September 2023

U.S. Carbon Management Overview

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OFFICE OF FOSSIL ENERGY AND CARBON MANAGEMENT

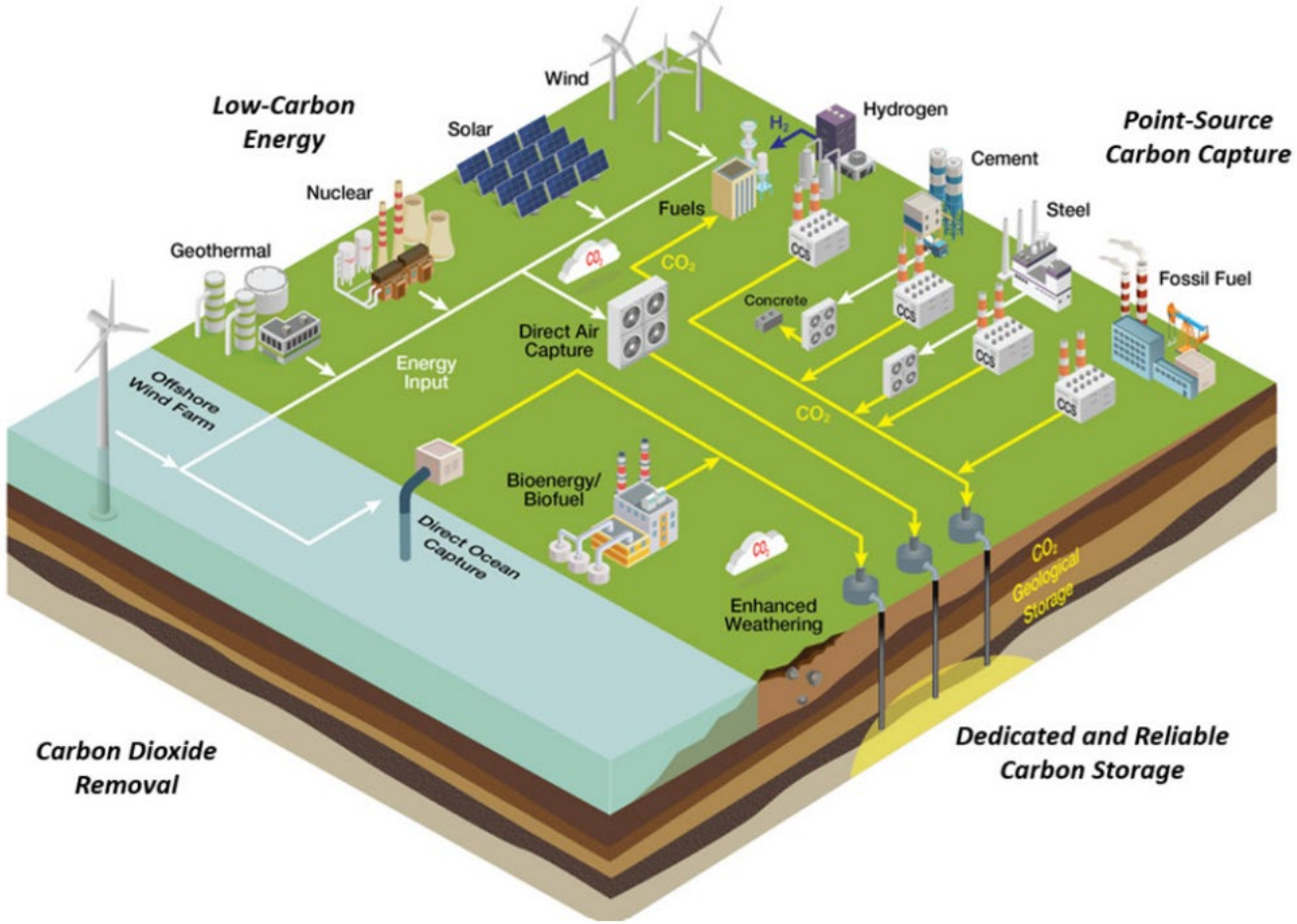
U.S. DEPARTMENT OF ENERGY
Fossil Energy and Carbon Management

The US-Japan partnership is critical for carbon management to scale globally

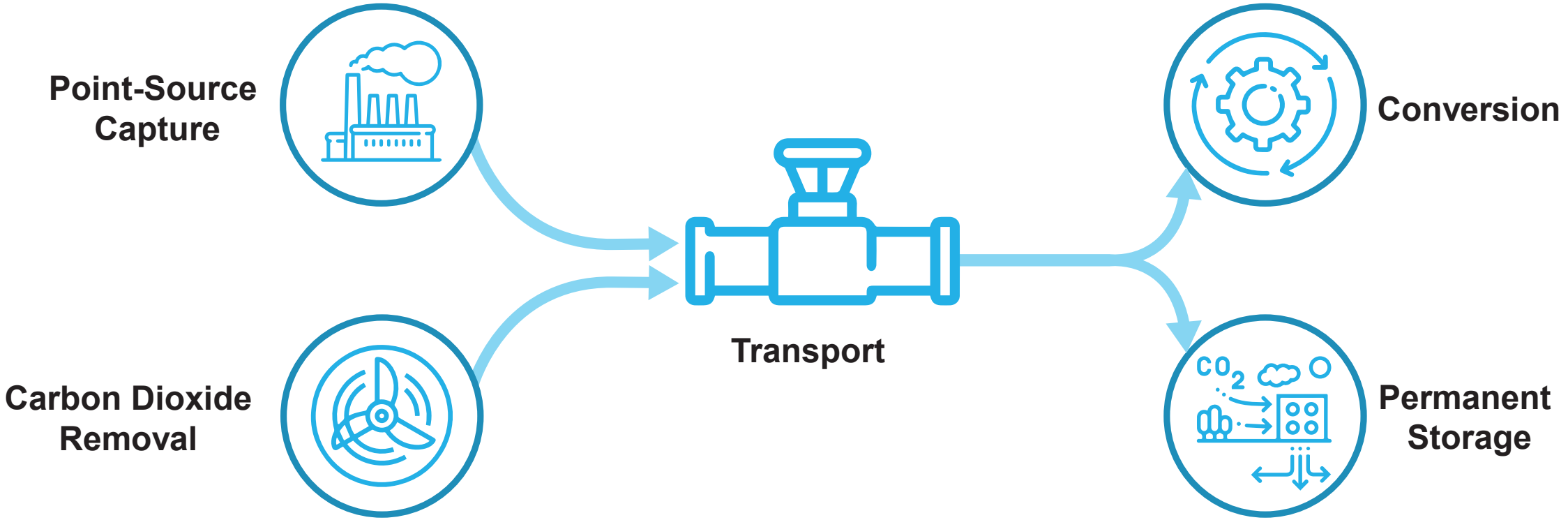
A diversity of clean energy approaches is critical for US to meet its climate goals

