Center for American Progress

GETTY IMAGES/ROBERT NICKELSBERG

Building an Ambitious Clean Energy Cabinet

A Guide for Newly Elected Governors

By Luke H. Bassett and Guillermo Ortiz November 2018

Center for American Progress

Building an Ambitious Clean Energy Cabinet

A Guide for Newly Elected Governors

By Luke H. Bassett and Guillermo Ortiz November 2018

Contents

Introduction and summary

The political adage "good people are good policy" is the critical starting point for thinking about clean energy policy goals in state government. Simply put, a newly elected governor may make no more important energy policy decision than his or her appointments for energy adviser, public utility commissioner, and state energy officer. By appointing a diverse set of individuals well-suited to tackling the complex issues in their state's rapidly changing energy landscape, governors can support their state's economic growth and good-paying jobs, improve the public health and prosperity of all of their state's communities, and much more. Understanding the roles of public utility commissions (PUCs), state energy offices, and the governor's energy adviser is paramount to navigating, crafting, implementing, and ultimately regulating a visionary and equitable clean energy agenda.

In the past two years, governors and other leaders across the country have proven the case that states are leading the nation on clean energy in the absence of federal action and often against strong political headwinds.[1] The evidence for a clean energy agenda is clear: Clean energy jobs are growing; related technology and integration costs are increasingly competitive; the public and investors strongly support these solutions; and extreme weather and other climate impacts have caused more frequent and intense destruction—particularly in communities of color and low-income areas, where vulnerabilities to such impacts are higher.[2] The scientific case for action on climate change has only grown clearer and more alarming in this time period.[3] State leaders have fueled the United States' growing clean energy economy by outlining ambitious goals and arming utilities, businesses, and consumers with the policies and incentives needed to reach them.

Now, as new governors enter office in several states, they have a vital opportunity—and responsibility—to enact bold and equitable clean energy agendas and put in place the people needed to achieve them. Each state contains a constellation of energy officials who oversee its policy and programs, state and federal funding, and electric utility regulation and planning. To reach strong clean energy goals, governors must recognize the critical importance of certain key positions in state government—in particular,

public utility commissioners, state energy officers, and their direct energy advisers. By nominating talented and diverse policymakers and regulators, new governors can use these appointments to signal their policy intentions, formalize collaboration across the many state agencies that influence energy policy, make equity a core aspect of energy planning and policy, and empower those officials to carry out their vision. Equally important, though, is the need to set guiding principles and goals that equip these officials to navigate each state's political environment and take a proactive stance on clean energy.

Rather than urging governors to adopt a specific set of policies, this report focuses on the thinking, actions, and decisions that frame any discussion of individual state energy policies. It identifies some of the decision points for newly elected governors that may determine progress toward increased clean energy and lower carbon emissions, as well as related benefits, in any state. To do so, the report describes the roles of and relationships among major state energy policy officials, and it outlines guiding principles that will aid governors in selecting and collaborating with their energy officials. Finally, it discusses certain current state-level energy policy debates—areas where incumbent leaders may increase their ambition and new champions may find ideas to incorporate into their clean energy vision.

The principles described in this report draw on the experience of current and former regulators; energy advisers; energy officers; and staff in California, Colorado, New York, Oregon, and Washington, obtained via personal communications with the authors in September and October 2018. Additionally, expert staff at national organizations dedicated to state government and environment organizations shared their expertise through personal communications with the authors in October 2018. The communications are on file with the authors.

The state of state actions on clean energy

In August 2017, the Center for American Progress Action Fund described the clean energy and climate policy stakes in seven gubernatorial races in 2017 and 2018. The authors argued that candidates should take a stand in favor of strong clean energy and climate actions and published an analysis showing that bold leadership in those seven states would approximately double the carbon emission reductions then covered by state-level commitments.[4] Since that publication, five of those states have elected governors who support taking action on this issue, and this encouraging sign grows even more encouraging when one considers the fact that gubernatorial elections in 36 states just concluded.[5] If every newly elected governor who pledged action on climate and clean energy as a candidate follows through on that pledge, seven additional states could join the existing cohort of 16 states, which would then altogether cover more than 38 percent of U.S. carbon emissions.[6] This presents an incredible opportunity for governors to lead with even greater ambition than that seen in the past two years.

The ranks of governors leading the charge on clean energy have also grown. Gov. Ralph Northam (D-VA) and Gov. Phil Murphy (D-NJ), both elected in 2017, have announced ambitious clean energy plans, including legislation, funding, and appointments of key advisers and regulators.[7] For example, Gov. Northam recently announced the 2018 Virginia Energy Plan, which calls for the deployment of 8,000 megawatts (MW) of solar and wind power by 2022 and directs Virginia's utilities to invest $115 million per year into energy efficiency programs.[8] In New Jersey, Gov. Murphy recently signed a law setting a statewide renewable energy standard of 50 percent by 2030—that's a 2 percent efficiency standard designed to save consumers $200 million on utility bills—and an energy storage goal of 2,000 MW by 2030.[9]

The broader picture of U.S. clean energy progress is very encouraging. Since June 1, 2017, the United States has added enough renewable energy to power more than 3 million homes, and recent analysis of existing binding and voluntary commitments to renewable energy sources at the subnational level forecasts these sources increasing to approximately 500 terawatt-hours by 2025—enough to power 56 million homes annually.[10] Similarly, clean energy jobs grew by 24 percent from 2016 to 2018.[11] In

September 2018, state, local, tribal, and other leaders gathered in San Francisco at the Global Climate Action Summit to discuss progress toward the Paris Agreement goals, including the U.S. nationally determined contribution of decreasing greenhouse gas emissions by 26 percent to 28 percent below 2005 levels by 2025.[12] U.S. state, local, and tribal government leaders, businesses, and civil organizations have already met half of the overall U.S. target and will likely reach two-thirds of that goal by 2025.[13] This achievement is remarkable in light of the aggressive rollback of federal environmental protections, but analysts have forecast that U.S. carbon emissions will likely increase if current federal policies go unchecked.[14]

The latest scientific report about global climate change clearly indicates that the targets set in Paris do not put the world on a path to limiting climate change to 2 degrees Celsius, let alone the safer limit of 1.5 degrees Celsius. Thus, all leaders, regardless of sector or level of government, must move more quickly to lower carbon emissions.[15] Given the current national political circumstances, progress at the state level has become more important than ever; new governors need to tap talented individuals to aid them in advancing clean energy policy in their states. Fortunately, clean energy solutions exist: They are competitive or less expensive than fossil fuel alternatives, attract investment, save money for consumers, and make money for utilities.

Building a state clean energy Cabinet

The transition period between Election Day and assuming office provides governors-elect and their staff time to recharge from the campaign, receive briefings on issues facing the state government, translate their platform into policy proposals, and plan appointments and hiring. The transition also enables governors-elect to communicate their management style, the structure of their offices and information flow, and the order of their policy and governing priorities.[16] By announcing the formation of a clean energy Cabinet during the transition, newly elected governors will highlight the importance of climate and energy policy to their agenda; indicate how they plan to manage relevant policies and programs across different agencies, mandates, and budgets; and elevate the issue for senior state officials, the legislature, and the public. Forming a clean energy Cabinet will empower governors, their advisers, their agency leads, and appropriate staff from independent agencies to share information, conduct policy analysis, and manage issues that cross multiple authorities—from equitable access to worker protections in clean energy—all while elevating the stature of clean energy issues outside the regular operation of broader Cabinet meetings.[17]

Naming an energy adviser is a critical first step from which additional hiring, policy planning, and enthusiasm for the clean energy Cabinet can follow. Energy policy applies across the jurisdictions and policy areas of multiple state agencies—from transportation and economic development to public health and emergency response, and more. Governors need an experienced and savvy energy adviser to navigate, advise on, and manage programs in these cross-cutting areas. Capable energy advisers may also assess budget and other resource needs; build relationships with the legislature directly; and convene political appointees, independent agency staff, and others to address policy implementation.[18] As a senior adviser to the governor, an energy adviser may assist the formation of the governor's entire clean energy Cabinet, nominating individuals to lead relevant agencies and later convening those leaders to tackle policy issues together.

To formulate and promote a comprehensive vision for clean energy, governors should move swiftly to communicate the principles that will guide their hiring, management of agencies, and legislative proposals. These principles include broadly shared good governance practices, from exercising fiscal responsibility to maintaining appropriate public engagement and stakeholder processes.[19] In the context of clean energy, those principles must also include an understanding of the political, economic, and even technical structure of the state's energy system and an ability to discern when to tailor a policy to the existing circumstances or to reshape those circumstances to meet a policy goal. As one example, it is important for a governor and his or her transition team to recognize the market dynamics in a state with large, investor-owned utilities versus one predominantly served by rural electric cooperatives. From that understanding, governors and their energy officials can determine whether to craft policies that match those different utility structures or to guide those utilities into a new policy and regulatory environment. By developing literacy on state energy issues, governors and their energy advisers will more deftly navigate appointments and policy development—matching talent and expertise with ambitious plans.

Promoting clean energy effectively requires raising its stature as a priority across state government agencies—through public and internal communications and coordination with the legislature. By first recognizing the importance of the relationship between the governor's office and the legislature, a strategic governor and his or her energy adviser will need to manage the complex set of political relationships that shape the budget, any new clean energy legislation, and critical appointments. Building relationships with the legislature's leadership and key members will aid funding, policy, and personnel priorities. A governor's initial meetings with those officials presents an excellent opportunity to set his or her clean energy agenda as a legislative priority.

Each state's executive branch has a varying degree of independence from its legislature to shape policies, fund programs, and perform regulatory duties. To determine the course of these executive branch activities, governors should carefully consider the people they appoint to two key roles: the regulator, or public utility commissioner, and the implementer, or leading state energy official. For both positions, newly elected governors should recognize the benefits gained by hiring or nominating diverse candidates: Hiring for diversity across education, gender, work experience, race, and much more enables decision-making about policies, funding priorities, or what determines a fair regulatory outcome to better reflect the full range of citizens affected. In addition, by emphasizing diversity in hiring, governors can remove biases in state energy planning that perpetuate inequities. The following sections describe how each of these roles carries out the policymaking, funding, and regulatory processes of state government and how they factor into a clean energy agenda.

The regulators: Public utility commissioners

In 37 states and the District of Columbia, governors appoint—and state legislatures confirm—commissioners to the state's top regulatory position overseeing utilities that provide electricity, natural gas, other energy resources, water, telecommunications, transportation, and other services.[20] The incoming class of governors will make up to 60 appointments total to public utility commissions in 2019 alone.[21] In the remaining 13 states, voters elect utility commissioners outright or—in the cases of South Carolina and Virginia—the state legislatures elect them.[22] Whether appointed or elected, commissioners typically have staggered terms so that PUCs remain politically independent and maintain the quorum required to make rulings.[23] This report's Appendix also indicates which states have vacant commissioner posts in 2019 and the regulatory authorities that each commission covers.

