

50 States of GRID MODERNIZATION

Q4 2022 Quarterly Report
& 2022 Annual Review

Executive Summary

AUTHORS

Emily Apadula
Rebekah de la Mora
Justin Lindemann
Brian Lips
Vincent Potter
Autumn Proudlove
David Sarkisian

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.

CONTACT

Autumn Proudlove (afproudl@ncsu.edu)

PREFERRED CITATION

North Carolina Clean Energy Technology Center, *The 50 States of Grid Modernization: 2022 Review and Q4 2022 Quarterly Report*, February 2023.

COVER DESIGN CREDIT

Cover design is by [Capital City Creative](#).

DISCLAIMER

While the authors strive to provide the best information possible, neither the NC Clean Energy Technology Center nor NC State University make any representations or warranties, either express or implied, concerning the accuracy, completeness, reliability or suitability of the information. The NC Clean Energy Technology Center and NC State University disclaim all liability of any kind arising out of use or misuse of the information contained or referenced within this report. Readers are invited to contact the authors with proposed corrections or additions.

PREVIOUS EDITIONS AND OTHER 50 STATES REPORTS

Previous executive summaries and older editions of *The 50 States of Grid Modernization* are available for download [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* and *The 50 States of Electric Vehicles*. 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

2022 GRID MODERNIZATION ACTION

In 2022, 49 states plus DC took a total of 778 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 778 actions identified, the most common were related to deployment (181), followed by policies (139), and financial incentives (132).

Table 1. 2022 Summary of Grid Modernization Actions

Type of Action	# of Actions	% by Type	# of States
Deployment	181	23%	42
Policies	139	18%	38 + DC
Financial Incentives	132	17%	35
Business Model and Rate Reform	124	16%	42 + DC
Planning and Market Access	103	13%	29 + DC
Studies and Investigations	99	13%	29 + DC
Total	778	100%	49 States + DC

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 2022

Ten states taking the greatest number of particularly impactful actions are noted below.

California

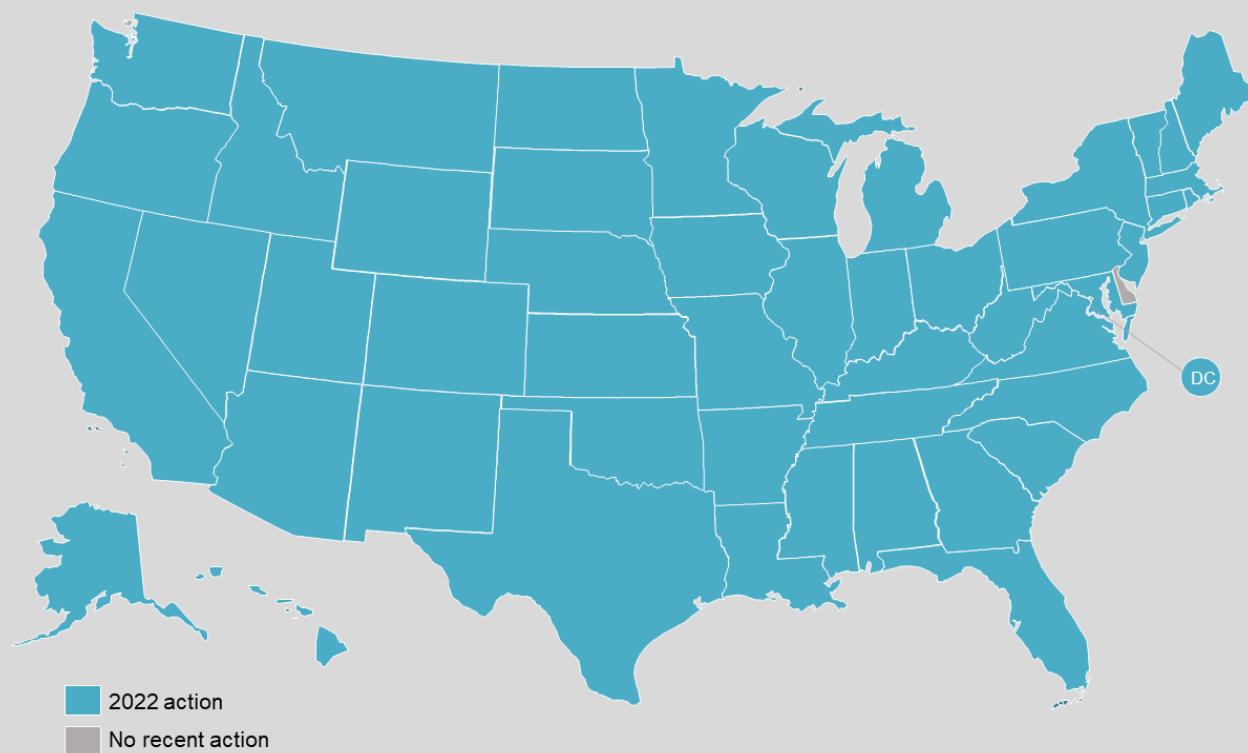
The California Public Utilities Commission opened a new rulemaking to advance demand flexibility through rates and released a white paper on demand flexibility strategies and customer distributed energy resource compensation, while continuing work to develop its microgrid program. The Commission considered a variety of utility proposals to deploy energy storage and smart grid technologies, and additional funding was allocated to energy storage incentives for low-income customers.

Connecticut

The Connecticut Public Utilities Regulatory Authority (PURA) approved a non-wires alternative program design, a reliability and resilience framework, and an innovative energy solutions

program during 2022. PURA also continued proceedings related to performance-based regulation and advanced metering infrastructure, while United Illuminating filed a rate case including new performance metrics, resiliency pilots, and projects to support distributed system planning.

Figure 1. 2022 Legislative and Regulatory Action on Grid Modernization



Massachusetts

In Massachusetts, regulators approved significant grid modernization plans for the state’s three major utilities – Eversource, National Grid, and Unitil – as well as Eversource’s latest performance-based ratemaking plan with new scorecard metrics. State lawmakers enacted legislation requiring utilities to develop electric sector modernization plans and directing the Department of Energy Resources to study mid- and long-duration energy storage.