Carbon management helps:

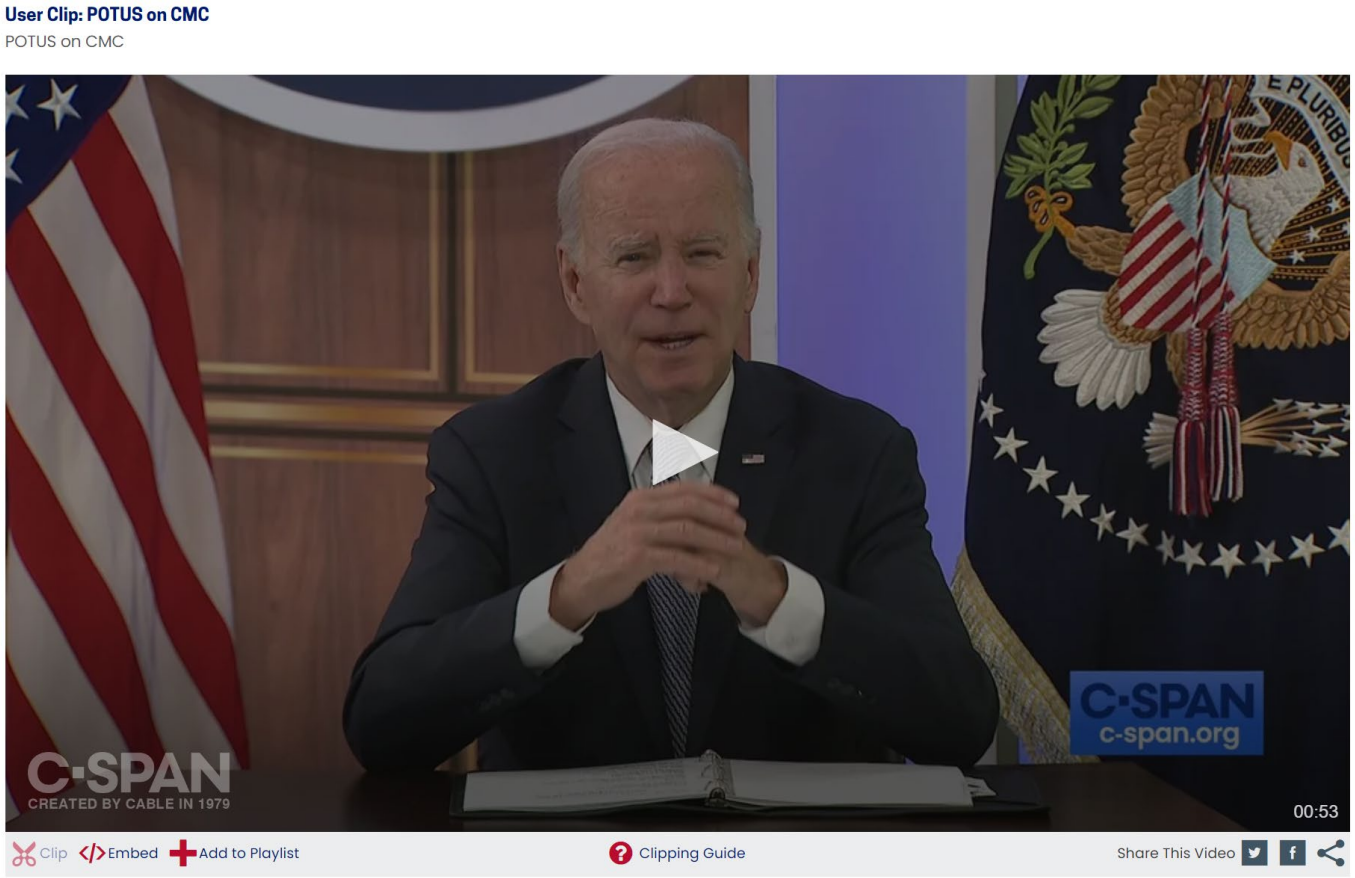
1. Net-zero heavy industry process and heat emissions
2. Enabling low-cost, reliable, net-zero power sector
3. Negative emissions to achieve net-zero faster, and then to go beyond and remediate legacy emissions



