

50

STATES OF POWER DECARBONIZATION

2023 Annual Review & Q4 2023 Report
Executive Summary



NC CLEAN ENERGY
TECHNOLOGY CENTER

DSIRE insight

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The [NC Clean Energy Technology Center](#) is a UNC System-chartered Public Service Center administered by the College of Engineering at North Carolina State University. Its mission is to advance a sustainable energy economy by educating, demonstrating and providing support for clean energy technologies, practices, and policies. The Center provides service to the businesses and citizens of North Carolina and beyond relating to the development and adoption of clean energy technologies. Through its programs and activities, the Center envisions and seeks to promote the development and use of clean energy in ways that stimulate a sustainable economy while reducing dependence on foreign sources of energy and mitigating the environmental impacts of fossil fuel use.

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FULL REPORT AND OTHER 50 STATES REPORTS

The full Q1 2023 50 States of Power Decarbonization report may be downloaded [here](#). In addition to *The 50 States of Power Decarbonization*, the NC Clean Energy Technology Center publishes additional quarterly reports called *The 50 States of Solar*, *The 50 States of Grid Modernization*, and *The 50 States of Electric Vehicles*. These reports may be purchased [here](#). Executive summaries and older editions of these reports are available for download [here](#).

ABOUT THE REPORT

WHAT IS POWER DECARBONIZATION?

Decarbonization is an expansive term generally referring to the reduction of carbon dioxide emissions. Decarbonization can be discussed in the context of any emitting sector – electric power, buildings, industrial processes, transportation, agriculture, or the economy as a whole. This report focuses specifically on decarbonization of the electric power sector, which may include economy-wide decarbonization actions that necessarily encompass the electric power sector.

PURPOSE

The purpose of this report is to provide timely, accurate, and unbiased updates to a broad audience of state lawmakers and regulators, state agencies, utilities, the clean energy industry, and other energy stakeholders, about how states are choosing to study, adopt, implement, amend, or discontinue policies associated with power decarbonization and how utilities are planning for and implementing future generation resource additions and retirements. This report catalogues proposed and approved executive, legislative, and regulatory changes affecting electric power decarbonization during the most recent quarter, as well as actions related to investor-owned utility resource plans and generation capacity changes.

The 50 States of Power Decarbonization report series provides regular quarterly updates and annual summaries of electric power decarbonization policy updates and utility resource planning, keeping stakeholders informed and up to date.

APPROACH

The authors identified relevant policy changes and resource planning updates through state utility commission docket searches, legislative bill searches, popular press, and direct communications with industry stakeholders and regulators.

Questions Addressed

This report addresses several questions about U.S. electric power sector decarbonization, including:

- What targets are states setting for clean/renewable electricity generation or the reduction of greenhouse gas emissions from the power sector?
- How are states reforming statutes and regulations governing utility generation resource planning, procurement, and retirement?

- What electric generation capacity additions and retirements are utilities planning over the near-term and long-term?
- What specific electric generation capacity additions are utilities seeking to implement in the near-term through direct development or procurement processes? What resources are utilities requesting approval to retire in the near-term?

Actions Included

This report focuses on cataloguing and describing important proposed and adopted policy changes related to electric power sector decarbonization.

In general, this report considers an “action” to be a relevant (1) legislative bill that has been introduced, (2) an open or recently decided regulatory docket or rulemaking proceeding, (3) an executive order or significant state agency initiative, (4) a recently published integrated resource plan, or (5) a competitive procurement under development or underway for electric generation capacity. Primarily, statewide actions and those related to investor-owned utilities are included in this report. Specifically, actions tracked in this issue include:

Studies and Investigations

State- or utility-led efforts to study issues related to electric power decarbonization, including decarbonization pathways, cost impacts, and other specific topics.

Clean Energy Targets

New state clean energy standards, renewable portfolio standards, or technology-specific capacity targets, or changes to existing targets. Changes to implementation rules, such as eligible technologies and facility sizes, covered entities, and alternative compliance payment rates are also included.

Emission Targets and Carbon Policies

New state greenhouse gas emission reduction targets or modifications to existing targets. Changes to implementation rules for emission reduction targets are also included, as well as state or regional carbon pricing policies, such as carbon taxes or cap-and-trade programs.

Planning and Procurement Rules

Changes to rules governing the utility integrated resource planning process, as well as rules governing utility procurement of electric generation resources or retirement of existing utility-owned generation facilities.

Utility Integrated Resource Plans

Integrated resource plans recently filed by investor-owned utilities and actively under review by regulators, as well as utility efforts to develop an integrated resource plan in advance of filing the plan with regulators.

Generation Capacity Changes

Utility-initiated requests to build, acquire, convert, or retire generation facilities, as well as utility green tariffs for large customers and state- or utility-led competitive procurements for electric generation resources (excluding utility requests for approval of individual power purchase agreements and competitive procurements for unbundled renewable energy certificates).

Actions Excluded

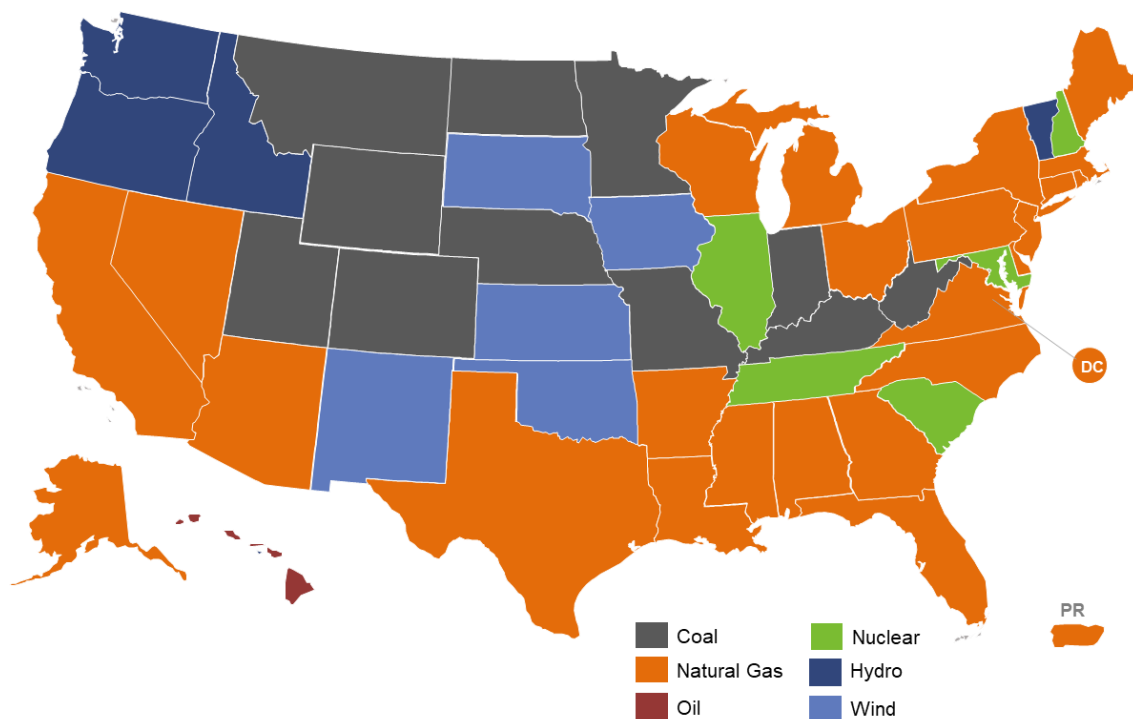
This report excludes actions that are specifically related to decarbonization of buildings, industrial processes, transportation, and agriculture. The report authors recognize that there are numerous important policy and regulatory issues related to clean energy project development that are highly relevant to overall electric power sector decarbonization. In order to maintain a well-defined scope of content, the report excludes actions specifically related to transmission and distribution planning, interconnection rules, and permitting and siting rules. Distribution system planning efforts are covered in the 50 States of Grid Modernization quarterly report, as well as a multitude of policies pertaining specifically to energy storage. Actions specific to distributed generation and community solar are covered in the 50 States of Solar quarterly report, and actions related to transportation electrification are covered in the 50 States of Electric Vehicles quarterly report. As noted above, utility requests for approval of individual power purchase agreements and competitive procurements for unbundled renewable energy certificates are excluded from this report.

