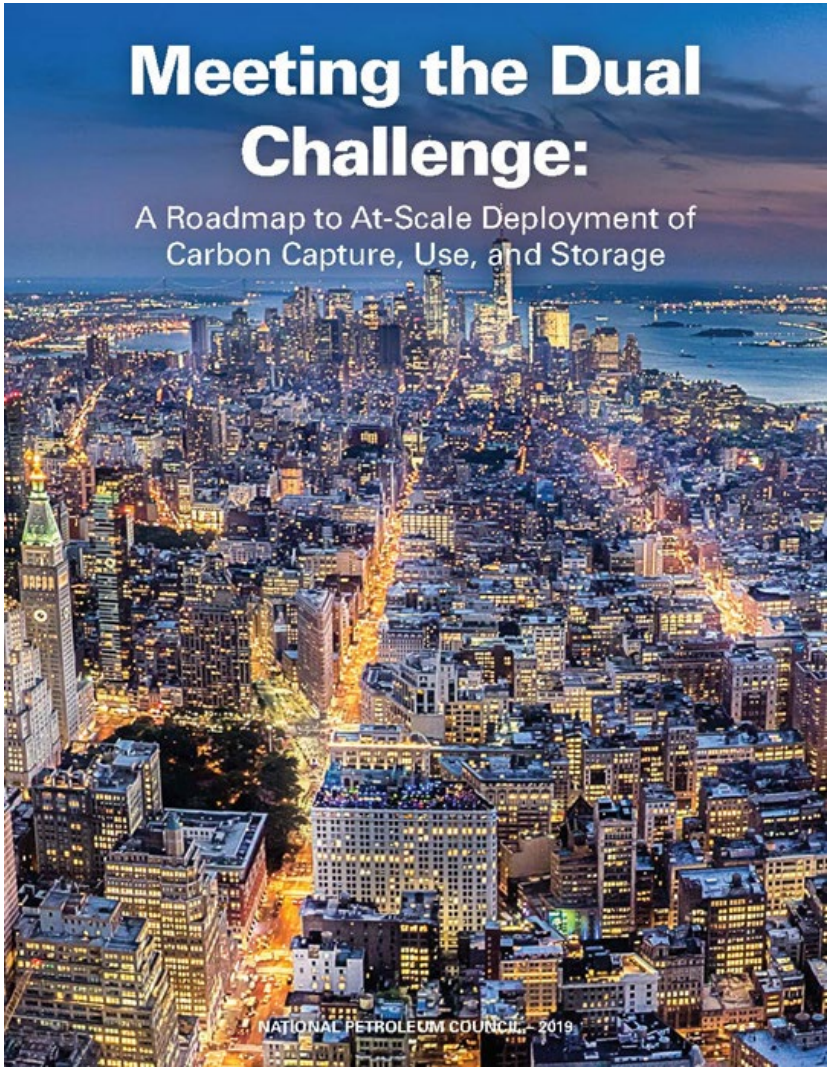
National Petroleum Council

Meeting the Dual Challenge:
A Roadmap to At-Scale Deployment of Carbon Capture, Use, and Storage

report available at
www.dualchallenge.npc.org

Center for Houston's Future Panel Discussion
March 16, 2021

Cindy Yeilding
On behalf of the NPC CCUS Study Team



In September 2017

The Secretary of Energy requested the NPC conduct a study

- Define the potential pathways for integrating CCUS at scale into the energy and industrial marketplace.
- The Secretary asked the Council to consider:
  - Technology options and readiness
  - Market dynamics, economics and financing
  - Cross-industry integration and infrastructure
  - Policy, legal and regulatory issues
  - Environmental footprint
  - Public acceptance