US policy is supporting the full “carbon management” value chain:



Scaling carbon management is a Biden Administration climate priority at home and abroad



DOE has 20+ years of research informing our confidence in scaling CO_2 storage

Base Program

Phase I: Integrated CCS Pre-Feasibility
12-18-month initiative

- Formation of team
- Inventory available data
- Purchase seismic data
- Purchase and condition well data
- Model scenarios
- Risk Assessment
- Community Benefits

Bipartisan Infrastructure Law Program

Phase II: Storage Complex Feasibility
18–24-month initiative

- Data collection
- Geologic analysis
- Analysis of contractual and regulatory requirements
- Subsurface modeling
- Risk Assessment
- Evaluate monitoring requirements
- Community Benefits

Phase III: Site Characterization and Permitting
<3-year initiative

- Detailed site characterization
- Prepare/Submit UIC Class VI or BSEE Permits to Construct
- CO_2 Source(s) Feasibility Study
- CO_2 Pipeline FEED Study
- Storage Field Development and Commercialization Plan
- NEPA process/approvals
- Community Benefits

Phase IV: Construction
<2.5-year initiative

- Drill and complete injection and monitoring wells
- Complete risk and mitigation plans
- Obtain EPA UIC Class VI or BSEE Permit/ Authorization to Inject
- Community Benefits

Phase III.5

- NEPA process/approvals
- CO_2 Pipeline FEED and supplemental analyses
- Community Benefits

2003

- DOE-led regional partnerships to validate CO_2 geologic storage.
- Completed injection test projects with monitoring of potential impacts to health or the environment.

2016

- Successful tests led to the CarbonSAFE program.
- Focused on ensuring CO_2 storage sites will be ready for integrated CCS system deployment in the 2025-2030 timeframe.

2023

- BIL builds on last 20+ years of CO_2 research.
- Enables commercial deployment of CO_2 storage.

