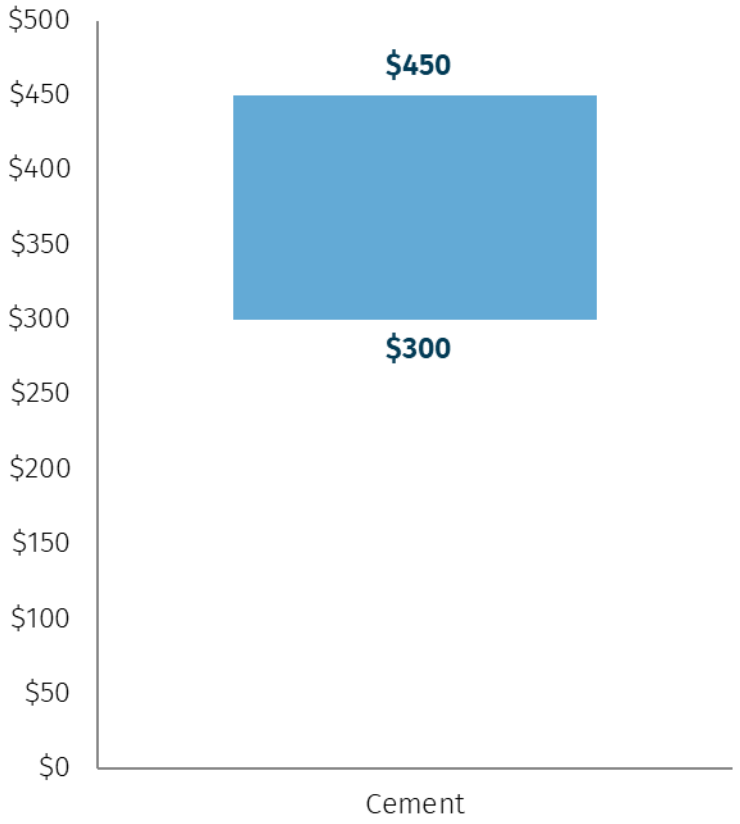
- If all near to intermediate term opportunities in South Carolina are pursued, $300 to $450 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in South Carolina total 100 to 140 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 90 to 120 ongoing jobs.
- In addition, $163 million in transport infrastructure will be required to support these projects. This investment will create 90 jobs on average each year over a 15-year deployment period.

South Carolina: Industrial Facilities

Carbon capture opportunities

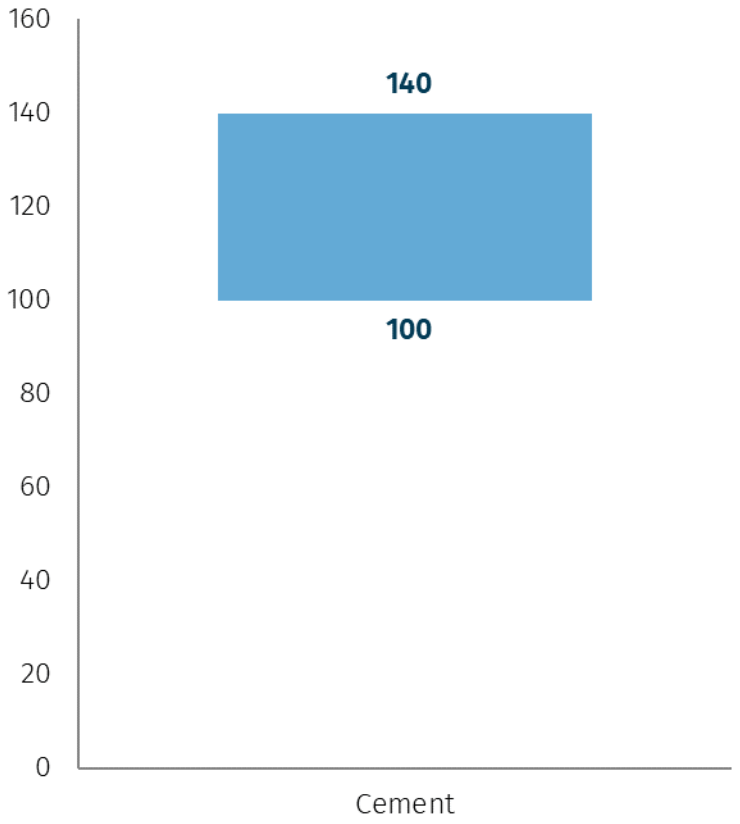
Capital Investment Requirement

Million $ USD



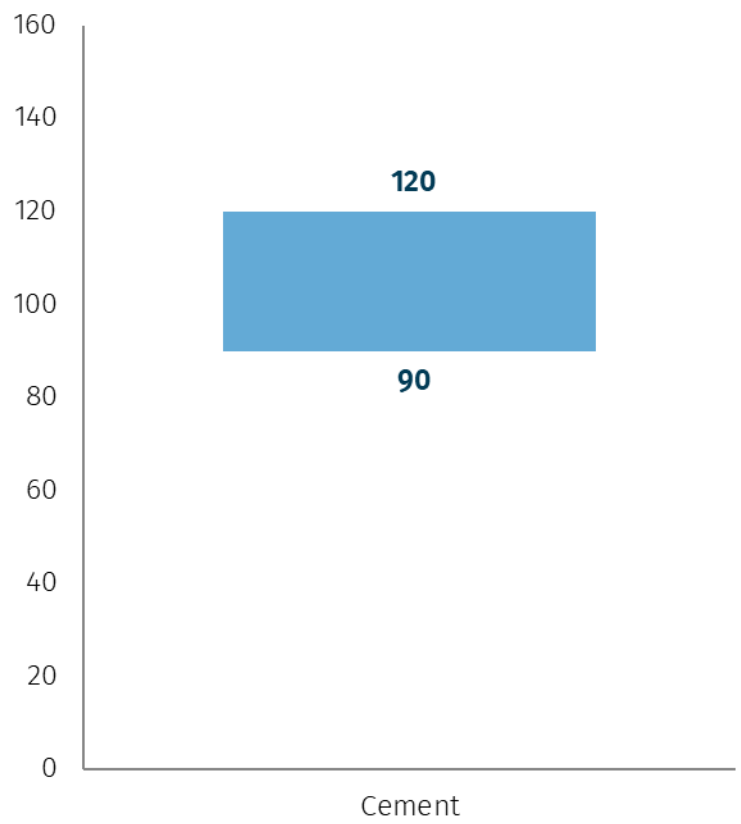
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



