

DECEMBER 2021

State Strategies for Expanding Economic Opportunity in Clean Energy

A Report by the Clean Resilient States Initiative

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Morgan Higman
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A Report of the CSIS Energy Security and Climate Change Program

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INTERNATIONAL STUDIES

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About the Clean Resilient States Initiative

States often play a leading role in energy and climate policy, but their approaches vary and the effectiveness of their policies is hard to gauge. The Clean Resilient States Initiative assesses the extent to which policies at the state level can reduce greenhouse gas emissions produced by the energy system, create economic opportunity in low-carbon energy, and enhance resilience to climate-related impacts.

The Clean Resilient States Initiative explores the relationship between state-level policy and various outcomes in four papers and an associated database of policies. These resources will provide insights for policymakers and identify priorities for future research. This paper, the second in the series, looks at policies to create or expand economic opportunity around clean energy.

To support deeper analysis and ensure continuity over the four papers, a sample of 16 U.S. states was selected to study during the project. The selection process centered on three priorities: to include the largest energy users, to ensure diversity of regulatory environments, and to represent the different regions of the country. Each attribute has important implications for emissions reductions, economics, and resilience.

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Introduction

The energy transition presents a big economic opportunity that U.S. states want to capitalize on. This ambition is evident across the United States—in small states and large, in big energy producers and states that produce little energy, in solidly Democratic states and solidly Republican states, and in states in between. This paper explores the strategies used by states to pursue economic opportunities related to the energy transition. It is informed by semi-structured interviews with 25 state officials and experts from 16 representative states, as well as a review of plans, policies, and programs in those states.¹ It explores four questions:

- Is climate ambition a prerequisite for states to pursue clean energy opportunities?
- What institutions do states employ to promote clean energy industries?
- How do states pursue broader political aims like environmental justice and equity?
- Is there evidence that such institutions and programs are successful?

Is Climate Ambition a Prerequisite for States to Pursue Clean Energy Opportunities?

There is an assumption, widespread in the literature and in the public discourse, that connects climate ambition with economic opportunity. States might take bolder climate action, the argument goes, because they see economic opportunities for themselves in the energy transition, or because the promise of energy jobs might act as a prerequisite for securing public support for climate action, or because a state with industries that can benefit from the transition might adopt more ambitious climate targets. There is an assumption, in short, of a virtuous cycle between climate ambition and economic opportunity—more of one begets more of the other in an ever escalating path to net-zero emissions.

But this is not what the research suggests. Even states without policies to reduce emissions are putting forth well-articulated and robust strategies for developing low-carbon industries. These states fell into one of two camps. Some, like Texas, Wyoming, and Louisiana, are looking at clean energy opportunities as a means to defend and evolve their hydrocarbon-based industrial sectors. This push is shaped by an understanding that the energy transition is happening and that existing industries in these states will have to adapt to be competitive.

The other states with clean energy ambitions that were divorced from any climate action were states where existing industries could benefit from the transition. Georgia stands out in this group, where existing competitive advantages in solar and batteries create opportunities for business, regardless of any climate ambition set at the state level. South Dakota was in this category, too, given its focus on biofuels. Just because a state does not have targets to reduce greenhouse gas emissions itself does not mean it has no aspirations to sell its products to others that do.

But even climate ambition is no guarantee that there is an industrial push to pursue economic opportunities—or, at least, that this push is economy-wide and continuous. Here, too, there is considerable variation. States like California, New York, and Massachusetts have economic development strategies that are embedded in state decarbonization plans. These states envision economic opportunity and lower emissions as reinforcing each other. But other climate-committed states—like Virginia, Oregon, Minnesota, and Pennsylvania—have climate ambitions without a corresponding economic development strategy. The focus is on reducing emissions, rather than nurturing industries and creating jobs in new sectors.

There is an assumption, in short, of a virtuous cycle between climate ambition and economic opportunity—more of one begets more of the other in an ever escalating path to net-zero emissions. But this is not what the research suggests. Even states without policies to reduce emissions are putting forth well-articulated and robust strategies for developing low-carbon industries.