Industry has decades of capture experience

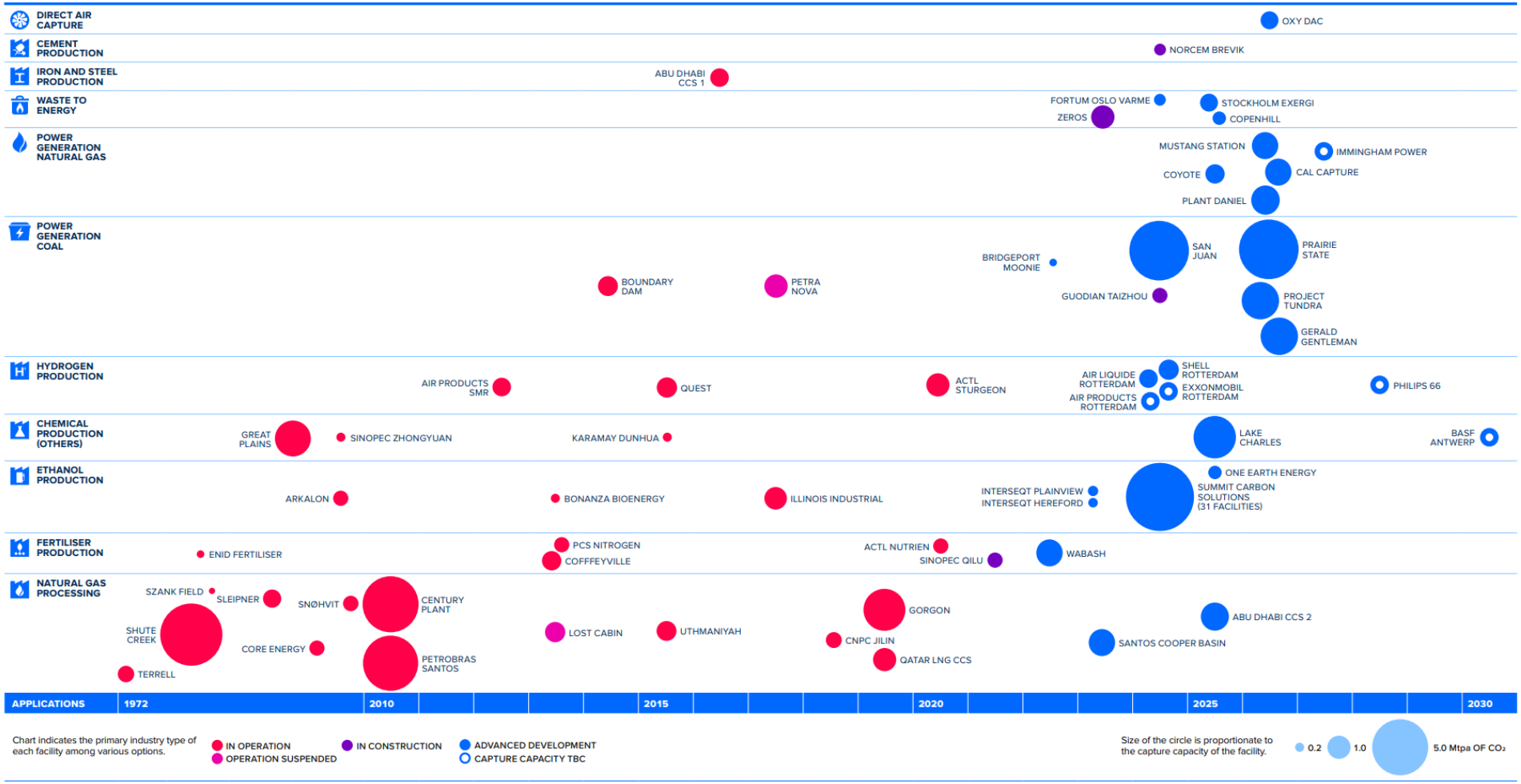
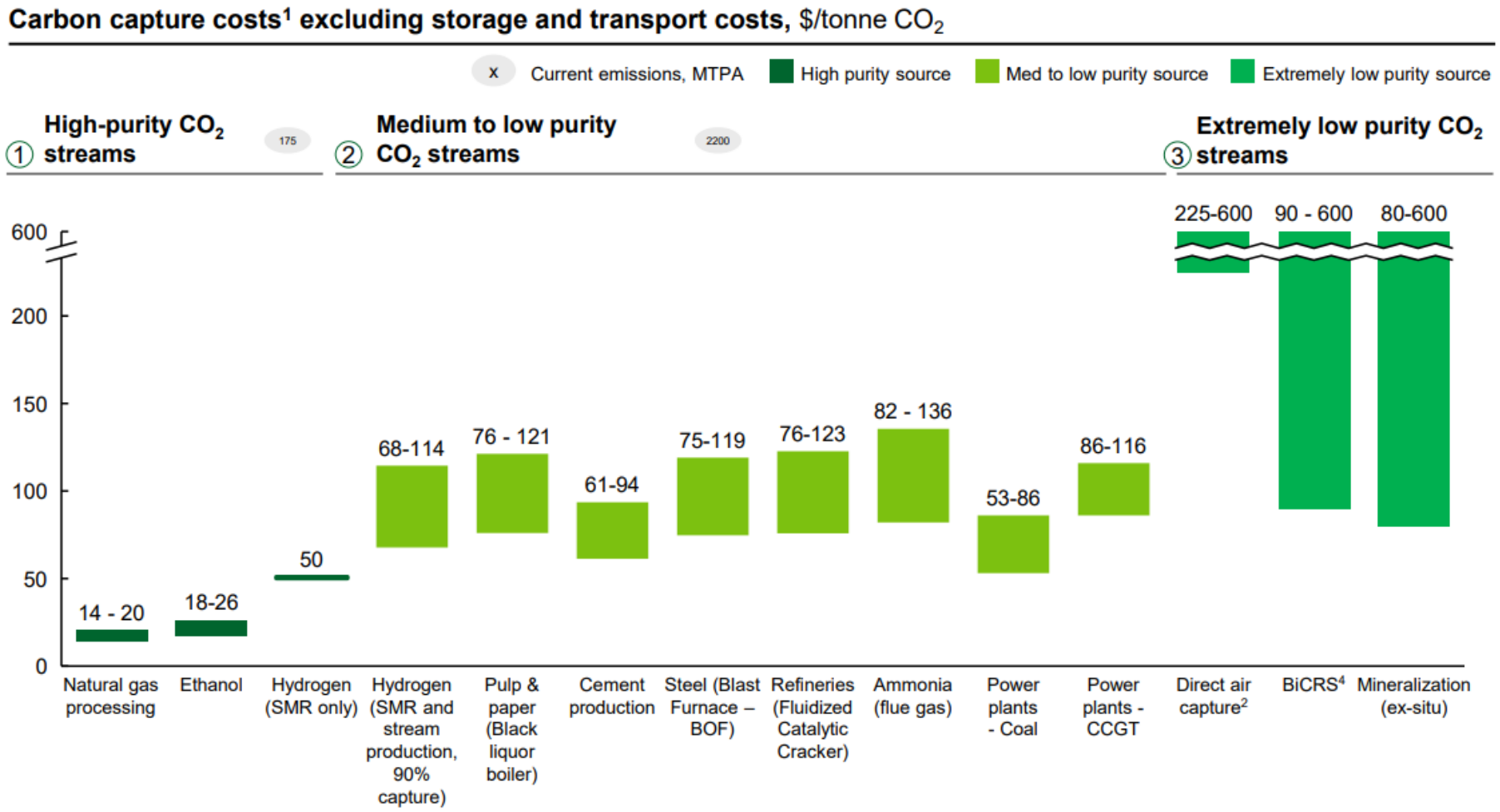


FIGURE 9 CCS PROJECTS BY SECTOR AND SCALE (BY CO_2 CAPTURE CAPACITY) OVER TIME

[Global Status of CCS 2022 - Global CCS Institute]

