NEW MEXICO

emnrd

Energy, Minerals and Natural Resources Department

Carbon Utilization and Storage Partnership

Melanie Kenderdine

September 10, 2024

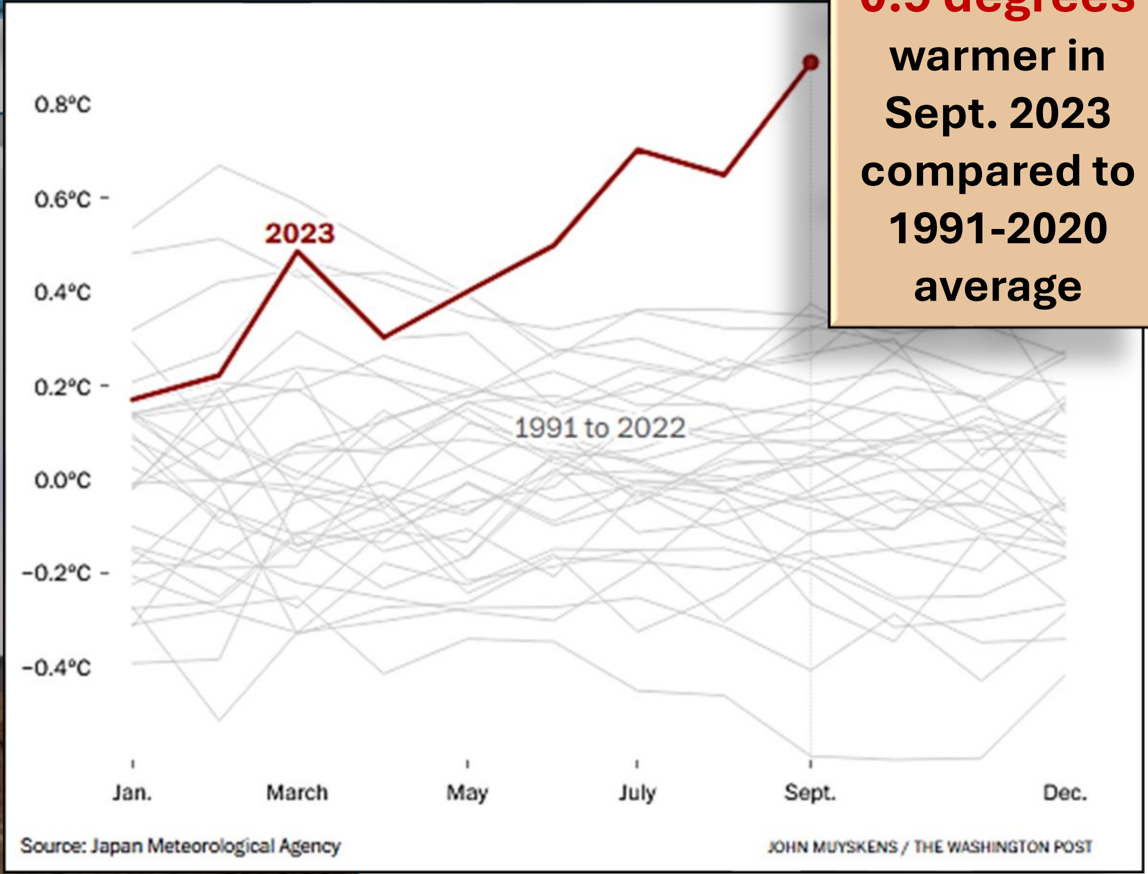
Santa Fe, New Mexico

NASA Satellite Photos, Elephant Butte Reservoir, New Mexico, My Home State

0.9 degrees warmer in Sept. 2023 compared to 1991-2020 average

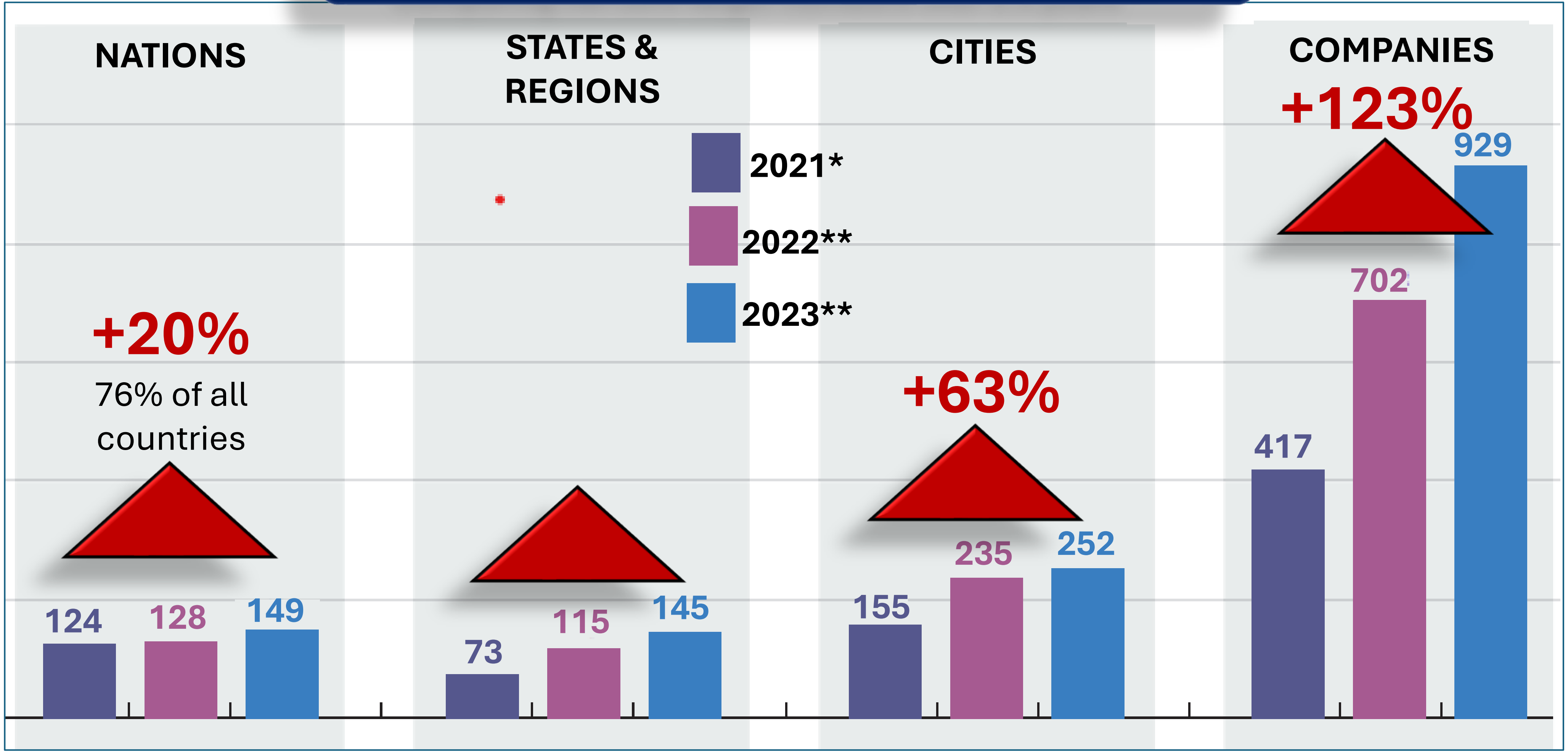
1994

On the ground at Elephant Butte, 2019



Net Zero Target Coverage, June 2023

Net Zero Target Setting
Comparing net zero target numbers over 2.5 years



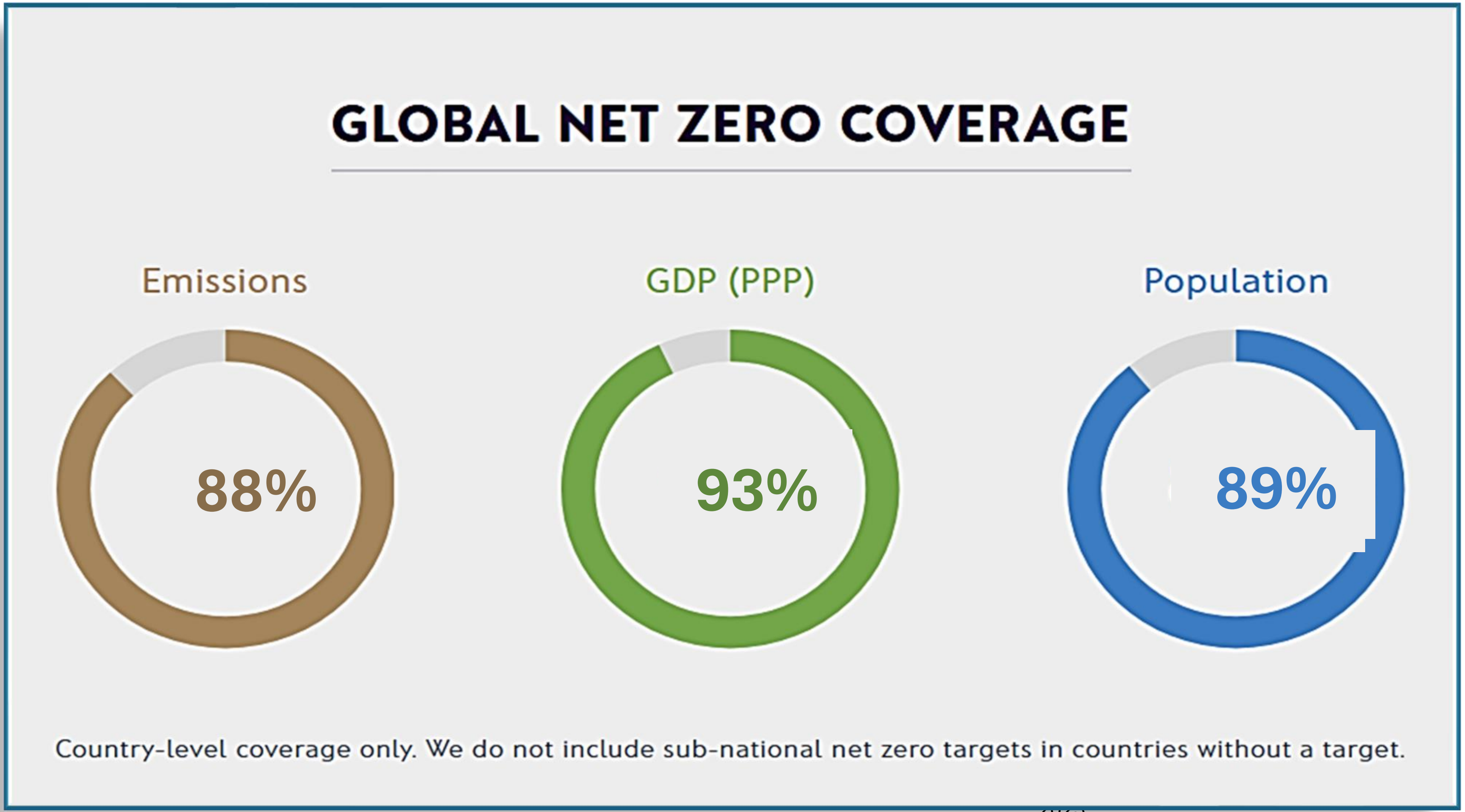
*Black et al. 2021, Data: Dec. 2020

**Net Zero Stocktake 2022, Data: June 2022

**Net Zero Stocktake 2023, Data: June 2023

https://zerotracker.net/analysis/net-zero-stocktake-2022

