Plugging In Renewable Energy

GRADING THE STATES

REPORT CARD
How Your State Ranks

Policies to Increase Renewable Energy:	tied for last (no commitments)
Use of Renewable Energy Today:	#27 (1%)
Renewable Energy Potential:	#6 (over 50 times today's needs)
Overall Grade:	D

Comment: Even though renewable resources could supply more than 50 times the energy your state needs today, your state has done little so far to develop them and has no policies in place that commit to making that happen.

Union of Concerned Scientists
Citizens and Scientists for Environmental Solutions

Plugging In Renewable Energy

GRADING THE STATES

by

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May 2003

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The Union of Concerned Scientists is a nonprofit partnership of scientists and citizens combining rigorous scientific analysis, innovative policy development, and effective citizen advocacy to achieve practical environmental solutions.

The UCS Clean Energy Program examines the benefits and costs of the country's energy use and promotes energy solutions that are sustainable both environmentally and economically.

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Contents

Figures & Tables

Figures

Tables

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Executive Summary

America's electricity system is dominated by fossil fuels. The result is a system that lacks diversity and security, threatens the health of our citizens, jeopardizes the stability of Earth's climate, and robs future generations of clean air, clean water, and energy independence.

This report assigns grades to each of the 50 states based on their commitment to supporting wind, solar, and other renewable energy sources. We measure commitment by the projected results of renewable electricity standards for electric companies and dedicated renewable electricity funds. Current state renewable energy generation is also considered. State renewable energy purchases, voluntary programs, and unenforceable goals are discussed, but not considered in the grading. We also compare the total development realized from state commitments with federal legislative proposals and each state's renewable energy potential.

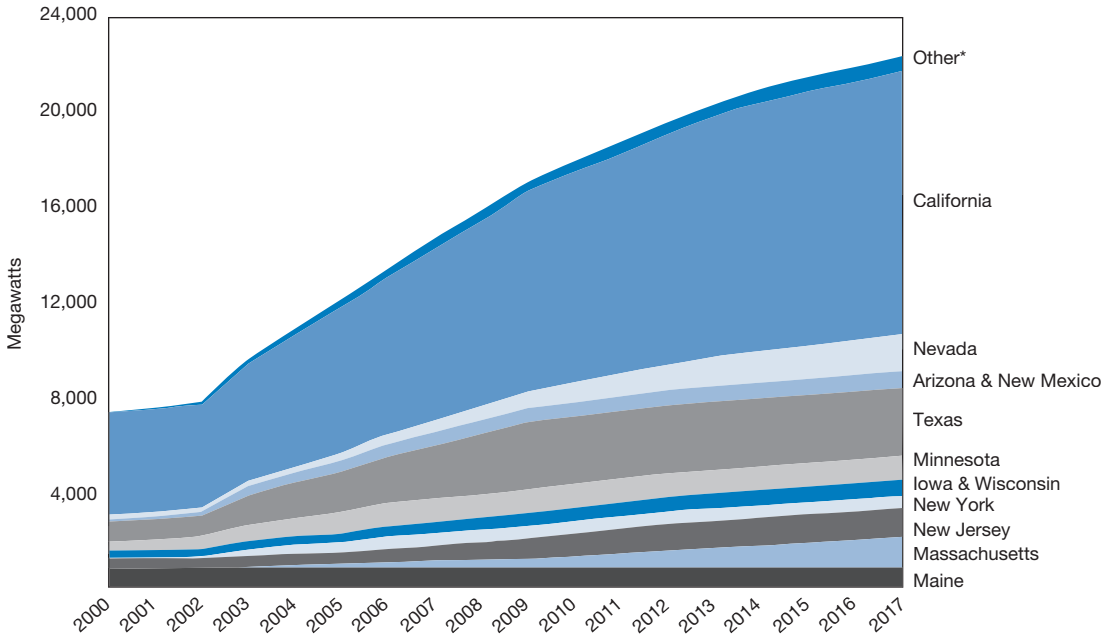
Our analysis shows that 19 states have stepped in to fill a leadership vacuum at the federal level by taking important first steps toward developing a clean energy system. Among our findings:

- A mere handful of states are responsible for most of the projected gains in renewable energy. California accounts for 44 percent of all projected new development; California and Texas together account for nearly 60 percent; and the top five states account for more than 80 percent.
- Only California and Nevada received A- grades for enacting standards that increase renewable electricity sales by one percentage point per year for at least 10 years, while covering utilities serving more than two-thirds of electricity use in each state.
- Thirty-four states received failing grades of D or F for their lack of commitment to renewable electricity, with six qualifying for our Hall of Shame.
- Most states have only begun to tap their abundant renewable electricity potential.
- Renewable energy generated through state standards and funds will significantly exceed voluntary purchases of renewable (or "green") electricity, but fall far short of what a fair, cost-effective national standard could produce.

Renewable Energy Potential. Wind, solar, bioenergy, geothermal, and landfill gas have the technical potential to provide more than five times the electricity currently needed by the United States. Thirty states have the potential to generate all of their electricity from nonhydroelectric renewable energy and still export clean power to others. While the upper Midwest and Great Plains states have the greatest potential, every state has the potential to produce more than one-quarter of its current electricity use from renewable energy.

Current Renewable Energy Use. Despite the enormous potential for renewable energy, only a few states are generating renewable electricity from sources other than hydroelectric facilities at meaningful levels. Maine ranks the highest, generating nearly 30 percent of its electricity from renewable energy, followed by Hawaii, California, and New Hampshire at approximately 10 percent each. Thirty states are at or below the national level of 1.8 percent, with 23 of those below one percent.

Figure ES-1
New and Existing Renewable Energy Capacity from State Standards and Funds



*Includes Connecticut, Delaware, Illinois, Montana, Oregon, Pennsylvania, and Rhode Island.
SOURCE: UCS, 2003.

Renewable Electricity Standards. Thirteen states have adopted renewable electricity standards, which UCS forecasts will lead to the development of 14,230 megawatts (MW) of new renewable capacity by 2017 and support the continued operation of more than 7,000 MW of existing renewable generators (Figure ES-1). Combined, this represents enough clean power to meet the electricity needs of nearly 15 million typical (nonelectric-heating) U.S. homes. California's standard will create the largest market for renewable energy, supporting more than half of the total capacity for all states. Because of its size, Texas will create the second largest market. Nevada, Massachusetts, and New Jersey complete the top five in this category, each with standards supporting more than 1,000 MW of total capacity.

Renewable Electricity Funds. Fifteen states have adopted renewable electricity funds, which UCS forecasts will invest nearly $4.5 billion over a 20-year period, thereby supporting an additional 1,000 MW of new renewable capacity by 2017—enough to meet the electricity needs of approximately 580,000 typical U.S. homes. California leads the nation in total dollar commitment to renewable energy, accounting for nearly half of all funding. Illinois, Massachusetts, Connecticut, New Jersey, Arizona, and Minnesota are also making significant commitments, each in excess of $100 million. Nine states have implemented both renewable electricity funds and standards.

Other Renewable Energy Policies and Markets. Several other policies and voluntary approaches have been adopted at the federal, state, and local levels. For example, 36 states have adopted net metering, which makes it easier and more affordable for customers to generate their own renewable electricity by feeding surplus power back into the grid. Nearly half of the states require electricity providers to disclose their fuel sources and environmental impact on

consumers' bills, and others offer financial incentives such as tax credits, grants, loans, and rebates.

In addition, millions of customers in 36 states now have the opportunity to support renewable energy directly through voluntary purchases. Customer choice has resulted in more than 980 MW of new renewable energy capacity to date, with another 430 MW in the planning stages. Four states (Washington, Kansas, Wyoming, and Texas) have installed two-thirds of the total capacity, with Washington leading the way at 321 MW, or one-third of the total. While these policies and voluntary measures will assist renewable energy development, they do not represent firm commitments and are therefore not considered in our grading.

Grading State Renewable Commitments. The variables that best reflect a state's commitment are the rate at which renewable energy generation is projected to increase, ramp-up duration, and the extent to which a standard applies to all electricity suppliers in the state. Another indication of a state's commitment is how much renewable energy generation it has previously supported and is still in operation today.