Public utility commissioners oversee electric utility companies that own and operate systems where physical or other constraints largely limit the service provided to the utility's control, and historically, these conditions have often prevented competition and made it possible to set unreasonable prices or bias the provision of service.[24] For example, a utility's power lines physically limit the flow of electricity from power plants to homes and thus enable the utilities that own the generators and power lines to raise or lower prices unfairly in the absence of regulation.

In the past several decades, many states have introduced retail competition to state electricity markets, and although those developments have expanded and altered the regulator's role, commissioners nevertheless remain vital arbiters of fairness, access, and affordability for consumers and providers alike.[25] The fundamental responsibility of PUCs remains "to ensure that such services are provided at rates and conditions that are fair, reasonable and nondiscriminatory for all consumers."[26] Citizens and their elected representatives have a stake in safeguarding their PUC's independence from political, industry, or other influence over decision-making due to the PUC's authority over the markets, services, and infrastructure that underpin economies and livelihoods.

There is no single ideal utility commissioner. Rather, ideal candidates possess a mix of attributes that enable them to act out of principle in their quasi-judiciary role as regulators. They should have foresight and understanding of the energy system and markets—as well as of environmental and consumer protections—so that they can think and plan alongside utilities and the public in the context of a rapidly changing landscape. An ideal commissioner would manage complex processes with understand-

ing and decisiveness while maintaining his or her independence from undue influence through data, analysis, and direct engagement with stakeholders. Maintaining such independence also requires political skill and an ability to know when best to collaborate or coordinate with state government on issues of energy policy.[27]

PUCs do not often have the budgetary and staff resources to perform on a level playing field with utilities and advocacy groups coming before them in rate cases or other decision-making processes. PUC funding varies by state but typically comes from fees levied through electricity or other utility rates.[28] These fees often have statutory limits, essentially creating de facto budget ceilings for PUCs; by extension, this fact limits their ability to make informed decisions in rapidly changing state energy landscapes.[29] Commissioners and staff must often analyze the current actions and potential effects of new market participants, rate structures, and technologies, but they may not have adequate analytical capabilities in-house or resources allowing them to contract with independent outside experts. For example, the Minnesota Public Utilities Commission has a budget of approximately $7.4 million, drawn from "special assessment[s]," or fees, on the utilities it regulates, but the PUC ranks among the lowest in the country in terms of budget amount per staff member as well as total staff size.[30] Equally problematic, the Oregon Public Utility Commission receives no funding from the state's general fund and instead generated an operating budget of nearly $43 million in the fiscal year 2015–2017 budget period through fees in the rate structure.[31] As part of the transition process, newly elected governors should identify the budget and staffing resources for their state's PUC and discuss with current commissioners and staff the degree to which those resources sufficiently enable the PUC to conduct analysis in rate cases, planning processes, and beyond. In the event that more resources are needed, governors should prioritize this in overall budget considerations.[32]

A PUC's two major regulatory functions are adjudicating rate cases and managing the utility planning process to meet state energy policy goals. Depending on the state, PUCs have authorities over a broad range of activities: siting power generation units and interstate transmission lines; overseeing utility business mergers and acquisitions; assessing resource adequacy and mix; regulating retail sales and rates to consumers; guiding utility planning; and setting standards for the types of consumers allowed to connect to the grid or provide electricity, among many other elements of electricity distribution.[33] Across this spectrum of activities, governors should encourage current commissioners and those they nominate to take a proactive approach to planning and improving the rate-making process and outcomes rather than maintaining a status quo process that defers to the timeline of utilities petitioning for rate changes.

In many states, PUCs are responsible for reviewing and approving integrated resource plans (IRPs) developed by utilities, including whether a particular IRP serves the public interest.[34] Utility and electricity system planning involve yearslong to decadeslong processes due to the cost of investment and the technical, environmental, and stakeholder review needed for major infrastructure projects.[35] The comparatively rapid changes in electricity markets may eclipse these planning processes by removing the need for one type of investment and adding others. This has proven true in several recent IRP publications, including the Tennessee Valley Authority's 2015 plan, which revealed a series of underestimated projections for growth in electricity demand, or in the revelation that an Indiana utility's 2018 plan presented a strong economic case for renewable generation over existing coal generation even in conditions favorable to coal.[36] The IRP process has become a pivotal feature in how utilities respond to changes in state energy policies, such as renewable portfolio standards, that originate in the legislature or governor's office, but by issuing guidance for IRPs proactively, utility commissions help further shape how utilities navigate the changing electricity landscape.[37]

Where public utility commissioners are elected, governors should approach the independent regulators by assessing their need for additional resources and the common need to share information on the state's energy markets. To pursue a proactive clean energy agenda while maintaining PUCs' independence, governors, their energy advisers, and clean energy Cabinet members should share information—including by submitting formal comments to regulatory proceedings—and invite commissioners to attend meetings as methods of establishing communication for the benefit of the regulator. Including PUCs—at the staff level or commissioners themselves—in processes will aid policy planning and implementation across state government and will introduce PUCs' perspectives. In the best circumstances, it may even prevent subsequent policy challenges before the commission.

The implementers: State energy officers

The role of state energy officer varies greatly from state to state, but in general, governors appoint them to work directly in the governor's office or in a relevant state agency such as one that is standalone or one that deals with commerce, economic development, or environmental issues.[38] State energy offices fund, finance, and work with legislatures to propose, pass, and implement energy laws and programs.[39] They fundamentally differ from PUCs because they typically have little or no statutory authorities and instead utilize state, utility-based, or federal funding for energy efficiency and

clean energy programs, including those that benefit low-income families.[40] As opposed to energy advisers directly in the governor's office, state energy officers may report up through firmly established state agencies and may thus have less influence on state policy and legislative proposals. Whereas energy advisers help craft and manage a governor's clean energy vision and utility commissioners ensure fairness in this vision's implementation, state energy officers fund and shape the implementation and therefore play a crucial role in transforming the state energy system.

Federal funding provides governors a key tool to incentivize and demonstrate the energy policy changes they seek to make more broadly. With this in mind, state energy officers have access to major energy-focused funding streams from the U.S. Department of Energy (DOE) and the U.S. Department of Health and Human Services (HHS). In each case, state energy officers can direct funding or work with third-party administrators to leverage federal dollars into larger partnerships that lead to more effective and further-reaching programs. The three main sources of federal funding to states include DOE's Weatherization Assistance Program and State Energy Program and HHS' Low-Income Home Energy Assistance Program (LIHEAP). Together, these funding sources aid governors in providing critical assistance to low-income and other disadvantaged families and in increasing their state's energy efficiency and clean energy deployment.

- **Weatherization Assistance Program:** To reduce the energy burden faced by low-income households and vulnerable populations, governors can direct Weatherization Assistance Program (WAP) funds to third parties that deliver essential weatherization services, including improvements to heating and cooling systems, insulation installation, door and window repair, and the installation of efficient appliances and lighting fixtures.[41] In fiscal year 2017, the WAP provided states with more than $186 million to improve the energy efficiency and safety of households across the country.[42] This funding can have tangible impacts at the state level: Since 2010, Florida has used $12.9 million in WAP funding to weatherize 2,400 homes.[43] Eligibility for weatherization assistance is based on state-determined income requirements within DOE guidelines, but households that already receive Supplemental Security Income or Aid to Families with Dependent Children are automatically eligible.[44]

- **State Energy Program:** Through DOE's State Energy Program (SEP), governors can utilize technical assistance and federal funding to empower state-led energy initiatives, reduce energy costs and waste, and promote energy security, resiliency, and emergency preparedness.[45] In FY 2017, states received nearly $38 million in

SEP formula grant funding; additionally, DOE awarded $5 million in competitive awards to 16 states and territories for projects ranging from state energy planning and streetlight efficiency upgrades to energy audits and electric vehicle charging infrastructure.[46] By thoughtfully crafting state annual plans and matching 20 percent of SEP allocations—both eligibility requirements for SEP assistance—state policymakers can act decisively to advance a clean energy agenda and address state-specific energy priorities.[47]

- **Low Income Home Energy Assistance Program:** Low-income households may spend up to three times more of their income on energy costs compared with households with a median annual income of $90,000.[48] To assist with this challenge, particularly in cold climates in winter or hot climates in summer, HHS' LIHEAP provides assistance to vulnerable households.[49] LIHEAP funding is allocated via block grants or emergency contingency funds, and state agencies—including energy offices and departments focused on housing, consumer affairs, or community development—may use it toward heating or cooling costs, minor energy-related home repairs, weatherization assistance, crisis assistance, and other efforts to reduce households' energy burden.[50] For example, New York Gov. Andrew Cuomo (D) made $3 million in LIHEAP funding available to install window air conditioners in low-income households that include individuals who have documented medical needs in an effort to reduce their exposure to summer heat waves.[51] LIHEAP assistance is contingent on household income level; specifically, it is available to those households in which annual income does not exceed 60 percent of the state median income or 150 percent of the federal poverty level.[52]

Additional clean energy Cabinet members to consider

Upon appointing an energy adviser and outlining how clean energy relates to other agencies and policy initiatives, newly elected governors should consider how best to organize and staff their clean energy Cabinet to address cross-cutting issues on an ongoing basis. Matching the makeup of state agencies and jurisdictions to who should make up the state clean energy Cabinet will require maintaining focus on the policy agenda tasked to that Cabinet; to that end, the governor should convene the clean energy Cabinet regularly. In addition to the energy adviser, state energy officer, and public utility commissioners (or their representative staff), governors should consider naming the following posts to their clean energy Cabinet:

- **Secretary of agriculture:** A state's secretary of agriculture focuses on regulating and creating incentives for farming and rural economic development, but rural areas contribute greatly to state energy economies. This role may aid in identifying policy solutions for financing clean energy infrastructure in those areas or agriculture-specific technologies to lower carbon emissions.[53]

- **Budget director:** Providing governors accurate financial information and budget analysis can allow them to identify strategies to maximize or redirect state funding to deliver on clean energy policy priorities.[54]

- **Chief information officer:** Governmentwide technology policies and standards, particularly how state governments approach privacy and cybersecurity and coordinate with relevant federal agencies on these matters, are critical to state policymaking in the energy sector.[55]

- **Chief resilience officer or emergency management director:** As extreme weather incidents increase in number and intensity, improving emergency preparedness, planning for response, and ensuring the resilience of state government itself calls for creating the chief resilience officer role in state government, if it does not exist, and involving that person on the clean energy Cabinet.[56]