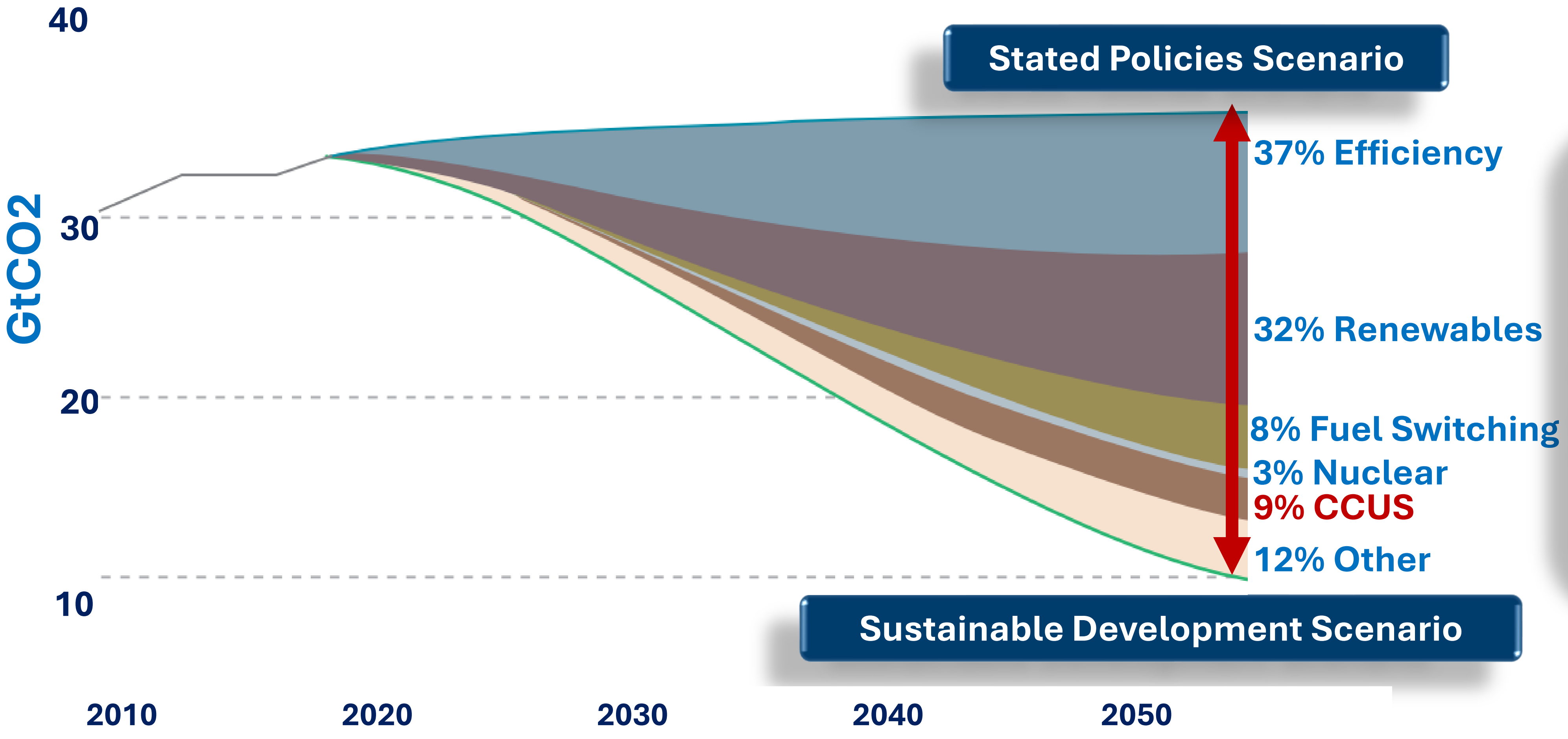
Net Zero Target Coverage, June 2023



https://zerotracker.net/analysis/net-zero-stocktake-2023

CCS: An Important Technology for Meeting Global Sustainable Development Targets

"Reaching net zero will be virtually impossible without CCUS" IEA, 02/20

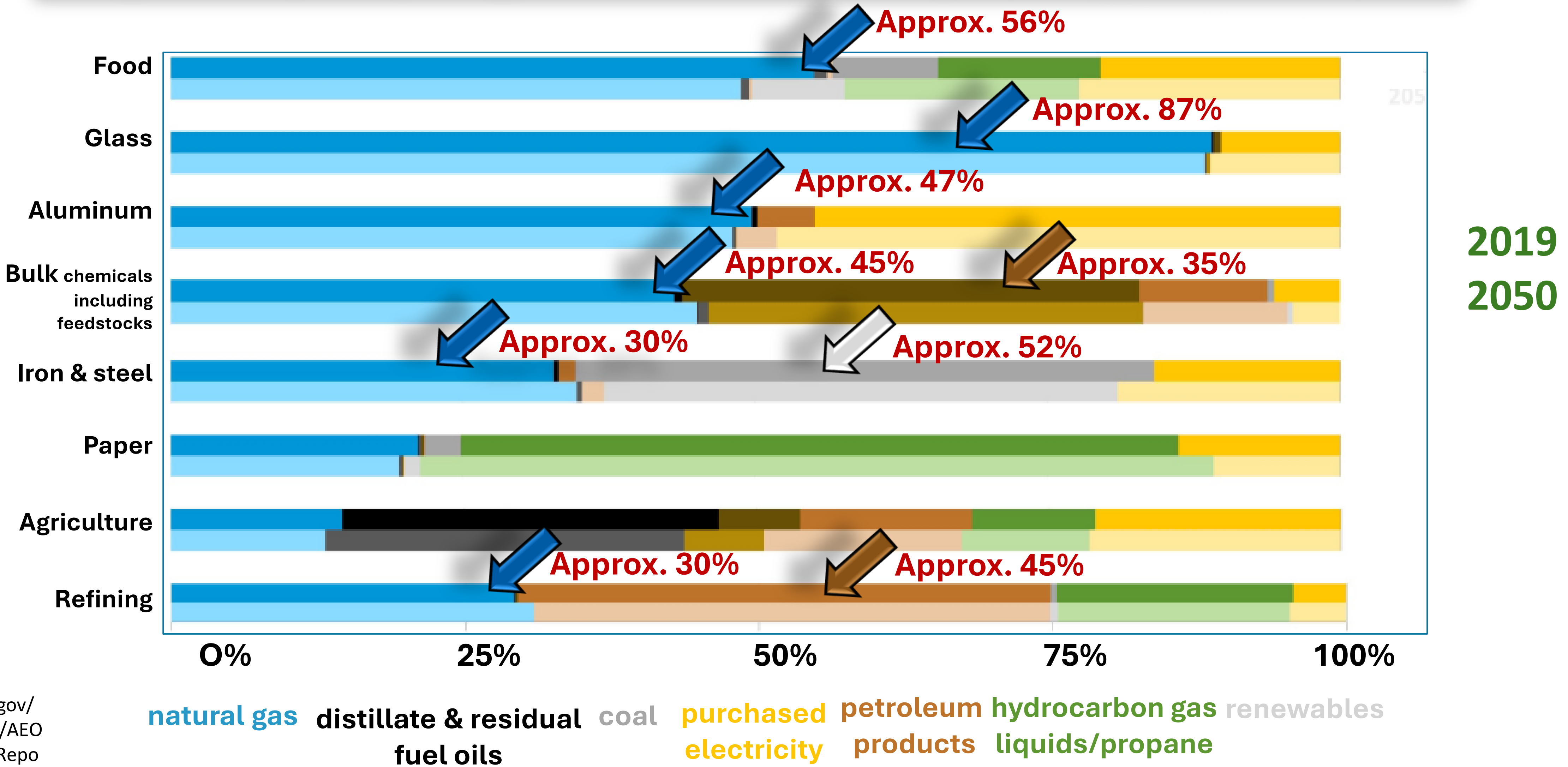


"... We need quick wins to reduce emissions as much as possible... We need to catch up on the years in which we procrastinated... If we don't do this, the 1.5°C goal will be out of reach before 2030."
UNEP Executive Director

Source: Adapted from IEA, 2019

US Industrial Uses of Energy

Energy Consumption by Energy Source Shares and Industry, % (EIA AEO2020 Reference Case)