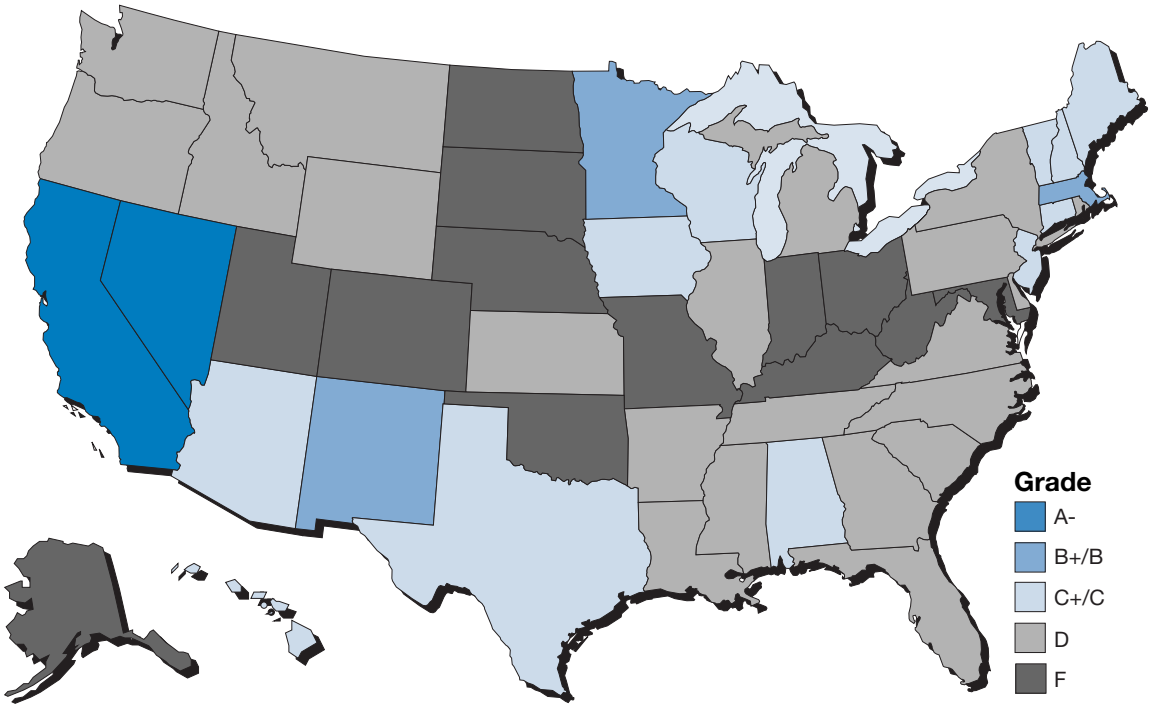
Passing Grades

A grades are reserved for states that have standards or funds projected to achieve a rate of increase of one percentage point per year, last at least 10 years, and apply to all suppliers. Unfortunately, no state achieved a straight A. UCS assigned A- grades to two states (California and Nevada) that meet the first two criteria, and apply to at least two-thirds of the electricity sales in each state (Figure ES-2).

B grades were given to states with standards or funds that require a rate of increase of at least 0.5 percent per year, last at least five years, and cover suppliers serving most customers. Three states qualified: Massachusetts, Minnesota, and New Mexico.

C grades were given to states with projected increases of at least 0.2 percent per year for at least

Figure ES-2 **Renewable Energy Report Card Map**



five years, and whose standards cover suppliers serving most customers. States also received a C if they did not meet this minimum ramp-up requirement but have a commitment to make new renewable energy more than one percent of total retail sales by 2017. States whose existing renewable resources provide five percent or more of retail sales also received C grades.

Failing Grades

States receiving a grade of D or F do not pass the test of using their available renewable resources today or making commitments to do so in the future.

D grades were given to states with a commitment to new renewable energy below one percent of total retail sales in 2017 or with existing renewable generation between one and five percent today.

F grades were given to states with no commitment to future renewable energy development whatsoever and low levels of existing renewable energy (below one percent of sales).

Only 16 states received a passing grade of C or better, with two receiving an A- and another three receiving a B+ or a B. The great majority of states—34—received a D or F. UCS also nominated six of the failing states to its Hall of Shame due to their high renewable energy potential but lack of commitment. We also designated 10 states as "Most Likely to Improve," because policy efforts to support future renewable energy development have been proposed.

Total Projected Development and the Case for a National Renewable Electricity Standard. UCS projects the 19 states that have enacted standards or funds will increase their renewable energy capacity 15,215 MW by 2017—a 113 percent increase over 1997 levels. This increase will provide enough electricity for 10.4 million typical U.S. homes and eliminate as much carbon dioxide—the main heat-trapping gas causing global warming—as taking 7.4 million cars off the road or planting 11.2 million acres of trees (an area approximately the size of Maryland and New Jersey combined).

The overall development resulting from standards and funds should significantly exceed development resulting from voluntary customer choice programs. A recent National Renewable Energy Laboratory (NREL) study found that customer choice programs may only add enough renewable generation to equal 0.1 percent of U.S. electricity sales by 2010. Existing state standards and funds are projected to add 8.3 times as much renewable generation by that date. Even under an optimistic scenario, NREL projects customer choice programs would add 27 percent less renewable generation than UCS projects for existing state standards and funds (not counting additional state and national policies that might be enacted).

The tremendous disparity in state programs and failing grades for 34 states speak to the need for a national renewable electricity standard. By setting a minimum requirement on which state standards and voluntary programs could build, a national standard would prove more equitable and lead to much higher and cost-effective levels of renewable energy generation.

The U.S. Senate passed a 10 percent by 2020 renewable electricity standard in its comprehensive energy bill in 2002, but the bill died when a House and Senate conference committee could not reconcile their versions. The renewable electricity standard, which was not included in the House bill, was one of the most contentious issues. The House Energy and Commerce Committee subsequently rejected a renewable electricity standard of 20 percent by 2025 earlier this year. The Senate is expected to debate the issue this May.

The 10 percent by 2020 national standard passed by the Senate last year would lead to the development of 3.4 times more new renewable generation

than existing state standards and funds. Studies by the U.S. Energy Information Administration (EIA) and UCS also show that such a standard could reduce prices for both electricity and natural gas.

A 20 percent by 2020 national standard would lead to the development of 12.8 times as much new renewable generation as existing state standards and funds. EIA found that this standard would reduce natural gas prices enough to offset nearly all of a modest four percent increase in electricity prices, resulting in virtually no net cost increase to consumers. UCS analysis suggests this standard could actually save consumers money while creating nearly $80 billion in new capital investment and more than $6 billion in revenues for rural communities and landowners.

Closing the renewable energy gap is too important a goal to leave to individuals and a handful of states. What America needs is a strong national policy with specific goals for plugging renewable energy into the electricity system.

Chapter 1

Introduction

Today, the United States has an electricity system that lacks diversity and security, threatens the health of our most vulnerable citizens every year, jeopardizes the stability of Earth's climate, and robs future generations of clean air, clean water, and energy independence. The nation's electricity generation is dominated by large power plants burning fuels that put public health and safety at risk. In fact, more than 90 percent of our electricity is generated from fossil fuels and nuclear power—energy sources that also endanger the environment through mining, refining, waste disposal, and vulnerable delivery systems.

Electricity generation using one type of fossil fuel, natural gas, is projected to triple in the next 20 years, reaching 36 percent of the total. Increasingly, this natural gas will come from outside North America (EIA, 2001). Recent experiences with natural gas price spikes and the implications of dependence on foreign oil are reminders that this path carries serious economic risks.

The Good News

Fortunately, we can reduce our growing reliance on fossil fuels and nuclear power with clean renewable energy sources such as solar, wind, geothermal, landfill gas, and bioenergy (fuel from organic materials including wood and agricultural wastes or crops grown specifically to produce energy). These safe, homegrown energy sources are available in significant quantities in most states and are increasingly cost-effective. Several recent studies by government agencies and nonprofit organizations such as UCS have shown that increasing the use of renewable technologies in the United States would create an energy system that:

- is more diverse;
- is safer;
- pollutes less;
- reduces the emissions causing global warming;
- creates jobs;
- saves consumers money; and
- stimulates rural economies.[1]

The Bad News

Despite the clear benefits renewable energy has over traditional electricity sources, an enormous "clean energy gap" exists in the United States. Renewable energy sources (not including hydropower) generate approximately two percent of our electricity today (EIA, 2003). Even worse, no national policy has been established to ensure that renewable energy becomes the significant source of electricity it can and should be.

In poll after poll, consumers make it resoundingly clear that they want more renewable energy. When asked recently whether we should reduce our dependence on fossil fuels by requiring power companies to generate 20 percent of their electricity using alternative sources of energy such as wind and solar, 70 percent of respondents said yes (Mellman Group, 2002). They agreed that these energy sources are cleaner and more secure than oil, gas, coal, and nuclear power. Other polls show 80 to 95 percent support for increased development of renewable energy

1 See Bailie, et al. 2003; Clemmer, et al. 2001; EIA, 2002; EIA, 2001b; IWG, 2000; UCS, 2002; UCS, 2002b.

What Is a Renewable Electricity Standard?

The renewable electricity standard, sometimes called a renewable portfolio standard, is a simple mechanism to diversify energy resources, stabilize energy prices, stimulate economic development, and reduce air pollution and other harmful effects of electricity generation. Under a renewable electricity standard, retail electricity providers covered by the standard supply a growing percentage of electricity from renewable energy sources (wind, solar, geothermal, and bioenergy).

