50 STATES OF GRID MODERNIZATION

Q4 2023 Report & 2023 Annual Review

Executive Summary

NC CLEAN ENERGY TECHNOLOGY CENTER | DSIRE insight

January 2024

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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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PREFERRED CITATION

North Carolina Clean Energy Technology Center, *The 50 States of Grid Modernization: 2023 Review and Q4 2023 Quarterly Report,* January 2024.

COVER DESIGN CREDIT

Cover design by Amira Ferjani and Justin Lindemann

COVER PHOTO CREDIT

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Full editions of and annual subscriptions to the 50 States of Grid Modernization may be purchased here.

The 50 States of Grid Modernization is a quarterly publication. Previous executive summaries and older full editions of *The 50 States of Grid Modernization* are available here.
In addition to *The 50 States of Grid Modernization*, the NC Clean Energy Technology Center publishes additional quarterly reports called *The 50 States of Solar*, *The 50 States of Electric Vehicles,* and *The 50 States of Power Decarbonization*. These reports may be purchased at here. Executive summaries and older editions of these reports are available for download here.

ABOUT THE REPORT

WHAT IS GRID MODERNIZATION?

Grid modernization is a broad term, lacking a universally accepted definition. In this report, the authors use the term grid modernization broadly to refer to actions making the electricity system more resilient, responsive, and interactive. Specifically, in this report grid modernization includes legislative and regulatory actions addressing: (1) smart grid and advanced metering infrastructure, (2) utility business model reform, (3) regulatory reform, (4) utility rate reform, (5) energy storage, (6) microgrids, and (7) demand response.

PURPOSE

The purpose of this report is to provide state lawmakers and regulators, electric utilities, the advanced energy industry, and other energy stakeholders with timely, accurate, and unbiased updates about how states are choosing to study, adopt, implement, amend, or discontinue policies associated with grid modernization. This report catalogues proposed and enacted legislative, regulatory, and rate design changes affecting grid modernization during the most recent quarter.

The 50 States of Grid Modernization report series provides regular quarterly updates and annual summaries of grid modernization policy developments, keeping stakeholders informed and up to date.

APPROACH

The authors identified relevant policy changes and deployment proposals 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 the changing U.S. electric grid:

- How are states adjusting traditional utility planning processes to better allow for consideration of advanced grid technologies?
- What changes are being made to state regulations and wholesale market rules to allow market access for distributed energy resources?
- How are states and utilities reforming the traditional utility business model and rate designs?

- What policy actions are states taking to grow markets for energy storage and other advanced grid technologies?
- Where and how are states and utilities proposing and deploying advanced grid technologies, energy storage, microgrids, and demand response programs?

Actions Included

This report focuses on cataloguing and describing important proposed and adopted policy changes related to grid modernization and distributed energy resources, *excluding policies specifically intended to support only solar technologies*. While some areas of overlap exist, actions related to distributed solar policy and rate design are tracked separately in the *50 States of Solar report series,* and are generally not included in this report.

In general, this report considers an "action" to be a relevant (1) legislative bill that has been introduced or (2) a regulatory docket, utility rate case, or rulemaking proceeding. Only statewide actions and those related to investor-owned utilities are included in this report. Specifically, actions tracked in this issue include:

Studies and Investigations

Legislative or regulatory-led efforts to study energy storage, grid modernization, utility business model reform, or alternative rate designs, e.g., through a regulatory docket or a cost-benefit analysis.

Planning and Market Access

Changes to utility planning processes, including integrated resource planning, distribution system planning, and evaluation of non-wires alternatives, as well as changes to state and wholesale market regulations enabling market access.

Utility Business Model and Rate Reform

Proposed or adopted changes to utility regulation and rate design, including performance-based ratemaking, decoupling, time-varying rates, and residential demand charges.

Grid Modernization Policies

New state policy proposals or changes to existing policies related to grid modernization, including energy storage targets, energy storage compensation rules, interconnection standards, and customer data access policies.

Financial Incentives for Energy Storage and Advanced Grid Technologies

New statewide incentives or changes to existing incentives for energy storage, microgrids, and other modern grid technologies.

Deployment of Advanced Grid Technologies

Utility-initiated requests, as well as proposed legislation, to implement demand response programs or to deploy advanced metering infrastructure, smart grid technologies, microgrids, or energy storage.

Actions Excluded

This report excludes utility proposals for grid investments that do not include any specific grid modernization component, as outlined above, as well as specific projects that have already received legislative or regulatory approval. Actions related exclusively to pumped hydroelectric storage or electric vehicles are not covered by this report (a separate report series available from the NC Clean Energy Technology Center covers electric vehicle actions). Time-varying and residential demand charge proposals are only documented if they are being implemented statewide, the default option for all residential customers of an investor-owned utility, or a notable pilot program. Actions related to inclining or declining block rates are not included in this report. While actions taken by municipal utilities and electric cooperatives are not comprehensively tracked in this report, particularly noteworthy or high-impact actions are included. The report also excludes changes to policies and rate design for distributed generation customers; these changes are covered in the 50 States of Solar quarterly report.

EXECUTIVE SUMMARY

2023 GRID MODERNIZATION ACTION

In 2023, all 50 states plus DC and Puerto Rico took a total of 774 policy and deployment actions related to grid modernization, utility business model and rate reform, energy storage, microgrids, and demand response. Table 1 provides a summary of state and utility actions on these topics. Of the 774 actions identified, the most common were related to policies (170), followed by utility business model and rate reform (130), and financial incentives (126).

Table 1. 2023 Summary of Grid Modernization Actions

Type of Action	# of Actions	% by Type	# of States
Policies	170	22%	36 + PR
Business Model and Rate Reform	130	17%	41 + DC
Financial Incentives	126	16%	37 + PR
Planning and Market Access	121	16%	32 + DC, PR
Deployment	118	15%	38
Studies and Investigations	109	14%	34 + DC, PR
Total	**774**	**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 particularly impactful actions are noted below.