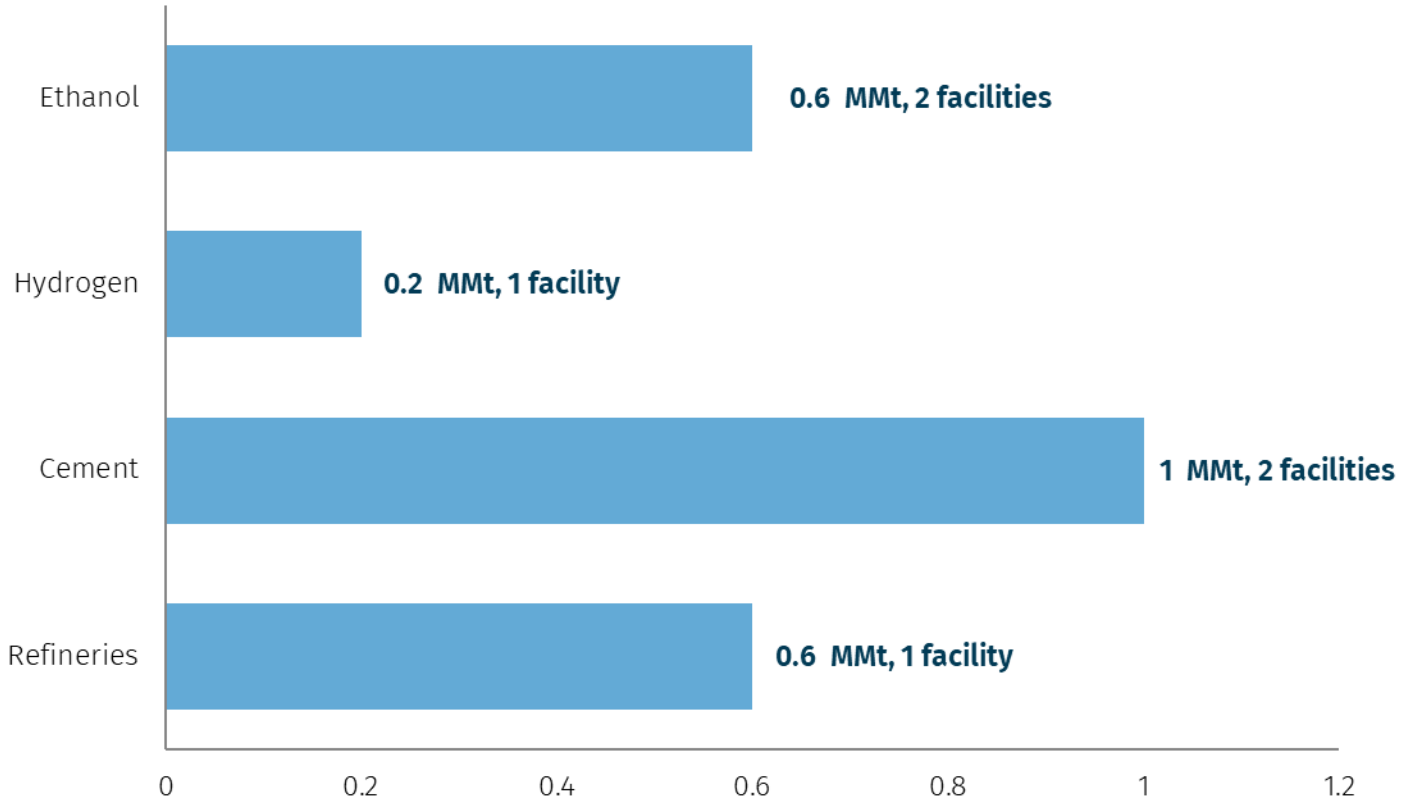
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Tennessee: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

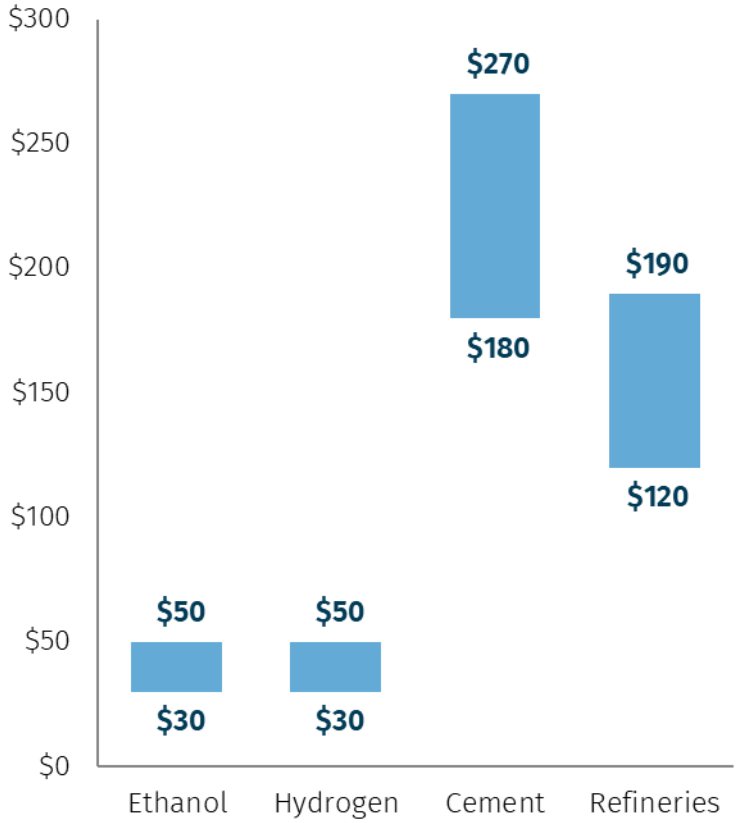
- If all near to intermediate term opportunities in Tennessee are pursued, $360 to $560 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Tennessee total 130 to 200 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 105 to 155 ongoing jobs.
- In addition, $270 million in transport infrastructure will be required to support these projects. This investment will create 150 jobs on average each year over a 15-year deployment period.