Some renewable electricity standards allow companies to comply with the standard by purchasing renewable energy credits. A government agency issues credits to generators for the amount of renewable energy produced, which they can sell to electricity suppliers without necessarily transmitting the electricity itself.

Tradable renewable energy credits enable electricity suppliers to achieve compliance with the renewable standard at the lowest cost, in the same way the Clean Air Act acid rain emission allowance trading system has reduced the cost of compliance with air pollution targets. This market-based approach is designed to provide the greatest amount of clean power for the lowest price and create an ongoing incentive to drive costs down.

sources (Gallup Organization, 2001; Hochschild and Hochschild, 2001; NRDC, 2003).

The higher initial cost of renewable technologies often serves as an excuse for not increasing their use. In reality, the costs of renewable energy have come down significantly in recent years, and studies show that increasing economies of scale and improved performance can continue to decrease the costs. Still, consumers also make it consistently clear through their responses to surveys that most are willing to pay more. A survey conducted by the Mellman Group in February 2002 found that 65 to 72 percent of consumers were willing to pay two or three dollars more on their monthly electricity bills if the increase resulted from utilities being required to obtain 20 percent of their electricity from renewable sources by 2020. In the last chapter of this report, however, we will review studies that show a 20 percent standard can be achieved without increasing overall consumer energy costs.

Closing the Gap

The benefits of increasing renewable energy are clear, the disadvantages of our current energy path are great, and the public's desire for more renewable energy is strong. A few states around the country understand this and are setting an example for other states and the nation to follow. Thirteen states, in fact, have adopted renewable electricity standards and 15 have adopted renewable electricity funds (a small charge on energy sold to customers is invested in renewable energy development). A number of states have also adopted policies such as net metering, financial incentives, and voluntary measures designed to remove market barriers and encourage renewable energy use.

The Purpose of this Report

In developing this report, the Union of Concerned Scientists set out to rank and grade all 50

states by examining their commitment to close the renewable energy gap. To accomplish this, UCS:

- reviewed the amount of renewable energy resources potentially available to each state,
- examined the current contribution that renewable energy is making to each state;
- ranked and graded states' commitments to developing renewable resources in the future; and
- compared the total projected results and carbon savings against what could be achieved through proposed national policies.

UCS focused specifically on a set of policies that states have adopted to support the development of renewable energy, especially renewable electricity standards and renewable electricity funds. Using this set of measures, UCS developed an overall grade for each state.

Chapter 2

Renewable Energy Potential

Diverse renewable resources exist throughout the United States, providing the nation with the technical potential to provide all the electricity we need many times over. The renewable resources with the greatest potential to generate electricity in the United States are solar, wind, and bioenergy. Combined, the technical potential of the major renewable technologies (wind, bioenergy, geothermal, and landfill gas) could provide 5.6 times the amount of electricity this country needs (Table 1).

Not all of these renewable energy sources' technical potential will be developed, due to economic, physical, and other limitations. Estimates of technical potential reflect the availability of a renewable resource (such as strong, steady winds, sunny skies, agricultural residues, or energy crops such as switchgrass) at or below a certain cost. Other factors, including land-use conflicts, transmission bottlenecks, and other market barriers, limit how quickly and to what extent we can tap this potential.

The primary question is whether these resources are sufficient to support the gradual transition proposed by a growing number of environmental and consumer groups and energy companies—a steady increase in the use of renewable energy of at least one percentage point per year—to at least 20 percent by 2020 or 2025.[2] Over the long run, proposals by the Bush administration and others to shift to hydrogen fuel could create the national infrastructure needed to utilize significantly higher levels of renewable resources to create hydrogen for transportation, electricity, and for direct use in buildings and by industry.

Solar, wind, bioenergy, geothermal, and landfill gas comprise the major nonhydroelectric renewable energy technologies with significant technical potential.[3] Thirty states in the United States have the technical potential to generate all of their electricity from these renewable sources and export renewable energy to others (Figure 1, p.10). The states of the upper Midwest and Great Plains have the most significant potential to develop renewable energy capacity. Table 2 (p.11) presents the top 10 states with the most renewable energy potential (as a percent of annual electricity sales to the state's consumers).

If even a fraction of this potential renewable energy

Table 1 **U.S. Renewable Energy Potential**

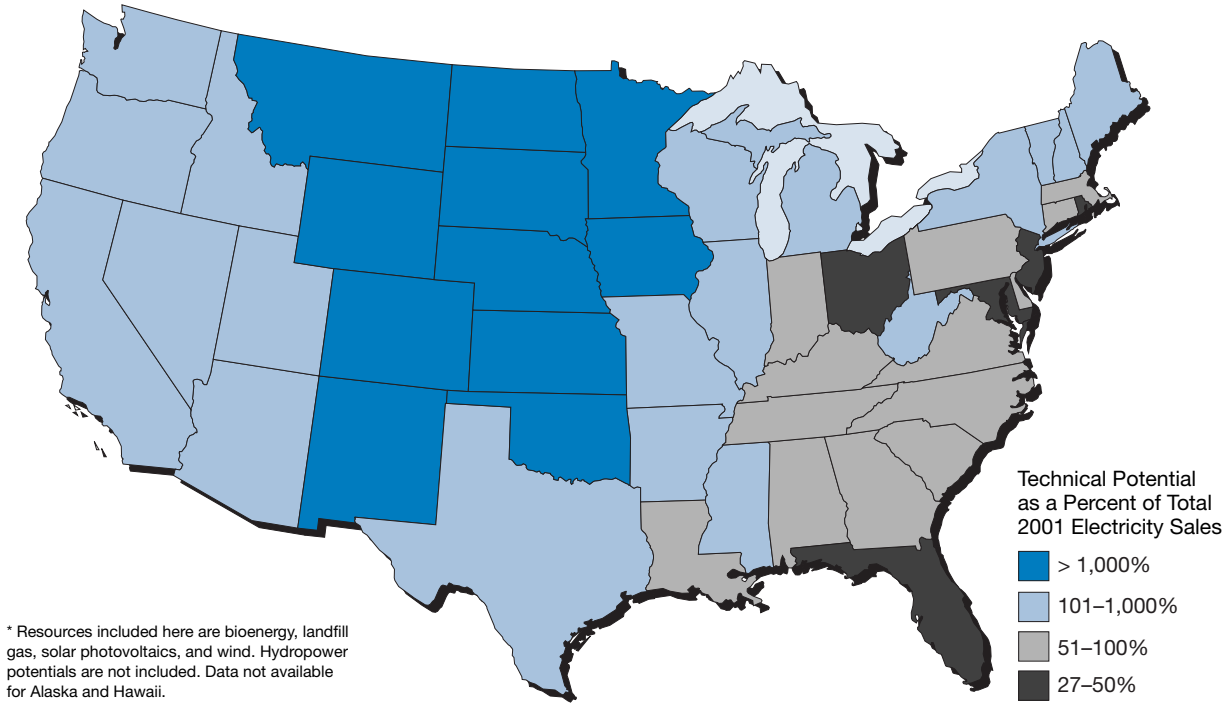
Resource	Generation (Billions of kWh)	Percent of 2001 Electricity Sales
Wind	14,244	459%
Solar*	2,203	71%
Bioenergy	742	24%
Geothermal	191	6%
Landfill Gas	40	1%
Total	**17,420**	**561%**

*Solar potential is a conservative estimate of distributed photovoltaics. See Appendix A for sources and assumptions.

2 See Bailie et al., 2003; Clemmer et al., 2001; UCS, 2002b; and USPIRG, 2003. During the 107th Congress, 20 percent by 2020 RES legislation was included in S. 1333, H. 3037, and H. 2478. In the current 108th Congress, H.1295 includes a 20 percent by 2025 national RES and S. 944 includes 20 percent by 2020 RES legislation.

3 Hydroelectric power is also "renewable," but opportunities for environmentally sound expansion are limited and thus are not the focus of this report.

Figure 1 **Renewable Energy* Potential**



* Resources included here are bioenergy, landfill gas, solar photovoltaics, and wind. Hydropower potentials are not included. Data not available for Alaska and Hawaii.

SOURCES: See Appendix A and B.

were developed, states with renewable resources and access to adequate transmission lines could become net exporters of significant amounts of clean electricity.

See Appendix B for a complete listing of renewable energy potential by state.

Wind

Wind has the potential to generate more than 4.5 times our nation's electricity needs. Well over half the states have the potential to generate 50 percent or more of their electricity by using wind to power generating turbines.

This potential is based on data regarding windy land area and average annual wind speeds, limited by proximity to transmission lines. The potential estimate also excludes wind development on certain types of land, depending on its current use and environmental sensitivity.