These different starting points and focus areas shape the tools and strategies that states employ. States with ambitious climate policies are more likely to have bigger and more enduring institutions to pursue these economic opportunities. But almost every state has some focus on developing new industries. The difference is, thus, one of degree. This also means that these are institutional setups that can appeal to states where climate ambition is nascent. Further, it means that innovation and new solutions are not necessarily tied to the states with the most robust climate policies.

In fact, industrial energy policies at the state level are a function of four overlapping dynamics. First, they are based on existing industries that offer a foundation for building new industries that could capitalize on the transition. Second, industrial strategies are formed based on resource endowments that could be exploited by new technologies (i.e., state resources that are suddenly exploitable, like offshore wind). Third, there is a focus on protecting existing industries from the threat of change and extending their longevity into the future. Fourth, there is the reality of market forces—what states can do is shaped very much by what is happening around them, whether this is demand for cleaner fuels or new technologies.

What Institutions Do States Employ to Promote Clean Energy Industries?

States use anchor institutions to promote, attract, and retain value-added activities in clean energy. These institutions bring together technical expertise, public resources, and private partners to concentrate competing, complementary, or interdependent firms into clusters based on common requirements for infrastructure, talent, and other resources. Often these institutions focus on innovation, with the expectation that successful research will produce spin-offs and start-ups.

These institutions vary in shape, scope, scale, and resources. Some are big bureaucracies with long-standing programs and financial support that is sizable and continuous. Others have institutions geared toward economic development in general, rather than energy in particular. Yet other states use targeted initiatives to spearhead development in a specific, niche area.

The Most Ambitious Climate States Tend to Favor Big Anchor Institutions

On one end of the spectrum are institutions like the New York State Energy Research and Development Authority (NYSERDA), Massachusetts Clean Energy Center (MassCEC), and the California Energy Commission (CEC), which exemplify the anchor institution in its most elaborate form. These highly centralized, enduring organizations operate with express mandates to drive energy innovation and low-carbon economic development and help cultivate reputations for climate leadership.

While their individual missions and activities vary, each of these institutions direct public resources and attract private capital to reduce scientific, financial, and market barriers for clean energy technologies. Broadly, their support spans three interconnected stages of development: applied research, demonstration, and commercialization.

At the earliest stages of technological development, clean energy technologies face well-documented challenges including high capital needs, long and unpredictable development times, and complex regulatory environments.² These institutions have experimented with various structures to support the development of new technologies. In California, for example, the CEC launched the California Energy Innovation Ecosystem in 2016.³ The program created a network of four regional energy innovation clusters and a grant program to support early-stage innovators. The regional clusters provide entrepreneurs with resources such as laboratory equipment and services to promote and protect intellectual property development. The complementary grant program (California Sustainable Energy Entrepreneur Development, or CalSEED) provides recurring funding for concept feasibility testing.⁴

Moving from applied research to demonstration, promising technologies are often confronted by challenges associated with attracting private sector interest and investment. Since 2009, NYSERDA's six clean energy business incubators have offered a full suite of mentoring, training, and technical support of this kind. The incubators are operated by a mix of state colleges and nonprofits in partnership with private companies. They provide access to professionals, services, and equipment that may be expensive or otherwise difficult to obtain, including pitch coaching, marketing materials design, legal advice, and physical workspaces.⁵ These supports help start-ups portray themselves as real, credible companies, making it easier for them to attract and retain investors, employees, and customers. The incubators also serve as a formal and informal avenue for networking within and across clean energy ecosystems around the state.

As low-carbon technologies become scalable, anchor institutions can help new entrants identify and address challenges around market expansion. MassCEC's Fleet Advisory Services Program is focused on the demand side of medium- and heavy-duty vehicle electrification.⁶ The program is built around a competitive solicitation open to fleet managers. Program participants (fleet managers) receive education about anticipating costs, selecting electric vehicles to match their needs, locating charging infrastructure, and operating and maintaining vehicles. A subset of participants receives a full electrification analysis and strategic plan, as well as assistance with procurement processes. Rather than offering an ongoing service, this program serves as a window of opportunity for stakeholders and the state to collaboratively learn about the nuances of the burgeoning market.

These examples illustrate how these institutions support new technologies from the lab to meaningful market penetration. Their comprehensive services are especially useful in enabling flourishing clusters, which help retain economic benefits locally. Of course, the success of these institutions is attributable in no small part to long-standing, sizeable, and stable funding. Legislative allocations, utility ratepayer surcharges, and revenues from emissions trading programs underwrite these funds—revenues often subject to political opposition elsewhere.