Connecticut

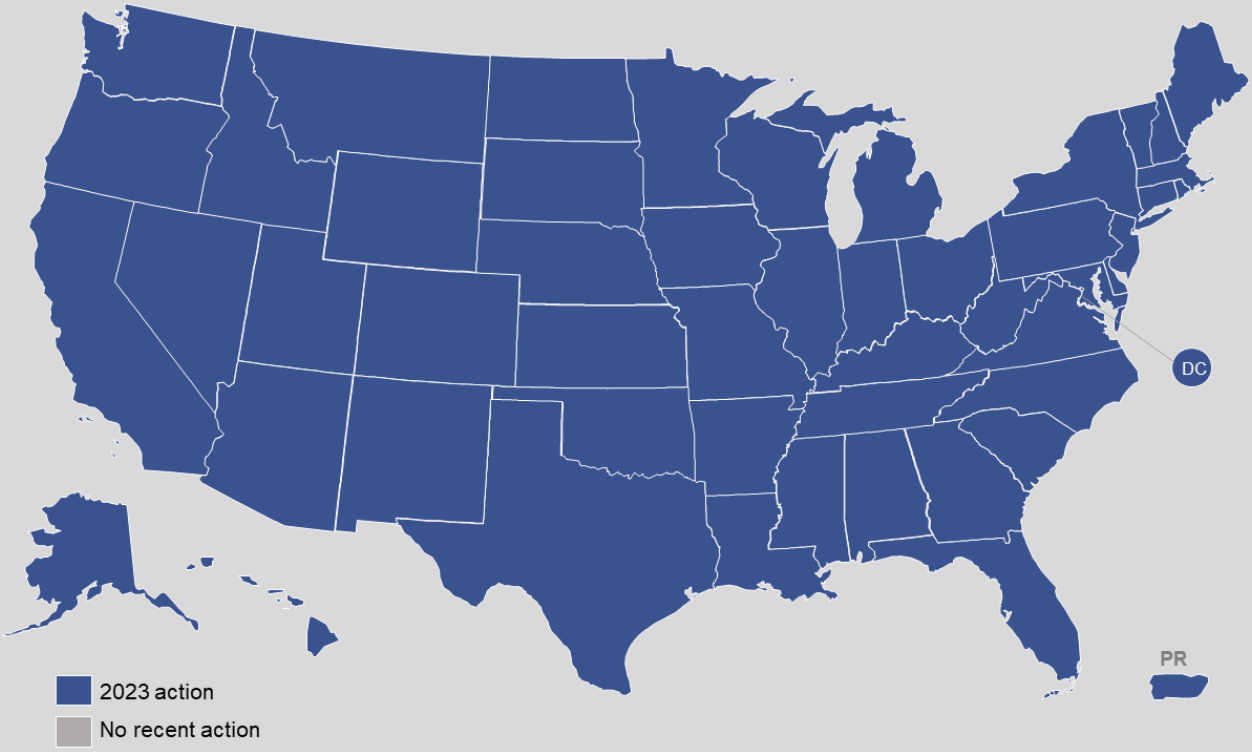
The Public Utilities Regulatory Authority (PURA) approved a framework for performance-based regulation in 2023 and opened new sub-proceedings on the topic. PURA issued a decision on AMI, which also addresses data access and requires utilities to file advanced rate design proposals. PURA also addressed interconnection, non-wires alternatives, resilience metrics, and distribution system planning. PURA increased its residential storage incentives, while a working group examined incentives for front-of-the-meter storage.

Maine

Maine lawmakers enacted legislation initiating studies on energy storage, rate design, and the design for a distribution system operator for the state. Regulators adopted revised interconnection rules and considered utility ownership and control of energy storage, as well

as rate design for energy storage. Utilities also filed draft climate protection plans, describing plans for climate change vulnerability studies and resilience plans. A referendum held in the fall asked voters to decide if a non-profit, customer-owned utility should be created.

Figure 1. 2023 Legislative and Regulatory Action on Grid Modernization



Michigan

Michigan lawmakers adopted an energy storage target and initiated a study on long-duration energy storage. The Public Service Commission initiated a workgroup on financial incentives and disincentives and held collaborative technical conferences on storage and resilience. Michigan utilities filed their distribution grid plans during the year, which include plans for a variety of investments in grid modernization.

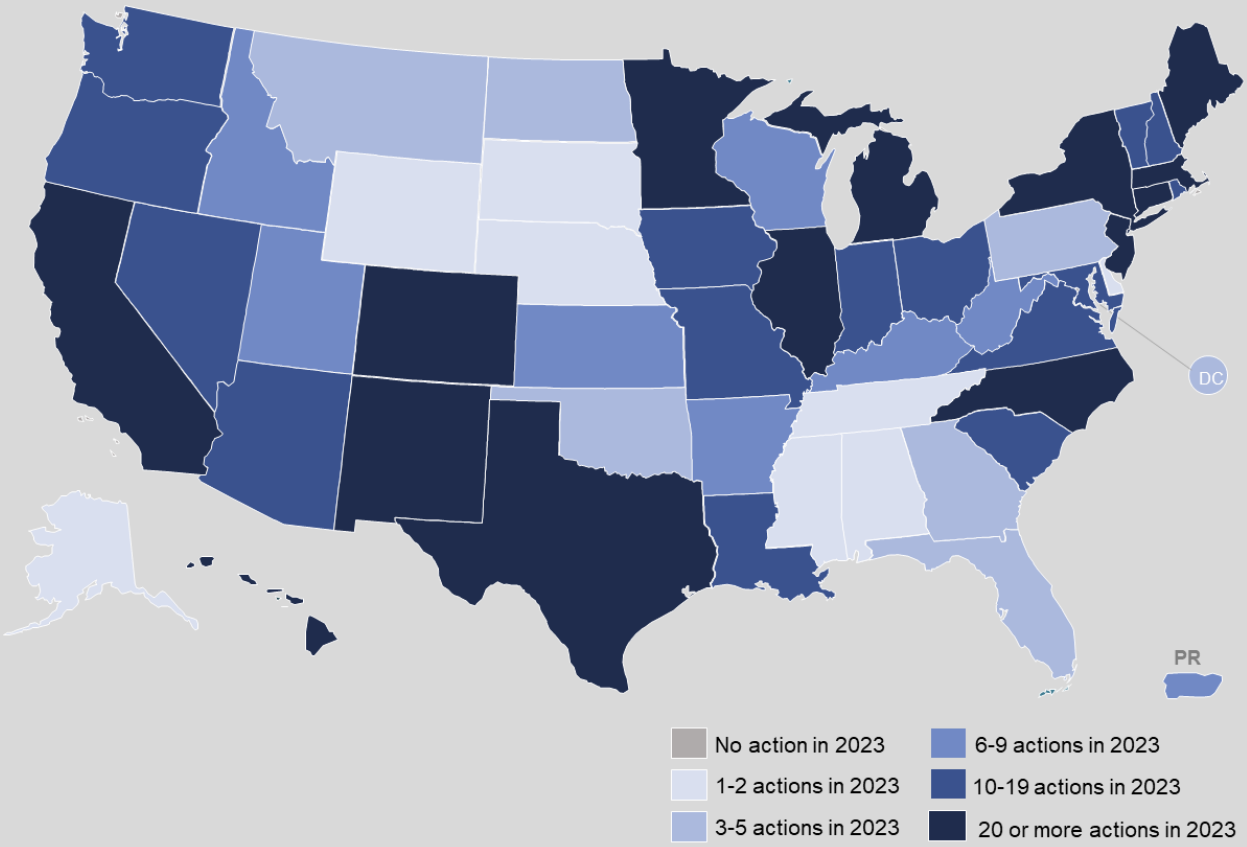
Massachusetts

Electric distribution companies filed their draft electric sector modernization plans during 2023, while the Grid Modernization Advisory Council provided recommendations. The Department of Energy Resources released its long duration energy storage study, and distribution companies filed proposed energy storage rates. Additionally, Unitil and National Grid filed performance-based ratemaking proposals.

California

The California Energy Commission approved a new incentive program for virtual power plants in 2023. The Public Utilities Commission approved utilities' demand response programs and pilots for 2024-2027. The Commission also created a data working group in its distributed energy resources rulemaking, while CAISO filed tariff revisions for energy storage resources. Utilities filed a multi-property microgrid tariff, as well as income-graduated fixed charge proposals.

Figure 2. 2023 Grid Modernization Activity, by Number of Actions



Illinois

Ameren Illinois and Commonwealth Edison filed their integrated grid plans and multi-year rate plan applications in early 2023, which include a variety of performance metrics and planned distribution grid investments. Regulators considered data access rules, and Ameren filed its regional transmission organization cost-benefit study. Lawmakers initiated an energy storage study, which will include the impacts of a proposed storage target.