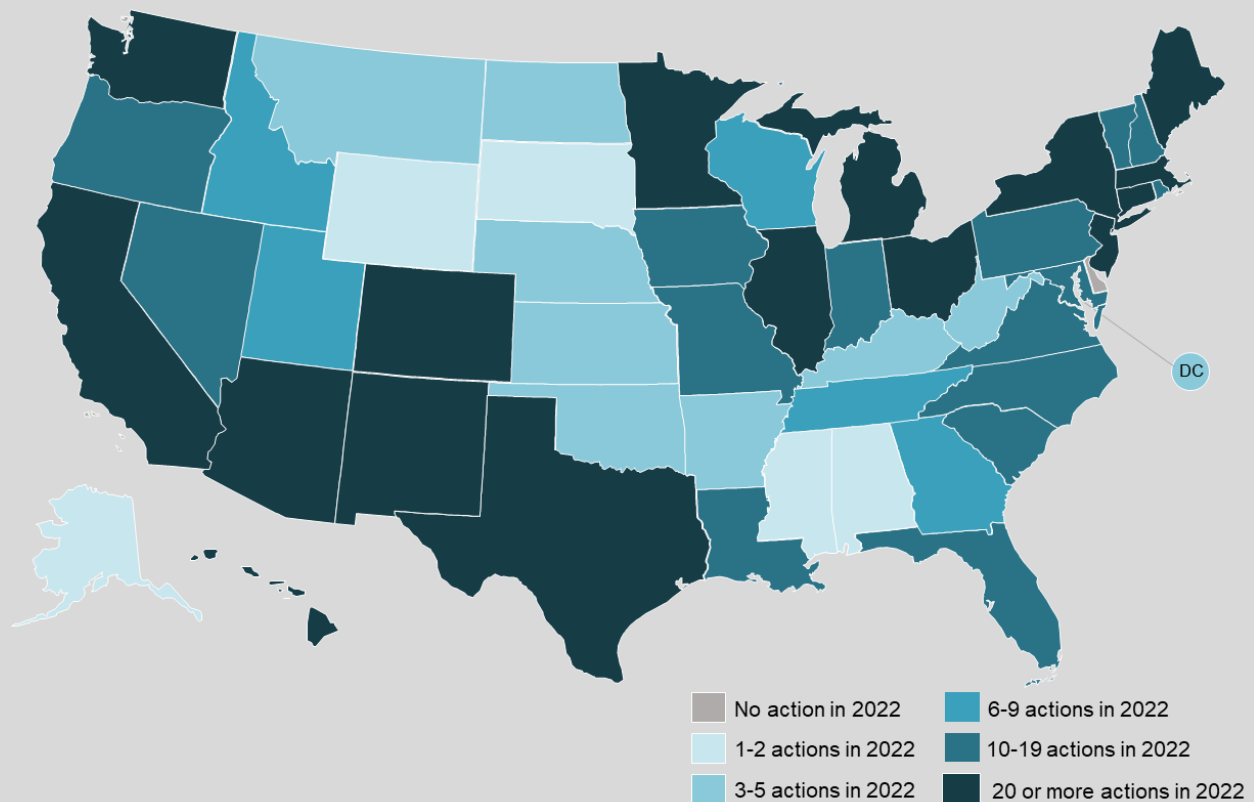
Hawaii

The Hawaii Public Utilities Commission approved additional performance incentive mechanisms for the HECO utilities in 2022, as well as an advanced rate design framework. The Commission approved a new smart dispatch program and the design for new distributed energy resource tariffs that focus on grid services. Regulators also continued efforts to implement a microgrid services tariff and opened a new proceeding on innovative pilots.

Maine

In Maine, state legislators enacted a bill requiring utilities to file grid plans including near-term grid investments that are needed. The Public Utilities Commission approved energy storage rates for Central Maine Power and Versant Power and considered Central Maine Power's proposed Grid Model Enhancement Project and energy storage projects. The Governor's Energy Office also created a quarterly energy storage forum.

Figure 2. 2022 Grid Modernization Activity, by Number of Actions



Illinois

The Illinois Commerce Commission approved new performance metrics for Ameren Illinois and Commonwealth Edison and took steps to develop guidelines for the integrated grid planning process. The Commission also completed its energy storage program report, adopted revised interconnection rules, and approved solar-plus-storage rebates for Ameren and Commonwealth Edison.

New Mexico

The New Mexico Energy, Minerals, and Natural Resources Department released its grid modernization roadmap in 2022, while the Public Regulation Commission approved revised rules for integrated resource planning and interconnection. El Paso Electric requested approval to deploy an advanced metering system, PNM filed its Grid Modernization Implementation Plan, and Xcel Energy proposed several grid modernization investments.

Colorado

In Colorado, regulators released proposed rules for organized wholesale markets, which require transmission utilities in the state to join a market by 2030. State legislators enacted bills establishing tax incentives for residential energy storage and a grant program to support microgrids for community resilience. Xcel Energy filed its first distribution system plan and a proposal to implement a resiliency service program (which was later withdrawn).

Michigan

Michigan regulators formed a new workgroup on grid integration and considered participation of energy storage resources in wholesale markets. Regulators approved revised interconnection rules and a new time-of-use rate for DTE Electric, while evaluating utilities' distribution system plans outlining planned grid investments. A workgroup on customer data access and privacy also filed their final report and recommendations during the year.

Minnesota

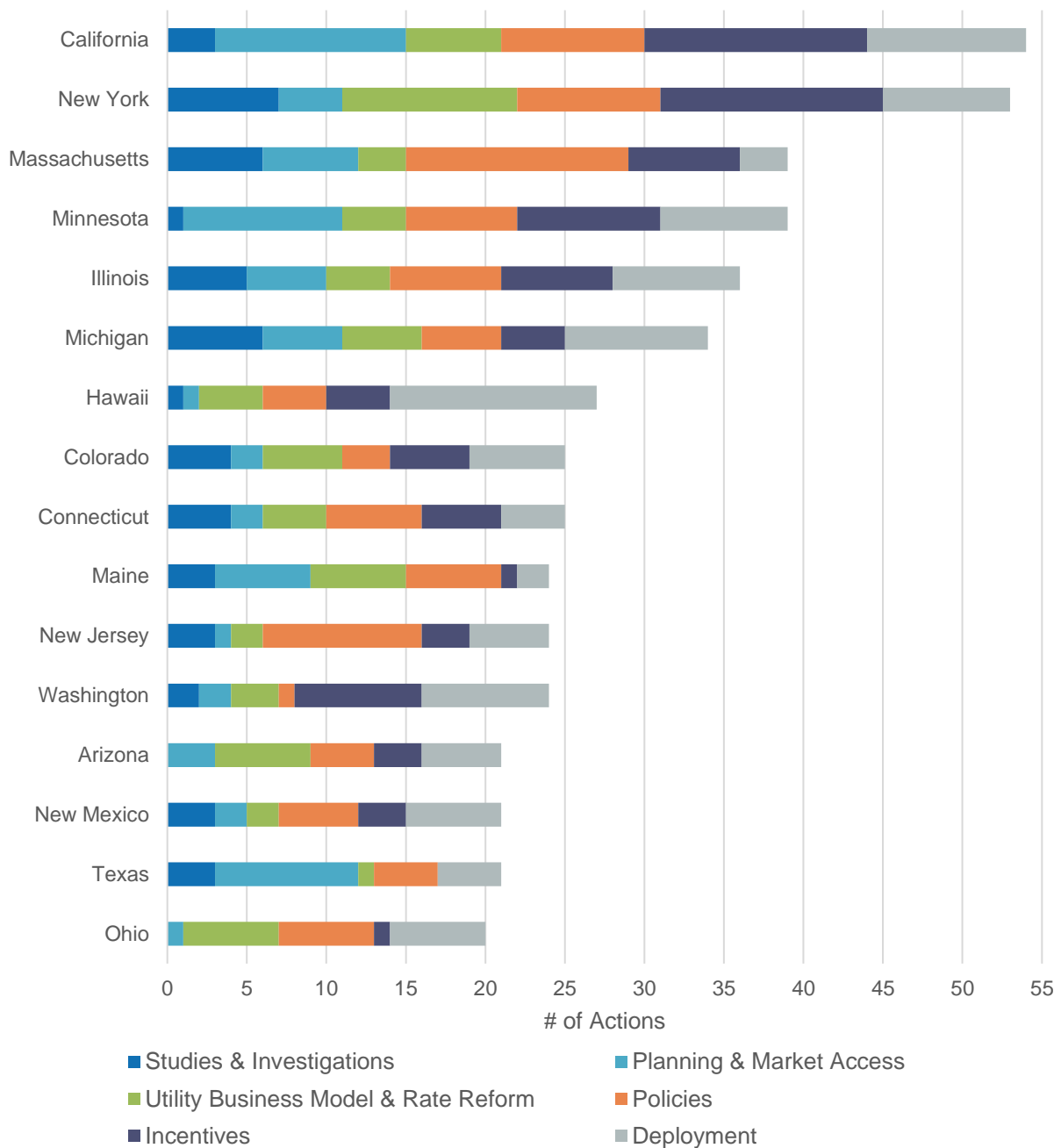
The Minnesota Public Utilities Commission accepted utilities' integrated distribution plans and approved new load flexibility pilot programs focused on demand response and thermal energy storage for Xcel Energy. The Commission considered Xcel Energy's proposal for a resiliency as a service program, while also addressing interconnection and data access rules during the year.