DECARBONIZING THE U.S. ELECTRIC POWER SECTOR

The electric power sector in the U.S. is the second largest source of greenhouse gas emissions, behind the transportation sector, with a majority of its energy resources coming from fossil fuels. The industrial end-use sector is right behind it, followed by commercial and residential buildings. Together, these sectors account for approximately 90% of U.S. greenhouse gas emissions.* While the electric power sector itself accounts for 25% of emissions, efforts underway to electrify transportation, buildings, and industrial processes amplify the impact of decarbonizing the power sector.

Current federal government goals have the U.S. attaining a carbon pollution-free power sector by 2035 and a net-zero economy by 2050. As of now, 20 states have set clean or renewable energy standards or goals to reach net-zero emissions by 2050 at the latest. In addition, a plethora of electric utilities have announced net-zero or carbon neutrality goals for Scope 1, Scope 2 – and for some – Scope 3 emissions.†

Figure 1. Largest Contributing Resource to State Electric Generation Mix (2022)



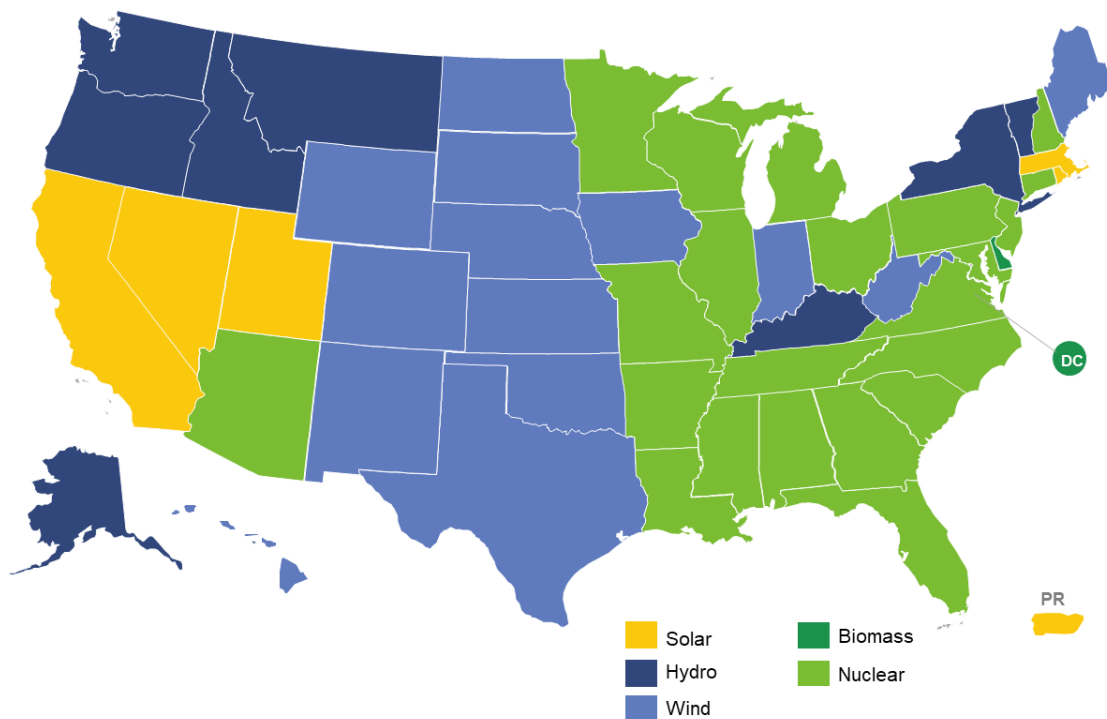
Data Source: U.S. Energy Information Administration – Electric Power Monthly, Net Generation by State by Type of Producer by Energy Source (Jan. – Dec. 2022).

* Environmental Protection Agency (EPA), *Sources of Greenhouse Gas Emissions*. EPA, May 2023, <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>.

† Smart Electric Power Alliance (SEPA), *Utility Carbon-Reduction Tracker™*. SEPA, May 2023, <https://sepapower.org/utility-transformation-challenge/utility-carbon-reduction-tracker/#:-:text=100%25%20carbon%2Dfree%20electricity%20by%20the%20end%20of%202030.&text=Carbon%20neutral%20scope%201%20and%202%20emissions%20by%202030.&text=Net%2Dzero%20scope%201%20and%202%20emissions%20by%202040.&text=Net%2Dzero%20CO2%20emissions%20by%202045>.

However, most U.S. states and the country as a whole still have a long way to go to achieve these goals. Natural gas (39.8%) and coal (19.5%) remain the nation’s dominant electric generation resources, and either natural gas, coal, or oil makes up the largest share of electricity generation in 36 states (See Figure 1).[‡] Despite the current dominance of fossil fuels, clean energy is becoming a mainstay in the nation’s energy mix, particularly as costs decline and states acquire cleaner resources to meet climate and other environmental objectives.

Figure 2. Largest Contributing Clean Resource to State Electric Generation Mix (2022)



Data Source: U.S. Energy Information Administration – Electric Power Monthly, Net Generation by State by Type of Producer by Energy Source (Jan. – Dec. 2022).

Nationwide, clean energy resources are currently led by nuclear (18.2%), followed by wind (10.2%), hydropower (6.2%), and solar (3.4%).[§] Across the country, these resource mixes vary greatly, with different resources leading each state’s clean electricity generation; currently, most states’ clean energy portfolios are led by either nuclear or wind energy (see Figure 2). The overall contribution of clean energy sources to states’ electricity generation also varies widely, ranging from 3% to 99% in 2022 (see Figure 3).

Power decarbonization involves a wide range of potential pathways and technological solutions, allowing decision-makers to pursue a variety of combinations that, in theory, lead to the same