- **Chief sustainability officer:** State governments should lead by example by coordinating government policies, programs, and initiatives to set and implement high standards of energy and water efficiency, promote clean energy, and incorporate resilience planning across agencies.[57]

- **Community or local affairs director:** Interfacing with local communities goes beyond providing them financial support, technical assistance, and training; governors should also see community or local affairs as a critical way to communicate their clean energy vision and implement key aspects of their policies. For example, the Colorado Department of Local Affairs

has worked alongside the governor's Energy Office to help local decision-makers implement the latest national model energy codes.[58]

- **Consumer affairs or protection director:** Protecting consumers and businesses from fraud, deception, or unfair business practices is a critical role of government, particularly as new distributed energy technologies appear on the market nearly every day. The state's consumer protection office should ensure a fair playing field for businesses and instill confidence in consumers so that clean energy technologies do not suffer at the hands of bad actors.[59]

- **Secretary of economic development or commerce:** Uniting clean energy deployment with economic development will ignite economic and job growth; governors should elevate clean energy on the economic agenda by involving their economic development office in decision-making at an early stage.[60]

- **Environmental protection agency chief:** As the state's lead agency charged with protecting air, land, and water resources and public health, there may be no more important agency than environmental protection or quality. Governors should name the lead environmental protection official—and his or her air and water quality deputies—to the state clean energy Cabinet to integrate energy and environmental policies in a more systematic and sustainable manner.[61]

- **Labor commissioner:** Responsible for ensuring workplace safety, fair wage standards, and workforce development, a labor commissioner will play a critical role in preparing a state's workforce as more states aim to develop clean energy economies.[62]

- **Natural resources and fish and wildlife director:** Developing clean energy facilities, particularly on public lands, requires a balance with the state's role in regulating and protecting its natural resources, including recreation areas, state parks, forests, and wildlife. Environmental review processes require thoughtful collaboration with natural resources and fish and wildlife departments.[63]

- **Secretary of transportation:** Tasked with maintaining and operating state transportation systems, including roads, airports, bridges, and railroads, secretaries of transportation may help advance a governor's clean energy agenda by funding electric vehicle charging infrastructure and pilot programs, increasing bicycle and transit system funding, and investing in replacing state fleet vehicles with electric or other vehicles.[64]

State governments frequently combine or separate these agencies and roles differently from one another.

Select policy issues facing state clean energy Cabinets

The policy opportunities available to governors and their clean energy Cabinets today are seemingly endless. The various policy debates playing out across the United States span from continental-scale electricity trading to neighborhood demand-management programs.[65] The incoming data and analysis of the electric grid moves at milliseconds, and the diversity of actors even in the smallest subsectors makes the policy arena fascinating—and frustrating to govern or regulate. The following sections of this report discuss several topics that have appeared in multiple states, reflect recurring trends, or otherwise present opportunities for governors to significantly advance their clean energy agenda in states across the country.

Efficiency: The building block of a high-performance energy system

Energy efficiency is the foundation on which governors should build their comprehensive clean energy agendas because it offers a wide range of benefits—cost savings foremost among them—to utilities, ratepayers, and grid operators. Energy efficiency improvements can allow a utility to defer costly transmission and distribution investments or the construction of a new power plant, lower electricity costs for ratepayers, and help grid operators maintain the reliability of the grid by lowering peak demand.[66]

Energy efficiency resource standards (EERS), are one type of policy proven by states to increase energy efficiency: By enacting an EERS, governors and legislatures set a target for decreasing demand for electricity and natural gas, and enable utilities to meet it either by trading credits, installing efficiency improvements in their own generation and distribution systems, or working with consumers to fund or finance improvements such as weatherization upgrades, lighting retrofits, or demand management programs.[67] In 1999, Texas became the nation's first state to adopt an EERS, calling for investor-owned utilities to meet 10 percent of their demand growth through efficiency, and since then, many states have followed suit.[68] Currently, 25 states have mandatory EERS policies, and four states have voluntary targets.[69] In May 2018, New Jersey became the most recent state to adopt an EERS, setting 2 percent electric and 0.75 percent natural gas efficiency goals within five years of program implementation.[70]

Although governors, their energy advisers, and legislatures typically draw up the details of an EERS, state energy offices and public utility commissions play an important role in implementing the programs and ensuring that their implementation meets statutory and grid operation guidelines so that outcomes apply fairly.[71] An EERS complements other energy efficiency policies, and some states have combined them with renewable portfolio standards or clean energy standards, which set targets for the sources of electricity generation in the state.[72] Typically, EERS policies combine financial incentives to aid utilities in complying with the efficiency target and with penalties for noncompliance.[73]

State electricity markets and rate structures

Retail electric markets, the regulatory domain of state PUCs, have undergone transformational changes in the past few decades. The traditional electric utility business model earns profits based on the amount of power sold to customers, arguing in so-called cost recovery or cost-of-service rate cases before their PUC that the corresponding rate should cover the cost of building and operating new equipment needed to meet that customer demand plus a reasonable profit margin for the utility.[74] The cost recovery model has not adapted well to the advent of new, inexpensive generation resources such as natural gas and renewables, electricity market shifts that have opened competition, distributed and interconnected grid technologies, and flat demand for electricity. Beginning in the 1990s, states began encouraging competition among electric utilities and third-party generators, providing customers choice among generation types and rates.[75] Rate structure and utility business model reform is a topic that industry, consumer and environmental advocates, and governments will continue to tackle for many years, but the need to address climate change and incorporate clean energy into the grid in ways that foster affordability and fair competition must become central to how governors and their clean energy Cabinets approach the matter. An illustrative summary of rate structures is as follows:

- **Cost recovery model:** Traditionally, under the so-called state regulatory compact, PUCs enabled utilities to set rates based on their operating and capital expenditures and a reasonable rate of return, and in return for recouping their costs, utilities provided service to customers in their territory.[76] In the context of flattening or declining demand, however, this rate structure may no longer cover utility costs or return a profit, and in general, the model aligned utility interests with ever-increasing demand growth rather than a realistic assessment of performance.[77]

- **Time-of-use, or time-variant, rates:** Throughout the day, the demand for and cost of electricity rise and fall on a second-by-second basis; however, the typical metered electricity rate, based on the volume (in kilowatt-hours, or kWh) used rarely reflects the true cost of generation at any given moment. In an effort to remedy this issue, some PUCs have adopted time-of-use or other time-variant rates that are based on the hour and demands on the system in order to nudge customers to use energy at times with lower demand.[78] Well-designed time-of-use rates ease grid congestion; aid utilities in avoiding costs related to demand management; reflect more accurate electricity costs to inform customer decision-making; and may incentivize or directly compensate distributed energy resources, such as grid-integrated water heaters, that assist demand management overall.[79]

- **Performance-based rate:** Rather than tying utility revenues to capital investments, the more recent performance-based rate-making model aligns utility revenues with successfully reaching predetermined performance metrics, such as quality-of-service metrics, reducing blackouts, or increasing the adoption of clean energy sources.[80] States have begun to consider performance metrics in their rate-making proceedings, and Hawaii has mandated a new rate model based on metrics for customer service, renewable integration, reliability, affordability, and other factors.[81]

One critical policy problem facing state regulators and policymakers is how to account for the costs and benefits of electricity generation technologies in a way that more comprehensively reflects so-called externalities, including pollution. Under the Obama administration, federal policymakers calculated a metric accounting for damages caused by greenhouse gas emissions called the social cost of carbon that aids in determining both the costs of pollution and the benefits of preventing or reducing greenhouse gas emissions.[82]

Governors and other state energy officials should incorporate the social cost of carbon into their policymaking and regulatory processes.[83] Estimates of the social cost of carbon vary due to challenges in predicting future emissions and social, ecological, and economic impacts, but some states have adopted the federal metric in policymaking and regulatory proceedings despite its rollback at the federal level.[84] In the past two years, the Colorado PUC required and the Nevada PUC proposed requiring utilities to incorporate the social cost of carbon into their integrated resource plans.[85] In 2017, the U.S. Climate Alliance and prominent think tanks announced a project to continue updating the social cost of carbon for use in state decision-making.[86]

Energy storage

The term "energy storage" refers to a broad and diverse set of technologies that store energy for later use or provide services to the grid such as balancing other resources. Common energy storage technologies include pumped storage hydropower, batteries, thermal storage, compressed air devices, and flywheels, and each of these technologies has its unique application, history of development and commercialization, and costs.[87] In recent years, falling costs, increasing renewable energy adoption, and changes in public policy at both the state and federal levels have enhanced the value proposition for energy storage technologies. For example, over the next five years, average costs for lithium-ion batteries are expected to fall by 36 percent, having already declined 79 percent since 2010.[88] Given the potential—and need—for renewable generation growth, the falling cost trends for storage technologies indicate their importance to state clean energy agendas.[89]

Despite this outlook, many states have not utilized the policy tools needed to encourage the deployment of energy storage technologies in electricity markets. Even with the recent falling costs of battery storage, some energy storage systems are not yet cost-competitive with transmission and generation technologies.[90] Additionally, there may be opportunities to retrofit existing facilities for higher efficiency or to add new energy storage capabilities—as proposed recently for the Hoover Dam.[91] In planning and policymaking, governors, state legislators, and utility commissioners should consider how to remove market and regulatory barriers for energy storage technologies, enable utilities to value the grid benefits these technologies provide in their rate structures, and ensure that consumers understand the benefits that extend to them as well.[92]

To fully realize the grid benefits of energy storage, state leaders across the country are starting to support and implement public policies that encourage the greater integration of energy storage into the electric grid. Several states, including California, New York, and New Jersey, have established energy storage targets that direct utilities to add specific amounts of energy storage capacity in their service territories, enabling utilities to adapt their business models in the process.[93] Utility commissions in states such as New Mexico and Washington have also encouraged or mandated the inclusion of energy storage technologies in IRPs, through which utilities forecast and propose actions to meet electricity demand and maintain a resource reserve.[94] State energy storage plans have also included incentives, whether via financing mechanisms through the utility commission, tax credits, or direct funding through grants.[95] These policies and programs serve as useful examples of how state leaders are capturing the benefits of energy storage for multiple policy goals.