Source: US EIA, 2020 AEO

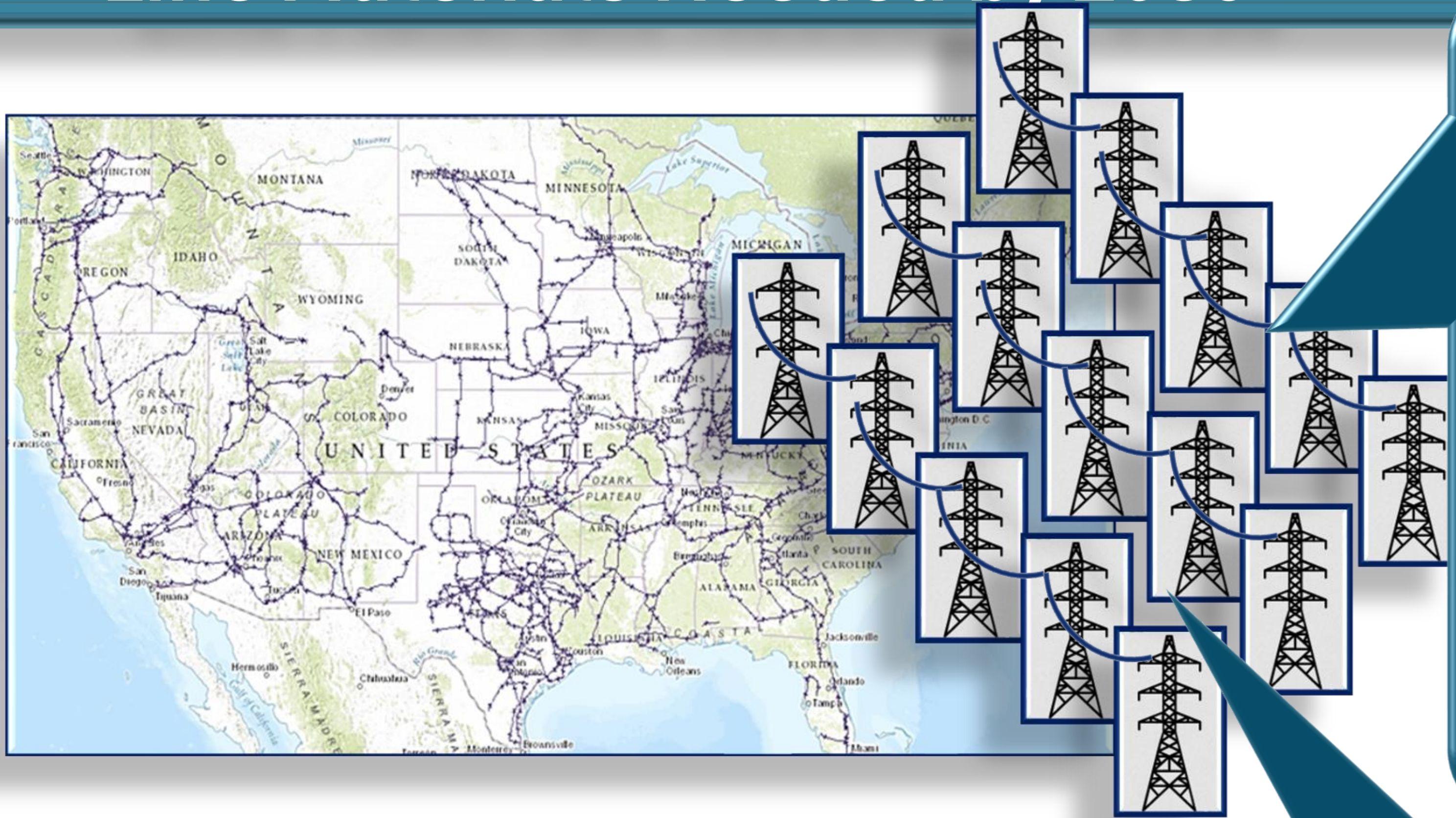
https://www.eia.gov/outlooks/aeo/pdf/AEO2020%20Full%20Report.pdf

Reference Frame: High Voltage Transmission Line Materials Needed by 2030

EIA: In 2016, there were 160,000 miles of high voltage transmissions lines

Princeton NZA (E+RE pathway with base land availability)**: The US will need a 75% increase in transmission capacity by <u>2030</u> to meet net zero targets**

Assume 60% of that capacity is achieved by adding new miles (the other 40% is met with technology improvements)



Transmission towers are made of steel, aluminum and copper, among other materials. So are transmission lines. So are wind turbines. So are cell towers. So are EVs. So are EV charging stations

60% of 96,000 translates to 72,000 miles of new high voltage transmission lines by 2030

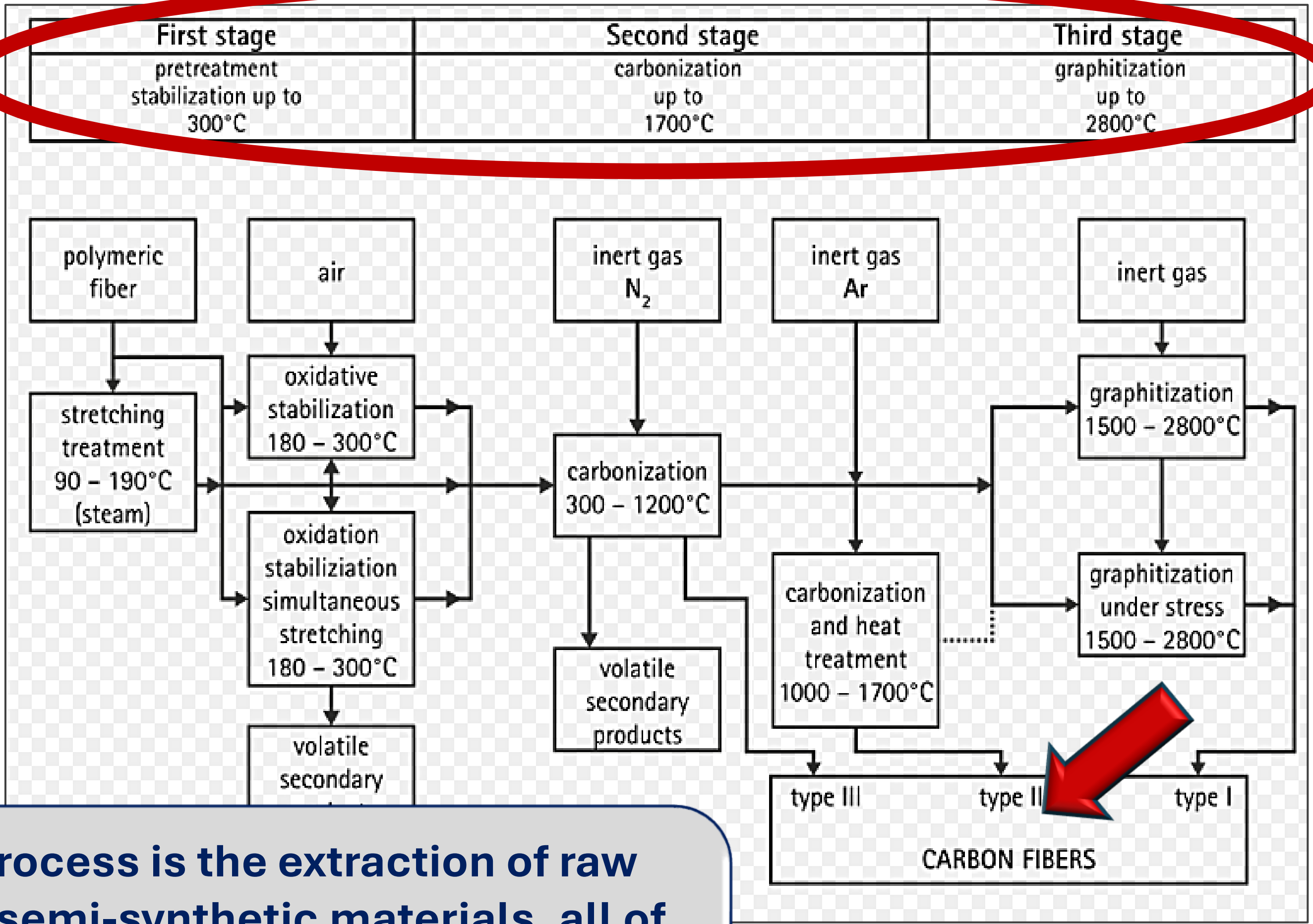
There are between 5 and 5.6 towers per mile on a high voltage transmission line (credible numbers range from 5 to 5.6)

At 5 towers/mile, we will <u>need 360,000 transmission towers by 2030</u>

https://www.eia.gov/todayinenergy/detail.php?id=27152

Key Technologies Need Both Heat and Oil

Wind turbine blades are manufactured using a composite mix of glass, carbon fiber, and plastic. It's a unique material that gives the blades the strength and durability to do its job.



The first step in the plastic manufacturing process is the extraction of raw materials…plastic is made from synthetic or semi-synthetic materials, all of which are derived from fossil fuels. The most common ones include natural gas, crude oil, and coal. These fossil fuels are extracted from the ground and then refined to create hydrocarbon-based feedstocks used to make plastic.