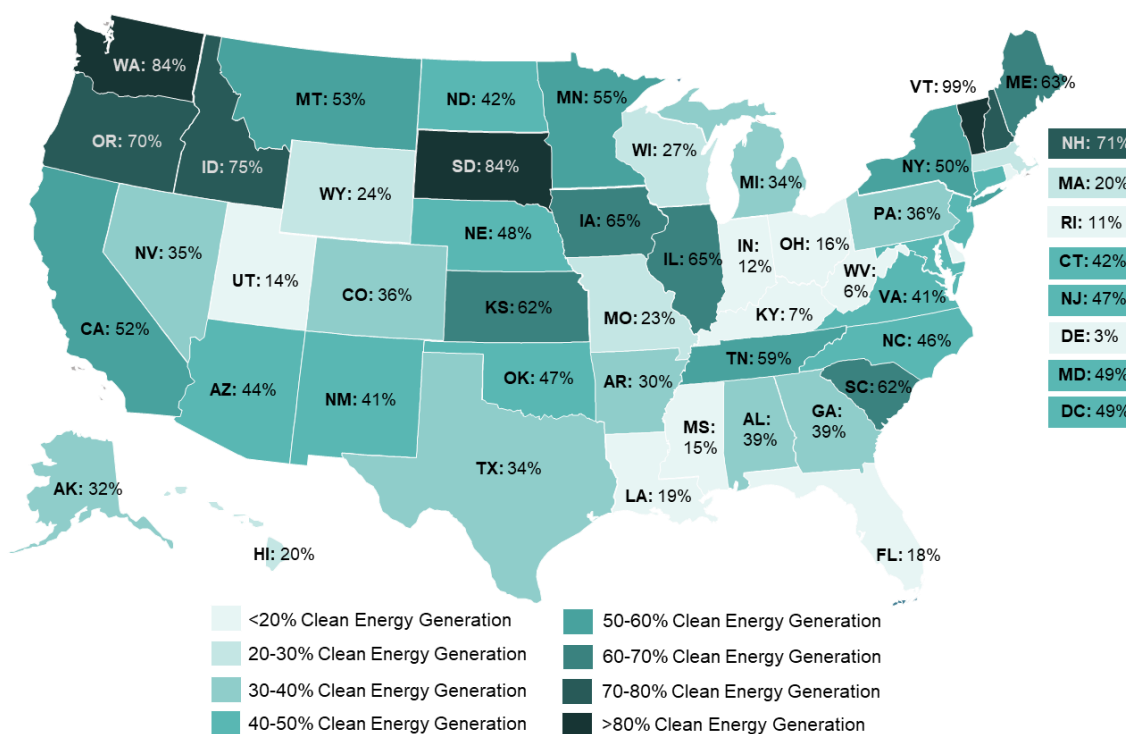
[‡] U.S. Energy Information Administration (EIA), *What is U.S. electricity generation by energy source?* U.S. EIA, February 2023, <https://www.eia.gov/tools/faqs/faq.php?id=427&t=3>. and U.S. EIA, *Electric Power Monthly, Net Generation by State by Type of Producer by Energy Source* (Jan. – Dec. 2022). <https://www.eia.gov/electricity/data/state/>.

[§] U.S. EIA, *What is U.S. electricity generation by energy source?* U.S. EIA, February 2023, <https://www.eia.gov/tools/faqs/faq.php?id=427&t=3>.

end goal. However, the cost of each pathway can vary dramatically, and challenges like global supply chains, transmission access, interconnection queues, and local permitting can impact the actual feasibility and timeline of each pathway. The timescale for implementation is a critical consideration for meeting climate goals, while cost is also highly important to minimize adverse economic impacts on individuals and businesses, particularly low-income households.

Another major factor influencing U.S. power decarbonization is the federal Inflation Reduction Act, signed into law in 2022. The Act includes significant incentives, including an array of tax credits and grants, for clean energy development and greenhouse gas emission reduction projects, upending the assumptions used in most existing technology deployment projections, cost-benefit analyses, and utility resource plans.

Figure 3. Percentage of Clean Electricity Generated by State (2022)



Data Source: U.S. Energy Information Administration – Electric Power Monthly, Net Generation by State by Type of Producer by Energy Source (Jan. – Dec. 2022). Map represents percent of total MWh generated in each state from clean energy sources (biomass, geothermal, hydroelectric, nuclear, solar, and wind).

Although there is much work to be done from where we currently stand to achieve state and utility power decarbonization goals, the future is looking bright. Power decarbonization is being actively considered by policymakers and regulators in nearly every state in the nation, and clean energy resources are dominating most states’ planned electric generation capacity additions in both the near-term and long-term. Meanwhile, states are working to create regulatory structures that will support the achievement of power decarbonization goals in the most fair and efficient ways.

EXECUTIVE SUMMARY

2023 POWER DECARBONIZATION ACTION

In 2023, all 50 states plus DC and Puerto Rico took a total of 609 actions related to electric power decarbonization and resource planning. Table 1 provides a summary of state and utility actions on these topics. Of the 609 actions tracked, the most common were related to clean energy targets (159), planning and procurement rules (124), and electric generation capacity changes (112).

Table 1. 2023 Summary of Power Decarbonization Actions

Type of Action	# of Actions	% by Type	# of States
Clean Energy Targets	159	26%	33 + DC
Planning and Procurement Rules	124	20%	38
Electric Generation Capacity Changes	112	18%	42 + PR
Utility Integrated Resource Plans	77	13%	30 + PR
Studies and Investigations	71	12%	29
Emissions Targets & Carbon Policies	66	11%	24
Total	609	100%	50 States + DC, PR

Note: The “# of States/ Districts” total is not the sum of the rows because some states have multiple actions. Percentages are rounded and may not add up to 100%.

TOP TEN MOST ACTIVE STATES OF 2023

Ten states taking the greatest number of actions related to power decarbonization and resource planning, or some of the most impactful actions, are noted below.

Michigan

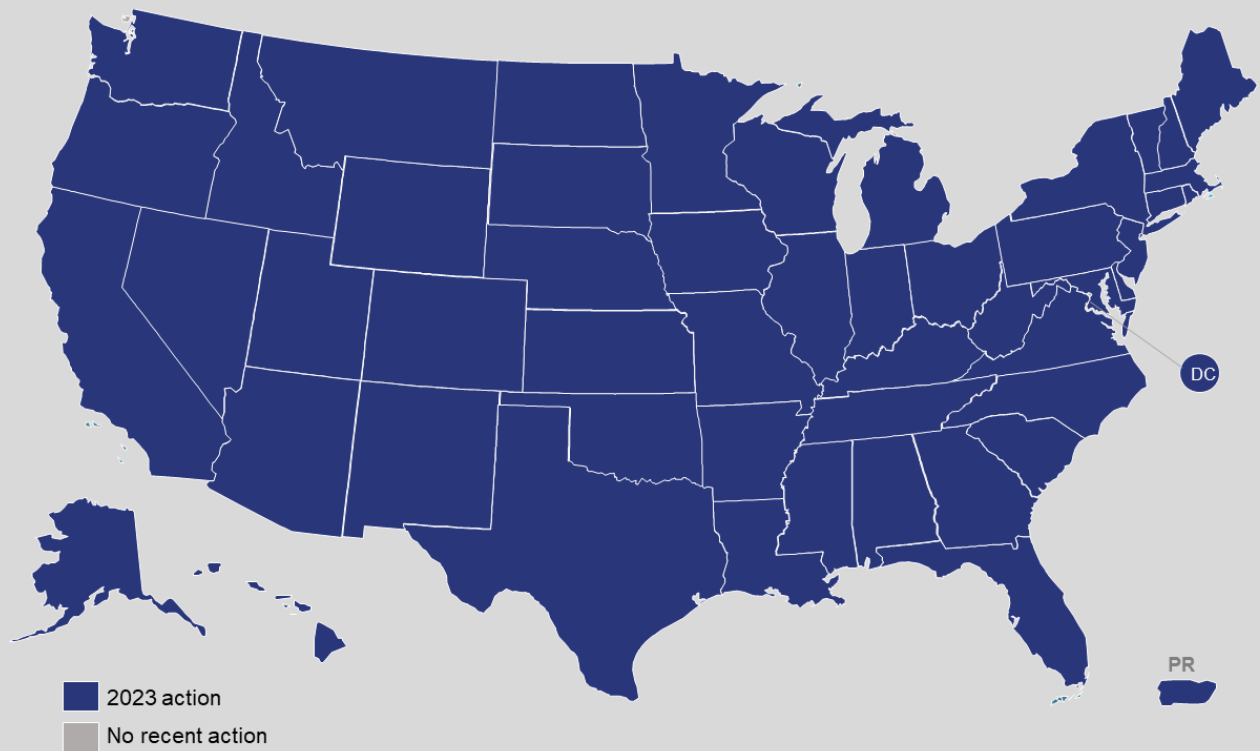
Michigan lawmakers enacted legislation increasing the state’s renewable portfolio standard to 60% by 2035 and establishing a 100% clean energy standard to be achieved by 2040. The legislation also creates an energy storage target of 2,500 MW by 2030. Lawmakers also enacted bills initiating a long-duration energy storage study and modifying resource planning rules, while regulators approved integrated resource plans for DTE Electric and Indiana Michigan Power.