Electric vehicles and charging infrastructure

Reducing air and carbon pollution from the transportation sector calls for the greatest amount of cooperation among state agencies because transportation crosses many jurisdictions and budget lines while also supporting vital state activities—from emergency services to economic development. Increasingly, governors have turned to electric vehicle incentives and charging infrastructure funding to tackled emissions in this sector. Their policymaking efforts have included reducing the cost of charging infrastructure, increasing accessibility to charging stations, and requiring utility investment.[96] Leaders in California, Arizona, Rhode Island, and New York have adopted financial incentives such as rebates, tax credits, and grants to promote plug-in electric vehicle charging infrastructure.[97]

According to recent Center for American Progress analysis, the United States needs to add 14 million plug-in electric vehicles (PEVs) cumulatively from 2018 to 2025 to continue on the emissions reduction pathway toward its climate goals under the Paris climate agreement.[98] To support this increase in PEVs, the United States should deploy 330,000 new public Level 2 and direct current (DC) fast charging outlets.[99] States such as California, Colorado, Connecticut, Hawaii, Maryland, Nevada, Oregon, Vermont, and Washington are leading the country to bridge the charging infrastructure deployment gap; each state has more than 15 percent of both the public Level 2 and DC fast chargers that CAP has estimated they will need by 2025.[100] Governors and their clean energy Cabinets should consider incorporating policy solutions such as state government fleet procurement requirements, electric vehicle charging infrastructure siting at state facilities, and incentives such as tax credits to stimulate growth in their state's electric vehicle market.

Conclusion: Principles and recommendations for leading an effective state clean energy Cabinet

Newly elected governors face a steep learning curve between Election Day and their inauguration. By hiring talented advisers, learning the basic contours of their state's energy policy landscape, and communicating clear guiding principles for prioritizing, shaping, and implementing clean energy policy, they can transform their state economies and energy systems and fuel the political will for other states—and even the entire country—to enact the solutions needed. The following principles and recommendations will help guide newly elected governors to communicate and achieve a clean energy vision for their states:

- Develop a basic understanding of the political, economic, and technical characteristics of the state energy system, keeping in mind that they may change rapidly.
- Build strong relationships with key legislators.
- Elevate the stature of clean energy as a statewide issue in public and internal communications, convening senior state leaders in a regular clean energy Cabinet meeting and connecting the importance of the issue to other policy areas and audiences.
- Set a hiring model by seeking candidates for state energy staff and appointments whose experience and talent align with the roles and responsibilities of the open position and who also bring diverse backgrounds and perspectives to government.
- Recognize that energy issues affect diverse sectors of the economy and society—from mobility to housing to jobs—and proactively seek analysis and advice on potential impacts beyond the immediate scope of an individual policy or program.

- Examine information from multiple angles by considering impacts to affordability, the energy system, security, the environment, and jobs, among others.

- Make decisions based on facts and analysis from a variety of sources—economic, energy, scientific, and more—not solely based on political factors.

- Uphold transparency, accountability, and government ethics in clean energy policy activities, including in data collection, analysis, decision-making, and hiring.

- Foster collaboration by charging multiple agency leaders and other senior officials with tackling cross-cutting policy issues, convening these leaders directly in regular clean energy Cabinet meetings, and ensuring they and their agencies and offices have adequate resources.

- Proactively engage executive branch staff, agency leaders, the legislature, the private sector, and the public in order to learn about obstacles and opportunities and communicate proposed solutions.

- Safeguard the independence of public utility commissions while including them in the discussion of state clean energy policy.

- Encourage members of the state clean energy Cabinet to take a proactive role in determining and implementing policies, rather than having them maintain a reactive stance in relation to the legislature, private sector, or other outside factors.

About the authors

Luke H. Bassett is the associate director of Domestic Energy and Environment Policy at the Center for American Progress.

Guillermo Ortiz is a research assistant for Energy and Environment at the Center.

Acknowledgments

Several former and current state energy and utility commission officials and experts generously shared their wisdom with the authors in developing this report. Additionally, the authors would like to thank Angelica Lujan for research assistance, Patrick Dolan for helping share this report with state leaders, and the CAP Editorial team for its steadfast work.

Appendix

APPENDIX TABLE 1

State clean energy Cabinets

Public utility commissions and their attributes

Name	Size	2019 vacancies	Selection process	Major regulatory authorities
Alabama Public Service Commission	3	2	Elected	Electricity, natural gas, water and sewer, telecommunications, transportation
Regulatory Commission of Alaska	5	1	Appointed	Electricity, natural gas, water and sewer, telecommunications
Arizona Corporation Commission	5	2	Elected	Electricity, natural gas, water and sewer, telecommunications
Arkansas Public Service Commission	3	2	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
California Public Utilties Commission	5	1	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Colorado Public Utilities Commission	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Connecticut Public Utilities Regulatory Authority	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications
Delaware Public Service Commission	5	2	Appointed	Electricity, natural gas, water and sewer, telecommunications
District of Columbia Public Service Commission	3	2	Appointed	Electricity, natural gas, telecommunications
Florida Public Service Commission	5	3	Appointed	Electricity, natural gas, water and sewer, telecommunications
Georgia Public Service Commission	5	2	Elected	Electricity, natural gas, telecommunications
Hawaii Public Utilities Commission	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Idaho Public Utilities Commission	3	2	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Illinois Commerce Commission	5	1	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Indiana Utility Regulatory Commission	5	4	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Iowa Utilities Board	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Kansas Corporation Commission	3	1	Appointed	Electricity, natural gas, telecommunications, transportation

Name	Size	2019 vacancies	Selection process	Major regulatory authorities
Kentucky Public Service Commission	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications
Louisiana Public Service Commission	5	1	Elected	Electricity, natural gas, water and sewer, telecommunications, transportation
Maine Public Utilities Commission	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Maryland Public Service Commission	5	1	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Massachusetts Department of Public Utilities	3	2	Appointed	Electricity, natural gas, water and sewer, transportation
Michigan Public Service Commission	3	1	Appointed	Electricity, natural gas, telecommunications
Minnesota Public Utilities Commission	5	1	Appointed	Electricity, natural gas, telecommunications, transportation
Mississippi Public Service Commission	3	0	Elected	Electricity, natural gas, water and sewer, telecommunications, transportation
Missouri Public Service Commission	5	2	Appointed	Electricity, natural gas, water and sewer, telecommunications
Montana Public Service Commission	5	2	Elected	Electricity, natural gas, water and sewer, telecommunications, transportation
Nebraska Power Review Board	5	2	Elected	Electricity, transportation
Nevada Public Utilities Commission	3	0	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
New Hampshire Public Utilities Commission	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications
New Jersey Board of Public Utilities	5	2	Appointed	Electricity, natural gas, water and sewer, telecommunications
New Mexico Public Regulation Commission	5	3	Elected	Electricity, natural gas, water and sewer, telecommunications, transportation
New York Public Service Commission	4	3	Appointed	Electricity, natural gas, water and sewer, telecommunications
North Carolina Utilities Commission	7	3	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
North Dakota Public Service Commission	3	2	Elected	Electricity, natural gas, telecommunications, transportation
Ohio Public Utilities Commission	5	2	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Oklahoma Corporation Commission	3	1	Elected	Electricity, natural gas, water and sewer, telecommunications, transportation
Oregon Public Utility Commission	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications
Pennsylvania Public Utility Commision	5	2	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Rhode Island Public Utilities Commission	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
South Carolina Public Service Commission	7	1	Elected by state legislature	Electricity, natural gas, water and sewer, telecommunications, transportation
South Dakota Public Utilities Commission	3	1	Elected	Electricity, natural gas, telecommunications
Tennessee Public Utility Commission	6	6	Appointed	Electricity, natural gas, water and sewer, telecommunications
Public Utility Commision of Texas	3	1	Appointed	Electricity, water and sewer, telecommunications

Name	Size	2019 vacancies	Selection process	Major regulatory authorities
State of Utah Public Service Commission	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications
Vermont Public Utility Commission	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications
Virginia State Corporation Commission	3	2	Elected by state legislature	Electricity, natural gas, water and sewer, telecommunications
Washington Utilities and Transportation Commission	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Public Service Commission of West Virginia	3	1	Appointed	Electricity, natural gas, water and sewer, telecommunications, transportation
Public Service Commission of Wisconsin	3	0	Appointed	Electricity, natural gas, water and sewer, telecommunications
Wyoming Public Service Commision	3	2	Appointed	Electricity, natural gas, water and sewer, telecommunications

Sources: A full list of sources is available at https://cdn.americanprogress.org/content/uploads/2018/11/13062606/BassettAppendixTable1Sources.pdf.

APPENDIX TABLE 2

State clean energy Cabinets

State energy offices or equivalents, their attributes and FY 2017 funding levels

Lead agency	Selection process	Weatherization Assistance Program (WAP)	State Energy Program (SEP)	Low-Income Home Energy Assistance Program (LIHEAP)	2017 state spending on low-income energy-efficiency programs
Alabama Department of Economic and Community Affairs, Energy Division	Appointed	$2,001,957	$619,070	$44,673,651	$7,188,231
Alaska Energy Authority	Appointed	$1,420,672	$297,970	$10,260,374	$4,950,000
Arizona Office of Grants and Federal Resources	Appointed	$1,035,535	$580,930	$20,745,499	$4,213,451
Arkansas Department of Environmental Quality, Energy Office	Appointed	$1,634,256	$479,930	$26,818,870	—
California Energy Commission	Appointed	$5,219,899	$2,564,420	$170,668,398	$422,500,000
Colorado Energy Office	Appointed	$4,570,469	$618,810	$51,040,984	$9,778,532
Connecticut Department of Energy and Environmental Protection	Appointed	$2,157,737	$562,840	$78,712,451	$33,439,825
Delaware Department of Natural Resources and Environmental Control, Division of Climate, Coastal, and Energy	Appointed	$469,478	$269,720	$12,035,851	$2,737,880
D.C. Department of Energy and Environment, Energy Administration	Appointed	$491,792	$255,140	$10,382,114	$4,748,481
Florida Department of Agriculture and Consumer Services, Office of Energy	Elected	$1,650,592	$1,369,050	$71,099,368	$8,054,647
Georgia Environmental Finance Authority, Energy Resources Division	Appointed	$2,498,770	$883,230	$56,223,772	$2,500,744
Hawaii Department of Business, Economic Development and Tourism, Hawaii State Energy Office	Appointed	$140,335	$282,700	$5,143,448	—
Idaho Governor's Office of Energy and Mineral Resources	Appointed	$1,629,400	$316,530	$19,019,105	$2,250,000
Illinois Department of Commerce & Economic Opportunity, Illinois Energy and Recycling Office	Appointed	$11,194,074	$1,598,560	$167,395,704	$73,500,000
Indiana Office of Energy Development	Appointed	$5,522,666	$937,810	$75,785,408	—
Iowa Economic Development Authority, Iowa Energy Office	Appointed	$4,082,535	$567,230	$53,714,858	$9,598,588
Kansas Corporation Commission: Kansas Energy Office	Appointed	$2,077,037	$499,840	$33,560,917	—
Kentucky Energy and Environment Cabinet, Office of Energy Policy	Appointed	$3,784,900	$634,000	$48,634,012	—
Louisiana Department of Natural Resources, Technology Assessment Division, State Energy Office	Appointed	$1,164,366	$785,980	$42,462,057	$616,649