TOP GRID MODERNIZATION TRENDS OF 2022

Focusing on Resilience in Grid Modernization Activities

There was a central theme of resilience present in many of the grid modernization activities taking place in 2022. Several states enacted legislation making resilience improvements eligible for property assessed clean energy financing, and utilities proposed grid investments focused on improving resilience. Some states also considered new incentive programs for resilience investments like storage and microgrids, while others undertook studies or dedicated planning efforts related to grid resilience.

Figure 3. Most Active States of 2022



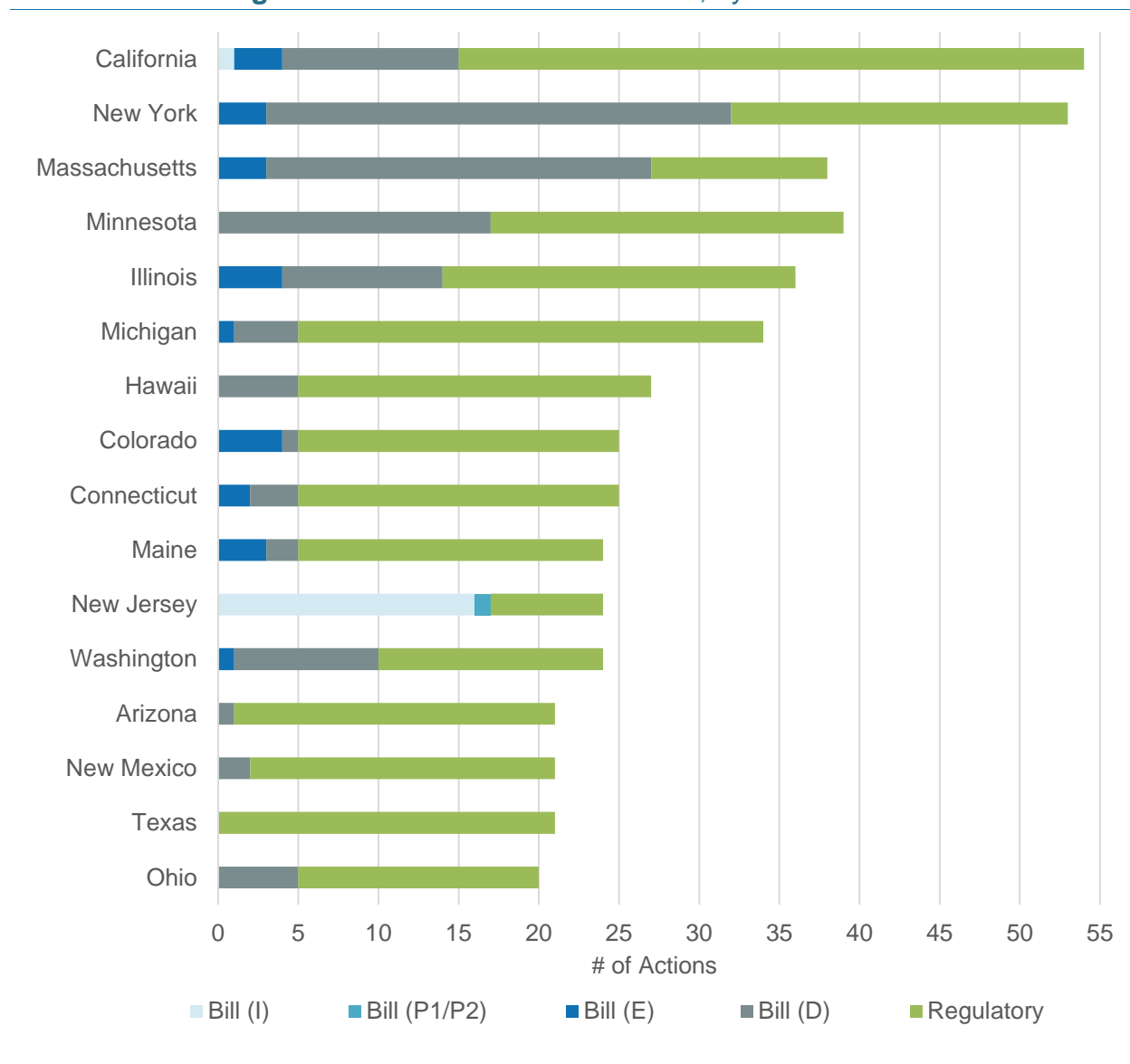
Undertaking Actions to Enhance Grid Management and Flexibility

An area of focus during 2022 was grid management and flexibility, with utilities planning investments in distributed energy resource management systems and battery storage and proposing new customer demand response programs and rate structures to shape load. A workgroup in Michigan is exploring grid integration of distributed energy resources, while a number of states have opened proceedings to consider demand response and flexibility practices, pursuant to a directive in the federal Infrastructure Investment and Jobs Act.

