Clean Energy Momentum

Ranking State Progress

Union of Concerned Scientists

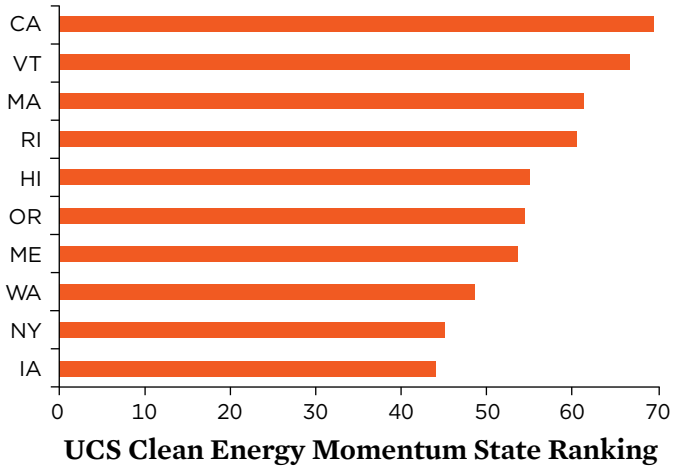
Executive Summary

Clean energy is moving forward in the United States, with significant, tangible, rapid progress. Wind farms in 41 states provide enough electricity to meet the needs of more than 20 million American households. In 2016 alone, the nation added enough solar electric panels to meet the needs of two million households. Investments in energy efficiency over the last quarter century have precluded the need for the equivalent of more than 300 additional large power plants. Electrification of the transportation sector, while nascent, is rapidly picking up steam, with more than half a million plug-in electric vehicles now on US roads.

Those advancements yield direct benefits. Clean energy substantially improves public health by reducing the power sector's harmful emissions, particularly emissions from coal-fired power plants. And more than half a million people now work in the fields of solar, wind, hydro, and geothermal energy; four times as many have jobs in energy efficiency.

To assess state leadership in this historic transformation, the Union of Concerned Scientists (UCS) created the Clean Energy Momentum State Ranking. While the federal government can play important roles in making efficiency, renewable energy, and vehicle electrification a national priority, states can be a consistent, powerful, positive force as well.

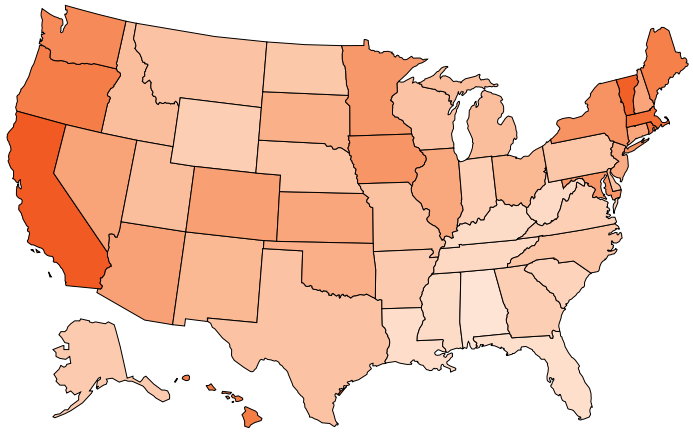
FIGURE ES-1. States Leading the Way in Clean Energy



To determine the clean energy momentum state ranking, UCS analyzed the 50 states on 12 metrics, such as job creation, pollution reduction, renewable energy in the electricity generation mix, and policies to advance clean energy. California leads the way, with strong showings on eight metrics and the number one position in electric vehicle adoption.

Note: For each metric, top-performing states receive a 10, bottom ones receive a zero, and other states are rated according to their position relative to those two benchmarks. A state's overall score is the total of their metric scores. The highest possible score is 120.

FIGURE ES-2. States Across the Nation Lead on Clean Energy Momentum



States from across the country drive clean energy momentum. Eight of the top 10 states in the UCS Clean Energy Momentum State Ranking are on the West Coast or in the Northeast, highlighting region-wide commitments to clean energy. Iowa leads in the Midwest, followed by Minnesota. Maryland, Colorado, Arizona, and Nevada also make the top 15.

Note: The higher the overall score a state received, the darker it appears.

Understanding which states lead, and how, will help the nation as a whole build momentum toward a clean energy future.

Our easy-to-understand ranking uses 12 metrics in three broad areas to gauge state leadership.

- **Technical progress:** How much of a state's electricity generation is based on renewable energy and how quickly has that changed in recent years? How much electricity are state utility programs saving, and how strong are electric vehicle sales?
- **Direct, visible effects on our daily lives:** How many jobs has clean energy created in each state? How much has it reduced pollution from power plants?
- **Policies to build the momentum for the future:** How much progress has a state made on policies to promote renewable energy, energy efficiency, and carbon reduction?

The UCS analysis identifies clear leaders among the 50 states (Figures ES-1, ES-2):

- **California**, a stellar all-around performer, leads the way on clean energy momentum. The Golden State appears in eight top-10 lists. It is tops in electric vehicle adoption and one of the top five on six other metrics: residential solar capacity per household, energy savings, clean energy jobs, renewable electricity standard targets, ease of

Cover image: Dennis Schroeder/NREL

corporate renewable energy procurement, and carbon reduction targets.

- **Vermont**, in second place, leads the nation in clean energy jobs per capita and for its carbon reduction target and has top-five scores in energy savings, electric vehicle adoption, and energy efficiency policy. The Green Mountain State earns 10 top-10 appearances, the most of any state.
- **Massachusetts**, in third place, garners top marks on one metric and top-10 appearances on nine metrics. It has the strongest energy efficiency resource standard and is a top-five performer in residential solar capacity per household, energy savings, clean energy jobs per capita, and carbon reduction targets.
- **Rhode Island**, number four, leads in energy savings. It is a top-five state in pollution reduction and policies around renewable electricity, energy efficiency, and carbon reduction.
- **Hawaii**, number five, is first in residential solar and scores high for electric vehicles and its renewable energy policy.
- **Oregon**, **Maine**, **Washington**, **New York**, and **Iowa** round out the top 10.

State leadership on even a single metric is worth noting. South Dakota tops the states on its use of renewable energy in electricity generation, even if much of that electricity supplies neighboring states. Wyoming may dominate coal production in the country, but it also handily leads in terms of renewable energy being built on a per-capita basis as the state harnesses its great wind resources.

That said, multifaceted leadership matters most. In all, 21 states score in the top 10 for at least three UCS metrics. Moreover, any state can be a leader, not just those better endowed with natural resources. Both momentum and leadership are apparent in millions of clean energy jobs and in reduced damage to public health from power plants. States lead, too, with policies that will propel clean energy momentum into the future.

Taken together, the metrics in the UCS Clean Energy Momentum State Ranking paint a picture of state successes and a 50-state race for clean energy leadership. They also point to several important conclusions:

AP Photo/Mark Lennihan

Businesses play a large role in driving renewable energy, motivated not just by the potential to save energy and money directly but also by the ability to demonstrate leadership in a key sector undergoing transformation. Swedish furniture giant IKEA has solar on 90 percent of its US stores.

> ***Leading states help make clean energy happen, create clean energy jobs, and remove barriers to the adoption of clean energy by local businesses.***

- The transition to clean energy is real, and clean energy momentum takes many forms.
- State choices translate into rapid growth in renewable energy, energy efficiency, and vehicle electrification.
- Any state can lead on clean energy, not just those with the strongest renewable energy resources.
- Job creation is a powerful incentive for additional action on clean energy.
- Businesses can make major contributions to clean energy progress—if states let them.

With uncertainty surrounding national energy policy, state leadership is more important than ever. This analysis prompts UCS to offer several recommendations for states to accelerate clean energy momentum and lead the nation to a new energy future:

- **Adopt policies supporting multiple dimensions of progress.** Many states have implemented policies that have a proven ability to foster clean energy development at reasonable costs. By adopting such policies in support of renewable energy, energy efficiency, and vehicle electrification, along with setting economy-wide targets for reducing global warming pollution, states can create a broad framework for clean energy progress.
- **Facilitate business involvement.** State policies should make it easier for businesses to adopt renewable energy, enabling them to be a powerful force for accelerating clean energy progress. For example, states could broaden the array of options available to businesses for acquiring renewable energy through utilities or third parties, and could remove barriers to installing solar panels or wind turbines on site.
- **Improve energy equity.** States should directly address the challenges faced by low-income communities and communities of color—those who are most affected by power plant pollution and other inequities in the electricity sector. State programs, for instance, can help low-income homeowners weatherproof their homes to save money and improve comfort, and can give low- and moderate-income households better access to solar power and electric vehicles.
- **Advocate for federal action.** While leading by example, states should also insist that the federal government be a full partner in building clean energy momentum, through strong support for innovation and deployment. Efficiency standards, tax credits, research support, and other nationwide activities would provide a strong impetus for continued progress in all 50 states.

Clean energy is happening, with states building momentum in many ways. As measures of progress, current status, and plans for the future show, the efforts of top states create jobs and reduce pollution. California, Vermont, Massachusetts, Rhode Island, and Hawaii—as well as many others—are rising directly to the challenge of transforming the nation's electricity sector and embracing all that clean energy has to offer.

Introduction

Across the 50 states, the growth in clean energy is truly impressive. Wind power generation grew more than tenfold over the past decade, while its cost dropped by two-thirds in just six years (EIA 2016a; AWEA 2016). Wind farms in 41 states now provide enough electricity to meet the needs of more than 20 million American households (AWEA n.d.a). US solar power capacity has grown more than 900 percent since 2011, with the cost of residential solar electric power dropping by more than 50 percent since 2009, and the cost of large-scale solar dropping even more (Perea et al. 2017, Barbose and Darghouth 2016). In 2016 alone, the country added enough solar to meet the electricity needs of two million households (Perea et al. 2017).

Investments in energy efficiency save hundreds of billions of kilowatt-hours of electricity each year, again equal to 20 million households' worth of electricity consumption (Gilleo 2016). Such investments over the last quarter century have avoided the need for the equivalent of more than 300 additional large power plants (Molina, Kiker, and Nowak 2016).