Hawaii

The Hawaii Public Utilities Commission issued an order on the implementation of HECO's advanced rate design, as well as the final design for the utility's new smart distributed energy resource and bring your own device tariffs. Regulators also considered a grid services performance incentive mechanism for HECO. HECO filed its final integrated grid plan report, which includes plans to add 3,477 MW of storage by 2050.

Colorado

In Colorado, regulators opened a new proceeding to explore implementation of virtual power plant pilots. Xcel Energy proposed new demand response and battery storage programs, as well as a new interconnection of distributed energy resources tariff that includes a performance incentive mechanism based on timely interconnection. Black Hills Energy filed its distribution system plan including plans for new grid investments.

Texas

Texas regulators considered a variety of market reforms in 2023 to improve reliability and resilience, including a performance credit mechanism. The Commission also considered market rules governing the state of charge for energy storage resources, as well as interconnection and cost recovery rules for distributed energy resources. Lawmakers enacted legislation adopting a backup power incentive program and promoting residential demand response.

North Carolina

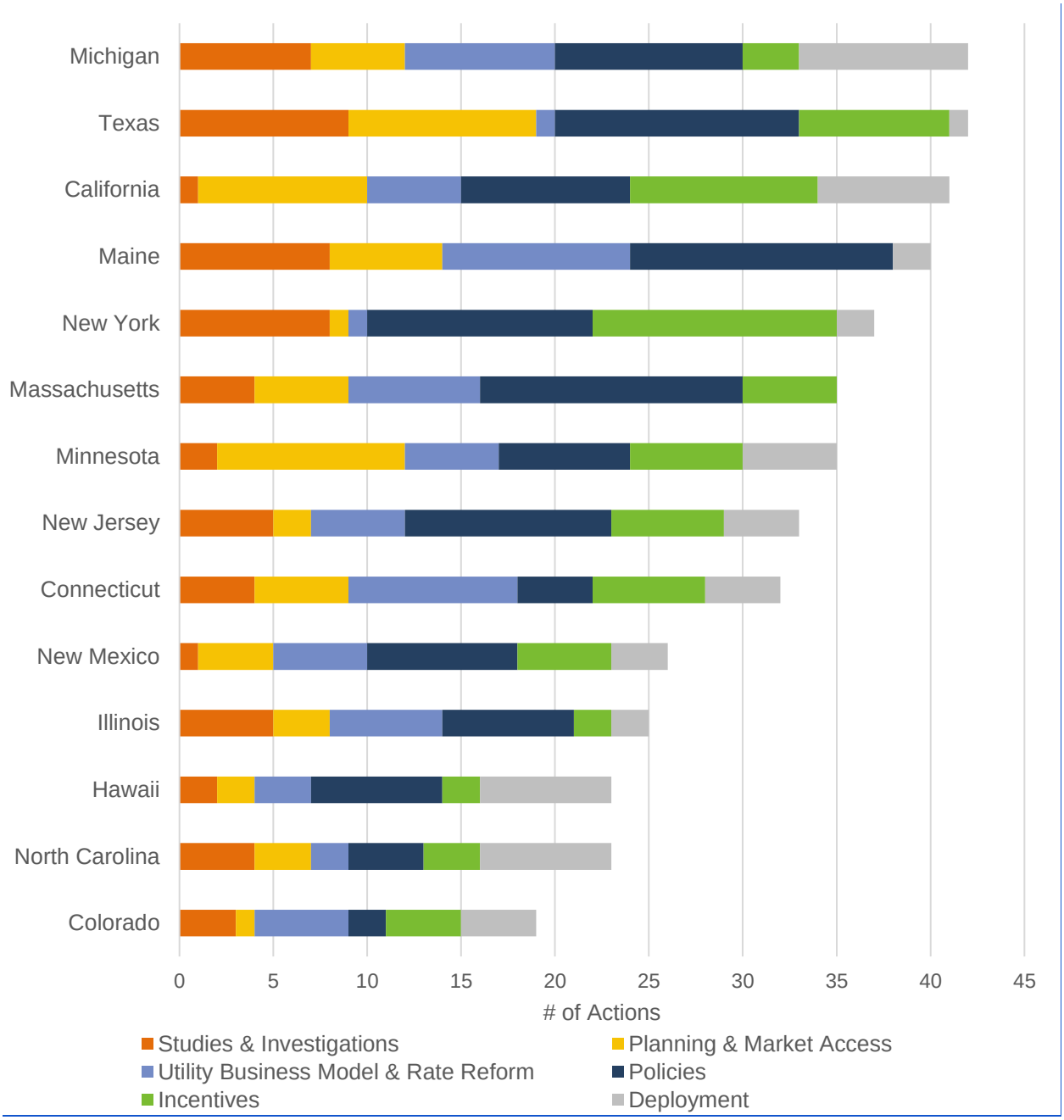
In North Carolina, regulators approved a new residential solar-plus-storage incentive program for Duke Energy, as well as performance incentive mechanisms and an array of distribution grid investments. Duke Energy filed a climate risk and resilience study, as well as its latest Carbon Plan, which includes the addition of 6,020 MW of energy storage by 2038 in the utility's preferred pathway.

TOP GRID MODERNIZATION TRENDS OF 2023

Interest Rapidly Growing in Virtual Power Plants

This past year saw a significant rise in the use of the term "virtual power plant", with states and utilities across the country pursuing efforts to aggregate distributed energy resources. The California Energy Commission approved a new incentive program to encourage virtual power plants, while Colorado regulators opened a new proceeding to explore implementation of virtual power plants.