Lead agency	Selection process	Weatherization Assistance Program (WAP)	State Energy Program (SEP)	Low-Income Home Energy Assistance Program (LIHEAP)	2017 state spending on low-income energy-efficiency programs
Maine Governor's Energy Office	Appointed	$2,553,361	$349,110	$37,748,756	$3,635,275
Maryland Energy Administration	Appointed	$2,223,918	$713,040	$74,051,242	$20,989,946
Massachusetts Executive Office of Energy and Environmental Affairs, Department of Energy Resources	Appointed	$5,401,178	$856,850	$147,124,184	$109,693,523
Michigan Agency for Energy	Appointed	$12,897,077	$1,326,440	$157,861,284	$26,470,052
Minnesota Department of Commerce, Division of Energy Resources	Appointed	$8,186,892	$827,520	$114,498,307	$12,753,000
Mississippi Development Authority, Energy and Natural Resources Division	Appointed	$1,302,843	$454,540	$29,685,504	$3,188,507
Missouri Department of Economic Development, Division of Energy	Appointed	$4,957,217	$771,000	$73,618,155	$7,562,669
Montana Department of Environmental Quality, Montana Energy Office	Appointed	$2,064,147	$294,920	$19,347,426	$3,504,151
Nebraska State Energy Office	Appointed	$2,060,888	$391,890	$29,344,891	$462,162
Nevada Governor's Office of Energy	Appointed	$738,256	$345,200	$10,207,878	—
New Hampshire Office of Strategic Initiatives, Energy Division	Appointed	$1,247,697	$329,380	$28,546,488	$4,998,360
New Jersey Board of Public Utilities, Clean Energy Division, Office of State Energy Services	Appointed	$4,276,478	$1,096,140	$120,141,895	$28,865,149
New Mexico Energy, Minerals and Natural Resources Department, Energy Conservation and Management Division	Appointed	$1,419,656	$359,830	$17,636,994	$1,677,950
New York State Energy Research and Development Authority	Appointed	$16,848,651	$2,162,140	$366,508,484	$55,517,919
North Carolina Department of Environmental Quality, Division of Energy, Mineral and Land Resources, Energy Group	Appointed	$3,475,888	$897,590	$84,227,719	$5,572,570
North Dakota Department of Commerce, Division of Community Services, Office of Renewable Energy & Energy Efficiency	Appointed	$2,047,757	$291,110	$19,356,710	—
Ohio Development Services Agency, Office of Energy and Redevelopment	Appointed	$11,343,947	$1,492,380	$148,086,520	$32,880,000
Oklahoma Office of the Secretary of Energy and Environment, State Energy Office	Appointed	$2,136,596	$562,640	$32,962,512	$9,966,652
Oregon Department of Energy	Appointed	$2,379,188	$505,310	$35,282,766	$12,727,646

Lead agency	Selection process	Weatherization Assistance Program (WAP)	State Energy Program (SEP)	Low-Income Home Energy Assistance Program (LIHEAP)	2017 state spending on low-income energy-efficiency programs
Pennsylvania Department of Environmental Protection, Energy Programs Office	Appointed	$12,318,492	$1,530,360	$209,106,656	$77,067,696
Rhode Island Office of Energy Resources	Appointed	$938,846	$303,790	$25,290,047	$16,961,439
South Carolina Office of Regulatory Staff, Energy Office	Appointed	$1,453,102	$561,040	$35,692,535	—
South Dakota Bureau of Administration, Energy Management Office	Appointed	$1,552,251	$277,870	$17,377,954	—
Tennessee Department of Environment and Conservation, Office of Energy Programs	Appointed	$3,583,396	$747,340	$58,665,764	$15,013,215
Texas Comptroller of Public Accounts, State Energy Conservation Office	Appointed	$4,597,878	$2,350,100	$118,304,182	—
Utah Governor's Office of Energy Development	Appointed	$1,725,942	$398,370	$23,481,242	$3,987,150
Vermont Department of Public Service, Planning and Energy Resources Division	Appointed	$1,059,017	$267,710	$18,971,763	$8,100,000
Virginia Department of Mines, Minerals, and Energy, Division of Energy	Appointed	$3,335,823	$876,850	$83,571,402	—
Washington State Department of Commerce, Washington State Energy Office	Appointed	$3,842,933	$706,490	$56,970,949	$7,786,002
West Virginia Department of Commerce, West Virginia Office of Energy	Appointed	$2,631,469	$427,220	$28,851,846	$1,371,009
Wisconsin Public Service Commission, Wisconsin Office of Energy Innovation	Appointed	$7,278,486	$851,070	$103,064,918	—
Wyoming Business Council, Community Development Division, State Energy Office	Appointed	$854,557	$267,800	$9,220,838	$4,418

Notes: WAP refers to the U.S. Department of Energy's Weatherization Assistance Program; SEP refers to the U.S. Department of Energy's State Energy Program; Low-Income Home Energy Assistance Program is a program of the U.S. Department of Health and Human Services; The FY 2017 LIHEAP Block Grants data exclude tribal awards; The Arizona Office of Grants and Federal Resources was created by executive order and acts as the state's single point of contact for grant applications made by the state and the recipient of federal funds; New Jersey's Office of State Energy Services is located within the Division of Clean Energy, which operates within the New Jersey Board of Public Utiltiies; For more information, please visit https://www.state.nj.us/bpu/about/divisions/edep/; The North Carolina Energy Policy Council advises the governor and General Assembly on legislation and rulemaking that addresses domestic energy exploration, protects the environment, and encourages economic development; The council is staffed by the North Carolina Department of Environmental Quality; For more information, please visit https://deq.nc.gov/about/divisions/energy-mineral-land-resources/energy-policy-council.

Sources: A full list of sources is available at https://cdn.americanprogress.org/content/uploads/2018/11/13062707/BassettAppendixTable2Sources.pdf.

Endnotes

1 The White House Office of the Press Secretary, "Statement by President Trump on the Paris Climate Accord," Press release, June 1, 2017, available at https://www.whitehouse.gov/briefings-statements/statement-president-trump-paris-climate-accord/; Global Climate Action Summit, "Global Climate Action Summit," available at https://www.globalclimateactionsummit.org/ (last accessed September 2018); Brad Plumer, "They Defied Trump on Climate Change. Now, It's Their Moment of Truth," *The New York Times*, September 11, 2018, available at https://www.nytimes.com/2018/09/11/climate/california-climate-summit.html; Nate Hultman and others, "Fulfilling America's Pledge: How States, Cities, and Businesses Are Leading the United States to a Low-Carbon Future" (New York: Bloomberg Philanthropies, 2018), available at https://www.bbhub.io/dotorg/sites/28/2018/09/Fulfilling-Americas-Pledge-2018.pdf.

2 Robert Walton, "The energy sector is driving job growth, but not where you think," Utility Dive, June 7, 2018, available at https://www.utilitydive.com/news/energy-sector-is-driving-job-growth-but-not-where-you-think/524600/; National Association of State Energy Officials and Energy Futures Initiative, "U.S. Energy and Employment Report" (2018), available at https://static1.squarespace.com/static/5a98cf80ec4eb7c5cd928c61/t/5afb0ce4575d1f3cdf9ebe36/1526402279839/2018+U.S.+Energy+and+Employment+Report.pdf; Robert M. Simon and David J. Hayes, "America's Clean Energy Success, By the Numbers" (Washington: Center for American Progress, 2017), available at https://www.americanprogress.org/issues/green/reports/2017/06/29/435281/americas-clean-energy-success-numbers/; Natural Resources Defense Council, "Revolution Now," available at https://www.nrdc.org/revolution-now (last accessed November 2018); Melissa De Witte, "Public support for climate policy remains strong, according to new poll," Stanford News, July 16, 2018, available at https://news.stanford.edu/2018/07/16/poll-shows-consensus-climate-policy-remains-strong/; Matthew Ballew and others, "Americans are More Worried about Global Warming, and Show Signs of Losing Hope," Yale Program on Climate Change Communication, October 9, 2018, available at http://climatecommunication.yale.edu/publications/americans-are-more-worried-about-global-warming-but-show-signs-of-losing-hope/; Hultman and others, "Fulfilling America's Pledge"; Kristina Costa, Miranda Peterson, and Howard Marano, "Extreme Weather, Extreme Costs: How Our Changing Climate Wallops Americans' Wallets" (Washington: Center for American Progress, 2017), available at https://www.americanprogress.org/issues/green/reports/2017/10/27/441382/extreme-weather-extreme-costs/.

3 U.N. Intergovernmental Panel on Climate Change, "Global Warming of 1.5 Degrees Celsius: Summary for Policymakers" (2018), available at http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf.

4 Luke Bassett and Christy Goldfuss, "Governors' Races that Matter for Climate Action" (Washington: Center for American Progress Action Fund, 2017), available at https://www.americanprogressaction.org/issues/green/reports/2017/08/01/168200/governors-races-matter-climate-action/.

5 The states that the Center for American Progress Action Fund analyzed include Florida, Illinois, Michigan, New Jersey, Ohio, Virginia, and Wisconsin. Of those, New Jersey and Virginia elected governors campaigning on climate and clean energy in 2017, and Illinois, Michigan, and Wisconsin elected governors campaigning with similar messages in 2018. At the time of writing, Florida's gubernatorial race was not called. See also ibid.; Sarah Almukhtar and others, "Governor Election Results: Democrats Take Several States," *The New York Times*, November 16, 2018, available at https://www.nytimes.com/interactive/2018/11/06/us/elections/results-governor-elections.html.

6 Authors' analysis and calculations based on campaign statements made by governors-elect in Illinois, Kansas, Maine, Michigan, Nevada, New Mexico, and Wisconsin, as well as the current membership of the U.S. Climate Alliance. Greenhouse gas emissions calculated using state energy-related data. For more information, For more information, see Energy Information Administration, *September 2018 Monthly Energy Review* (U.S. Department of Energy), available at https://www.eia.gov/totalenergy/data/monthly/archive/00351809.pdf (last accessed November 2018); Christy Goldfuss, "6 New Governors Who Will Lead the Way on Climate Action," Center for American Progress, November 7, 2018, available at https://www.americanprogress.org/issues/green/news/2018/11/07/460598/6-new-governors-will-lead-way-climate-action/; Women for Kansas, "KS Governor Laura Kelly," available at http://womenforkansas.org/ks-governor-laura-kelly/ (last accessed November 2018); U.S. Climate Alliance, "About: Governors," available at https://www.usclimatealliance.org/governors-1/ (last accessed November 2018).