Minnesota

Minnesota legislators enacted a bill setting a 100% by 2040 carbon-free energy standard, while increasing the state’s renewable portfolio standard to 55% by 2035. State lawmakers also

enacted a bill initiating a study to determine the optimal energy storage system capacity to be installed by utilities in the state. Regulators approved Minnesota Power’s integrated resource plan early in the year, while Minnesota Power and Xcel Energy released RFPs for solar and wind capacity.

Figure 4. 2023 Action on Power Decarbonization and Resource Planning



Colorado

In Colorado, state legislators enacted bills adopting new economy-wide and power sector greenhouse gas emission reduction goals. The bills set a target for 100% overall emission reduction by 2050 (over 2005 levels) and 80% emission reduction by 2030 for retail electric sales (compared to 2005 levels). Lawmakers also enacted a bill directing the Colorado Energy Office to prepare a carbon management roadmap and the Public Utilities Commission to examine geothermal and hydrogen.

Maine

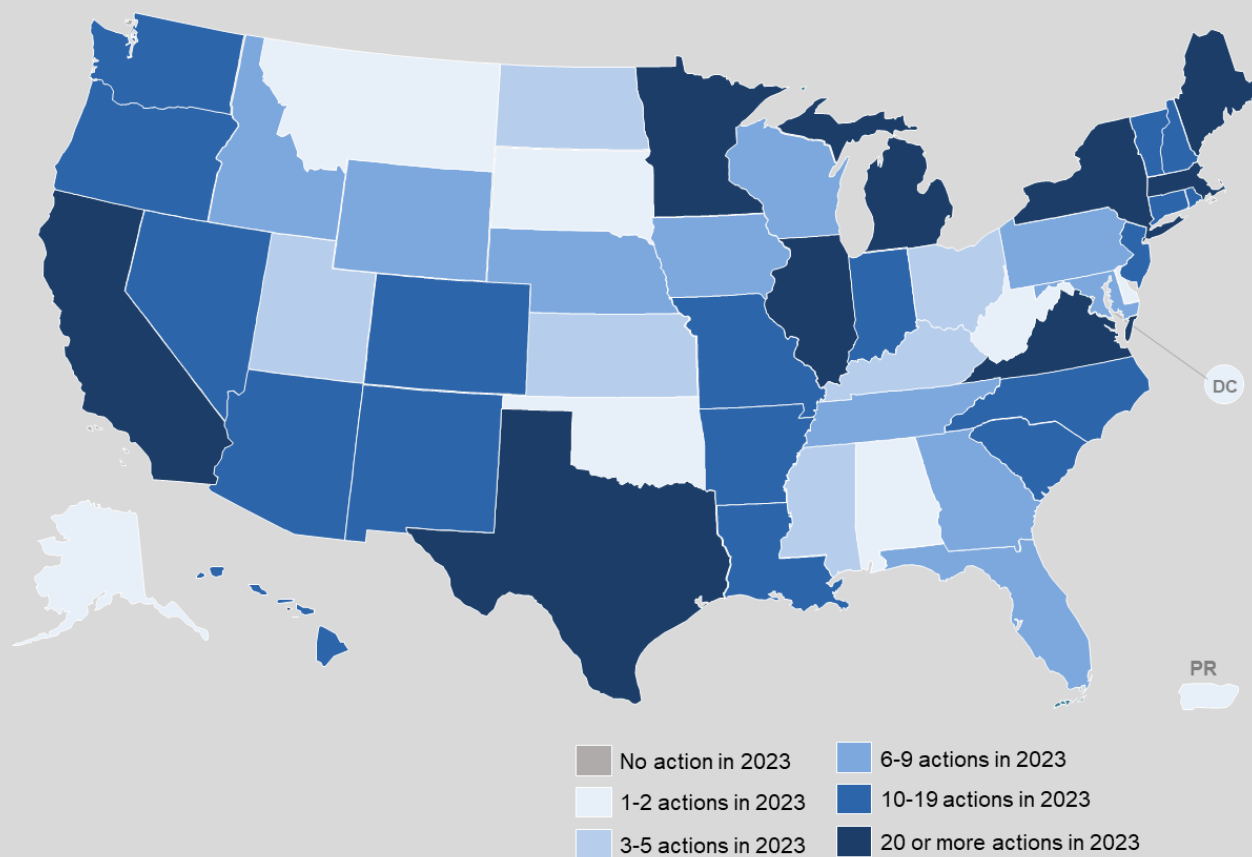
In Maine, state legislators enacted several bills during the year, including legislation establishing an offshore wind target, addressing resource procurement, and directing the

Governor's Energy Office and Public Utilities Commission to review impacts of the state's renewable portfolio standard. Meanwhile, the Governor's Energy Office kicked off its Maine Energy Plan: Pathway to 2040 effort.

North Carolina

The North Carolina's Governor's Office released its Deep Decarbonization Pathways Analysis, while state lawmakers approved legislation changing the state's renewable portfolio standard to a clean energy standard. The North Carolina Utilities Commission approved rules to merge the carbon plan and integrated resource plan processes, and Duke Energy filed its first combined carbon plan and integrated resource plan.

Figure 5. 2023 Action on Power Decarbonization and Resource Planning, by Number of Actions



Virginia

Virginia lawmakers enacted several bills during the year, including legislation modifying integrated resource planning requirements, allowing biomass-fired generating units to continue

operation, and accelerating offshore wind procurement targets. The state also took steps to withdraw from the Regional Greenhouse Gas Initiative, with several environmental groups challenging this action. Dominion Energy filed an integrated resource plan, while utilities also released RFPs for solar and energy storage resources.

