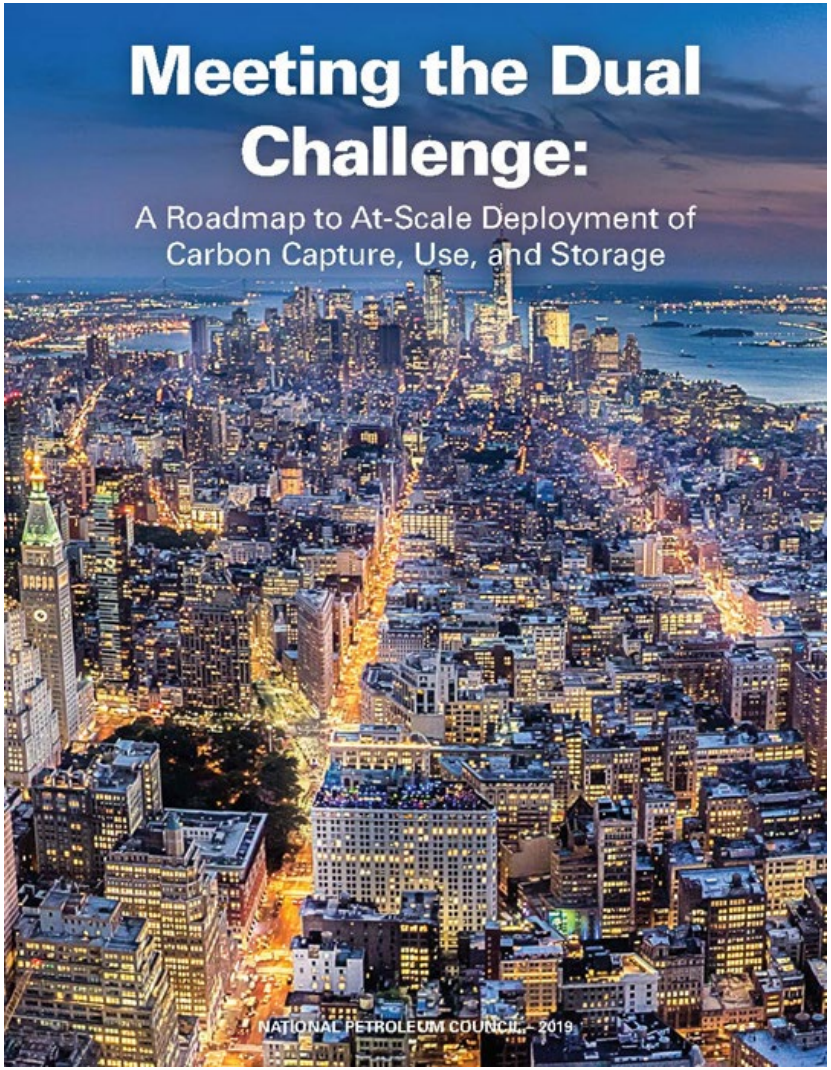
National Petroleum Council

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

www.dualchallenge.npc.org



Interstate Oil and Gas Compact Commission
Environment and Safety Committee
July 15, 2020

Leslie Savage, Railroad Commission of Texas
On behalf of the National Petroleum Council

What is the National Petroleum Council (NPC)

Origins	Continuation of WWII government / industry cooperation
Purpose	Sole purpose is to advise U.S. Secretary of Energy and Executive Branch by conducting studies at their request
Organization	A federally chartered, self-funded Advisory Committee; not an advocacy group, does not lobby
Membership	Broad and balanced. Approximately 200 members from all segments of the oil and gas industries and many outside interests
Study Participants	Diverse interests and expertise relating to the topic being addressed

DOE Request of the NPC

In September 2017, the Secretary of Energy requested the NPC conduct a study to:

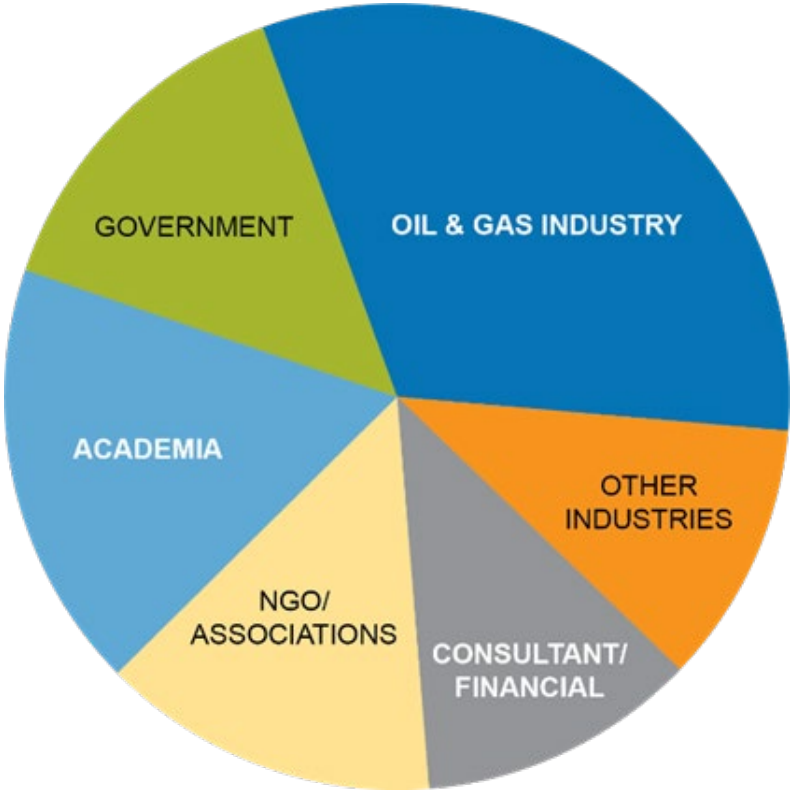
- Define the potential pathways for integrating CCUS at scale into the U.S. energy and industrial marketplace.

- The request included five key questions:

1. What are U.S. and global future energy demand outlooks, and the environmental benefits from the application of CCUS technologies?
2. What R&D, technology, infrastructure, and economic barriers must be overcome to deploy CCUS at scale?
3. How should success be defined?
4. What actions can be taken to establish a framework that guides public policy and stimulates private-sector investment to advance the deployment of CCUS?
5. What regulatory, legal, liability or other issues should be addressed to progress CCUS investment and to enable the U.S. to be global technology leaders?

Study Participation

- Over two-thirds of study participants came from outside the oil and gas industry.
- The Coordinating Subcommittee membership included 22 individuals representing upstream and downstream oil & gas, LNG, biofuels, power, NGOs, and state and federal governments.
- Overall study team included over 300 participants representing more than 110 US and international organizations.



Summary

NPC:

- Defined “at scale” deployment of CCUS to be ~500 million tonnes of CCUS capacity, versus current U.S. capacity of ~25 million tonnes.
- To determine a path for “at scale” deployment, assessed the costs of deployment (cost curve) and a policy path to provide supportive conditions for deployment.
- Assessed the national cumulative economic impact of “at scale” deployment over a 25-year period.

NPC study report

Executive Summary (Volume 1)

- Transmittal letter
- Report outline
- Preface
- Executive Summary, Roadmap and Recommendations

Appendices

A. Request Letter and NPC Description

B. Study Group Rosters

CCUS Deployment At-Scale (Volume 2)

- **Chapter 1:** The Role of CCUS in Future Energy Mix
- **Chapter 2:** CCUS Supply Chains & Economics
- **Chapter 3:** Policy, Regulatory & Legal Enablers
- **Chapter 4:** Stakeholder Engagement

Appendices

C. CCUS Project Summaries

D. Integrated Economic Analysis (ERM Memo)

CCUS Technologies (Volume 3)

- **Technology Introduction**
- **Chapter 5:** CO_2 Capture
- **Chapter 6:** CO_2 Transport
- **Chapter 7:** CO_2 Geologic Storage
- **Chapter 8:** Enhanced Oil Recovery
- **Chapter 9:** CO_2 Use