Clean energy is also helping clean up the transportation sector. US sales of plug-in electric vehicles (battery electric and plug-in hybrid), while still modest, have risen from 17,000 in 2011 to 159,000 in 2016, and now account for almost one in every 100 car purchases; Americans purchased close to 600,000 electric vehicles between 2011 and early 2017 (Inside EVs n.d.).

Clean energy progress is important for many reasons, not the least of which are the jobs it creates and its contributions

to improving public health. More than 500,000 people work in solar, wind, hydro, and geothermal energy; jobs in solar power alone grew 25 percent in 2016 (DOE 2017; Solar Foundation 2017). The energy efficiency sector as a whole employs almost two million people (E2 and E4TheFuture 2017).

Just as important are decreases in pollution from the power sector. Between 2011 and 2015, US power plant emissions of two key pollutants with substantial public health impacts fell substantially, with sulfur dioxide emissions down 47 percent and emissions of nitrogen oxides down 24 percent (EIA 2016b). Emissions of carbon dioxide, the key heat-trapping gas driving climate change, fell 11 percent in that same period (EIA 2016b). Reams of data confirm momentum away from dirty fossil fuels like coal and toward clean energy sources like efficiency, wind, and solar.

How does all this happen? Where does leadership come from?

At both the federal and state levels, tax credits and research and development funding have played a key role in driving clean energy innovation, deployment, and cost reductions. However, given diminished prospects for leadership from Washington, D.C., state leadership has become even more crucial.

In some cases, state leadership reflects the local availability of wind, solar, or other renewable energy resources. In other cases, it is based on a range of policies aimed at propelling clean energy for public health and economic development, including the enactment of renewable electricity standards and energy efficiency resource standards.

The Union of Concerned Scientists (UCS) Clean Energy Momentum State Ranking incorporates a range of metrics to assess many of the ways states are leading in the transition to clean energy. From promoting renewable energy sources, to supporting energy efficiency for homes and businesses, to making electric vehicles a reality for cutting transportation pollution, leading states help make clean energy happen, create clean energy jobs, and remove barriers to the adoption of clean energy by local businesses.

Topher Donahue

Clean energy means saving money, reducing pollution, and creating jobs. In 2016, 260,000 people worked in solar energy in the United States, up 25 percent from 2015.

Methods and Metrics

Clean energy momentum in the electricity sector can take many forms, and each of our 12 metrics points to an opportunity for leadership.[1] Clean energy comes from various types of technology, including renewable energy, energy efficiency, and transportation electrification. And momentum involves the current status in each state and also recent progress and future direction.

Our state ranking is unique in offering a simple, straightforward assessment of a range of dimensions of clean energy, as well as in considering a range of timeframes. The 12 metrics cover technical progress, broad impacts, and public policies, and they look at each state's recent history, current conditions, and future prospects.

We based the analysis on both primary sources and other analyses of the transition to clean energy and states' roles in it. Snapshot metrics use the most recent data available (2015 or 2016). Metrics looking at the recent past compare 2015, the most recent year for which data are broadly available, with 2011. Forward-looking metrics cover either four years (2016 to 2019) for information on new power plants or the period to 2030, which is a standard medium-term end date for climate and energy policies.

Six metrics are technical, assessing key trends in the deployment of renewable energy, efficiency, and electric vehicles:

1. **Renewable energy generation, 2015:** The portion of a state's electricity generation that is based on renewable energy. Renewable energy sources include wind, solar, geothermal, hydroelectric, and bioenergy.
2. **Renewable energy generation increase, 2011 to 2015:** How quickly a state increased the proportion of in-state generation that is based on renewable energy.
3. **New renewable energy capacity, 2016 to 2019:** How much renewable energy is being built. Where a state is headed is as important as where it has come from.
4. **Residential solar electric, 2016:** The amount of installed residential solar capacity. The arrival of affordable

rooftop solar represents a major shift in the connections between households and their electricity supplies.

5. **Energy savings, 2015:** Success in achieving energy savings through targeted state programs. The cleanest (and cheapest) energy is energy that is never used.
6. **Electric vehicle adoption, 2016:** Sales of electric vehicles (EVs) as a percentage of new car sales. Transportation electrification is a major frontier for cutting carbon pollution, with a broad array of options for producing electricity cleanly and a dearth of options for clean gasoline.

Two metrics look at selected positive effects of clean energy success on our daily lives:

7. **Clean energy jobs, 2015 and 2016:** The number of jobs in clean energy, per capita. Among clean energy's benefits is its potential to drive economic development and create local jobs.
8. **Power plant pollution reduction, 2011 to 2015:** Reductions in emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_x), and carbon dioxide (CO_2) from power plants fueled by coal, oil, and natural gas. Clean energy can avoid the substantial negative effects on public health and the climate from fossil fuel plants.

Four metrics gauge the state policy environment for driving clean energy:

9. **Renewable electricity standard increase, 2017 to 2030:** The strength of requirements for increasing the proportion of electricity that providers get from renewables. A renewable electricity standard (RES) is a powerful driver of renewable energy development.
10. **Corporate renewable energy procurement, 2016:** Progress on creating environments for business leadership in clean energy. Businesses can drive renewable energy and efficiency for the savings and cost stability those technologies can offer. The same businesses can demonstrate the value of clean energy investments.
11. **Energy efficiency resource standard, 2015:** Requirements that participating utilities meet energy savings targets through customer energy efficiency programs. An energy efficiency resource standard (EERS) is an important tool for driving efficiency.
12. **Global warming emissions reduction target, 2030:** Economy-wide limits on carbon pollution. The electricity sector offers some of the best options for cutting carbon emissions—through renewables, efficiency, transportation electrification, and other methods.

Most of the metrics gauge progress that depends on state policy decisions, not each state's renewable energy resources.

SCORING

For each metric, UCS assigns a value of 10 to the top performing state and a zero to the bottom state. Some metrics have more than one component; the state score on a metric is the average across the component metrics. The overall score for each state is the sum of the scores on the 12 metrics.

States differ in size, population, economic activity, and access to renewable energy and other resources. This analysis manages many such differences by putting results in a local context: some metrics look at per-capita or per-household statistics, and some consider data as a percentage of a state's total. Although this approach tends to improve the standing of small states, it provides a more level playing field for assessing leadership based on attributes other than size.

Clean energy is often most visible in wind turbines and solar panels, and the local availability of renewable energy resources figures into a state's score on several metrics. For example, some states have strong wind resources and lower population densities, making them especially ripe to benefit from low-cost renewable energy. Similarly, utility-grade geothermal resources are available only in certain parts of the country.

However, differences in the local availability of specific resources are a minor factor. Some resources, including energy efficiency and solar, are abundant in virtually every state. State and regional electricity prices can make clean energy technologies more attractive, regardless of renewable energy resource constraints. Most of the metrics gauge progress that depends on state policy decisions, not each state's renewable energy resources.

ASSESSING EQUITY

Assessments of clean energy momentum in its various forms can show the degree to which states are leading in the transition to a future with electricity production that is not only clean and affordable but just.

We sought to capture how clean energy progress affects the residents of each state—particularly its effect on low-income and minority communities, which historically have been left behind or negatively affected by business as usual

in the power sector. For example, more than three-quarters of African Americans live within 30 miles of a coal-fired power plant, and residents living near coal plants are more likely to be lower income and people of color (Wilson et al. 2012). Public health statistics reflect the results. For example, power plants are a major contributor to elevated asthma rates; African American children are 60 percent more likely to suffer from asthma than their white counterparts (NIH 2012). Power plants are also a major contributor to climate change, with disproportionate impacts on low-income households and communities of color. For example, the rising intensity of heat waves and reductions in air quality affect urban residents more deeply (Crimmins et al. 2016).

Unfortunately, few comprehensive data are available for assessing energy equity. In particular, the lack of 50-state data points precludes inclusion of calculations of equity, let alone state-to-state comparisons, in the UCS ranking.

That said, many of our metrics have implications for equity. Wind farms and solar arrays, key to clean energy progress, are especially encouraging if they lead to positive effects for all residents of a community and all consumers of the resulting electricity. Also, the impact of clean energy progress on energy bills can help or harm low-income households disproportionately; such households on average spend three times more on energy bills than do non-low-income households as a portion of income (Drehobl and Ross 2016).

Solar's recent progress is impressive, but efforts to broaden access to it in low- and moderate-income neighborhoods are just emerging. Similarly, few jurisdictions focus on electric vehicle adoption by low-income households. Energy efficiency, in general a powerful tool for decreasing energy costs, is less accessible to low-income households, including renters and multifamily residences (Drehobl and Ross 2016).

Analyzing reductions in power plant pollution, as one metric does, is one way of looking at progress on an aspect of the US electrical system that does severe and disproportionate damage to many communities of color and low-income communities. Health concerns are playing an important role in driving the closure of older, highly polluting fossil fuel plants and the adoption of clean energy.

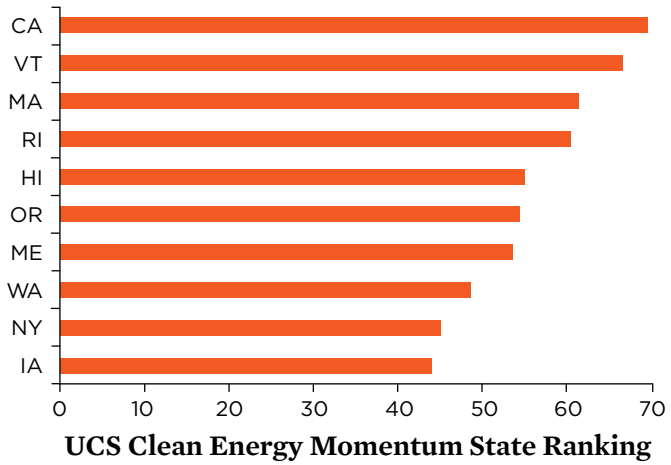
Ranking the States

As the UCS Clean Energy Momentum State Ranking shows, many states are moving forward on clean energy. The ranking shows also that leadership takes many forms—different states score high on different metrics. The strongest leadership in driving clean energy momentum depends on performing well on a range of metrics, finding many ways to move energy systems and economies toward sustainability.