Figure 6. Most Active States of 2023

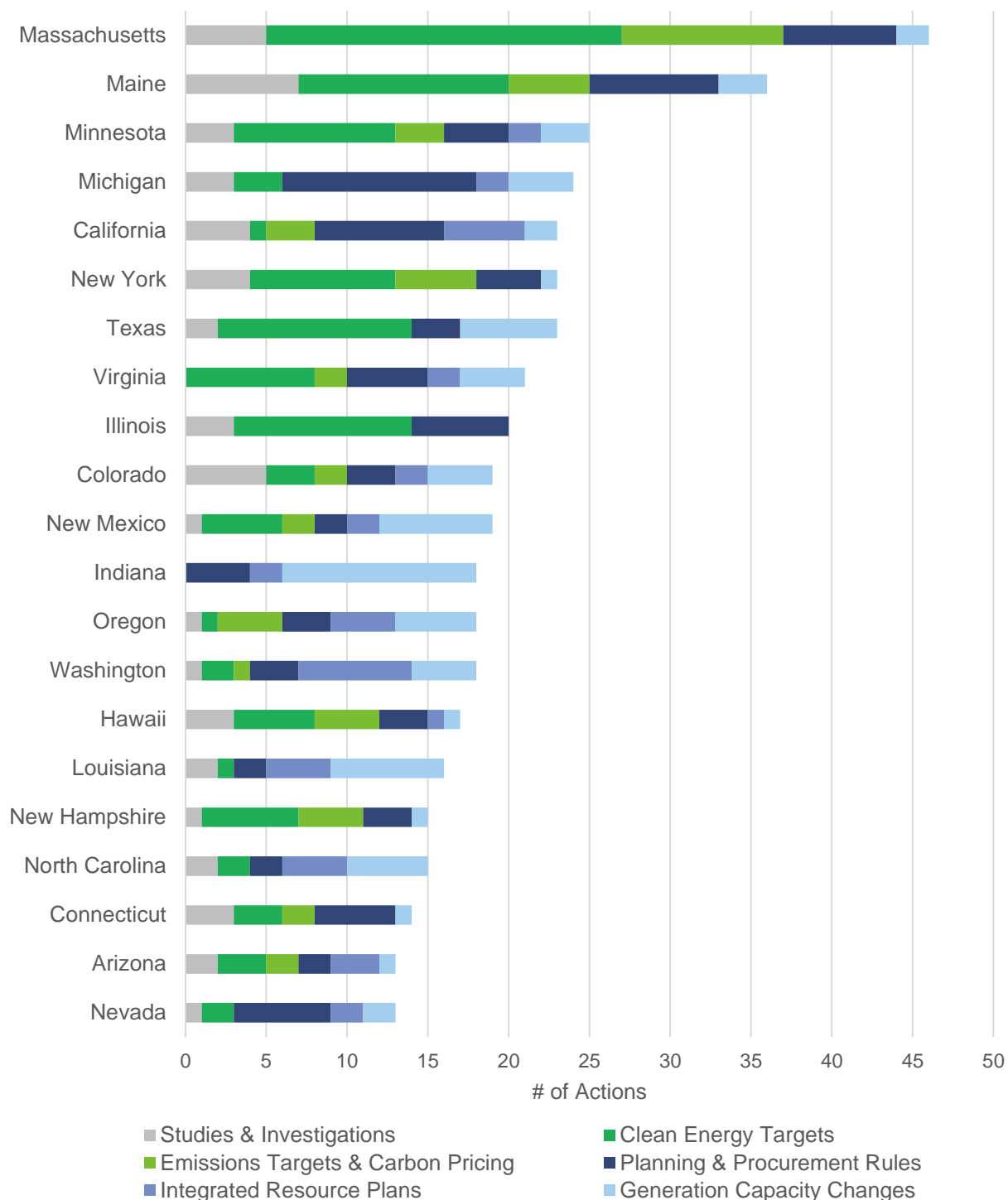
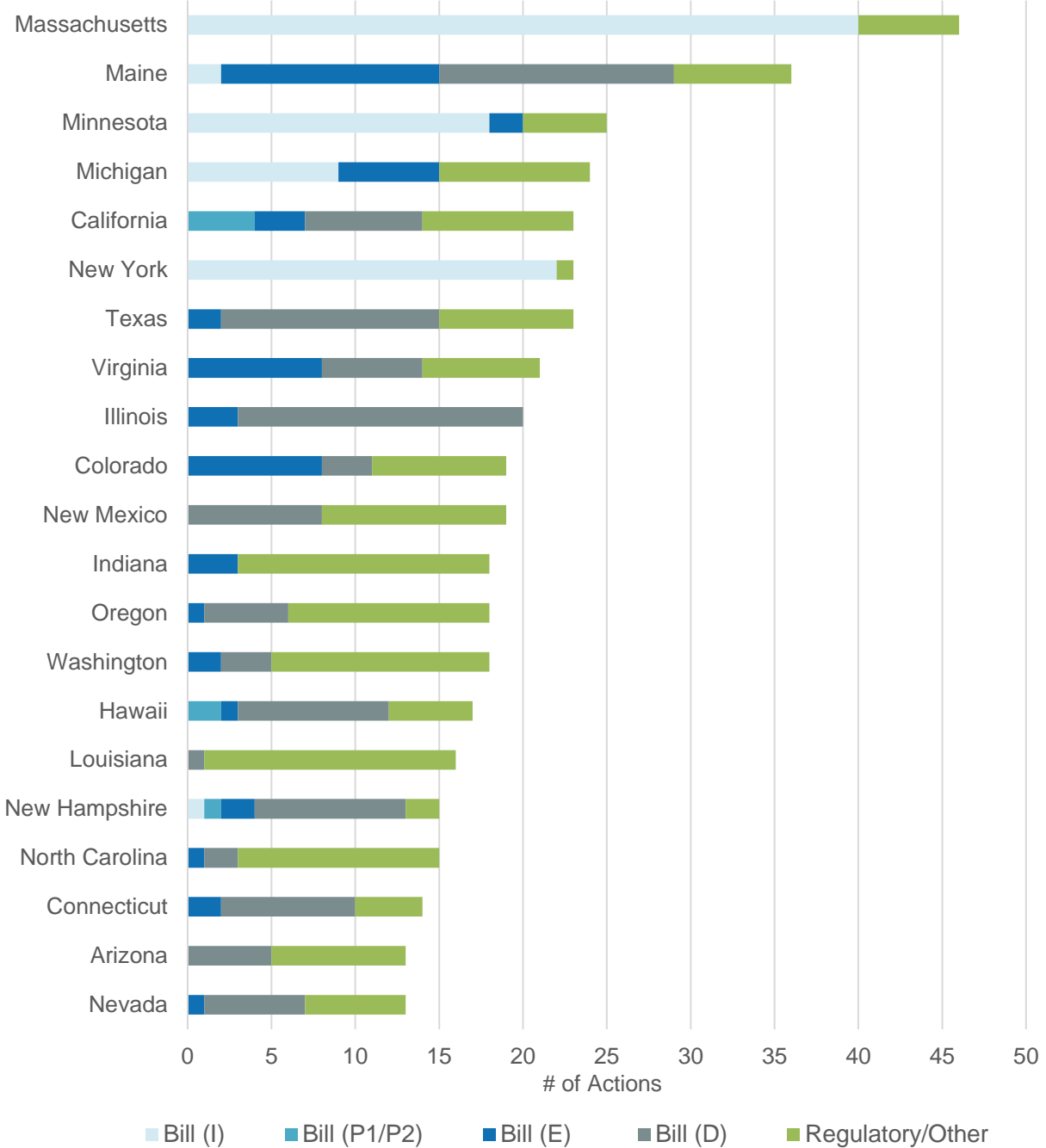


Figure 7. Most Active States of 2023, by Action Status



Connecticut

Connecticut’s Department of Economic and Community Development published an offshore wind strategic roadmap, and the Department of Energy and Environmental Protection released RFPs for offshore wind and zero-carbon resources. Meanwhile, state lawmakers enacted legislation modifying eligibility requirements for compliance with the state’s renewable portfolio standard and initiating a study on the feasibility of advanced nuclear in the state.

Hawaii

The Hawaii Energy Office released its Pathways to Decarbonization report in 2023, which evaluates four decarbonization scenarios to meet the state's emission targets. The HECO companies also filed their final integrated grid plan, as well as a supplemental report to elaborate upon its plans. HECO also issued an RFP for firm renewable capacity and selected 15 projects, which use solar-plus-storage, biofuels, renewable combined heat and power, and wind.

Maryland

Maryland lawmakers enacted legislation during the year increasing the state's offshore wind development target to 8,500 MW by 2031 and proposing an analysis of transmission system upgrade options to accommodate offshore wind infrastructure. Legislators also created an energy storage target for the state of 3,000 MW by 2033. The Public Service Commission is working to develop a program to help the state achieve this target, including guidelines for procurement of energy storage resources.

