NEW MEXICO

emnrd

Energy, Minerals and Natural Resources Department

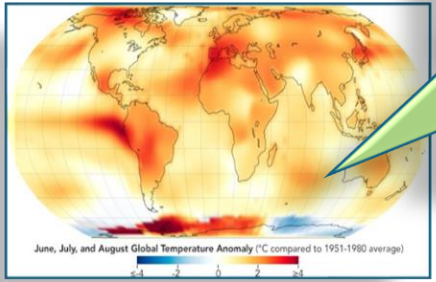
Powering New Mexico

Melanie Kenderdine

November 4, 2024

Santa Fe, New Mexico

Climate Change Impacts, 2023



Last decade warmer than any period for ~125,000 years

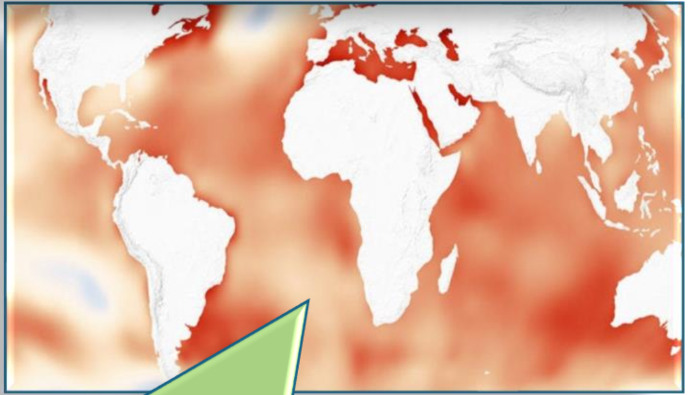
Glacial retreat unmatched for 2,000+ years

The share of the global population exposed to flooding will rise by 24%

Summer Arctic ice coverage smaller than any time in the last 1,000 years

Sea level rise faster than any prior century for 3000 years

Ocean warming faster than at any time since the last ice age and ocean acidification at highest level in the last 26,000 years

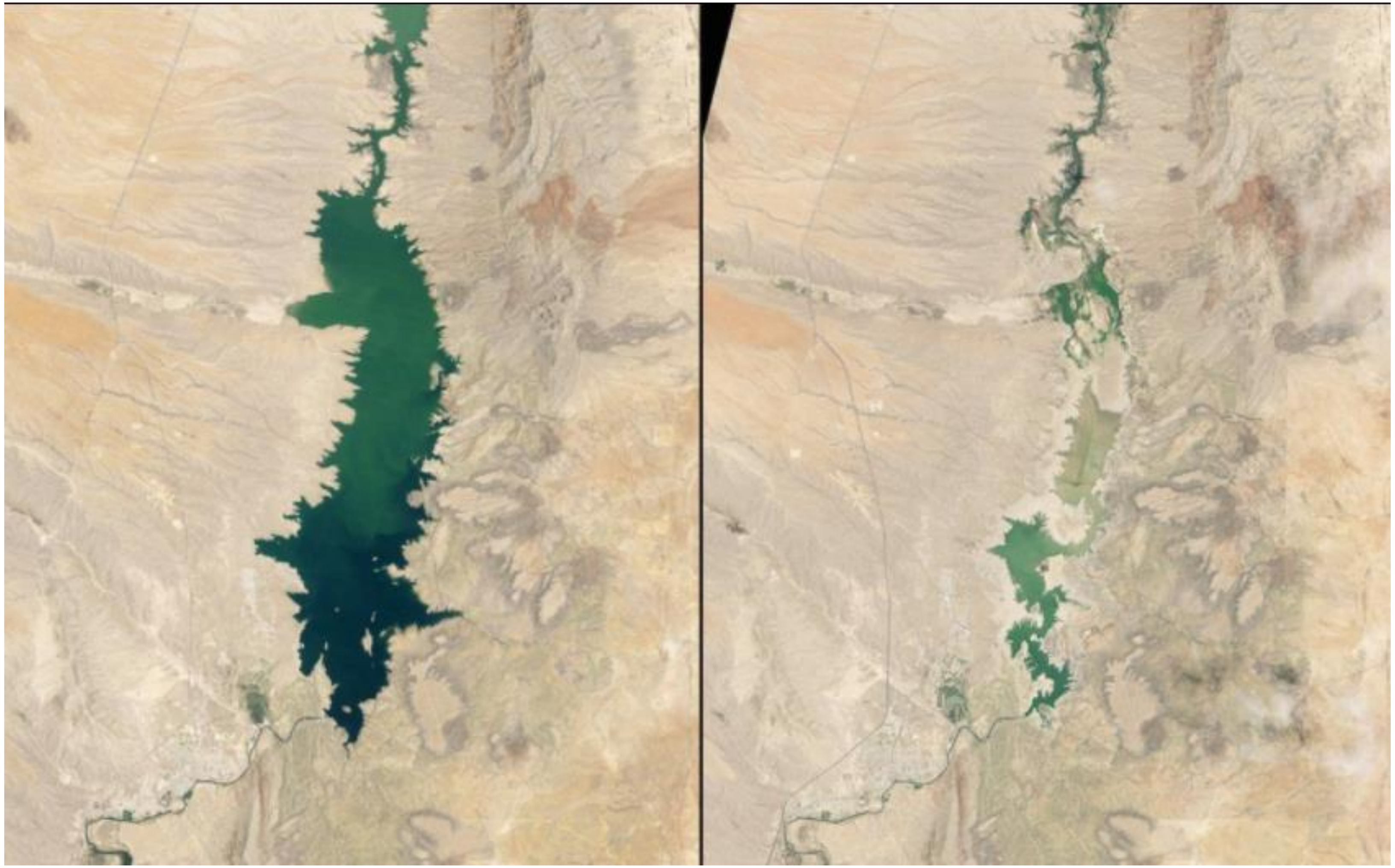


950 million people across the world's drylands will experience water stress, heat stress and desertification

https://www.cnn.com/2024/09/13/climate/mega-tsunami-landslide-greenland-seismic-signal/index.html
https://www.wri.org/insights/2023-ipcc-ar6-synthesis-report-climate-change-findings

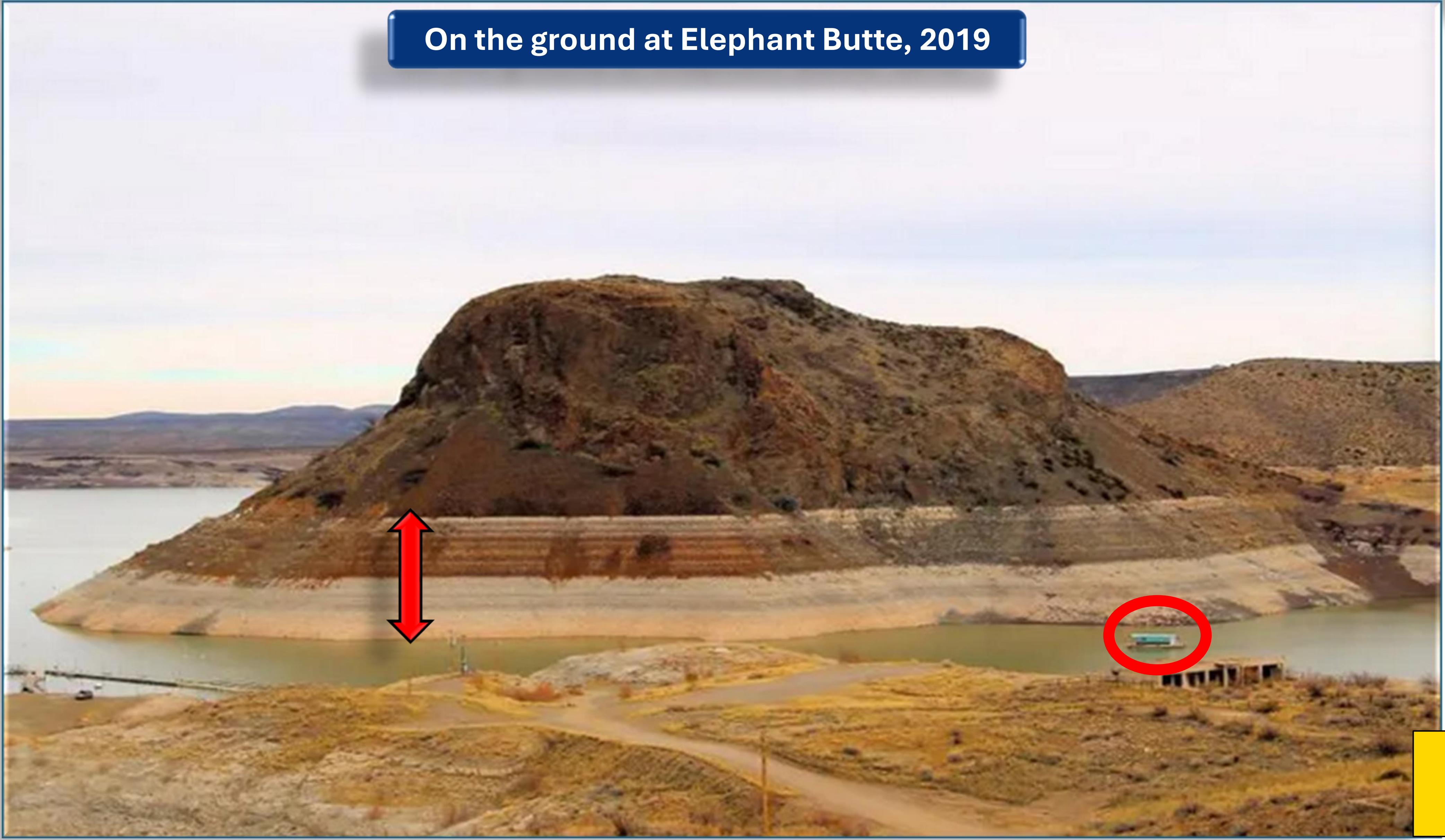
NASA Satellite Photos, Elephant Butte Reservoir, New Mexico, My Home State

1994 **2013**

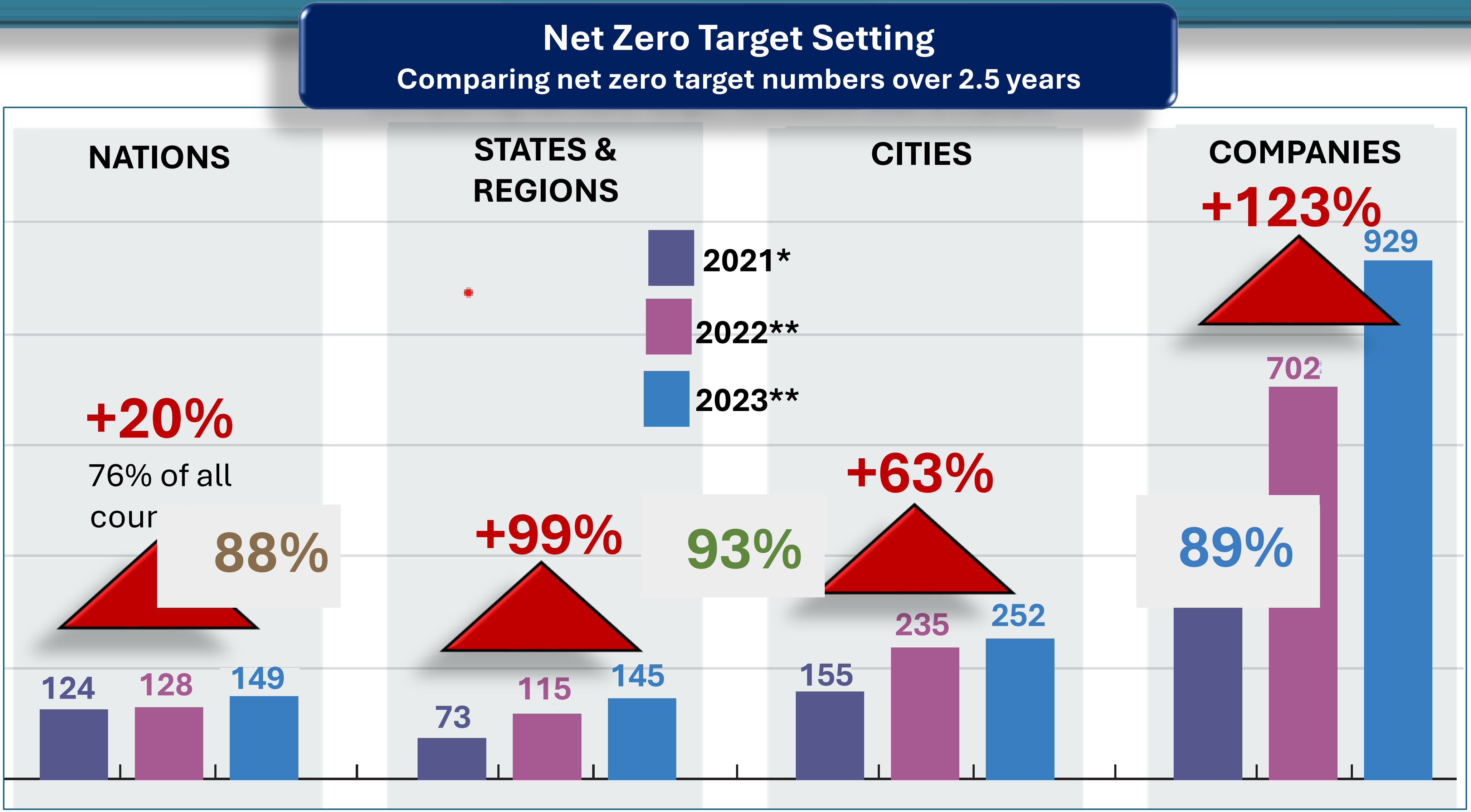


NASA Satellite Photos, Elephant Butte Reservoir, New Mexico, My Home State

On the ground at Elephant Butte, 2019



Net Zero Target Coverage, June 2023



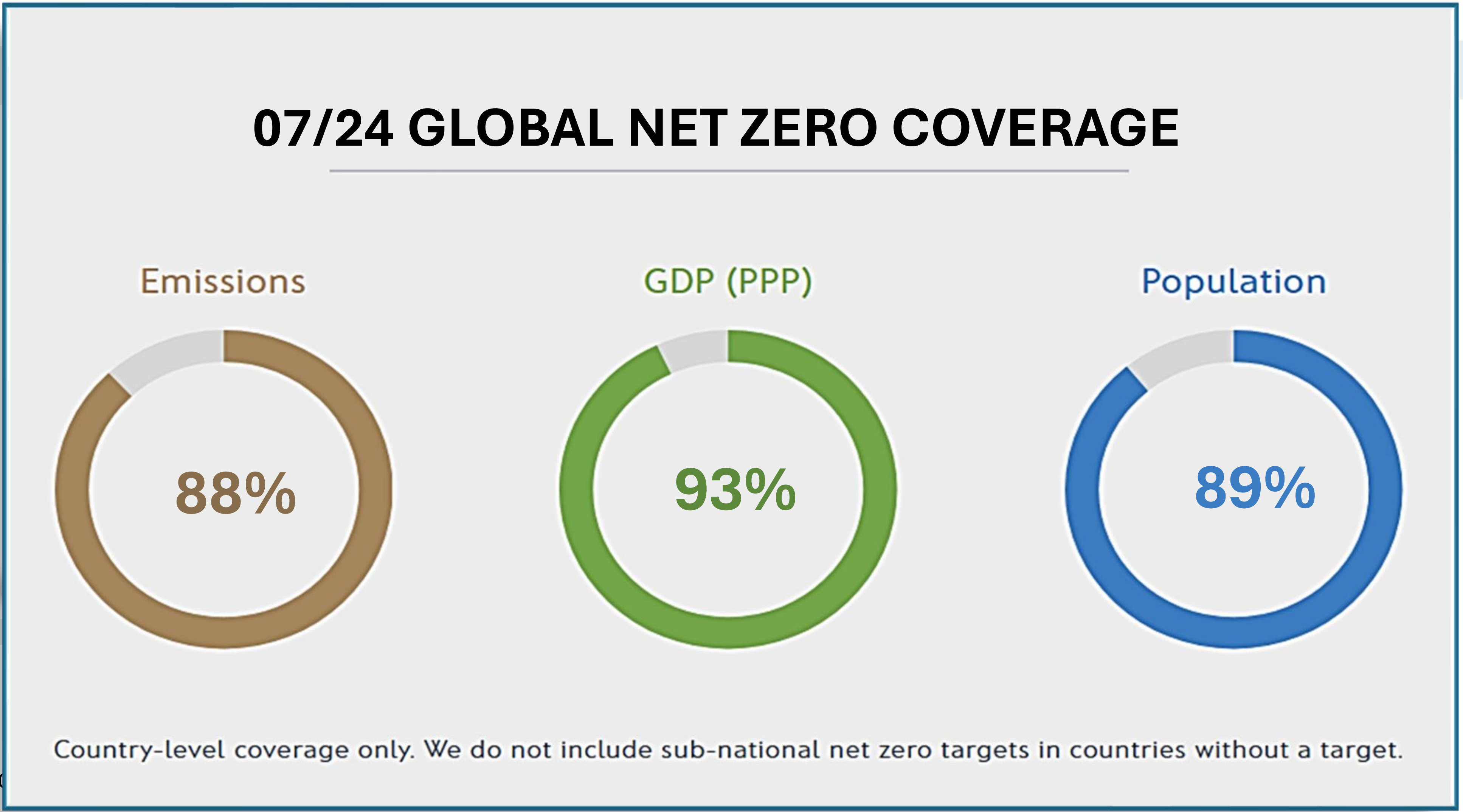
*Black et al. 2021, Data: Dec. 2020

**Net Zero Stocktake 2022, Data: June 2022

**Net Zero Stocktake 2023, Data: June 2023

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

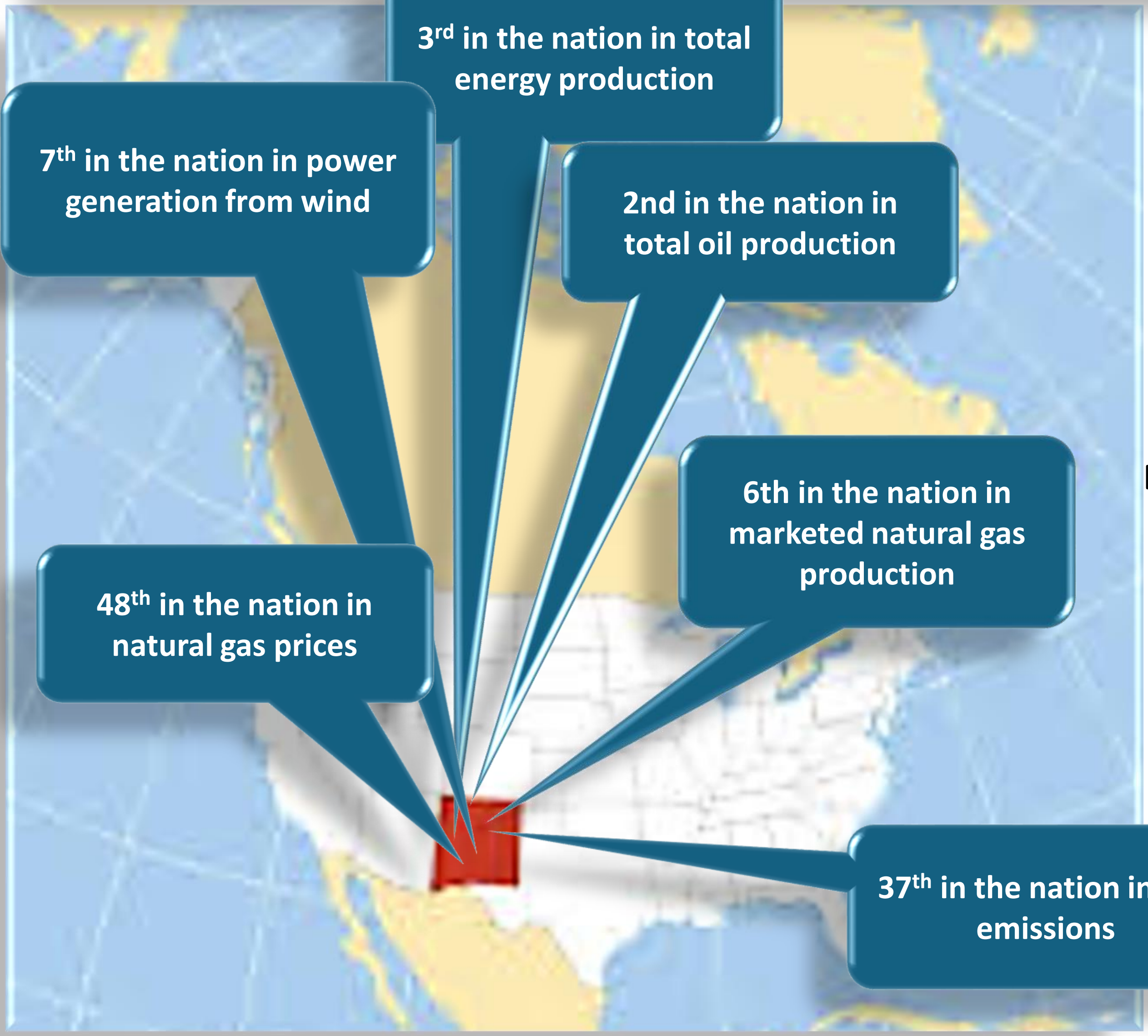
Net Zero Target Coverage, June 2023



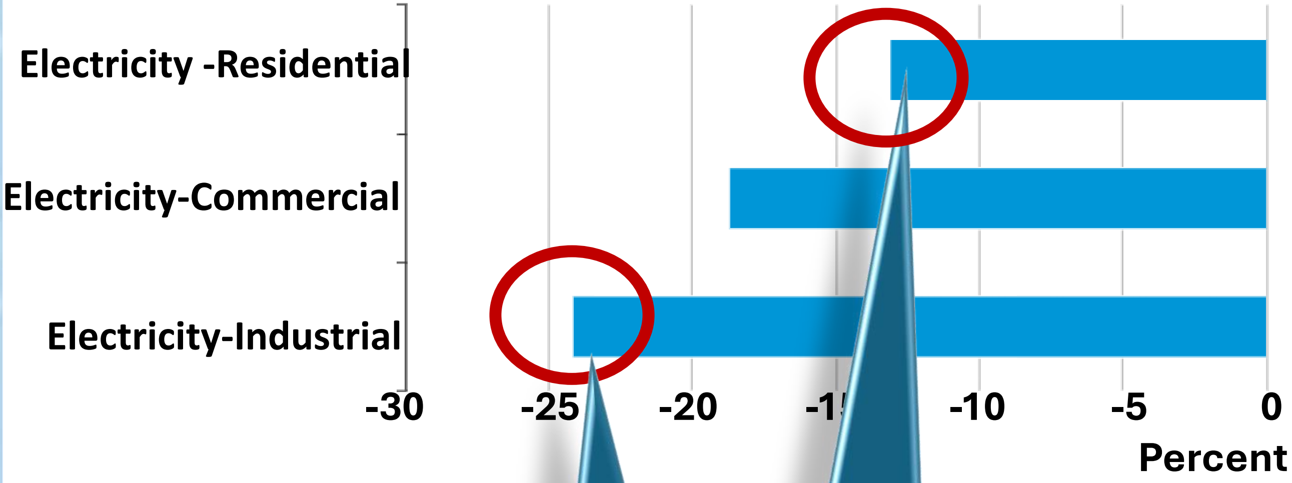
*Black et al. 20

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

New Mexico Energy Rankings



NM Price Differences from US Average (most recent monthly)