While offshore wind is becoming an increasingly important area for development, a consistent national estimate of offshore wind potential is not yet available and is not included in these estimates. The inclusion of offshore wind would add significantly to the overall potential of several states.

As Table 3 shows, the best wind resources are in the Great Plains and upper Midwest states.

Solar

Solar photovoltaic (PV) cells convert sunlight directly into electricity. Much of the United States has significant potential for generating electricity from solar energy using this technology. Generally, states across much of the western part of the country, along with states along the southern Atlantic coast (North Carolina, South Carolina, Georgia, and Florida) have either very good or excellent solar

radiation levels. States in the Southwest, particularly Arizona, California, Colorado, Nevada, New Mexico, and Utah, have the highest solar energy potential. Parts of Kansas, Oklahoma, and Texas have similarly high potential.

Our estimate of solar power potential is based on the assumption that solar panels and supporting infrastructure would be installed on only 0.5 percent of any state's total land area. We also accounted for the quality of solar resources in different states and technology performance assumptions. The potential calculated here for generating electricity from solar PV does not include applications such as concentrating solar, centralized solar thermal systems, or solar direct heat or hot water.

In order to make a comparison among states, we also examined states' solar energy potential as a percent of annual electricity sales. Table 4 presents the 10 states with the highest potential relative to 2001 electricity sales.

Bioenergy

The terms bioenergy and biomass refer to a wide range of natural materials including switchgrass, agricultural residues such as corn stover (stalks), forest residues, and even animal wastes. All of these materials contain energy that can be used to generate power. Bioenergy fuels are burned directly or converted to a gas or liquid, which is then used to generate electricity. After solar and wind, bioenergy has the potential to provide the greatest amount of electricity. More than half the states could potentially generate 20 percent or more of their electricity from bioenergy.

In estimating bioenergy potential, we only look at resources available at a modest cost, and we exclude materials that are contaminated, already being used for other purposes, found in environmentally sensitive areas, grown in areas that would require irrigation, or are needed to maintain soil quality and prevent erosion.

Table 2 **Top 10 States by Overall Technical Potential (as a Percent of Total Sales)**

Rank	State	Percent of 2001 Electricity Sales
1	North Dakota	18,611%
2	South Dakota	16,781%
3	Montana	10,977%
4	Wyoming	8,432%
5	Nebraska	6,247%
6	Kansas	5,356%
7	Iowa	2,674%
8	Oklahoma	2,524%
9	New Mexico	2,279%
10	Minnesota	1,940%

SOURCES: See Appendix A and B.

Table 3 **Top 10 States by Wind Technical Potential (as a Percent of Total Sales)**

Rank	State	Percent of 2001 Electricity Sales
1	North Dakota	17,722%
2	South Dakota	15,779%
3	Montana	9,913%
4	Wyoming	7,807%
5	Nebraska	5,863%
6	Kansas	5,073%
7	Iowa	2,438%
8	Oklahoma	2,367%
9	Minnesota	1,785%
10	New Mexico	1,661%

SOURCES: See Appendix A and B.

Table 4 **Top 10 States by Solar Technical Potential (as a Percent of Total Sales)**

Rank	State	Percent of 2001 Electricity Sales
1	Montana	967%
2	South Dakota	712%
3	Wyoming	607%
4	New Mexico	581%
5	North Dakota	550%
6	Nevada	357%
7	Utah	324%
8	Idaho	313%
9	Nebraska	250%
10	Colorado	202%

SOURCES: See Appendix A and B.

Table 5 Top 10 States by Bioenergy Technical Potential (as a Percent of Total Sales)

Rank	State	Percent of 2001 Electricity Sales
1	North Dakota	339%
2	South Dakota	289%
3	Nebraska	133%
4	Iowa	128%
5	Montana	96%
6	Kansas	92%
7	Mississippi	64%
8	Idaho	56%
9	Minnesota	55%
10	Arkansas	52%

SOURCES: See Appendix A and B.

Table 6 Top Nine States by Geothermal Technical Potential (as a Percent of Total Sales)

Rank	State	Percent of 2001 Electricity Sales
1	Nevada	80%
2	Idaho	47%
3	Oregon	46%
4	California	46%
5	Utah	43%
6	Colorado	41%
7	New Mexico	27%
8	Arizona	9%
9	Washington	3%

SOURCES: See Appendix A and B.

The top 10 bioenergy states, shown in Table 5, include states of the Great Plains and Midwest, plus Mississippi, Arkansas, and Idaho.

Geothermal

Geothermal energy (heat from inside the earth) is a source of steam that can be used to power electricity-generating turbines. There are nine states in the United States with this type of geothermal energy potential; Nevada has by far the greatest potential as a share of electricity sales. Other states with significant potential are all located in the western part of the country: Utah, California, Oregon, Colorado, Idaho, and New Mexico (Table 6).

Only identified geothermal sites with temperatures high enough for electricity production are included in these estimates.

Landfill Gas

Organic material in landfills decomposes and forms a gas that can be captured and used to generate electricity. Seven states (California, Colorado, Rhode Island, Illinois, New York, New Jersey, and New Hampshire) have the potential to generate between two and four percent of their electricity sales from landfill gas. Thirty-one states have the potential to generate about one percent of their electricity this way (see Appendix A and B for sources).

Other Resources

Other sources of energy including ocean tidal, ocean thermal, hydropower, and municipal solid waste (MSW) are not included in our overall estimate of renewable energy potential.

Ocean tidal and thermal are promising but emerging technologies for which reliable data on technical potential are not yet available. Hydropower, while "renewable," is an established technology and already a significant source of electricity in the United States. Furthermore, there is little potential for environmentally acceptable expansion of hydropower other than in a few select areas. While some states and the federal government consider MSW to be "renewable", most environmental groups do not because it is usually mixed with inorganic materials and environmentally preferable recycling policies should lead to a progressively smaller waste stream.

Chapter 3

Current Renewable Energy Use

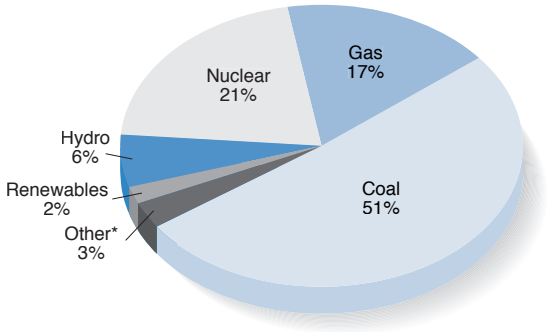
Despite the plentiful availability of renewable energy sources and strong interest from consumers, only a few states are using those resources to generate electricity at meaningful levels. Nationally, renewable energy from nonhydroelectric sources provided just 1.8 percent of our electricity in 2001 (EIA, 2003). The United States instead relies on coal, nuclear power, and natural gas (Figure 2).

In Table 7 below, we present the top and bottom 10 states according to renewable energy generation as a percent of 2001 electricity sales. Only one state—Maine—currently approaches 30 percent. Renewable energy provides roughly 10 percent in only three other states: Hawaii, California, and New Hampshire. Another three (Nevada, Alabama, and Vermont) get 5 to 10 percent of their electricity from renewable sources.

The 10 states with the lowest levels of renewable energy development vary by size and location. However, most of these states have significant renewable energy potential (more than 100 percent of their electricity needs), including Arizona, Missouri, Nebraska, New Mexico, North Dakota, South Dakota, and West Virginia.

Overall, 30 states generate renewable energy at or below the national level of 1.8 percent. Twenty-three of those states use renewable energy for less than one percent of their electricity. See Appendix C for details.

Figure 2 **U.S. Electricity Mix, 2001**



* Includes oil, municipal solid waste, and other fuels.
SOURCE: EIA, 2003.

Table 7 **State Ranking of Renewable Energy* Generation as a Percent of Total Sales, 2001**

Top 10			Bottom 10		
Rank	**State**	**Renewable Energy Generation as a % of Sales**	**Rank**	**State**	**Renewable Energy Generation as a % of Sales**
1	Maine	28.4%	50	West Virginia	0.00%
2	Hawaii	11.4%	49	Missouri	0.01%
3	California	10.3%	48	North Dakota	0.01%
4	New Hampshire	10.1%	47	Kentucky	0.02%
5	Vermont	7.3%	46	Delaware	0.04%
6	Alabama	5.5%	45	Arizona	0.06%
7	Nevada	5.3%	44	Indiana	0.09%
8	Louisiana	4.2%	43	New Mexico	0.11%
9	Arkansas	4.1%	42	South Dakota	0.11%
10	Mississippi	4.1%	41	Nebraska	0.15%

* Renewable energy resources included here are solar, wind, bioenergy, geothermal, and landfill gas. Hydropower is not included in this estimate.
SOURCES: See Appendix A and C.