Delaware

Although Delaware's actions on power decarbonization and resource planning were few in number, they were particularly significant. State lawmakers enacted legislation establishing a statewide target to reach net-zero carbon emissions by 2050 and requiring the creation of a state climate action plan. Legislators also enacted a bill directing the state energy office to prepare a state energy plan to support emission reduction targets.

TOP POWER DECARBONIZATION TRENDS OF 2023

States Establishing 100% Clean Energy Targets

A significant trend in 2023 was that of states setting 100% clean energy targets. Lawmakers in two states – Michigan and Minnesota – increased their renewable energy standards while adopting new 100% clean electricity targets. Meanwhile, Delaware legislators adopted a target to achieve net-zero greenhouse gas emissions, and New Jersey's governor signed an executive order for the state to achieve 100% clean electricity.

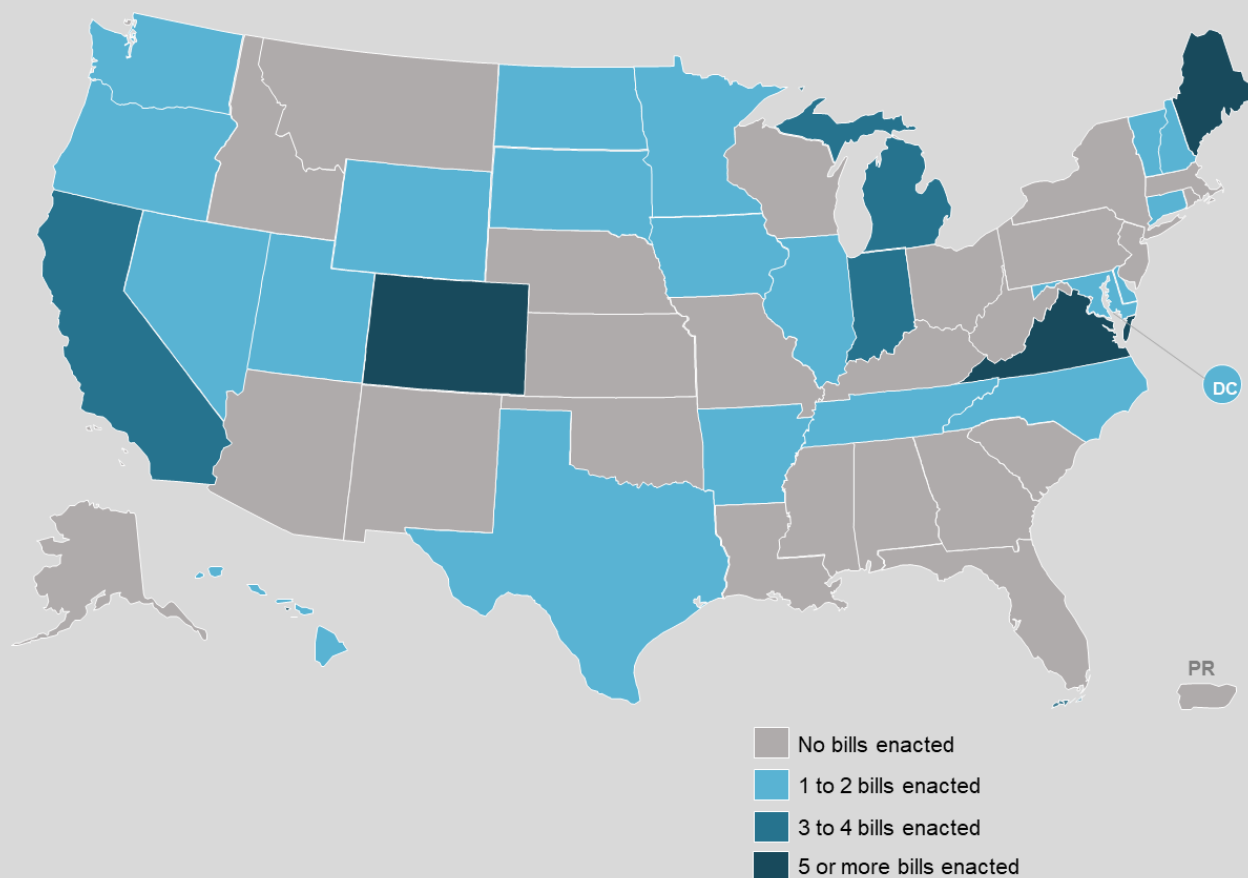
Renewables Dominating Planned Capacity Additions in Integrated Resource Plans

Across the country, renewable energy resources are making up the majority of utilities' planned generation capacity additions in their integrated resource plans. In 2023, the most prevalent resources included in utilities' planned generation capacity additions were solar (120,913 MW), wind (70,863 MW), and battery storage (34,247 MW). Of the 27 states with utility integrated resource plans under consideration in 2023, solar, wind, or storage was the largest planned resource addition in all but four of these states.

Modifying Resources Eligible for Compliance with Clean and Renewable Energy Targets

Lawmakers in several states with existing clean or renewable energy targets considered modifications to the resources eligible for compliance with these standards. Most of these changes pertain to the eligibility of nuclear, biomass, hydropower, and hydrogen resources. For example, Connecticut legislators redefined the types of hydropower facilities eligible for compliance and opened up eligibility to new nuclear generation.

Figure 8. Power Decarbonization and Resource Planning Legislation Enacted in 2023



State Lawmakers Promoting Offshore Wind Development

Policymakers in a number of states took actions to promote offshore wind development during the year. Maryland lawmakers increased the state's offshore wind deployment target to 8,500 MW, while Virginia lawmakers moved up the timeline for achieving the state's existing offshore wind target, and Maine legislators set a new offshore wind development goal of 3,000 MW.

Utilities Planning for Growing Electricity Demand

A trend emerging in utility integrated resource plans is that of planning for significantly increased electricity demand. In the Carolinas, Duke Energy refiled its carbon plan and integrated resource plan based on major increases in its load forecast. Arizona Public Service noted in its recent plan that the utility is planning for annual growth rates of 2.4% in peak demand and 3.7% in energy needs, largely driven by data center and large industrial customer growth, as well as electric vehicle adoption.

Studying the Feasibility of Advanced Nuclear

A trend among many states has been studying the feasibility of advanced nuclear and its potential to contribute to power sector decarbonization. The Michigan Public Service Commission completed a study on the feasibility of nuclear power generation in the state, while Arizona regulators opened a new proceeding to examine the feasibility of advanced nuclear. Connecticut legislators also initiated a study on the feasibility of small modular reactors, advanced nuclear reactors, and fusion energy facilities.

Utilities Proposing Hydrogen-Capable Natural Gas Generation Additions

Although renewables were the most prevalent planned capacity additions in utility integrated resource plans during 2023, several of these also include intentions to add new hydrogen-capable natural gas generation units, with hopes that green hydrogen will be available as a fuel source to support clean dispatchable generation in the future. Some of the utilities planning to add hydrogen-capable gas plants include Arizona Public Service, Avista Utilities, Duke Energy, and Puget Sound Energy.

Undertaking Economy-Wide Decarbonization Efforts

States are increasingly adopting economy-wide or multi-sector decarbonization goals and undertaking studies examining pathways to decarbonization across multiple sectors. In 2023, the Hawaii State Energy Office released a study on pathways to achieving economy-wide decarbonization goals, while Delaware lawmakers enacted legislation adopting economy-wide greenhouse gas emission reduction targets.