CCUS deployment At-Scale

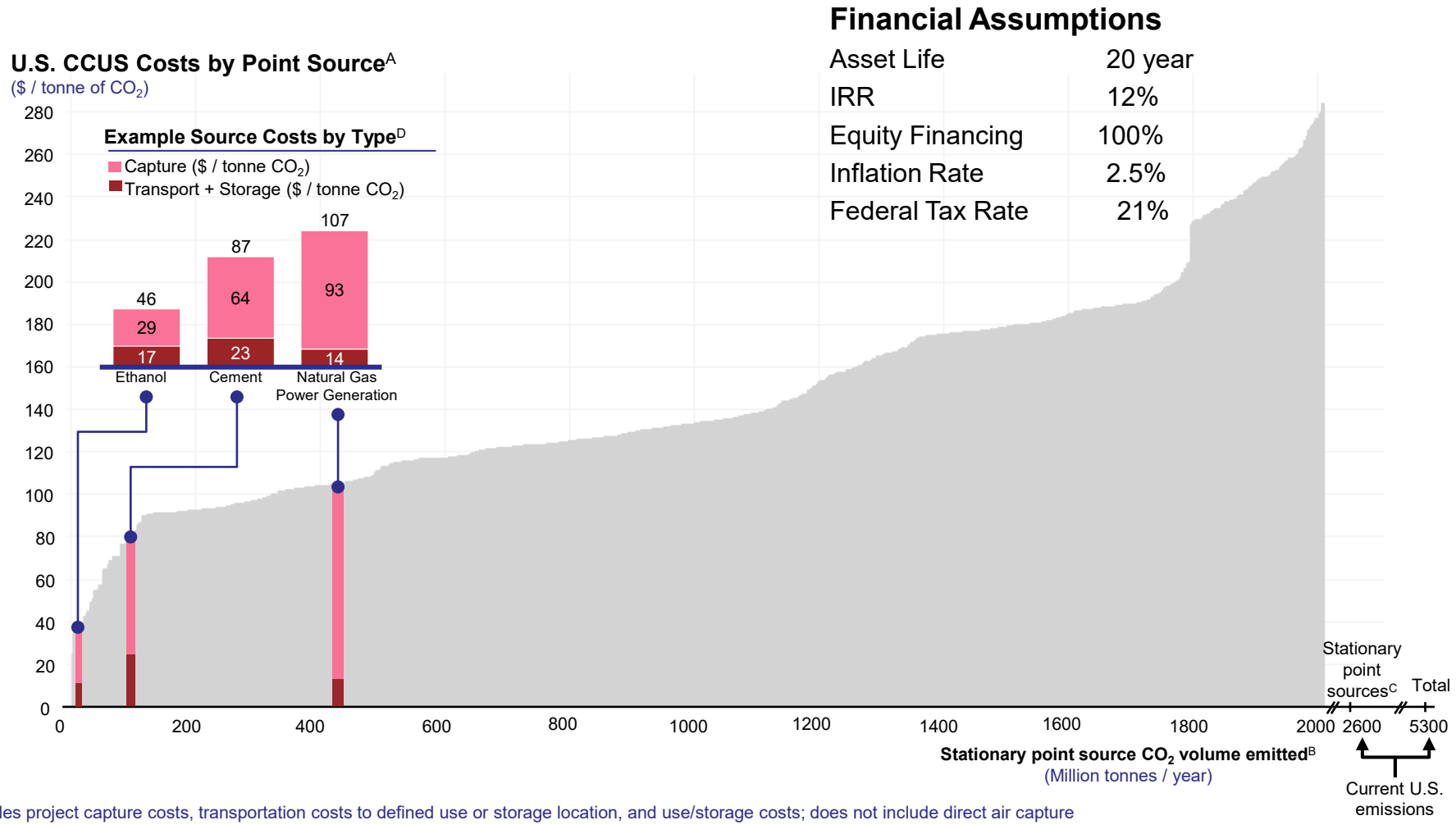
Will mean:

- Moving from 25 to **500 Million tonnes per annum** of CCUS capacity
- Infrastructure buildout equivalent of **13 million barrels per day** capacity
- Incremental investment of **$680 billion**
- Support for **236,000 U.S. jobs** and **GDP of $21 billion** annually

Will require:

- Improved **policies**, **incentives**, **regulations** and **legislation**
- Broad-based **innovation** and **technology** development
- Strong **collaboration** between **industry** and **government**
- Increased **understanding** and **confidence** in CCUS