Among the 50 states, clear leaders stand out (Figure 1):

- **California**, a stellar all-around performer, leads the way on clean energy momentum. The Golden State would dominate many of the metrics on an absolute basis, but it also appears in eight top-10 lists even on a per-capita or otherwise adjusted basis. It is tops in electric vehicle adoption and one of the top five on six other metrics: residential solar capacity per household, energy savings, clean energy jobs, renewable electricity standard targets, ease of corporate renewable energy procurement, and carbon reduction targets.
- **Vermont**, in second place, leads the nation in clean energy jobs per capita and for its carbon reduction target and has top-five scores in energy savings, EV adoption, and energy efficiency policy. The Green Mountain State earns 10 top-10 appearances, the most of any state.
- **Massachusetts**, in third place, garners top marks on one metric and top-10 appearances on nine metrics. It has the strongest energy efficiency resource standard and is a top-five performer in residential solar capacity per household, energy savings, clean energy jobs per capita, and carbon reduction targets.

FIGURE 1. States Leading the Way in Clean Energy



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- **Rhode Island**, number four, leads in energy savings. It is a top-five state in pollution reduction and policies around renewable electricity, energy efficiency, and carbon reduction.
- **Hawaii**, number five, is first in residential solar and scores high for EVs and its RES.

Oregon, **Maine**, **Washington**, **New York**, and **Iowa** round out the top 10 states. Each of the top 10 states, and 21 states overall, demonstrate enough clean energy momentum to appear on the leader board in at least three metrics. Even where they are not overall leaders, the top states on each metric can help all states assess where extra attention or broader efforts might pay off most.

METRICS OF TECHNICAL PROGRESS

One set of metrics focuses on technical indicators of progress and drive.

METRIC 1. RENEWABLE ENERGY GENERATION

Renewable energy technology is a growing feature on the nation's landscape, from solar photovoltaic (PV) arrays on top of urban homes and businesses to wind farms in rural America. This metric assesses each state's generation of wind, solar, bioenergy, geothermal, and hydroelectric electricity as a percentage of total in-state generation. A state's facilitation of renewable energy development within its borders can indicate a strong commitment to clean energy.

Sometimes, wind farms and solar plants get built for electricity export: the construction of facilities may respond to renewable energy policies in a neighboring state as well as to a state's own policies. However, the 50-state data collected by the US government principally cover electricity generation rather than consumption, which would include resources (renewable or other) imported from neighboring states. Thus, generation data alone serve as the basis for this metric.

South Dakota is the top performer on renewable energy as a percentage of all in-state electricity generation (Figure 3).[2] Hydropower accounts for half of the Mount Rushmore State's electricity, a proportion that has changed little for decades, but wind now represents more than a quarter of generation. South Dakota generates enough wind power to supply hundreds of thousands of homes (AWEA n.d.b). It exports much of its wind generation to neighboring states to satisfy their renewable energy policies.

Washington, Idaho, and Oregon rank high largely because of hydropower, which historically has dominated in each. Recently, wind power has come on strong, now accounting for 6 percent of in-state generation in Washington, 14 percent in Idaho, and 11 percent in Oregon. In fifth-place Maine, bioenergy accounts for 25 percent and wind, 11 percent.

Overall, each of the top 10 states generates at least a quarter of its electricity with renewables; more than 20 states use renewables for at least 10 percent of generation.

FIGURE 2. States Across the Nation Lead on Clean Energy Momentum

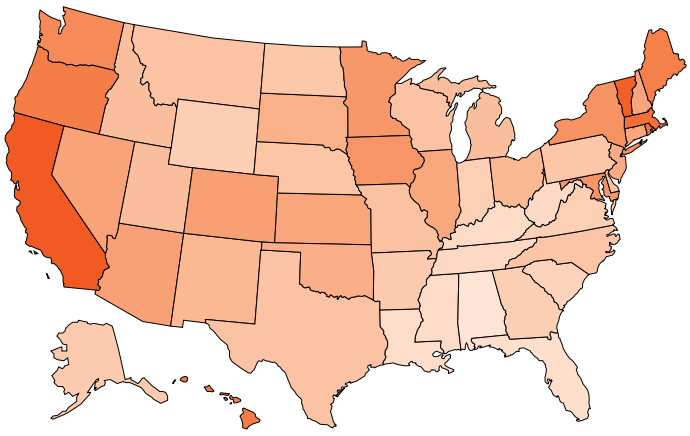

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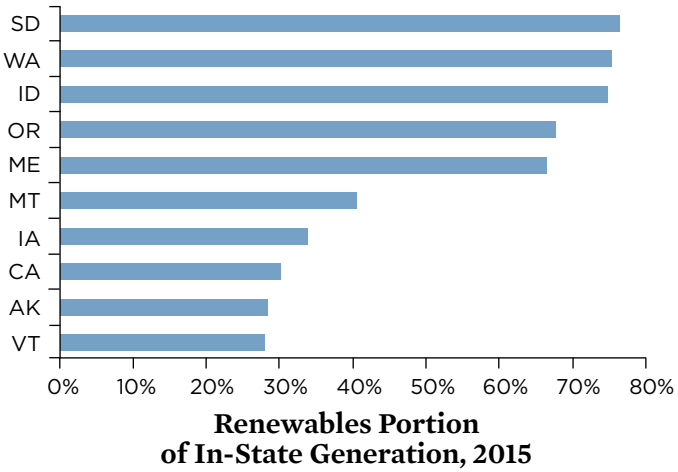
FIGURE 3. Renewable Energy Generation



South Dakota and Pacific Northwest states earn the top spots for renewable energy generation thanks to their historical use of hydropower and the recent rise of wind power.

SOURCE: EIA 2016A.

Audrey Eyring/UCS

Wind power capacity has grown tenfold in the past decade, while its generation costs continue to drop. Shifting from reliance on fossil fuels to large-scale wind power is not only economical, but also reduces emissions and public health risks.

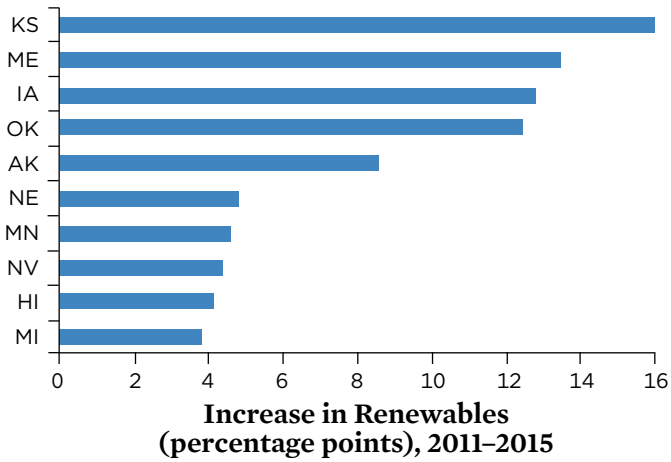
METRIC 2. RENEWABLE ENERGY GENERATION INCREASE

How quickly states increase their generation of renewable energy is a clear indicator of momentum. This metric examines how much in-state renewable energy generation increased compared to a state's total generation between 2011 and 2015.

Kansas ranks first based on its growing use of wind power (Figure 4). While the Sunflower State remains heavily connected to coal generation, it tripled its use of wind power from 2011 to 2015, both as a proportion of its generation, from 8 percent to more than 24 percent, and in absolute terms. That achievement comes in part from projects such as the Flat Ridge 2 wind farm near Wichita, which generates enough electricity to supply more than 120,000 homes (Sempra Renewables 2017). Wind power is the second largest source of electricity in the state. Moreover, Kansas has the second best technical potential for land-based wind of any state (NREL n.d.).

Maine, Iowa, and Oklahoma all increased their renewable energy by more than 10 percentage points between 2011 and 2015. Maine more than doubled its contribution from wind while halving natural gas generation. Iowa and Oklahoma each ramped up wind production while ramping down coal.

FIGURE 4. Renewable Energy Generation Increase



How quickly states increase their generation of renewable energy is a clear indicator of momentum. From 2011 to 2015, Kansas tripled its wind power, from 8 percent of overall generation to more than 24 percent. Maine, Iowa, and Oklahoma also increased their use of wind power, while ramping down reliance on coal or natural gas.

SOURCE: EIA 2016A.

Fifth-place Alaska's nine-point increase was driven largely by increases in hydro and wind paired with solid declines in natural gas and oil generation.

METRIC 3. NEW RENEWABLE ENERGY CAPACITY

Renewable energy is the leading source of new power plant capacity in the United States. Few coal plants are under construction; nuclear units under development are limited to a handful in the Southeast, only two of which are projected to be completed during the period under consideration (2016 to 2019). In recent years, only natural gas has rivaled solar and wind in added capacity. In 2016, the largest share of new capacity belonged to solar (39 percent); renewable energy as a whole accounted for more than 60 percent of new capacity (Perea et al. 2017). Solar and wind's annual contribution has averaged 54 percent over the last five years (Perea et al. 2017).

This metric assesses renewable energy development as a solid indicator of the direction a state is heading. It considers renewable energy completed in 2016 or 2017, under construction, or in advanced stages of development and targeted for completion by 2019; it does so as a function both of overall power plant construction and per capita.[3]

Renewable energy—chiefly wind farms and solar arrays—accounts for at least 95 percent of new electricity generation capacity completed or projected for 2016 to 2019 in each of 15 states, as well as at least half of new capacity in 10 additional states. Many projects represent a major investment in renewables. For example, seven wind projects larger than 100 megawatts (MW) came online in Oklahoma just in 2016; each generates enough to meet the needs of tens of thousands of typical US homes. Twelve such projects were in Texas, including the 300 MW South Plains Wind Farm in the Texas Panhandle (Box 1).