While not every state will develop big bureaucracies to support clean energy economic activities, some of their useful design features are readily transferable. First, the highly centralized structure of these institutions raises visibility among key stakeholders, including researchers, investors, and consumers. Second, they support a wide range of technologies and activities, such that failure of one project is not determinative for the larger enterprise. Third, these institutions provide more than funding; they staff, partner with, and contract technical experts who can refine and advance their goals. Finally, NYSERDA and MassCEC have the benefit of being “all carrot, no stick,” setting the stage for more open, collaborative relationships with stakeholders than might arise in agencies with regulation and adjudication obligations.

Energy Can Be Embedded into Broader Economic Development Institutions

Ohio's Third Frontier is an economic development program launched in 2002 with an initial \$1.4 billion, 10-year commitment to accelerate the growth of diverse start-up and early-stage technology companies. Third Frontier boasts some of the design features described above, but it works from a broader mandate, with a statewide network of resources providing access to business expertise, mentorship, capital, and talent for a range of technologies.⁷

Though Third Frontier is not energy specific, the program garnered the attention of energy advocates early on with its 2004 Fuel Cell Program, which sought to establish a sustainable fuel cell supply chain industry in the state. The Fuel Cell Program is widely viewed as successful in attracting federal support and private capital as an outgrowth of existing resources, industry, and research expertise. A nonprofit Fuel Cell Corridor Coalition, housed in a community college, continues to foster academic and private-sector activities.⁸ In 2016, the nonprofit was competitively selected by the U.S. Department of Energy (DOE) to serve as a regional center for the domestic supply chain.⁹ Between 2003 and 2008, Third Frontier had similar success cultivating a solar photovoltaics (PV) supply chain cluster, which helped position Ohio as the country's leader in solar manufacturing. The state currently accounts for about 30 percent of the nation's solar panels and will account for nearly half by 2023.¹⁰

In the last decade, energy has become one of several secondary investment priorities for Third Frontier, representing only about 5 percent of its funding, while its primary investment area, biomedical and healthcare industries, receives about 50 percent.¹¹ Institutions like Third Frontier—with broad mandates to drive significant economic activity—can drive significant, persistent economic benefits in the clean energy sector, but ongoing commitment to it is not guaranteed over time unless the promotion of clean energy is embedded in the institutional mission, à la NYSERDA, etc.

Some Institutions Can Be Narrowly Focused

In contrast to Third Frontier's broad mandate, Wyoming's Integrated Test Center (ITC) was devised to promote research and testing of a narrow subset of technologies: those for carbon capture, utilization, and sequestration (CCUS). In lieu of funding, the ITC offers researchers exclusive access to capital-intensive infrastructure.¹² The center's 20-megawatt coal-based flue gas power plant has put the state on the map for CCUS development because it provides real-world conditions to test commercial pilot and demonstration projects at scale. Launched in 2014 with about \$30 million in legislative resources and \$6 million more from private industry, the facility has attracted high-profile projects attached to DOE funds, as well as international firms like Japan-based Kawasaki.¹³ While to date the projects tested at this site have yielded limited capital investment or value-added activity for the state's coal industry, the ITC signifies Wyoming's ongoing commitment to CCUS technologies and now features prominently in the state's effort to help extend and transform the value of its fossil fuel resources.

Large, Bureaucratic Structures Are Not Necessary

Successful economic programs are built around bringing the right people to the table, and state convening powers and technical expertise carry weight. Not all states employ sophisticated, bureaucratic anchor institutions to support cluster development. Leaner models tend to use cost-share grants as seed

money to incentivize projects that can attract capital and achieve self-sufficiency in the near to medium term. This approach tends to be favored by states with fewer policy aspirations for decarbonization.