Figure 3. Most Active States of 2023



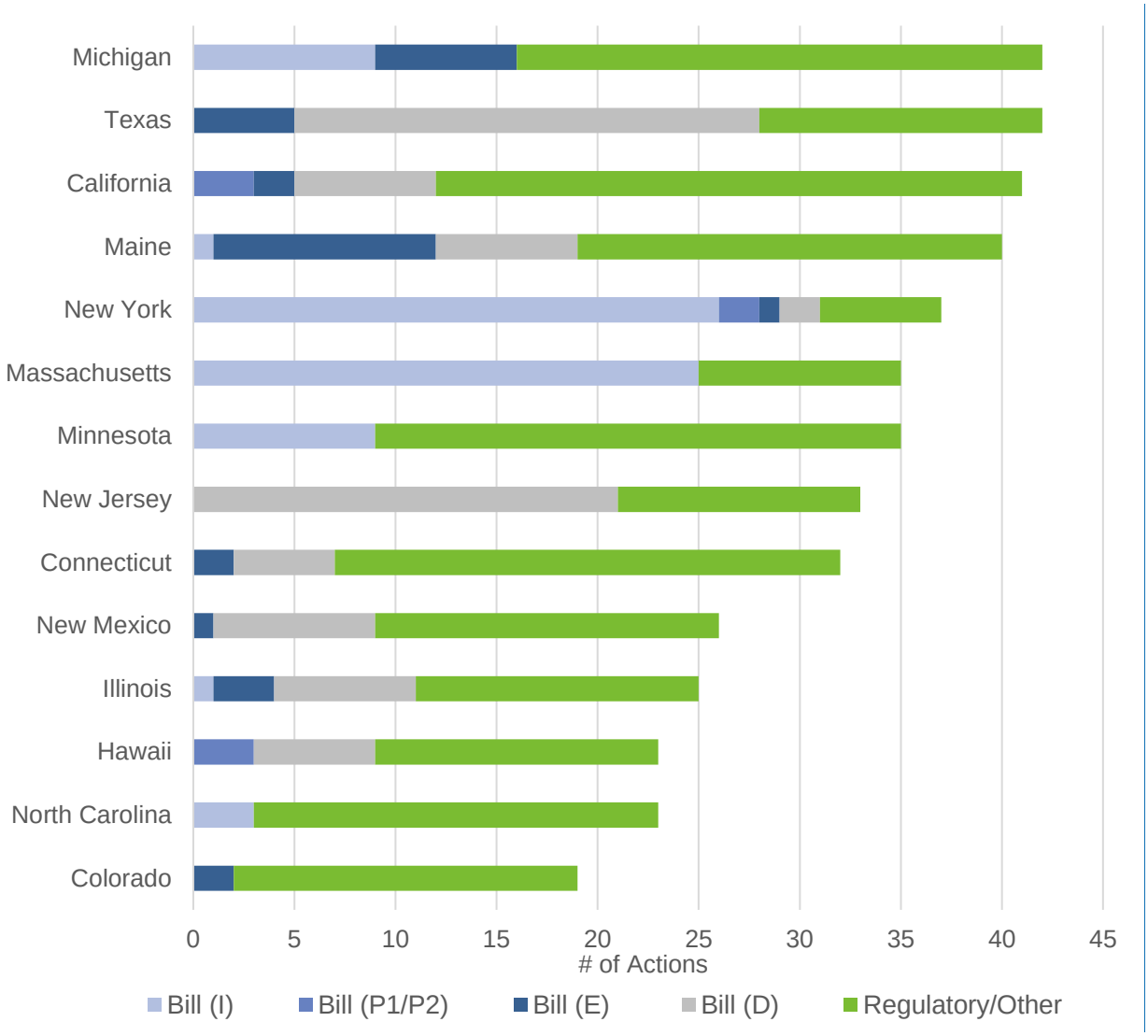
Addressing Cost Recovery for Interconnection Upgrades

Several states are revising interconnection rules for distributed energy resources, and particularly rules regarding cost recovery for grid upgrades triggered by interconnection applications. In Connecticut, regulators addressed cost-sharing for non-residential interconnection upgrades, as well as utility payment for residential upgrades needed in environmental justice areas. Other states examining cost recovery issues include Maine, Maryland, and Texas.

Examining the Impacts of Wholesale Market Participation

A number of states examined possible energy market reforms, including wholesale market participation, during the year. A study released in South Carolina calculated potential cost savings of joining a regional transmission organization, while a study completed by Ameren Illinois detailed costs and benefits of remaining in MISO or joining PJM. In Arizona, utilities also filed studies examining impacts of participation in CAISO or the Southwest Power Pool.

Figure 4. Most Active States of 2023, by Action Status



Studying Long-Duration Energy Storage

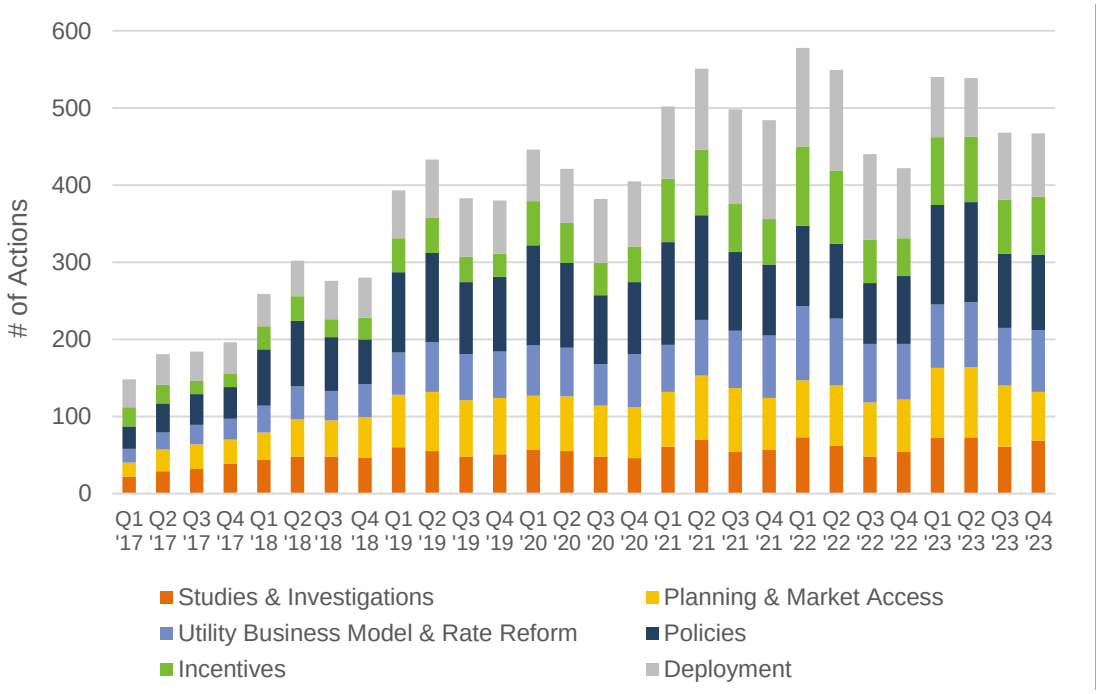
Interest is growing in the potential for long-duration storage, with some states undertaking formal studies on the technology during 2023. In Massachusetts, the Department of Energy Resources released its long-duration storage study, while legislation enacted in Maine directs the Governor's Energy Office to conduct a study of the technology and provide

recommendations to the legislature. In Michigan, lawmakers also enacted legislation directing the Public Service Commission to conduct a long-duration storage study.

Utilities Proposing New Performance Incentive Mechanisms

Several utilities proposed new performance incentive mechanisms (PIMs) during the year, with many of these PIMs focusing on peak load reduction, interconnection of distributed energy resources, enrollment in time-varying rates, and system reliability. Regulators in Illinois, Massachusetts, New Hampshire, and North Carolina, among others, considered new PIMs proposed by utilities, while regulators in Connecticut and Hawaii also continued efforts to design PIMs.