Solar is likewise progressing. New capacity in 2016 included the 250 MW Moapa Southern Paiute Solar Project in Moapa, Nevada, and the 200 MW Tranquility project in California's Central Valley. Five other states—Arizona, Colorado, Georgia, Minnesota, and Texas—also added solar projects of at least 100 MW.

Renewable energy accounts for at least 95 percent of new electricity generation capacity completed or projected for 2016 to 2019 in each of 15 states.

Wyoming and North Dakota lead the overall ranking for this metric, taking into account both the renewable energy percentage of new development and the per-capita data (Figure 5). Wyoming also leads the nation on a component of the metric, per-capita renewable energy development, based on almost 1,000 MW being built. Both Wyoming and North Dakota have small populations and strong wind resources, with considerable wind development underway (NREL n.d.). Nevada is third overall based on its strong solar development.

A state's development of renewable energy is noteworthy even if it results mostly from a neighbor's policies. Wyoming's total includes the first phase of the Chokecherry and Sierra Madre Wind Energy Project, where some 3,000 MW of wind turbines will make it North America's largest wind farm; that energy will be transmitted to Las Vegas and then likely on to neighboring California (Wilderness Society n.d.).

BOX 1.

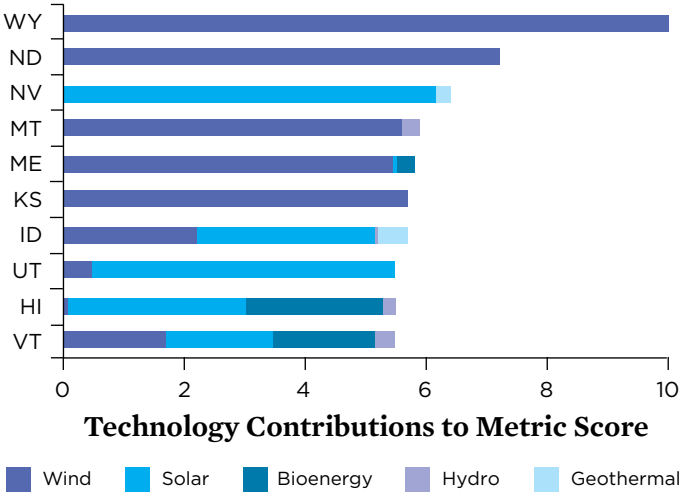
What About Texas?

Texas has arguably done more than any other state to advance a key component of the clean energy transformation: wind power. Texas is the clear leader for total installed wind power capacity—more than 20,000 MW, enough to satisfy the electricity needs of 7 million US households and almost three times as much as Iowa, the number-two state (AWEA n.d.a). It also has by far the most wind-sector jobs—more than three times as many as number-two state Oklahoma (Hensley 2017). Moreover, a business-friendly approach enables abundant wind development and makes it easy for businesses to acquire renewables (Metric 10, p. 17).

The state's successes derive in part from early renewable energy policies and a commitment to building the transmission lines necessary to bring energy from windy parts of west Texas to the major cities in the state's east. Why then does Texas not show up as a leader in clean energy momentum?

One reason is that the state's large population dilutes results in per-capita assessments. Texas also has a heavy appetite for electricity: even its nation-leading wind total does not put it in the top 10 for renewable electricity generation percentage (Metric 1, p. 8). And while Texas set an aggressive 2025 target for renewable energy early on, it met that target in 2010 and has not strengthened it since (Metric 9, p. 17).

FIGURE 5. New Renewable Energy Capacity



For new renewable energy capacity being built in each state, Wyoming handily takes the top spot, based on both the renewable energy portion of new power plant capacity, 2016 to 2019 (100 percent, in the case of Wyoming) and new renewable energy capacity per capita. The top states for this metric are using a variety of technologies. Abundant wind resources power new plants for Wyoming, second-place North Dakota, and other top states. Third-place Nevada and others are drawing chiefly on solar, while bioenergy, geothermal, and hydro systems also come into play.

SOURCE: SNL 2017.

METRIC 4. RESIDENTIAL SOLAR ELECTRIC

This metric measures how much residential photovoltaic capacity a state has per household. The recent progress in solar is one of the more visible signs of clean energy momentum, with solar panels in fields and on rooftops. Residential PV is an important part of solar's success: home systems accounted for 17 percent of solar installations in 2016, with residential installations up 19 percent compared with 2015's (Perea et al. 2017).

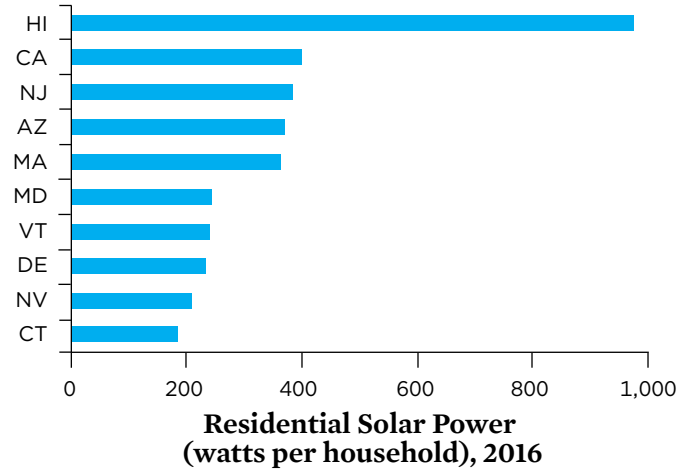
State policies play a pivotal role in solar's momentum. While federal policy, notably an investment tax credit of 30 percent of a system's cost, has helped bring solar within reach of many potential customers, many states have added tax incentives or rebates to make solar even more attractive. Forty-one states allow homeowners to deduct their own solar generation from their electricity bill (DSIRE 2016). Moreover, specific requirements in some renewable electricity standards obligate utilities to facilitate not just renewables in general but solar specifically. And most states allow involvement by non-utility third parties: their lease or financing offers may require little or no money up front, making it considerably easier for homeowners to get solar. Third-party offerings have accounted for more than 70 percent of home installations in some states in recent years (Perea et al. 2017).

Derrick Z. Jackson

The arrival of affordable rooftop solar represents a major shift in the connections between households and their electricity supplies. Residential solar installations during 2016 were 19 percent higher than during 2015, buoyed by continued price drops.

Hawaii leads the pack on residential solar per household: 960 watts, equivalent to three to four large PV panels (Figure 6). One in seven Aloha State homes has solar, prompted by abundant sunshine and the nation's highest electricity rates (Perea et al. 2017, EIA 2016c, Census Bureau n.d.). California

FIGURE 6. Residential Solar Electric



Hawaii handily leads in residential solar per capita, pushed by high electricity prices and pulled by abundant sunshine. One out of every seven Hawaiian households has solar panels. California produces the most megawatts from residential solar and ranks second in terms of watts per household.

SOURCE: EIA 2017.

dominates in terms of overall megawatts, generating more than four times any other state's total, and it takes second in residential solar per household.

Other leading states show that abundant sunshine is not a prerequisite for success. New Jersey is third; Massachusetts, fifth; and Vermont, seventh.

METRIC 5. ENERGY SAVINGS

Energy efficiency is key to clean energy progress, given its ability to provide solid returns on investments for electricity consumers while reducing pollution and enhancing energy security. This metric draws on a 50-state assessment of electricity program savings conducted by the American Council for an Energy-Efficient Economy (ACEEE) (Berg et al. 2016). The ACEEE assessment covers savings from utility programs and interventions ranging from easy and cost-effective efforts—installing more efficient lighting or upgrading appliances—to more comprehensive approaches—for example, those that focus on whole buildings.

Rhode Island takes top honors, with energy savings in 2015 equaling 2.9 percent of the state's electricity sales, more than 220,000 megawatt-hours (MWh)—what an average Ocean State household would use over 31,000 years (EIA 2016c) (Figure 7).

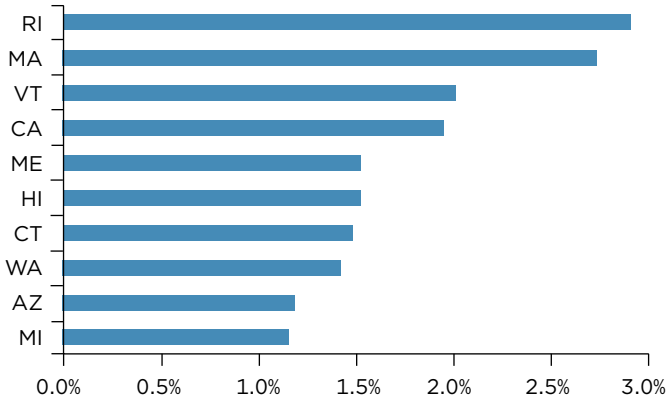
Massachusetts, which has topped ACEEE's overall energy efficiency scorecard for six years, takes second place on this metric, with 1.5 million MWh of savings, equal to 2.7 percent of electricity sales in the state. Vermont and California each save around 2.0 percent.

METRIC 6. ELECTRIC VEHICLE ADOPTION

Sales of electric vehicles as a percentage of new car sales is a measure of progress in harnessing the public health and environmental benefits of electrifying transportation. Vehicle electrification, one of the fastest growing areas in clean energy, is increasingly visible on America's roads. US drivers now enjoy close to 600,000 EVs (Inside EVs n.d.). For most US drivers, EVs offer strong environmental benefits that will increase as the country's electricity mix gets cleaner (Nealer, Reichmuth, and Anair 2015).

California is laps ahead of the other states on this metric (Figure 8). EVs account for more than one out of every 30 new cars in the state, and its 2016 sales, 73,000 vehicles, represented half the nation's total for that year. California's zero emission vehicle regulation, incentive programs, and infrastructure investments are major factors driving sales. Number two Oregon and number three Washington have EV sales accounting for 1.9 and 1.8 percent, respectively (IHS Markit 2017). In addition to California and Oregon, three other top states (Connecticut, Massachusetts, and Vermont) have zero emission vehicle requirements.