In South Dakota, the Governor's Office of Economic Development houses a Research and Commercialization program.¹⁴ Through a periodic, competitive solicitation, the program provides up to five years of funding for research centers focused on developing inventions, spin-offs, and start-ups. Since the program's inception in 2005, 10 research centers have continued operations after exhausting state support.¹⁵ While the program is not inherently energy oriented, two centers are currently pursuing improvements in lithium-ion batteries.¹⁶ A third seeks to advance fluorinated functional materials science used in both solar PV and battery applications.¹⁷

Texas's Governor's University Research Initiative (GURI) is quite like South Dakota's program in structure, though it features a considerably larger funding endowment and is more focused on attracting prominent scholars than building up those already in the state.¹⁸ Texas's program, established in 2015, replaced the state's Emerging Technology Fund, which was embroiled in scandal related to allegations of cronyism and lack of transparency.¹⁹ Like the funding allocated by the South Dakota program, Texas's GURI is not energy specific, but currently 5 of its 19 matching grants fund research related to clean energy production and storage.

An advantage of these governor-led, research-focused approaches to building technology clusters is that they may require fewer resources than larger institutions. They also allow governors to place bets on the next big thing in technological advances, where legislative efforts to do so may lose out to gridlock or competing priorities. The success of this model partly depends on the selection of research areas that are well positioned to secure funding beyond that provided by the state, usually owing to commercial potential and viability. A drawback is that these research centers tend to concentrate in the state's institutions of higher education, meaning the potential benefits to other geographic or demographic areas of the state may be limited. Additionally, this model tends to promote strong research programs, but there is not always a clear path or directive to retain downstream, value-added opportunities that follow successful research endeavors, like demonstration projects or manufacturing activities.

An advantage of these governor-led, research-focused approaches to building technology clusters is that they may require fewer resources than larger institutions. They also allow governors to place bets on the next big thing in technological advances, where legislative efforts to do so may lose out to gridlock or competing priorities.

Some States Use External Partners as Anchor Institutions

Minnesota's 2021 Energy Conservation and Optimization Act enables the development of a new, state-level energy technology accelerator to support an energy efficiency and conservation cluster

in Minneapolis.²⁰ The accelerator is envisioned to mobilize a consortium of manufacturers to build technology supply chains, with buy-in from local industry heavyweights like 3M, Honeywell, and 75F, a Minnesota-based start-up. But the state is likely to cede authority and about \$5 million in utility ratepayer funds to a nonprofit to administer the accelerator, in lieu of a government-run program.

Minnesota's new accelerator is modeled after the Northwest Energy Efficiency Alliance, which boasts support for emerging technologies, standards development, and midstream incentives to expand the market penetration of maturing technologies.²¹ The new institution could be a promising kick start to a cluster that will support energy efficiency technologies from early-stage research to commercial-scale deployment. The only catch is that it may be difficult for policymakers to influence which technologies or markets benefit from this new institution. In all likelihood, this is a policy design feature and not a bug, reflecting a strategic compromise in the country's only divided legislature between (Democratic) policy priorities for climate and energy with (Republican) preferences for more market-based policy tools.

Convening Power Can Be Important Too

Georgia's Centers of Innovation (COI) nurtures industry clusters in five targeted fields: aerospace, energy technology, information technology, logistics, and manufacturing.²² COI distributes limited funding. Instead, the primary asset is the COI staff—experts with industry backgrounds and savvy—who operate like consultants. They provide industry-specific business counsel to prospective, new, and expanding companies and connect them to the state's research and development hubs and investor networks. The energy technology group at COI has helped cultivate the state's rapidly expanding clusters in solar and battery supply chains, working to understand the needs of both firms and start-ups from the state's universities.²³ The COI energy team also oversees 11 living laboratories around the state, which pilot smart mobility technologies.²⁴

In July 2021, Georgia's governor announced a new venue to convene clean energy experts and stakeholders. The Electric Mobility and Innovation Alliance is intended to further advance the state's position in electrification-related manufacturing and innovation.²⁵ It will bring together government agencies, industry representatives, electric utilities, and advocacy groups to work on five committees that will engender support in supply chain, infrastructure, workforce, innovation, and policy.²⁶

An important caveat about the success of Georgia's COI model is that it does not really seek to create something from nothing. The ecosystems promoted by COI, and the new alliance, are grounded in the state's university systems and technical schools. The value of COI is akin to that of an air traffic controller, positioned to take a long and high-level view of the industry and make recommendations about how to improve the coordination and efficiency of ongoing activities.