Figure 5. Total Number of Grid Modernization Actions by Quarter



Undertaking Grid Resilience Planning

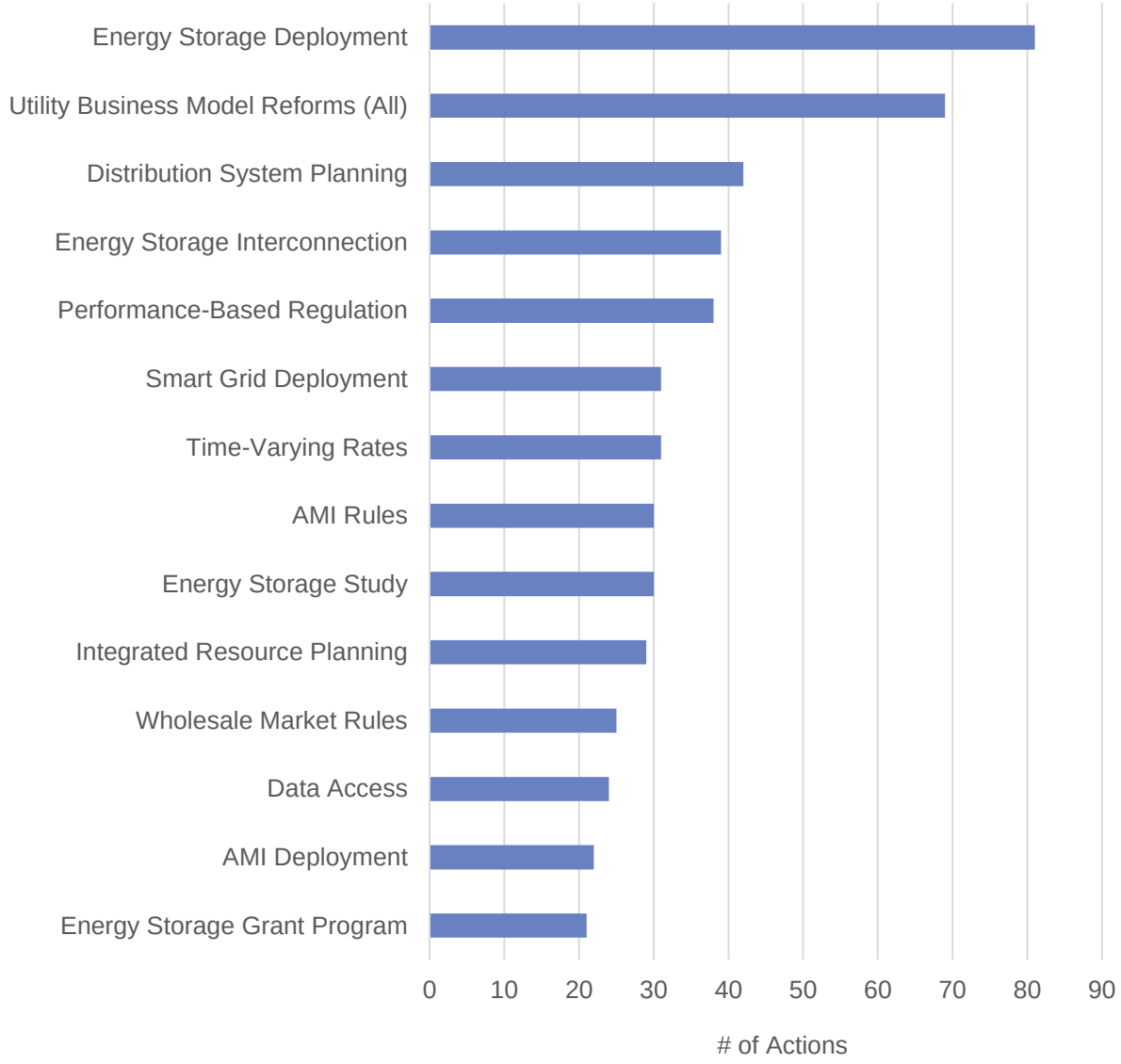
Increasingly, states and utilities are undertaking dedicated grid resilience planning efforts to examine potential threats and necessary distribution system investments to promote resilience. Louisiana regulators worked to develop rules for electric utility grid resilience plans, while the Maine utilities filed climate protection plans, which will include vulnerability studies and resilience plans.

Utilities Pursuing Innovative Pilot Programs and Projects

Across the country, utilities are pursuing an array of innovative pilot programs and projects, with some states establishing streamlined review and approval processes for these pilots. In

Michigan, Consumers Energy requested approval for an expedited pilot review workplan, with four focus areas for expedited pilots. In Vermont, Green Mountain Power is pursuing an all-electric resilient neighborhood pilot, and Washington's Avista Utilities is implementing a connected communities pilot to demonstrate non-wires alternatives.

Figure 6. Top Grid Modernization Actions of 2023



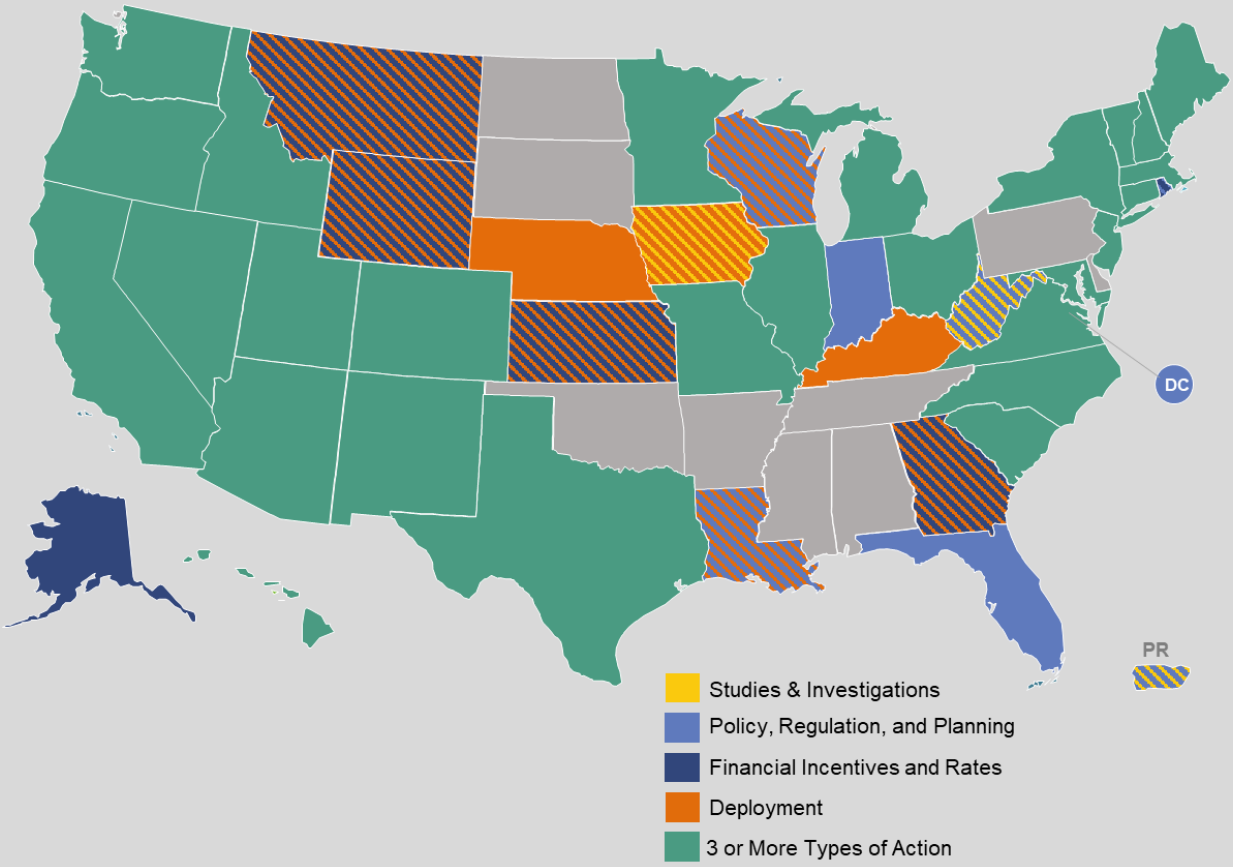
Utilizing Green Button Standards for Access to Customer Energy Usage Data

Many states have been exploring issues around customer and third-party access to energy usage data, with a number of states opting to use Green Button standards for this. The Michigan Public Service Commission directed utilities to implement a data sharing tool that is interoperable with Green Button, while Connecticut regulators issued a decision requiring Green Button functionality for utilities' data access plans. New Hampshire regulators are developing an energy data platform that will conform to Green Button standards.