FIGURE 7. Energy Savings

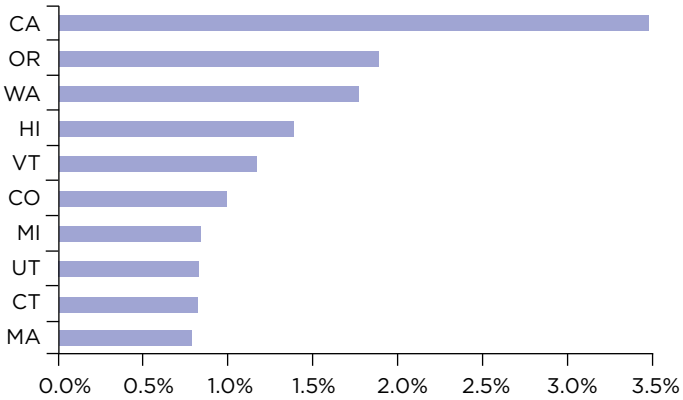


Utility Program Savings as Portion of Retail Electricity Sales, 2015

Energy efficiency saves consumers money and reduces pollution. One approach to efficiency, the programs of utilities, can include easy interventions to install efficient lighting or upgrade appliances, or more comprehensive approaches focusing on whole buildings. Rhode Island leads in saving electricity, followed by Massachusetts.

SOURCE: BERG ET AL. 2016.

FIGURE 8. Electric Vehicle Adoption



EVs as Portion of New Car Sales, 2016

California is miles ahead when it comes to sales of new electric vehicles, thanks to the state's zero emission vehicle regulation, incentive programs, and infrastructure investments. In 2016, EVs accounted for more than one out of every 30 new vehicles sold in California, and the state accounts for half of all new EVs sold in the United States.

SOURCE: IHS MARKIT 2017.

iStock.com/neonmaciej

Transportation electrification is a major frontier for cutting carbon pollution, with a broad array of options for producing electricity cleanly and a dearth of options for clean gasoline. For most US drivers, EVs offer strong environmental benefits that will increase as the country's electricity mix gets cleaner.

KEY METRICS OF CLEAN ENERGY SUCCESS

Clean energy momentum is about more than technology. The second set of metrics focuses on important outcomes of state progress: jobs in clean energy and reductions in power plant pollution.

METRIC 7. CLEAN ENERGY JOBS

Clean energy jobs encompass a range of activities. For example, renewable energy involves manufacturing, project development, construction, transportation, operations and maintenance, and related financial services. On diverse project sites, technicians and electricians install and connect wind turbines and solar panels. Energy efficiency experts retrofit buildings to make them more cost effective and more comfortable.

Clean energy employers range from small firms that offer efficiency services to manufacturing behemoths like General Electric and Siemens. Some companies are based in the United States, while foreign firms also provide significant US employment. Vestas, the world's largest wind turbine manufacturer, employs 3,500 people at four Colorado factories (Miller 2017).

Nine states have at least 10 people per thousand residents employed in efficiency, solar, or wind.

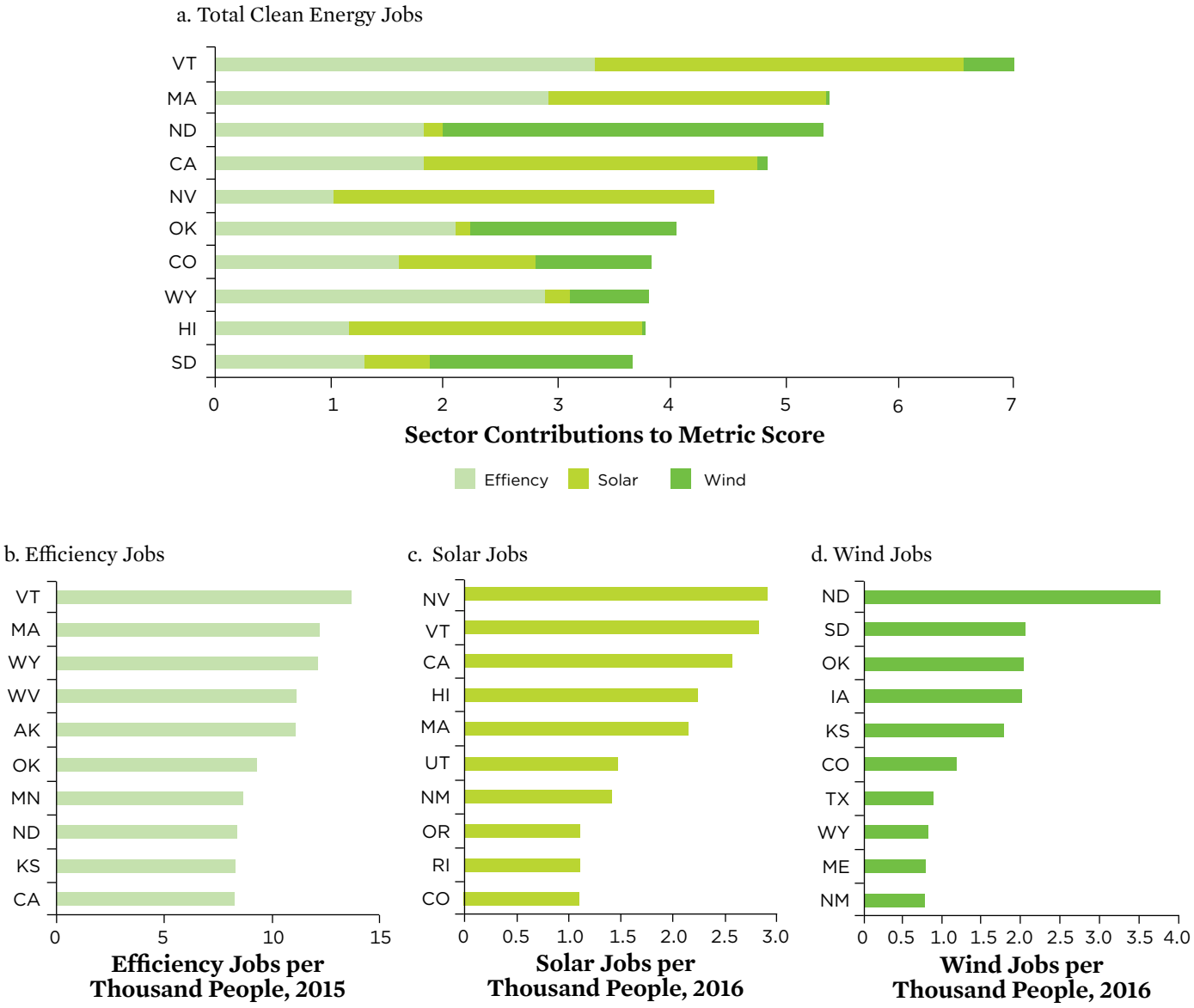
Metric 7 measures jobs per capita in three clean energy sectors, drawing on recent assessments of energy efficiency (conducted by E2 and E4TheFuture), wind (by the American Wind Energy Association), and solar (by the Solar Foundation). Each of these sectors represents a major presence in the economy or major growth.

Vermont is the overall leader in clean energy jobs per capita (Figure 9, p. 14). The state scores well on energy efficiency and solar jobs, with a total of more than 10,000 people employed in those two sectors. Massachusetts scores second,

with almost 100,000 clean energy jobs, chiefly in efficiency and solar. North Dakota takes third overall based on a sector-leading performance in wind jobs per capita, followed by California (efficiency and solar) and Nevada (number one in solar). Nine states have at least 10 people per thousand residents employed in efficiency, solar, or wind.

In terms of the specific sectors, energy efficiency is the biggest job producer in clean energy: 1.9 million jobs nationwide in 165,000 companies account for three-quarters of clean energy jobs (E2 and E4TheFuture 2016). The best performer is Vermont: 13.7 jobs in energy efficiency per thousand residents (Figure 9b).

FIGURE 9. Clean Energy Jobs



Clean energy means jobs—from manufacturing workers and project developers to construction workers, electricians, and efficiency experts. Vermont is the overall leader per capita: more than 10,000 people work in its efficiency, solar, and other clean energy sectors. Vermont also takes the top spot for jobs in the efficiency sector, based on strong state policies aimed at saving energy. Nevada leads in solar jobs, taking advantage of its abundant sunshine. North Dakota, harnessing strong winds, comes out on top for the large workforce relative to its population.

SOURCES: UCS ANALYSIS; E2 AND E4THEFUTURE 2016; SOLAR FOUNDATION 2017; HENSLEY 2017.

The 2016 National Solar Jobs Census counted 260,000 solar workers, up 25 percent from the year before (Solar Foundation 2017). Nevada leads the nation, with 2.9 jobs in solar per thousand residents (Figure 9c).

In 2016, more than 100,000 people built wind farms, made wind turbines and parts in more than 500 factories in all 50 states, or worked elsewhere in the wind industry, a 30 percent increase over the previous year (DOE 2017, Alvarez 2017). North Dakota leads in wind jobs, with almost 3.8 jobs in the sector per thousand residents (Figure 9d).

The 2016 National Solar Jobs Census counted 260,000 solar workers, up 25 percent from 2015.

METRIC 8. POWER PLANT POLLUTION REDUCTION

Power plant contributions to air pollution and climate change substantially affect health. The electric sector is the largest source of sulfur dioxide emissions, which, along with contributing to haze and acid rain, can cause breathing problems, particularly among the young, the elderly, and those with asthma (EPA 2016a). Similarly, nitrogen oxides, for which power plants are the second largest source, can contribute to asthma attacks (EPA 2016b). Climate change affects human health as a result of higher temperatures, decreased air quality, increased flooding, and increased exposure to vector-borne diseases, among other ways (Crimmins et al. 2016).

States can cut harmful power plant emissions by retiring fossil fuel plants, particularly coal plants, whether the decision is driven by state policy, federal requirements, the advanced age of the plants, or the eroding economics of coal as a power source. Pollution control equipment on power plant smokestacks can also lessen harmful emissions. Reducing use of fossil fuel plants, particularly coal, can also cut carbon dioxide pollution. Even long-time leaders in cutting power plant pollution can find ways to cut emissions further.