Electricity Inadequate for Key Industrial Processes

At a high level, glass is sand that's been melted down and chemically transformed. To make sand melt, you need to heat it to roughly 1700°C (3090°F)

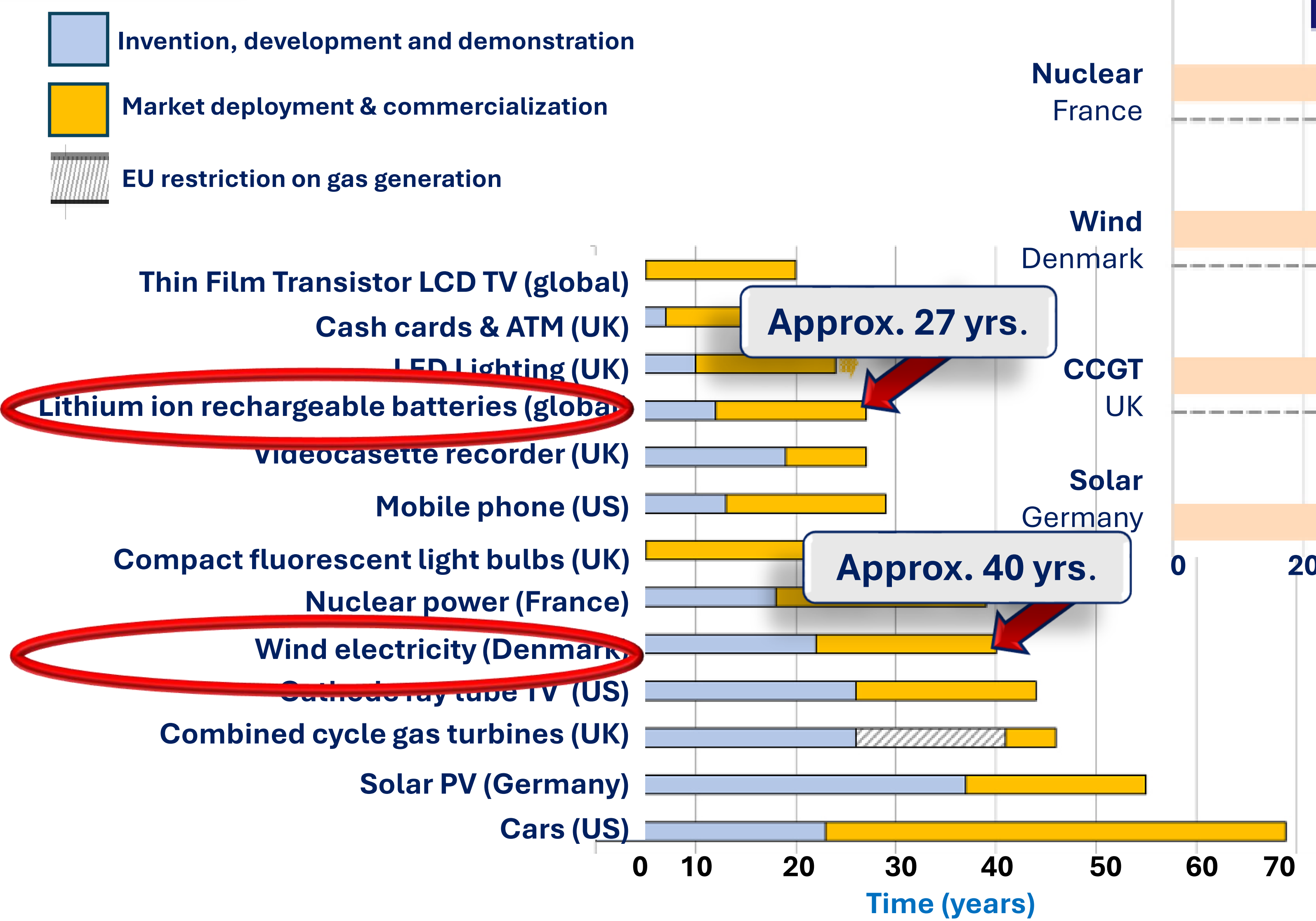
Metallurgical and ceramic processes require high heat… 99.5% aluminum melts at 1,214°F (657 °C), and carbon steel begins melting at 1,425°F (734°C). Ceramics require kiln temperatures from 2,124°F to 2,264°F

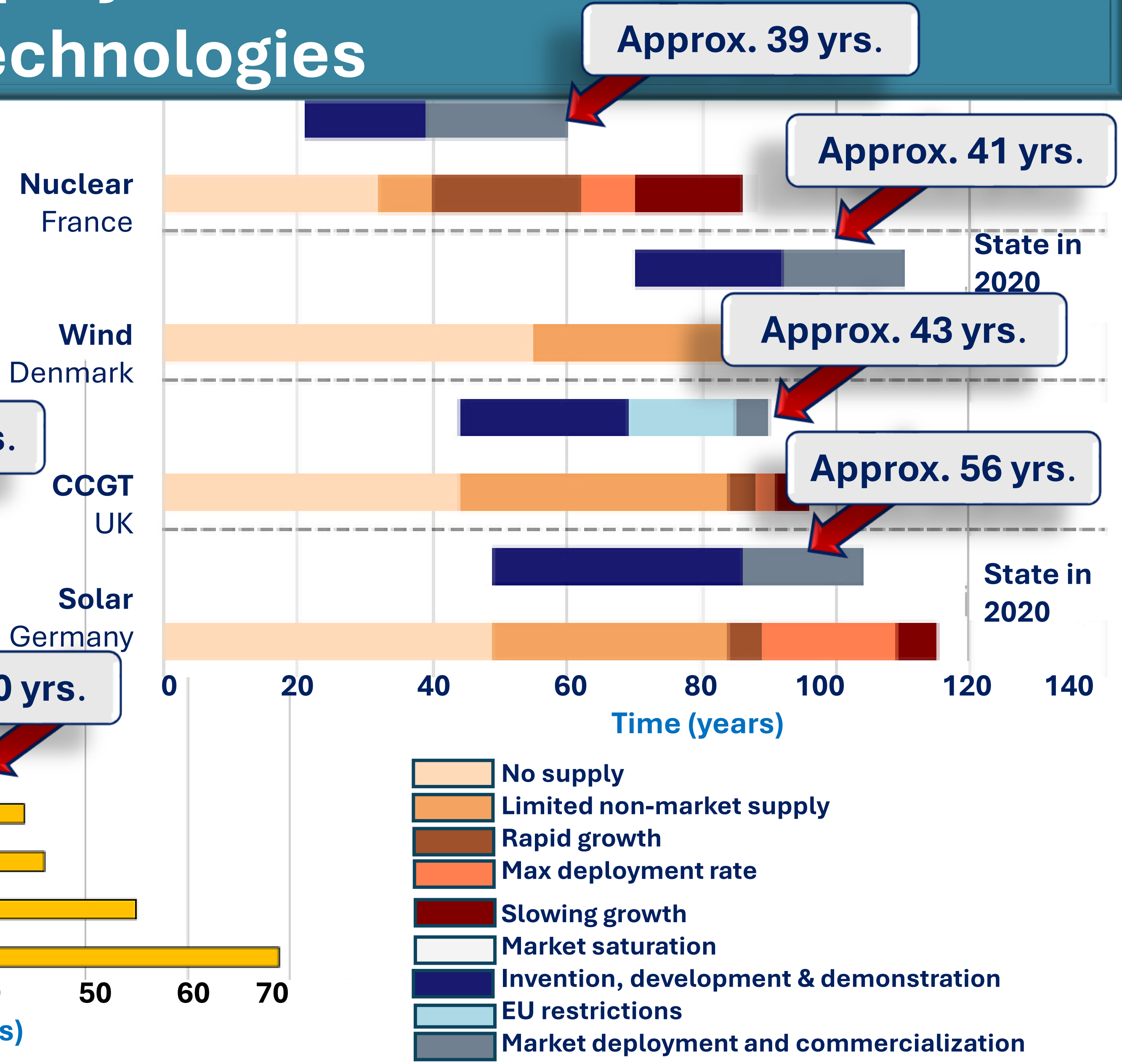
Forging and shaping steel is typically done at temperatures from 1400 F – 2000 F. And forge welding is done at temperatures above 2000 F.

Concentrated solar collectors: approx. 32 - 400 degrees
Deep geothermal energy: approx. 175 - 380 degrees
Woody biomass: approx. 32 - 400 degrees

…approximately 32 percent of key industry processes require very high temperatures (>1000 °); another 16% require high temperatures (400-1000 °). Technologies for achieving high heat other than from fuel combustion are still in the research or pilot phases. These processes currently require a fuel such as natural gas to affordably achieve the levels of heat needed.

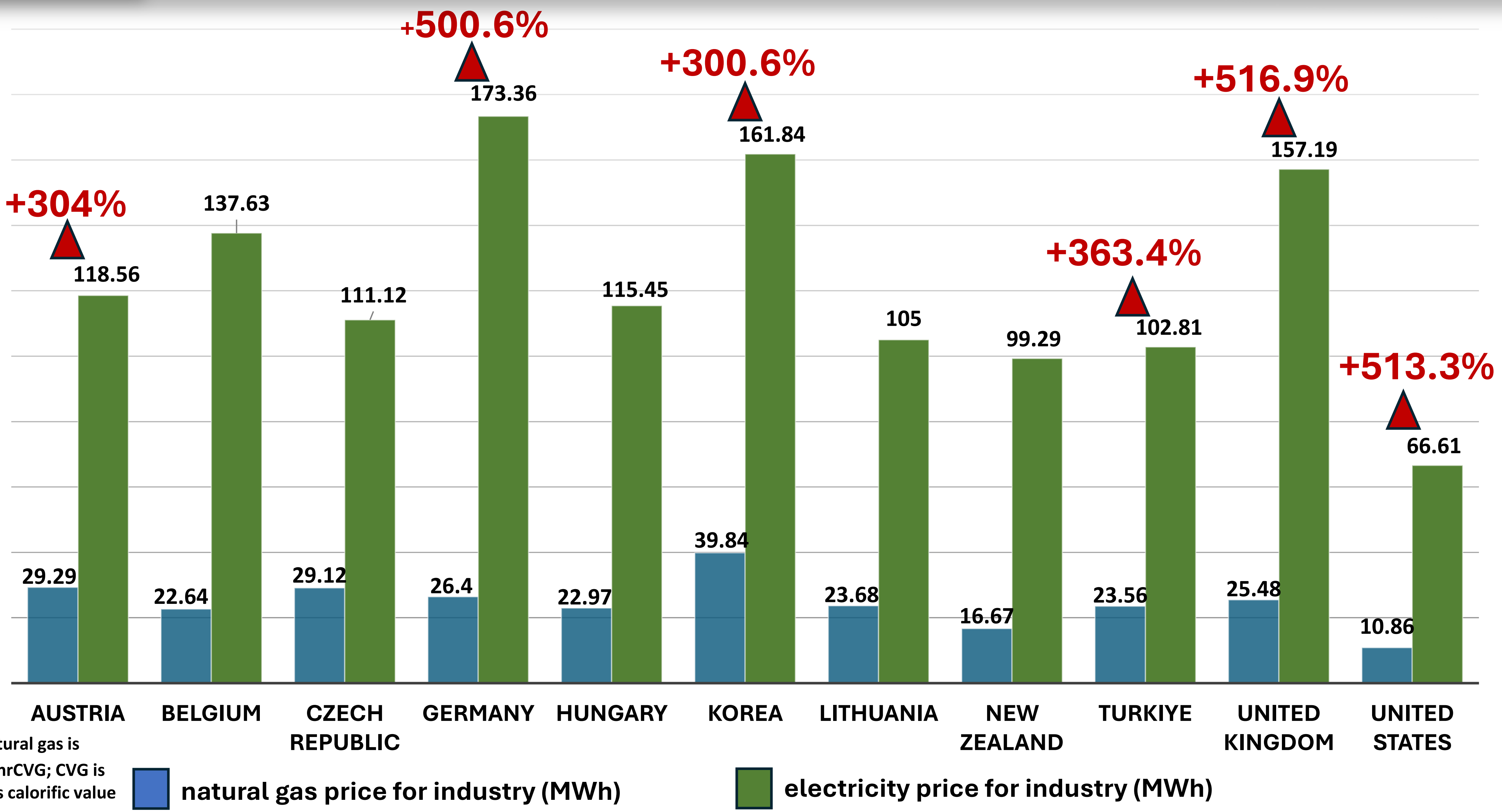
Development/Deployment Timelines for Key Technologies