Appendices

E. Mature CO_2 Capture Technologies

F. Emerging CO_2 Capture Technologies

G. CO_2 EOR Case Studies

H. CO_2 EOR Economic Factors and Considerations

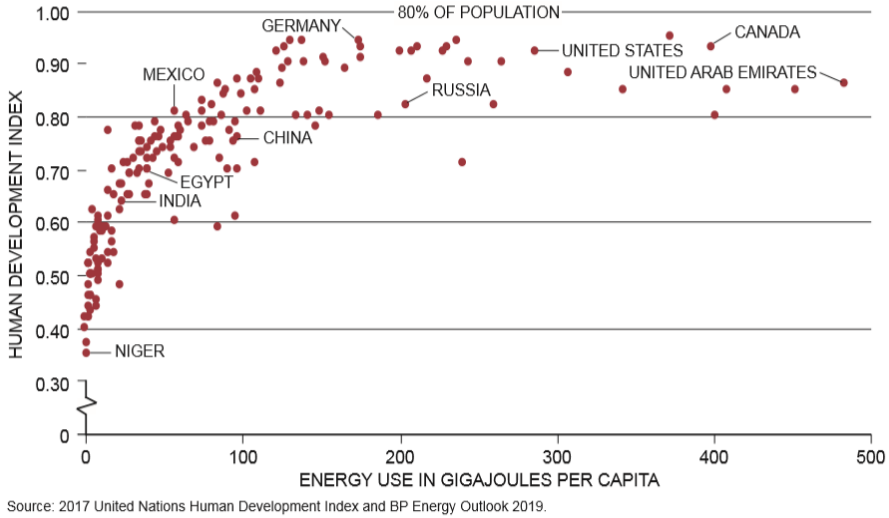
List of Topic Papers
Abbreviations, Units, Glossary

Findings and Recommendations

Full Report

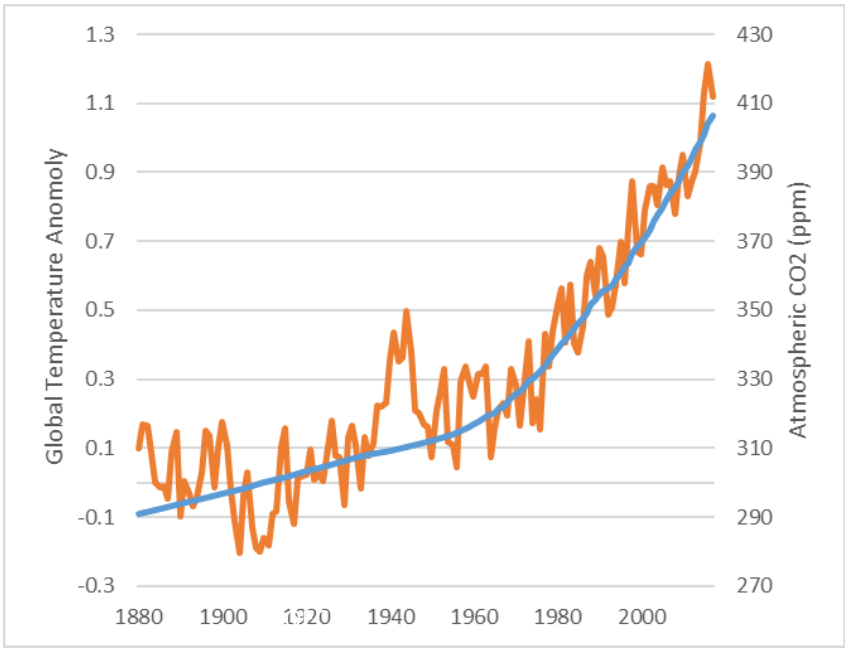
Understanding the dual challenge

The world faces a dual challenge of providing affordable, reliable energy while addressing the risks of climate change.



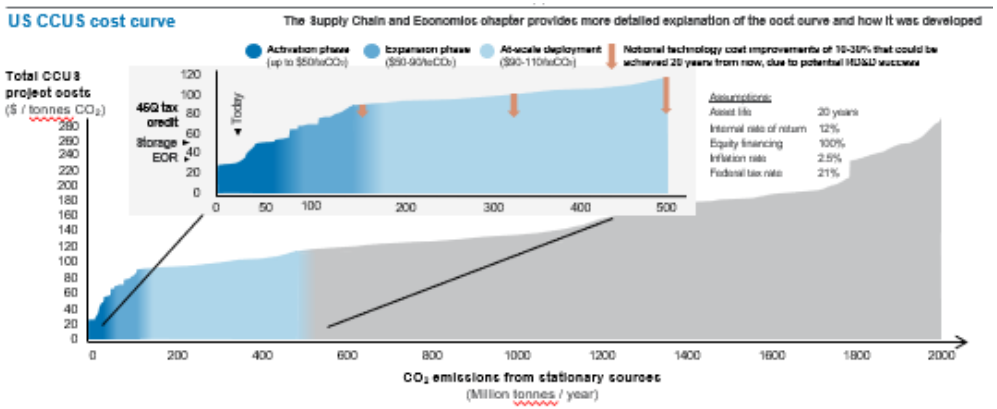
Source: 2017 United Nations Human Development Index and BP Energy Outlook 2019.