This metric looks at power plant emissions of SO_2, NO_x, and CO_2, assessing both recent changes in emissions and remaining emissions per capita for each pollutant. It reflects state progress in building renewables and in shifting away from less efficient fossil-fueled power plants, long the mainstay of the nation's electricity grid. While some states have moved toward overreliance on nonrenewable natural gas, others have cut pollution and improved public health using clean energy.

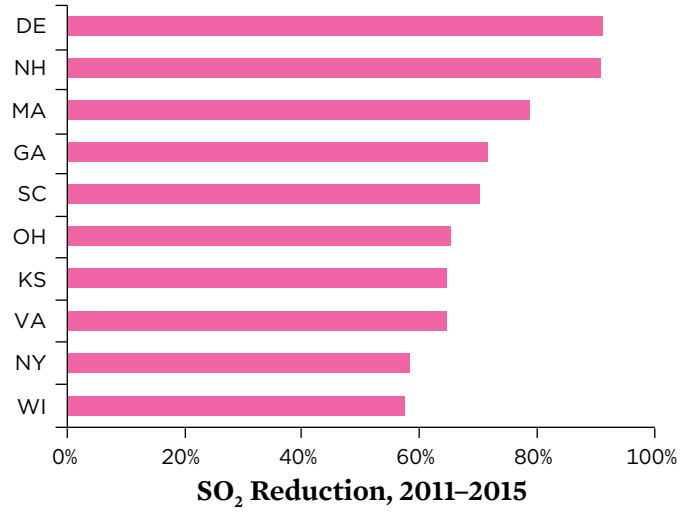
Overall, the top performing states are New Hampshire and South Dakota, based on the combination of reductions in power plant pollution and remaining pollution per capita.

Farmepool

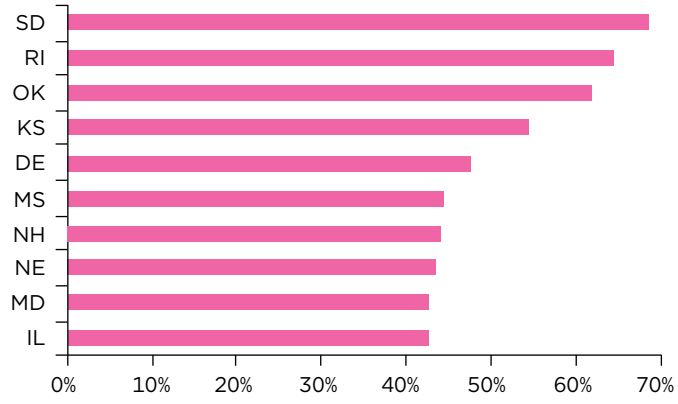
Coal-fired power plants directly affect the health of those living nearby in addition to contributing to climate change. Residents living near coal plants are more likely to be lower income and people of color, and these communities face disproportionally high incidences of asthma and other respiratory diseases. Health concerns are playing an important role in driving the closure of older, highly polluting fossil fuel plants and the adoption of clean energy.

FIGURE 10. Power Plant Pollution Reduction

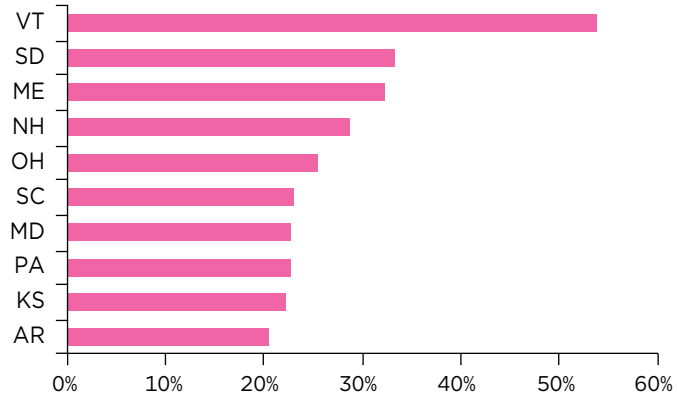
a. Reductions in Power Plant Pollution



SO_2 Reduction, 2011–2015

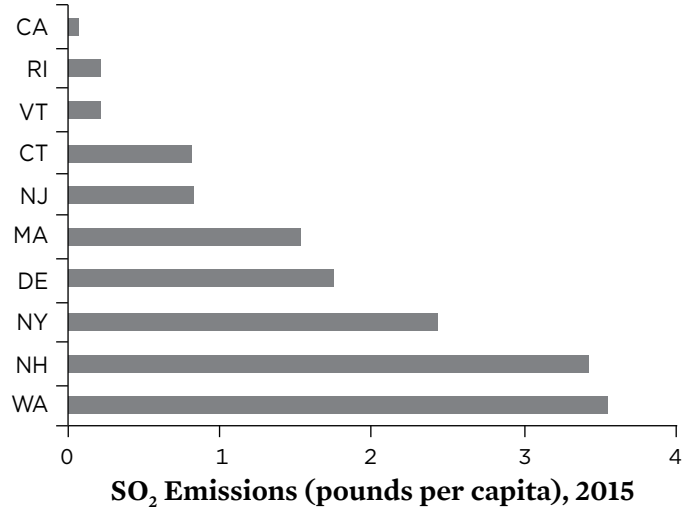


NO_x Reduction, 2011–2015

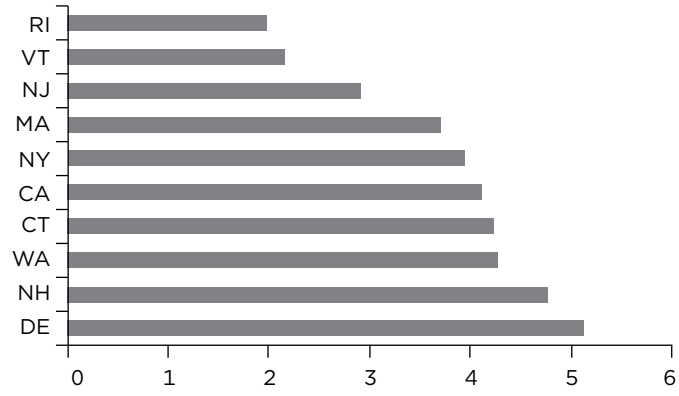


CO_2 Reduction, 2011–2015

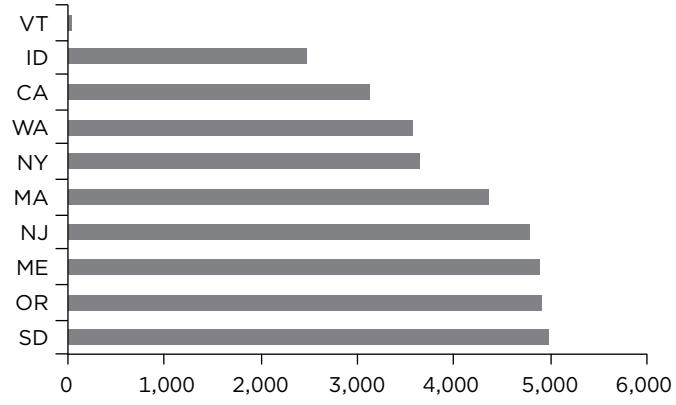
b. Overall Power Plant Pollution



SO_2 Emissions (pounds per capita), 2015



NO_x Emissions (pounds per capita), 2015



CO_2 Emissions (pounds per capita), 2015

Emissions from fossil-fueled power plants harm public health and contribute to climate change. To reduce emissions, states must not only invest in new clean energy projects, but also retire plants that rely on coal and other fossil fuels. New Hampshire and South Dakota are the top states overall, based on both reductions in power plant pollution and least pollution remaining per capita. For those and other leading states, reduced generation from coal plants was a large factor in reducing pollution.

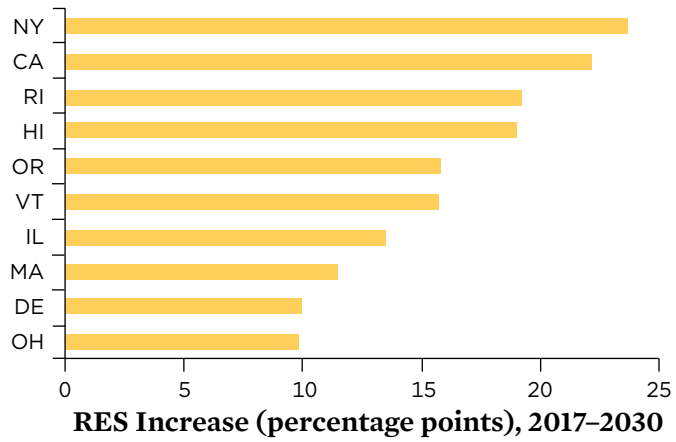
SOURCE: EIA 2016A.

The Granite State cut emissions of the pollutants from its power plants through pollution controls and a decrease in fossil fuel generation, including a 60 percent drop in coal power. For South Dakota, a 40 percent decrease in coal generation was key. Kansas, Delaware, and South Carolina ranked high as well.

On percentage reductions between 2011 and 2015, different states lead for different pollutants (Figure 10a). For SO_2, Delaware and New Hampshire perform best, with reductions of more than 90 percent, Delaware's drop corresponding with a steep drop in coal generation. For NO_x, South Dakota leads, having cut that pollutant by 68 percent, although in part by replacing one fossil fuel, coal, with another, natural gas. On CO_2, Vermont leads the nation with a 54 percent cut, driven by reduced generation with natural gas and oil.

On a per-capita basis, some states had power plant emissions orders of magnitude lower than others (Figure 10b). Among the best states for each, California has the lowest SO_2 emissions per capita, with its use not just of natural gas and nuclear but also solar, hydro, and wind. Rhode Island, with no coal generation, leads on NO_x. Vermont scores best on CO_2, based on its strong use of renewable energy.