Francehttps://reader.elsevier.com/reader/sd/pii/S0301421521000240?token=875F291C875B56A06A22FF61D6E0AFD903726134EEA017D8914E90A9DB516318501601DD1CDF1A5072CFFED060D141A1&originRegion=us-east-1&originCreation=20210715180413

Natural Gas and Electricity Prices, Select OECD countries, 2021 (MWhr*)

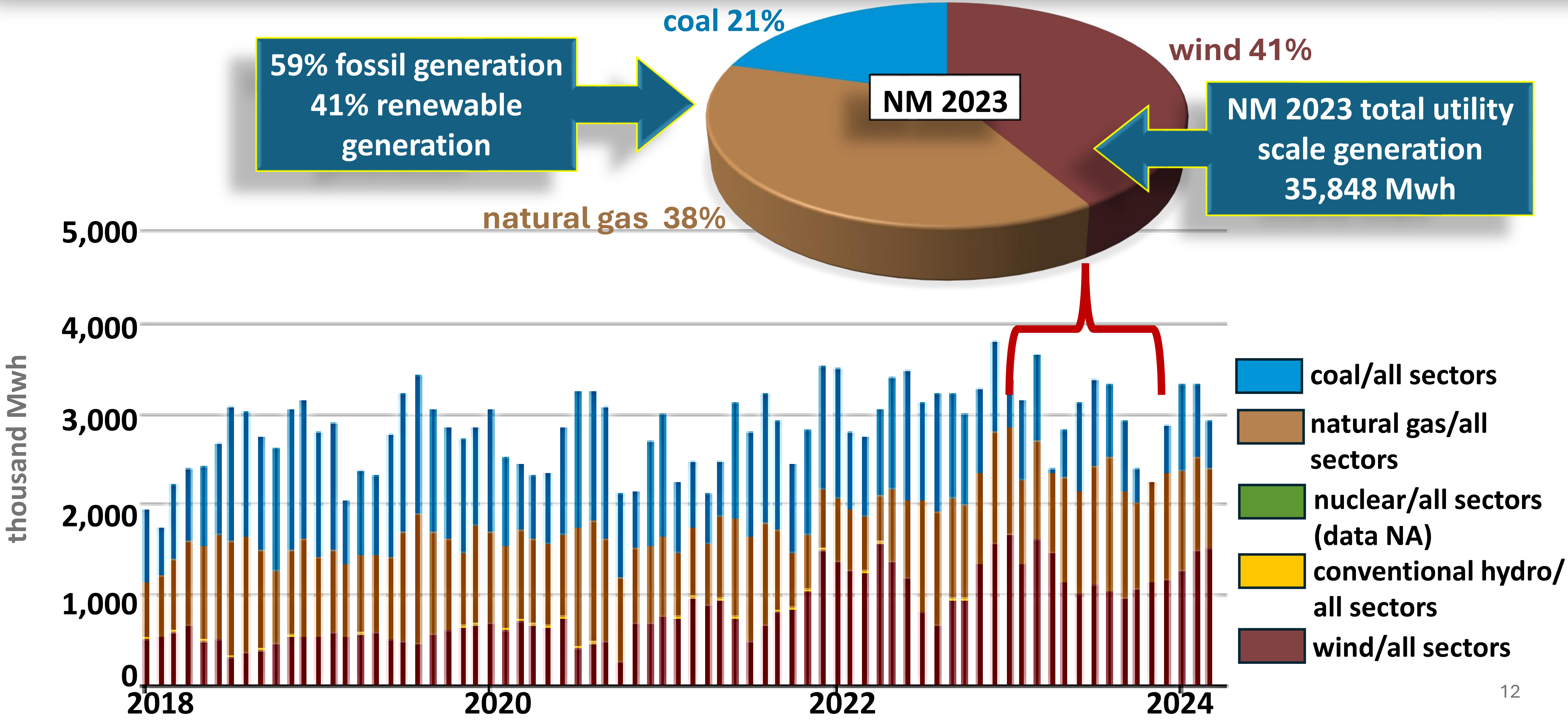


*natural gas is MWhrCVG; CVG is gross calorific value

New Mexico Net Electricity Generation (utility scale) by Energy Source (thousand Mwh)

59% fossil generation
41% renewable generation

NM 2023 total utility scale generation 35,848 Mwh



https://www.eia.gov/beta/states/states/nm/data/dashboard/electricity

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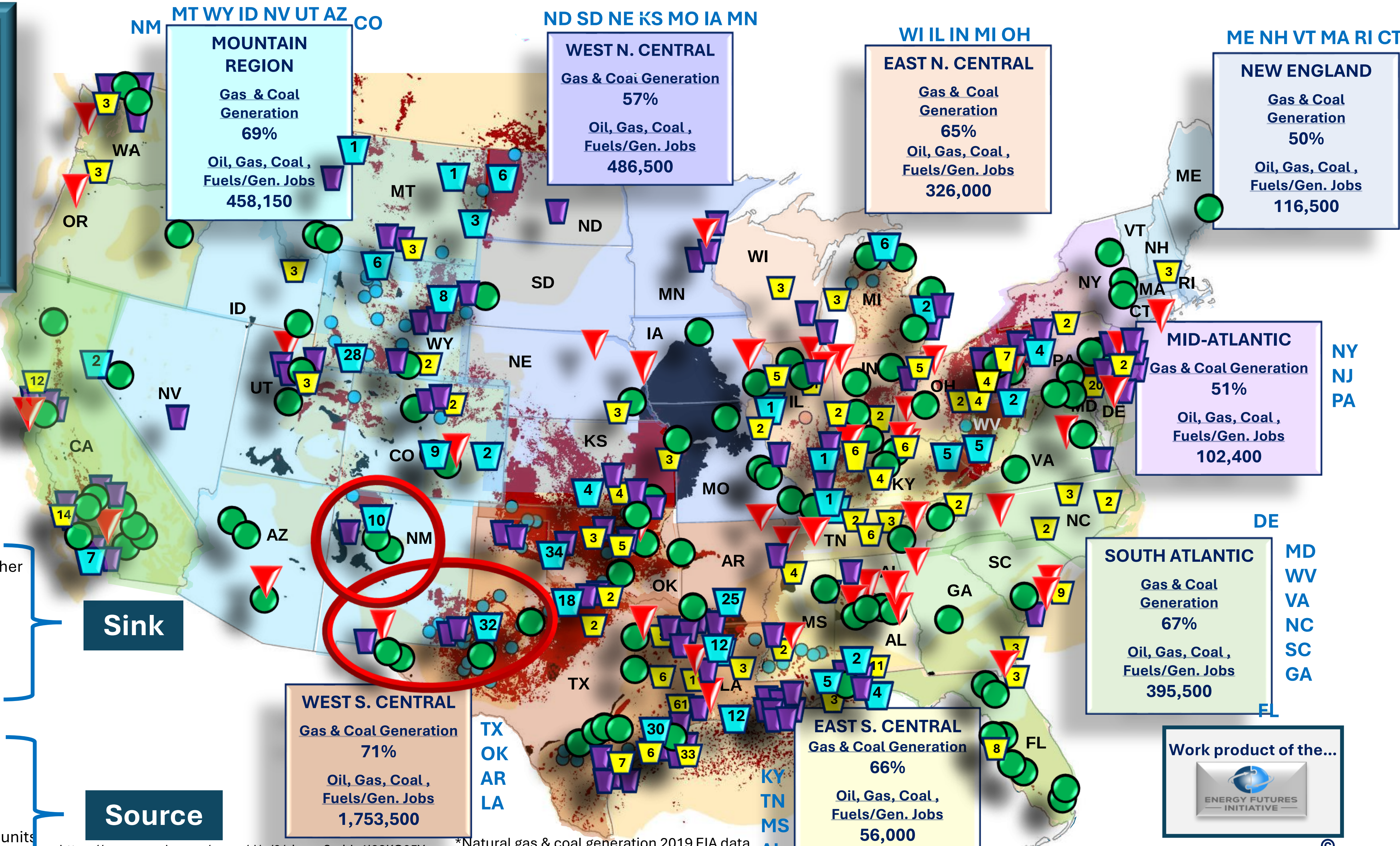
The Need for CCS: Where & Why