Loose Committees Can Also Catalyze Action— under the Right Conditions

Shortly after his inauguration in 2020, Louisiana's governor created a Climate Initiatives Task Force by executive order.²⁷ In a state first, the task force was charged with developing recommendations to address greenhouse gas emissions while ensuring the state maintains its position as “a world leader in energy, industry, agriculture, and transportation.”²⁸ Four advisory councils and six sector committees support the task force—over 120 members in all. Without legislative authorization, the

task force's ultimate impact is contingent on how much the governor's office can operationalize and institutionalize its activities.

The situation in Florida is similar. There, the state's agriculture commissioner—and statewide-elected Democrat—formed an Advisory Council on Climate & Energy (FACCE) representing a range of stakeholder interests.²⁹ Conveniently, the state's Office of Energy is housed under the commissioner's domain, in the Department of Agriculture and Consumer Services. In recognition of the political, regulatory, and institutional constraints FACCE is up against, each of the plan's nine focus areas include recommendations about what could be achieved (1) with legislative action, (2) with only collaboration from other state agencies and/or stakeholders, and (3) without additional legislative authority or funding. Each focus area section concludes with "questions for future engagement . . . meant to spark conversation about solutions to Florida's energy and climate issues."³⁰

The planning and advisory activities in Florida and Louisiana are not just about creating economic activity in clean energy. Rather, their assemblies of experts and stakeholders aim to support a holistic set of climate-related goals. These planning activities make way for a compelling thought exercise: What does a comprehensive, economy-wide decarbonization plan look like in places that have not made much progress to date? These cases might also represent the best test of the economic co-benefits hypothesis—that opportunities may motivate support for climate policy—because there is decidedly little political will among leaders in these states to support decarbonization activities (apart from the two identified champions).

How Do States Pursue Broader Political Aims Like Environmental Justice and Equity?

State efforts to direct economic co-benefits to certain groups or regions usually reflect population composition and distribution characteristics. Initiatives to support equity and inclusion among low-income communities and communities of color are perhaps most deeply rooted in states with deep and long-standing climate commitments. But even states where climate commitment is not as deeply intertwined with economic development policy have focused on supporting these groups. Meanwhile, states without strong climate targets tend to have the fewest programs and policies to benefit particular groups. Where they occur, they often focus on rural communities and those that may face significant losses associated with the decline of carbon-based industry.

Forecasting Workforce Needs

Since ongoing efforts to remediate race, class, and other social injustices are vested in education, workforce development, and jobs programs, these areas are natural loci for disseminating clean energy-related opportunities and co-benefits. These initiatives typically promulgate tools to better anticipate job readiness requirements, support hands-on training, and facilitate local hiring and procurement, even if they are not always energy specific.

In Virginia, for example, legislation enacted in 2021 created an Office of Education and Labor Market at the state's economic development corporation.³¹ The office is to be charged with forecasting and developing recommendations to enhance alignment between education, workforce development, and the needs of the labor market. The idea is to identify and address challenges like an “unhealthy college-for-all orientation” and “unwarranted credential inflation . . . that makes it difficult for job seekers to secure well-compensated employment for which they have the necessary skills and capabilities.”³² As

Virginia's energy transition takes hold, this support for mid-skill labor may prove useful and necessary in ensuring that local workers have the needed skills and abilities to participate in new energy and technology markets.

Just Transitions Are a Priority in States with Carbon-Based Industries

There is also mounting attention to the needs of communities where power plants or other extractive activities are likely to be phased out over time. In New Mexico, the slated 2022 closure of the San Juan coal-fired generating station and adjacent mine is becoming a test bed for supporting new, clean economic opportunities that minimize losses associated with such closures.³³

Enabling legislation in 2019 spearheaded New Mexico's just transitions program. It prioritizes "affected communities," defined in the legislation as residents within 100 miles of an electricity plant closure resulting in at least 40 displaced workers.³⁴ The de facto beneficiaries of this definition are rural New Mexicans—and in San Juan, especially Native Americans, who represent about 80 percent of the workforce around the site. The program is anticipated to support education and apprenticeship programs for renewables deployment, from which new energy facility construction projects will be required to hire. The state plans to underwrite program funding through securitization of uneconomic coal-fired power plants, an approach now in place in about half of all states.³⁵