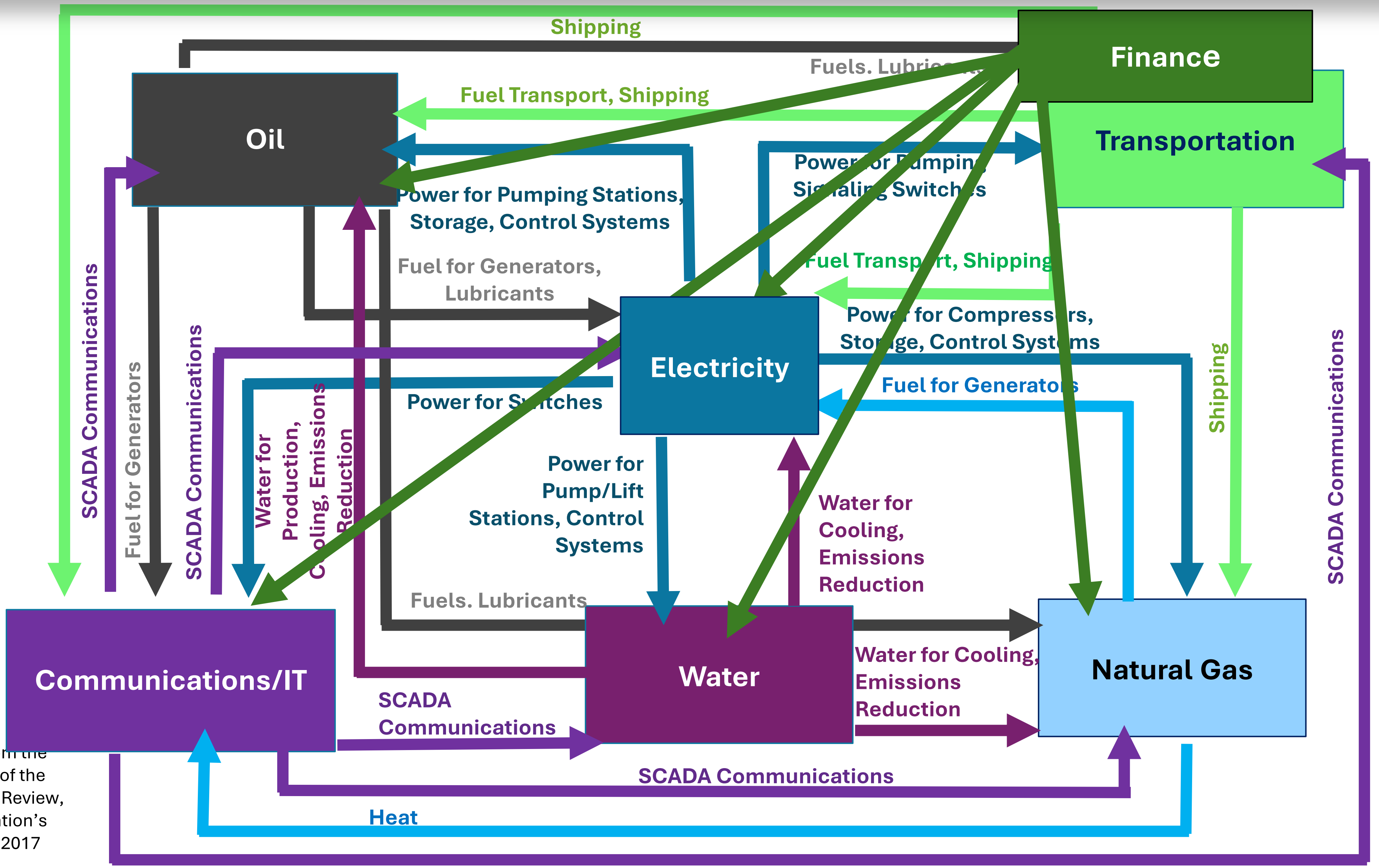


Very good for cost of living

Very good for business

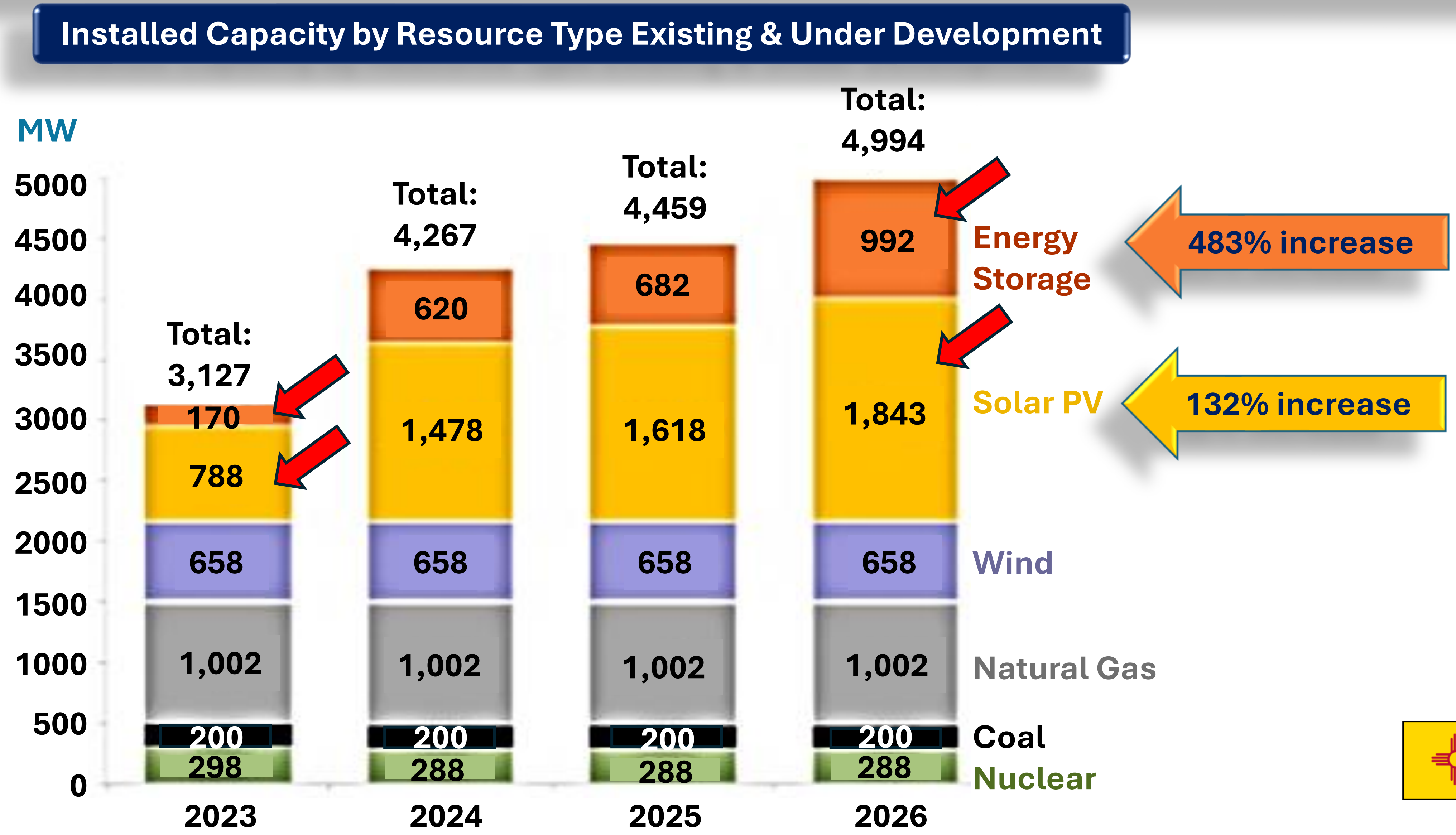
https://www.eia.gov/state/?sid=NM#tabs-5

Electricity and Lifeline Network Interdependencies



Source: Modified from the Second Installment of the Quadrennial Energy Review, Transforming the Nation's Electricity Systems, 2017

PNM's Generation Portfolio w/ Existing and Under Development Resources (nameplate capacity, 2023-26)



https://www.prc.nm.gov/wp-content/uploads/2024/07/RPS-Report-6-28-Final-1.pdf

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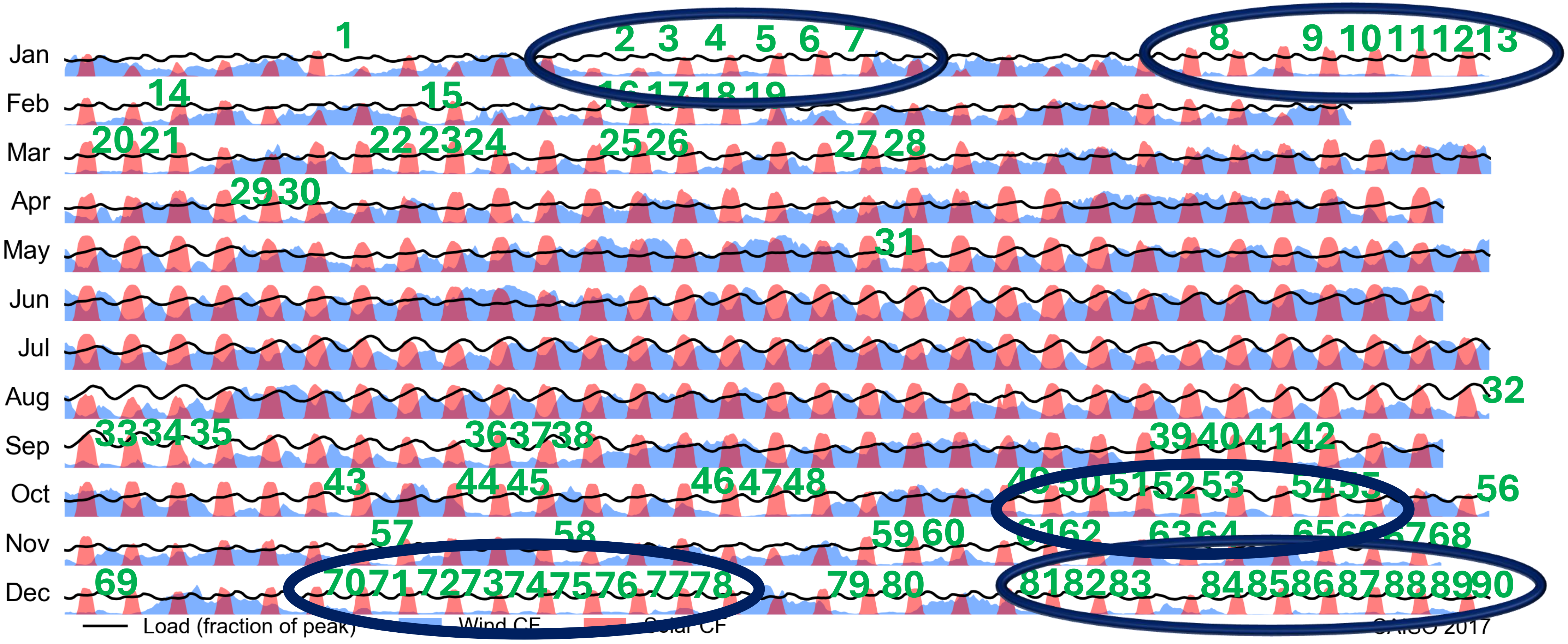
The Challenges of Integrating Intermittent Renewables

Over the course of a year large-scale dependence on both wind and solar will result in significant periods requiring very large-scale back-up options



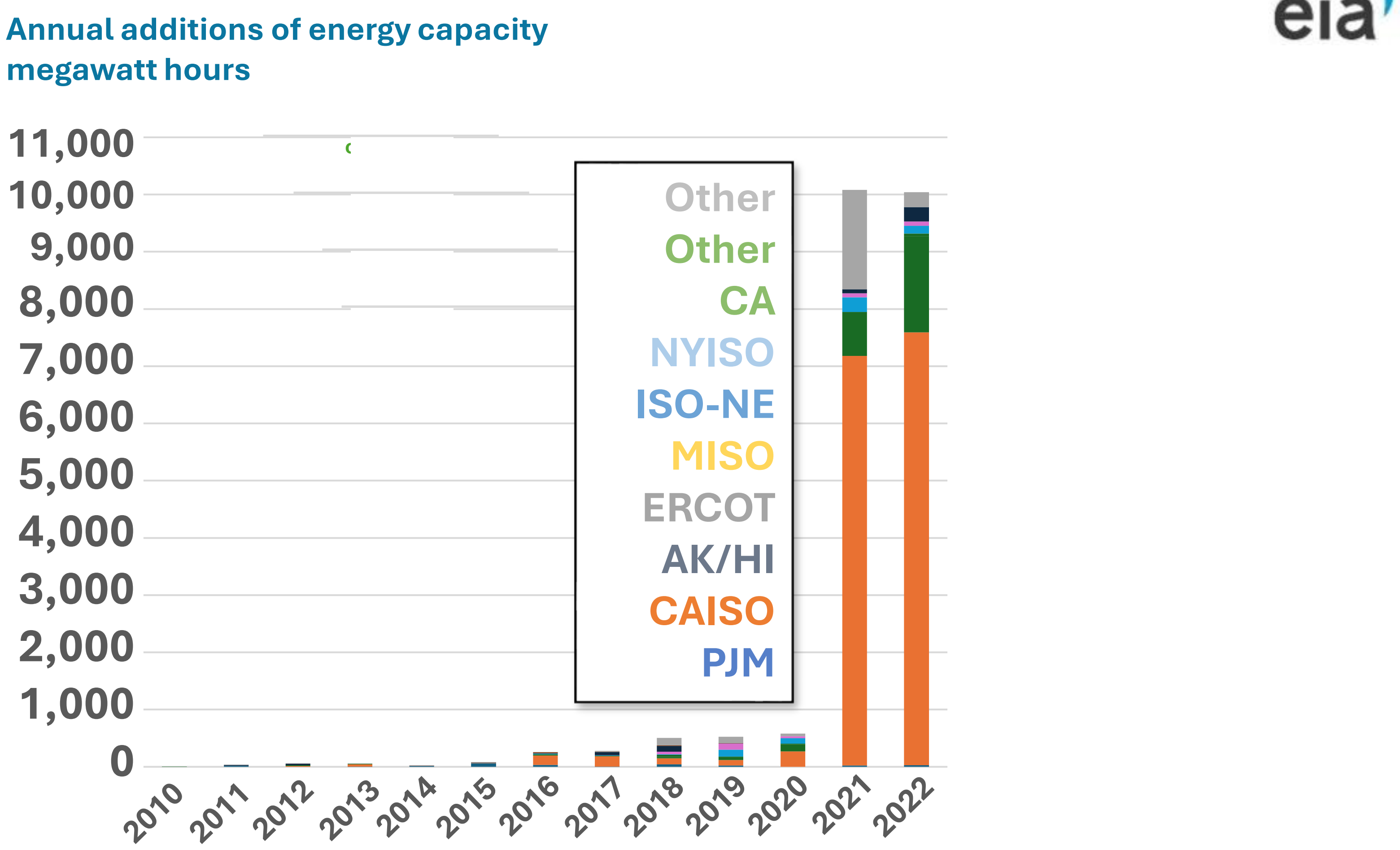
Hourly trends in solar and wind capacity factors in CA for 2017 aligned to normalized variation in hourly load relative to peak daily load

Source: CAISO data, EFI analysis

Source: EIA, 2020

The Challenges of Integrating Intermittent Renewables

Large-scale battery storage additions by region (2010-2022)



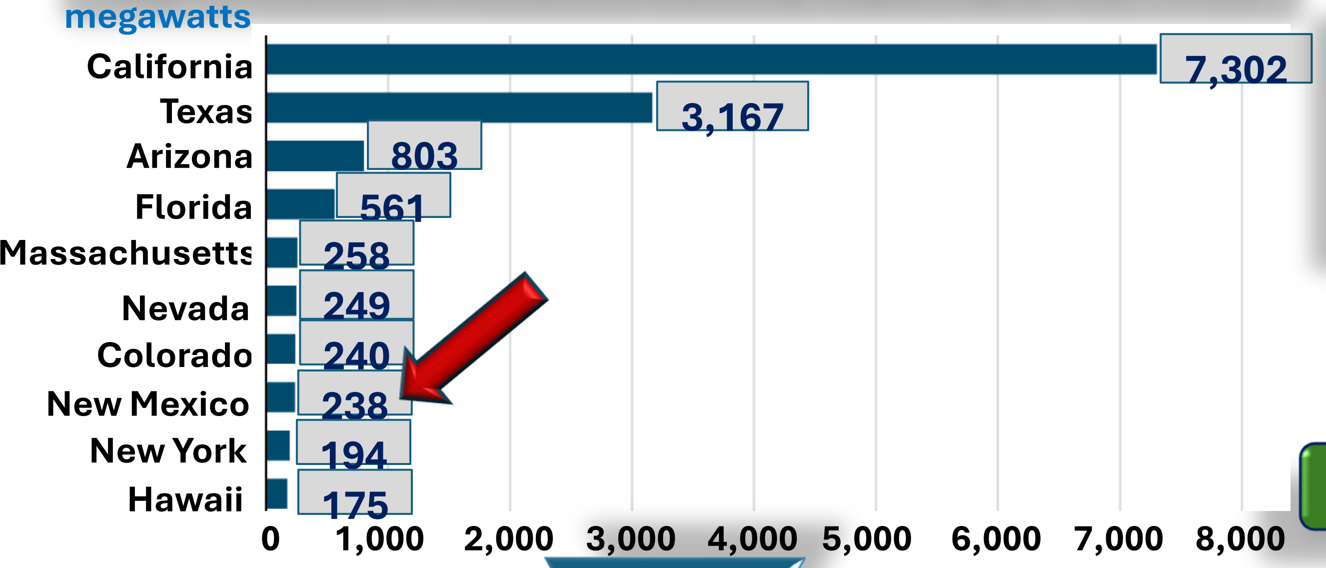
Data source: U.S. Energy Information Administration, *2022 Form EIA-860 Early Release, Annual Electric Generator Report*

Source: CAISO data, EFI analysis

Source: EIA, 2020

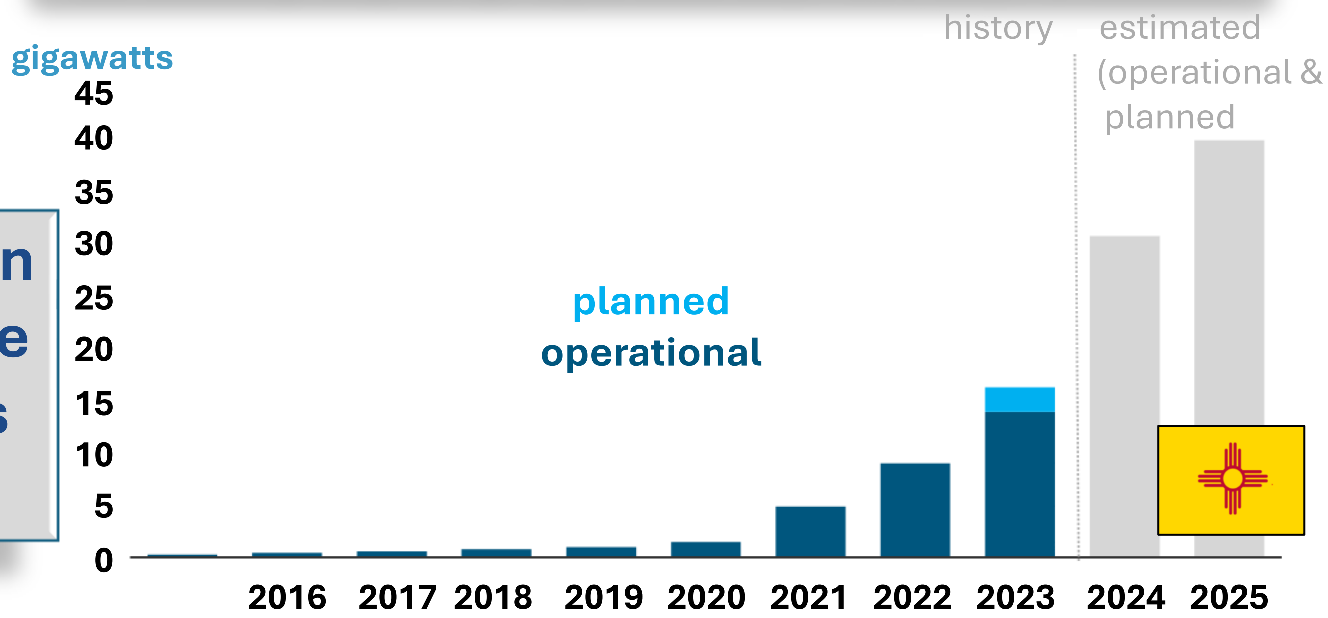
US Battery Storage: 2023 State Rankings, Forecasts of Capacity 2024/25

Top 10 states in installed battery capacity, (Mw) 11/23



Operational battery storage in the US went from virtually zero gigawatts in 2016 to 15 gigawatts by 2023

US Battery Capacity: Operational, Planned, Forecasts



13,187 Mw of installed battery capacity in top 10 US states in 2023. Net utility scale generation in these states that year was 1,403,453 thousand Mwh.