- Enhanced Recovery & Other
- Geologic Sequestration
- Oil and Gas Reservoirs
- Saline Formations
- Unmineable Coal Seams

Sink

- Cement plant
- Steel plant
- Refinery
- Approx.# gas processing units
- # Chemical processing Facilities, 2019****

Source

https://www.google.com/maps/d/u/0/viewer?mid=1l83KG05Yxac2ZL9CaqwJO1oahUk&ll=35.78235042370692%2C-88.7570173125&z=6

https://earthjustice.org/sites/default/files/map-refineries2_800.png

*Natural gas & coal generation 2019 EIA data

** Natural gas, coal generation, fuels jobs, assumes induced jobs of 3.5X, rounded to nearest 100

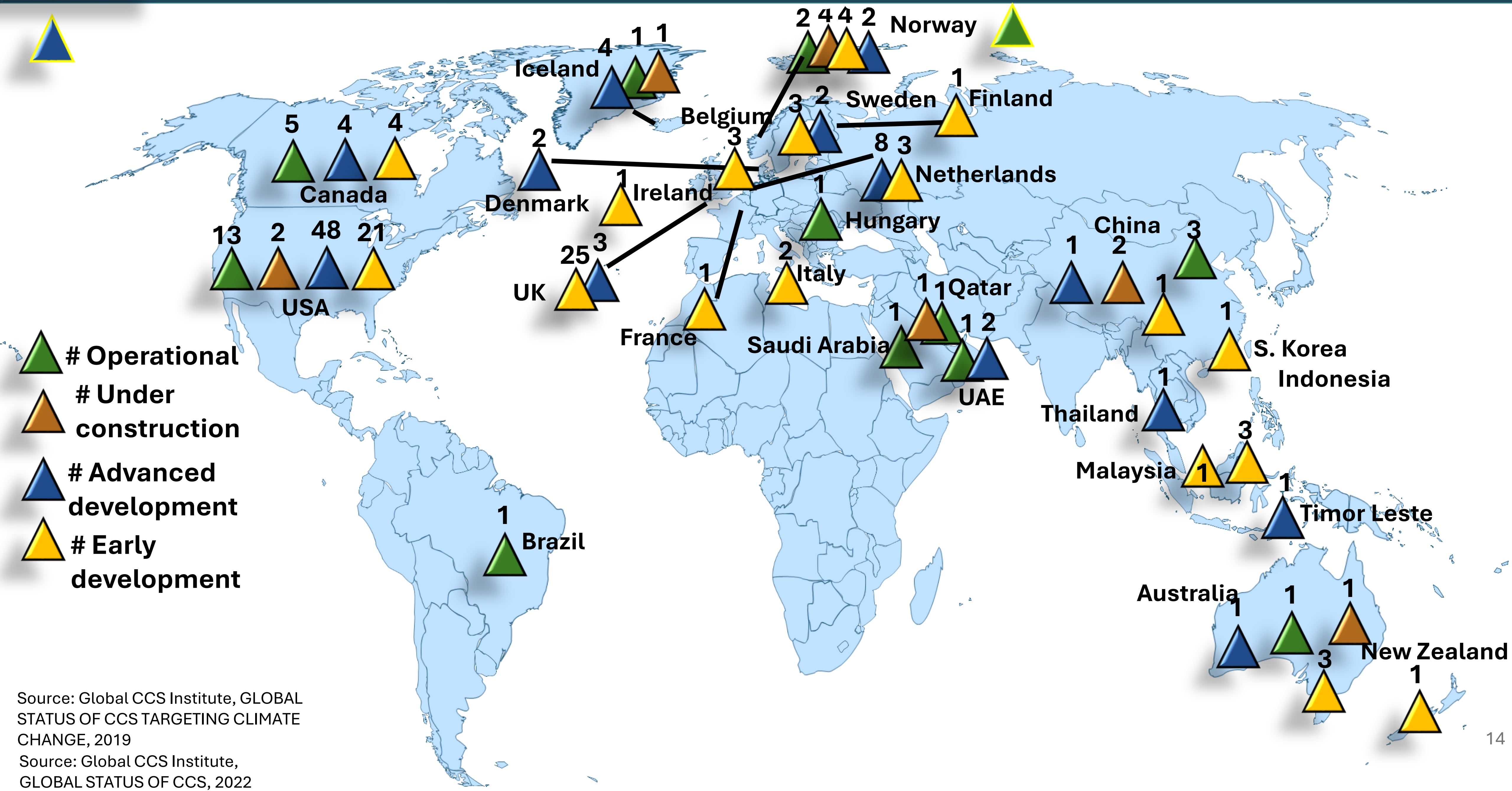
*** Locations of facilities are proximate

EPA website accessed 02/04/21

Work product of the... ENERGY FUTURES INITIATIVE

Source: EFI, 2019, compiled using data from EPA and NETL

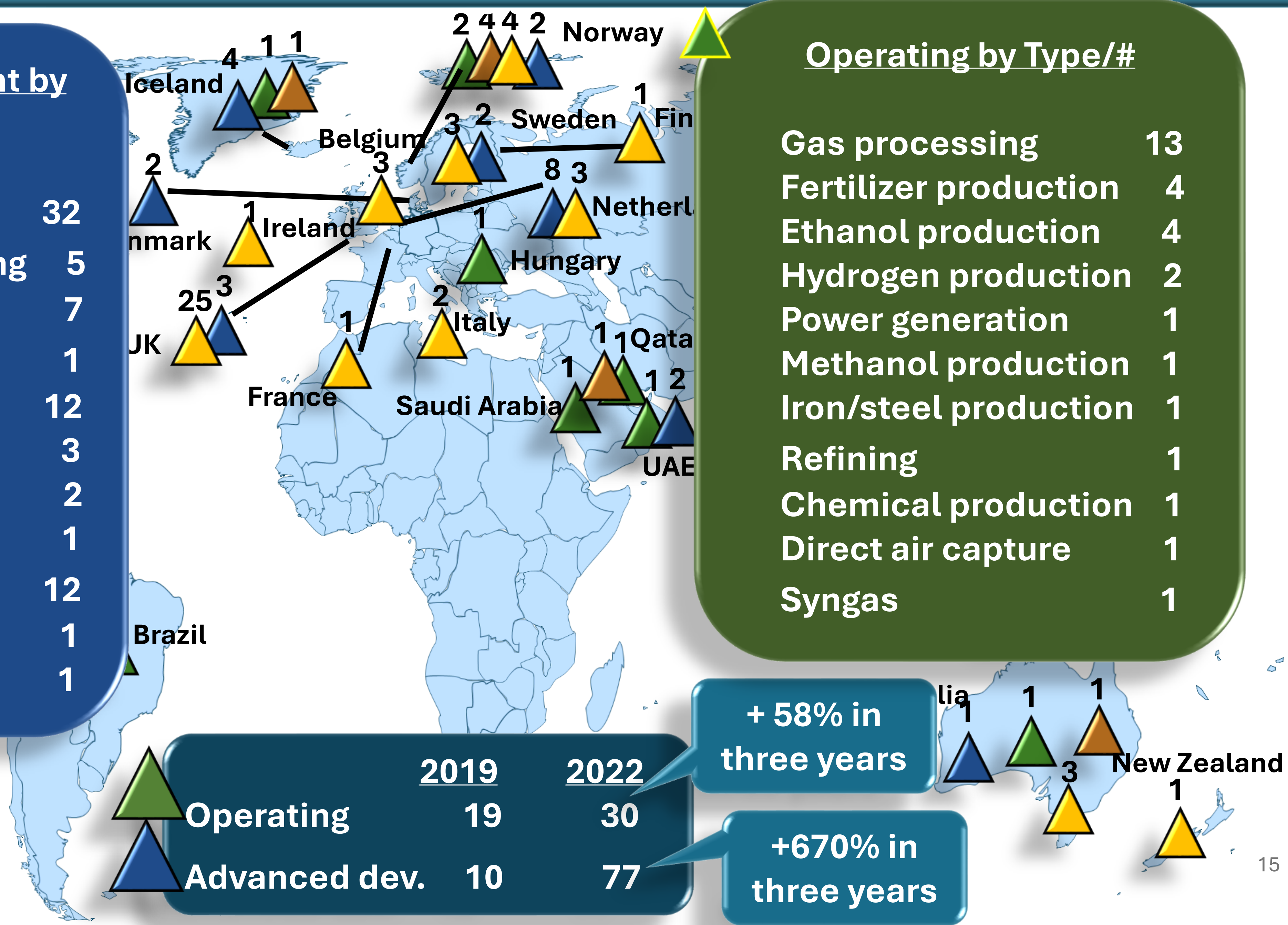
CCS Projects 2022, Operational, Under Construction, Advanced/Early Development



Source: Global CCS Institute, GLOBAL STATUS OF CCS TARGETING CLIMATE CHANGE, 2019

Source: Global CCS Institute, GLOBAL STATUS OF CCS, 2022

CCS Projects 2022, Operational, Under Construction, Advanced/Early Development



Advanced Development by Type/#

Ethanol production	32
Natural gas processing	5
Hydrogen production	7
Fertilizer production	1
Power generation	12
Bioenergy	3
Chemical production	2
Refining	1
Various	12
Direct air capture	1
Waste incineration	1

Operating by Type/#

Gas processing	13
Fertilizer production	4
Ethanol production	4
Hydrogen production	2
Power generation	1
Methanol production	1
Iron/steel production	1
Refining	1
Chemical production	1
Direct air capture	1
Syngas	1

	2019	2022
Operating	19	30
Advanced dev.	10	77

+ 58% in three years

+670% in three years

Source: Global CCS Institute, GLOBAL STATUS OF CCS TARGETING CLIMATE CHANGE, 2019

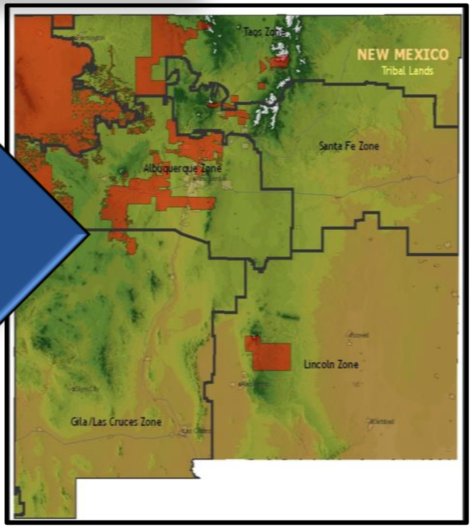
Source: Global CCS Institute, GLOBAL STATUS OF CCS, 2022

State Primacy in Historical Context

Safe Drinking Water Act: OCD's Underground Injection Control (UIC) Program awarded primacy authority for Class II injection wells (March 7, 1982)

Water Quality Control Commission (WQCC)**: delegated primacy authority over the UIC program for Class I, III, and V injection wells (August 10, 1983)**

EPA announced the availability of funding under the Bipartisan Infrastructure Law to support state and tribes in their efforts to establish and implement Class VI programs (2023).