In 2021, New Mexico expanded its work in this area by creating a Sustainable Economy Task Force.³⁶ The task force, composed of cabinet officials (or their appointees) from 12 state agencies, is to develop and implement a concrete action plan for economic diversification to move the state away from its current dependence on the oil and gas sectors. The state's Economic Development Department has recruited a nonprofit research institute to help facilitate plan development and an associated online platform.³⁷

Despite its foresight, the state—and others with similar goals—is likely to face some challenges. In the case of San Juan, the state reached a securitization agreement, but other utilities have expressed reluctance about this compensation scheme, which does not fully offset anticipated profits.³⁸ The local government in which the San Juan plant resides is also pushing to restart the coal-fired generating operations in partnership with a new owner who would retrofit the facility with CCUS technology.³⁹ Finally, a state survey notes public reservations about the availability and quality of clean energy jobs and benefits, a pattern also observed in other states with prominent carbon-based industries.⁴⁰ This example illustrates that state-supported just transitions are likely to require continuous negotiation with the communities they aim to benefit, even with proactive plans and leadership in place.

Environmental Justice Is Gaining Traction in More Diverse States

Environmental justice initiatives seek to empower historically excluded and marginalized groups. Illinois has demonstrated ongoing commitment of this kind. Its 2016 Future Energy Jobs Act took an approach that is increasingly common among states, linking an effort to deploy clean energy in low-income communities with a program to hire from them. The bill required that companies utilizing a low-income distributed generation incentive "commit to hiring job trainees for a portion of their low-income installations."⁴¹ However, the act did not specify what was meant by "a portion" or who qualified as a "job trainee." Illinois' 2021 Climate and Equitable Jobs Act corrected for the shortcomings

of earlier legislation with more specific definitions; quotas; and statewide, programmatic management to support a comprehensive suite of labor, diversity, and equity standards in clean energy jobs.⁴²

Illinois' Climate and Equitable Jobs Act is unique for its encompassing definition of "equity focused populations." It includes groups conventionally understood to be historically and contemporarily excluded, like people of color, Indigenous people, low-income individuals, women, and people with disabilities. But Illinois' definition also includes formerly convicted individuals, those who are or were in the child welfare system, queer and transgender individuals, and energy workers and their dependents who may be subject to displacement.

To benefit equity-focused populations, Illinois' bill supports the creation of 16 clean jobs workforce hubs across the state. Much like previously described efforts to facilitate innovation, this state program is envisioned to work in partnership with industry to understand and develop needed workforce training and skills, as well as provide a kind of matchmaker service between work-ready individuals and firms in need of talent. A Transition Workforce Commission will help inform ongoing needs to steer, refine, or expand new programs as future needs arise. Additionally, the legislation specifies that all non-residential clean-energy projects must pay prevailing wages and, under the state's renewable portfolio standards, all utility-scale renewable energy projects that qualify must use project-labor agreements.

Illinois' legislative effort is too new to speak to its effectiveness, but it looks to be the most comprehensive effort by any state to promote inclusive job opportunities in clean energy. Its strengths appear to reside in its encompassing definition of targeted beneficiaries and its commitment to apprenticeship, prevailing wages, and organized labor across the state.

Is There Evidence That Such Institutions and Programs Are Successful?

While most states support economic development related to clean energy, few evaluate the impacts of those efforts systematically. Part of this challenge resides in ambiguity about what to measure and how. States that focus on deployment can more easily evaluate the results, looking at capacity additions across different geographies of the state, direct and indirect employment, and occasionally employee characteristics like education or union membership. While these reports provide some sense of progress, they tend to cite third-party estimates of employment figures and trends, like the U.S. Energy & Employment Report, which can be difficult to link to specific programs or policies.