Data source: US EIA, Preliminary Monthly Electric Generator Inventory, based on Form EIA-860M
EIA Electricity Data Browser, Net Generation, accessed 09/15/24

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Levelized Cost of Electricity (LCOE) & Storage (LCOS) for Plants Entering Service in 2027

USC Coal → **$82.61**

$52.11

85%

Combined Cycle → **$39.94**

$9.36

87%

Advanced Nuclear → **$88.24**

$60.71

90%

Battery Storage → **$128.55**

$64.03

10%

Combustion Turbine → **$117.86**

$53.78

10%

Geothermal → **$39.82**

$22.04

90%

Capacity Resource Technologies

Dispatchable

Total system LCOE or LCOS (2020 $/MWhr)
Levelized capital cost
Capacity factor

Onshore Wind → **$40.23**

$29.90

41%

Solar Standalone → **$36.49**

$26.60

29%

Offshore Wind → **$136.51**

$103.77

44%

Hydroelectric → **$64.27**

$46.58

54%

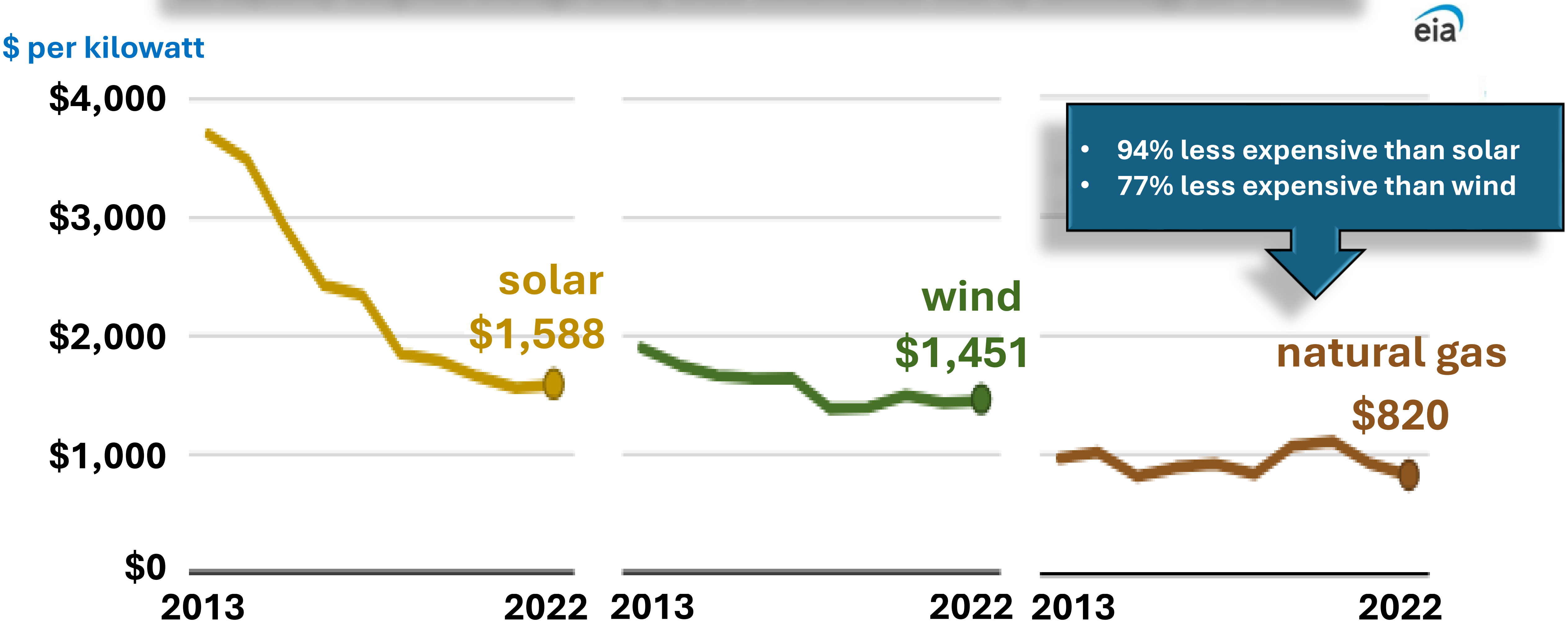
Resource Constrained Technologies

"Energy "too cheap to meter" has long been a sci-fi dream. But as the cost of solar power plummets toward zero, it might just become a reality."
NYT Magazine, 09/01/24

https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf

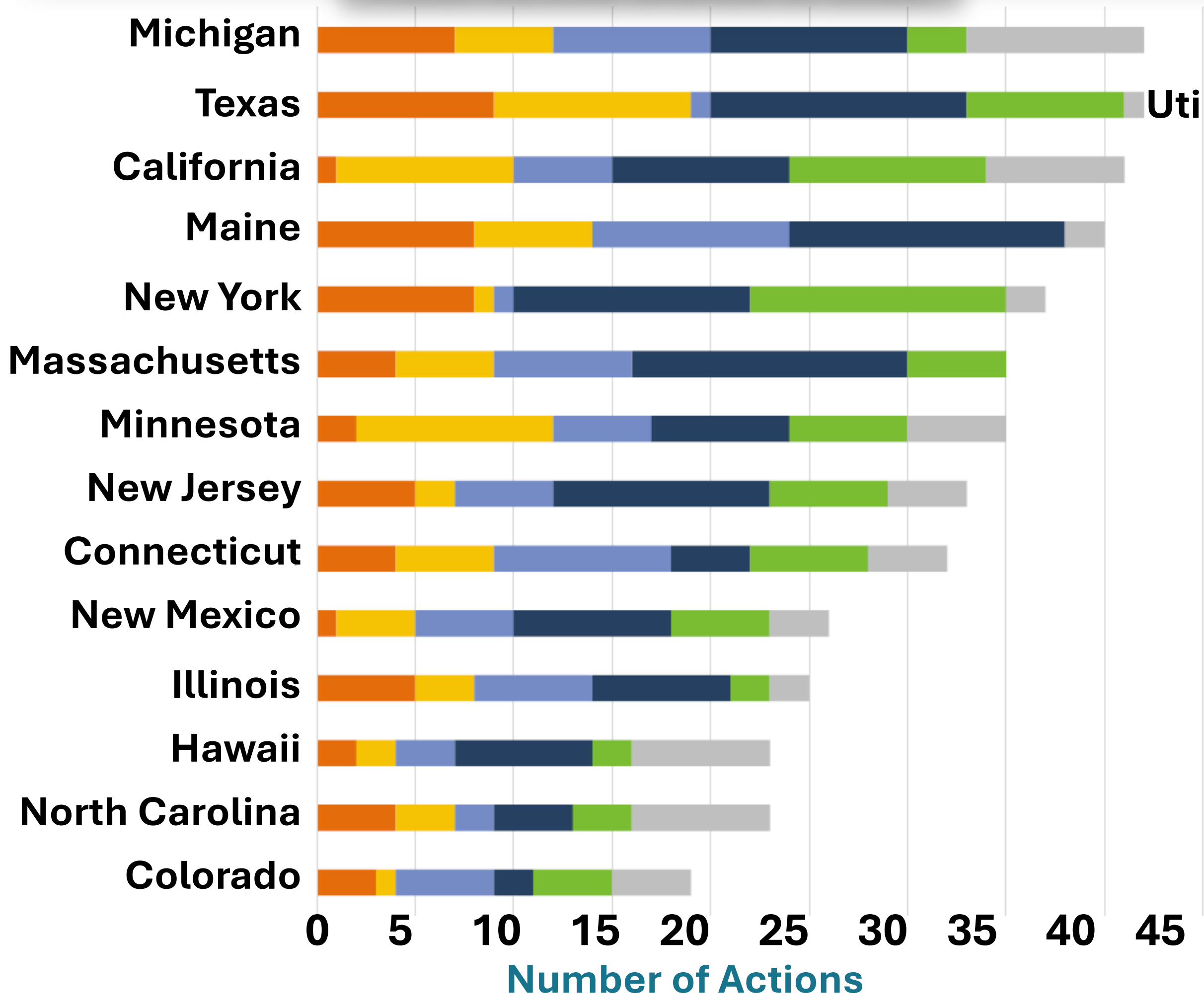
US Construction Costs for Wind, Solar, Natural Gas Generation, 2022

US capacity-weighted average utility-scale construction cost by technology (2013-2022)

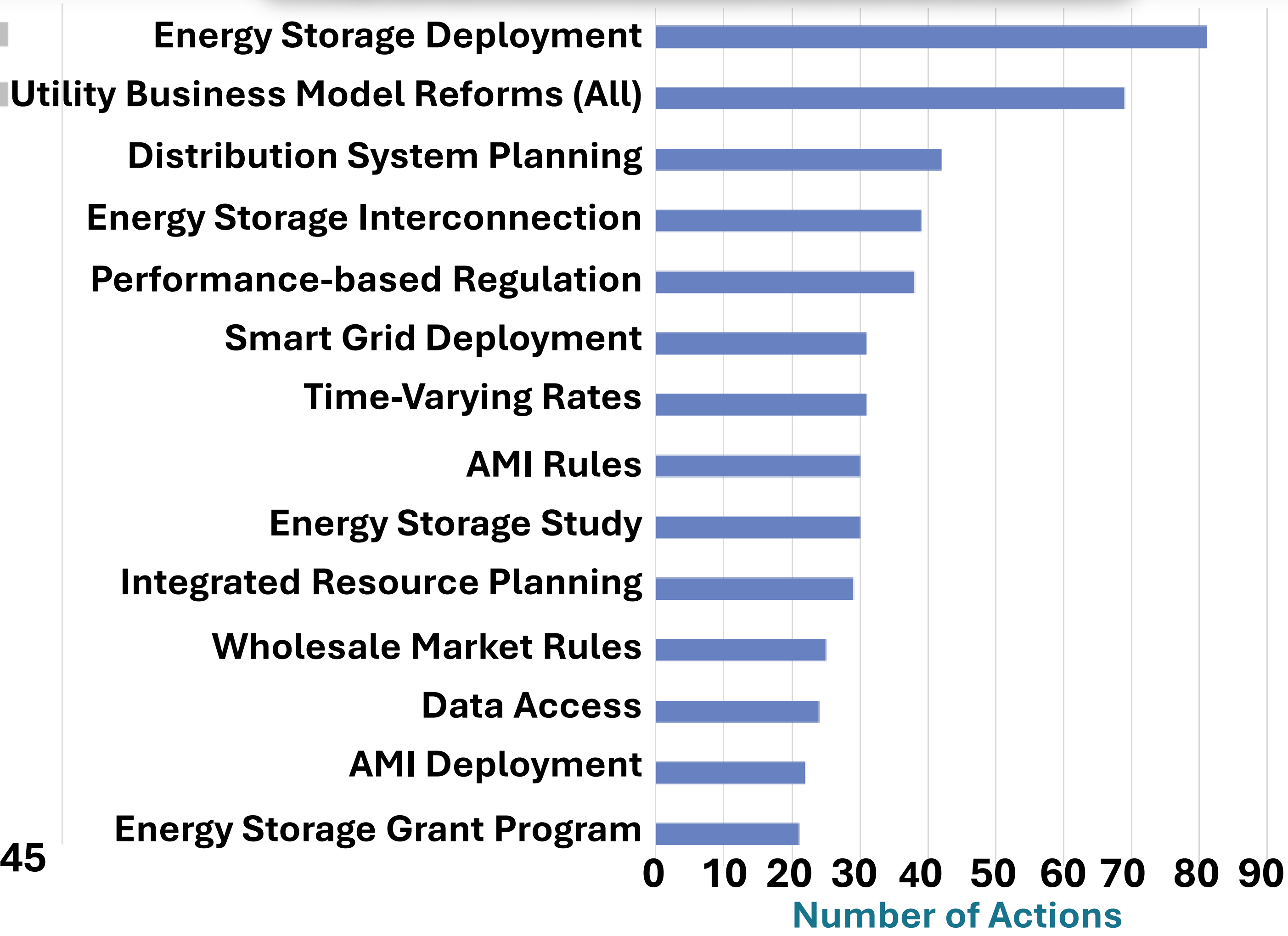


State Actions on Grid Modernization, 2023

Most Active States of 2023



Top Grid Modernization Actions of 2023



Studies & Investigations
Planning & Market Access
Incentives
Policies
Utility Business Models & Rate Reform
Deployment

Source: 50 States of Grid Modernization: Q42023 Report and 2023 Annual Review, NC Clean Energy Technology Center

State Actions on Grid Modernization, 2023

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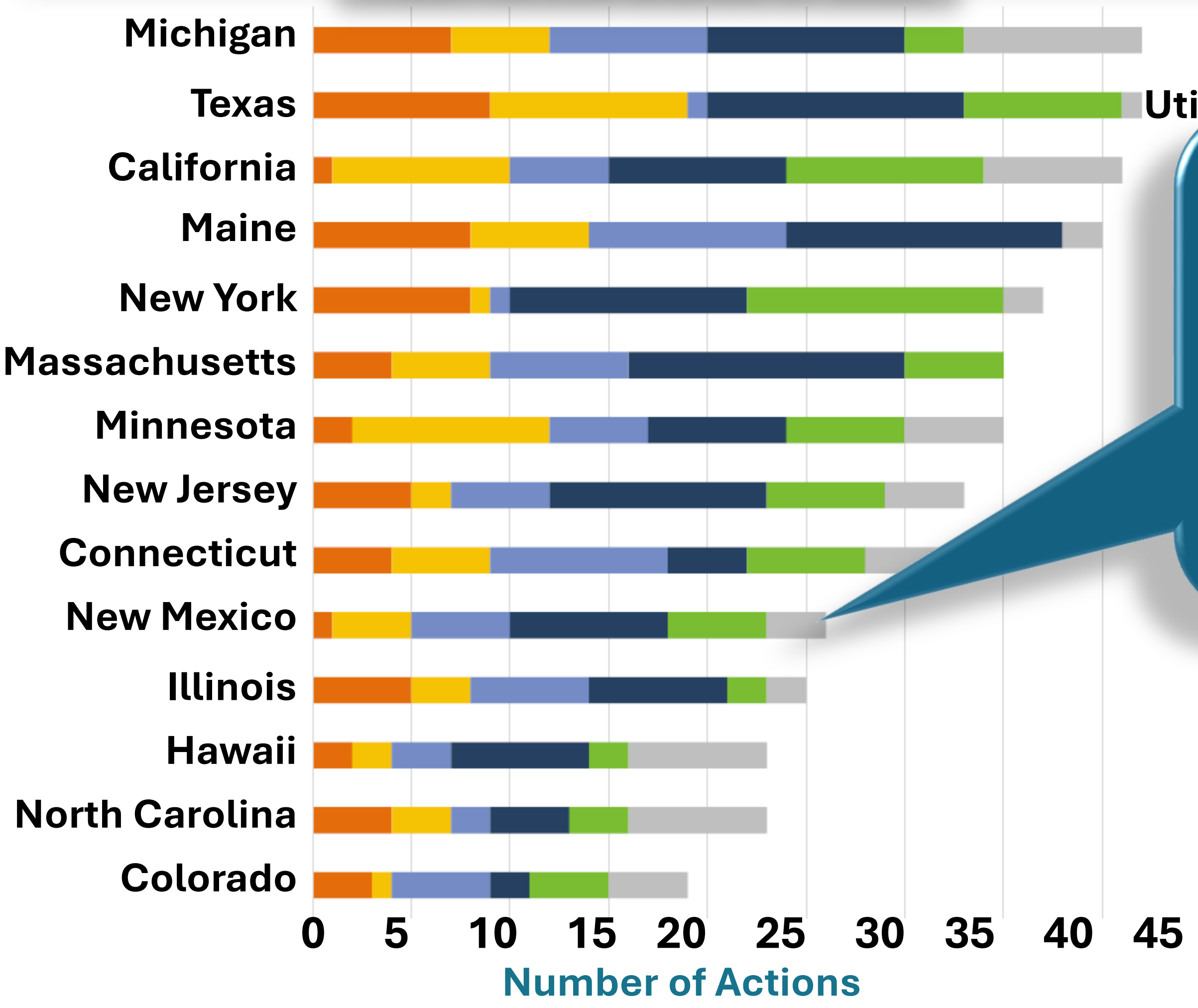

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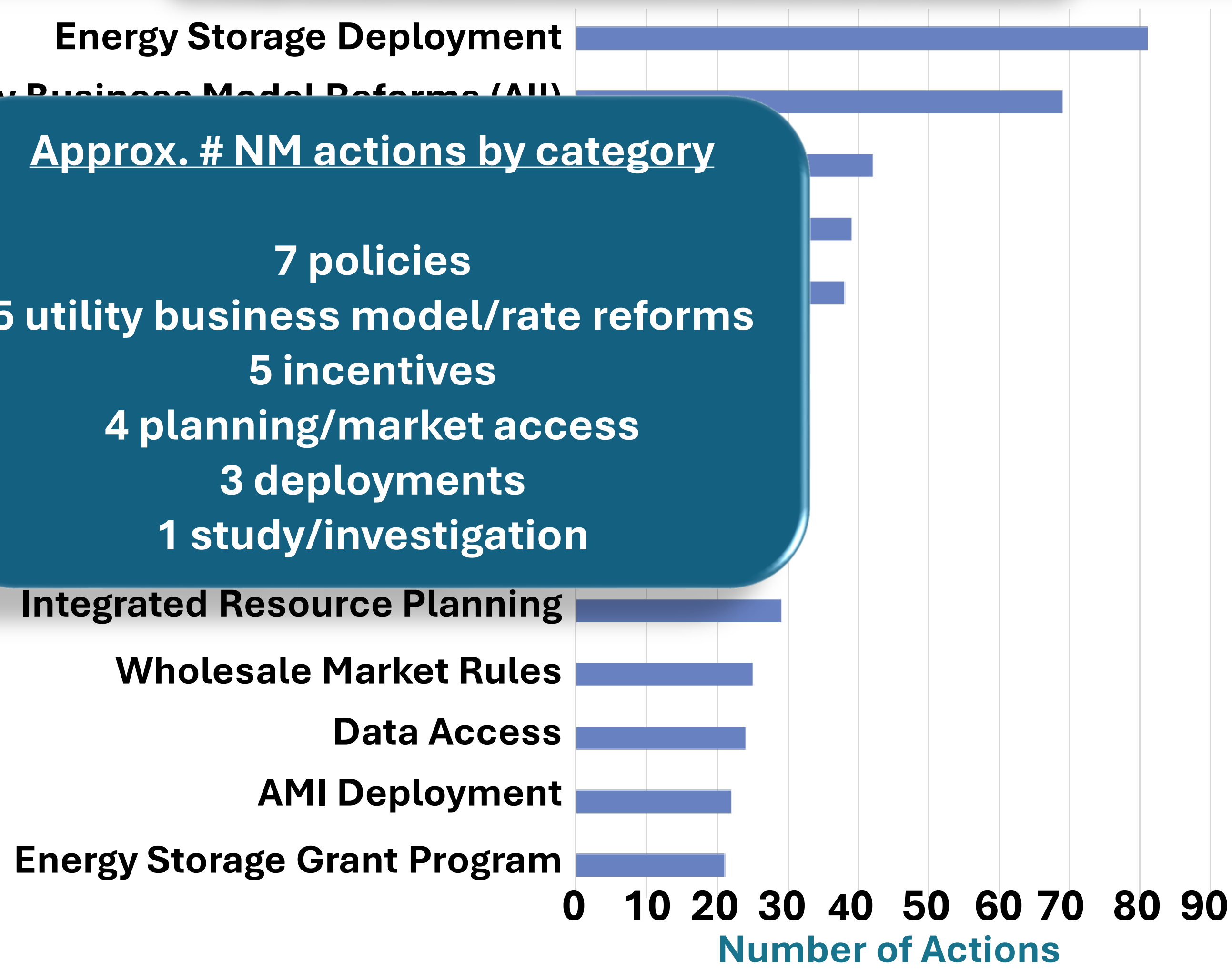
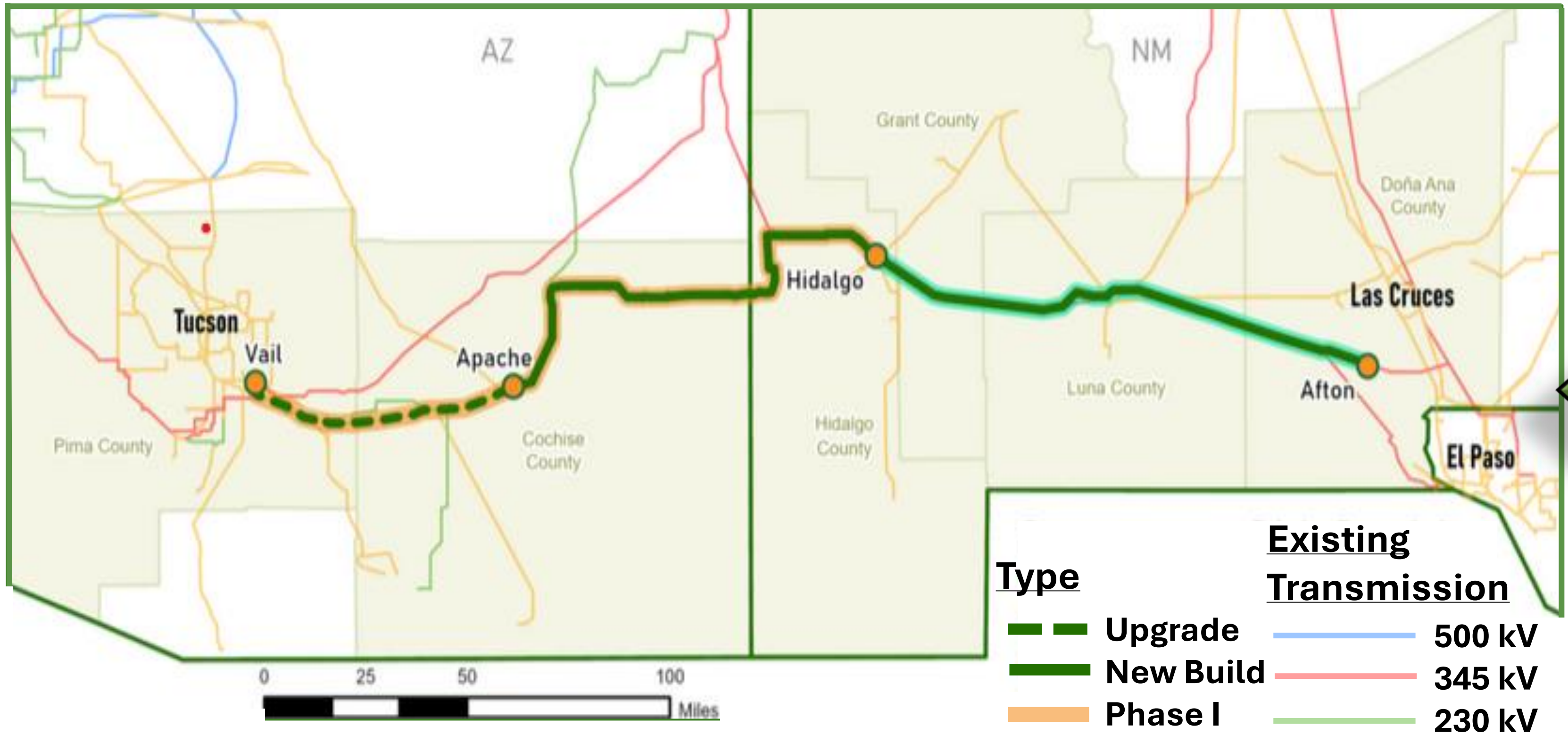


Approx. # NM actions by category

7 policies
5 utility business model/rate reforms
5 incentives
4 planning/market access
3 deployments
1 study/investigation

Source: 50 States of Grid Modernization: Q42023 Report and 2023 Annual Review, NC Clean Energy Technology Center

NM/AZ Project Funded at $1.3 billion Under DOE's Transmission Facilitation Program (2021 BIL)