Some capture applications already low-cost



U.S. poised for commercial liftoff

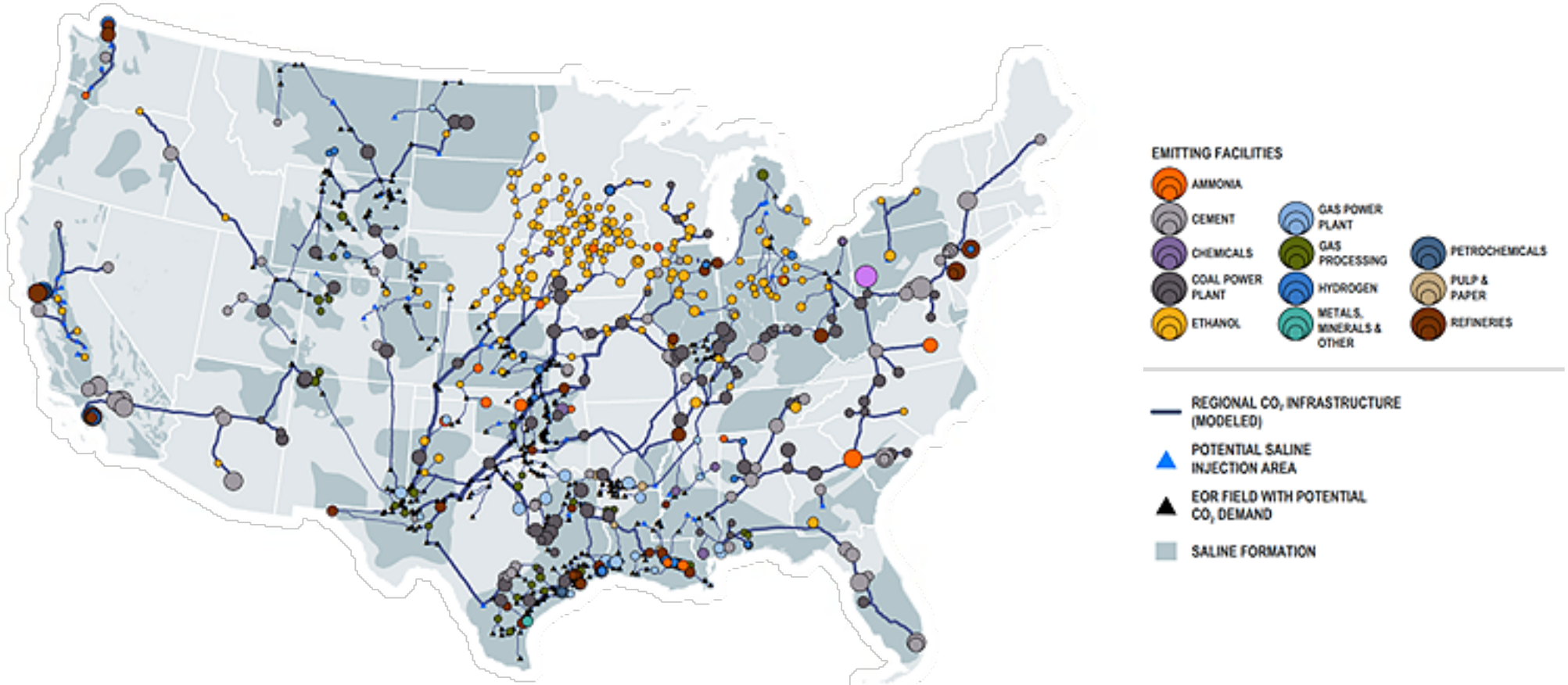
Pathways to Commercial Liftoff: Carbon Management

Pathways to Commercial Liftoff: Carbon Management (energy.gov)

U.S. policy enables full range of projects

Policy Lever	**Updated 45Q tax credits** *($85/t subsidy in Inflation Reduction Act)*	**Pilot and demo funding** *(~$12B from Bipartisan Infrastructure Law)*	**Carbon credits + Buy Clean** *(voluntary corporate + state/ local governments)*
Expected Project Impacts	Higher concentration point sources near pipelines and/or storage 100Ms t/y by 2030	Lower concentration point sources and novel capture technologies 10Ms t/y by 2030	Carbon dioxide removal and conversion demonstrations Ms t/y by 2030

Modeled estimates of 300M+ tCO_2 capture by 2035



transport and storage network deployment modeling from the Great Plains Institute finds that, under 45Q, a shared, interconnected CO_2 transport and storage system could capture, transport and store 300 million metric tons of CO_2 per year by 2035 from industrial facilities and power plants.