Utilities Proposing New Performance Incentive Mechanisms

Regulators in several states considered the adoption of new performance incentive mechanisms (PIMs) during 2022. The Illinois Commerce Commission approved a variety of new PIMs for Ameren and Commonwealth Edison, while Duke Energy Progress filed its plans for new PIMs with North Carolina regulators. In Hawaii, regulators approved additional PIMs for the HECO companies related to reliability, interconnection, and cost control.

Figure 4. Most Active States of 2022, by Action Status



States Considering Wholesale Market Participation

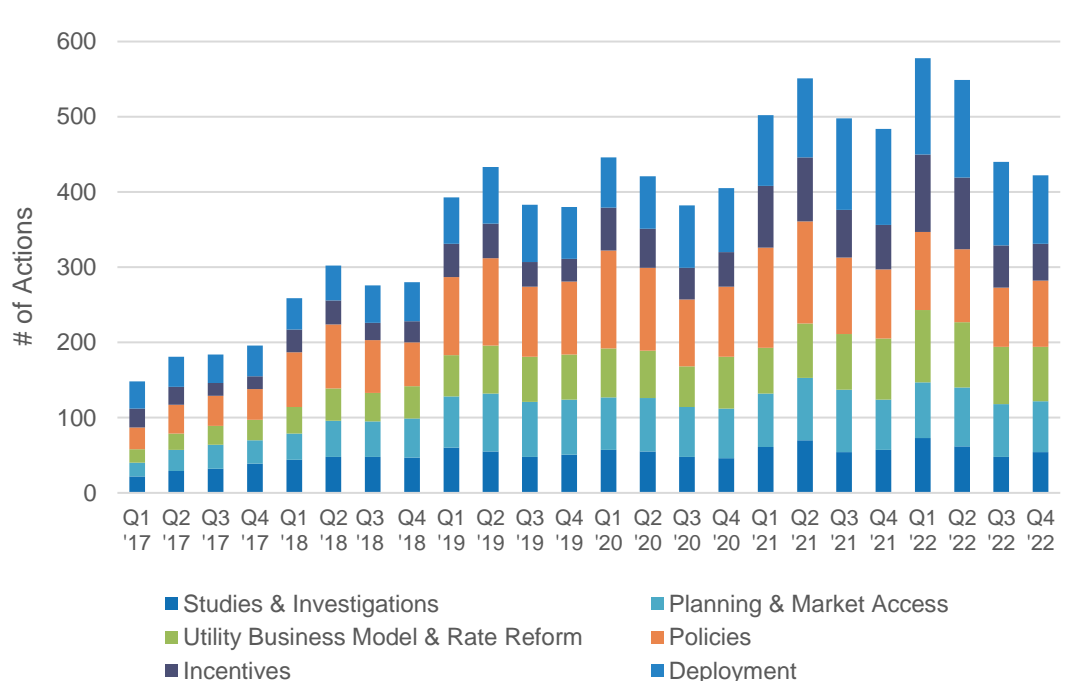
Wholesale markets continued to be a major area of attention for many states during 2022, with states generally moving toward wholesale markets. The Colorado Public Utilities Commission issued a decision requiring transmission utilities in the state to join organized wholesale

markets, while regulators in Arizona and South Carolina have been considering joining a market. Florida utilities also received approval to join the Southeast Energy Exchange Market.

Establishing Formal Distribution System Planning Processes

Across the country, more states are establishing formal processes for distribution system planning. In 2022, state lawmakers in Maine and Massachusetts enacted legislation requiring utilities to undertake such grid planning processes. Illinois regulators also took steps to implement a new grid planning process. Other states with formal distribution system planning requirements include Colorado, Michigan, Minnesota, and Oregon.

Figure 5. Total Number of Grid Modernization Actions by Quarter



Utilities Pursuing Resiliency as a Service Programs

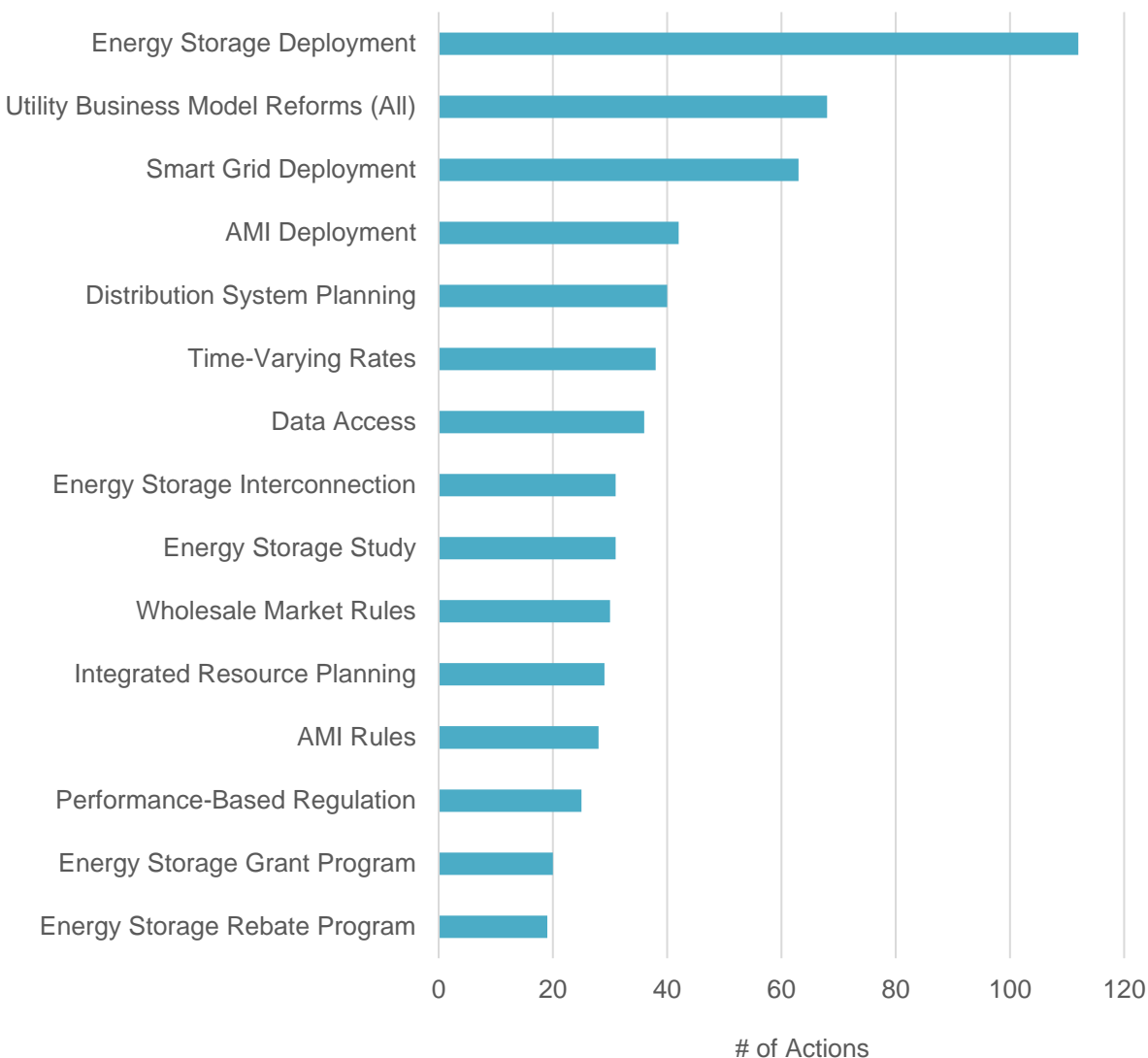
A growing number of utilities are filing proposals to offer “resiliency as a service” programs, where utilities deploy battery storage systems at customer locations in order to provide resiliency benefits, especially to critical facilities. Regulators approved Georgia Power’s resilience asset service tariff, while regulators in California and Colorado considered utility plans for customer resiliency programs. Utilities in Connecticut, Minnesota, and Vermont also proposed investments focused on customer resilience.