CCUS cost assessment: methodology

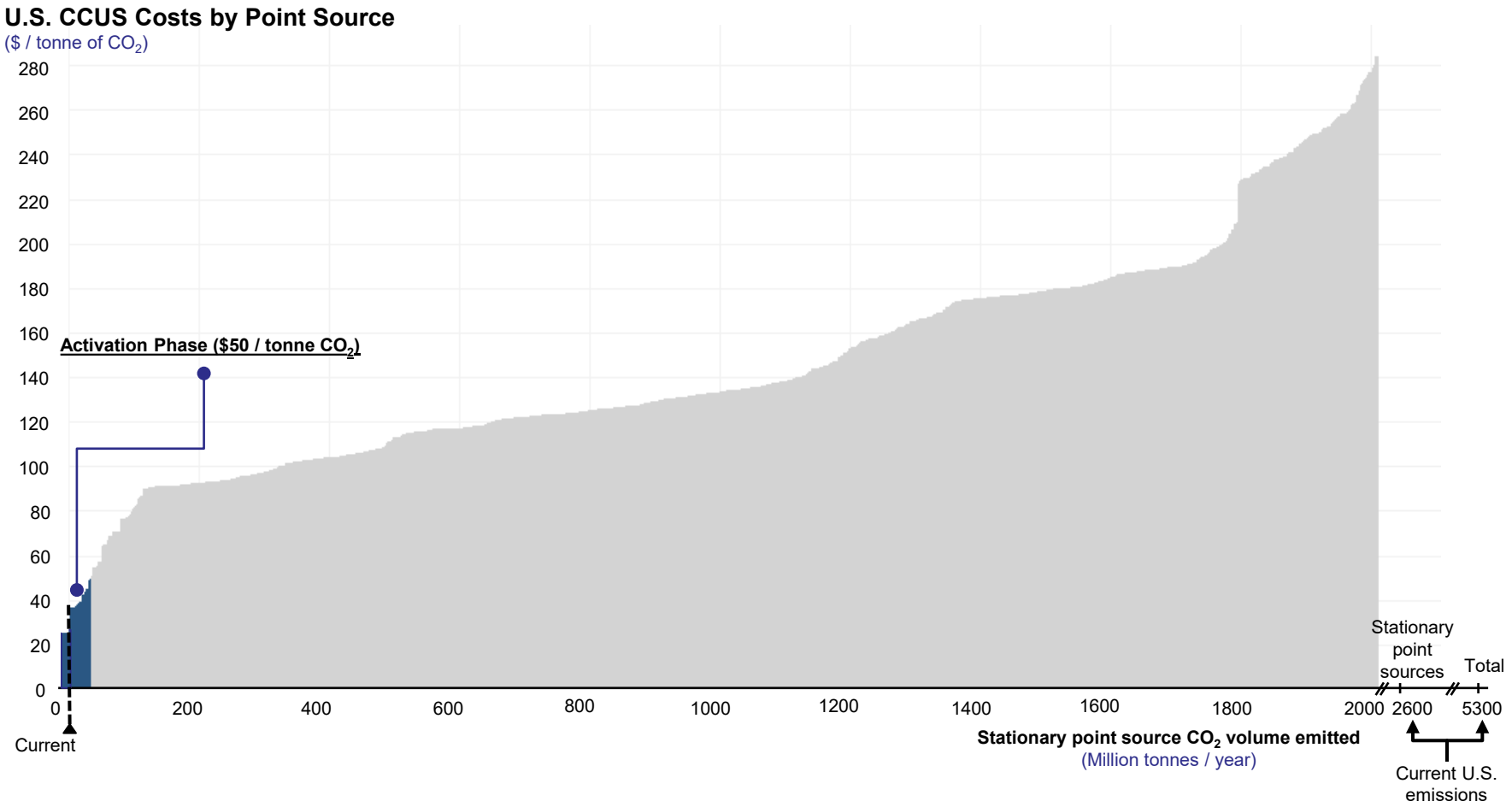


Financial Assumptions

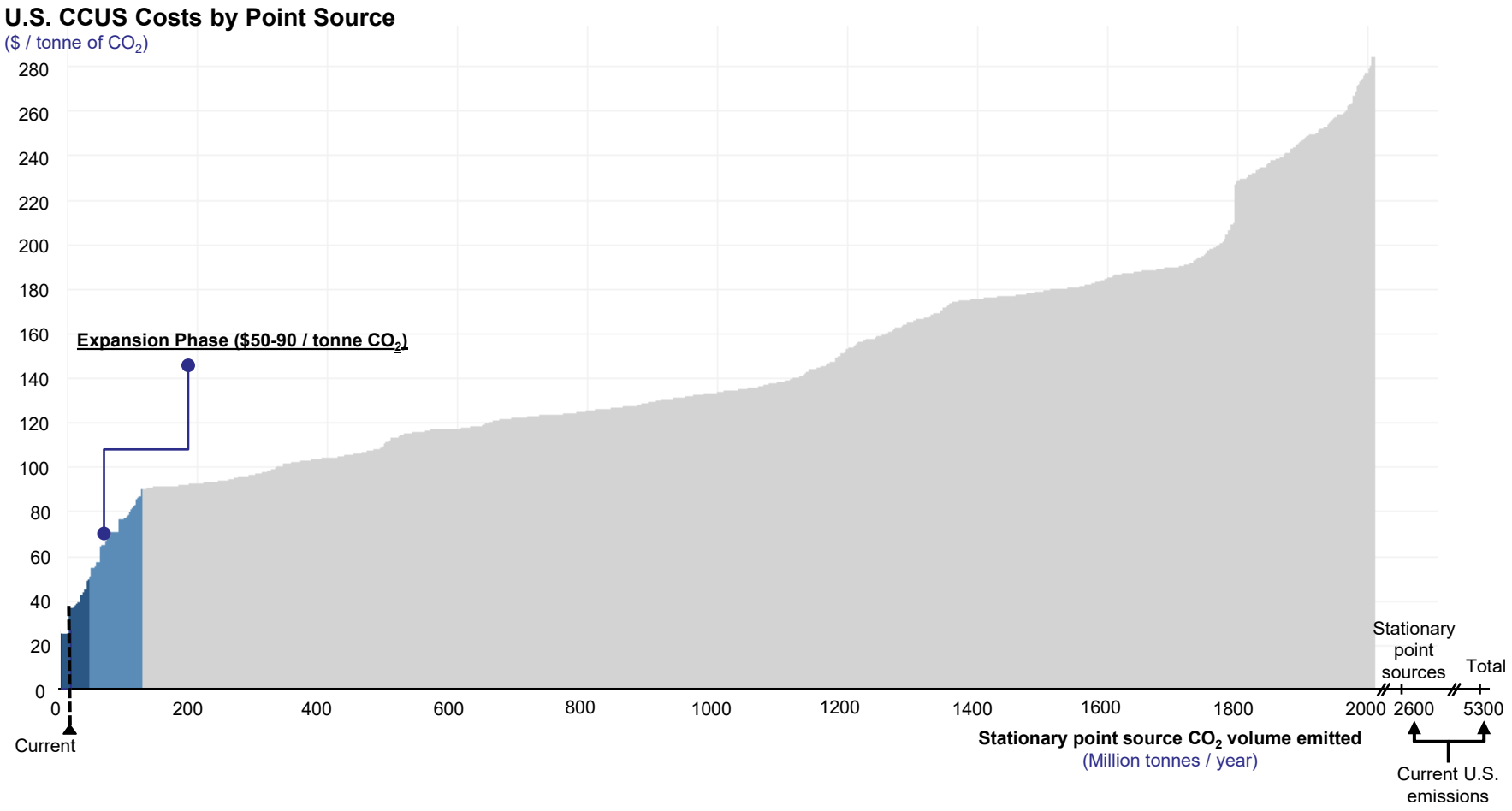
Asset Life	20 year
IRR	12%
Equity Financing	100%
Inflation Rate	2.5%
Federal Tax Rate	21%

A Includes project capture costs, transportation costs to defined use or storage location, and use/storage costs; does not include direct air capture
B This curve is built from bars that each represent an individual point source with a width corresponding to the total CO_2 emitted from that individual source
C Total point sources include ~600 MTPA of point sources emissions without characterized CCUS costs
D Widths of bars are illustrative and not indicative of volumes associated with each source