Providing Customers With Demand Response Incentive Opportunities

Many utilities are implementing new programs that provide customers with opportunities to participate in demand response programs and earn both upfront and regular incentive payments. In these programs, utilities are typically able to directly manage customer-owned smart thermostats or battery storage systems. For example, Duke Energy Kentucky proposed a new "bring your own thermostat" program, which will offer customers with smart thermostats annual bill credits to participate in direct load management by the utility.

Figure 7. 2023 Energy Storage Action, by Type of Action



Utilities Exploring Opt-Out Time-Varying Rates

A growing number of utilities are exploring the possibility of, or even moving forward with, time-of-use (TOU) rates that are implemented on an opt-out, rather than an opt-in basis. In Minnesota, Xcel Energy filed a proposal for an opt-out residential TOU rate, following active efforts in its Colorado service territory to roll out default TOU rates. In Missouri, utilities will be transitioning to TOU rates as the default option, and Connecticut utilities are to file a report on whether their future TOU rates should be opt-in or opt-out.

LOOKING BACK: 2017 to 2023

Total grid modernization action held relatively consistent compared to last year, with a high level of activity taking place across the country. States and utilities took approximately 774 actions in 2023, compared to 778 actions in 2022, 823 actions in 2021, 658 actions in 2020, 612 actions in 2019, 460 actions in 2018, and 288 actions in 2017. In 2023, activity increased slightly in the areas of studies and investigations, planning and market access, and rate and utility business model reform. All 50 states, plus DC and Puerto Rico, took grid modernization actions in 2023.

Figure 8. Number of Grid Modernization Actions 2017-2023

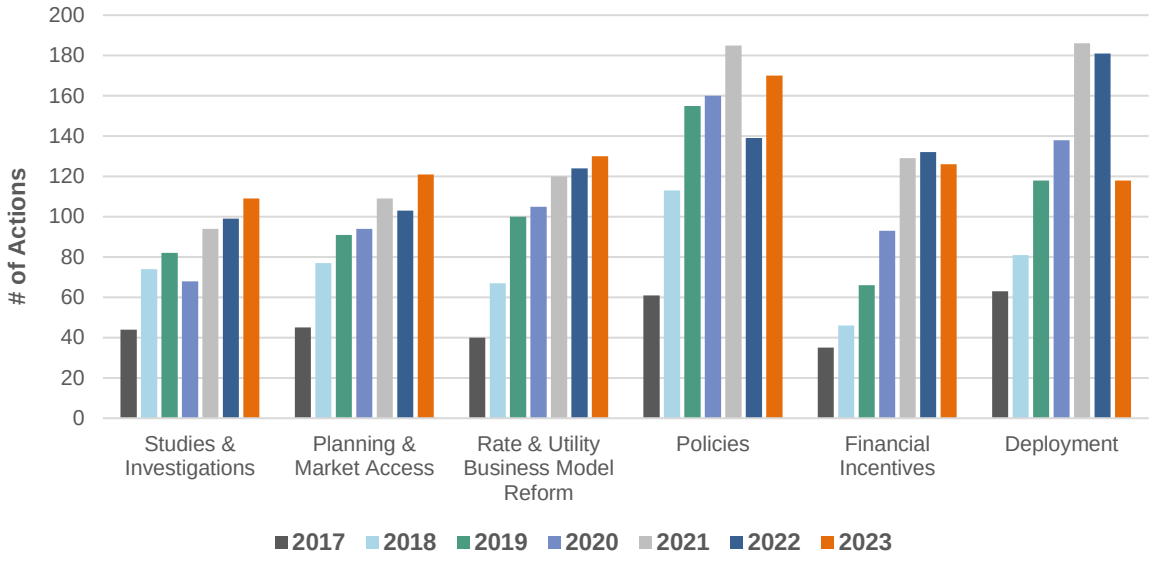
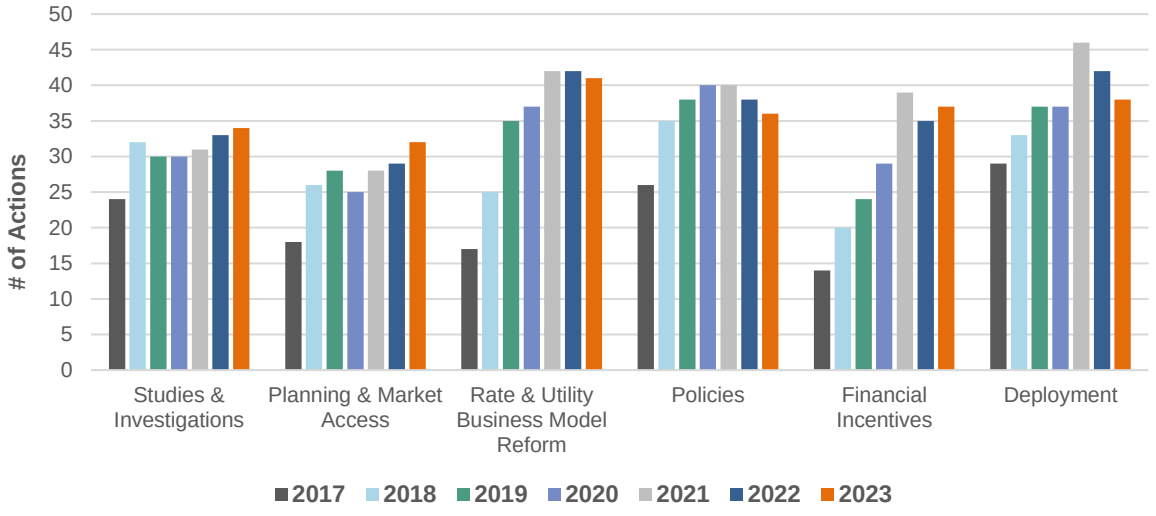


Figure 9. Number of States Taking Grid Modernization Actions 2017-2023



Q4 2023 GRID MODERNIZATION ACTION

In the fourth quarter of 2023, 48 states plus DC and Puerto Rico took a total of 467 policy and deployment actions related to grid modernization, utility business model and rate reform, energy storage, microgrids, and demand response. Table 2 provides a summary of state and utility actions on these topics. Of the 467 actions catalogued, the most common were related to policies (98), deployment (82), and utility business model and rate reform (80).

Table 2. Q4 2023 Summary of Grid Modernization Actions

Type of Action	# of Actions	% by Type	# of States
Policies	98	21%	25 + PR
Deployment	82	18%	35
Business Model and Rate Reform	80	17%	37
Financial Incentives	75	16%	26
Studies and Investigations	69	15%	29 + DC, PR
Planning and Market Access	63	13%	23 + DC, PR
Total	**467**	**100%**	**48 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 5 GRID MODERNIZATION DEVELOPMENTS OF Q4 2023

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

Michigan Lawmakers Adopt Energy Storage Target

In November 2023, Michigan lawmakers enacted legislation establishing a statewide energy storage target of 2,500 MW, to be achieved by December 31, 2029. Utilities are to submit plans for meeting this target, which will be apportioned based on each utility's annual average contribution to peak load. The legislation also directs the Public Service Commission to complete a study on long-duration energy storage systems within a year.