Utilities Designing New Battery Storage Demand Response Programs

A number of utilities filed plans to offer new battery storage demand response programs during the year, which typically offer a performance-based incentive or bill credit for energy

discharged during certain times. Idaho regulators approved a new battery demand response program for PacifiCorp, while Entergy New Orleans and Green Mountain Power were among the utilities filing plans for new programs. Michigan regulators denied DTE’s proposed program, instead expressing interest in exploring the design further.

Figure 6. Top Grid Modernization Actions of 2022



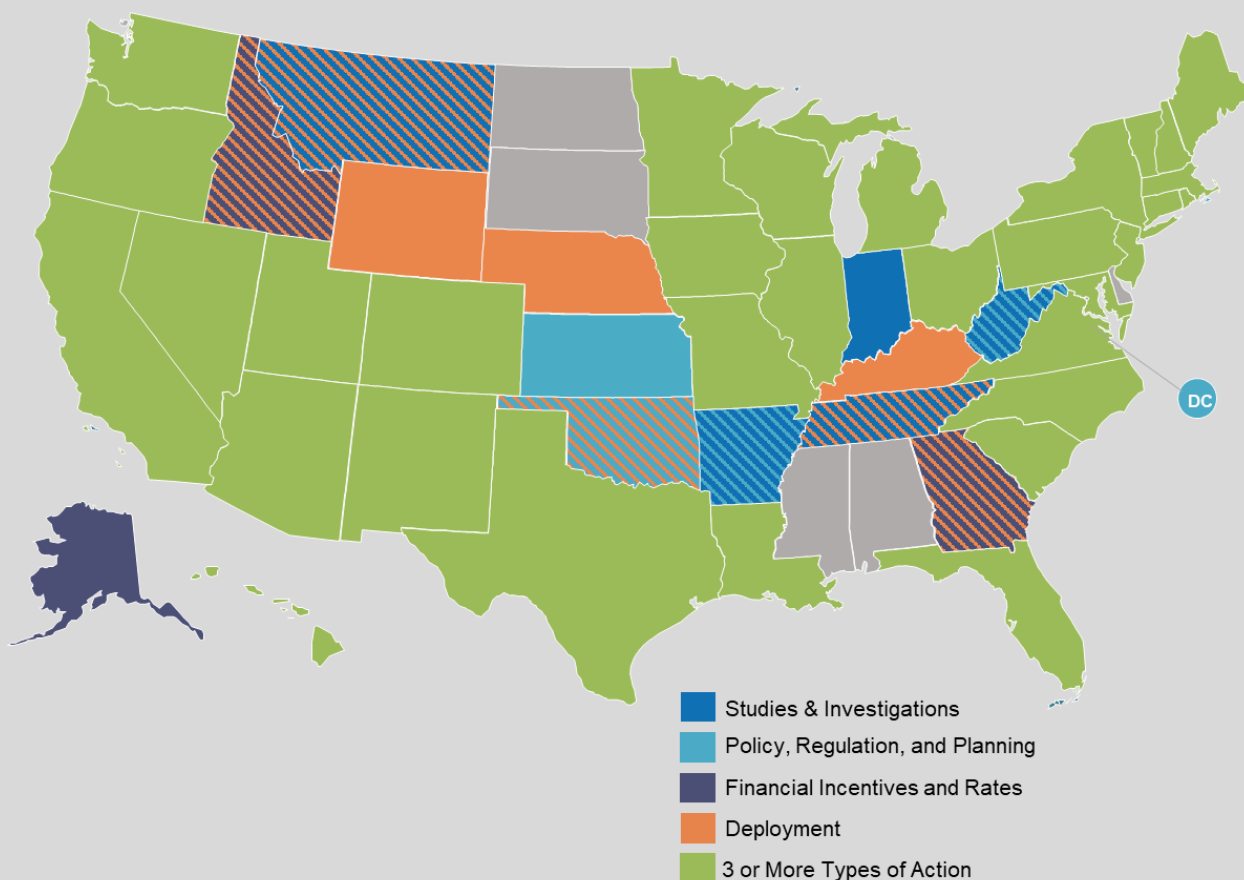
States Allowing Cost Sharing for Grid Upgrades Needed for Interconnection

Regulators around the country considered interconnection rule revisions that would allow for the sharing of costs among generation owners for grid upgrades necessary for interconnection. The Connecticut Public Utilities Regulatory Authority opened a proceeding to investigate cost sharing proposals for distributed energy resource interconnection upgrades, while regulators in Minnesota, New Mexico, Vermont, and other states also considered cost sharing for grid upgrades.

Incorporating Critical Peak Pricing into Rate Structures

As more utilities continue to offer time-of-use (TOU) rate options, an increasing number of these rates are incorporating critical peak pricing periods. The North Carolina Utilities Commission approved new dynamic rate designs for Duke Energy that include critical peak pricing elements, while Tennessee regulators approved a new TOU rate for Kingsport Power that includes a critical peak charge.

Figure 7. 2022 Energy Storage Action, by Type of Action



Examining Battery Storage Decommissioning and Recycling

Several states initiated efforts to address the decommissioning and recycling of battery storage facilities. South Carolina legislators enacted a bill to develop regulations managing the decommissioning of larger solar and storage facilities, and Virginia lawmakers created a task force to analyze the life cycle of energy facilities including energy storage. In Tennessee, legislators initiated a study that will examine end-of-life management for battery storage systems.