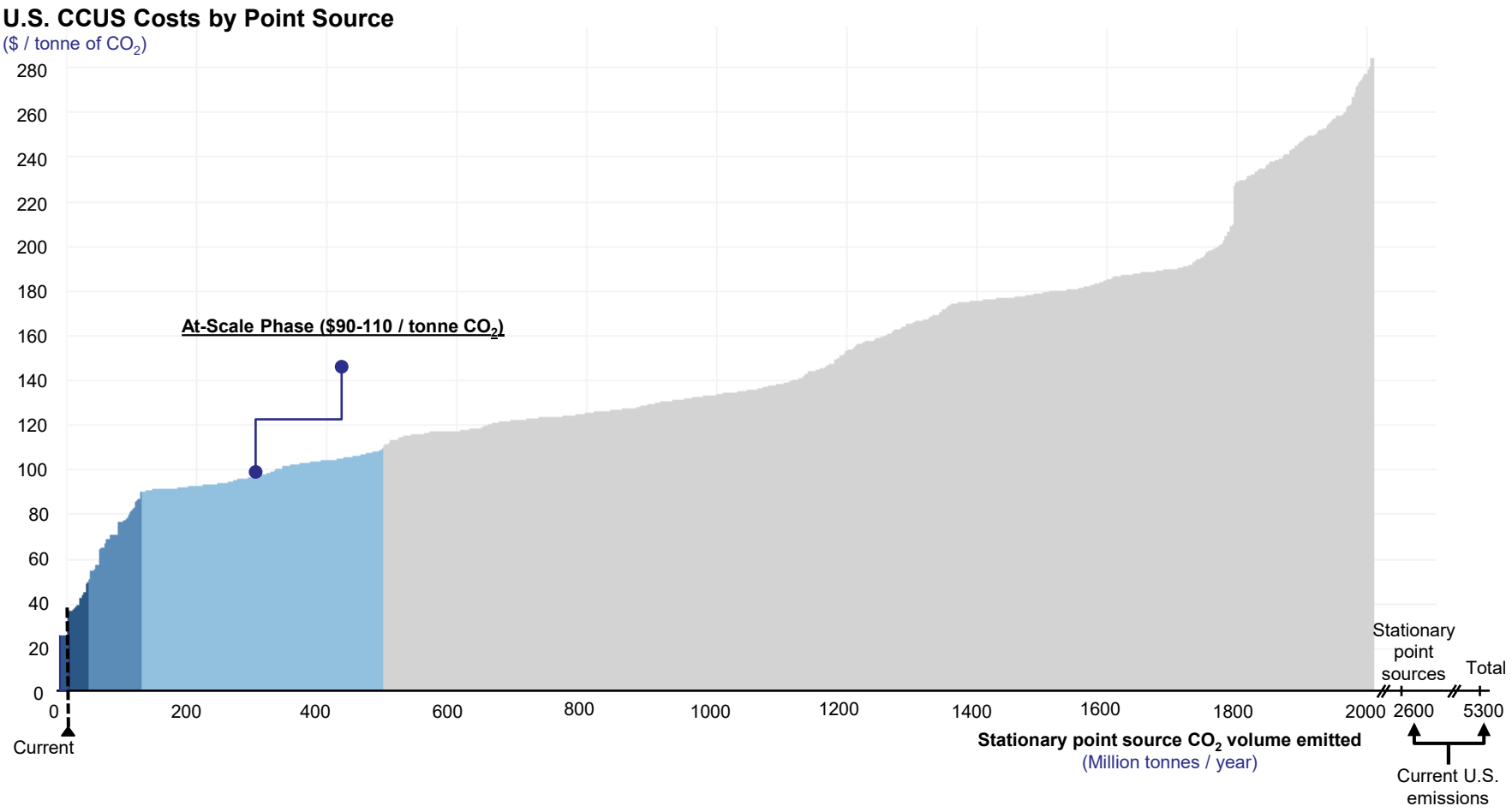
Activation phase



Expansion phase



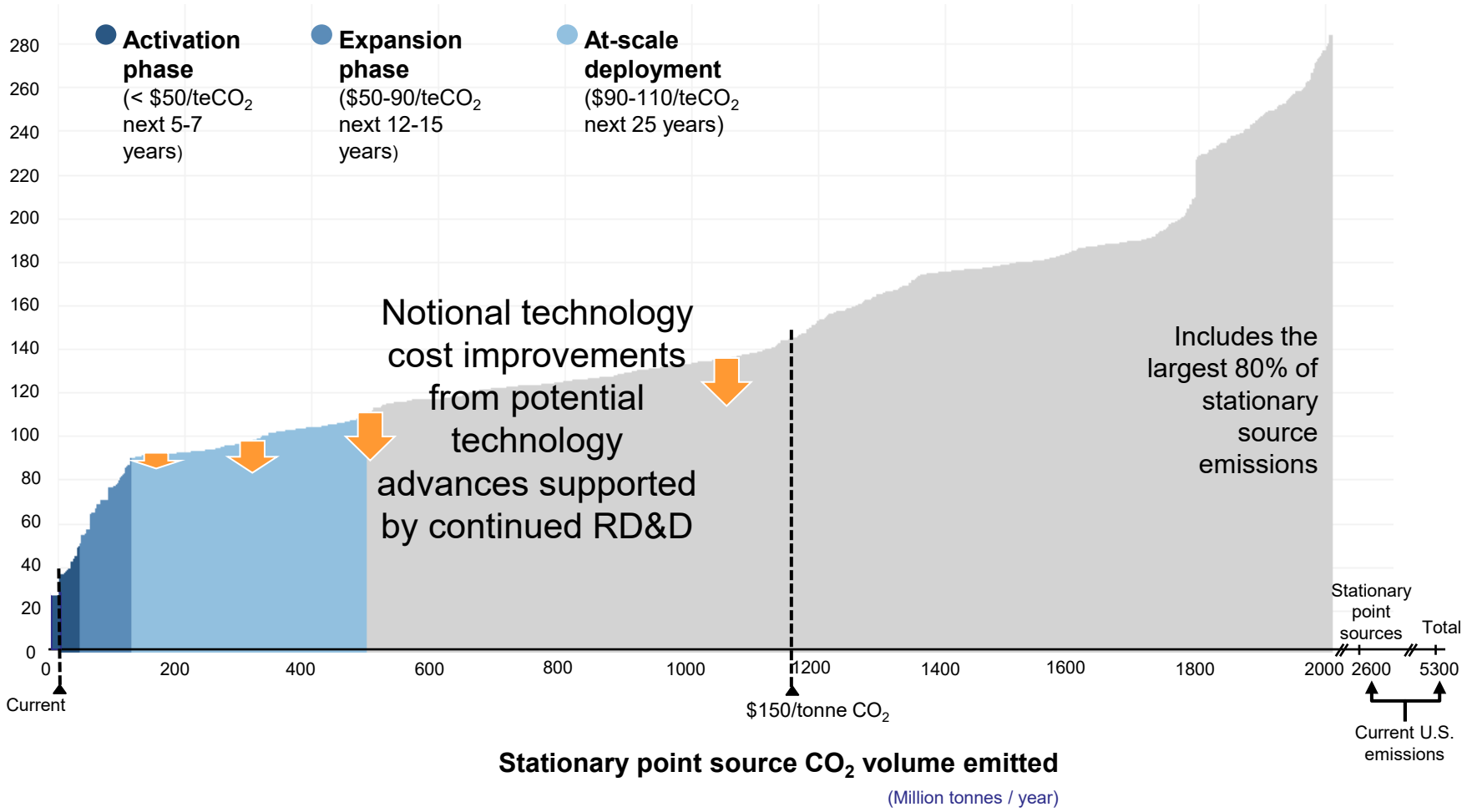
At-Scale phase



CCUS cost assessment: phases of deployment

U.S. CCUS Costs by Point Source

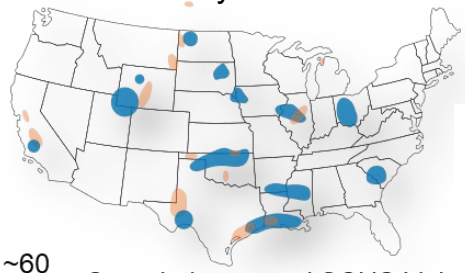
($ / tonne of CO_2)



Phases of deployment

Activation Phase

5-7 years



~60 Mtpa Cumulative annual CCUS Volume

~$50 B investment (cumulative)

~$2 B pipeline infrastructure investment

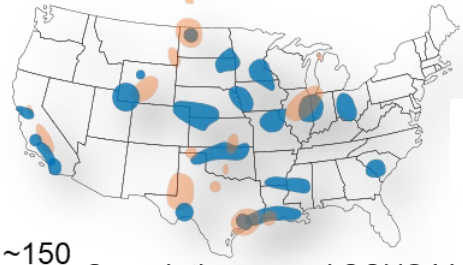
~10K annual jobs

9% of US oil system by volume

Enabled through clarification of existing federal tax policy and regulations

Expansion Phase

15 years



~150 Mtpa Cumulative annual CCUS Volume

~$175 B investment (cumulative)