Figure ES-2. 2017 Human Development Index and Energy Consumption per Capita



Roadmap for CCUS deployment

- The Secretary requested a roadmap of actions needed to drive widespread deployment of CCUS in the U.S. over the next 25 years
- To develop the roadmap, NPC developed a CCUS cost curve:
  - Assessed the costs to capture, transport and store the largest 80% of U.S. stationary source CO_2 emissions – source, industry, and location specific and use transparent assumptions
  - Plotted the cost to capture, store and transport one tonne of CO2 against the volume of CO2 abatement possible – identifies the level of value (incentives, revenue, etc.) needed to enable deployment.



- The roadmap details recommendations in four pathways – financial incentives, regulatory frameworks, technology and capability, and stakeholder engagement and across three phases – activation, expansion and at-scale, designed to achieve widespread deployment.

Findings 1- 4

1. As global economies and populations continue to grow and prosper, the world faces the dual challenge to provide affordable, reliable energy while addressing the risks of climate change.

2. Widespread CCUS deployment is essential to meeting the dual challenge at the lowest cost.

3. Increasing deployment of CCUS can deliver benefits and favorably position the U.S. to participate in new market opportunities as the world transitions to a lower CO_2 intensive energy system.

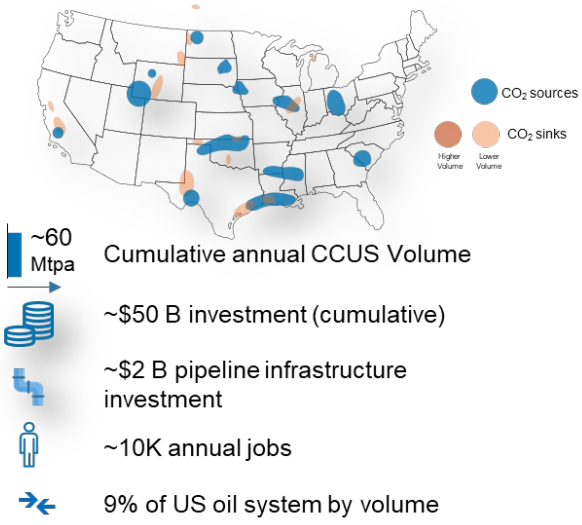
4. The U.S. is uniquely positioned as the world leader in CCUS and has substantial capability to drive widespread deployment.

Finding 5: Activation Phase

5. Clarifying existing tax policy and regulations could activate an additional 25 to 40 million tons per annum (Mtpa) of CCUS, doubling existing U.S. capacity within the next 5 to 7 years. (No congressional action required)

Recommendations

- IRS to clarify Section 45Q requirements for transferability, secure geologic storage, construction start date, and credit recapture
- DOI and states to establish a process for access to and use of pore space for geologic storage on federal and state lands
- EPA to issue a Class VI permit to drill within six months
- EPA, upon receipt of a completed well report, to review and make any necessary modifications, and issue a Class VI permit to inject within six months
- EPA to undertake planned periodic review of Class VI regulations to align with site-specific risk and performance-based approach



** note: 35mtpa is likely overstated based on current 12 year life of 45Q tax credit – the increase to 20 years does not come until Expansion phase*

Finding 6: Expansion Phase

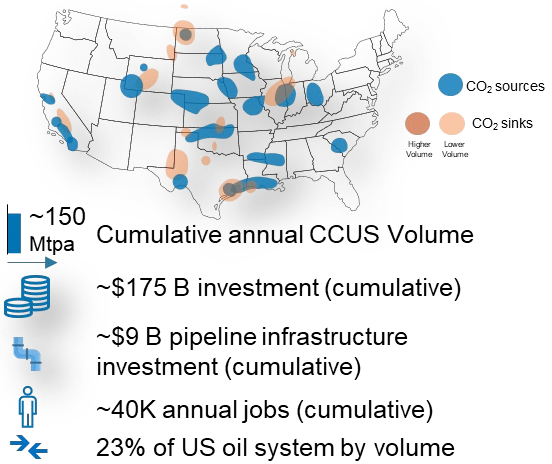
6. Extending and expanding current policies and developing a durable legal and regulatory framework could enable the next phase of CCUS projects (an additional 75-85 Mtpa) within the next 15 years.