100M+ t/y capacity by 2030 announced in US

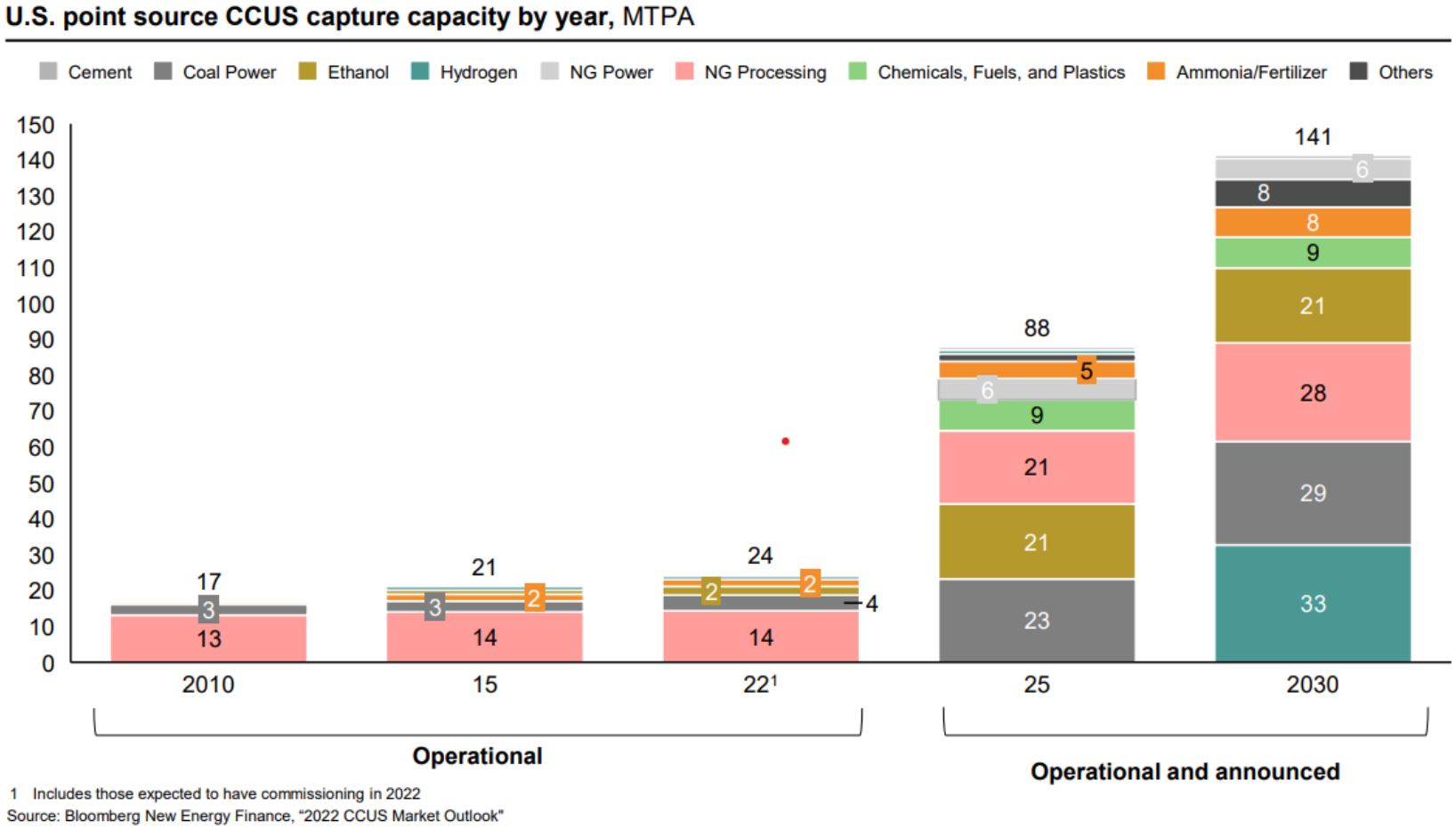
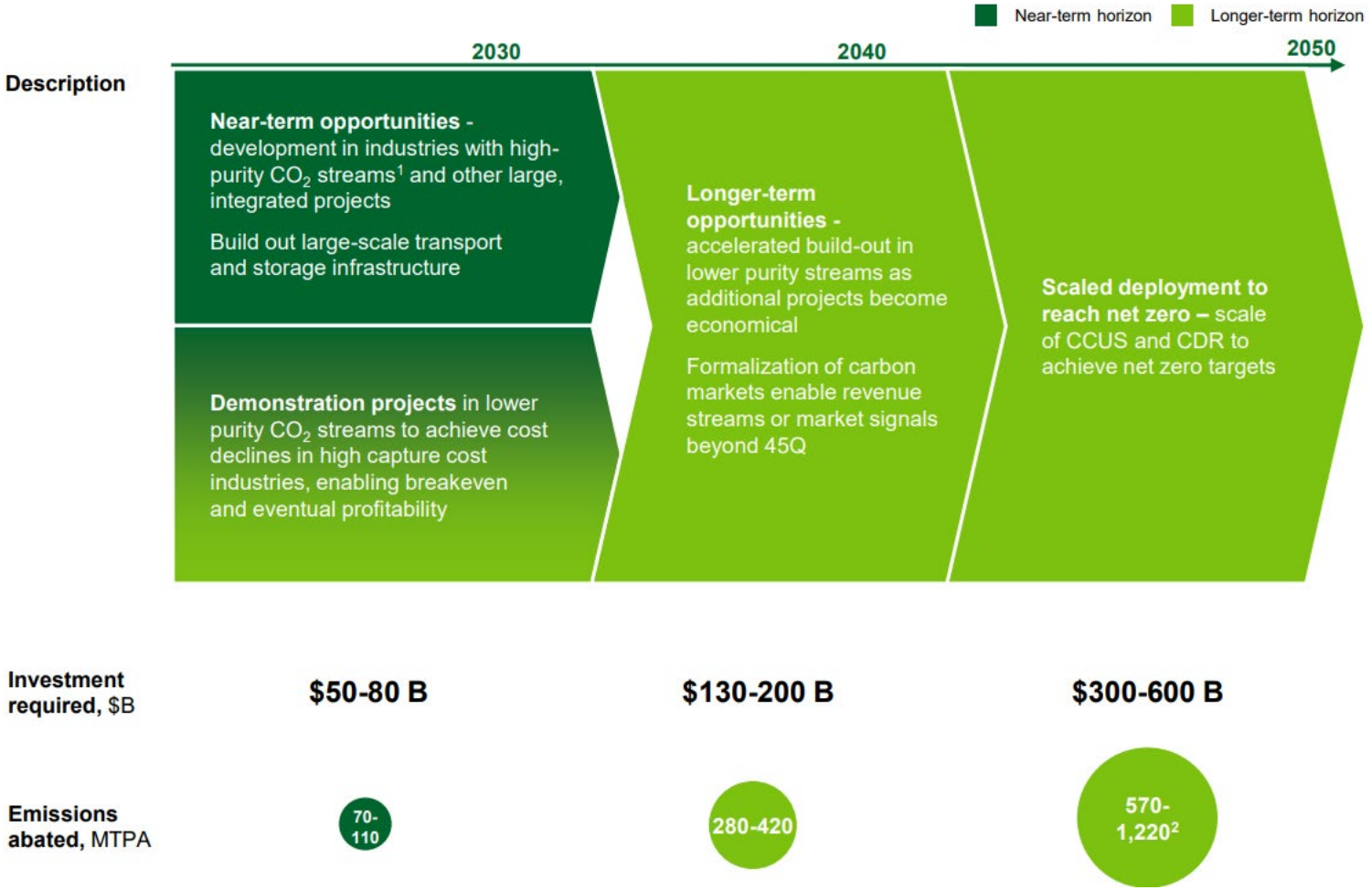