Chapter 4

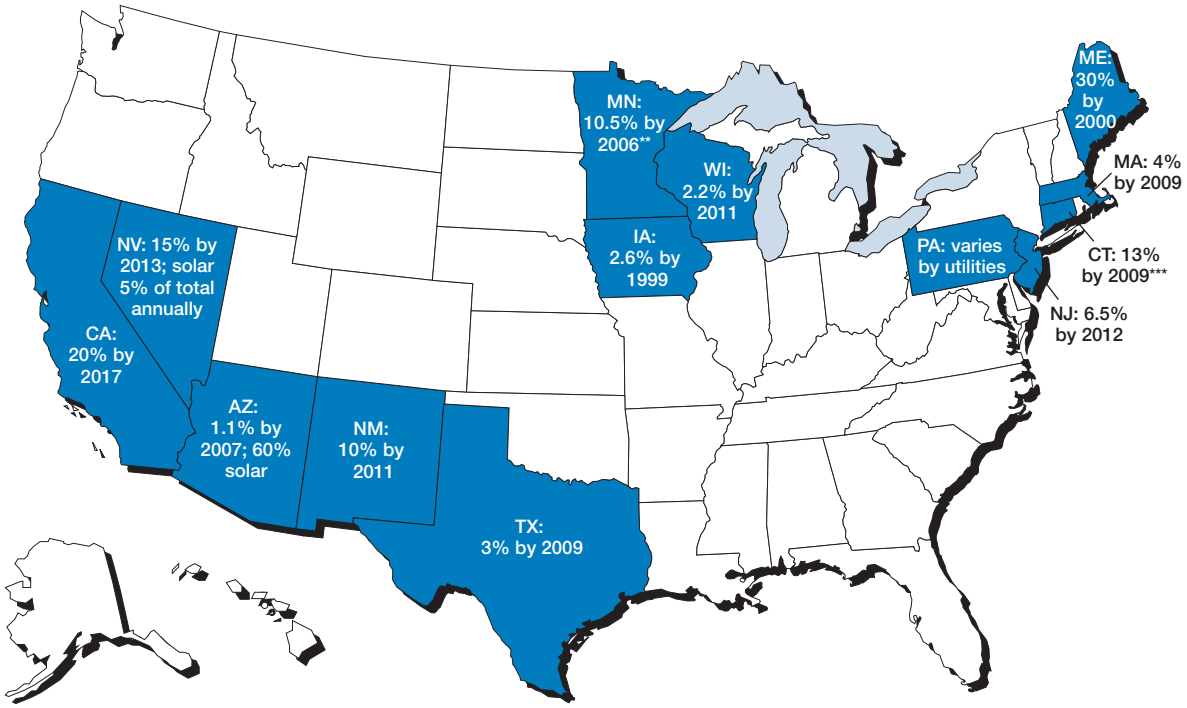
Renewable Electricity Standards

In the past five years, renewable electricity standards (RES) have emerged as an effective and popular tool for promoting the development of renewable energy resources. The RES (sometimes called a renewable portfolio standard or RPS) is a market-based policy mechanism that achieves a diverse electricity supply by establishing a minimum commitment to generate electricity from renewable resources. Though the design varies from state to state, an RES essentially requires electricity providers to gradually increase the share of renewable energy in their power supply. State efforts in RES implementation have demonstrated that this policy can successfully reduce existing market barriers and create new markets for renewable energy.

To date, 13 states have established a minimum RES, as shown in Figure 3. Many of the states (Arizona, Connecticut, Maine, Massachusetts, Nevada, New Jersey, New Mexico, and Texas) enacted standards during the process of restructuring their electricity industry to allow retail energy consumers to choose their provider. Pennsylvania included an RES in restructuring settlements with distribution companies.

Four states have enacted minimum requirements outside of restructuring. California and Iowa have enacted standards for regulated utilities. Minnesota

Figure 3 **State Renewable Electricity Standards***



* Standards expressed as total renewable energy generation as a percent of covered companies' retail sales.
** MN has a minimum requirement for one utility, Xcel.
*** CT requirement is for sales to nonstandard-offer customers only. See text for further discussion.
SOURCE: UCS, 2003.

Table 8 **Renewable Electricity Standard Ramp-up Rates for Covered Companies**

Rank	State	Average Annual Rate of Increase	Ramp-up Duration (Years)
1	New Mexico	1.1%	9
2	California	1.0%	15
3	Nevada	1.0%	11
4	Massachusetts	0.8%	15
5	Minnesota	0.8%	12
6	Iowa	0.6%	4
7	New Jersey	0.3%	12
8	Wisconsin	0.2%	9
9	Arizona	0.2%	7
9	Texas	0.2%	7
11	Connecticut	NA	NA
11	Maine	NA	NA
11	Pennsylvania	NA	NA

SOURCE: See Appendix A.

established a minimum requirement for only one regulated utility—Xcel Energy—but that utility accounts for more than half of the state's electricity use. Wisconsin enacted an RES for regulated, municipal, and cooperative utilities as part of reliability legislation.

Several states have already revisited and strengthened their standards. Most recently, Minnesota moved the timeline for Xcel's minimum renewable energy requirement up six years, from 2012 to 2006. In December 2002, New Mexico joined Nevada as the second state to increase its renewable energy targets significantly.

Eight states (California, Connecticut, Massachusetts, New Jersey, New Mexico, Nevada, Texas, and Wisconsin) designed their standards to provide ongoing support for existing renewable energy sources while pushing the market to develop new resources. The regulatory rules implementing the Massachusetts RES, however, do not include a mechanism to guarantee the continued generation of existing renewable energy, so it is uncertain whether the Massachusetts market will be sustained.

Minnesota, Iowa, and Arizona have focused only on encouraging new renewable energy generation. Maine and Pennsylvania do not have specific requirements to develop new renewable sources and, therefore, may only support the continued operation of some existing facilities.

State standards vary in a couple of other important ways. For example, most standards do not require all electricity providers in the state to comply with renewable energy targets. In every state but Arizona and Wisconsin, publicly owned utilities ("munis") and rural electric cooperatives are exempt. The California RES applies only to the three largest investor-owned utilities in the state, Iowa's RES applies to two utilities, and the Minnesota requirement applies to only one. Exempting certain utilities reduces the overall effectiveness of the RES in supporting renewable energy development and overcoming market barriers.

State standards also vary considerably in the rate at which they require electricity providers to increase their use of renewable energy. As shown in Table 8, average annual ramp-up rates range from one percent or above per year in California, Nevada, and New Mexico to as little as 0.2 percent per year in Arizona, Texas, and Wisconsin. The table ranks each state RES first by the average annual rate of increase in new renewable energy development from the start date of the ramp-up to either the end date or 2017, whichever is sooner, and then by the duration of the ramp-up. Strong ramp-up rates are important because they trigger renewable energy development in levels that achieve economies of scale and reduce renewable energy costs more effectively, ensuring gradual but steady market growth. The economic and environmental benefits of a clean, sustainable power supply are also realized sooner.

Voluntary Renewable Energy Goals

Three states have adopted voluntary renewable energy goals in an effort to promote clean power sources. In 2001, Hawaii and Illinois established nonbinding targets of nine percent by 2009 and 15 percent by 2020, respectively. That same year, Minnesota set a goal—in addition to its mandatory requirement for Xcel—suggesting that each utility "make a good-faith effort" to generate or procure at least 10 percent of its electricity from renewable energy sources by 2015.

While these goals should be applauded for their intent, they are not regulations and cannot be enforced. Because they provide no mechanism to guarantee new renewable energy development or support existing facilities, we do not include them in our evaluation. Significant new renewable energy markets would emerge, however, should Hawaii, Illinois, or Minnesota opt to change their voluntary goals into binding requirements.

Measuring Renewable Electricity Standards

To assess a standard's impact, we attempted to reflect state-specific conditions by collecting information from each state's laws and rules and its experience to date. Since most state standards rely on market-based decisions, however, it is not feasible to determine precise results in advance. In addition, many states are in the initial stages of implementing their standards. It is not generally clear what the mix of technologies will be, or if any adjustments will be made to the policies over time. For this report, all projections are carried out to 2017, which is the latest benchmark year of any state standard.

We measure state commitments to renewable energy development in several ways. First, we estimate the expected total (new and existing) renewable energy capacity supported by state standards. This measure provides a sense of the overall market size and in which states the majority of the development will occur. However, states with higher electricity demand will naturally tend to produce larger markets, and vice versa. So, in order to compare states fairly, we measure renewable energy commitments as a share of electricity sales.

Since many state standards do not require compliance by all electricity providers in the state, we use this measure first to examine new renewable energy generation as a percent of electricity sales for those companies covered under each state standard. We then compare these results to new renewable energy generation as a percent of total electricity sales in each state. Finally, we present the combined new and existing commitments to renewable energy sources by state standards.