FIGURE 11. Renewable Electricity Standard Increase



Under renewable electricity standards, states establish renewable energy targets and leave technology choices largely to the market. The RES is a powerful tool for driving clean energy development. New York and California have the highest targets for increasing the portion of electricity coming from renewable energy by 2030. Each has committed to sourcing half of their electricity from renewable energy by that date.

SOURCE: UCS ANALYSIS, BASED ON COLE ET AL. 2016.

POLICY METRICS

The third set of metrics examines public policies proven to drive clean energy momentum in renewable energy, energy efficiency, and overall carbon reduction. In addition, some clean energy developments not registered in the metrics are worth noting, particularly state investments in bringing new technologies to bear (Box 2, p. 18).

METRIC 9. RENEWABLE ELECTRICITY STANDARD INCREASE

This metric looks to the future, assessing the strength of renewable electricity standards. Iowa implemented the first RES in 1983; 29 states now have standards in place.[4] The RES takes a market-based approach to driving the development of renewables: the policy establishes renewable energy targets and then leaves the choice of technologies largely to the market. This attracts those on both sides of the political divide (Deyette 2011). While, until recently, progress on renewable electricity standards had stalled in the face of shifting politics and polarization, a wave of state laws in the last two years has breathed new life into this approach. Several states recently expanded their RES targets to at least 50 percent renewables.

New York and California lead in RES policy increases (Figure 11). Each has committed to getting half of its electricity from renewable energy between now and 2030. Rhode Island's 2016 increase in its future RES, to more than 30 percent by 2030, and Hawaii's commitment to 40 percent by 2030 (toward 100 percent by 2045) earn them the number three and four spots; Oregon edges out Vermont for fifth. Vermont is the most recent state to adopt an RES; its voluntary standard gave way in 2015 to a mandatory one calling for 75 percent renewables by 2032, up from the current requirement of over 50 percent.

New York and California have committed to getting half of their electricity from renewable energy between now and 2030.

METRIC 10. CORPORATE RENEWABLE ENERGY PROCUREMENT

Businesses play a large role in driving renewable energy, motivated not just by the potential to save energy and money directly but also by the ability to demonstrate leadership in a key sector undergoing transformation. Swedish furniture giant IKEA has solar on 90 percent of its US stores (SEIA n.d.). Companies like Facebook, Google, and Microsoft are investing in wind farms and committing to powering much of their operations with renewable energy (Hardy 2016).

BOX 2.

A New Generation of Technologies

Along with progress on current measures of clean energy momentum, states are driving a new generation of technologies and approaches. Some examples:

Offshore wind. Offshore wind is a powerful resource just off the US coast, close to many major cities. In 2016, Rhode Island staked its claim to leadership by inaugurating the Western Hemisphere's first offshore wind farm, a five-turbine, 30 megawatt installation off Block Island (Deepwater Wind 2017). New York is following suit with a 90 megawatt facility east of Montauk, Long Island, approved in 2017 and scheduled for installation by 2022 (NYSERDA 2017). State policy underlies this progress, with a supportive Rhode Island legislature behind the Block Island project, a 2016 law in Massachusetts requiring utilities to contract for up to 1,600 MW—more than 10 percent of the state's need—by 2030, and a 2017 call by New York Governor Andrew Cuomo for 2,400 MW of offshore wind, also by 2030 (Elmer 2016, Massachusetts 2016, NYSERDA 2017). The Great Lakes may also be getting in on the action, with a six-turbine project near Cleveland (Funk 2017).

Energy storage. Energy storage plays an important role in the balancing act between electricity supply and demand; that role will increase as the electricity mix incorporates ever-greater amounts of variable resources like wind and solar. Pumped hydro facilities account for almost all current storage capacity in the United States, but leading states are moving to develop new options. Under 2013 legislation, California is pushing its major utilities to secure at least 1,300 MW of energy storage capacity by 2020, equivalent to the average power demand of 1.7 million California households (EIA 2016c, St. John 2013). Oregon implemented an energy storage mandate in 2015, and 2016 legislation in Massachusetts is shaping the requirement there (Spector 2017, Trabish 2015).

Demand flexibility. How customers use the electricity grid can have a big impact on how clean and cost-effective the grid is to run. In particular, electricity demand can be dynamic instead of fixed, and utilities can encourage customers to use electricity when clean energy resources are ready and available, instead of requiring additional fossil-fuel power plants to meet potential peak periods of use. Many states have been rolling out "smart meters" that can provide near real-time information on electricity use. States and utilities are coupling these new meters with electricity rates that move up and down to encourage or discourage electricity use during specific periods, and they are just beginning to explore ways to bundle the many small actions of lots of individuals for participation in large energy markets (McNamara 2017). California, a leader in deploying smart meters, has installed more than 11 million smart meters for residential customers, covering 83 percent of homes (EIA 2016d). In New York, millions of smart meters have been proposed as part of the Reforming the Energy Vision project, a broad reworking of the state's electricity system (Tweed 2015).

Metric 10 is based on Clean Edge's assessment of which states do the most to help companies acquire renewable energy (Rector et al. 2017). The research and advisory firm looked at such issues as utility markets and options for buying power from competitive electricity suppliers, the ability of companies to enter into agreements for renewable energy from non-utility parties, and the ease of siting renewable energy at business consumers' facilities.

Iowa takes the top spot, based on the ease with which in-state companies can buy clean energy through their utility or acquire it from third parties, followed by Illinois, New Jersey, California, and Texas (Figure 12).

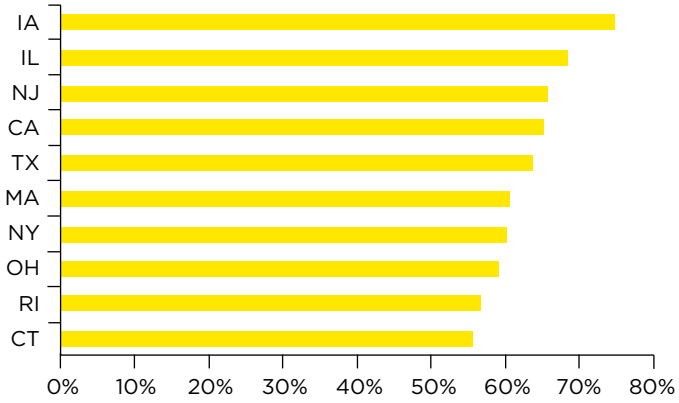
METRIC 11. ENERGY EFFICIENCY RESOURCE STANDARD

Metric 11 derives from the American Council for an Energy-Efficient Economy's assessment of the strength of state energy efficiency resource standards, in place in more than half the states (Berg et al. 2016). States with EERSs tend to invest

Kuchina/Shutterstock

Energy efficiency is a powerful clean energy resource, and has played a key role in building momentum across states. Energy efficiency resource standards drive efficiency for homes and businesses.

FIGURE 12. Corporate Renewable Energy Procurement

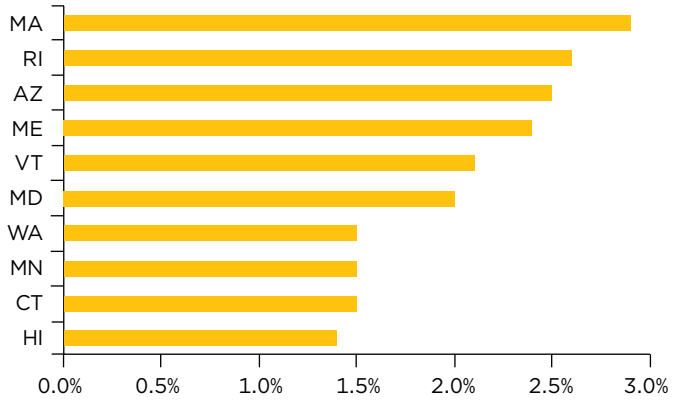


Clean Edge Score for Corporate Renewable Energy Procurement, 2016

Businesses are important drivers of clean energy as they seek to save energy, stabilize costs, and demonstrate leadership. States can encourage businesses to purchase and use renewable energy in various ways. Iowa leads on this metric, based on the ease with which in-state companies can buy clean energy from utilities or third parties.

SOURCE: RECTOR ET AL. 2017.

FIGURE 13. Energy Efficiency Resource Standard



Approximate Annual Electric Savings Target, 2014–2020

Under energy efficiency resource standards, utilities meet energy savings targets by offering energy efficiency programs to their customers. An EERS is another powerful state tool for clean energy progress. Massachusetts has the strongest EERS, requiring annual electricity savings of almost 3 percent.

SOURCE: BERG ET AL. 2016.

much more in energy efficiency—and save much more energy—than non-EERS states (Berg et al. 2016). Strong standards, says ACEEE, include multiyear, mandatory targets for savings and enough funding for implementation (Berg et al. 2016).

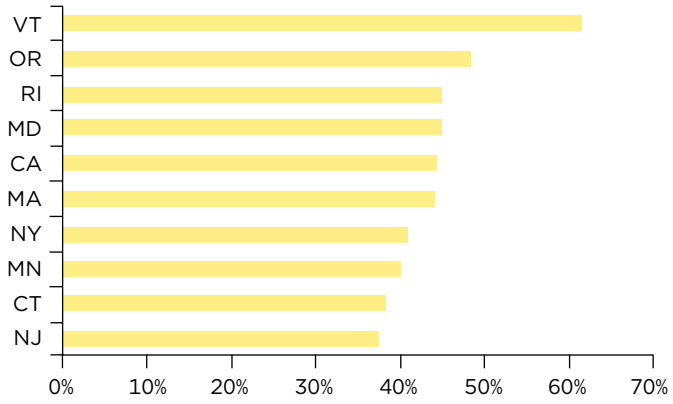
ACEEE assessed the approximate annual savings required under each EERS from 2014 to 2020. Energy efficiency leader Massachusetts is first, requiring 2.9 percent savings per year (Figure 13). Rhode Island, Arizona, Maine, and Vermont follow, and nine states require annual energy savings of at least 1.5 percent.