Figure 5: The U.S. has over 20 MTPA of operational point source CCUS capacity, with an announced project pipeline of ~140 MTPA as of Dec 2022

$100Bs in additional project finance required



Carbon Management Challenge

Launched in April, 13 countries joined to date

Recognition of CCUS and CDR as essential to keep 1.5 degree target within reach, and need for vast and rapid scale up of carbon management projects

Provide transparency for country-level commitments and action, and platform for accelerating action

Multilateral engagement opportunities abound

Technology analysis and knowledge sharing

ASIA CCUS NETWORK

GLOBAL CCS INSTITUTE

CCUS and CDR technology and policy coordination

CLEAN ENERGY MINISTERIAL
Accelerating the Global Clean Energy Transition

MISSION INNOVATION
Accelerating the Clean Energy Revolution

CDRLaunchpad.org
Global coordination on carbon dioxide removal demonstrations

R&D coordination

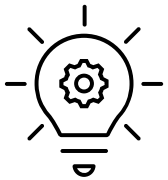
ieaghg

Accelerating CCS Technologies

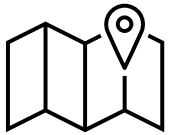
CET Partnership

US bilateral efforts to advance projects

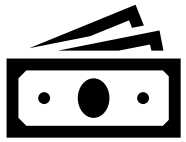
Technical knowledge and resource sharing



Analysis, mapping and test center collaboration



Connecting to private sector



U.S. DEPARTMENT OF ENERGY
Fossil Energy and Carbon Management

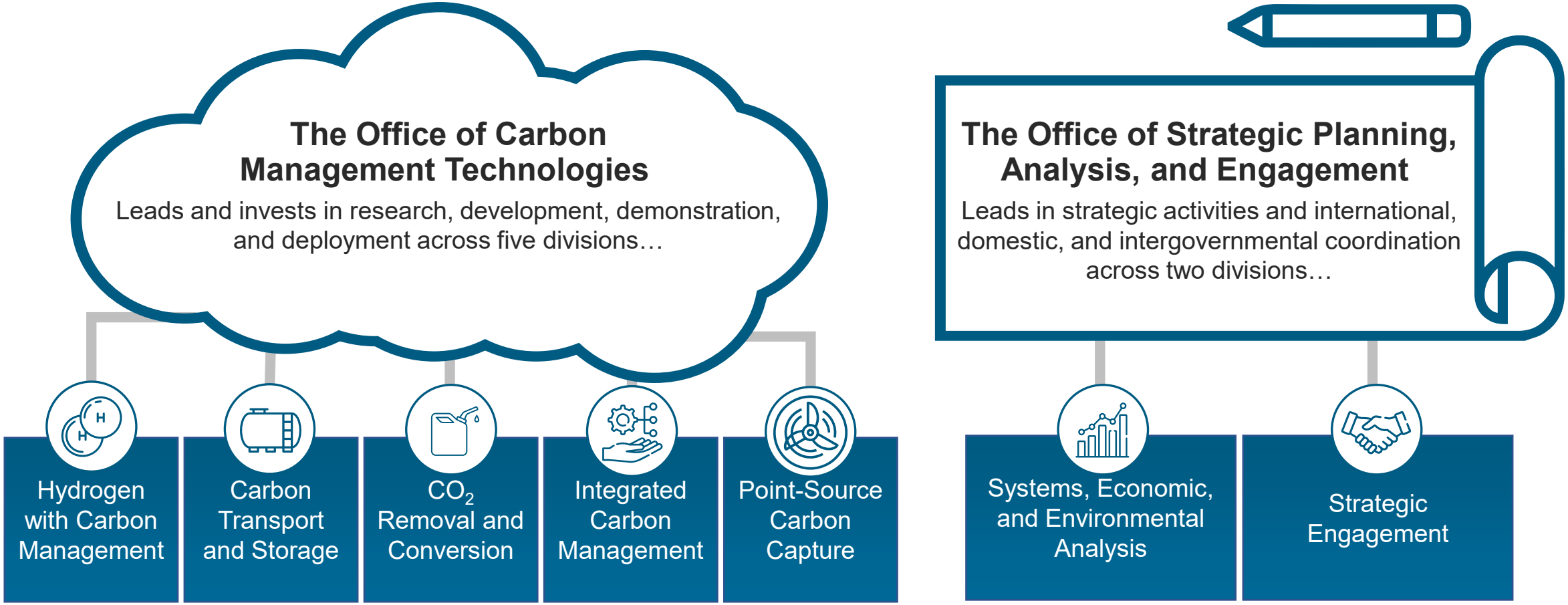
Thank You!

Questions?