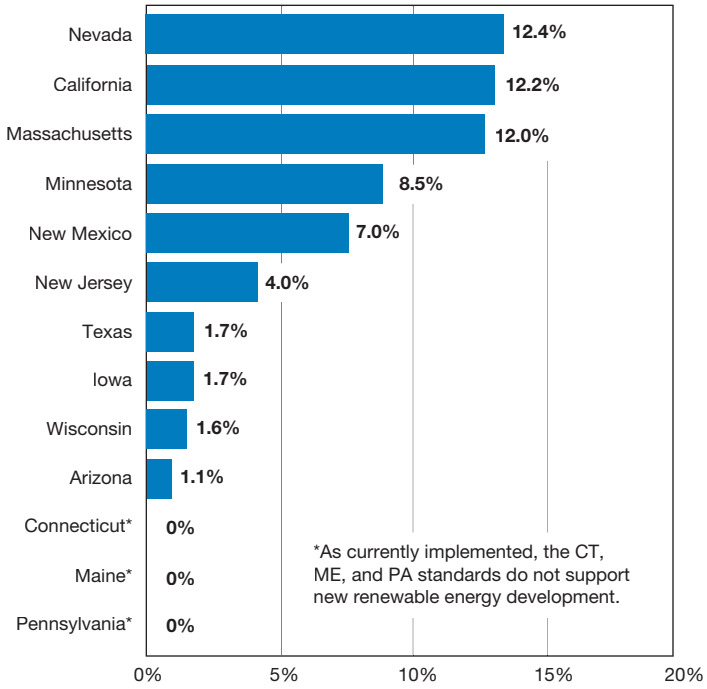
Expected Renewable Energy Development

UCS estimates that the 13 state standards will result in the development of 14,230 megawatts (MW) of new renewable energy by 2017 (a 105 percent increase from 1997 levels) and support 7,020 MW of existing facilities. When combined, the 21,250 MW of total capacity will generate enough clean power to meet the electricity needs of 14.8 million U.S. homes. Leading the nation in terms of total capacity supported is the California RES, which provides a market for more than 11,000 MW of renewable energy—more than half of the total for all states. At 2,880 MW, the Texas RES supports the second largest renewable energy market. Nevada, Massachusetts, and New Jersey complete the top five in this category, each with standards supporting more than 1,000 MW of total capacity.

New Renewable Energy Commitments

In terms of new renewable energy as a percent of electricity sales, Nevada and California lead the way at 12.4 percent and 12.2 percent by 2017, respectively (Figure 4). Unless the state energy office elects to terminate new renewable energy

Figure 4 **New Renewable Energy Share of Electricity Sales from Companies Covered by Renewable Electricity Standards in 2017**



SOURCE: UCS, 2003.

Table 9 **New Renewable Energy Share of Electricity Sales from Renewable Electricity Standards in 2017**

Rank	State	Percent of Covered Companies' Electricity Sales	Percent of Total State Electricity Sales
1	Nevada	12.4%	11.2%
2	California	12.2%	8.3%
3	Massachusetts	12.0%	10.3%
4	Minnesota	8.5%	4.9%
5	New Mexico	7.0%	4.9%
6	New Jersey	4.0%	3.9%
7	Texas	1.7%	1.4%
8	Iowa	1.7%	1.3%
9	Wisconsin	1.6%	1.4%
10	Arizona	1.1%	1.1%
11	Connecticut	0%	0%
11	Maine	0%	0%
11	Pennsylvania	0%	0%

SOURCE: See Appendix A.

growth after 2009, the Massachusetts RES will follow closely behind at 12 percent by 2017.[4] Several other states have also made important commitments to new renewable energy, ranging from 4 percent to 8.5 percent of covered electricity sales.

Texas makes the second largest commitment to renewable energy capacity, but ranks in the bottom half of state standards in share of electricity use. This is because Texas is the largest electricity consumer in the nation, accounting for more than nine percent of U.S. electricity consumption in 2001. Arizona also ranks near the bottom by this measure, but sits atop the list of states (along with Nevada) by making the largest commitment to solar power development.[5] Standards in Maine and Pennsylvania do not have any specific requirements to develop new renewable energy sources. The Connecticut RES also provides no support for new renewable resources at this time (see discussion below).

Table 9 ranks the generation of new renewable energy from state standards as a percent of covered companies' electricity sales, and compares this measure with new renewable energy's share of total state electricity sales. In nearly every state, the share of renewable energy is lower as a percent of total electricity sales due to various electricity provider exemptions. By not requiring all providers to meet the RES, a significant amount of renewable energy development is lost in each state, particularly in California, Minnesota, and New Mexico.

4 The Massachusetts legislation requires that the RES increase to four percent by 2009, and one percent annually thereafter, until a date determined by the state energy office. Though it is not certain, we assume that the standard will continue to increase at this rate through our 2017 benchmark.

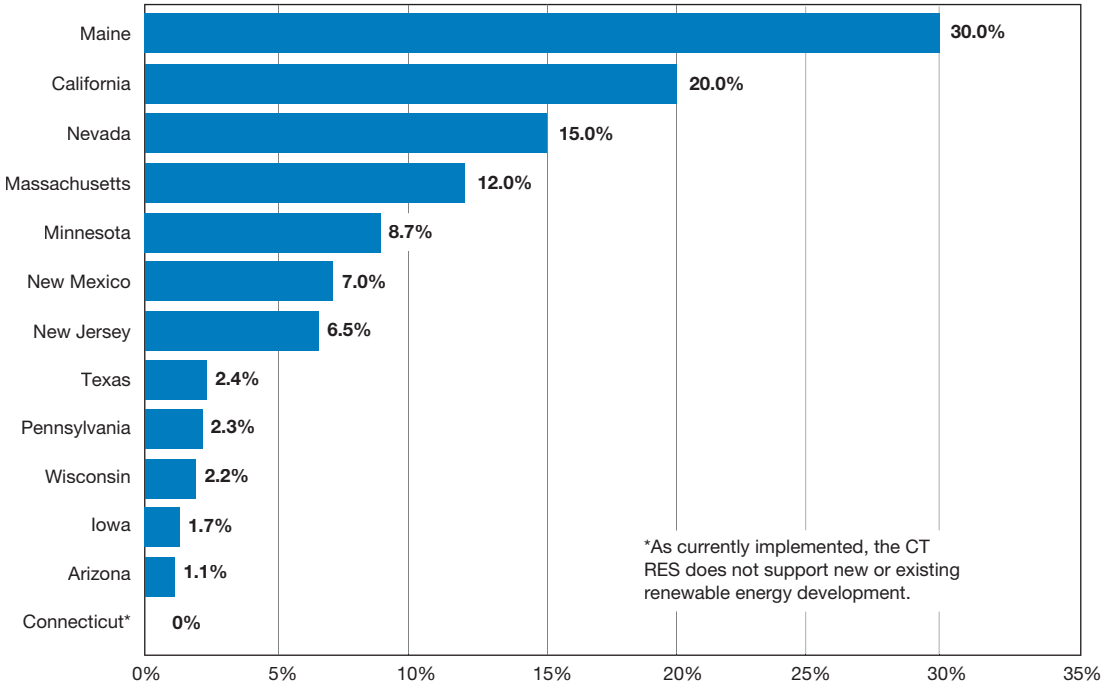
5 Arizona requires 60 percent of its target to come from solar power; Nevada requires five percent of each annual requirement to come from solar power.

Total Renewable Energy Commitments

As shown in Figure 5, Maine leads all states in its overall commitment to new and existing renewable energy (30 percent). However, at the time Maine passed its electricity restructuring bill and RES, approximately 45 percent of the state's electricity came from bioenergy and hydropower—a mature and fully developed resource eligible to meet the RES. Therefore, the 30 percent standard actually represents something of a step backward. In addition, the vast majority of the RES can be met with existing hydropower from other New England states and Canada, leaving Maine's important bioenergy industry susceptible to decline. The Maine legislature is presently considering a bill (LD 1312) that would increase renewable energy development in the state. The state Public Utility Commission is expected to study solutions to these problems and recommend options to improve the RES.

California and Nevada's standards, 20 percent and 15 percent respectively, also support a high percentage of covered utilities' electricity sales from both new and existing renewable energy sources. In contrast to the Maine RES, these standards will gradually increase the contribution of new nonhydro renewable resources while providing ongoing support for existing generation. Minnesota, New Jersey, Texas, and Wisconsin make similar, but smaller, commitments in their standards. Like Maine, the Wisconsin RES provides support for existing hydropower technology, but limits its contribution to 0.6 percent of retail sales. The Massachusetts standard ranks third due to its strong support for new development, but state regulations do not currently provide for the continued use of existing generation. The Connecticut RES currently provides no support for new or existing renewable resources.

Figure 5 **New and Existing Renewable Energy Share of Electricity Sales from Companies Covered by Renewable Electricity Standards in 2017**



SOURCE: UCS, 2003.