Tennessee: Industrial Facilities

Carbon capture opportunities

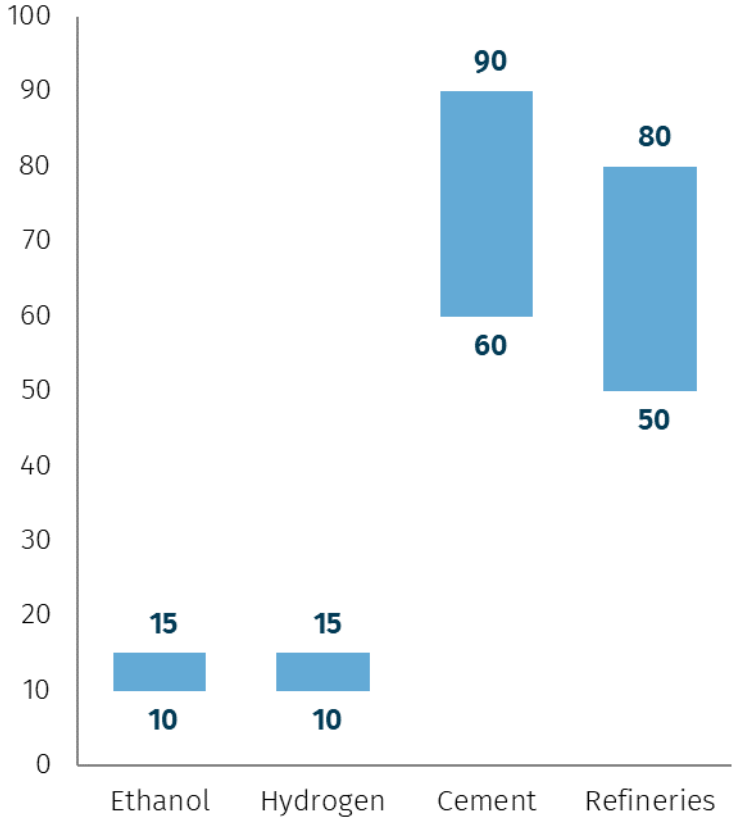
Capital Investment Requirement

Million $ USD



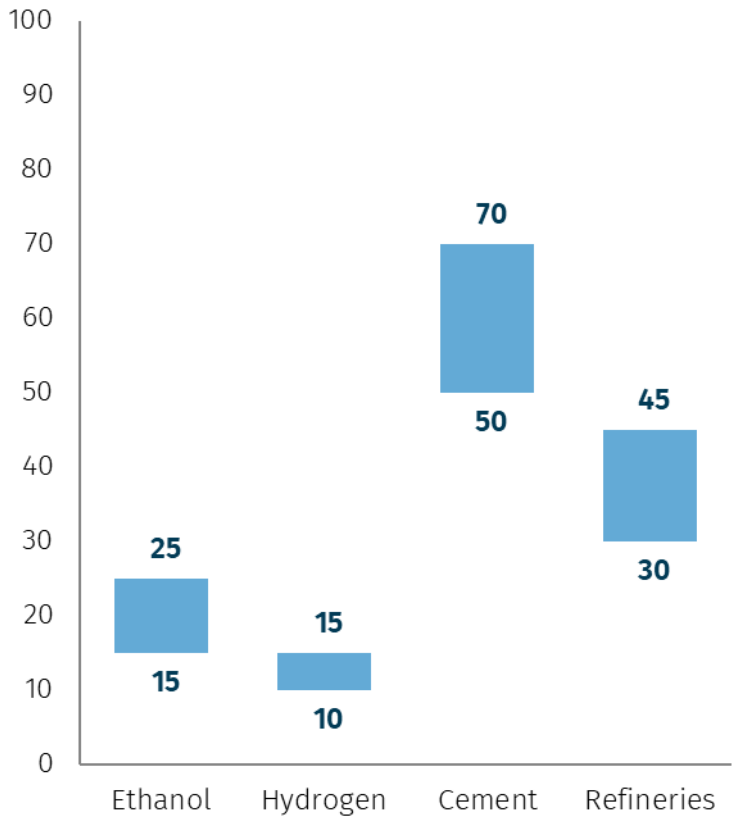
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



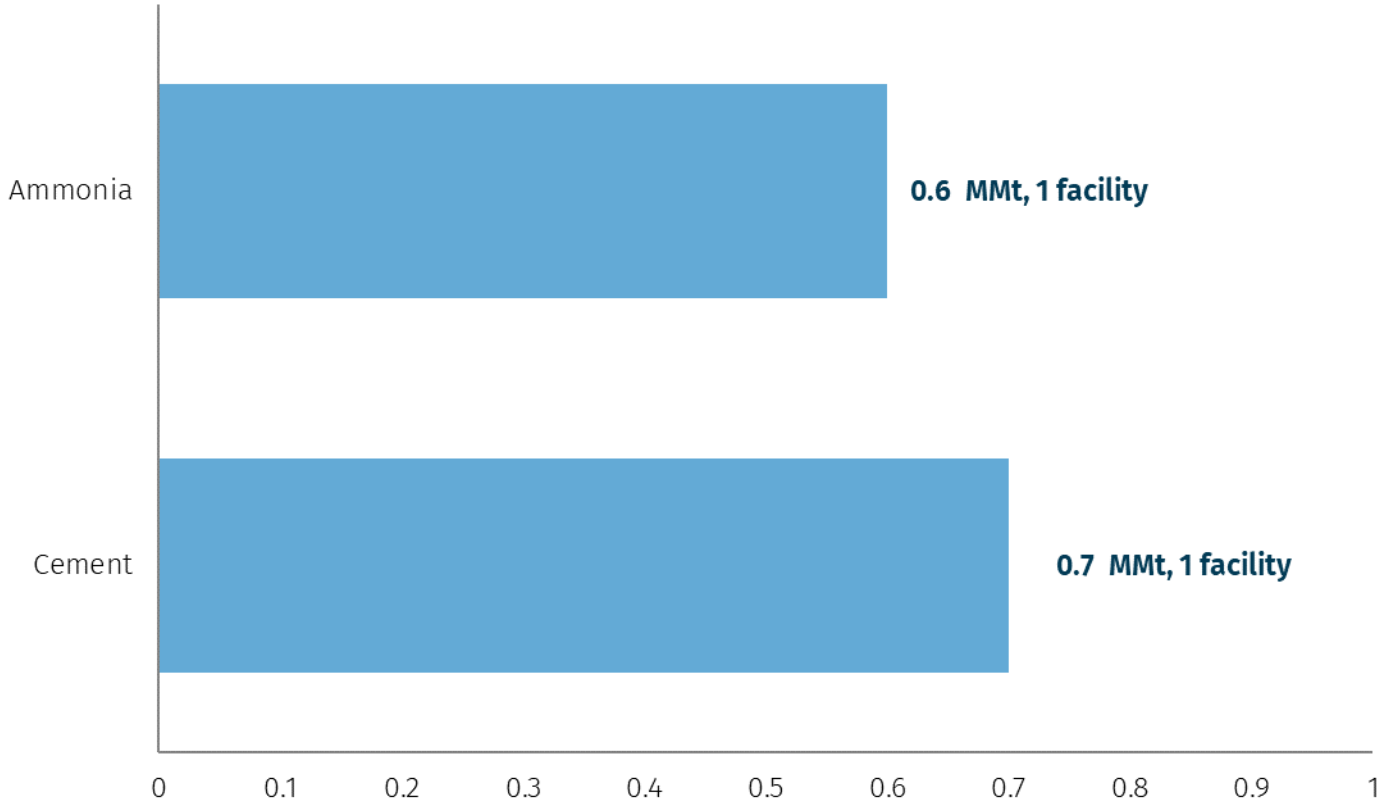
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Virginia: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

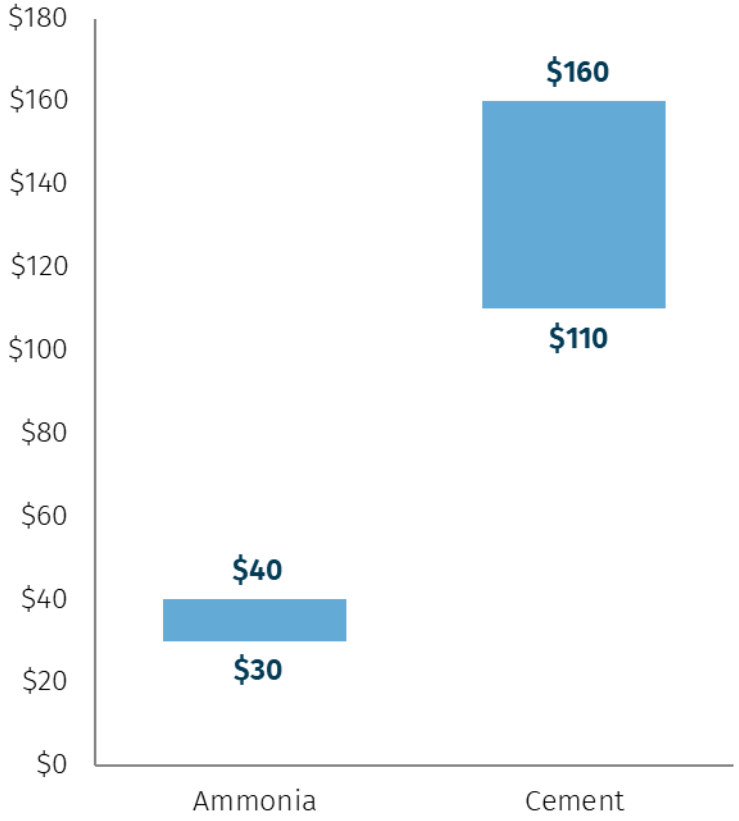
- If all near to intermediate term opportunities in Virginia are pursued, $140 to $200 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Virginia total 40 to 60 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 40 to 55 ongoing jobs.
- In addition, $118 million in transport infrastructure will be required to support these projects. This investment will create 60 jobs on average each year over a 15-year deployment period.