Contact Noah Deich, Deputy Assistant Secretary for Carbon Management: **Noah.Deich@hq.doe.gov**

FECM's Office of Carbon Management

Focused on minimizing the environmental and climate impacts of fossil fuels and industrial processes, while working to achieve net-zero GHG across our economy

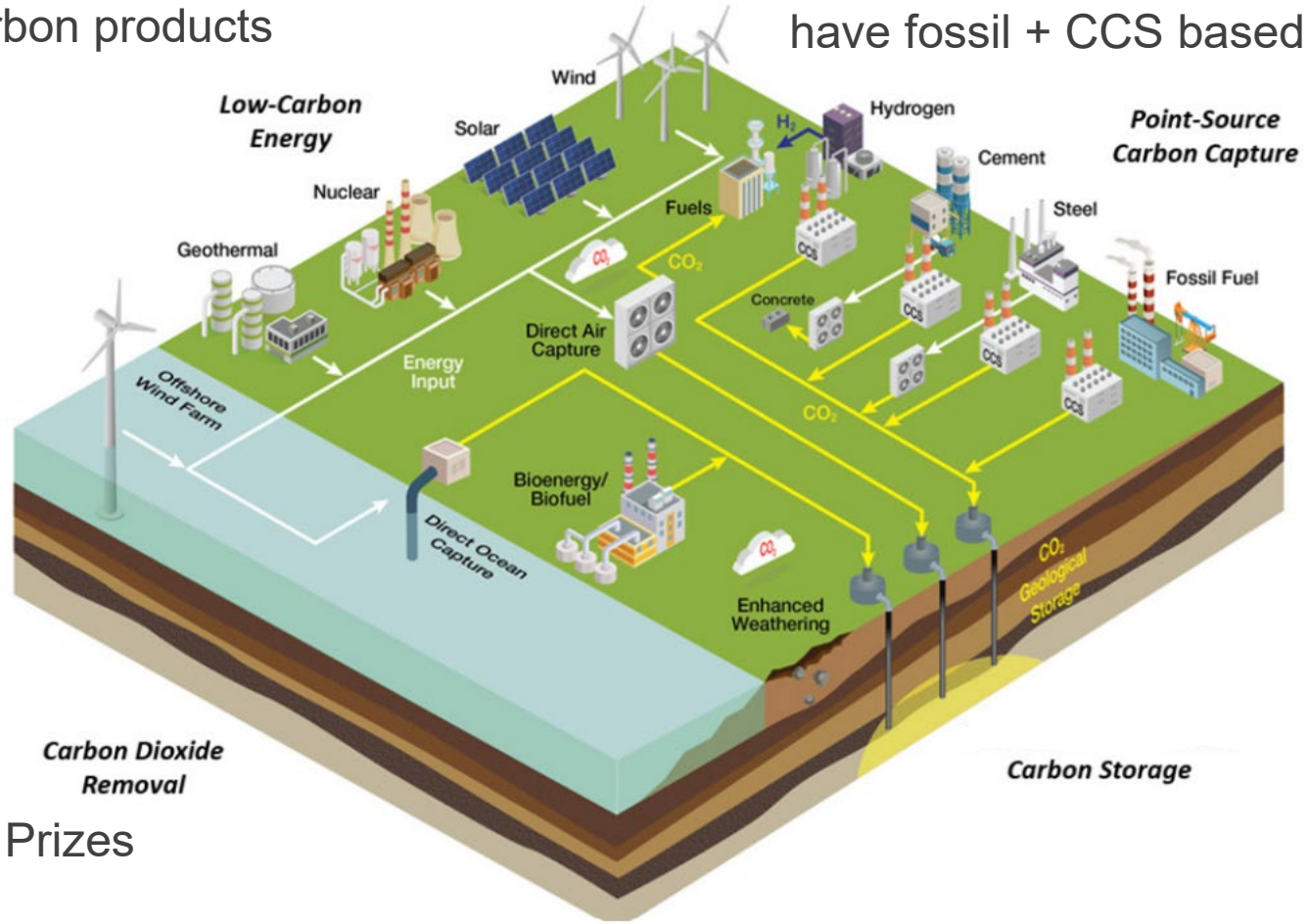


Bipartisan Infrastructure Law funding

$300M for CO2 conversion grants for low embodied carbon products

$8B for H2 Hubs, of which at least one will have fossil + CCS based H2 production

$2.5B for CO2 transportation loan support via CIFIA program
$100M for CO2 transportation engineering studies



$2.5B for commercial CCS demonstrations
$1B for small CCS pilots

$3.5B for Direct Air Capture Hubs
$115M for Direct Air Capture Technology Prizes

$2.5B for expanding DOE's CarbonSAFE storage characterization and buildout initiative

Social and environmental impacts essential for project success

DOE includes community, workforce, and environmental criteria in funding opportunities (up to 20% on major demos)

DOE supports community and stakeholder engagement activities

DOE requires monitoring and data collection to inform life cycle analysis, including non-CO_2 emissions and water usage impacts

About Mission Innovation CDR

Launched at COP-26 in November 2021

Scope

- Accelerate RD&D of technological CDR approaches
- Emphasize long-term, secure CO_2 storage and conversion into long-lived products

Coalition

- Co-leads – Canada, Saudi Arabia, United States
- Members – Australia, EC, India, Japan, Norway, United Kingdom
- Observers – Bahrain, Iceland, Germany, Costa Rica

Flagship project: CDR Launchpad

- Members commit to build >1000 tonne per year CDR demo facility
- Share data and learnings
- Provide in-kind support for MRV

MI CDR Activities to Date

- Several workshops – Life Cycle Analysis, Roadmapping and Action Plan, BiCRS
- Released Roadmap and Action Plan at Global Clean Energy Action Forum (GCEAF) in September 2022
- Released BiCRS Technical Track Scope of Work
- Launched first “sprints”
  - CDR Launchpad
  - Mapping of Demonstrations/Deployments and Resources
  - LCA Case Studies
- Increased presence at other events (e.g., COP 27)

Opportunities for Industry Actions Globally

- Elevate carbon management responsibly in climate conversations
- Participate in knowledge sharing to accelerate learning-by-doing globally
- Engage in Article 6 and development banks for project opportunities internationally
- Apply model for meaningful participation of communities for projects globally