7 For example, Gov. Northam recently announced the 2018 Virginia Energy Plan, which calls for investor-owned utilities to invest $1.1 billion in energy efficiency programs and 5,000 megawatts of utility-owned and utility-operated wind and solar resources. See Virginia Office of the Secretary of Commerce and Trade, "The Commonwealth of Virginia's 2018 Energy Plan" (2018), available at https://www.governor.virginia.gov/media/governorvirginiagov/secretary-of-commerce-and-trade/2018-Virginia-Energy-Plan.pdf.

8 Ibid.

9 Additionally, Gov. Murphy signed Executive Order No. 28, which directed state agencies to develop "an updated Energy Master Plan" that puts New Jersey on a path "to achieve 100 percent clean energy by 2050." See Office of New Jersey Gov. Phil Murphy, "Governor Murphy Signs Measures to Advance New Jersey's Clean Energy Economy," Press release, available at https://nj.gov/governor/news/news/562018/approved/20180523a_cleanEnergy.shtml (last accessed November 2018).

10 Hultman and others, "Fulfilling America's Pledge."

11 The authors calculated the total U.S. clean energy jobs using energy efficiency, solar, wind, hydroelectric, energy storage, and smart grid employment data from the following sources: U.S. Department of Energy, *2016 Energy and Employment Report*, available at https://www.energy.gov/sites/prod/files/2016/11/f34/U.S.%20Energy%20and%20Employment%20Report.pdf (last accessed October 2018); National Association for State Energy Officials and Energy Futures Initiative, "Energy Employment by State" (2018), available at https://static1.squarespace.com/static/5a98cf80ec4eb7c5cd928c61/t/5af72033562fa7deeeb50451/1526145078893/USEER2018_StateFacts.pdf.

12 Global Climate Action Summit, "Global Climate Action Summit"; U.N. Framework Convention on Climate Change, "U.S.A. First NDC Submission," available at https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/United%20States%20of%20America%20First/U.S.A.%20First%20NDC%20Submission.pdf (last accessed November 2018).

13 Hultman and others, "Fulfilling America's Pledge."

14 The Energy and Environment Team, "While Trump Was Tweeting: Tracking the Trump Administration's Attacks on Our Air, Water, and Public Lands," Center for American Progress Action Fund, May 14, 2018, available at https://www.americanprogressaction.org/issues/green/reports/2018/05/24/168720/trump-tweeting-tracking-trump-administrations-attacks-air-water-public-lands/; John Larsen and others, "Taking Stock 2018" (New York: Rhodium Group, 2018), available at https://rhg.com/research/taking-stock-2018/.

15 U.N. Intergovernmental Panel on Climate Change, "Global Warming of 1.5 Degrees Celsius."

16 National Governors Association, "Transition and the New Governor: A Planning Guide" (2018), available at https://www.nga.org/wp-content/uploads/2018/10/NGA-Transition-and-the-New-Governor-2018.pdf.

17 The Council of State Governments, "Table 4.6: State Cabinet Systems," available at http://knowledgecenter.csg.org/kc/system/files/4.6.2017.pdf (last accessed November 2018).

18 National Governors Association Office of Management Consulting & Training, "Transition and the New Governor: 2018 Edition" (2010), available at https://www.nga.org/wp-content/uploads/2018/09/TransitionGuide.pdf.

19 The National Governors Association (NGA) Center for Best Practices has extensive resources for newly elected governors and their chiefs of staff, including principles and guides for good governance. Additionally, the NGA has resources for governors regarding their state's energy sector and relevant state agencies. See National Governors Association, "NGA Center for Best Practices," available at https://www.nga.org/bestpractices/ (last accessed October 2018); NGA Center for Best Practices, "Environment, Energy and Transportation Division," available at https://www.nga.org/bestpractices/divisions/eet/ (last accessed October 2018); National Governors Association Consulting "Critical Lessons for Governors-Elect: 2018 Edition" (2010), available at https://www.nga.org/wp-content/uploads/2018/09/10LessonsGovElects-1.pdf.

20 The regulatory authorities of each commission vary by state, and this report focuses primarily on those authorities governing the functioning of energy markets, chiefly retail electricity markets. See Appendix for further information and sources.

21 Analysis conducted by authors. See Appendix for further information and sources.

22 See Appendix for further information and sources.

23 See, for example, California Public Utilities Commission, "Commissioners," available at http://www.cpuc.ca.gov/General.aspx?id=710 (last accessed November 2018); Maine Public Utilities Commission, "About MPUC," available at https://www.maine.gov/mpuc/about/how_commission_works.shtml (last accessed November 2018); Montana Public Service Commission, "What We Do for You," available at http://psc.mt.gov/About-Us/What-We-Do (last accessed November 2018).

24 U.S. Department of Energy, *Quadrennial Energy Review: Transforming the Nation's Electricity System: The Second Installment of the QER* (2017), available at https://www.energy.gov/sites/prod/files/2017/02/f34/Quadrennial%20Energy%20Review--Second%20Installment%20%28Full%20Report%29.pdf.

25 Ibid.

26 National Association of Regulatory Utility Commissioners, "About NARUC," available at https://www.naruc.org/about-naruc/about-naruc/ (last accessed September 2018); National Association of Regulatory Utility Commissioners, "Regulatory Commissions," available at https://www.naruc.org/about-naruc/regulatory-commissions/ (last accessed September 2018).

27 Scott Hempling, "On Appointing Excellent Regulators," ScottHemplingLaw.com, February 2018, available at https://www.scotthemplinglaw.com/essays/a-letter-to-governors-and-legislators.

28 See, for example, Wyoming Public Service Commission, "About Us," available at http://psc.state.wy.us/pscdocs/aboutus.html (last accessed November 2018); Idaho Public Utilities Commission, "About the Commission," available at https://www.puc.idaho.gov/about/about.html (last accessed November 2018); Georgia Public Service Commission, "An Introduction to the PSC," available at http://www.psc.state.ga.us/pscinfo/pscintro.asp (last accessed November 2018); Pennsylvania Public Utility Commission, "About the PUC," available at http://www.puc.state.pa.us/about_puc.aspx (last accessed November 2018).

29 See, for example, The Office of the Revisor of Statutes, "2018 Minnesota Statutes," available at https://www.revisor.mn.gov/statutes/cite/216B.62 (last accessed November 2018).

30 State of Minnesota, "2020-21 Biennial Budget: Public Utilities Commission: Agency Profile" (2018), available at https://mn.gov/mmb-stat/documents/budget/research-and-data/summary-of-agencies-programs-activities/public-utilities-commission.pdf.

31 Additional funding includes federal funding and telecommunications fees that pass through to keep rates for basic services reasonable across the state. See also Oregon Public Utility Commission, "2017-2019 Legislatively Adopted Budget" (2017), available at https://www.puc.state.or.us/docs/2017-19PUCLABFinalReduced.pdf.

32 U.S. Department of Energy, *Quadrennial Energy Review: Transforming the Nation's Electricity System*.

33 Ibid.

34 See, for example, Oregon Public Utility Commission, "Frequently Asked Questions: General Integrated Resource Plan (IRP) Information," available at https://www.puc.state.or.us/admin_hearings/IRP-FAQs.pdf (last accessed November 2018); Minnesota Commerce Department, "Integrated Resource Plans," available at https://mn.gov/commerce/industries/energy/utilities/regulation-planning/regulation-planning.jsp#integrated (last accessed November 2018); Indiana Utility Regulatory Commission, "Integrated Resource Plans," available at https://www.in.gov/iurc/2630.htm (last accessed November 2018).

35 U.S. Department of Energy, *Quadrennial Energy Review: Transforming the Nation's Electricity System*.

36 David Roberts, "After rising for 100 years, electricity demand is flat. Utilities are freaking out.", Vox, February 27, 2018, available at https://www.vox.com/energy-and-environment/2018/2/27/17052488/electricity-demand-utilities; Tennessee Valley Authority, "Integrated Resource Plan: 2015 Final Report" (2015), available at https://www.tva.gov/file_source/TVA/Site%20Content/Environment/Environmental%20Stewardship/IRP/Documents/2015_irp.pdf; Gavin Bade, "Even in Indiana, new renewables are cheaper than existing coal plants," Utility Dive, October 25, 2018, available at https://www.utilitydive.com/news/even-in-indiana-new-renewables-are-cheaper-than-existing-coal-plants/540242/; Northern Indiana Public Service Company, "NIPSCO Integrated Resource Plan – 2018 Update: Public Advisory Meeting Five" (2018), available at https://www.nipsco.com/docs/default-source/about-nipsco-docs/nipsco-irp-public-advisory-meeting-october-18-2018-presentation.pdf.

37 Rachel Wilson and Bruce Biewald, "Best Practices in Electric Utility Integrated Resource Planning" (Montpelier, VT: Regulatory Assistance Project, 2013), available at https://www.raponline.org/wp-content/uploads/2016/05/rapsynapse-wilsonbiewald-bestpracticesinirp-2013-jun-21.pdf.

38 National Association of State Energy Officials, "State Energy Offices," available at https://www.naseo.org/state-energy-offices (last accessed October 2018).

39 Ibid.

40 Ibid.

41 Office of Energy Efficiency & Renewable Energy, *Weatherization Works!* (U.S. Department of Energy, 2018), available at https://www.energy.gov/sites/prod/files/2018/06/f52/EERE_WAP_Fact%20Sheet-v2.pdf.

42 U.S. Department of Energy, *Weatherization Program Notice 17-2: Program Year 2017 Grantee Allocations* (2017), available at https://www.energy.gov/sites/prod/files/2017/06/f35/wpn-17-2-grantee-final.pdf.

43 U.S. Office of Energy Efficiency & Renewable Energy, "Weatherization and Intergovernmental Programs Office: Project Map – Florida," available at https://www.energy.gov/eere/wipo/downloads/weatherization-and-intergovernmental-programs-office-project-map-florida (last accessed November 2018).

44 Benefits.gov, "Weatherization Assistance Program for Low-Income Persons," available at https://www.benefits.gov/benefits/benefit-details/580 (last accessed November 2018).

45 U.S. Office of Energy Efficiency & Renewable Energy, "About the State Energy Program," available at https://www.energy.gov/eere/wipo/about-state-energy-program (last accessed November 2018).

46 The U.S. states and territories receiving competitive awards in 2017 included: Alabama; Alaska; Colorado; Guam; Maryland; Minnesota; Missouri; New Jersey; New Mexico; New York; North Carolina; Rhode Island; Utah; Washington, D.C.; West Virginia; and Wisconsin. See U.S. Office of Energy Efficiency & Renewable Energy, "State Energy Program Competitive Award Selections (2012-2017)," available at https://www.energy.gov/eere/wipo/state-energy-program-competitive-award-selections-2012-2017 (last accessed November 2018); National Association of State Energy Officials, "U.S. State Energy Program (SEP): Formula Grant Allocations: 2005-2017," available at https://www.naseo.org/Data/Sites/1/sep-allocations_2005-2017_12-11-17_final.pdf (last accessed November 2018).