Virginia: Industrial Facilities

Carbon capture opportunities

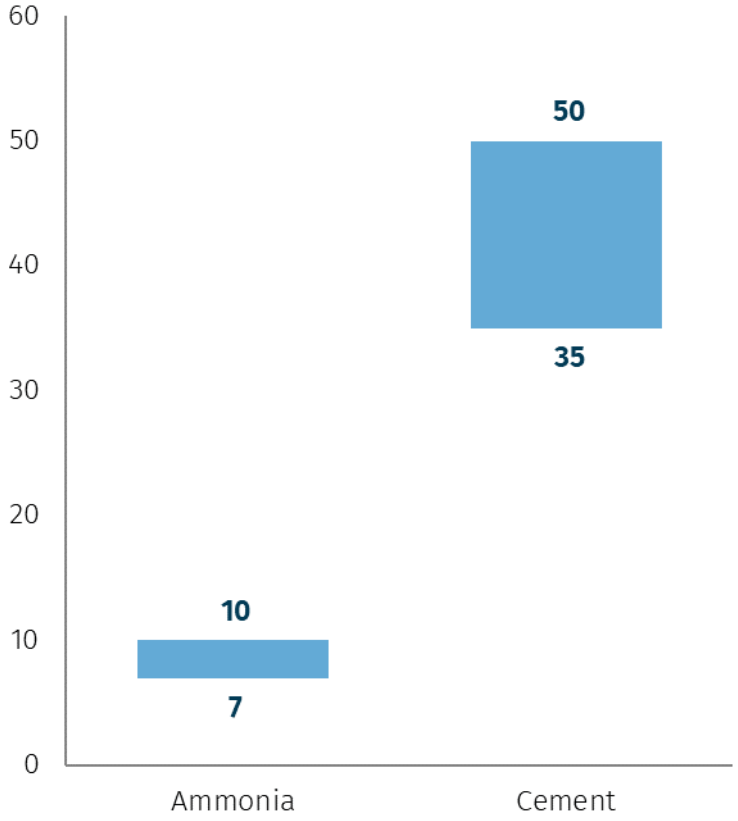
Capital Investment Requirement

Million $ USD



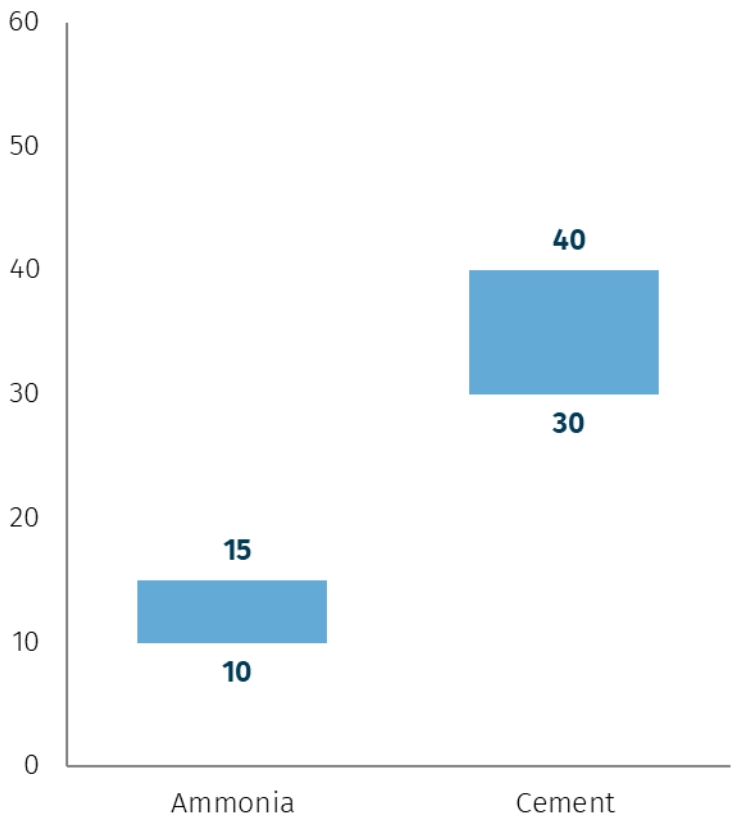
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



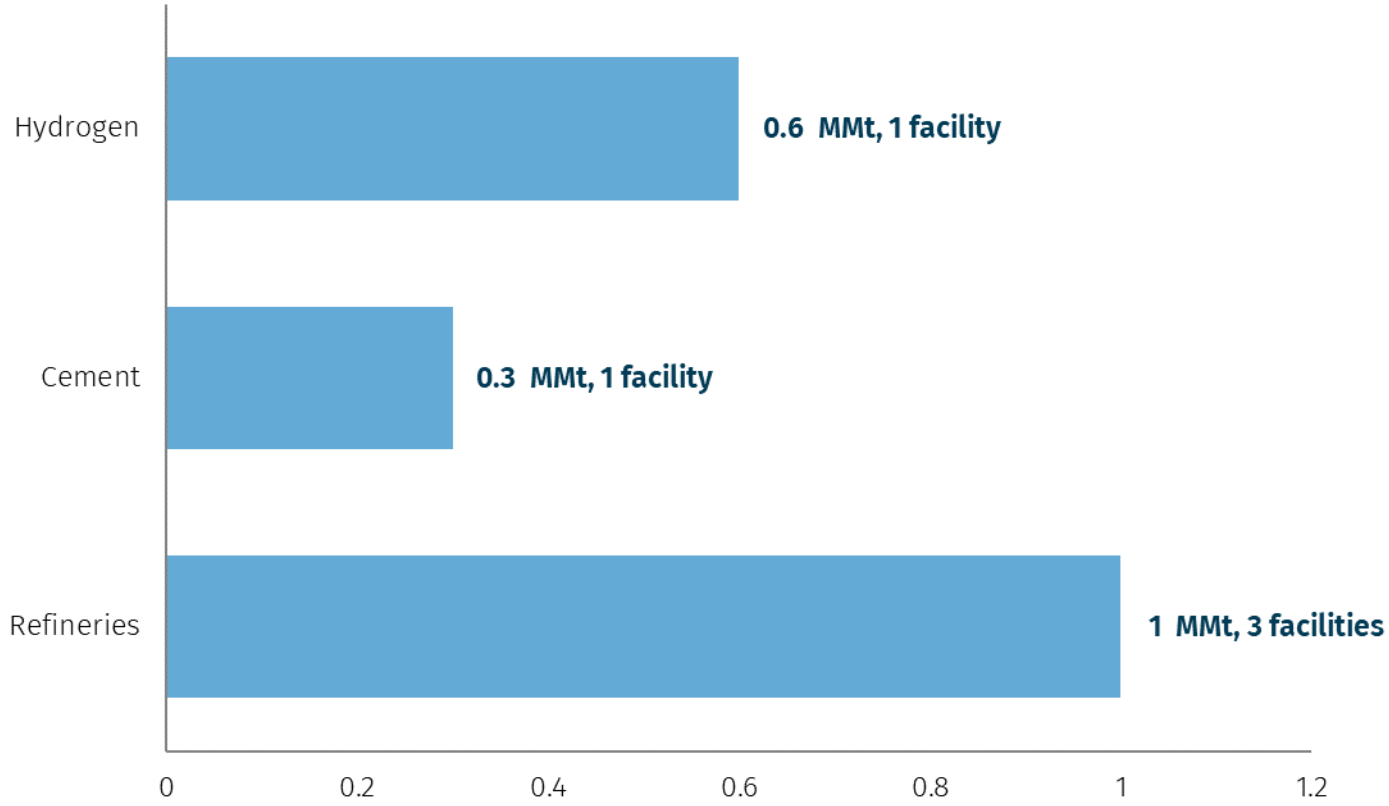
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Washington: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