Estimating the impacts of state anchor institutions and effects on clean energy clusters is considerably more complicated because few institutions narrowly define anticipated outcomes or benefits. South Dakota and Georgia report direct impacts (funding awarded for the former, clients engaged for the latter), but cite difficulty estimating broader impacts on innovation and cluster formation. Climate-motivated states with large, centralized anchor institutions may be best-positioned to take a high-level view because the institutions generally hold responsibility for strategic planning, budgets, and programmatic data. For example, NYSEERDA's strategic outlook details strategies to support innovation, workforce development, and its green bank, with indicators of progress for each.⁴³

To the extent that clean energy economic activities are anticipated to empower disadvantaged and vulnerable groups, it is especially important for states to establish criteria against which the scale and quality of realized benefits can be contextualized. But stakeholder input can offer competing visions for what these criteria should entail and how they should be measured, if at all. A related challenge in quantification lies in setting goals around sectors, clusters, and regions where clean energy technologies do not yet factor deeply into economic activity—most notably in industrial applications.

To the extent that clean energy economic activities are anticipated to empower disadvantaged and vulnerable groups, it is especially important for states to establish criteria against which the scale and quality of realized benefits can be contextualized.

A variety of methods can be employed to conduct more rigorous assessments of clean economic development goals. First and foremost, evaluation initiatives benefit from efforts to preemptively define and quantify anticipated impacts, with detailed descriptions of where, how, when, and by whom pertinent data points should be collected and amalgamated. In anticipation of this need, New Mexico recently formed a new Economic and Energy Diversification Coordinator position, responsible for collecting and assessing data related to education, workforce, and industry presence to help benchmark anticipated improvements. Once data are collected, the simplest evaluation approaches take the form of input-output models or case studies. More sophisticated models are available in a variety of prefabricated and publicly available tools, including the U.S. Bureau of Economic Analysis's Regional Input-Output Modeling System; Impact Analysis for Planning; and Regional Economic Models, Inc. Where such evaluations are prohibitively costly or complex, data transparency and accessibility could go a long way in supporting both accountability and third-party opportunities for economic benefit assessment.

Conclusions

This paper explored four core questions:

- Is climate ambition a prerequisite for states to pursue clean energy opportunities?
- What institutions do states employ to promote clean energy industries?
- How do states pursue broader political aims like environmental justice and equity?
- Is there evidence that such institutions and programs are successful?

There is no evidence that climate ambition is closely connected with efforts to chase opportunities in clean energy. This research, instead, identified four possibilities. There are some states, like California, New York, and Massachusetts, where climate ambition goes hand in hand with economic development. Other states, like Virginia, Oregon, Pennsylvania, and Minnesota, tend to have climate ambitions that are not directly tied to a specific economic development doctrine.

Similarly, a state does not need internal climate ambitions to make clean energy a mainstay of its economic development plans. There are some states with sizable hydrocarbon industries. These states are keen to ensure the economic viability of their industries during the energy transition. They are looking to encourage innovations in related sectors where they have a competitive advantage. And there are, finally, states where legacy industries are well positioned to exploit new market developments without a corresponding element of climate ambition on behalf of the state. Georgia's push on solar and battery manufacturing stands out in this regard.

The institutional approaches that states employ vary as well. Some states have big, complex, and well-funded bureaucracies. Others have loose organizations or small offices meant to act as convenors or

connectors. This is an important finding. A state does not need a NYSEDA-scale institution to nurture clean energy industries. But scale, accountability, a clear mandate, and adequate resourcing all help.

Clean energy development is often linked to broader socioeconomic objectives. Some states, like Virginia, are looking to prepare themselves better for the jobs that are coming. Others, like New Mexico, are instituting targeting programs to help communities affected by the energy transition (in New Mexico's case, the closure of a mine and coal-fired power plants). Others, like Illinois, are making a more systematic effort to channel the opportunities created by the energy transition to groups that have been previously marginalized or disadvantaged.

A state does not need a NYSEDA-scale institution to nurture clean energy industries. But scale, accountability, a clear mandate, and adequate resourcing all help.

All these efforts, however, are rarely evaluated rigorously. There is a dearth of relevant data or even a consensus on what to measure and how. As a result, states spend a lot of money and resources to build industries without knowing whether those efforts are successful. This is a major blind spot for policymakers—one that, over time, states would be well advised to address.

In the end, it is clear that states are looking at the economic opportunities created by the energy transition and are eager to participate. What they focus on is shaped by their politics, existing industries, and resource endowments, and by rapid changes in the marketplace. But every state is, in one way or another, looking to play in this space. There are many options for how to chase these opportunities. But as they do, states will need to stay nimble, experiment, learn from each other, and measure success more systematically.

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Endnotes

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