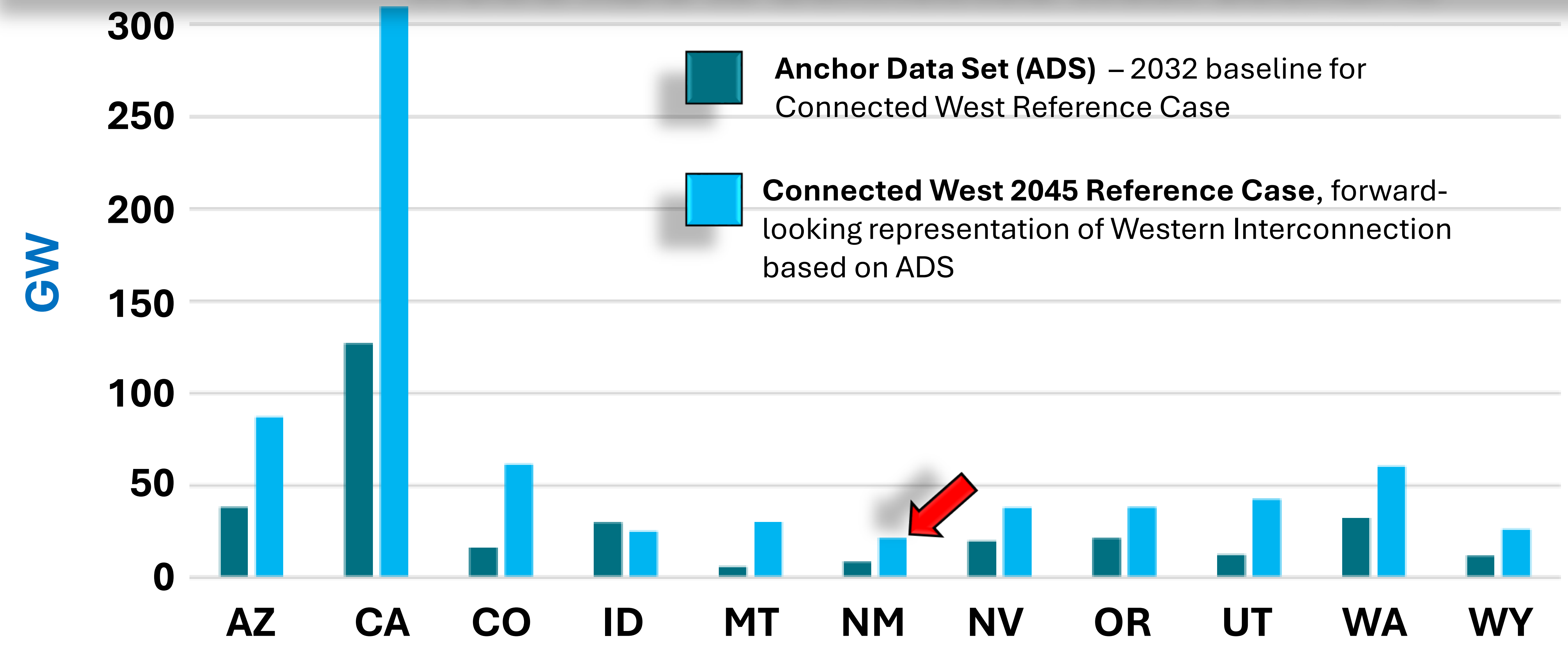


- **Project:** Southline Transmission Project
- **Applicant/Selectee:** South line Transmission LLC (Grid United LLC, Black Forest Partners LP, Hunt Transmission Services LLC)
- **Type of Financial Assistance:** Capacity Contract
- **Project Size:** 1000 MW (full line capacity), 175 miles (for phase 1)
- **Project Location:** NM to AZ

"Southline will be approximately 280 miles long, connecting the electrical systems of El Paso and Tucson metropolitan areas via the Afton, New Mexico, Apache, Arizona, and Vail, Arizona substations. The project will enable substantial renewable development opportunities and be an outlet for abundant generation by providing access to new markets."

https://southlinetransmission.com/
https://www.powermag.com/three-key-transmission-links-get-1-3b-boost-with-federal-capacity-contracts/

Installed Generation Capacity Comparison (GW): WECC ADS to Connected West Scenario



The 2045 generation fleet is roughly two times the size of the forecasted fleet in 2032 or 750 GW. The majority of the incremental capacity additions come from new wind, solar, geothermal and storage resources.

Connected West Reference Case, Generation Additions, Transmission Lines in 2045

Generator Additions by Technology

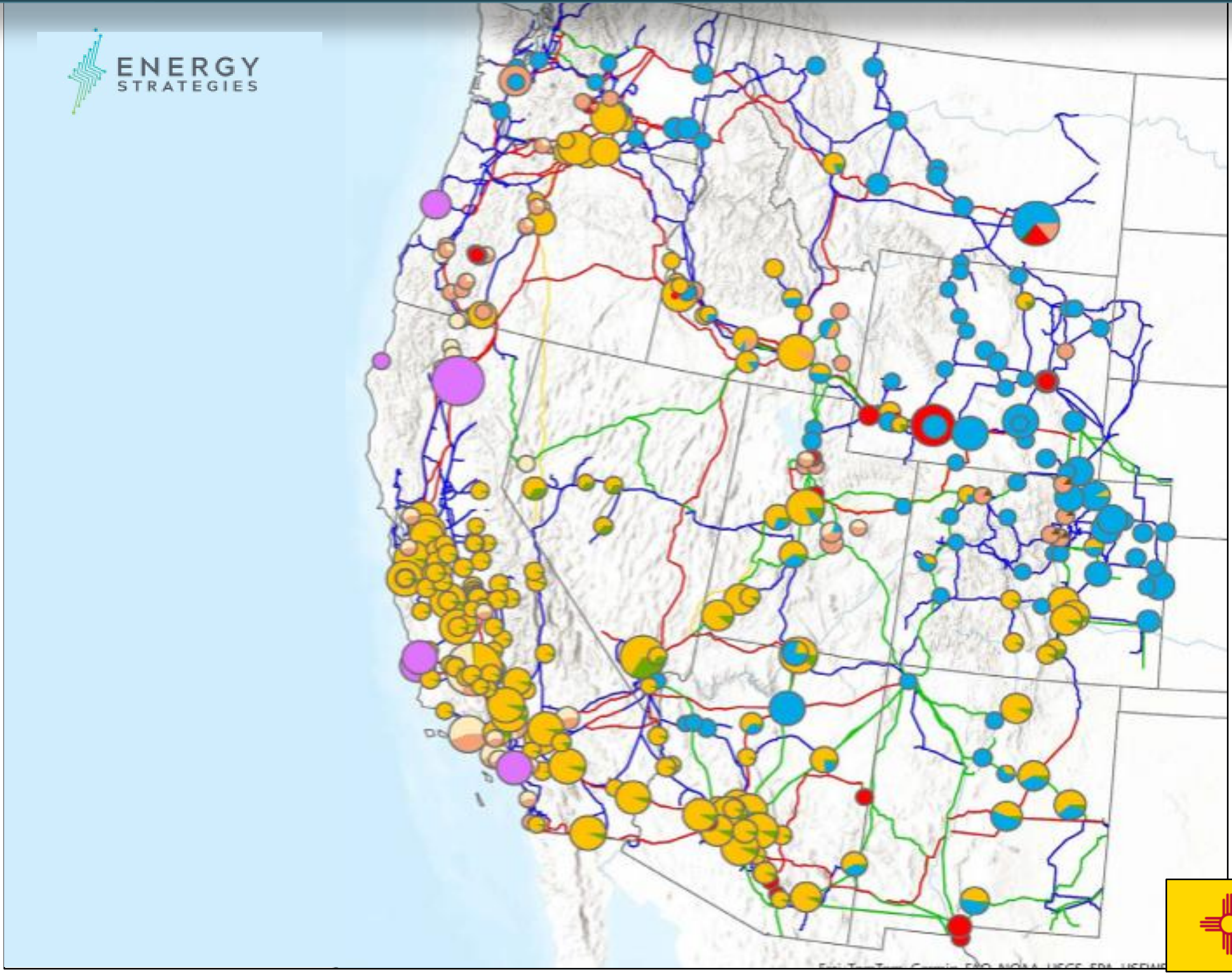
- Solar PV
- Onshore wind
- Offshore wind
- Battery storage
- Biomass
- Geothermal
- Natural gas CC
- Natural gas CT

Sum of Selected Fields

7.300
3.700
0.73

WECC Transmission Lines

- 230-300 kV
- 345 kV
- 500 kV
- DC Line



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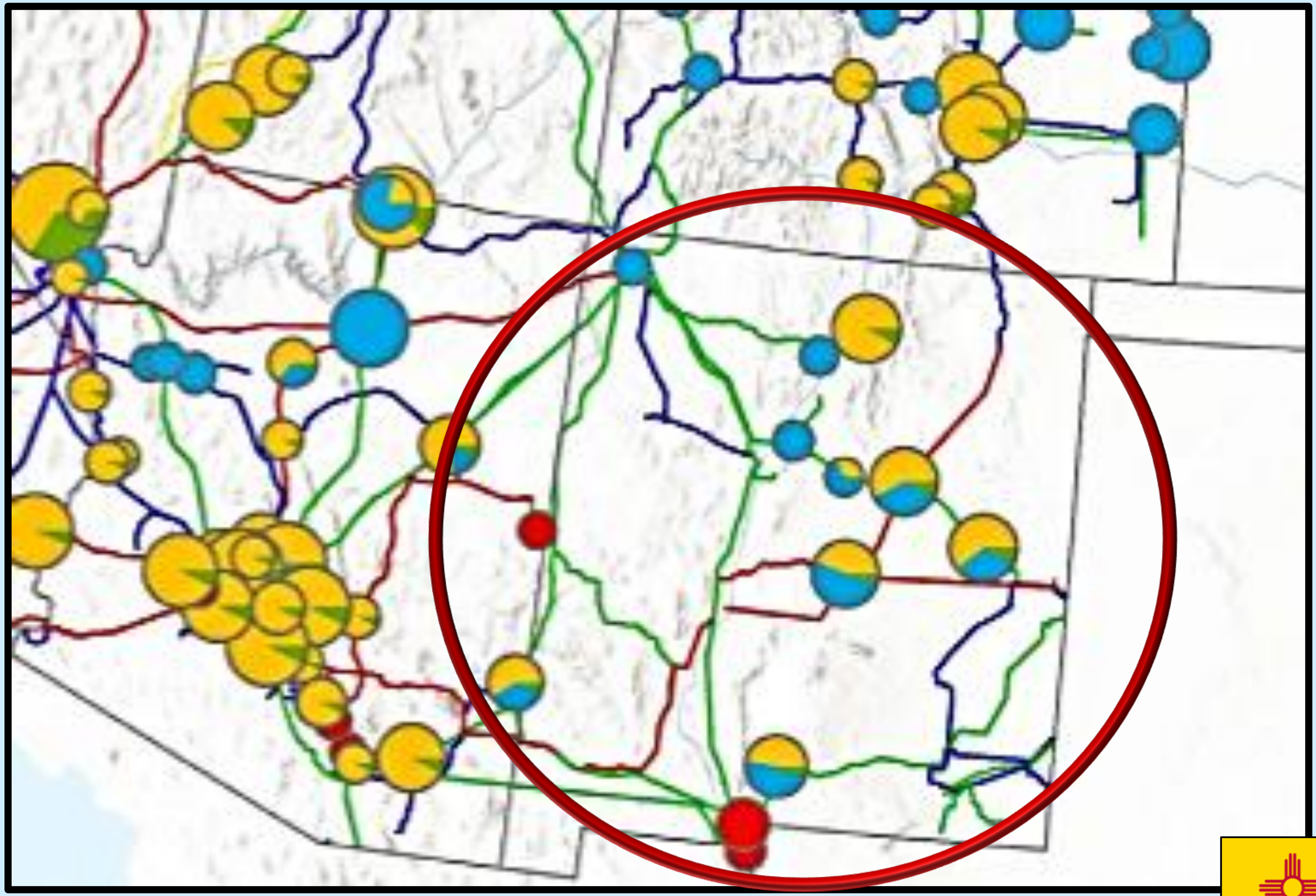
ENERGY STRATEGIES



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Reference Frame: High Voltage Transmission Line Materials Needed by 2030

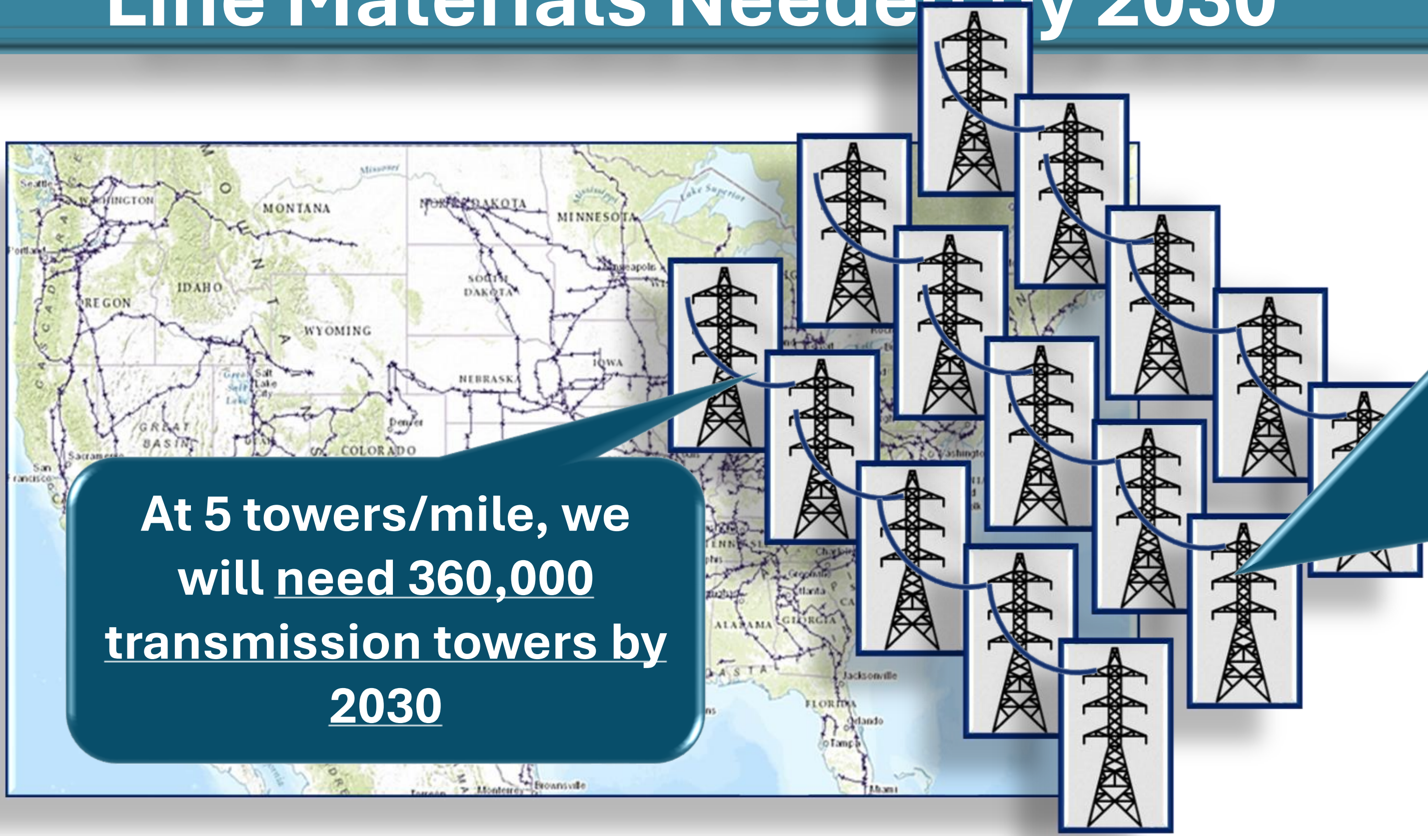
EIA: In 2016, there were 160,000 miles of high voltage transmissions lines

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

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

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)



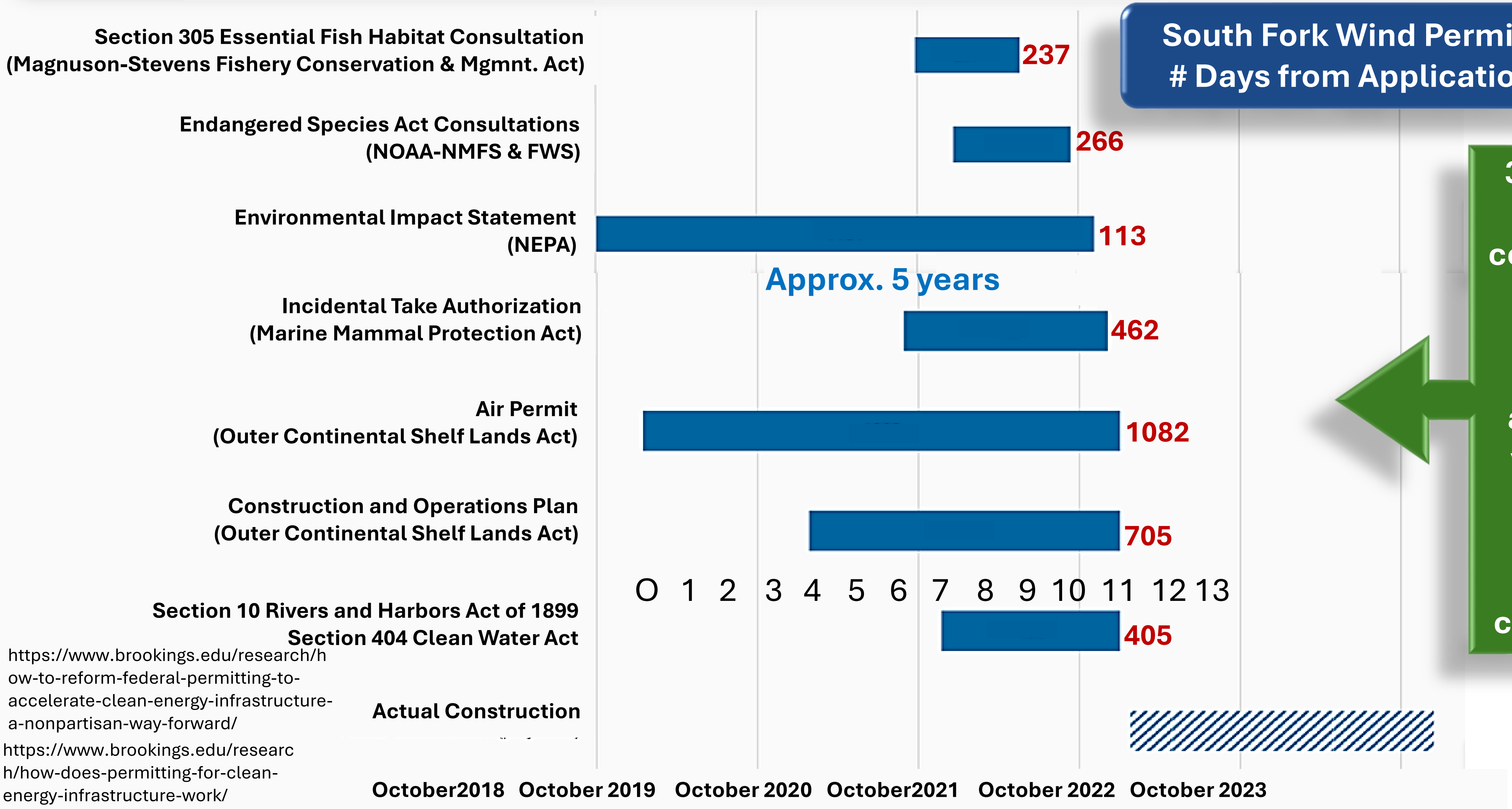
At 5 towers/mile, we will need 360,000 transmission towers by 2030

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

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

Permitting Times: Issue for Both Clean and Conventional Energy

South Fork Wind Permitting Timeline # Days from Application to Decision



3.1 years to get to construction, seven different reviews, almost five years from start of process to end of construction

https://www.brookings.edu/research/how-to-reform-federal-permitting-to-accelerate-clean-energy-infrastructure-a-nonpartisan-way-forward/

https://www.brookings.edu/research/how-does-permitting-for-clean-energy-infrastructure-work/

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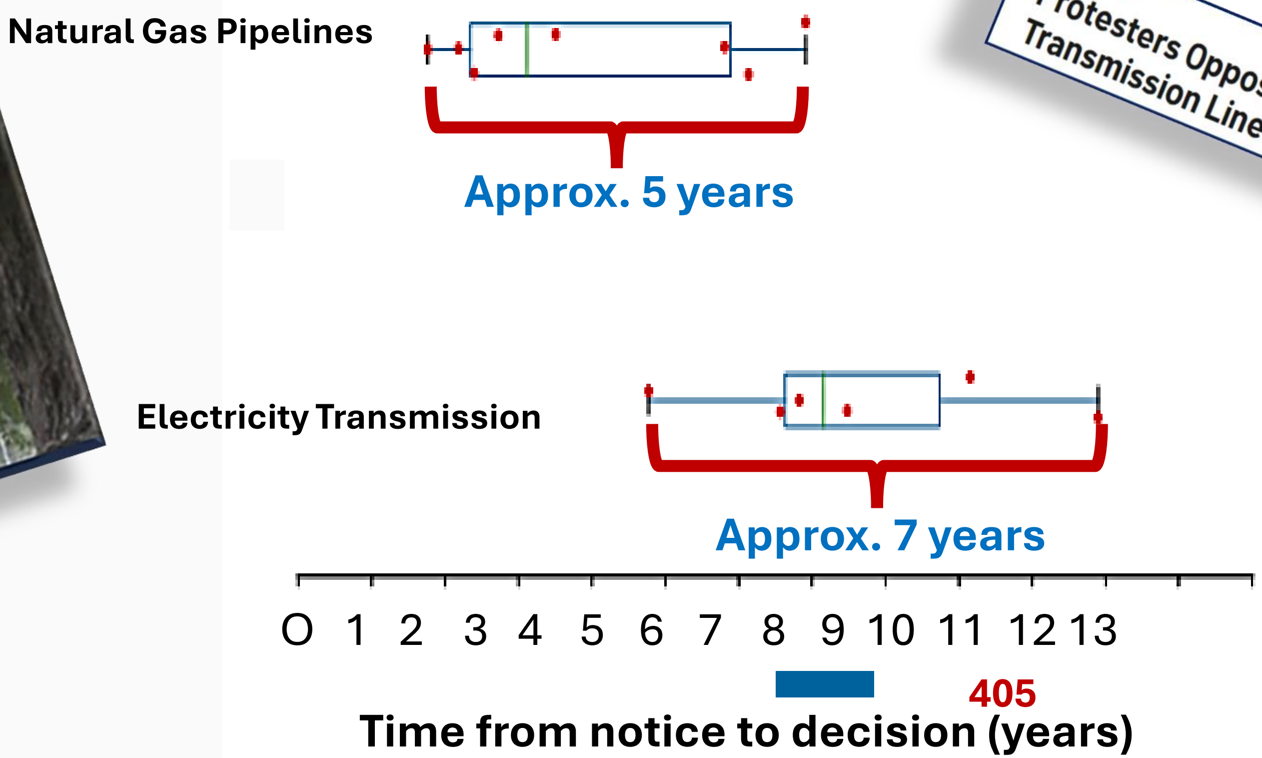
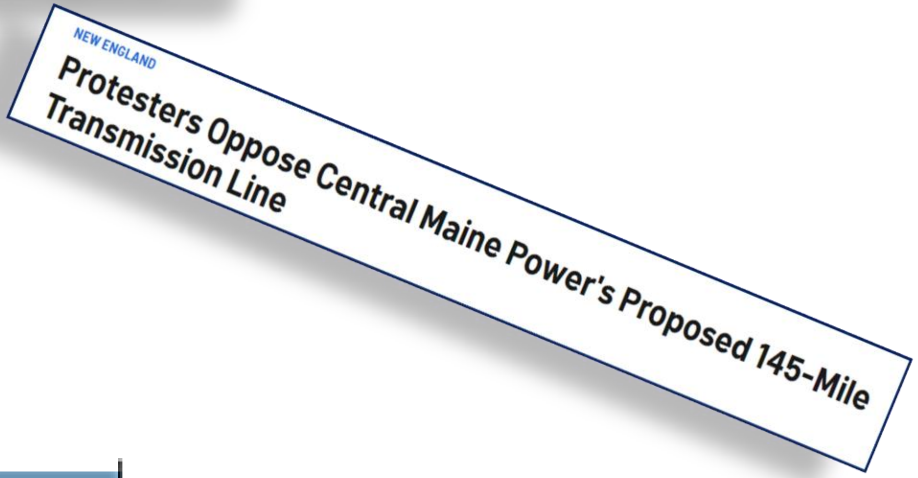
Permitting Times: Issue for Both Clean and Conventional Energy