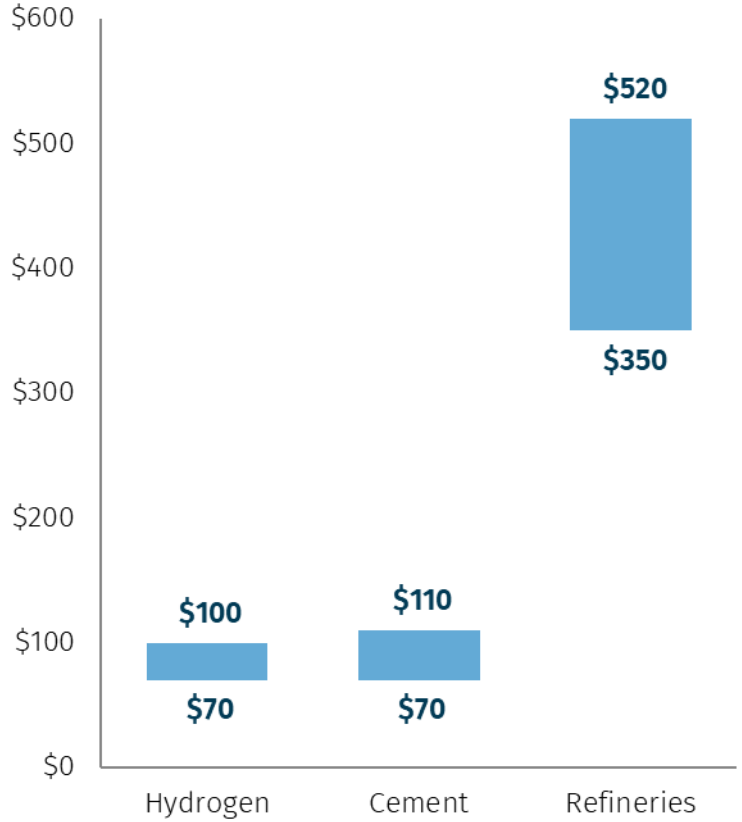
- If all near to intermediate term opportunities in Washington are pursued, $490 to $730 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Washington total 160 to 245 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 110 to 150 ongoing jobs.
- In addition, $234 million in transport infrastructure will be required to support these projects. This investment will create 110 jobs on average each year over a 15-year deployment period.

Washington: Industrial Facilities

Carbon capture opportunities

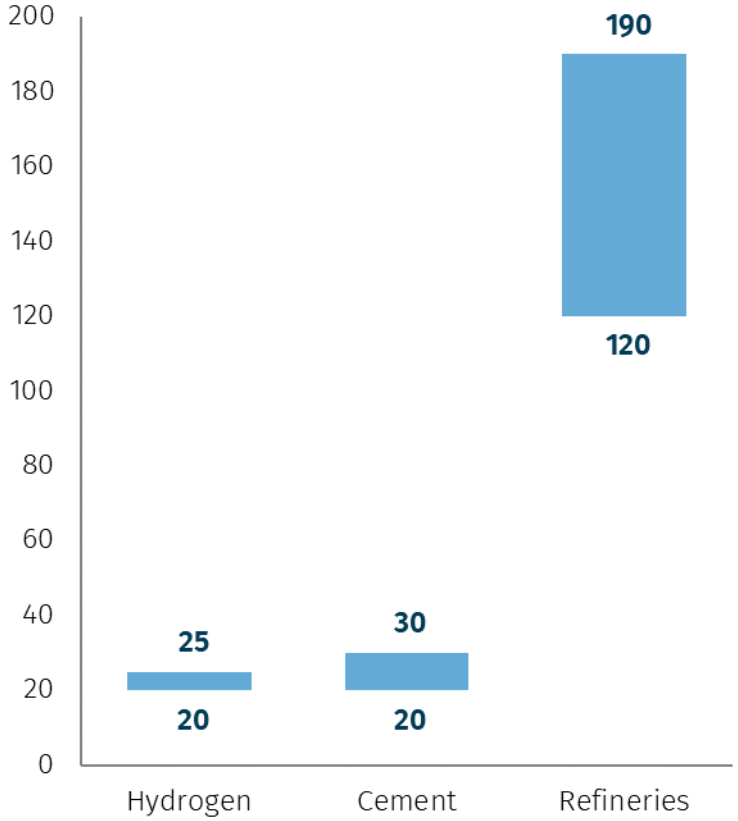
Capital Investment Requirement

Million $ USD



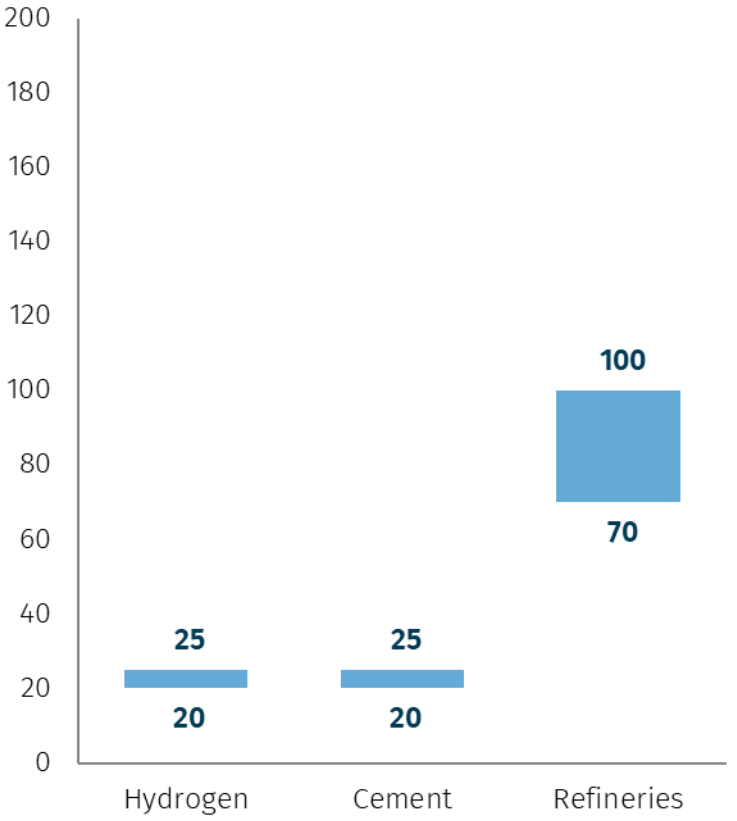
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