~$9 B pipeline infrastructure investment (cumulative)

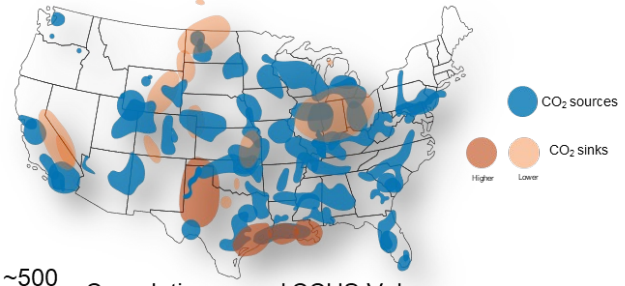
~40K annual jobs (cumulative)

23% of US oil system by volume

Enabled through enhancement or expansion of existing policies

At-Scale Deployment

25 years



~500 Mtpa Cumulative annual CCUS Volume

~$680 B investment (cumulative)

~$28 B pipeline infrastructure investment (cumulative)

~230K annual jobs (cumulative)

76% of US oil system by volume

Enabled through additional financial incentives and policy support

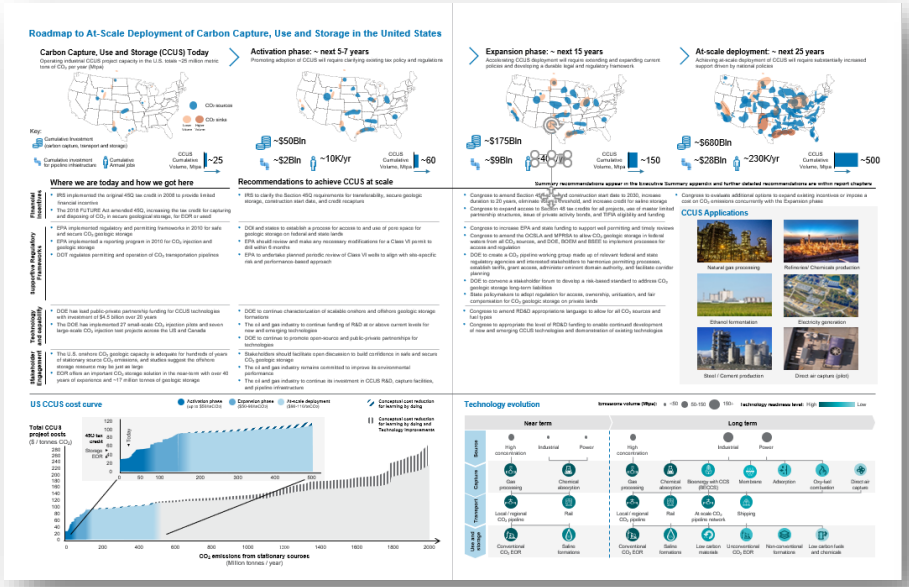
RD&D

Key messages

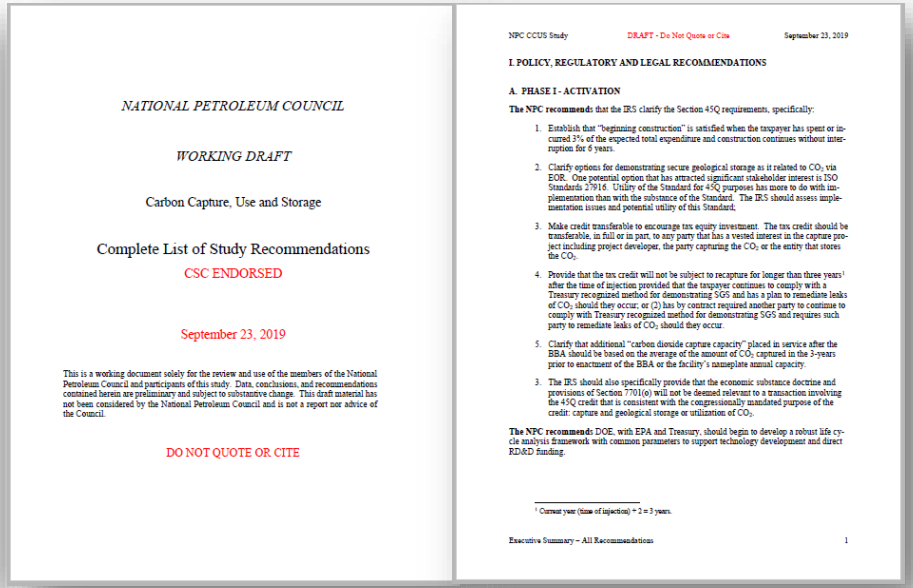
- CCUS refers to the complete supply chain needed to capture, transport and permanently use or store CO_2, eliminating it from the atmosphere.
- All credible future energy scenarios recognize that fossil fuels will remain part of the total energy mix for the next several decades.
- CCUS is essential to addressing the dual challenge of providing affordable, reliable energy to meet the world's growing demand while addressing the risks of climate change.
- The United States is the world leader in CCUS and uniquely positioned to deploy the technologies at scale.
- To achieve CCUS deployment at scale, the U.S. government will need to reduce uncertainty on existing incentives, establish adequate additional incentives, and implement a durable regulatory and legal environment that drives industry investment.
- A commitment to CCUS must include a commitment to continued research, development, and demonstration.
- At-scale CCUS deployment will create a new industry, driving job creation and economic growth across the nation.
- Increasing understanding and confidence in CCUS as safe and reliable is essential for public and policy stakeholder support.
- The oil & natural gas industry is positioned to lead CCUS deployment.

Roadmap and full list of recommendations

Roadmap to At-Scale CCUS Deployment



All Study Recommendations



NATIONAL PETROLEUM COUNCIL

WORKING DRAFT

Carbon Capture, Use and Storage

Complete List of Study Recommendations

CSC ENDORSED

September 23, 2019

This is a working document solely for the review and use of the members of the National Petroleum Council and participants of this study. Data, conclusions, and recommendations contained herein are preliminary and subject to substantive change. This draft material has not been considered by the National Petroleum Council and is not a report nor advice of the Council.

DO NOT QUOTE OR CITE

I. POLICY, REGULATORY AND LEGAL RECOMMENDATIONS

A. PHASE I - ACTIVATION