Time Taken for Federal Permit Review as of 9/23/22
For Completed Gas Pipeline and Transmission Projects




NEW ENGLAND
Protesters Oppose Central Maine Power's Proposed 145-Mile Transmission Line

https://www.brookings.edu/research/how-to-reform-federal-permitting-to-accelerate-clean-energy-infrastructure-a-nonpartisan-way-forward/

https://www.brookings.edu/research/how-does-permitting-for-clean-energy-infrastructure-work/

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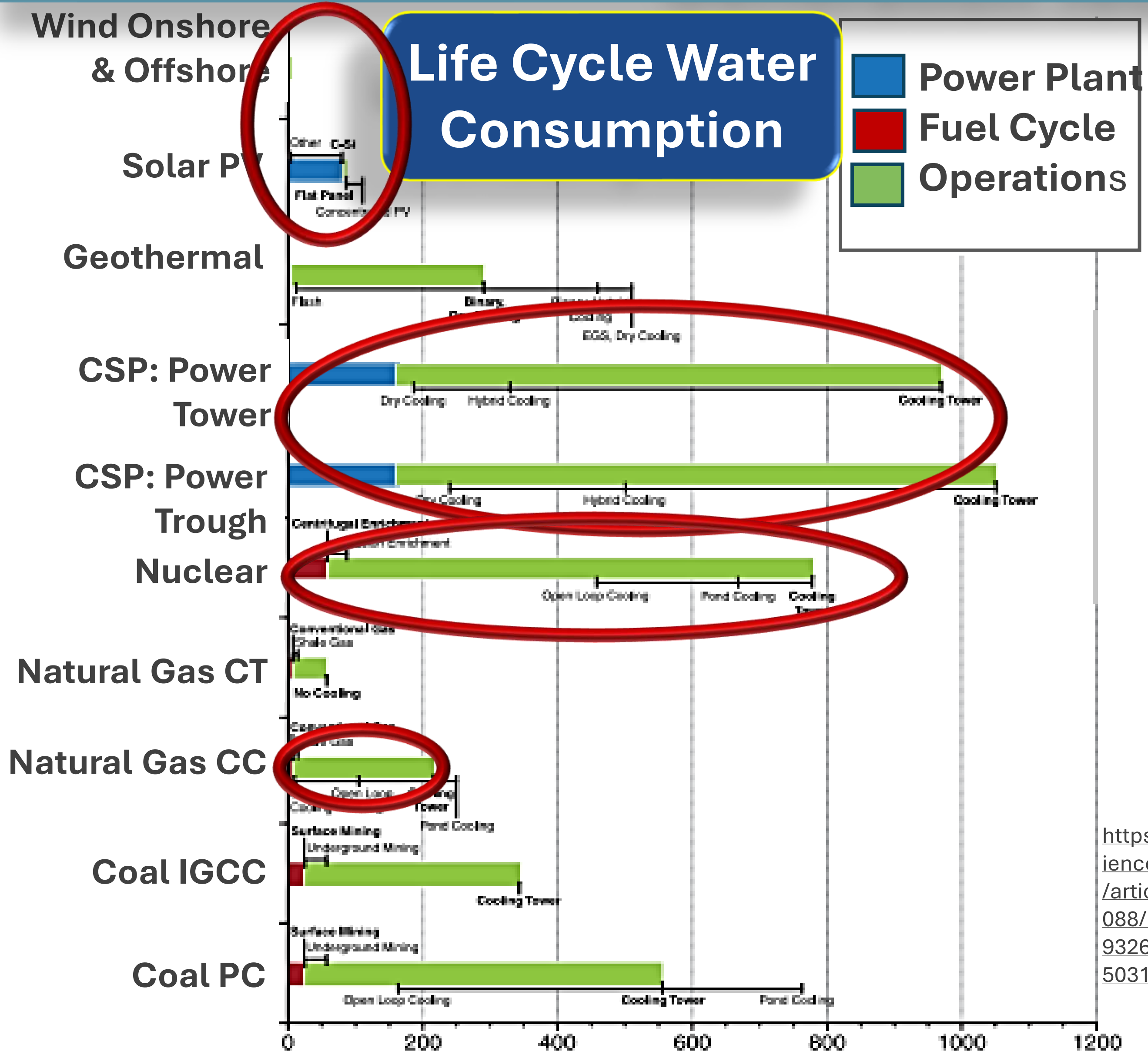
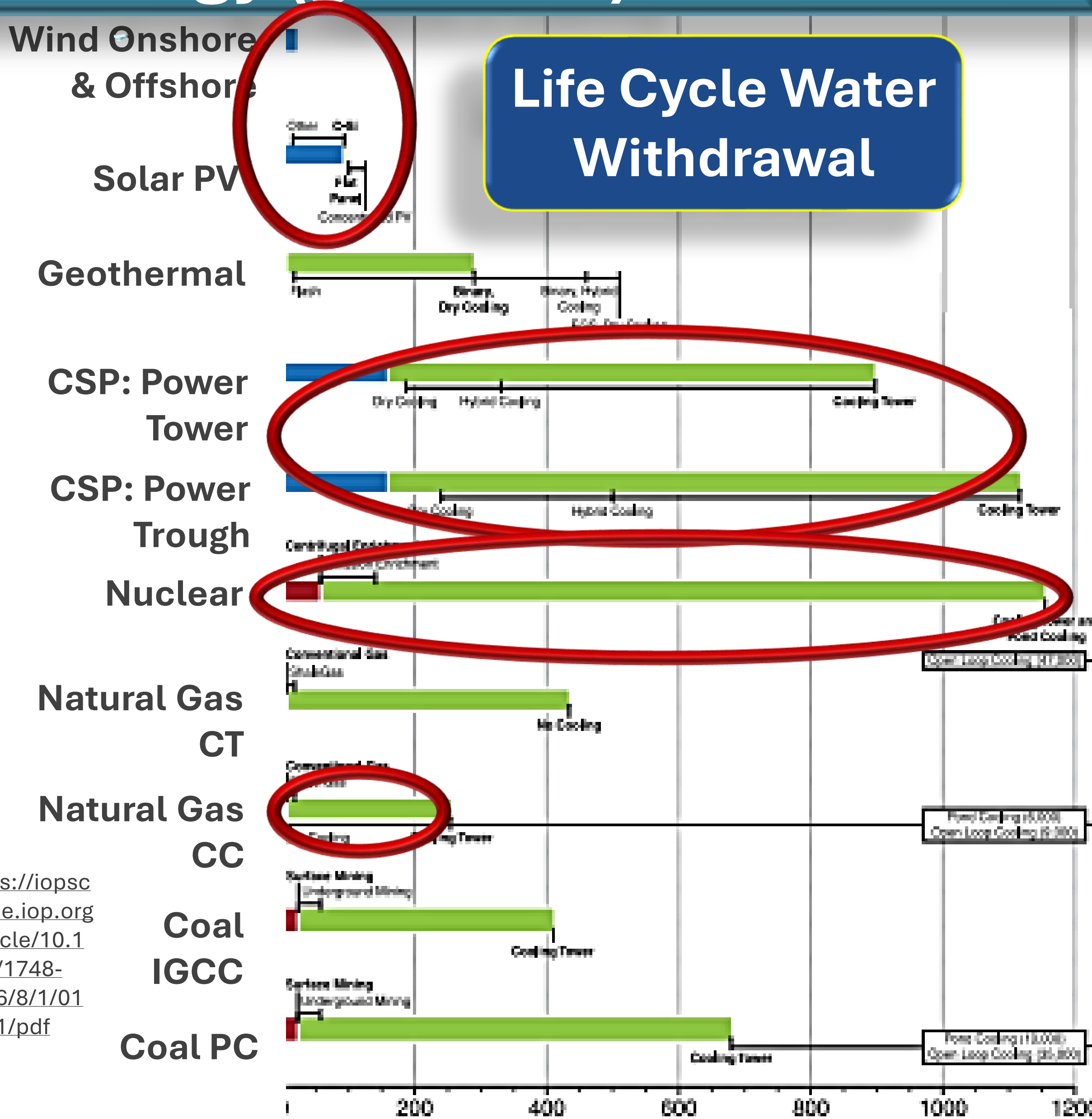
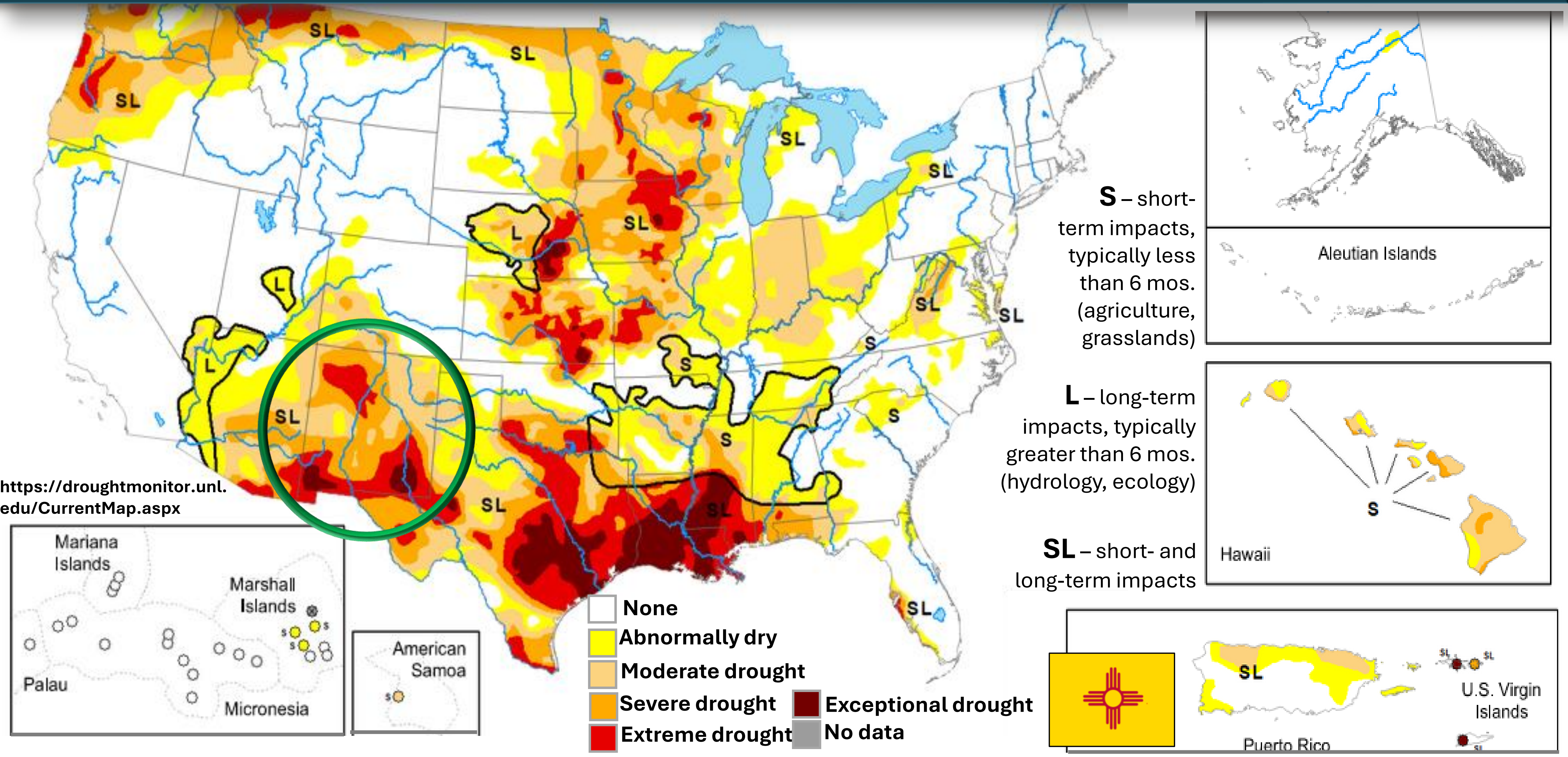
Life Cycle Water Consumption and Withdrawal by Generation Technology (gal/Mwh)



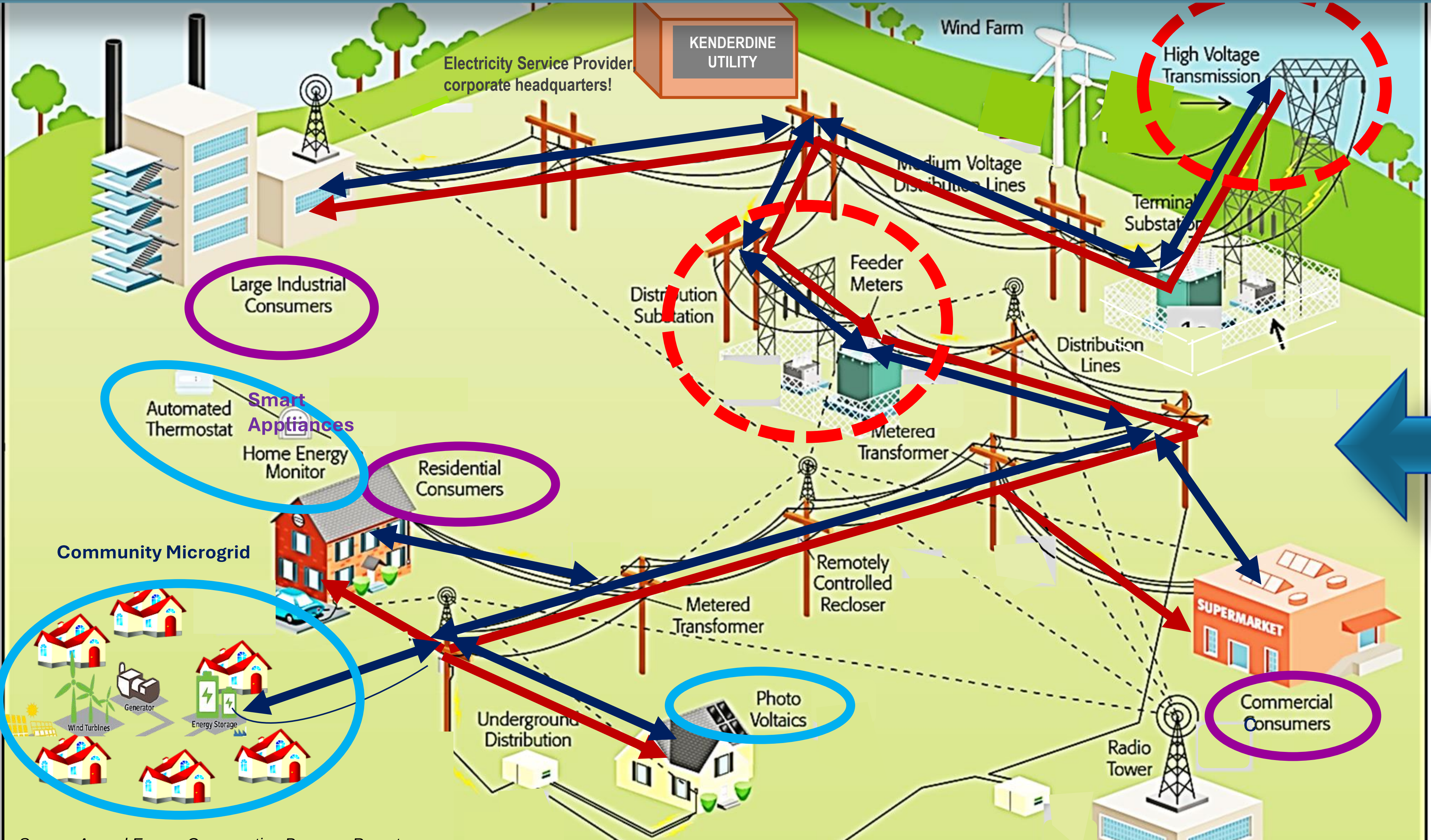
https://iopscience.iop.org/article/10.1088/1748-9326/8/1/015031/pdf



U.S. Drought Monitor (map released 09/26/23)



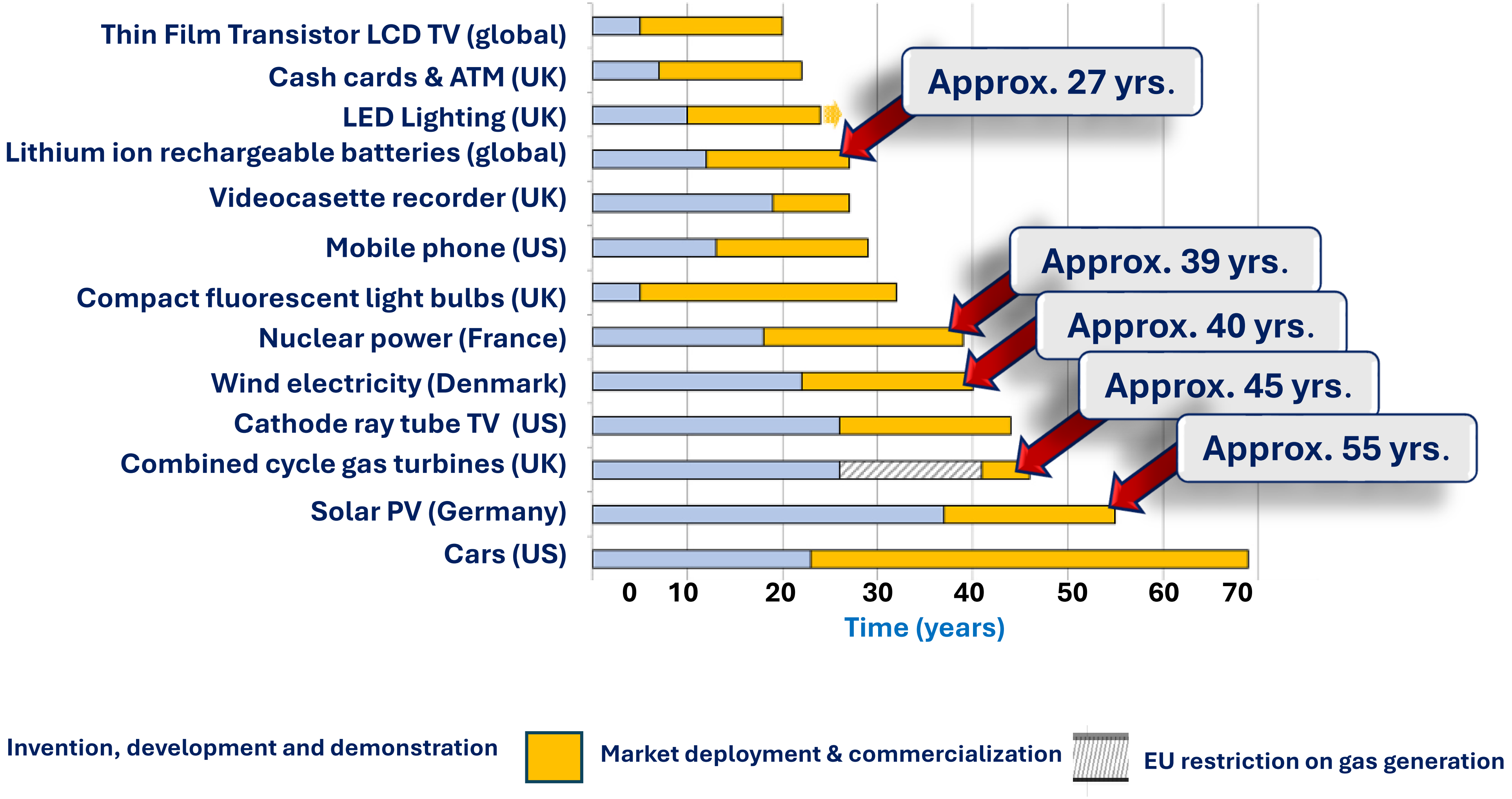
Two Way Electricity Flows and Grid Security



Source: *Annual Energy Conservation Progress Report, 2010 (Volume One): Managing a Complex Energy System.* Toronto, ON, modified for presentatio

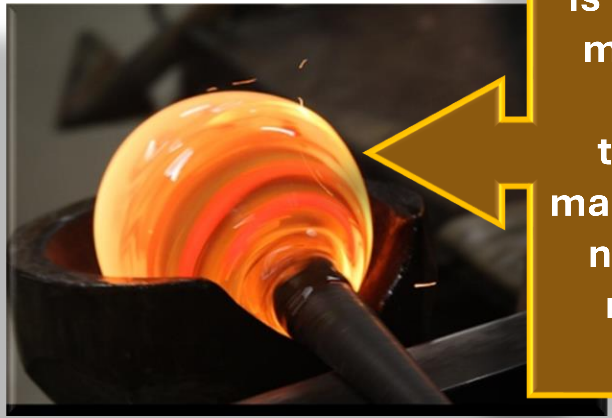
"…emerging advancements in … smart grid technologies, cloud computing services, grid-cyber vulnerability & assessments, and distributed energy resources represent significant cybersecurity threats to the continuity of delivered power. "
(Sandia National Laboratory)