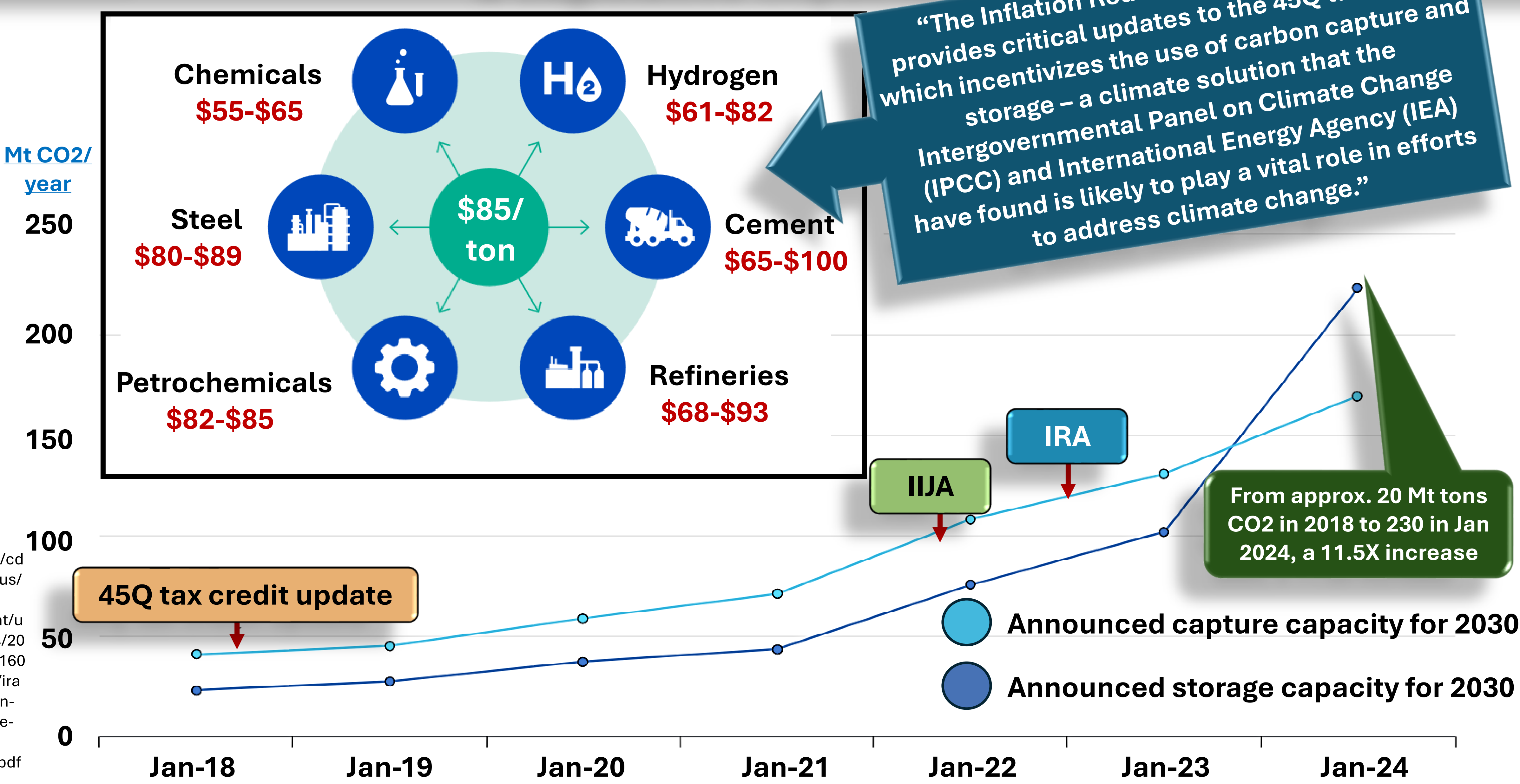


https://www.slideshare.net/slideshow/underground-injection-well-overview-lorrie-council/40920740

https://search.aol.com/aol/image;_ylt=Awr48PYICNxmON0SVVBpCWVH;_ylu=Y29sbwNncTEEcG9zAzIEdnRpZAMEc2VjA3Nj?q=Class+VI+wells+native+american+land+new+mexico&v_t=comsearch#id=45&iurl=https%3A%2F%2Fgacc.nifc.gov%2Fswcc%2Fimages%2Fmap_agency_bia_nm.jpg&action=click

https://search.aol.com/aol/image;_ylt=Awrg0dq.C9xmhDoV8Q9pCWVH;_ylu=Y29sbwNncTEEcG9zAzEEdnRpZAMEc2VjA3BpdnM-?q=safe+drinking+water+act&s_it=searchtabs&v_t=comsearch#id=3&iurl=https%3A%2F%2Fstateimpactcenter.org%2Fimages%2Fgeneral%2F_metadata%2FIssues-in-Focus-Ocean-Water-Policy-Safe-Drinking-Water-Act-Image.jpg&action=click

US Announced Capture and Storage Capacity, 2018-2024 & Legislative Impacts/Value



https://cdn.catf.us/wp-content/uploads/2023/02/16093309/ira-carbon-capture-fact-sheet.pdf

EPA Class VI Primacy Grant Allocations, Active & Pending as of 02/24

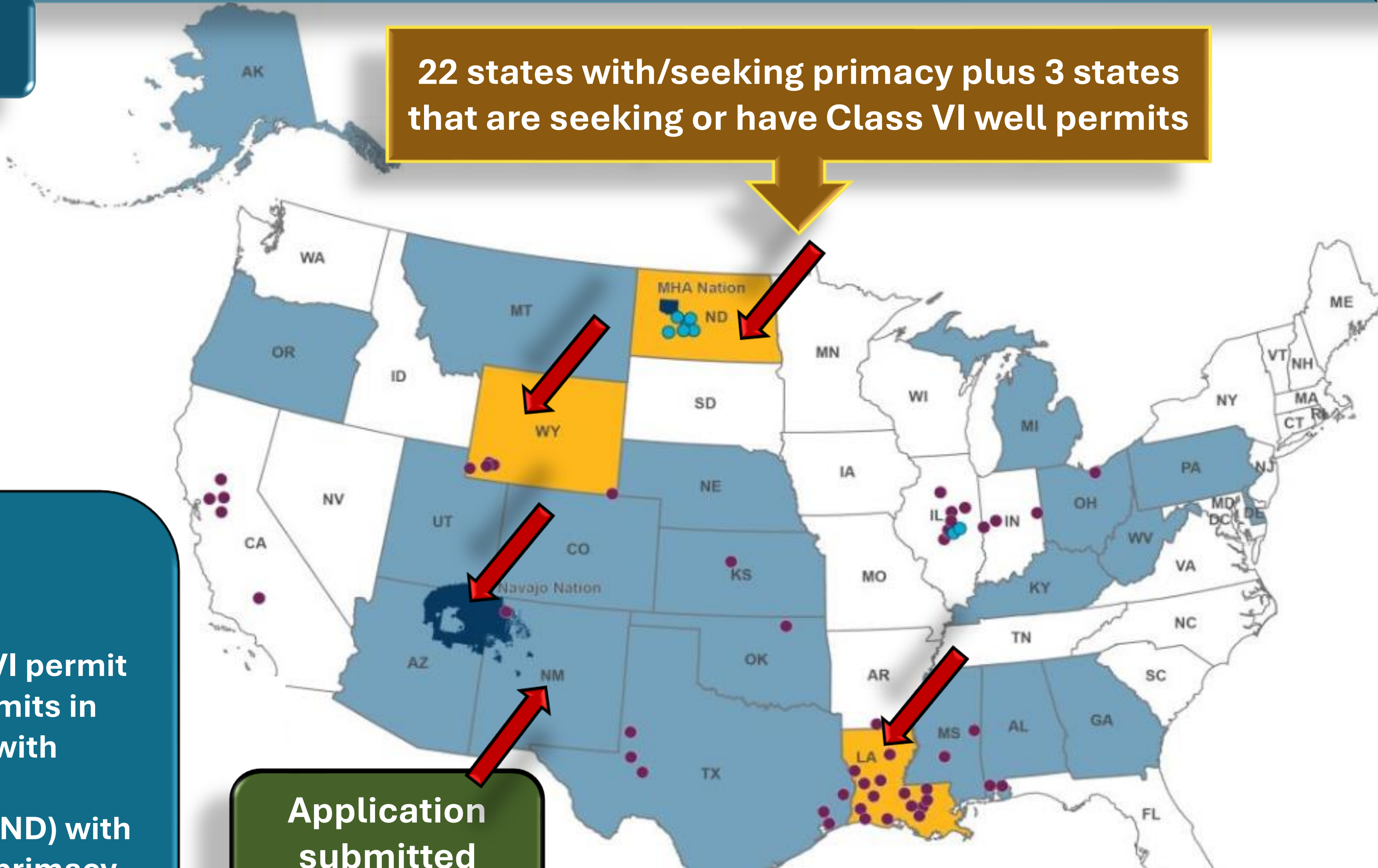
Grants allocated to states to oversee and develop Class VI Primacy