LOOKING BACK: 2017 to 2022

Total grid modernization action decreased somewhat in 2022 compared to last year, while remaining at a very high level of activity. States and utilities took approximately 778 actions in 2022, compared to 823 actions in 2021, compared to 658 actions in 2020, 612 actions in 2019, 460 actions in 2018, and 288 actions in 2017. In 2022, activity increased slightly in the areas of studies and investigations, rate and utility business model reform, and financial incentives. The number of states taking actions held relatively steady in most categories from 2017 to 2022.

Figure 8. Number of Grid Modernization Actions 2017-2022

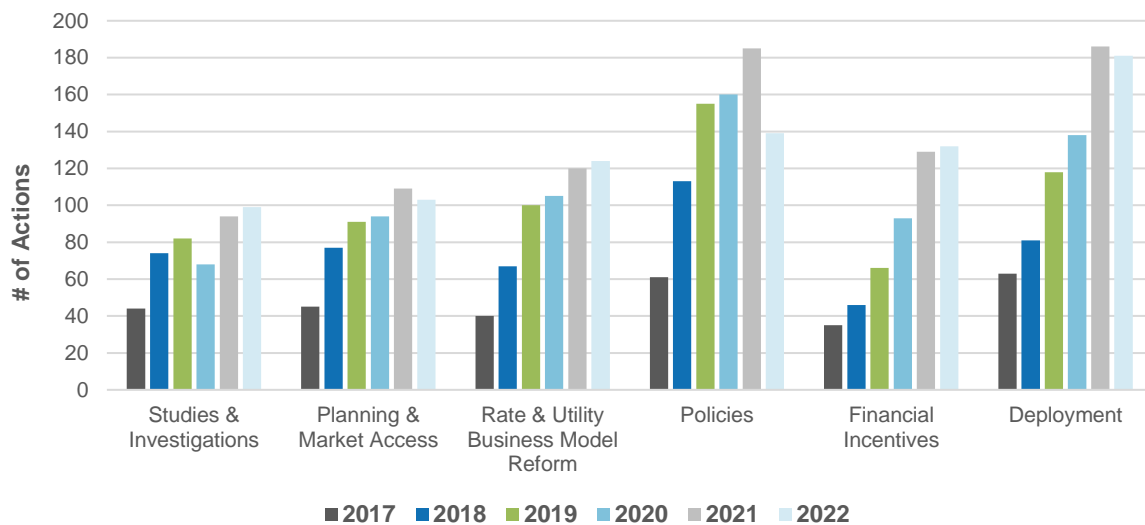
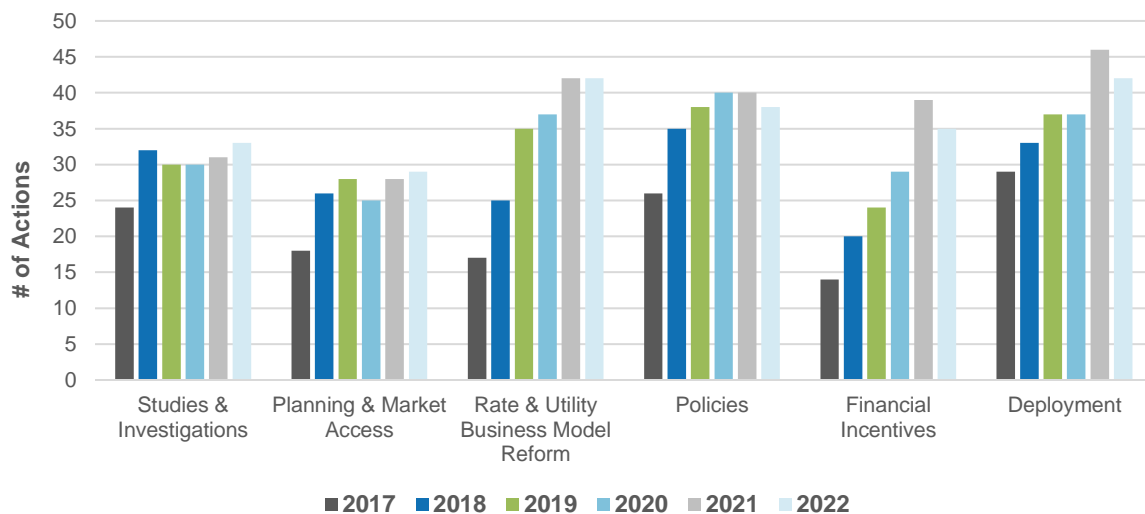


Figure 9. Number of States Taking Grid Modernization Actions 2017-2022



Q4 2022 GRID MODERNIZATION ACTION

In the fourth quarter of 2022, 47 states plus DC took a total of 422 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 422 actions identified, the most common were related to deployment (91), followed by policies (88), and utility business model and rate reform (72).

Table 2. Q4 2022 Summary of Grid Modernization Actions

Type of Action	# of Actions	% by Type	# of States
Deployment	91	22%	37
Policies	88	21%	25 + DC
Business Model and Rate Reform	72	17%	32 + DC
Planning and Market Access	68	16%	25 + DC
Studies and Investigations	54	13%	26 + DC
Financial Incentives	49	12%	20
Total	422	100%	47 States + DC

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 2022

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

Massachusetts Regulators Approve Utility Grid Modernization Plans

In November 2022, the Massachusetts Department of Public Utilities approved 2022 – 2025 grid modernization plans filed by Eversource, National Grid, and Unitil. The plans include investments in a variety of technologies, such as AMI and distributed energy resource management systems. Overall, the Department pre-authorized a total of \$1.017 billion in grid-facing and customer-facing investments for the three utilities.