Development/Deployment Timelines for Key Technologies



Francehttps://reader.elsevier.com/reader/sd/pii/S0301421521000240?token=875F291C875B56A06A22FF61D6E0AFD903726134EEA017D8914E90A9DB516318 501601DD1CDF1A5072CFFED060D141A1&originRegion=us-east-1&originCreation=20210715180413

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

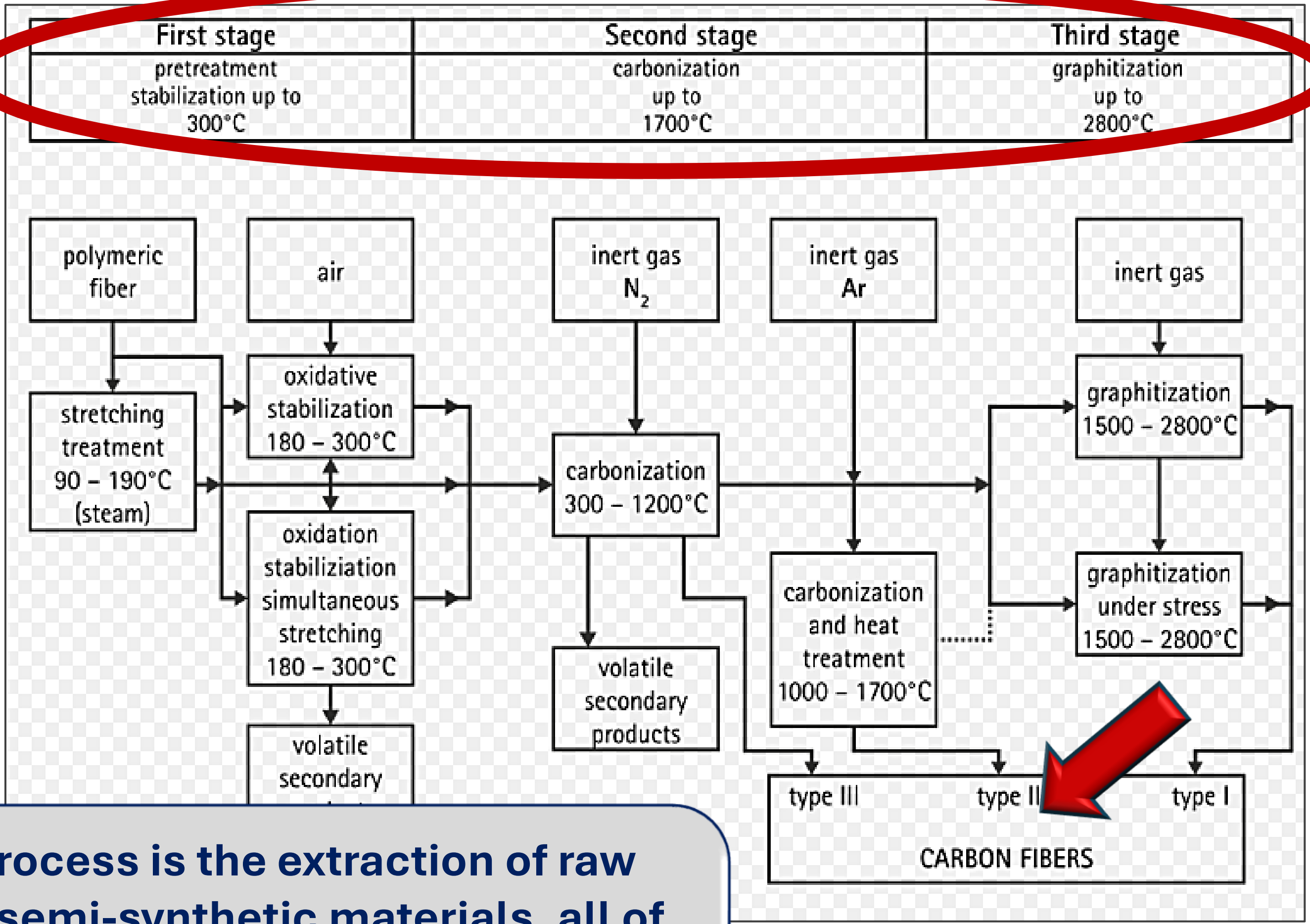
Forging and shaping steel is typically done at temperatures from 1400 F – 2000 F. And forge welding is done at temperatures above 2000 F.

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.

Key Technology Needs Both Heat and Oil

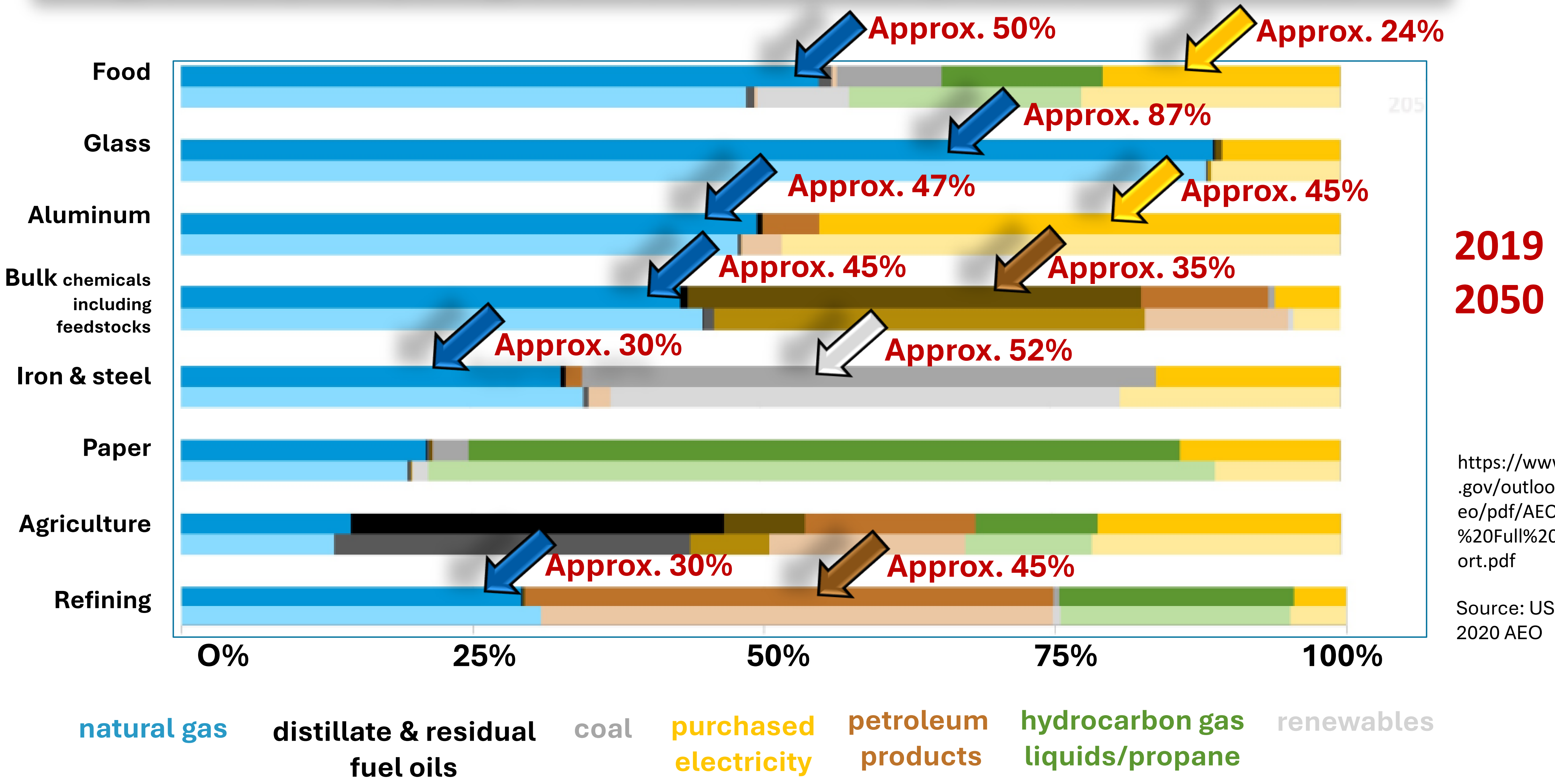
Wind turbine blades are manufactured using a composite mix of glass, carbon fiber, and plastic. It's a unique material that gives the blades the strength and durability to do its job.



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.

US Industrial Uses of Energy

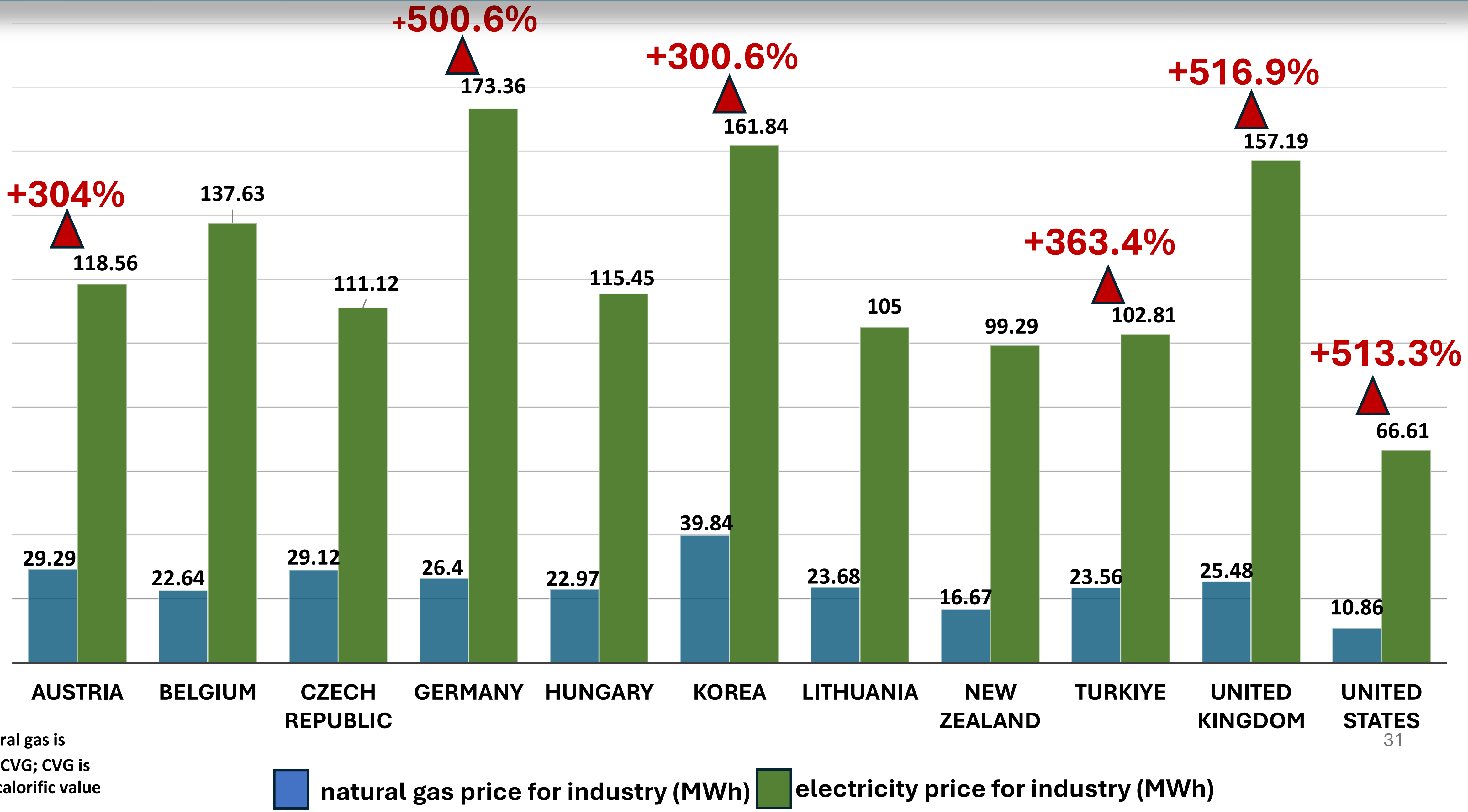
Energy Consumption by Energy Source Shares and Industry, % (EIA AEO2020 Reference Case)



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

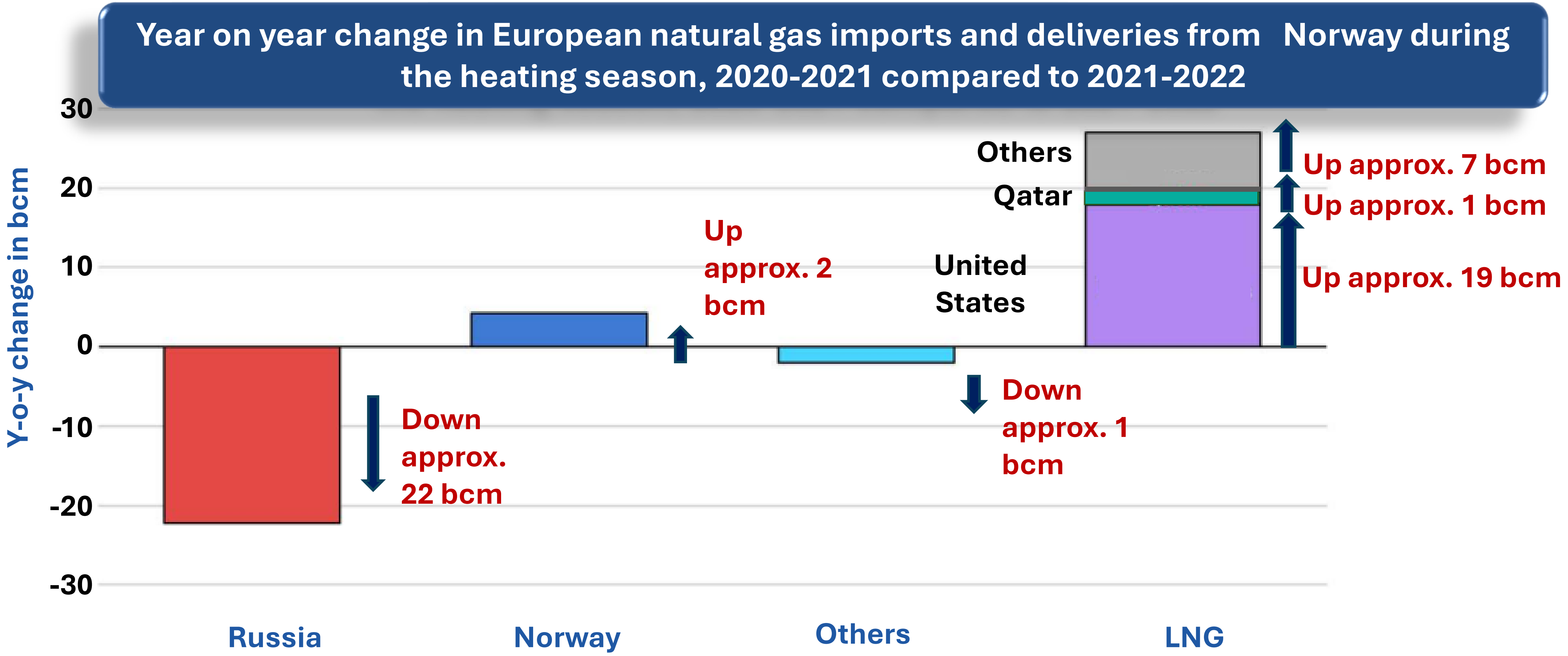
Source: US EIA, 2020 AEO

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



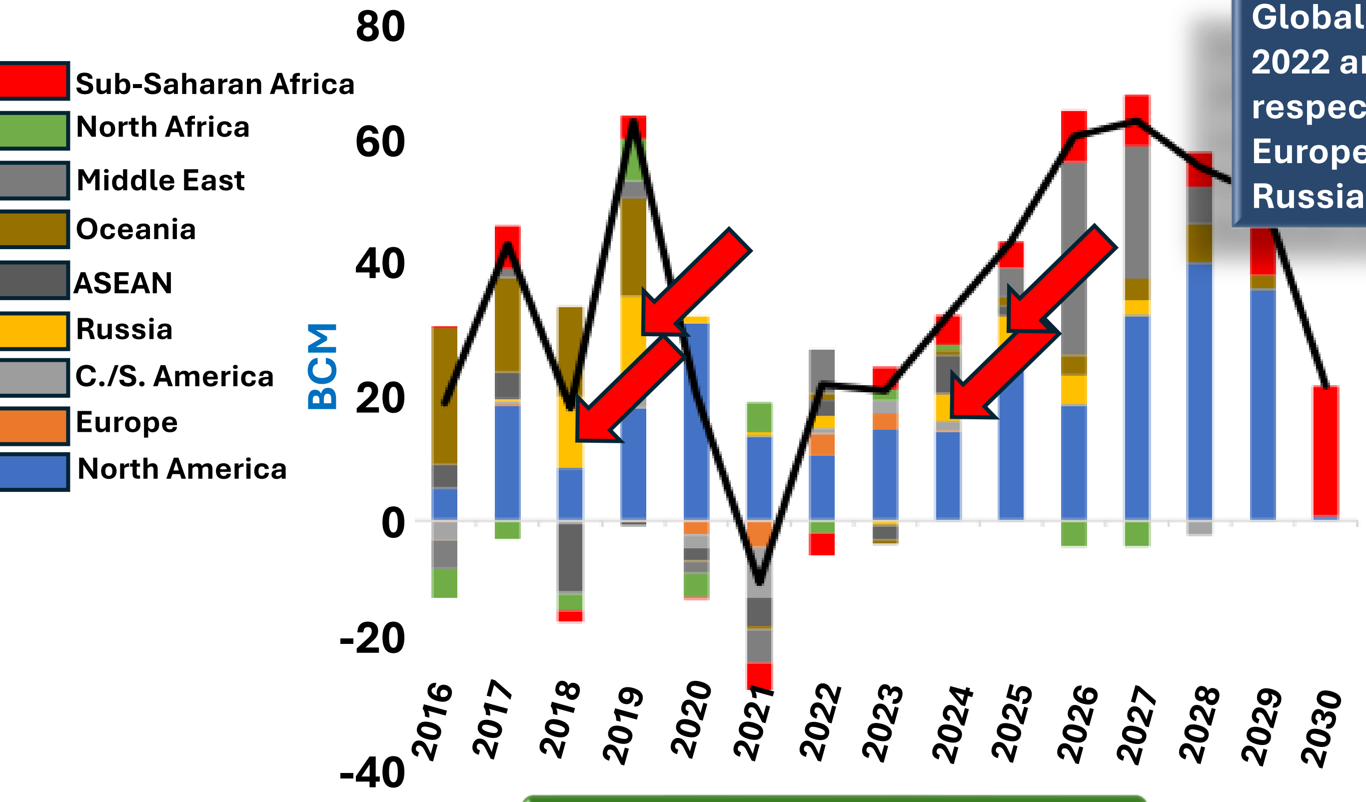
*natural gas is MWhrCVG; CVG is gross calorific value

Lower Russian Piped Gas Flows to Europe Largely Compensated by Record Levels of LNG Inflow, 2021-2022



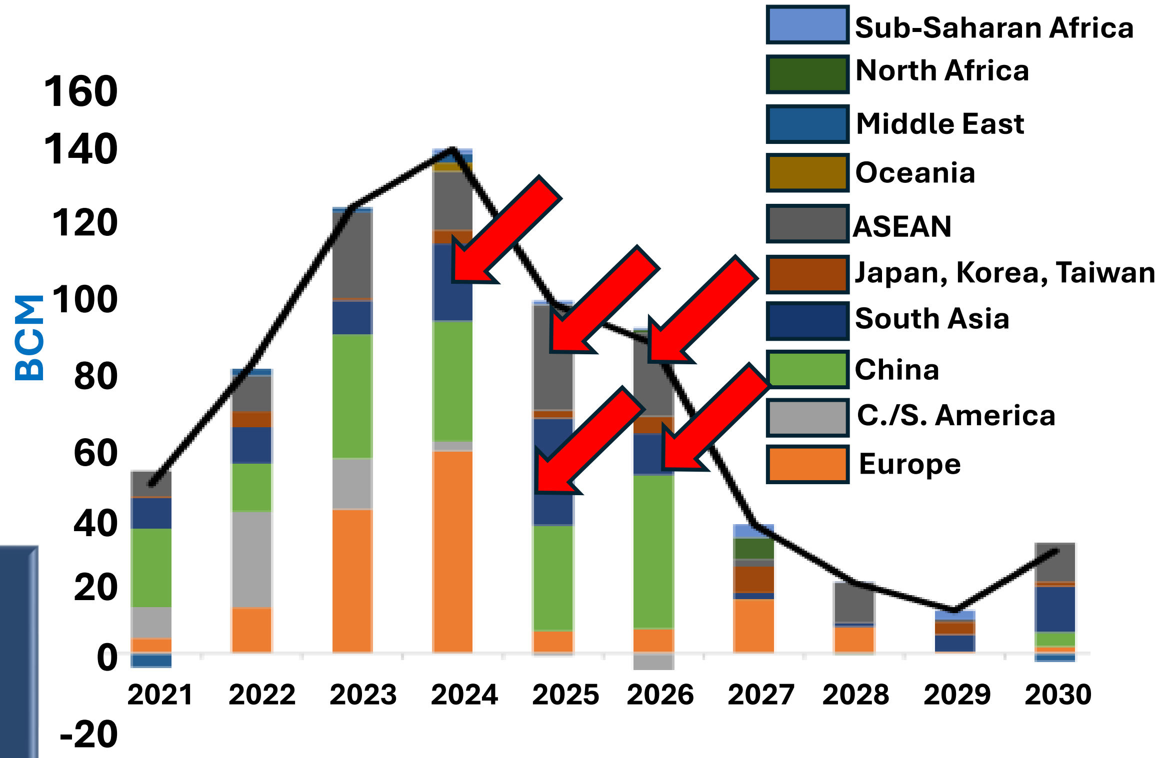
Source: IEA Gas Market Report, q2-2022

LNG Export/Import Capacity Growth to 2030



Global LNG import capacity is expected to grow by some 550 bcm between 2022 and 2030. China and Europe lead the way with 145 bcm and 135 bcm, respectively, followed by ASEAN (120 bcm) and South Asia (95 bcm). Europe's growth, predominantly in 2023 and 2024, in response to the Russian invasion of Ukraine