47 Office of Energy Efficiency & Renewable Energy, *State Energy Program: Operations Manual* (U.S. Department of Energy, 2017), available at https://www.energy.gov/sites/prod/files/2017/06/f34/SEP-ops-manual_0720.pdf.

48 Ariel Drehobl and Lauren Ross, "Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low Income and Underserved Communities" (Washington: American Council for an Energy-Efficient Economy, 2016), available at https://aceee.org/sites/default/files/publications/researchreports/u1602.pdf.

49 American Council for an Energy-Efficient Economy, "Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low-Income and Underserved Communities" (2016), available at https://aceee.org/research-report/u1602.

50 Office of the Administration for Children & Families Office of Community Services, "Low Income Home Energy Assistance Program (LIHEAP)," available at https://www.acf.hhs.gov/ocs/programs/liheap (last accessed November 2018); Office of the Administration for Children & Families Office of Community Services, "LIHEAP State and Territory Contact Listing," available at https://www.acf.hhs.gov/ocs/liheap-state-and-territory-contact-listing (last accessed November 2018).

51 Office of New York State Gov. Andrew Cuomo, "Governor Cuomo Announces $3 Million to Help Vulnerable New Yorkers Stay Cool this Summer," Press release, May 11, 2018, available at https://www.governor.ny.gov/news/governor-cuomo-announces-3-million-help-vulnerable-new-yorkers-stay-cool-summer.

52 Office of the Administration for Children & Families Office of Community Services, "LIHEAP Assistance Eligibility," available at https://www.acf.hhs.gov/ocs/resource/liheap-eligibility-criteria (last accessed November 2018).

53 Indiana State Department of Agriculture, "Welcome," available at https://www.in.gov/isda/ (last accessed November 2018); U.S. Office of Energy Efficiency & Renewable Energy, "U.S. Department of Agriculture," available at https://www.energy.gov/eere/solarpoweringamerica/us-department-agriculture (last accessed November 2018).

54 State of Michigan, "State Budget Office," available at https://www.michigan.gov/budget/ (last accessed November 2018); State of Rhode Island Office of Management and Budget, "Budget Office," available at http://www.omb.ri.gov/budget/ (last accessed November 2018); National Governors Association, "Governors' Office Functions," available at https://www.nga.org/consulting/office-functions/ (last accessed November 2018).

55 National Association of State Chief Information Officers, "About NASCIO | Mission," available at https://www.nascio.org/AboutNASCIO (last accessed November 2018); National Association of State Chief Information Officers, "NASCIO History," available at https://www.nascio.org/AboutNASCIO/History (last accessed November 2018); U.S. Office of Electricity, "Grid Modernization and the Smart Grid," available at https://www.energy.gov/oe/activities/technology-development/grid-modernization-and-smart-grid (last accessed November 2018); U.S. Department of Energy, *Quadrennial Energy Review: Transforming the Nation's Electricity System*.

56 Michael Berkowitz, "What a Chief Resilience Officer Does," 100 Resilient Cities, March 18, 2015, available at http://www.100resilientcities.org/what-a-chief-resilience-officer-does/; Office of Oregon Gov. Kate Brown, "Resilience," available at https://www.oregon.gov/gov/policy/Pages/resilience.aspx (last accessed November 2018); U.S. Bureau of Labor Statistics, "Occupational Employment Statistics: Occupational Employment and Wages, May 2017: 11-9161 Emergency Management Directors," available at https://www.bls.gov/oes/current/oes119161.htm (last accessed November 2018); National Emergency Management Association, "What is NEMA?", available at https://www.nemaweb.org/index.php/about/what-is-nema (last accessed November 2018); California Energy Commission, "Energy Emergency Response Plan Program," available at https://www.energy.ca.gov/emergencies/plan.html (last accessed November 2018).

57 City of Alexandria, VA, "Local Government Sustainability Director – Job Description" (2011), available at https://www.alexandriava.gov/uploadedFiles/tes/oeq/info/Appendix_B_SustainabilityCoordinators_JobDescriptions.pdf; City of San Antonio, "Chief Sustainability Officer," available at https://www.sanantonio.gov/sustainability/About/Director (last accessed November 2018); Denver Office of Sustainability, "Who We Are," available at https://www.denvergov.org/content/denvergov/en/office-of-sustainability/about-us/Staff.html (last accessed November 2018).

58 Colorado Department of Local Affairs, "Executive Overview: FY 2012 - 2013 Strategic Plan" (2012), available at http://www2.cde.state.co.us/artemis/locserials/loc120internet/loc120201213execinternet.pdf; Colorado Department of Local Affairs, "Colorado Energy Codes," available at https://www.colorado.gov/pacific/dola/colorado-energy-codes-0 (last accessed November 2018).

59 Office of the Illinois Attorney General, "Protecting Consumers," available at http://www.ag.state.il.us/consumers/ (last accessed November 2018); National Consumer Law Center, "Consumer Protection & Regulatory Issues," available at https://www.nclc.org/issues/consumer-protection-a-regulatory-issues.html (last accessed November 2018).

60 Norton Francis, "What Do State Economic Development Agencies Do?" (Washington: Urban Institute, 2016), available at https://www.urban.org/sites/default/files/publication/83141/2000880-What-Do-State-Economic-Development-Agencies-Do.pdf.

61 Mass.gov, "MassDEP Organization," available at https://www.mass.gov/service-details/massdep-organization (last accessed November 2018); Connecticut Department of Energy & Environmental Protection, "About Us," available at https://www.ct.gov/deep/cwp/view.asp?a=2690&q=322476&deepNav_GID=1511 (last accessed November 2018).

62 Minnesota Department of Labor and Industry, "About the Department," available at http://www.doli.state.mn.us/about-department (last accessed November 2018); Minnesota Department of Labor and Industry, "Agency Leadership," available at http://www.doli.state.mn.us/about-department/about-dli/agency-leadership (last accessed November 2018); Office of New Jersey Gov. Phil Murphy, "Governor Murphy Signs Measures to Advance New Jersey's Clean Energy Economy."

63 Maryland Department of Natural Resources, "About the Department of Natural Resources," available at http://dnr.maryland.gov/Pages/about_dnr.aspx (last accessed November 2018); North Carolina Environmental Quality, "Michael S. Regan," available at https://deq.nc.gov/about/leadership/michael-s-regan (last accessed November 2018).

64 Washington State Department of Transportation, "Roger Millar," available at https://www.wsdot.wa.gov/about/secretary/roger-millar (last accessed November 2018); Staff, "Delaware DOT Pilots Electric Vehicles," Government Fleet, February 9, 2018, available at https://www.government-fleet.com/278668/delaware-dot-pilots-electric-vehicles.

65 Hydro Québec, "Hydro-Québec participates in Connecticut clean energy solicitation," Press release, September 14, 2018, available at http://news.hydroquebec.com/en/press-releases/1413/hydro-quebec-participates-in-connecticut-clean-energy-solicitation/; Robert Walton, "Straight Outta BQDM: Consolidated Edison looks to expand its non-wires approach," Utility Dive, July 19, 2017, available at https://www.utilitydive.com/news/straight-outta-bqdm-consolidated-edison-looks-to-expand-its-non-wires-appr/447433/.

66 Brandon Baatz, "Everyone Benefits: Practices and Recommendations for Utility System Benefits of Energy Efficiency" (Washington: American Council for an Energy-Efficient Economy, 2015), available at http://aceee.org/sites/default/files/publications/researchreports/u1505.pdf.

67 Center for Climate and Energy Solutions, "Energy Efficiency Standards and Targets," available at https://www.c2es.org/document/energy-efficiency-standards-and-targets/ (last accessed November 2018); American Council for an Energy-Efficient Economy, "Energy Efficiency Resource Standard," available at https://aceee.org/sector/state-policy/energy-efficiency-resource-standard (last accessed November 2018).

68 American Council for an Energy-Efficient Economy, "State Energy Efficiency Resource Standards (EERS): January 2017," available at https://aceee.org/sites/default/files/state-eers-0117.pdf (last accessed November 2018); Energy.gov, "Required Energy Efficiency Goals," available at https://www.energy.gov/savings/required-energy-efficiency-goals (last accessed November 2018).

69 The states with mandatory targets include: Arkansas; Arizona; California; Colorado; Hawaii; Illinois; Indiana; Iowa; Maine; Maryland Massachusetts; Michigan; Minnesota; New Hampshire; New Jersey; New Mexico; New York; Ohio; Pennsylvania; Rhode Island; Texas; Vermont; Virginia; Washington; and Wisconsin. The states with voluntary targets include: Connecticut; Delaware; Florida; and Missouri. See NC Clean Energy Technology Center, "Programs," available at http://programs.dsireusa.org/system/program (last accessed November 2018).

70 American Council for an Energy-Efficient Economy, "Energy Efficiency Resource Standards," available at https://database.aceee.org/state/energy-efficiency-resource-standards (last accessed November 2018).

71 Center for Climate and Energy Solutions, "Energy Efficiency Standards and Targets."

72 NC Clean Energy Technology Center, "Programs."

73 U.S. Energy Information Administration, "Today in Energy: Many states have adopted policies to encourage energy efficiency," August 3, 2017, available at https://www.eia.gov/todayinenergy/detail.php?id=32332.

74 U.S. Department of Energy, "Chapter II: Maximizing Economic Value and Consumer Equity." In U.S. Department of Energy, *Quadrennial Energy Review: Transforming the Nation's Electricity System: The Second Installment of the QER* (2017), available at https://www.energy.gov/sites/prod/files/2017/02/f34/Chapter%20II--Maximizing%20Economic%20Value%20and%20Consumer%20Equity.pdf.

75 U.S. Department of Energy, *Quadrennial Energy Review: Transforming the Nation's Electricity System*.

76 Ibid.

77 Ibid.; David Roberts, "The simple reason most power utilities suck," Vox, September 4, 2017, available at https://www.vox.com/2016/6/29/12038074/power-utilities-suck; Mike O'Boyle, "Can a 'DER Authority' fix the utility information problem to boost clean energy?", Utility Dive, July 30, 2018, available at https://www.utilitydive.com/news/can-a-der-authority-fix-the-utility-information-problem-to-boost-clean-en/528803/.

78 U.S. Department of Energy, *Quadrennial Energy Review: Transforming the Nation's Electricity System*; Environmental Defense Fund, "Time-variant electricity pricing can save money and cut pollution," available at https://www.edf.org/sites/default/files/time-variant_pricing_fact_sheet_-_april_2015.pdf (last accessed November 2018).