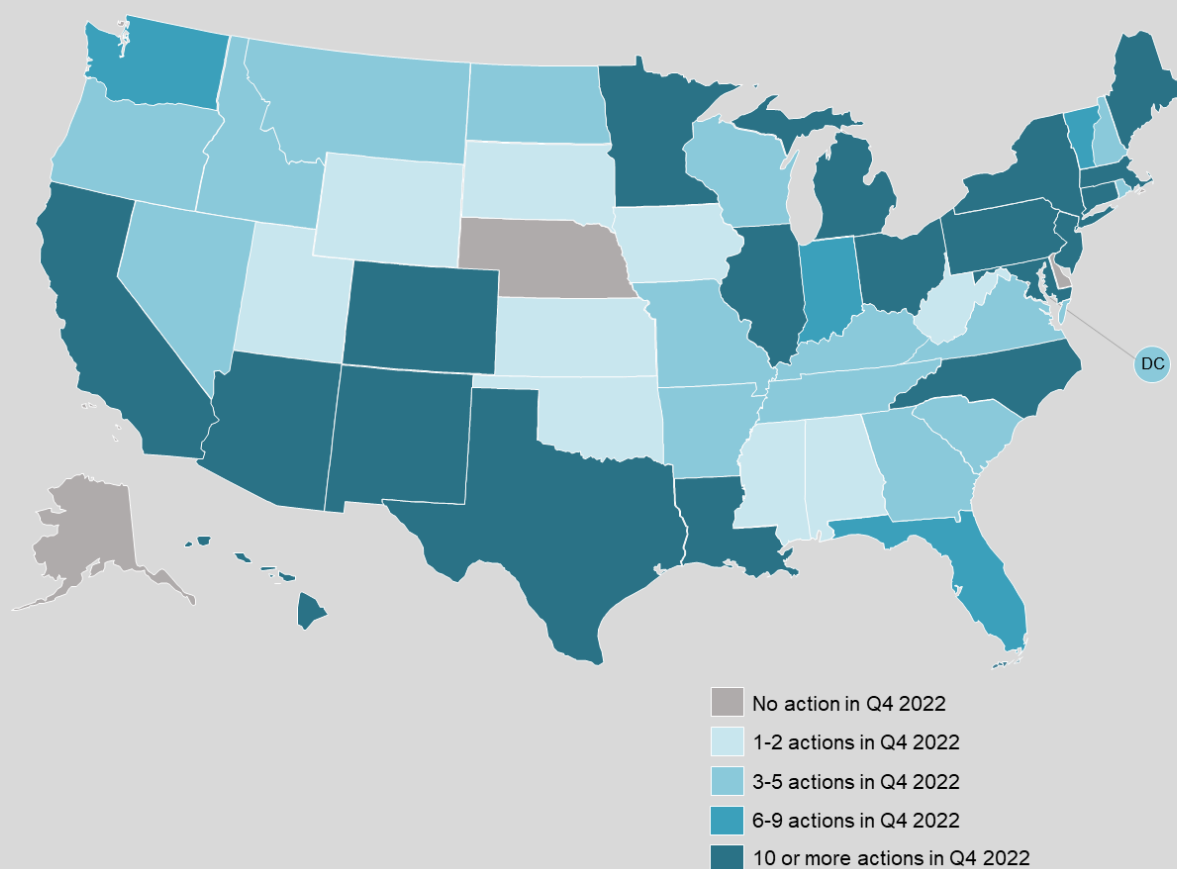
Rhode Island Energy Proposes New Grid Modernization Plan

Rhode Island Energy filed its Grid Modernization Plan in late December 2022, which describes the utility’s vision for future grid modernization proposals through 2042. The plan includes new investments in fault location, isolation, and service restoration, as well as a distributed energy resource management system coupled with distributed energy resource monitoring and management. The plan’s cost estimate for foundational investments is \$529 million.

Duke Energy Progress Requests Approval for Performance-Based Regulation Plan

Duke Energy Progress filed a multi-year rate plan in October 2022 including new performance incentive mechanisms (PIMs), a decoupling mechanism, and an earnings sharing mechanism. The utility is proposing four PIMS based on peak load reduction, low-income affordability, reliability, and renewables integration and encouragement. Duke also included three tracking PIMS in its plan based on customer service, CO₂ emissions, and beneficial electrification from electric vehicles.

Figure 10. Q4 2022 Legislative and Regulatory Action on Grid Modernization



PNM Files Grid Modernization Implementation Plan in New Mexico

PNM filed its Grid Modernization Implementation Plan with New Mexico regulators in October 2022. The plan includes deployment of AMI, an automated distribution management system, a distributed energy resource management system, and a fault location isolation and service restoration module. The total six-year budget for the plan is \$344 million.

Hawaii Public Utilities Commission Adopts Advanced Rate Design Framework

The Hawaii Public Utilities Commission issued an order in October 2022 adopting an advanced rate design implementation framework. The framework lays out the foundational design for future rates, which will include three-period time-of-use energy rates, a fixed charge, and a grid access fee based on bidirectional customer demand. The rates will be rolled out in a phased approach.

MOST ACTIVE STATES AND SUBTOPICS OF Q4 2022

The most common types of actions across the country related to energy storage deployment (50), followed by utility business model reforms (44), smart grid deployment (29), distribution system planning (27), and data access policies (23). The states taking the greatest number of actions related to grid modernization in Q4 2022 can be seen in Figure 12. California, New York and Massachusetts took the greatest number of actions during the quarter, followed by Illinois, Minnesota, New Jersey, Michigan, and Connecticut.