Utilities Pursuing All-Source Competitive Procurements

Many utilities across the country are utilizing all-source competitive procurement mechanisms to identify and procure the most cost-effective resource options to meet system needs. In some cases, utilities are also leaving resource options open while specifying characteristics, such as dispatchable, firm, or renewable. Some of the utilities releasing all-source RFPs during the year include AES Indiana, Arizona Public Service, Evergy, NV Energy, Public Service Company of Oklahoma, and SWEPCO.

Q4 2023 POWER DECARBONIZATION ACTION

In the fourth quarter of 2023, 46 states plus Puerto Rico took a total of 333 actions related to electric power decarbonization and resource planning. Table 2 provides a summary of state and utility actions on these topics. Of the 333 actions tracked, the most common were related to electric generation capacity changes (74), clean energy targets (72), and utility integrated resource plans (62).

Table 2. Q4 2023 Summary of Grid Modernization Actions

Type of Action	# of Actions	% by Type	# of States
Electric Generation Capacity Changes	74	22%	34 + PR
Clean Energy Targets	72	22%	18
Utility Integrated Resource Plans	62	19%	26 + PR
Planning and Procurement Rules	58	17%	25
Studies and Investigations	36	11%	19
Emissions Targets & Carbon Policies	31	9%	14
Total	333	100%	46 States + PR

Note: The “# of States/ Districts” total is not the sum of the rows because some states have multiple actions. Percentages are rounded and may not add up to 100%.

TOP 5 POWER DECARBONIZATION ACTIONS OF Q4 2023

Five of the quarter’s top policy developments are highlighted below.

Michigan Lawmakers Adopt Clean Energy Standard

Michigan lawmakers enacted legislation in November 2023 increasing the state’s renewable portfolio standard to 60% by 2035 and establishing a new 100% clean energy standard to be achieved by 2040. The bill also creates an energy storage target of 2,500 by 2030 and directs the Public Service Commission to complete a study of long-duration energy storage resources.

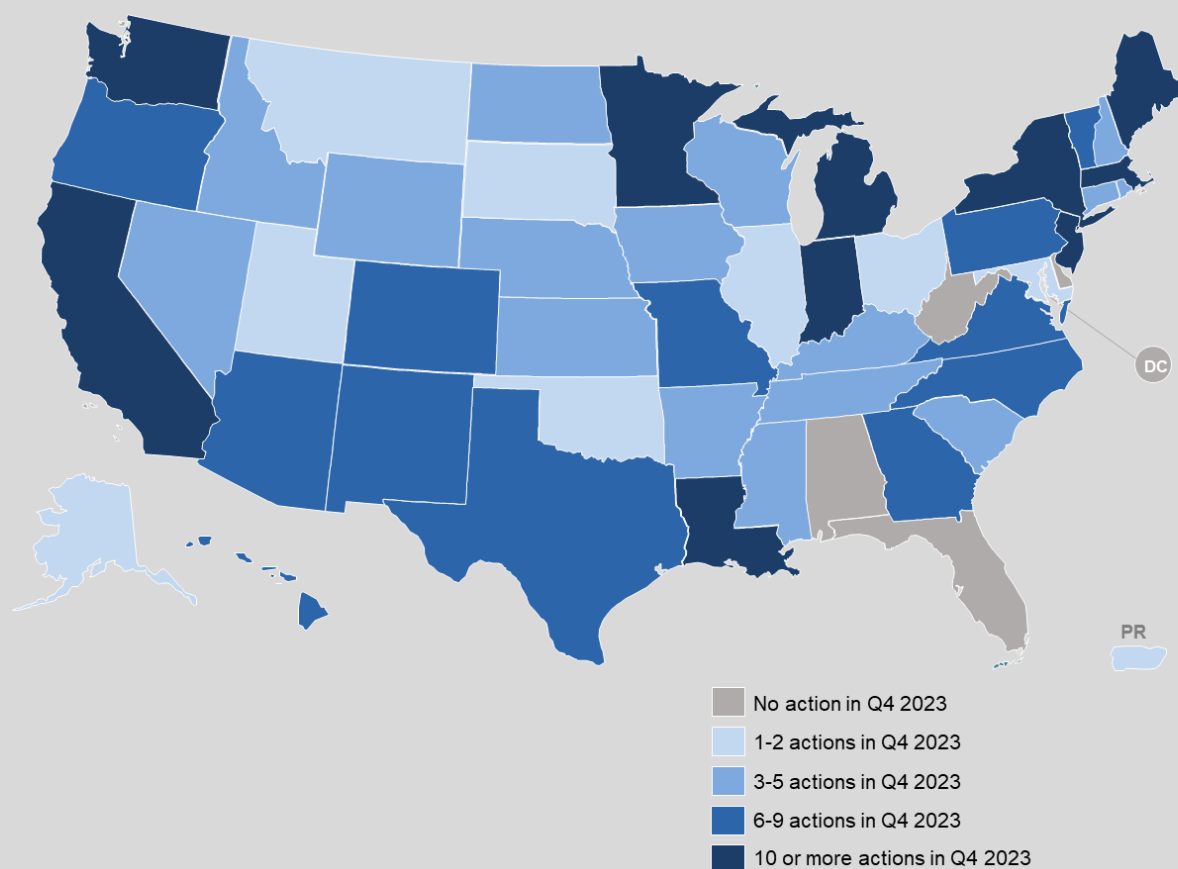
Arizona Utilities File Integrated Resource Plans

Arizona’s three investor-owned utilities – Arizona Public Service (APS), Tucson Electric Power (TEP), and UNS Electric – filed their 2023 integrated resource plans in November 2023. All three utilities have plans to add hydrogen-capable natural gas generation, solar, energy storage, and wind resources over the next 15 years, with the majority of the additions coming from renewables and storage.

Hawaii Energy Office Releases Decarbonization Pathways Study

In December 2023, the Hawaii Energy Office released its Pathways to Decarbonization study, which evaluates four decarbonization scenarios that would achieve the state's emission reduction targets. The four scenarios include a business as usual case, a case using widespread electrification and fuel switching, a case building on this and including additional demand reductions in buildings and transportation, and a case that uses alternative measures like sustainable aviation fuel and negative emissions technologies to meet emissions targets.

Figure 10. Q4 2023 Action on Power Decarbonization and Resource Planning



PNM and Xcel Energy Submit Integrated Resource Plans in New Mexico

In New Mexico, PNM and Xcel Energy filed their 2023 integrated resource plans during Q4 2023. PNM plans to add 2,238 MW of solar, 2,042 MW of storage, 1,160 MW of natural gas, 592 MW of wind, and 592 MW of hydrogen generation by 2042, while Xcel Energy is planning to add approximately 7,960 – 11,200 MW of storage, 7,720 – 9,840 MW of wind, and 2,769 – 3,680 MW of solar by 2043.

Northeastern States File Offshore Wind Memorandum of Understanding

In October 2023, the Connecticut Department of Energy and Environmental Protection, Massachusetts Department of Energy Resources, and Rhode Island Office of Energy Resources signed a memorandum of understanding regarding offshore wind coordination. When conducting solicitations for offshore wind, each state will consider participation and coordination with the other two, particularly for multi-state bids.

POWER DECARBONIZATION: LOOKING AHEAD

Although coal and natural gas currently account for the majority of U.S. electricity generation, solar and wind are making up the largest planned generation capacity additions for most utilities. Among integrated resource plans (IRPs) recently filed or under review by regulators in Q4 2023, planned capacity additions totaled 84,123 MW for solar, 56,727 MW for wind, 50,492 MW for storage, and 28,334 MW for natural gas, while planned coal retirements totaled 39,165 MW.