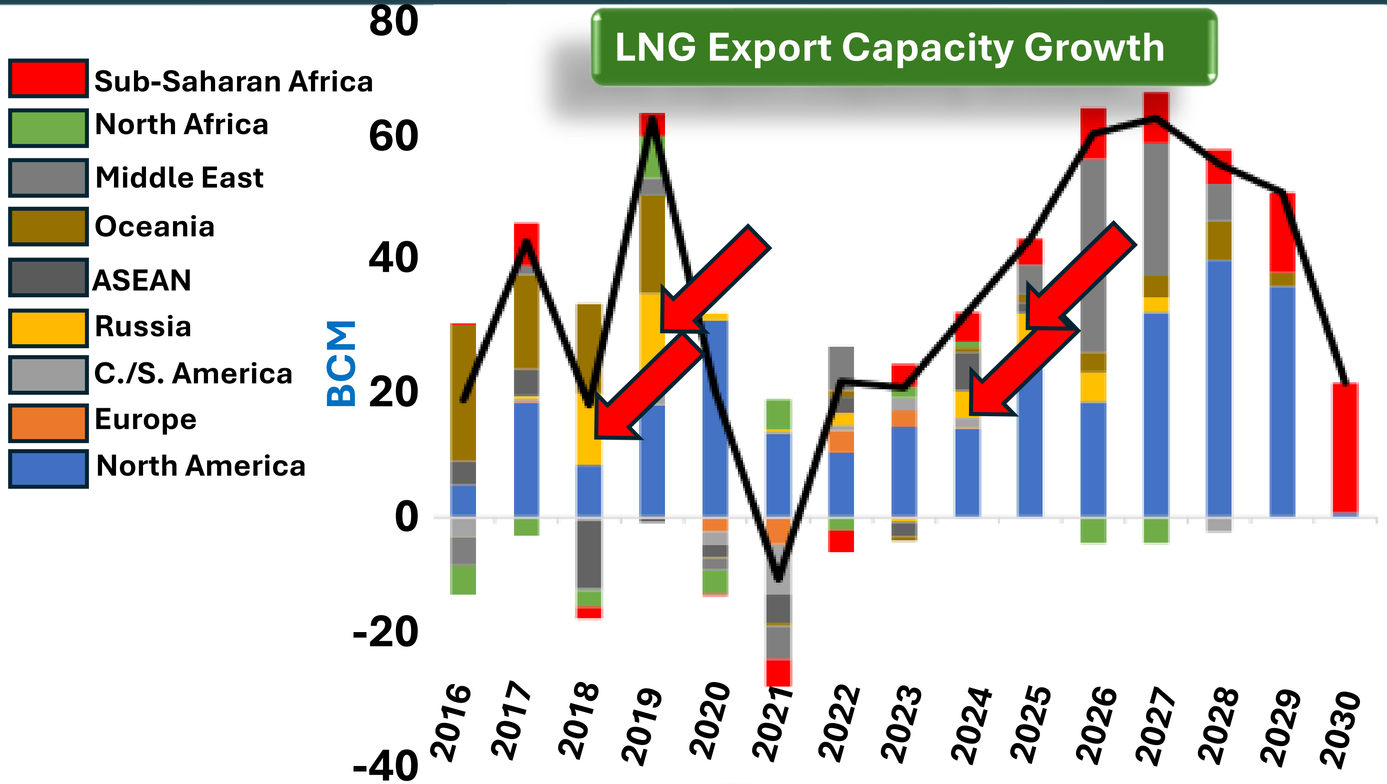
LNG Import Capacity Growth

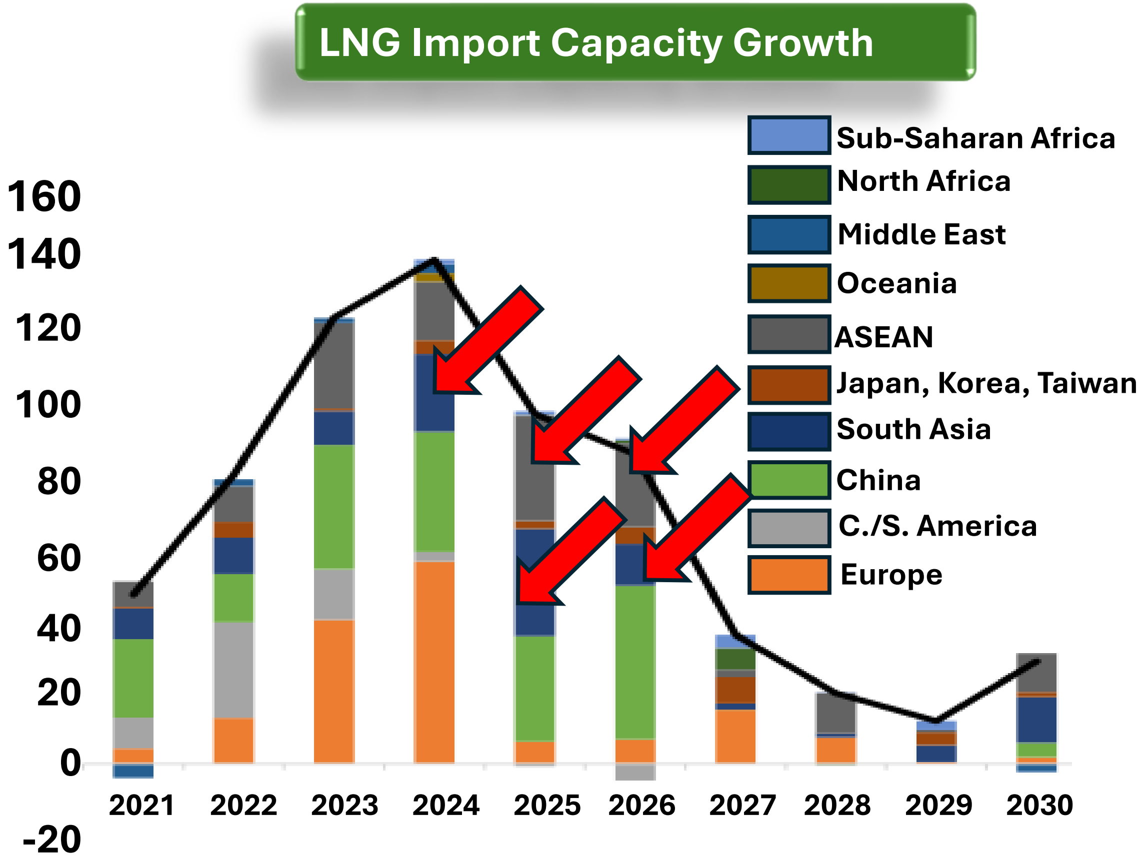


LNG Export Capacity Growth

Global LNG export capacity is expected to grow by over 350 bcm between 2022 and 2030, a rise of 60 per cent over the 2022 average . 80 per cent of this rise has already taken FID, and over half the increase is from North America. Six projects have already taken FID and will come on-line before 2030.

LNG Export/Import Capacity Growth to 2030





ALERT!

Import Capacity Additions by 2030: 550 bcm

Export Capacity Additions by 2030: 350 bcm

There are enormous geopolitical implications if Russia fills this gap

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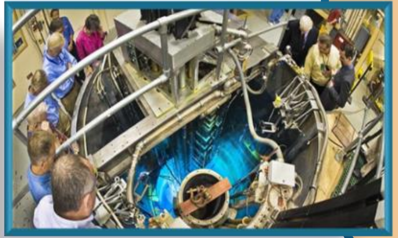
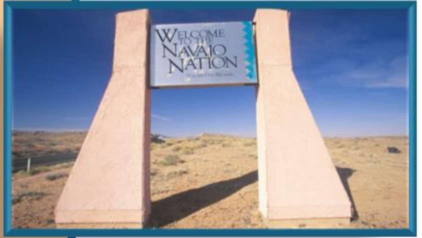
What NM Brings to the Table on Hydrogen

- ✓ State revenue and many jobs in New Mexico depend on the fossil industry. Hydrogen is an energy carrier of the future that aligns with the skills of the fossil energy workforce
- ✓ Major oil, gas, refined products, and CO_2 pipelines cross the state some of which are at low utilization, and some abandoned providing opportunities for retrofit
- ✓ The top three GHG point sources in New Mexico (excluding electricity generation, oil and gas production) are refineries, cement (Tijeras), and mining (major mining operations with several large potash and copper mines)
- ✓ Innovation assets in the hydrogen industry including Sandia and Los Alamos National Labs; and a focus on energy related research and work force development at universities, colleges and technical schools
- ✓ Significant existing pipeline rights of way and the strong potential for blending are being researched by Sandia National Laboratory
- ✓ The largest population of Native Americans is in the Navajo Nation and Native Americans also have a history of energy production and other restorative justice considerations





The Value of NM's Produced and Brackish Water

According to Mike Hightower with the New Mexico Produced Water Research Consortium at NMSU --

- NM is estimated to generate of 4 million barrels of produced water per day. Much of this is disposed of through deep well injections
- Up to 150,000 acre feet of produced water is available on an annual basis (3X the water used by ABQ)
- Treatment and reuse is an avoided cost for oil and gas companies. This could lower costs to consumers
- NM also has two billion acre feet of brackish water that could utilized for green hydrogen production

According to a Dec. 2023 press release announcing Governor Lujan Grisham's strategic water supply initiative, "Diverting just 3% of the produced water disposed of in injection wells to make hydrogen could result in enough energy to fully power over 2 million homes annually."

https://nmbizcoalition.org/nm-oil-and-gas-producers-making-progress-on-produced-water/
https://nmpwrc.nmsu.edu/_assets/public_information/Water-Needs-for-Hydrogen-Development.pdf

New Mexico GHG Emissions Sources, 2020 (Mt CO2e)

6.1 Mt CO2e Buildings

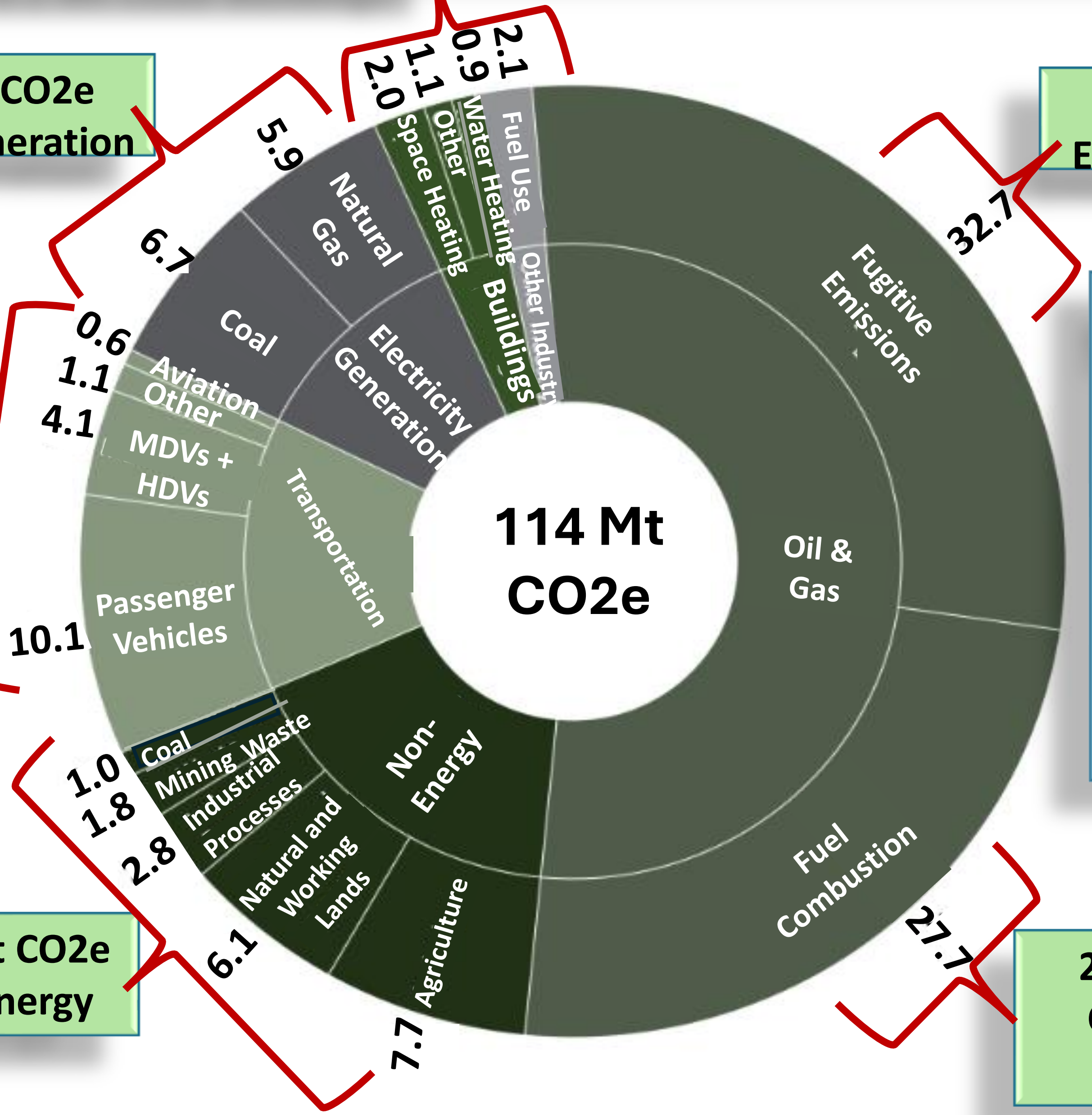
12.6 Mt CO2e Power Generation

15.9 Mt CO2e Transportation

19.4 Mt CO2e Non-energy

32.7 Mt CO2e Fugitive Emissions from Production

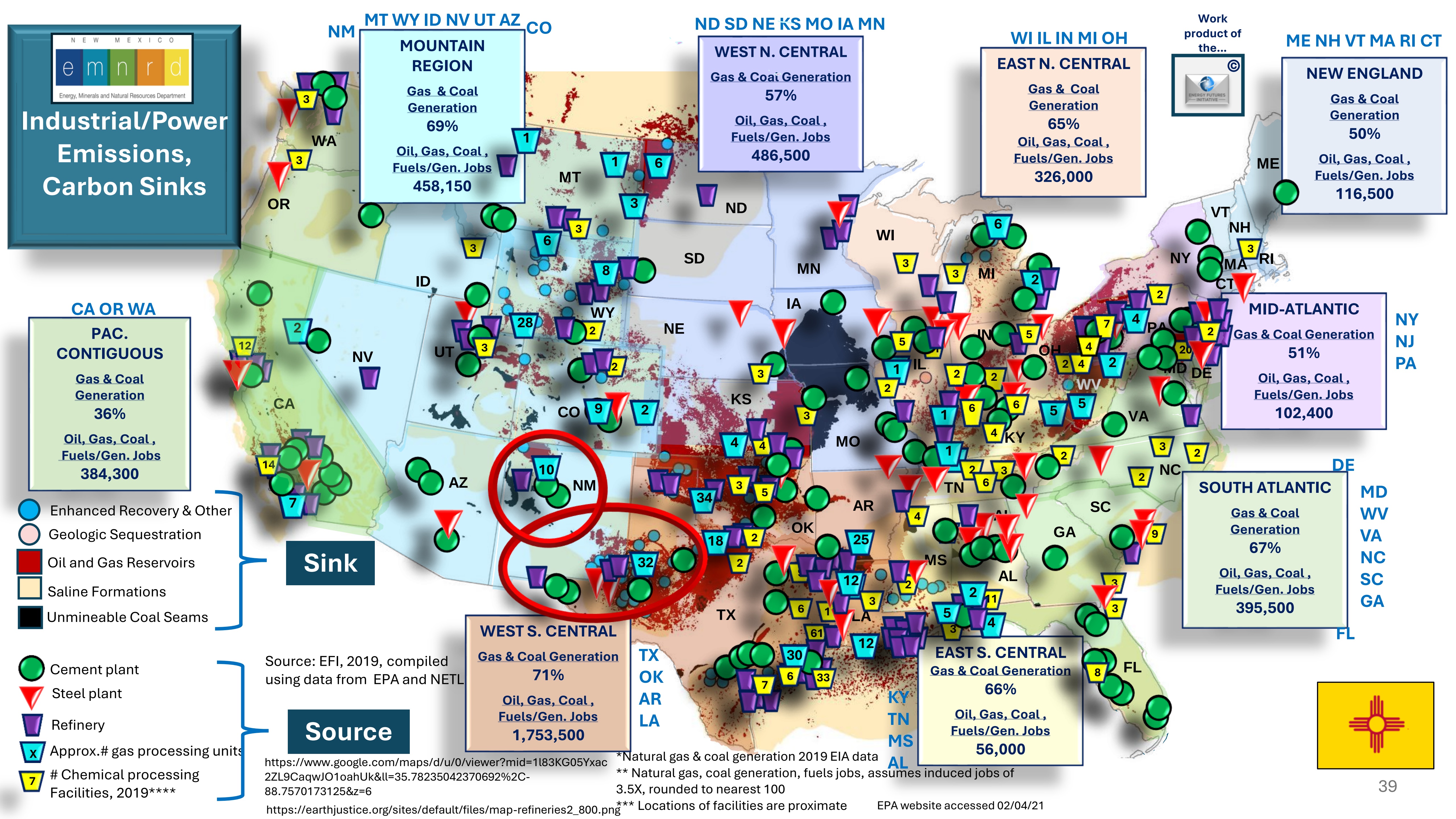
27.7 Mt CO2e Fuel Combustion from Production



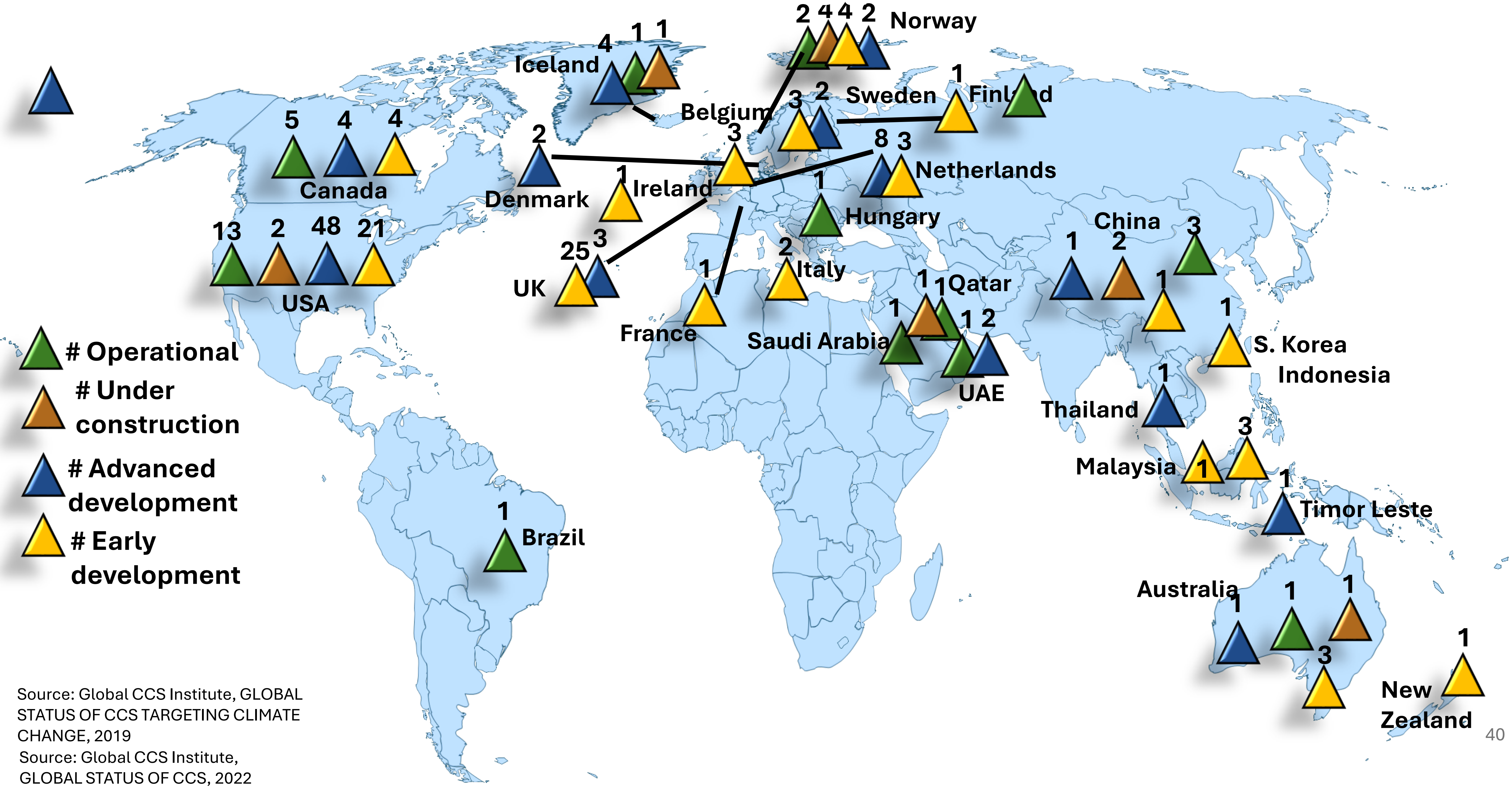
Source: Defining and Envisioning a Clean Hydrogen Hub for New Mexico March 2022

NM GHG Emissions Sources, 2020

- 5.1% from buildings/industry
- 11% from power generation
- 13.8% from transportation
- 17% from non-energy sources
- 53% from oil and gas production


NEW MEXICO emnrd
Energy, Minerals and Natural Resources Department
Industrial/Power Emissions, Carbon Sinks
NM
MT WY ID NV UT AZ
CO
MOUNTAIN REGION
Gas & Coal Generation
69%
Oil, Gas, Coal, Fuels/Gen. Jobs
458,150
ND SD NE KS MO IA MN
WEST N. CENTRAL
Gas & Coal Generation
57%
Oil, Gas, Coal, Fuels/Gen. Jobs
486,500
WI IL IN MI OH
EAST N. CENTRAL
Gas & Coal Generation
65%
Oil, Gas, Coal, Fuels/Gen. Jobs
326,000
Work product of the...
ENERGY FUTURES INITIATIVE
ME NH VT MA RI CT
NEW ENGLAND
Gas & Coal Generation
50%
Oil, Gas, Coal, Fuels/Gen. Jobs
116,500
CA OR WA
PAC. CONTIGUOUS
Gas & Coal Generation
36%
Oil, Gas, Coal, Fuels/Gen. Jobs
384,300
MID-ATLANTIC
Gas & Coal Generation
51%
Oil, Gas, Coal, Fuels/Gen. Jobs
102,400
NY NJ PA
SOUTH ATLANTIC
Gas & Coal Generation
67%
Oil, Gas, Coal, Fuels/Gen. Jobs
395,500
DE MD WV VA NC SC GA FL
WEST S. CENTRAL
Gas & Coal Generation
71%
Oil, Gas, Coal, Fuels/Gen. Jobs
1,753,500
TX OK AR LA
EAST S. CENTRAL
Gas & Coal Generation
66%
Oil, Gas, Coal, Fuels/Gen. Jobs
56,000
KY TN MS AL
WA OR CA NV ID MT WY UT CO AZ NM ND SD NE KS OK TX MN IA MO AR LA WI MI IL IN OH KY TN MS AL GA SC NC VA WV PA NY VT NH ME MA RI CT MD DE FL
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
Source: EFI, 2019, compiled using data from EPA and NETL
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