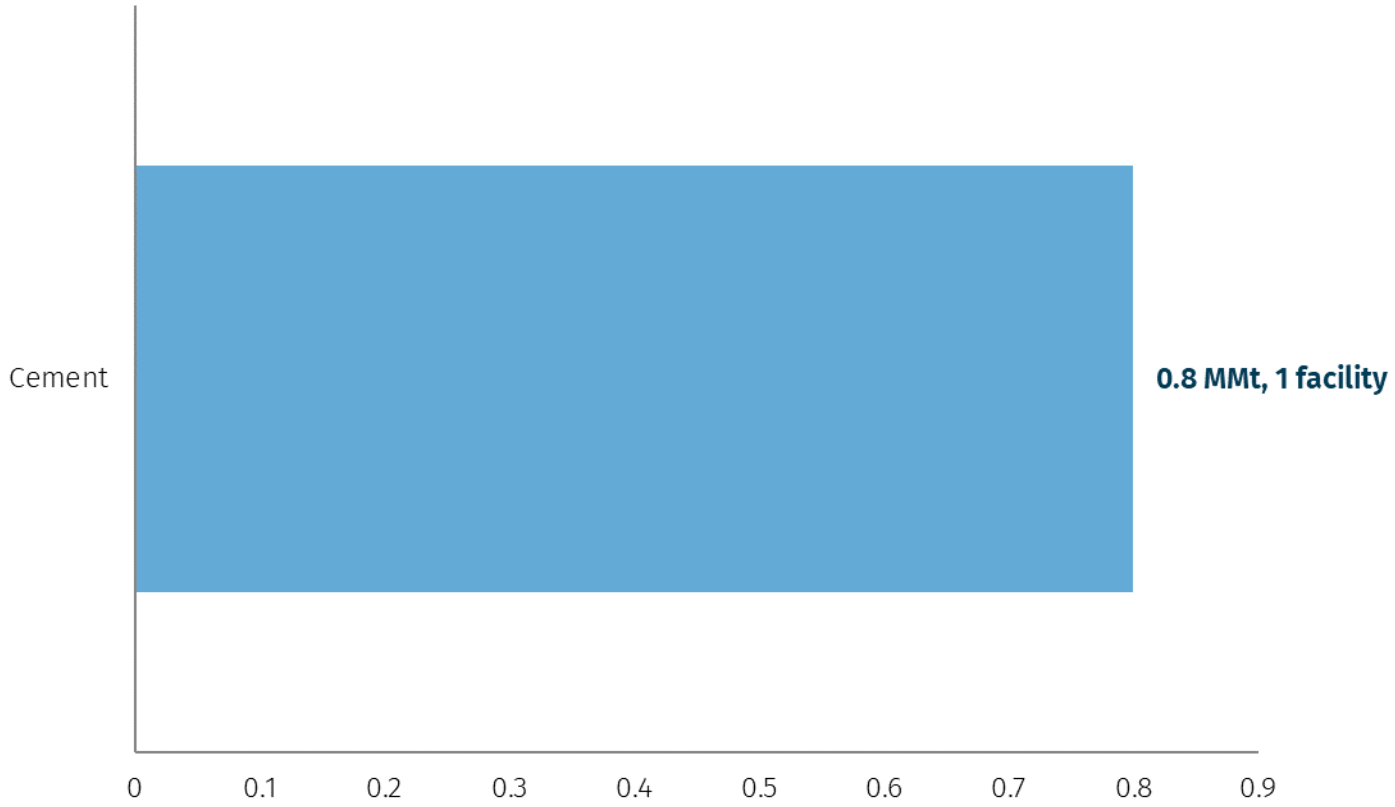
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

West Virginia: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

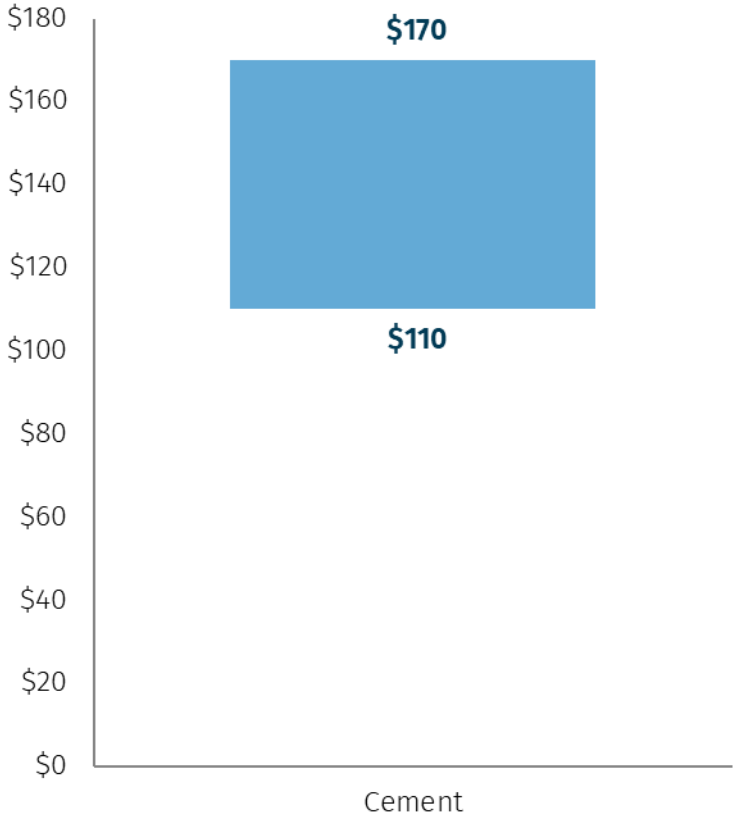
- If all near to intermediate term opportunities in West Virginia are pursued, $110 to $170 billion in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in West Virginia total 35 to 60 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 35 to 45 ongoing jobs.
- In addition, $115 million in transport infrastructure will be required to support these projects. This investment will create 60 jobs on average each year over a 15-year deployment period.