Figure 11. Q4 2023 Utility IRP Action, by Largest Planned Resource Addition

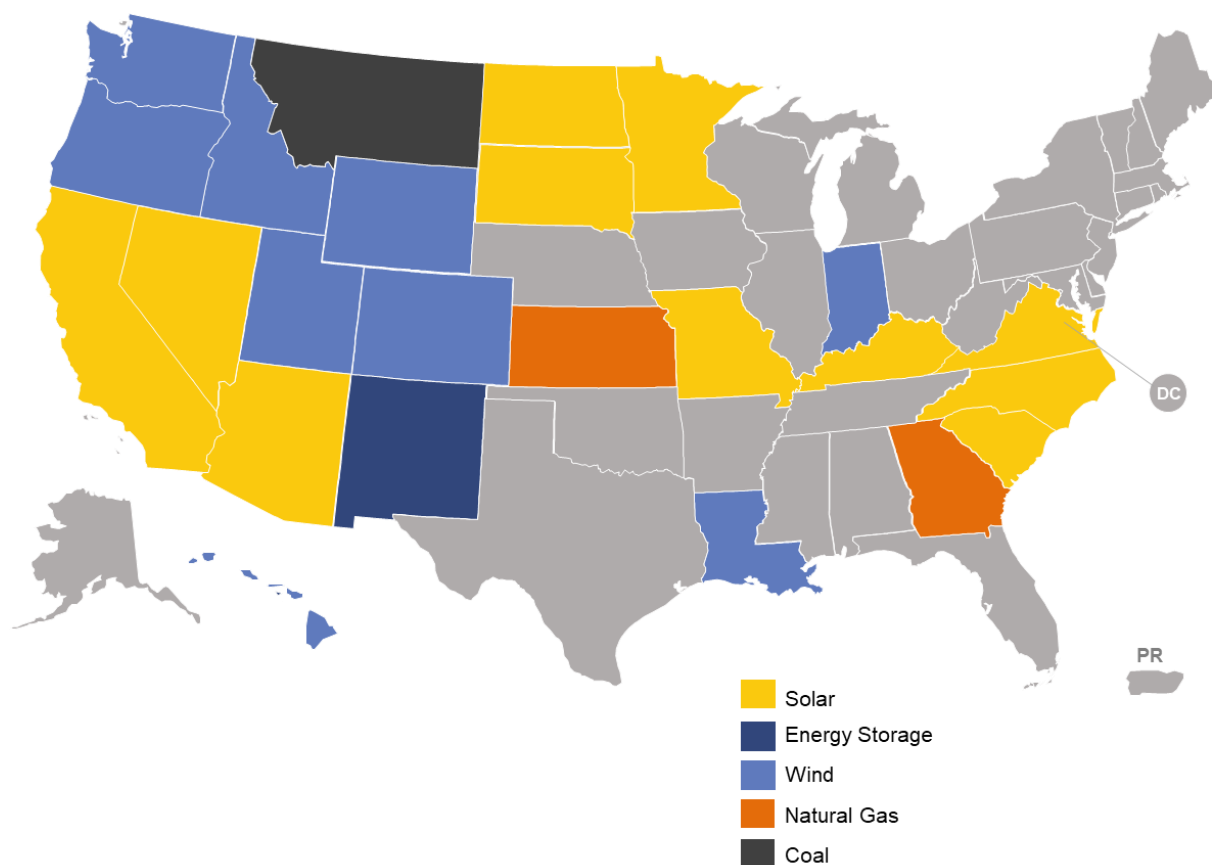
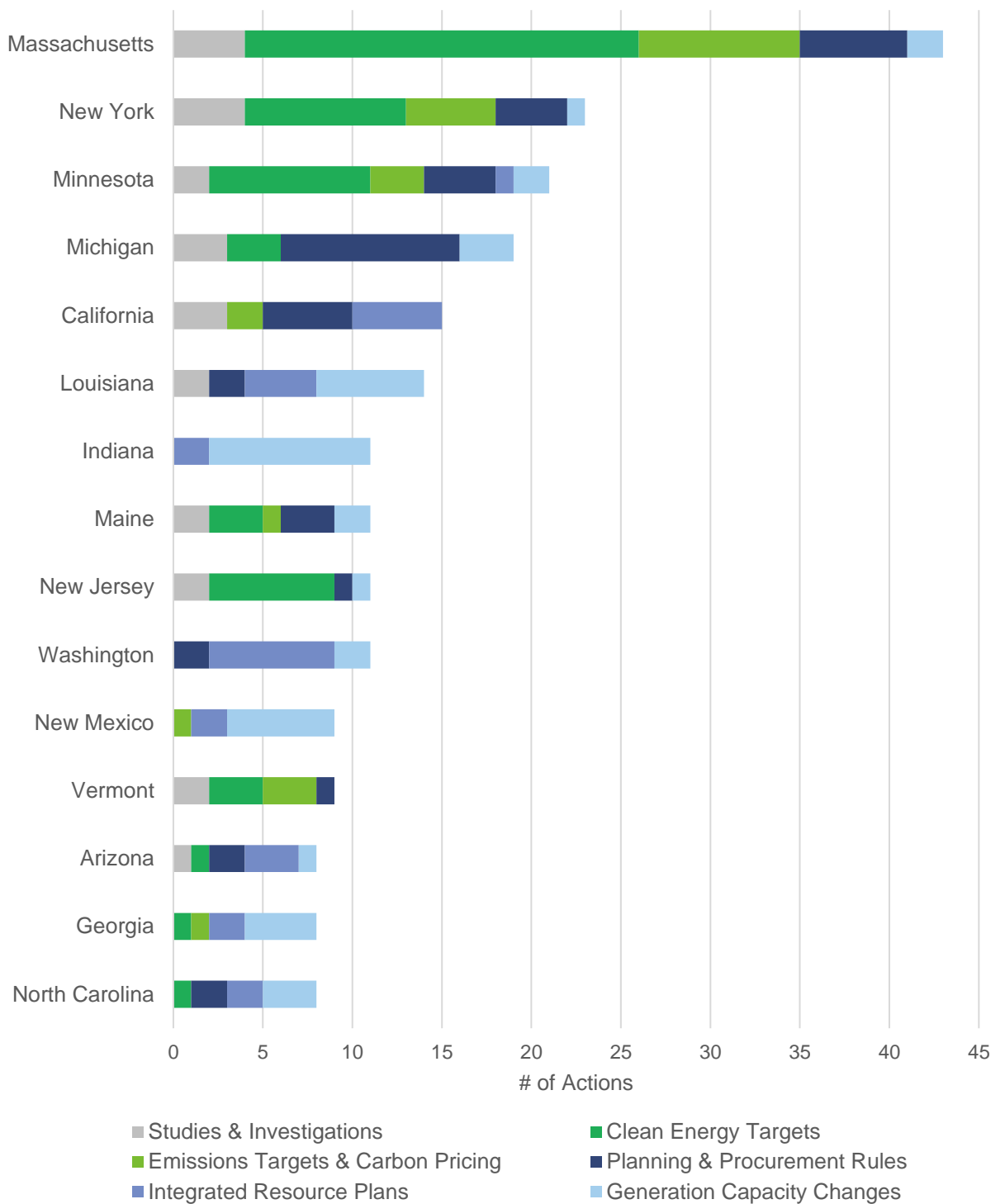


Figure 12. Most Active States of Q4 2023



FULL REPORT PRICING DETAILS

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50 States of Power Decarbonization Add-On to Any Other Subscription	\$1,200	N/A