- State
- State w/ Class VI primacy
- Tribe
- Pending Class VI well permit
- Active Class VI well permit

Grants to:

- 3 states with primacy status
- 19 states seeking primacy status
- Navajo Nation with 1 pending Class VI permit
- Approx. 25 pending Class VI well permits in non-primacy states and 17 in states with primacy
- Five active Class VI permits in state (ND) with primacy and 2 in a state not seeking primacy status (IL)

22 states with/seeking primacy plus 3 states that are seeking or have Class VI well permits



Application submitted June 17, 2024

https://carboncapturecoalition.org/wp-content/uploads/2024/05/Class-VI-Fact-sheet-5.pdf

NM Class VI Primacy Program Overview

EMNRD's OCD divisions has identified the following general steps to primacy

Step 1

Pre-application review package for initial engagement with EPA

Step 2

OCD petitions NM's WQCC to conform NM rules to EPA's program requirements

- Need regulatory framework before submitting primacy package to EPA

Step 3

EPA reviews new rules

Step 4

Once final rule-making complete, EPA undertakes an application evalu-ation

- Includes a public comment process and preliminary decision by EPA

Step 5

EPA conducts federal rulemaking to approve/ disapprove a state's primacy application or program revision.

EPA Primacy Grant Key Timeline for NM

Milestone #1

March 19, 2023

EMNRD submits Notice of Intent to EPA

Milestone #2

June 17, 2024

Grant application submitted to EPA

Milestone #3

July 8, 2024

New Mexico Tech picked as lead support for EMNRD/ OCD primacy effort

Milestone #4

August 28, 2024

New Mexico Tech holds kick-off meeting

Milestone #5

Pending w/ EPA

State primacy granted?

Impacts on EMNRD's Oil Conservation Division (OCD)

- **EMNRD's OCD is standing up a new departmental section to implement the Class VI Program**
- **Implementation will require a significant increase in technical staff**

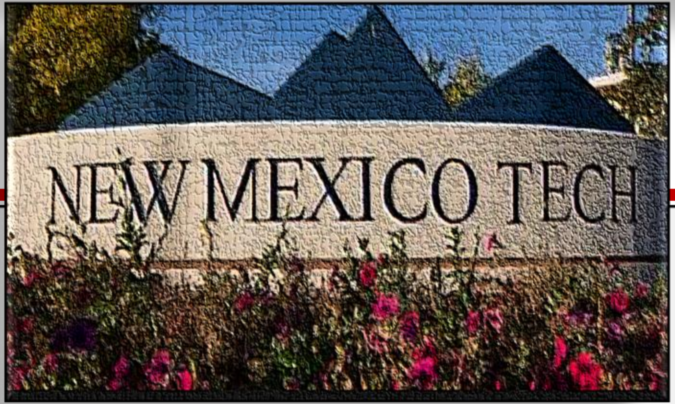
Proposed Budget For UIC Class VI Wells Program Implementation

Project Dates and Categories	FY2025	FY2026	FY2027	FY2028	FY2029	
State Fiscal Year Start Date	October 1, 2024*	July 1, 2025	July 1, 2026	July 1, 2027	July 1, 2028	
State Fiscal Year Ending Date	June 30, 2025	June 30, 2026	June 30, 2027	June 30, 2028	June 30, 2029	SF-424A Total Per Category
SF-424A 6. Object Class Categories a. Personnel	$85,059	$100,000	$120,000	$120,000	$140,000	$565,059
SF-424A 6. Object Class Categories b. Fringe Benefits**	$29,771	$35,000	$42,000	$42,000	$49,000	$197,771
SF-424A 6. Object Class Categories c. Travel	$15,000	$20,000	$20,000	$20,000	$20,000	$95,000
SF-424A 6. Object Class Categories f. Contractual***	$100,000	$600,000	$200,000	$0	$0	$900,000
SF-424A 6. Object Class Categories i. Total Direct Charges	$229,830	$755,000	$382,000	$182,000	$209,000	$1,757,830
SF-424A 6. Object Class Categories j. Indirect Charges**	$25,917	$30,470	$36,563	$36,563	$42,656	$172,170
SF-424A 6. Object Class Categories k. TOTALS	$255,747	$785,470	$418,563	$218,563	$251[illegible]	$1,930,000

*Start Date represents the date of fund availability and not the actual date for the beginning of the state fiscal year.
**Estimated using the current rates for these categories: Fringe Benefit rate of 35% and IDC rate of 22.57%. These rates only applied to a. Personnel category.
***f. Contractual: funding to be applied to Contractor in support of rulemaking.

Nine Key Tasks for NM Tech + (Duration)

NM Tech will initially focus on tasks 1,2,3,4,8 and $976,464 has been approved to support the initial tranche of work.



1. Class VI Research and Planning (3 MOS.)
2. Class VI Rule Development (6 MOS)
3. Stakeholder Education and Engagement (9 MOS)
4. Continued Proposed Rule Development based on Feedback from Task 3 (9 MOS)
5. EPA Preapplication Review Package (9 MOS)
6. Undertake State Level Class VI Rulemaking (12 MOS)
7. Formal Class VI Application for Submittal (9 MOS)
8. Identify Potential State-Level Legislative Changes Necessary to Support a Successful Class VI Program (6 MOS)
9. General Legal Support (18 MOS)

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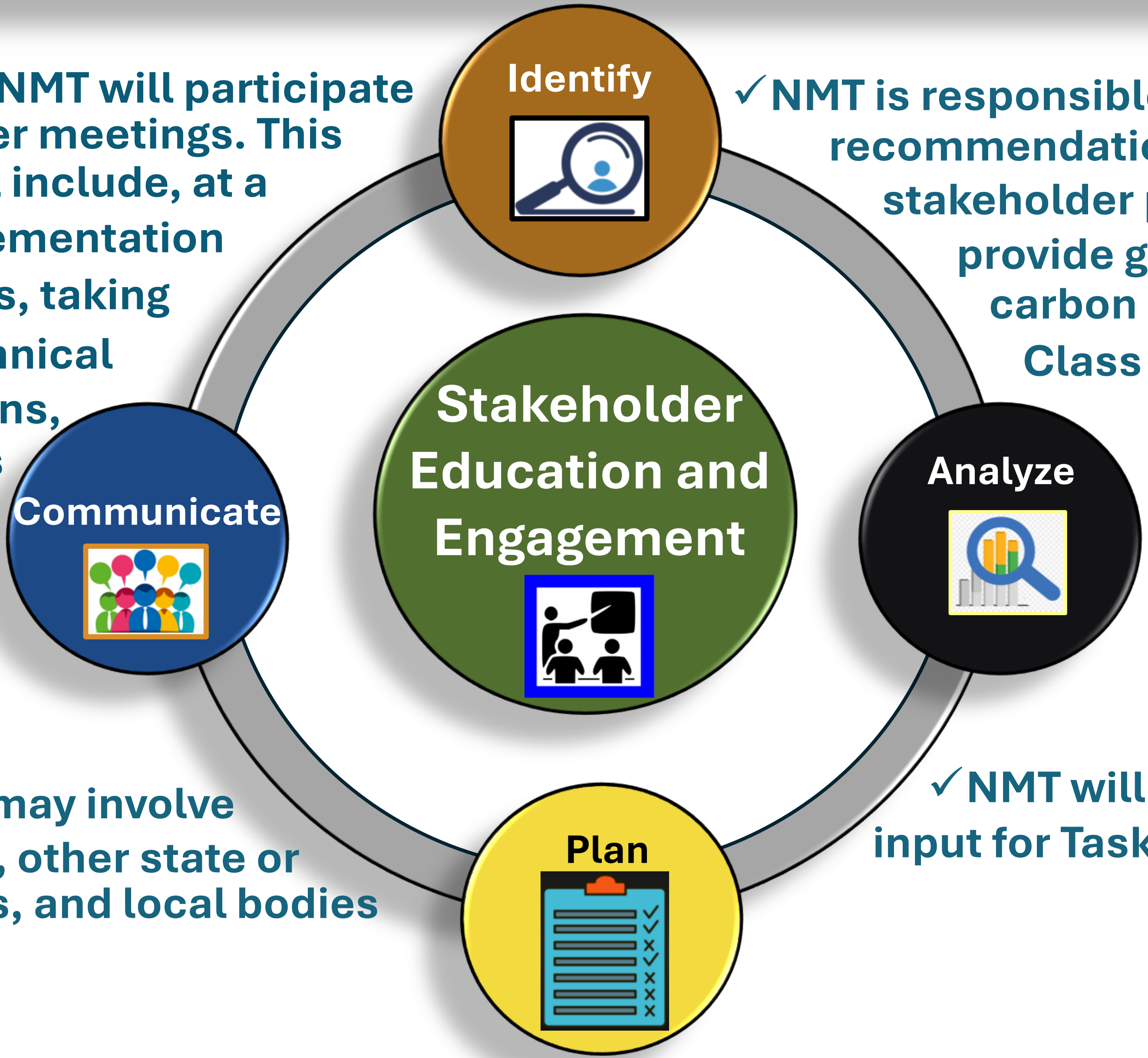
Task 3 for Class VI Primacy: Stakeholder Education and Engagement

✓OCD and NMT will participate in stakeholder meetings. This participation shall include, at a minimum, meeting implementation (e.g., obtaining facilities, taking notes, etc.), technical presentations, and other tasks

✓NMT is responsible for submitting recommendations to OCD on a stakeholder process that would provide general education on both carbon sequestration and the Class VI process



✓Stakeholder meetings may involve members of the public, other state or federal agencies, and local bodies

✓NMT will solicit stakeholder input for Task 2 rule development

Source: variation of Image: www.collidu.com