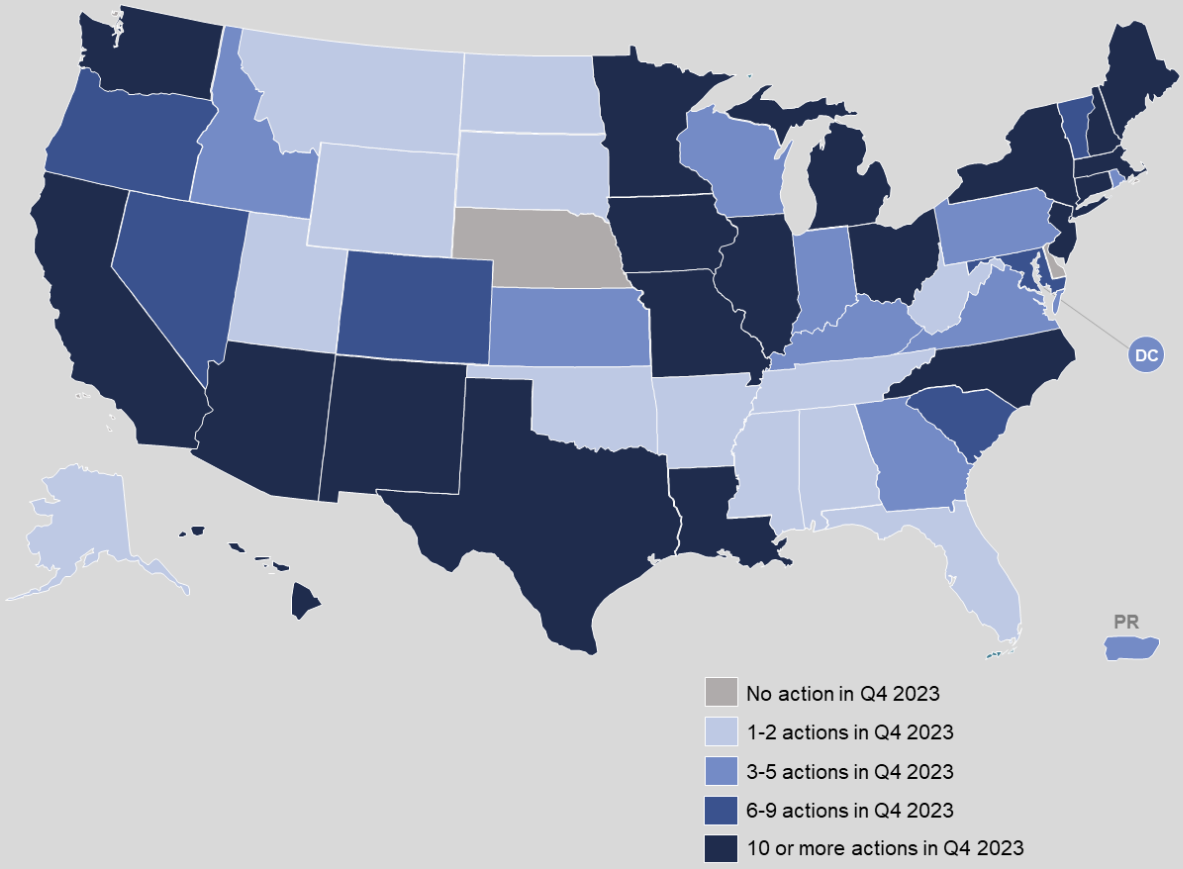
Maine Utilities File Climate Change Protection Plans

Central Maine Power and Versant Power filed their first climate change protection plans during the quarter, pursuant to legislation enacted in 2022. The plans detail upcoming efforts to undertake climate change vulnerability studies and to prepare climate change resilience plans, which will identify strategic resilience measures and site-specific resilience measures.

Massachusetts Releases Mid- to Long-Duration Energy Storage Study

The Massachusetts Department of Energy Resources released its mid- to long-duration energy storage study in late December 2023, pursuant to legislation enacted in 2022. The study identifies various barriers that are slowing deployment and includes several recommendations to advance storage deployment in the state, including adjusting incentive programs, supporting long-duration storage pilots, and pursuing resiliency use cases.

Figure 9. Q4 2023 State and Utility Action on Grid Modernization



Green Mountain Power Proposes Zero Outages Initiative in Vermont

In Vermont, Green Mountain Power filed a petition for first-phase approval of its Zero Outages Initiative in October 2023. The utility is proposing to accelerate its grid resilience efforts with requested authorization for up to $250 million of additional storm hardening investments. The utility is also requesting an additional $30 million for customer and community energy storage.

Missouri Regulators Enable Distributed Energy Resource Aggregation

In October 2023, the Missouri Public Service Commission issued an order partially lifting the state's ban on participation in wholesale markets by large commercial and industrial demand response customers and aggregators. The decision allows commercial and industrial customers with demands of 100 kW or more to participate in wholesale markets either directly or through third-party aggregators.

MOST ACTIVE STATES AND SUBTOPICS OF Q4 2023

The most common types of actions across the country related to energy storage deployment (52), utility business model reforms (40), interconnection rules (25), and performance-based regulation (25).

The states taking the greatest number of actions related to grid modernization in Q4 2023 can be seen in Figure 11. Michigan, Massachusetts, New York, and New Jersey saw the most action during the quarter, followed by California, Minnesota, and Connecticut. Overall, 48 states, plus DC and Puerto Rico, took actions related to grid modernization in Q4 2023.