Current Progress

So far, the Texas RES has been most effective in stimulating new renewable energy development. The first milestone called for 400 MW to be installed by the end of 2002. Instead, more than 900 MW were installed, largely because of the cost-effectiveness of wind power projects in the western part of the state and the 2001 expiration of the federal production tax credit for wind (later extended by Congress through 2003). This standard has been successful, in part, due to the availability of good renewable energy resources and key provisions in the RES including:

- Near-term requirements that are high enough to trigger market growth
- Requirements that apply to most electricity providers
- Requirements that can be met using tradable credits
- Substantial financial penalties for non-compliance (Wiser and Langniss, 2003)

Significant development has also occurred in Wisconsin, Iowa, and Minnesota. Wisconsin utilities, in fact, have acquired enough renewable electricity to meet their targets through at least 2008. Progress has recently taken place in both Nevada and California, where long-term contracts have been signed between utilities and project developers.

Connecticut receives the dishonor of having the most ineffective standard to date. Its RES passed as part of electricity restructuring in 1998 with high expectations, requiring 13 percent of electricity sales to come from renewable energy by 2009. However, as interpreted by the Connecticut Public Utilities Commission (PUC), the requirement applies only to customers that switch from their existing utility to a competitive supplier. Utilities that supply power to standard-offer (nonswitching) customers are exempt. Connecticut is the only state to apply an anti-competitive interpretation to an RES, which has always been defined by proponents as competitively neutral.

During the early stages of implementation, a small percentage of customers did switch to competitive suppliers, but not in numbers great enough to sustain a fully competitive electricity market. As a result, nearly all competitive retail suppliers have left the state. Until the Connecticut PUC or legislature corrects this problem by requiring all retail electricity providers to meet the standard, the RES cannot support either new or existing renewable energy in the state.[6]

Existing state standards are an excellent start, but not enough to ensure a clean, sustainable energy future for our entire nation. Many other states recognize the effectiveness of renewable electricity standards in promoting a strong renewable energy market, and more than a dozen have considered adopting a new RES or strengthening an existing one in 2003. None, however, have been enacted thus far.[7] Continued inaction by the 37 states without an RES increases the need for a national standard.

6 A bill currently under consideration in the Connecticut legislature (SB-733 JF) would require all retail electricity providers in the state to meet renewable energy targets. This is the third attempt by the legislature to fix the RES and its passage is uncertain.

7 In his State of the State speech, New York Governor Pataki instructed the state Public Regulatory Commission (PRC) to adopt a rule requiring 25 percent of the state's electricity to come from renewable energy by 2013. The PRC is currently in the process of developing this rule, which is expected to be finalized by Spring 2004.

Chapter 5

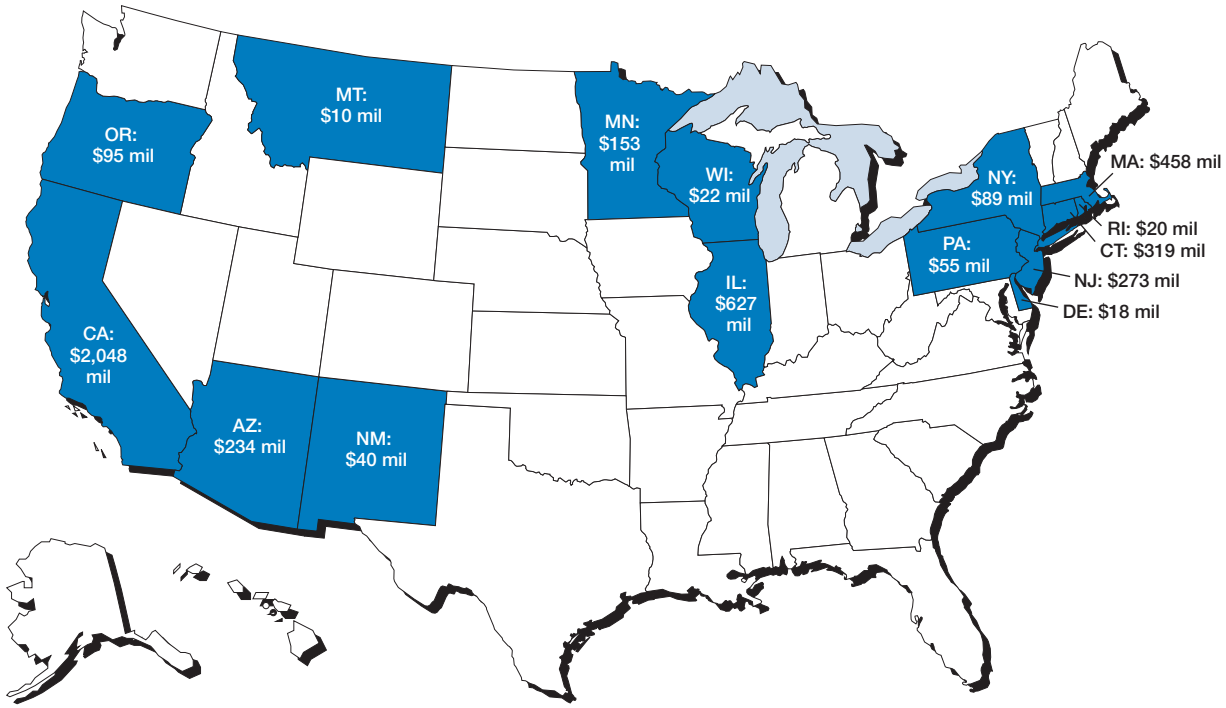
Renewable Electricity Funds

Renewable electricity funds, also referred to as public benefits funds, emerged as a policy tool for supporting clean power during restructuring of the electric industry. As competition was introduced into the industry, some states created funds to help sustain the public benefits programs that were traditionally administered by regulated electric utilities. In most cases, these funds are generated by placing a small fee on consumers' monthly electricity bills. The 15 states that have already implemented renewable electricity funds are projected to collect nearly $4.5 billion to promote clean, sustainable energy between 1998 and 2017 (Figure 6).

California leads the nation in total dollar commitment to renewable energy, accounting for nearly half of all state renewable electricity funding. Illinois, Massachusetts, Connecticut, New Jersey, Arizona, and Minnesota are also making significant commitments to their funds, each in excess of $100 million.

The duration of renewable electricity funds varies among states, ranging from open-ended funds in Delaware, Massachusetts, and Minnesota to five-year funds in Montana and Pennsylvania. Several states, including California, New York, and Rhode Island, have extended the term of their funds. Illinois supplemented its state fund in 2001 with $500 million

Figure 6 **State Renewable Electricity Funds, Cumulative 1998–2017**



SOURCE: UCS, 2003.

in state revenue bonds dedicated to building new renewable energy facilities over a period of 10 years. By helping to remove market barriers, lower financing costs, develop infrastructure, and educate the public, longer-term funds provide greater stability for renewable energy developers and are therefore more likely to be effective.

Nine states (Arizona, California, Connecticut, Massachusetts, Minnesota, New Mexico, New Jersey, Pennsylvania, and Wisconsin) have implemented both funds and renewable electricity standards. These two policies complement each other in stimulating the renewable energy market: Standards "pull" renewable energy technologies into the electricity mix by providing a long-term market and reducing investment risk; funds "push" clean energy technologies by lowering market barriers through direct investment incentives or support for the infrastructure needed to develop renewable energy. Together, state standards and funds can also work effectively in supporting high-cost but high-value emerging technologies that would otherwise go undeveloped.

The impact of state funds on new and existing renewable energy capacity is difficult to calculate. In our analysis, we assume that new projects require an equivalent incentive of two cents per kilowatt-hour (kWh) over their projected 30-year life (except where we had more precise estimates). This estimate is highly uncertain, however, due to the wide variety of approaches states have taken in allocating their funds.[8]

In addition, development occurring as a result of renewable electricity funds may be used to help meet the RES in several states that have both policies. A provision in the California RES, for example, authorizes the use of funds to buy down the above-market cost of renewable energy, and exempts utilities from meeting the standard if insufficient funds are available. The result is no net increase in renewable energy over what would be achieved by the standard alone. A similar situation exists in Massachusetts and New Jersey. In contrast, laws in Minnesota, New Mexico, and Wisconsin require that their funds be used to support new renewable energy projects above the minimum RES target.

With these caveats in mind, UCS projects that state renewable electricity funds could support the development of 1,000 MW of new renewable energy capacity by 2017—enough to meet the electricity needs of approximately 580,000 typical U.S. homes. As explained above, this estimate does not include development resulting from the funds in California, Massachusetts, and New Jersey, which we assume will be used to meet the RES targets in those states. Nearly half of the projected new development (496 MW) comes from the New York renewable electricity fund, much of which is being used to support utility-scale wind projects (Peterson, 2003). Significant development is also expected from the state fund in Illinois.