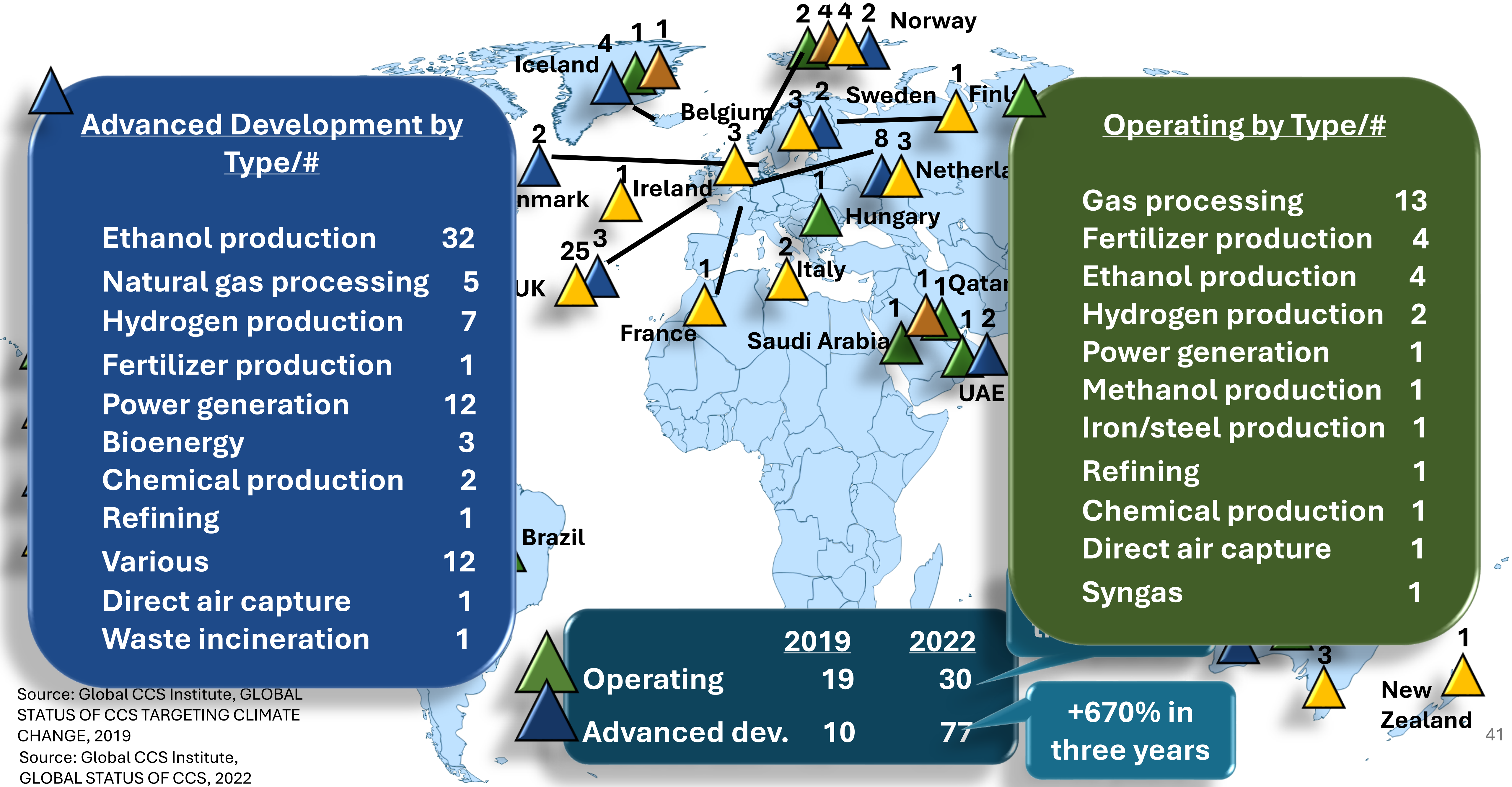
CCS Projects 2022, Operational, Under Construction, Advanced/Early Development



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

+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

Metals/Minerals 2022 % US Import Dependence, Key Uses

100% Import Dependent

Arsenic	Lumber preservatives, pesticides, lead acid batteries, solar cells
Tantalum	Electronic components, gas turbine alloys
Strontium	Pyrotechnics, ceramic magnets, drilling fluids
Scandium	Alloys, fuel cells, electronics
Rubidium	Electronics, glass
Rare Earths	Catalysts, ceramics, glass, alloys, metallurgy
Niobium	Steel alloys
Manganese	Steel production
Indium	LCD screens, electrical components
Graphite	Lubricants, batteries, fuel cells steel making
Gallium	Integrated circuits, optical devices (LEDs)
Fluorspar	Aluminum manufacturing, gasoline, uranium fuel, refrigerants
Cesium	Oil/gas well drilling, fuel cells
Yttrium	Catalysts, ceramics, metallurgy, jet engines
Asbestos	Oil industry, rubber sheet, vehicle friction products
Mica (sheet)	Oil drilling, roofing, rubber products

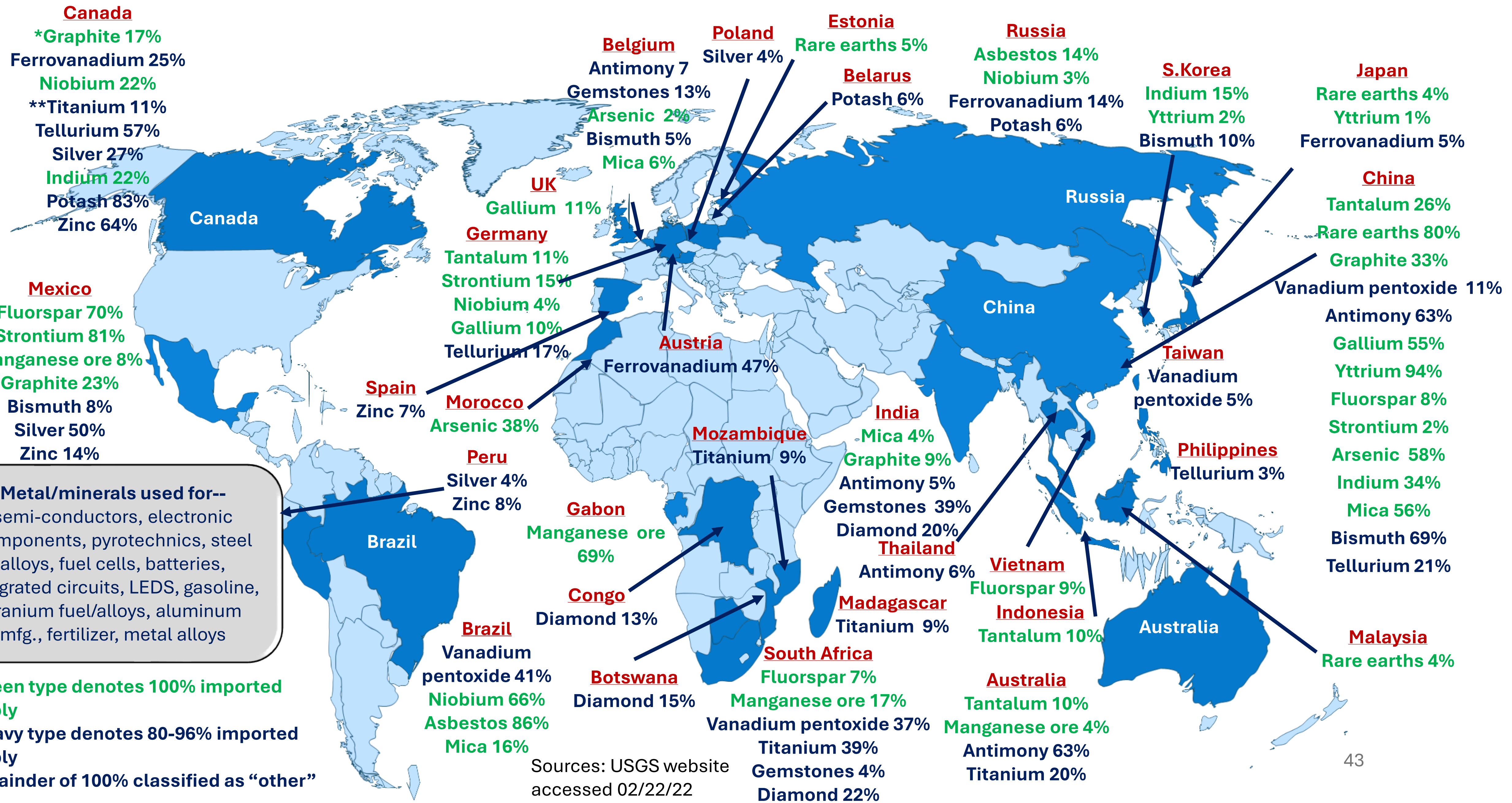
96 - >50% Import Dependent

Vanadium	96%	Metal, steel, uranium alloys
Tellurium	>95%	Cooling, energy production, solar cells, cast iron production
Bismuth	94%	Used in medical/ atomic research
Potash	90%	Fertilizer, chemical, & industrial apps
Titanium*	>88%	White pigment, metal alloys
Diamond	84%	Computer chips, O&G drilling, transportation
Zinc	83%	Metal galvanizing
Antimony	81%	Flame retardants, metal products, ceramics, glass
Silver	80%	Electricity, electricity conductivity, batteries, plastics
Platinum	79%	Catalytic agents
Rhenium	76%	Lead-free gasoline, super alloys
Cobalt	76%	Rechargeable batteries, superalloys
Barite	>75%	Oil/gas drilling
Bauxite	>75%	Cement, petroleum industries
Iron Oxide	>75%	Concrete, construction materials
Tin	75%	Coatings & alloys for steel
Chromium	75%	Stainless steel, other alloys
Gold	>52%	Electrical/electronics
Tungsten	>50%	Wear-resistant metals
Germanium	>50%	Fiber optics, solar cells
Lithium	>50%	Batteries, EVs
Nickel	>50%	Steel alloys

Note: Navy type indicates on USGS Critical List 2022
Red type highlights some key energy uses

Sources: USGS; Methodological Note to the Inventory of Export Restrictions on Industrial Raw Materials
*Titanium mineral concentrates

US Metals, Minerals on Which the US 80 to 100% Import Dependent, Country Suppliers of US Market/% Total Imports from Country



Metal/minerals used for--
semi-conductors, electronic components, pyrotechnics, steel alloys, fuel cells, batteries, integrated circuits, LEDS, gasoline, uranium fuel/alloys, aluminum mfg., fertilizer, metal alloys

* Green type denotes 100% imported supply
** Navy type denotes 80-96% imported supply
Remainder of 100% classified as "other"

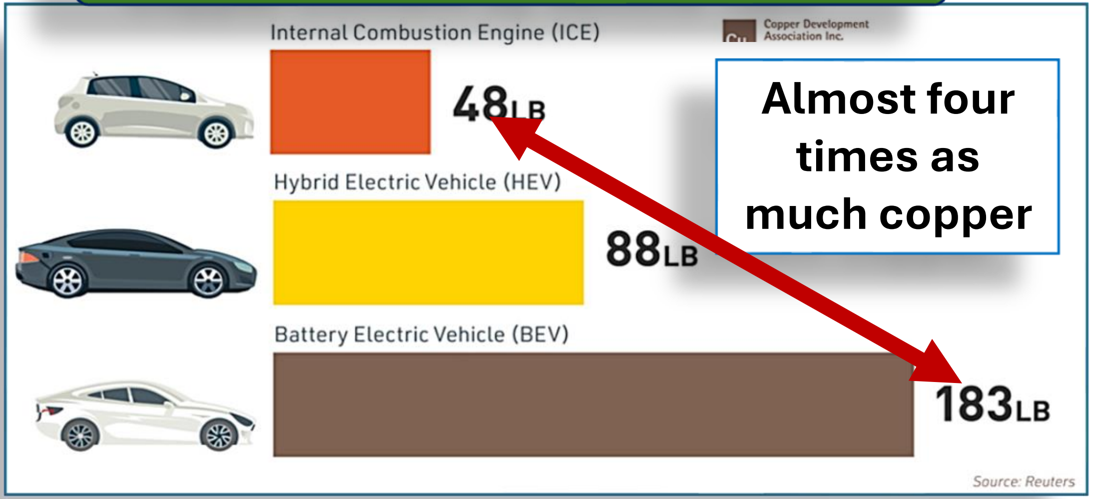
Sources: USGS website accessed 02/22/22

Demand for Electrification/Transportation = $10,000 per ton Copper

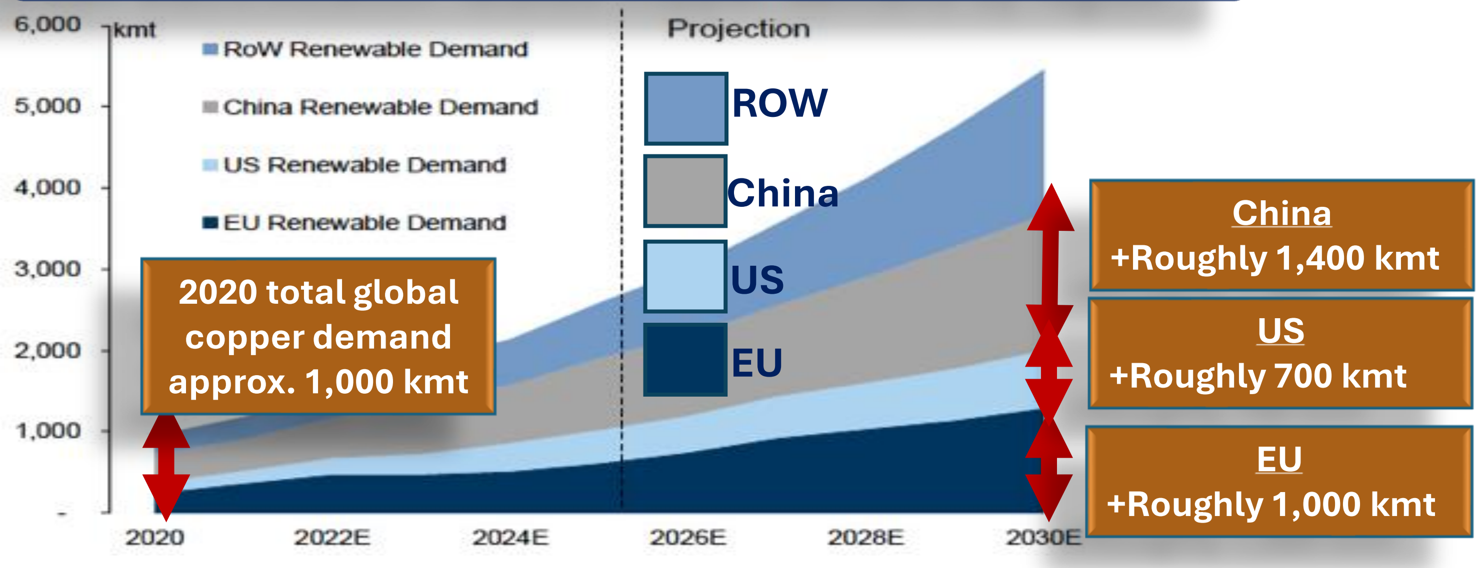
NEW MEXICO emnrd
Energy, Minerals and Natural Resources Department

Copper, 5 Year Price Chart

Copper Content by Vehicle Type



Green electrification related copper demand by region



140 M EVs by 2030 in IEA's SDS X 183 lbs. of copper/EV = 11.6 million Mt of copper for EVs

Global production, 2020: approx. 20 million Mt

US uses (%): building construction, 43%; electrical and electronic products, 21%; transportation equipment, 19%; consumer and general products, 10%; and industrial machinery and equipment, 7%.

Frik Els | April 13, 2021 | 2:16 pm

NM Metals, Minerals on Which the US is 75-100% Import Dependent, Country Suppliers of US Market/% Total Imports from Country

All are on the 2022 USGS Critical List

Found and/or Produced in NM

Mineral	% Import Dependent	% Suppliers	Key Uses
Antimony	81	63% China	Ceramics, glass
Arsenic	100	58% China	Lumber preservatives
Bismuth	94	69% China	Medical, atomic research
Gallium	100	55% China	LEDs
Graphite	100	9% India 33% China 23% Mexico 7% Canada	Batteries, fuel cells
Indium	100	34% China 22% Canada 15% S. Korea	Electrical components
Manganese	100	69% Gabon	Steel production
Niobium	100	22% Canada	Steel alloys
Rare earths	100	80% China	Metallurgy, glass, wind turbines
Scandium	100	China, Japan Europe (% NA)	Aluminum, fuel cells electronics
Tellurium	95	57% Canada	Solar cells, cooling
Titanium	75	39% South Africa 20% Australia 11% Canada	Steel alloys
Vanadium	95	37% South Africa 14% Russia 11% China	Steel
Zinc	83	64% Canada 14% Mexico	Metal galvanizing

The Obama Administration's Quadrennial Energy Review (QER): Example of a Strategic Energy Plan

Presidential Memorandum -- Establishing a Quadrennial Energy Review

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

Affordable, clean, and secure energy and energy services are essential for improving U.S. economic productivity, enhancing our quality of life, protecting our environment, and ensuring our Nation's security. Achieving these goals requires a comprehensive and integrated energy strategy resulting from interagency dialogue and active engagement of external stakeholders. To help the Federal Government better meet this responsibility, I am directing the undertaking of a Quadrennial Energy Review…

Establishing the Quadrennial Energy Review Task Force…

(a) There is established the Quadrennial Energy Review Task Force (Task Force), to be co-chaired by the Director of the Office of Science and Technology Policy and the Director of the Domestic Policy Council, which shall include the heads of each of the following, or their designated representatives:

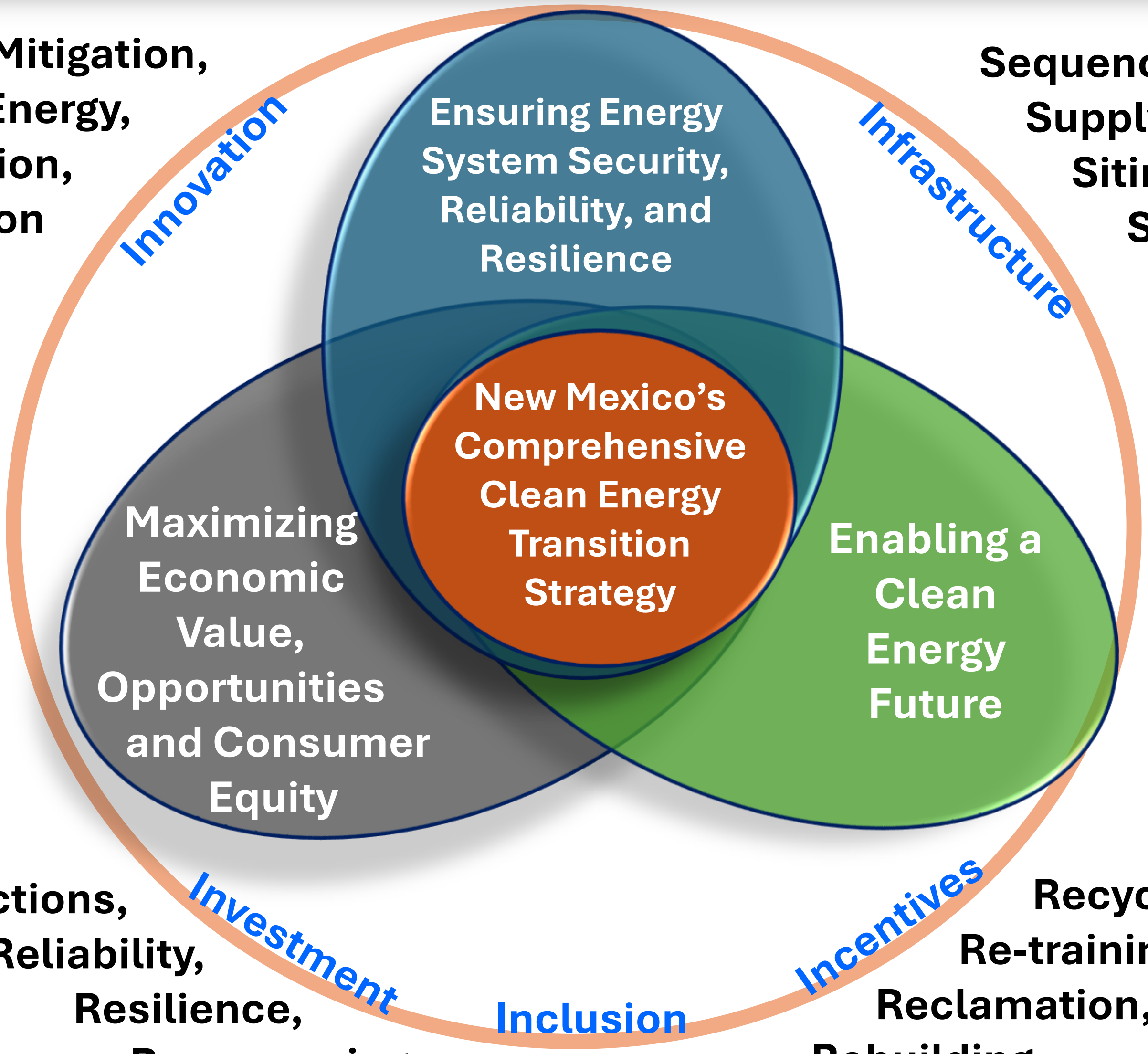
(i) the Department of State;
(ii) the Department of the Treasury;
(iii) the Department of Defense;
(iv) the Department of the Interior;
(v) the Department of Agriculture;
(vi) the Department of Commerce;
(vii) the Department of Labor;
(viii) the Department of Health and Human Services;
(ix) the Department of Housing and Urban Development;
(x) the Department of Transportation;
(xi) the Department of Energy;
(xii) the Department of Veterans Affairs;
(xiii) the Department of Homeland Security;
(xiv) the Office of Management and Budget;
(xv) the National Economic Council;
(xvi) the National Security Staff;
(xvii) the Council on Environmental Quality;
(xviii) the Council of Economic Advisers;
(xix) the Environmental Protection Agency; QER Report: Energy Transmission, Storage, and Distribution Infrastructure | April 2015 **v**
(xx) the Small Business Administration;
(xxi) the Army Corps of Engineers;
(xxii) the National Science Foundation; and
(xxiii) such agencies and offices as the President may designate.

New Mexico's "Energy Trilemma"

Climate Change Mitigation,
Clean Energy,
Collaboration,
Conservation

Sequencing,
Supply Chains,
Siting,
Safeguards,
Standardization,
Services

Affordability,
Acceleration,
Adaptation,
Accessibility,
Allocation of
Resources



Decarbonization
Technologies,
Design of Markets,
Deployment,
Diversification,
Disaster Prevention and
Recovery

Reductions,
Reliability,
Resilience,
Re-purposing,

Recycling,
Re-training,
Reclamation,
Rebuilding