Figure 10. Most Common Types of Actions Taken in Q4 2023

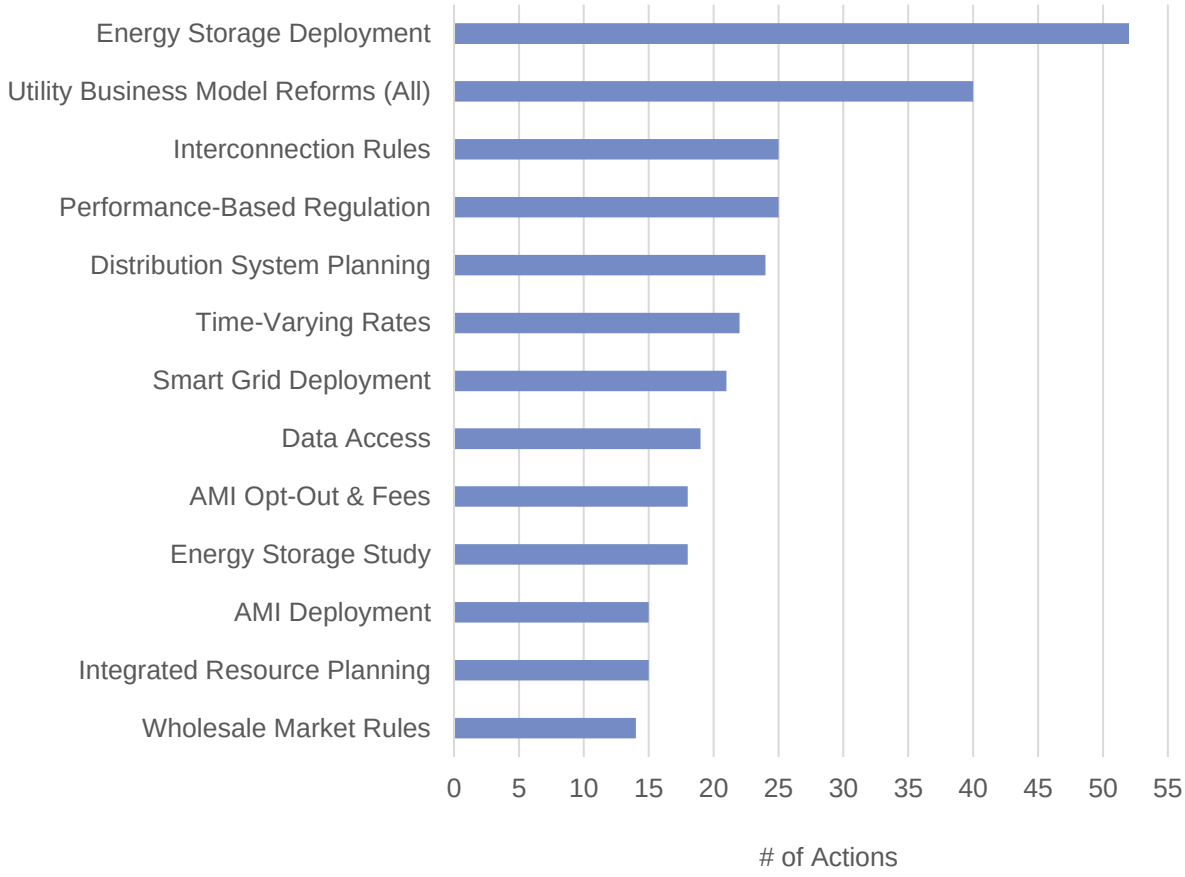
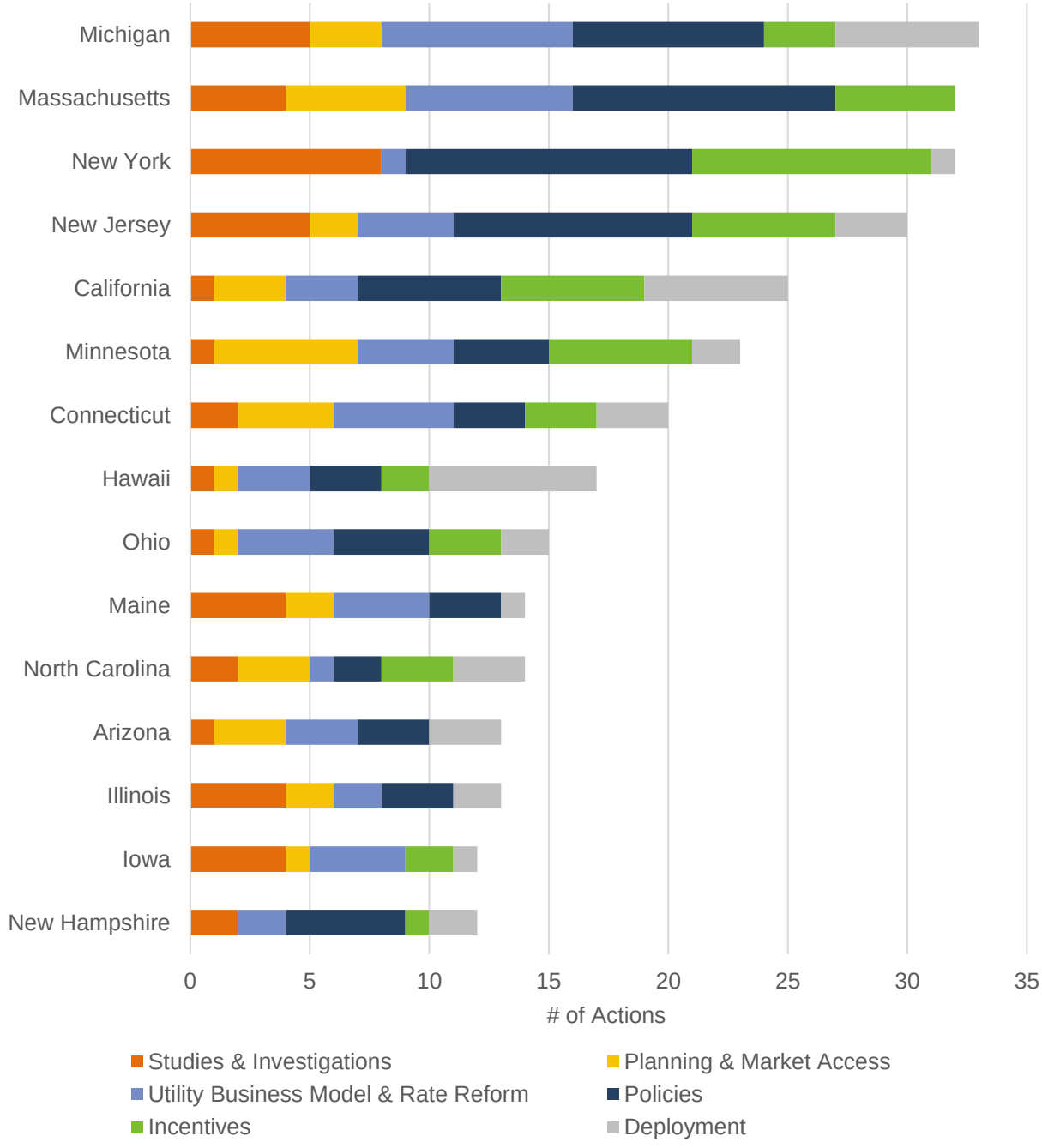


Figure 11. Most Active States of Q4 2023



FULL REPORT DETAILS & PRICING

FULL REPORT DETAILS

Content Included in the Full Quarterly Report:

- Detailed tables describing each pending and recently decided state and utility grid modernization action addressing: (1) smart grid and advanced metering infrastructure, (2) utility business model reform, (3) regulatory reform, (4) utility rate reform, (5) energy storage, (6) microgrids, and (7) demand response. Actions are broken out into the following categories:
    - Studies and Investigations
    - Planning and Market Access
    - Utility Business Model and Rate Reforms
    - Policies
    - Financial Incentives
    - State and Utility Deployment
- Links to original legislation, dockets, and commission orders for each legislative and regulatory action
- Excel spreadsheet file of all actions taken during the quarter and separate Powerpoint file of all summary maps available upon request
- Qualitative analysis and descriptive summaries of grid modernization policy action and trends
- Outlook of action for the next quarter

WHO SHOULD PURCHASE THIS REPORT

The 50 States of Grid Modernization allows those involved in the electric industry to easily stay on top of legislative and regulatory changes. The report provides a comprehensive quarterly review of actions. At a cost of $500 per issue (or $1,500 annually), the 50 States of Grid Modernization offers a significant time and financial savings. With direct links to original sources for all actions, customers may stay on top of policy developments between quarterly reports.

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- Identify new market opportunities, as well as changing and risky markets
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Investor-Owned and Public Power Utilities

- Learn about the approaches being taken by other utilities facing similar opportunities and challenges

- Stay on top of relevant state policy developments
- Utilize an objective source of information in legislative and regulatory proceedings

Investors and Financial Analysts

- Identify new investment opportunities and emerging areas of growth, as well as risky investments
- Identify active utility investment proceedings

Advocacy Organizations

- Learn about the diverse grid modernization actions occurring across the country
- Learn about the outcomes of other states' policy decisions
- Utilize an objective source of information in legislative and regulatory proceedings

Researchers and Consultants

- Access valuable data requiring a vast amount of time to collect first-hand
- Identify research needs to inform grid modernization proceedings
- Cite an objective source in your own research and analysis

PRICING

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