West Virginia: Industrial Facilities

Carbon capture opportunities

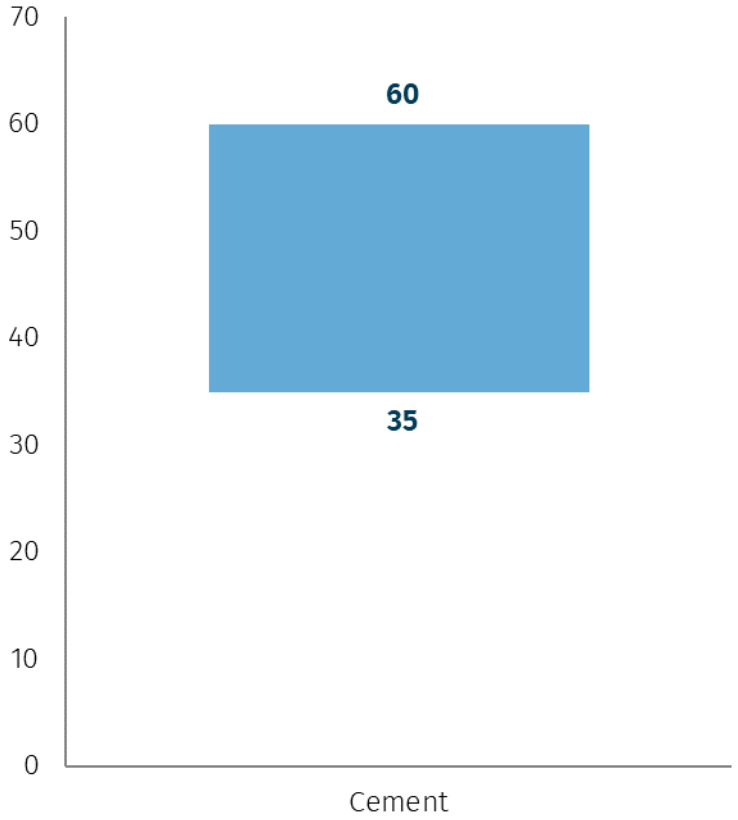
Capital Investment Requirement

Million $ USD



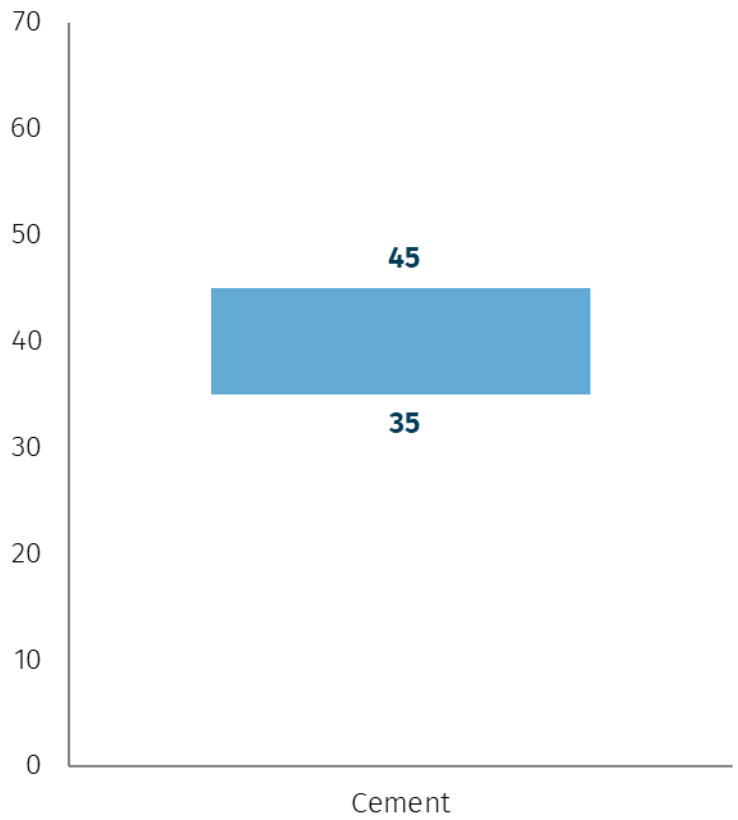
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



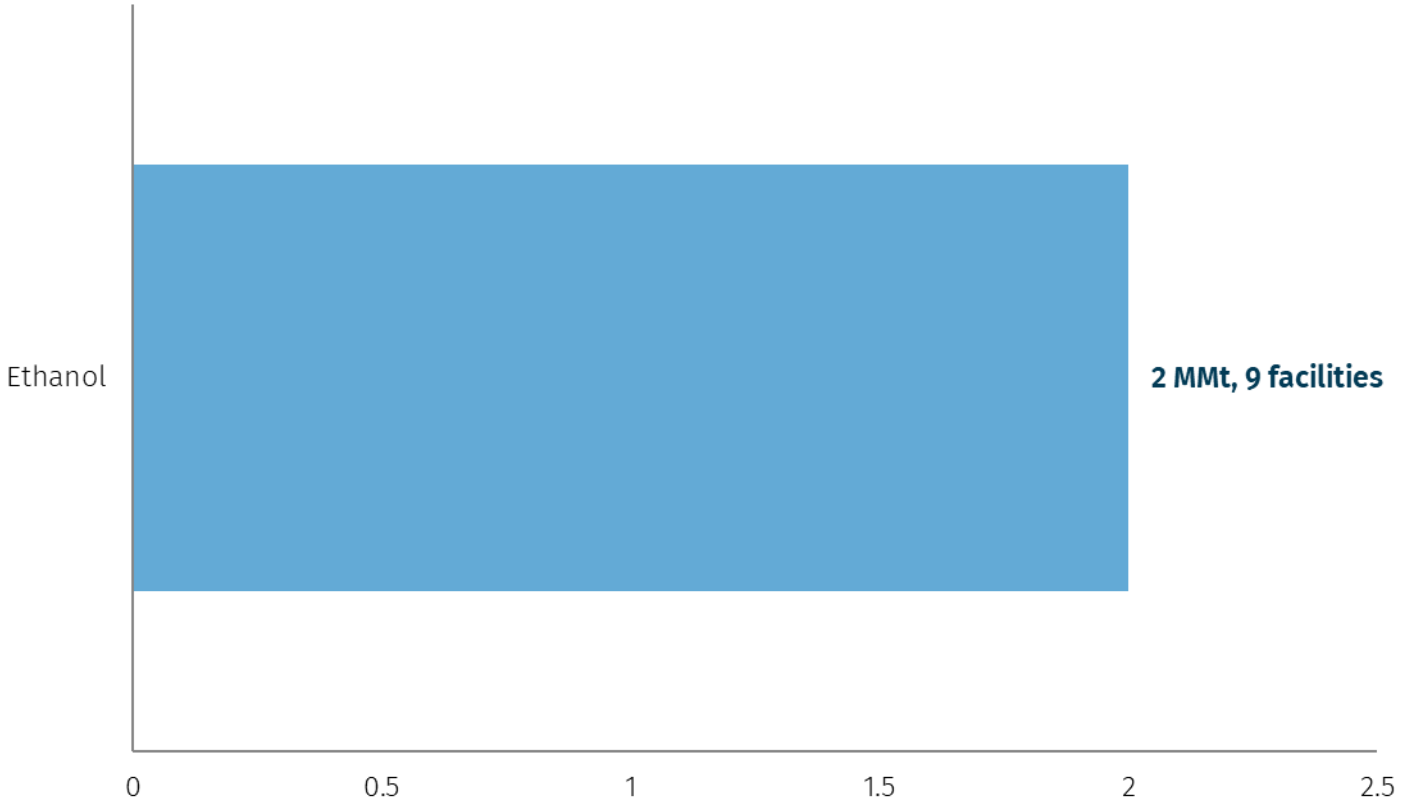
Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

Wisconsin: Carbon Capture Potential

Near and medium-term retrofit opportunities in the industrial and electric power sector