79 U.S. Department of Energy, *Quadrennial Energy Review: Transforming the Nation's Electricity System*.

80 G. A. Comnes and others, "Performance-Based Ratemaking for Electric Utilities: Review of Plans and Analysis of Economic and Resource-Planning Issues" (Oak Ridge, TN: Oak Ridge National Laboratory Energy Division, 1995), available at http://eta-publications.lbl.gov/sites/default/files/report-lbnl-37577.pdf; Herman K. Trabish, "Can performance-based ratemaking save utilities?", Utility Dive, April 17, 2014, available at https://www.utilitydive.com/news/can-performance-based-ratemaking-save-utilities/252683/; MIT Energy Initiative, "Utility of the Future" (2016), available at http://energy.mit.edu/wp-content/uploads/2016/12/Utility-of-the-Future-Full-Report.pdf; Peter Maloney, "Hawaii launches performance-based rate proceeding to drive renewables," Utility Dive, April 20, 2018, available at https://www.utilitydive.com/news/hawaii-launches-performance-based-rate-proceeding-to-drive-renewables/521784/.

81 Maloney, "Hawaii launches performance-based rate proceeding to drive renewables."

82 Iliana Paul, Peter Howard, and Jason A. Schwartz, "The Social Cost of Greenhouse Gases and State Policy" (New York: Institute for Policy Integrity, 2017), available at https://policyintegrity.org/files/publications/SCC_State_Guidance.pdf; Howard Shelanski and Maurice Obstfeld, "Estimating the Benefits from Carbon Dioxide Emissions Reductions," Obama White House Blog Archive, July 2, 2015, available at https://obamawhitehouse.archives.gov/blog/2015/07/02/estimating-benefits-carbon-dioxide-emissions-reductions; Brad Plumer, "Trump Put a Low Cost on Carbon Emissions. Here's Why It Matters," *The New York Times*, August 23, 2018, available at https://www.nytimes.com/2018/08/23/climate/social-cost-carbon.html.

83 Paul, Howard, and Schwartz, "The Social Cost of Greenhouse Gases and State Policy."

84 The White House, "Presidential Executive Order on Promoting Energy Independence and Economic Growth," March 28, 2017, available at https://www.whitehouse.gov/presidential-actions/presidential-executive-order-promoting-energy-independence-economic-growth/.

85 Colorado Public Utilities Commission, "Proceeding No. 16A-0396E," available at https://www.dora.state.co.us/pls/efi/efi_p2_v2_demo.show_document?p_dms_document_id=863402 (last accessed November 2018); Nevada Legislature, "Proposed Regulation of the Public Utilities Commission of Nevada" (2018), available at https://www.leg.state.nv.us/Register/2018Register/R060-18P.pdf.

86 U.S. Climate Alliance, "U.S. Climate Alliance Partners with Resources for the Future and the Climate Impact Lab on Calculating Cost of Climate Damages," Press release, November 14, 2017, available at https://www.usclimatealliance.org/publications/2018/1/12/rrujek4dbg2e7n-9knymsltkqrw007b; Climate Impact Lab, "Measuring the Real-World Costs of Climate Change," available at http://www.impactlab.org/ (last accessed November 2018).

87 Battery technologies, especially at the utility scale, can help integrate renewables and support transmission and distribution infrastructure, as well as help the grid address demand issues. For example, batteries can help grid operators maintain grid stability by providing ancillary services such as frequency regulation, voltage support, and peak shaving to balance shifts in electricity supply and demand. Additionally, battery technologies can store excess energy produced by variable energy resources such as solar and wind and can discharge when demand is high, thereby avoiding the curtailment of renewable energy resources—a process called electrical energy time-shift. These services aid utilities in complying with grid reliability standards. See Ben Bovarnick, "Integrated Energy Storage in the United States" (Washington: Center for American Progress, 2015), available at https://www.americanprogress.org/issues/green/reports/2015/12/07/126777/integrated-energy-storage-in-the-united-states/; Paul Denholm and others, "The Value of Energy Storage for Grid Applications" (Golden, CO: National Renewable Energy Laboratory, 2013), available at https://www.nrel.gov/docs/fy13osti/58465.pdf.

88 Lazard, "Lazard's Levelized Cost of Storage Analysis–Version 3.0" (2017), available at https://www.lazard.com/media/450338/lazard-levelized-cost-of-storage-version-30.pdf; Claire Curry, "Lithium-ion Battery Costs and Market" (New York: Bloomberg New Energy Finance, 2017), available at https://data.bloomberglp.com/bnef/sites/14/2017/07/BNEF-Lithium-ion-battery-costs-and-market.pdf.

89 Today, about 25 gigawatts (GW) of grid-connected energy storage is in operation in the United States. GTM Research predicts that the U.S. energy storage market will be 17 times larger in 2023 that it was in 2017 and will grow 14 times in dollar value over the same period. By 2023, the U.S. energy storage market will be worth 4.3 billion dollars. See U.S. Office of Electricity Delivery & Energy Reliability, "DOE Global Energy Storage Database," available at https://www.energystorageexchange.org/projects (last accessed November 2018); Wood Mackenize, "U.S. Energy Storage Monitor: Q2 2018 Executive Summary" (2018), available at https://www.greentechmedia.com/research/report/u-s-energy-storage-monitor-q2-2018.

90 The rise of residential solar plus storage may be reversing this trend, according to a University of California, Berkeley, study that expects the combination to become cost-competitive with grid-supplied electricity by 2020. See Daniel Kammen, Noah Kittner, and Felix Lill, "Energy storage deployment and innovation for the clean energy transition," *Nature Energy* 2 (17125) (2017): 1–6, available at https://rael.berkeley.edu/publication/energy-storage-deployment-and-innovation-for-the-clean-energy-transition-2/.

91 Historically, energy storage has primarily consisted of pumped-storage hydropower—representing nearly 94 percent of energy storage capacity in operation. However, in recent years, new technologies such as flywheels, compressed air energy storage systems, thermal energy storage systems, and batteries have contributed to the energy storage industry's growth. Today, investments in battery technologies for grid applications are driving recent growth, particularly dominated by lithium-ion batteries, which represent more than 80 percent of large-scale battery storage capacity in the United States. See U.S. Office of Electricity Delivery & Energy Reliability, "DOE Global Energy Storage Database"; Ivan Penn, "The $3 Billion Plan to Turn Hoover Dam Into a Giant Battery," *The New York Times*, July 24, 2018, available at https://www.nytimes.com/interactive/2018/07/24/business/energy-environment/hoover-dam-renewable-energy.html; Energy Information Administration, *U.S. Battery Storage Market Trends* (U.S. Department of Energy, 2018), available at https://www.eia.gov/analysis/studies/electricity/batterystorage/pdf/battery_storage.pdf; U.S. Department of Energy, *Quadrennial Energy Review: Transforming the Nation's Electricity System*.

92 Bovarnick, "Integrated Energy Storage in the United States."

93 In California, the Public Utilities Commission requires investor-owned utilities to procure 1.3 GW of energy storage by 2020. In New York, Gov. Andrew Cuomo set a 1.5 GW energy storage target by 2025, with plans for a larger goal by 2030. Additionally, New Jersey has pledged to reach 2 GW of energy storage by 2030. See Peter Maloney, "California looks to next steps as utilities near energy storage targets," Utility Dive, June 12, 2018, available at https://www.utilitydive.com/news/california-looks-to-next-steps-as-utilities-near-energy-storage-targets/525441/; Lulia Gheorghiu, "New York unveils roadmap to 1.5 GW storage by 2025," Utility Dive, June 21, 2018, available at https://www.utilitydive.com/news/new-york-unveils-roadmap-to-15-gw-storage-by-2025/526292/; Peter Maloney, "N.J. sets 'aggressive' 2 GW storage target by 2030," Utility Dive, May 29, 2018, available at https://www.utilitydive.com/news/new-jersey-sets-aggressive-target-2-gw-by-2030-for-energy-storage/524422/.

94 Wilson and Biewald, "Best Practices in Electric Utility Integrated Resource Planning."

95 For example, in 2017, Maryland established a state tax credit for certain installed costs of energy storage systems located on residential and commercial properties. California's Self-Generation Incentive Program provides rebates to support distributed energy resources, including energy storage projects. In Massachusetts, the state awarded $20 million in grants to 26 projects, which will draw in an additional $32 million in matching funds, further developing the state's energy storage market. See Maryland Energy Administration, "Energy Storage Tax Credit Program - Tax Year 2018," available at https://energy.maryland.gov/business/Pages/EnergyStorage.aspx (last accessed November 2018); California Public Utilities Commission, "Self-Generation Incentive Program," available at http://www.cpuc.ca.gov/sgip/ (last accessed November 2018); Office of Gov. Charlie Baker and Lt. Gov. Karyn Polito, "Baker-Polito Administration Awards $20 Million for Energy Storage Projects," Press release, December 7, 2017, available at https://www.mass.gov/news/baker-polito-administration-awards-20-million-for-energy-storage-projects.

96 Lia Cattaneo, "Plug-In Electric Vehicle Policy" (Washington: Center for American Progress, 2018), available at https://www.americanprogress.org/issues/green/reports/2018/06/07/451722/plug-electric-vehicle-policy/.

97 Ibid.

98 Lia Cattaneo, "Investing in Charging Infrastructure for Plug-In Electric Vehicles" (Washington: Center for American Progress, 2018), available at https://www.americanprogress.org/issues/green/reports/2018/07/30/454084/investing-charging-infrastructure-plug-electric-vehicles/.

99 Ibid.

100 Ibid.

Our Mission

The Center for American Progress is an independent, nonpartisan policy institute that is dedicated to improving the lives of all Americans, through bold, progressive ideas, as well as strong leadership and concerted action. Our aim is not just to change the conversation, but to change the country.

Our Values

As progressives, we believe America should be a land of boundless opportunity, where people can climb the ladder of economic mobility. We believe we owe it to future generations to protect the planet and promote peace and shared global prosperity.

And we believe an effective government can earn the trust of the American people, champion the common good over narrow self-interest, and harness the strength of our diversity.

Our Approach

We develop new policy ideas, challenge the media to cover the issues that truly matter, and shape the national debate. With policy teams in major issue areas, American Progress can think creatively at the cross-section of traditional boundaries to develop ideas for policymakers that lead to real change. By employing an extensive communications and outreach effort that we adapt to a rapidly changing media landscape, we move our ideas aggressively in the national policy debate.

Center for American Progress

1333 H STREET, NW, 10TH FLOOR, WASHINGTON, DC 20005 • TEL: 202-682-1611 • FAX: 202-682-1867 • WWW.AMERICANPROGRESS.ORG