METRIC 12. GLOBAL WARMING EMISSIONS REDUCTION TARGET

Economy-wide targets can lead to decisions that favor strong action in the electric sector—renewables, efficiency, and electrification—as the best path for quickly reducing carbon dioxide and other heat-trapping emissions. Metric 12 gauges the strength of a state's target for reducing global warming emissions for 2030 versus its 2005 emissions.[5]

Vermont is first, with a commitment, established by 2005 legislation, to cut global-warming pollution to better than 60 percent below 2005 levels by 2030 (Vermont 2005) (Figure 14). The carbon reduction commitments in Oregon's 2007 statute equate to a reduction of almost 50 percent by 2030 (Oregon 2007). Laws in Maryland and Rhode Island mandate reductions of 45 percent below 2005 levels by 2030 (Maryland 2016, Rhode Island 2014).

FIGURE 14. Global Warming Emissions Reduction Target



2030 Carbon Reduction Goals vs. 2005

Public policies requiring statewide reductions in emissions of carbon dioxide and other heat-trapping gases can drive progress in the electricity sector because of the opportunities that efficiency, renewables, and electrification present. Vermont takes first place based on its goal of reducing emissions in 2030 by more than 60 percent from 2005 levels.

SOURCE: UCS ANALYSIS, BASED ON C2ES 2016.

Conclusions

Taken together, the metrics in the UCS Clean Energy Momentum State Ranking paint a picture of state successes and a 50-state race for clean energy leadership—and they also point to several important conclusions.

The transition to clean energy is real, and happening. In leading states, clean energy is proceeding at an unprecedented pace. State choices translate into rapid growth in the role of renewable energy sources in the electric generation mix and energy efficiency as a key source of energy "supply," the one with the cleanest and often the cheapest profile.

Clean energy momentum takes many forms. While wind turbines and solar panels are more visible than efficient motors and appliances, energy efficiency and vehicle electrification are crucial areas for progress. Energy efficiency, tried and true, bears ever more fruit as new technologies, new policies, and rising market awareness come together for ongoing reductions in electricity use. EVs, still new to the market, already produce significant results.

Any state can lead. Clean energy leadership, like clean energy itself, can take many forms. Even states with fewer renewable energy resources can drive clean energy momentum. While strong wind resources help improve the standing of many states, the clean energy leaders are not necessarily endowed with those resources. States take advantage of what they have available to accelerate the transition to clean energy.

Job creation is a powerful reason for enthusiasm about clean energy. While coal mining jobs have fallen by two-fifths over the last eight years, clean energy has proven itself to be a strong job creator (DOE 2017). Many of the installation and service jobs for wind and solar are in rural areas, where they serve as vital additions to farming, ranching, and other sectors.

Policies matter. States cannot leave clean energy progress solely to markets. Few states made the top 10 without strong energy efficiency standards, strong economy-wide climate targets, or both. Seven of the top 10 states in the overall analysis score in the top 10 in terms of the strength of their RES policy.

Corporations matter, too. Businesses can make major contributions to clean energy progress—if states let them. All but one of the top 10 states overall were in the top half of states in Clean Edge's assessment of ease of renewable energy procurement by businesses.

Multiple fronts are better. The range of technologies and policy opportunities offers a range of ways states can gain clean energy momentum. Every top 10 state overall had top 10 appearances on at least three metrics.

Good data are critical. Analyses such as this one depend on the availability of comprehensive data on all 50 states, particularly from the US Department of Energy's Energy Information Administration and the US Environmental Protection Agency.

Recommendations

Top states find a range of ways to build clean energy momentum, and their efforts are creating jobs, cutting pollution, and improving public health. In some cases, progress in one state may result in part from leadership in another, as wind farms and solar arrays—or manufacturing jobs—spring into being to satisfy renewable energy demand elsewhere. Yet our broad assessment shows clearly which states are rising most directly to the challenge of transforming the nation's electricity sector and embracing all that clean energy has to offer.

With uncertainty surrounding national energy policy, state leadership is more important than ever. This analysis points to recommendations for states as they build on clean energy momentum and continue strong progress toward a new energy future.

Adopt policies supporting multiple dimensions of progress. Renewable electricity standards have proven their ability to foster considerable development of renewable energy at reasonable costs (Mai et al. 2016). Yet clean energy is about more than renewables, and efficiency is often by far the lowest-cost option for addressing energy needs. Thus, states should also drive efficiency as much as possible, including through EERSs. In addition, the electrification of transportation is a frontier for clean energy development, and policies accelerating that transition can serve states well. And economy-wide targets for reducing global warming pollution can create a broad framework for clean energy progress.

Facilitate business involvement. States policies should make it easier for businesses to adopt renewable energy, enabling them to be powerful forces for accelerating clean energy progress. Public policy can broaden the array of options for businesses to acquire renewables through their utilities or from third parties and remove barriers to siting renewables directly on businesses' facilities.

Improve energy equity. State policies should directly address imbalances in the electricity sector for low-income communities and communities of color. For example:

- The Federal Weatherization Assistance Program provides funding to every state to help low-income households seal their homes better for saving money and improving comfort; utilities in many states can improve their

low-income programs by broadening and coordinating such offerings (DOE n.d.a; Cluett, Amann, and Ou 2016).

- Programs and organizations in various states are working to make solar more broadly accessible. These include California's single family and multifamily affordable solar home programs, for example, which offer solar incentives to low-income households and affordable housing projects, and Massachusetts's subsidized solar loans (GRID Alternatives, Vote Solar, and Center for Social Inclusion 2017).
- California offers increased incentives to help low- and moderate-income households acquire EVs, and multiple pilot projects target increasing access to EVs in disadvantaged communities (California EPA 2015).

States should design such programs to maximize health benefits for minority and low-income communities, which are most affected by power plant pollution.

Advocate for federal action. While leading by example, states should insist that the federal government be a full partner in building clean energy momentum:

- Progressively stronger federal minimum energy efficiency standards for appliances and other equipment have helped drive innovation in manufacturing, with broad and long-term benefits for consumers.
- Congress's multiyear extension of tax credits for solar and wind in late 2015 provided customers, project developers, manufacturers, and their financial backers with more certainty for continued renewable energy investment. Extending the tax credits (set to expire soon) and broadening the list of clean energy technologies that can qualify for them (such as energy storage) will help reduce emissions and get more clean energy deployed.
- Maintaining or increasing federal funding for clean energy research, development, and demonstration will continue the introduction of innovative technologies and the movement to lower costs, as through the Department of Energy's loan guarantee programs and the ARPA-E (Advanced Research Projects Agency-Energy) program that funds "game-changing energy technologies" in early stages (DOE n.d.b, DOE n.d.c).
- A national renewable electricity standard would drive clean energy nationwide just as state standards have achieved at a regional level.
- Federal leadership in the form of a price on carbon emissions, an idea with strong bipartisan support, would provide significant impetus for continued clean energy progress by making fossil fuel options bear the cost of their pollution.

John Rogers *is a senior analyst in the UCS Climate and Energy Program.* ***Paula Garcia*** *is an analyst in the program.*

ACKNOWLEDGMENTS

This report was made possible in part through the generous support of the Energy Foundation and the Frankel Family Foundation, and UCS members.

For their insightful comments and expert review of the report, we thank Ariel Drehobl and Weston Berg (American Council for an Energy-Efficient Economy) and Jenny Heeter (National Renewable Energy Laboratory). We also thank UCS staff members who provided valuable input on the analysis and the report, including Angela Anderson, Chris Bliss, Steve Clemmer, Robert Cowin, Jeff Deyette, Mike Jacobs, Nicholas Mailloux, Julie McNamara, Melanie Moore, Peter O'Connor, Dave Reichmuth, Megan Rising, Liz Schmitt, Ashley Siefert, Ortal Ullman, Ashanti Washington, and Laura Wisland. Finally, we are indebted to our editor Marc S. Miller for making the report more readable, Bryan Wadsworth and Cynthia DeRocco for overseeing the production process, and David Gerratt for designing the report.

The opinions expressed herein do not necessarily reflect those of the organizations that funded the work or the individuals who reviewed it. The Union of Concerned Scientists bears sole responsibility for the report's content.

ENDNOTES

1 *More details about the analysis and results are available in the appendices available at www.ucsusa.org/EnergyProgress.*
2 *Vermont has the highest portion of in-state generation from renewable energy, at around 99 percent, but its standing, in both this metric and the following, owes much to the retirement of the state's sole nuclear plant at the end of 2014. With that retirement, the state now imports more than 60 percent of its electricity (EIA n.d.). Rather than skew the assessment based on this outlier, our analysis uses 2014 data for Vermont in place of 2015 in Metrics 1 and 2.*
3 *A later date than 2019 would favor technologies with long lead times—nuclear power and coal plants, for example. Those technologies would already be visible in 2017 data at the expense of faster-to-build technologies such as solar and wind.*
4 *This assessment credits only mandatory requirements. Another eight states have voluntary standards (DSIRE 2017).*
5 *This metric considers only requirements enacted by legislatures (statutory requirements), except for New York, where executive orders set the requirement. In several other states, recent inaction indicates little intent to be guided by executive orders issued during prior administrations.*

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Our results show clean energy momentum takes many forms and that this variety enables any state to lead, regardless of their renewable energy resources. We also found that strong state policies bolster efforts to make clean energy happen, create clean energy jobs, and improve public health. States should continue to build and maintain momentum by adopting policies supporting multiple dimensions of progress, improving energy equity, and facilitating business involvement.

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NATIONAL HEADQUARTERS
Two Brattle Square
Cambridge, MA 02138-3780
Phone: (617) 547-5552
Fax: (617) 864-9405

WASHINGTON, DC, OFFICE
1825 K St. NW, Suite 800
Washington, DC 20006-1232
Phone: (202) 223-6133
Fax: (202) 223-6162

WEST COAST OFFICE
500 12th St., Suite 340
Oakland, CA 94607-4087
Phone: (510) 843-1872
Fax: (510) 843-3785

MIDWEST OFFICE
One N. LaSalle St., Suite 1904
Chicago, IL 60602-4064
Phone: (312) 578-1750
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