Carbon Capture Opportunity by Industry

Million metric tons of annual CO_2 capture



Source: Rhodium Group analysis, The Great Plains Institute

State Summary

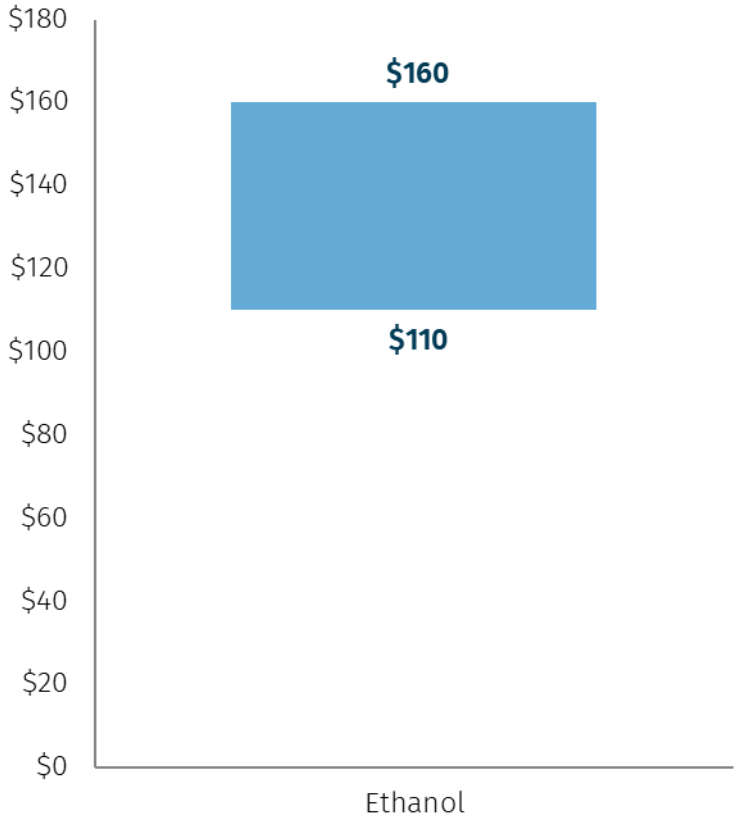
- If all near to intermediate term opportunities in Wisconsin are pursued, $110 to $160 million in investment will be required to support these projects.
- Jobs associated with carbon capture capital investment in Wisconsin total 30 to 45 on average per year over the next 15 years.
- Annual jobs to operate carbon capture retrofits total 45 to 60 ongoing jobs.
- In addition, $202 million in transport infrastructure will be required to support these projects. This investment will create 110 jobs on average each year over a 15-year deployment period.

Wisconsin: Industrial Facilities

Carbon capture opportunities

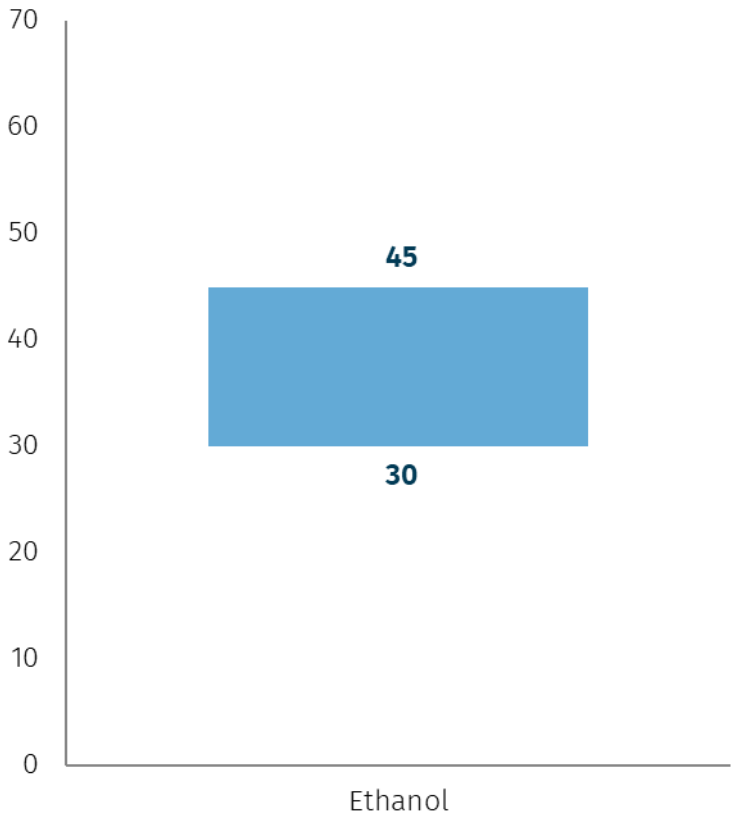
Capital Investment Requirement

Million $ USD



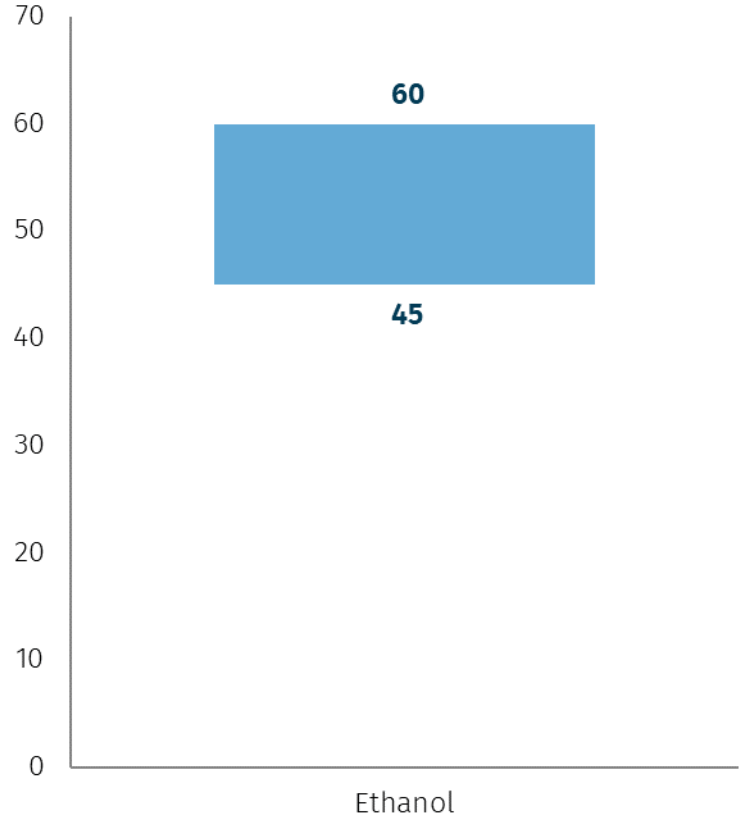
Jobs Associated with Capital Investment

Average Jobs Each Year, 2021-2035



Ongoing Jobs

Annual Operation Jobs



Source: Rhodium Group analysis. Note: The values above are not cumulative. The actual jobs associated with capital investment in any given year will depend on the pace of project development. Capital investment job values above reflect the average over the 15-year study period. Ongoing jobs include on-site and off-site jobs.

The Economic Benefits of Carbon Capture

Investment and Employment Estimates for Eastern and Western States

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NEW YORK | CALIFORNIA | HONG KONG | PARIS
TEL: +1 212-532-1157 | FAX: +1 212-532-1162
www.rhg.com

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