Recommendations to Congress:

- Amend 45Q to extend construction start date to 2030, increase duration to 20 years, lower volume threshold, and increase credit for saline storage
- Expand access to Section 48 tax credits for all projects
- Expand access to MLPs, private activity bonds, and TIFIA eligibility/funding for all projects
- Increase EPA and state regulatory funding to support primacy, well permitting and timely reviews
- Amend OCSLA and MPRSA to allow geologic storage in federal waters from all CO_2 sources

Recommendations to Federal/State Agencies:

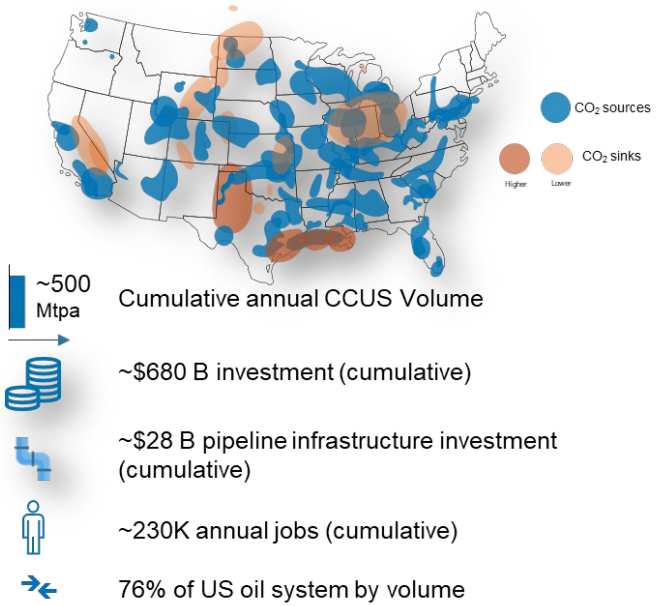
- DOE & DOI to implement process for access and regulation
- DOE to create CO_2 pipeline working group made up of relevant agencies and stakeholders to harmonize permitting processes, establish tariffs, grant access, administer eminent domain authority, and facilitate corridor planning
- DOE to convene stakeholder forum to develop a risk-based standard to address long-term liabilities
- State policymakers to adopt regulation for access, ownership, unitization & fair compensation for storage on private lands



Finding 7: At-Scale Deployment Phase

7. **Achieving CCUS deployment at scale, an additional 350-400 Mtpa, in the next 25 years will require substantially increased support driven by national policies.**

Recommendation:
To achieve at-scale deployment, congressional action should be taken to implement economic policies amounting to about $110/tonne. Evaluation of policies should occur concurrently with the expansion phase.



Finding 8: Research, Development and Demonstration

8. **Increased government and private research, development, and demonstration is needed to improve performance, reduce costs, and advance alternatives beyond currently deployed technology.**

Recommendation: Congress should appropriate $15 billion of RD&D funding over the next 10 years to enable the continued development of new and emerging CCUS technologies and demonstration of existing technologies.

Technology	R&D (including pilot programs)	Demonstrations	Total	10-Year Total
Capture (including negative emissions technologies)	$500 million/year	$500 million/year	$1.0 billion/year (over 10 years)	$10 billion
Geologic Storage	$400 million/year		$400 million/year (over 10 years)	$4 billion
Nonconventional Storage (including EOR)	$50 million/year		$50 million/year (over 10 years)	$500 million
Use	$50million/year		$50 million/year (over 10 years)	$500 million
Total	**$1.0 billion/year**	**$500 million/year**	**$1.5 billion/year**	**$15 billion**

Findings 9 and 10: Public and Industry Engagement

9. Increasing understanding and confidence in CCUS as a safe and reliable technology is essential for public and policy stakeholder support.

Recommendations:

- Government, industry, and associated coalitions design policy and public engagement opportunities to facilitate open discussion, simplify terminology & build confidence that CCUS is a safe, secure means of managing emissions.
- Oil and natural gas industry remain committed to improving its environmental performance and the continued development of environmental safeguards.

10. The oil and natural gas industry is uniquely positioned to lead CCUS deployment due to its relevant expertise, capability, and resources.

Recommendation:

- The oil and natural gas industry continue investment in CCUS, specifically:
  - Current and next generation capture facilities
  - Development of new technologies
  - CO_2 pipeline infrastructure needed for EOR and saline storage
  - R&D for advancing CCUS technologies

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

Key messages

- CCUS includes the complete supply chain needed to capture, transport and permanently use or store CO_2.
- 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 U.S. is the world leader in CCUS and uniquely positioned to deploy the technologies at scale.
- To achieve CCUS deployment at scale, the U.S. will need to reduce uncertainty on existing incentives, establish adequate additional financial 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.