Figure 11. Most Common Types of Actions Taken in Q4 2022

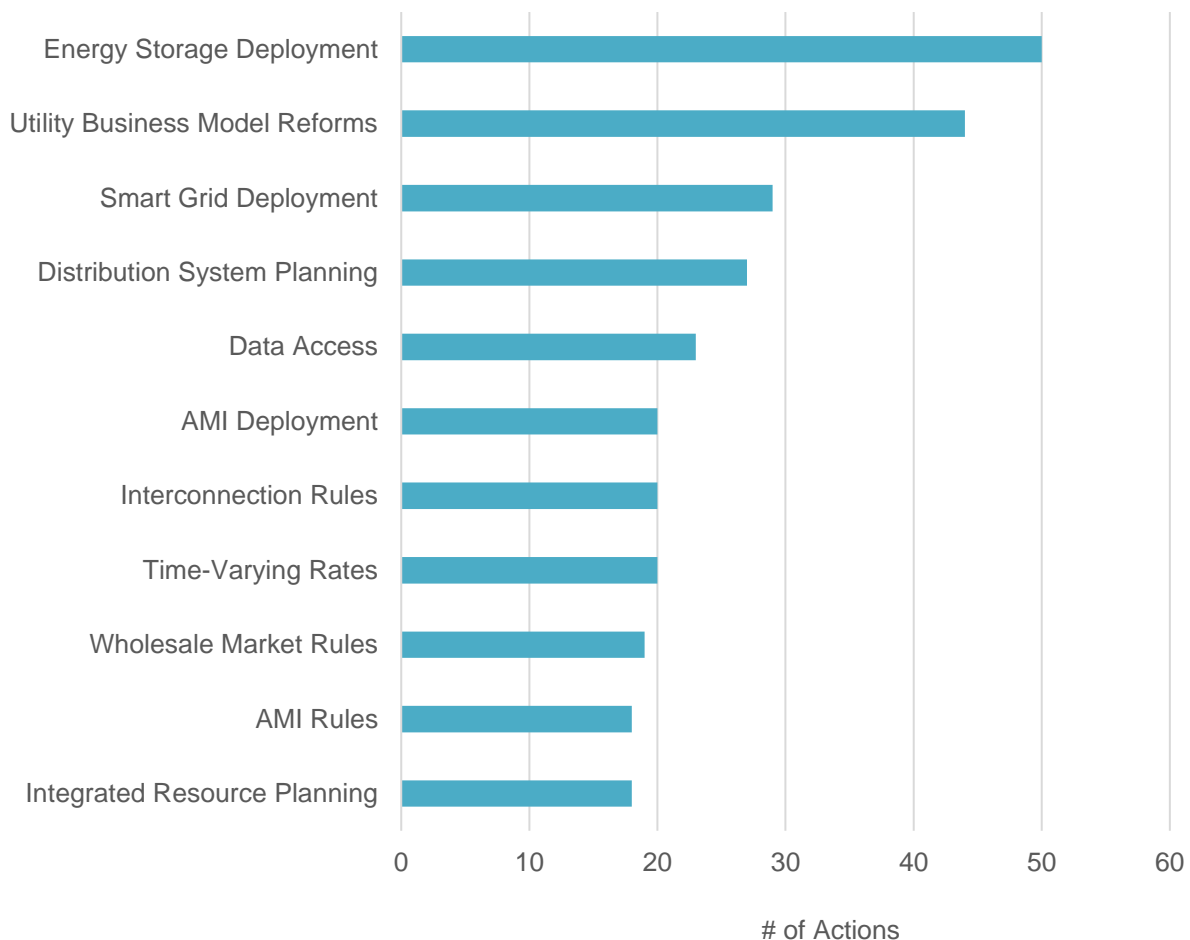
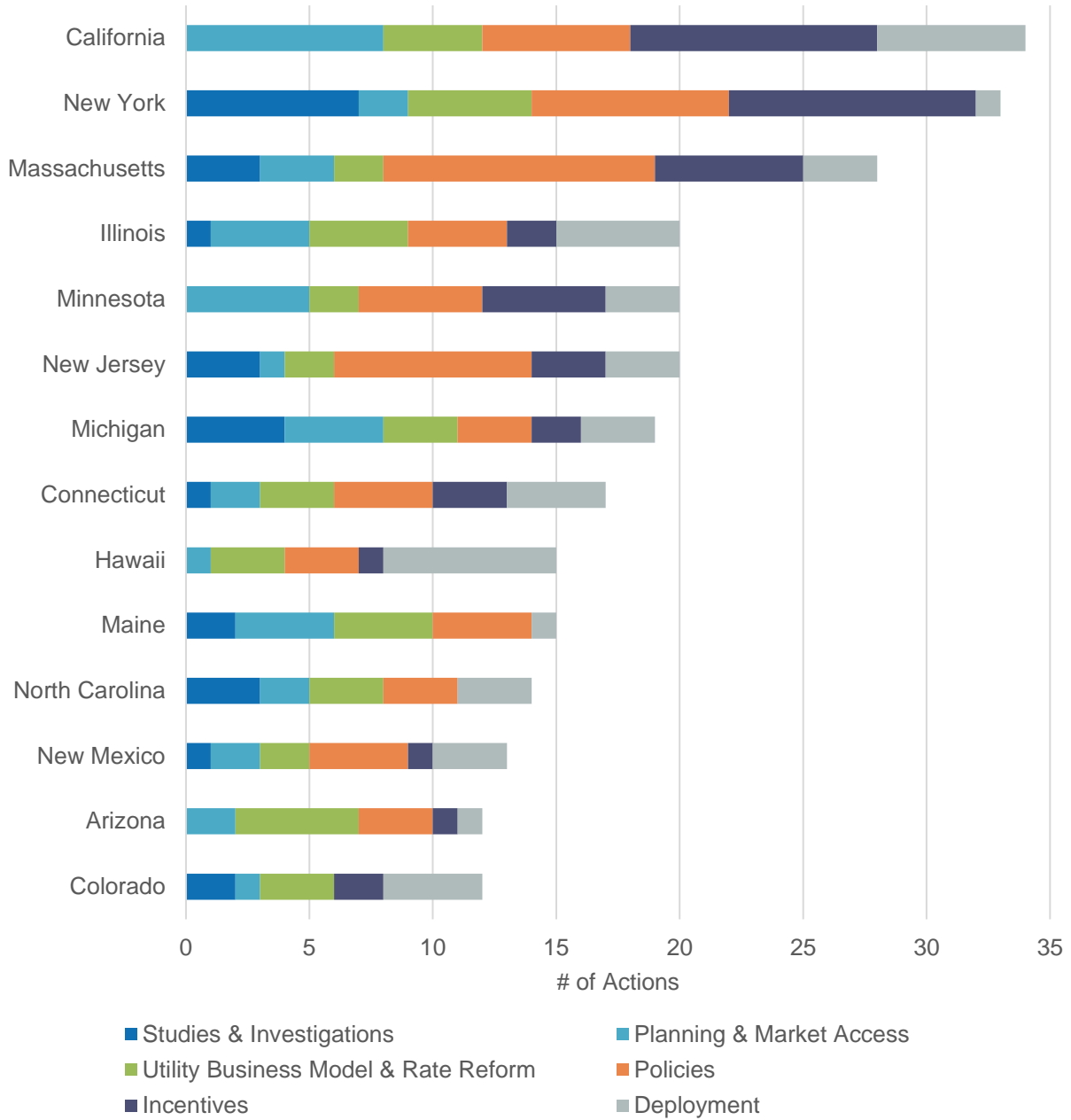


Figure 12. Most Active States of Q4 2022



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.

Advanced Energy Technology Businesses

- Identify new market opportunities, as well as changing and risky markets
- Stay on top of state policy developments relevant to your business
- Give your own team a head start in tracking legislative and regulatory proceedings

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

Visit <https://www.dsireinsight.com/subscriptions/> to purchase the full 50 States of Grid Modernization 2022 Annual Review and Q4 Quarterly Report or learn more about our additional subscription offerings.

Subscription Type	Annual Subscription	Single Report
50 States of Grid Modernization Report	\$1,500	\$500
Single-Tech Subscription (Grid Modernization & Energy Storage) <i>(Includes 50 States of Grid Modernization report, plus biweekly legislative & regulatory grid modernization/energy storage tracking, policy data sheets, & curated monthly policy updates)</i>	\$4,500	N/A
All-Tech Subscription <i>(Includes 50 States of Grid Modernization report, 50 States of Solar report, & 50 States of Electric Vehicles report; plus biweekly legislative & regulatory tracking; policy data sheets, & curated monthly policy updates)</i>	\$10,500	N/A

Customers purchasing an annual subscription receive complimentary access to all past editions of the report. Previous editions of the 50 States of Grid Modernization are offered at a discounted rate upon request.

COMPLIMENTARY COPIES FOR POLICYMAKERS

We offer complimentary copies of the 50 States of Grid Modernization, 50 States of Solar, and 50 States of Electric Vehicles to **policy makers and regulators only** (limited to federal and state legislators and staffers, utility commissioners, utility commission staff, state consumer advocate office staff, and state energy office staff). [Contact us](#) to receive a complimentary copy of the most recent report.

CUSTOMIZED SOLUTIONS

The NC Clean Energy Technology Center also offers customized policy research and analysis services. Visit <http://www.dsireusa.org/services/> to learn more.