The NPC recommends that the IRS clarify the Section 45Q requirements, specifically:

1. Establish that "beginning construction" is satisfied when the taxpayer has spent or incurred 3% of the expected total expenditure and construction continues without interruption for 6 years.
2. Clarify options for demonstrating secure geological storage as it related to CO_2 via EOR. One potential option that has attracted significant stakeholder interest is ISO Standards 27916. Utility of the Standard for 45Q purposes has more to do with implementation than with the substance of the Standard. The IRS should assess implementation issues and potential utility of this Standard;
3. Make credit transferable to encourage tax equity investment. The tax credit should be transferable, in full or in part, to any party that has a vested interest in the capture project including project developer, the party capturing the CO_2 or the entity that stores the CO_2.
4. Provide that the tax credit will not be subject to recapture for longer than three years[1] after the time of injection provided that the taxpayer continues to comply with a Treasury recognized method for demonstrating SGS and has a plan to remediate leaks of CO_2 should they occur; or (2) has by contract required another party to continue to comply with Treasury recognized method for demonstrating SGS and requires such party to remediate leaks of CO_2 should they occur.
5. Clarify that additional "carbon dioxide capture capacity" placed in service after the BBA should be based on the average of the amount of CO_2 captured in the 3-years prior to enactment of the BBA or the facility's nameplate annual capacity.
3. The IRS should also specifically provide that the economic substance doctrine and provisions of Section 7701(o) will not be deemed relevant to a transaction involving the 45Q credit that is consistent with the congressionally mandated purpose of the credit: capture and geological storage or utilization of CO_2.

The NPC recommends DOE, with EPA and Treasury, should begin to develop a robust life cycle analysis framework with common parameters to support technology development and direct RD&D funding.

[1] Current year (time of injection) + 2 = 3 years.

Acknowledgements

- U.S. Department of Energy
- The National Petroleum Council leadership and staff
- Members of the National Petroleum Council
- The NPC Infrastructure Study leadership and team

… and especially the 300+ participants who helped to develop and deliver this comprehensive study on Carbon Capture, Use, and Storage