The recent national economic downturn and subsequent state budget shortfalls have put some existing renewable electricity funds at risk and stalled efforts to adopt new funds. The Massachusetts legislature recently pulled $17 million from its renewable energy trust fund to help offset budget overruns for fiscal 2003, and has threatened to take more if necessary to balance future budgets. A similar effort to redirect renewable electricity funds is currently under consideration in Wisconsin.

8 See Wiser et al., 2002, for a summary of the types of programs implemented by states with renewable electricity funds, including detailed case studies.

Chapter 6

Other Renewable Energy Policies and Voluntary Measures

Several other policies and voluntary approaches have been adopted at the federal, state, and local levels to remove market barriers and encourage renewable energy development.

Other Policies

Policies and regulations that have been popular in many states include net metering, generation disclosure, contractor licensing, equipment certification, solar/wind access laws, construction and design standards, and government green power purchasing requirements. Financial incentives such as tax incentives, grants, loans, rebates, industry recruitment, and production incentives have also appealed to states.[9]

Net metering has been especially popular, with 36 states adopting the policy to date. This strategy allows utility customers to generate their own power with renewable energy generators and use the electrical grid as a backup. When the customer generates more power than needed, the excess flows into the grid, spinning the customer's electric meter backward. The customer only pays for the net electricity consumed; customers who generate more power than they use are either compensated at the wholesale price of electricity or simply donate their excess power to the utility.

Not all net metering policies are the same, however. While most states specify the maximum size of a qualifying system, that size ranges widely from 10 to 1,000 kilowatts (kW). A few states have no size limit, which allows customers to install systems sized according to their need. Rural schools, factories, and farms in Iowa, for example, have installed larger, more cost-effective wind turbines. California recently raised its maximum size from 10 kW to 1,000 kW. This change, combined with state incentives for customer-owned renewable energy systems and the recent electricity crisis, resulted in record numbers of net-metered solar and wind systems installed in the state in 2000 and 2001.

While the technologies eligible for net metering also vary by state, wind and solar systems are eligible in most states. The rules (or lack thereof) for connecting renewable energy generators to the electrical grid also vary widely. The lack of interconnection standards has been a key barrier to the success of net metering in many states.

Governors from five states (Illinois, Maryland, New Jersey, New York, and Pennsylvania) have implemented minimum purchases to power government facilities partially with renewable energy. These voluntary purchases send an important message to consumers that state governments recognize the benefits of renewable energy and are willing to share directly in the responsibility of supporting their development. We do not, however, factor these goals into our grading criteria.

Customer Choice

Millions of customers in 36 states now have the opportunity to support renewable energy directly through voluntary purchases (Wiser et al.,

9 For a comprehensive description of federal, state, and local policies and voluntary measures, see North Carolina Solar Center's Database of State Incentives for Renewable Energy, online at www.dsireusa.org.

2001). According to the National Renewable Energy Laboratory (NREL; Bird and Swezey, 2003), nine states currently have active competitive markets for renewable energy ("green marketing"), and more than 300 investor-owned utilities, municipal utilities, and cooperatives in 32 states have either implemented or announced plans to offer a special rate on renewable energy purchases ("green pricing").

Customer choice has resulted in more than 980 MW of new renewable capacity to date, with another 430 MW in the planning stage (NREL; Bird and Swezey, 2003). Four states (Washington, Kansas, Wyoming, and Texas) have installed two-thirds of the total capacity, with Washington leading the way at 321 MW, or one-third of the total (see Appendix D).

In terms of green pricing programs, Austin Energy has the highest new renewable energy sales (29 average MW). The Los Angeles Department of Water and Power has the largest number of customers participating (72,732). Moorhead Public Service has the highest customer participation rate (5.8 percent). To date, wind, solar, and landfill gas are the resources most commonly used for green pricing programs, with wind representing the largest portion of total capacity (79 percent). Wind also represents 99 percent of total capacity from green marketing.

Pennsylvania is the leader in planned capacity, with more than 91 MW, followed by Texas with 80 MW; together, the two states account for 40 percent of the total. The next four states (California, Oklahoma, North Dakota, and South Dakota) each have plans to install 40 to 50 MW or more of new capacity, which will also amount to more than 40 percent of the total.

Development resulting from voluntary customer choice is much smaller in scope than the projected development resulting from state standards and funds. A recent NREL study found that customer choice programs may only add enough renewable generation to equal 0.1 percent of U.S. electricity sales by 2010 (Wiser et al., 2001; EIA, 2003). UCS projects that existing state renewable electricity standards and funds will add 8.3 times as much renewable generation by that date.

Even under an optimistic scenario, NREL projected that customer choice programs would add 27 percent less renewable generation than UCS projects for existing state standards and funds (not counting additional state and national policies that might be enacted in the future). Ideally, renewable generation created by customer choice programs should be considered distinct from renewable generation created by state standards and funds, but some states allow these programs to be supported by renewable electricity funds and to count toward state standards.

Other policies and voluntary approaches have been effective in stimulating some renewable energy development and removing some market barriers. However, the development resulting from these approaches has been relatively small and, in many cases, difficult to attribute to specific policies. Development resulting from other policies and voluntary approaches through 2001 is included in our ranking of existing renewable energy generation by state (see Appendix C), but we did not include planned development in our forecasts because there is no guarantee that these projects will be built.[10]

10 For a listing of proposed wind projects by state, see the American Wind Energy Association's website at www.awea.org. These projects are the result of renewable electricity standards and funds, other policies, and voluntary measures.

Chapter 7

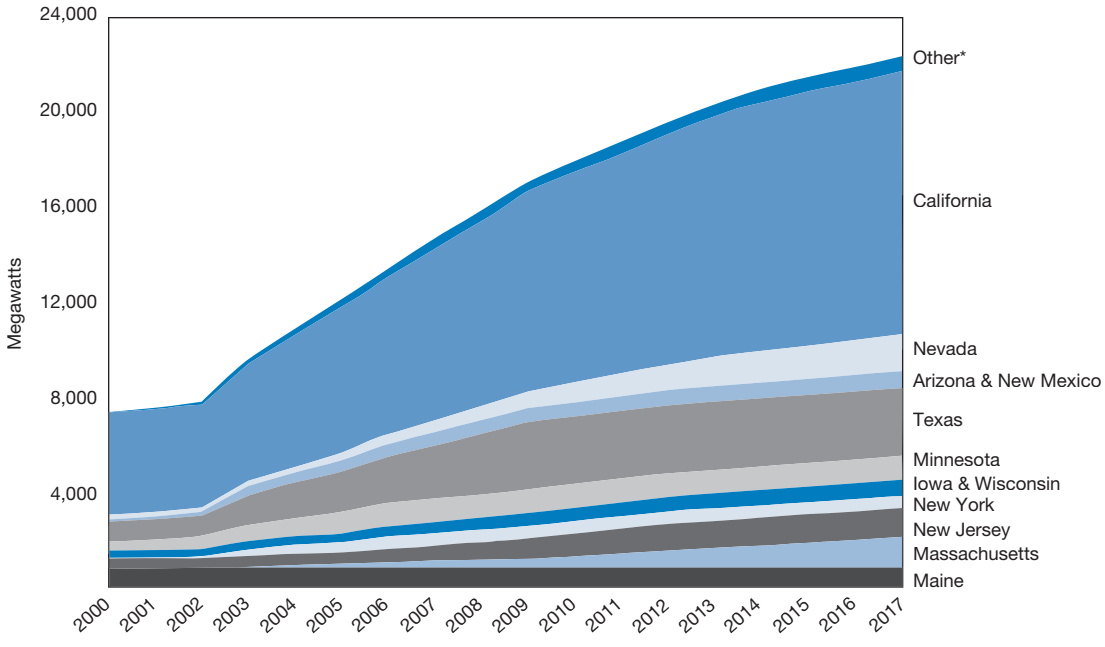
State Standards and Funds Summary

Significant new markets for clean energy mean more opportunity for developers, reduced renewable energy costs, and important benefits for consumers and the environment. As shown in Figure 7, state renewable electricity standards and funds will not only create new renewable energy markets, but also help support existing clean power capacity. UCS estimates that state standards and funds will lead to the development of 15,215 MW of new renewable energy capacity by 2017—enough to meet the electricity needs of 10.4 million typical homes. An additional 7,020 MW of existing renewable energy capacity receives ongoing support from state standards, for a total of 22,235 MW.

California, due to the significant commitments made in its standard and fund, will have the largest new market for renewable energy in 2017, at more than 6,750 MW (Figure 8). Texas, because of its size and the quality of its resources, will have the second largest new market, at 2,000 MW. These two states combined account for 58 percent of the total new development in all states. Nevada, Massachusetts, Minnesota, and New Jersey have also made significant commitments, each supporting greater than 500 MW of new renewable power. Combined, these five states account for 86 percent of the total new development in all states.

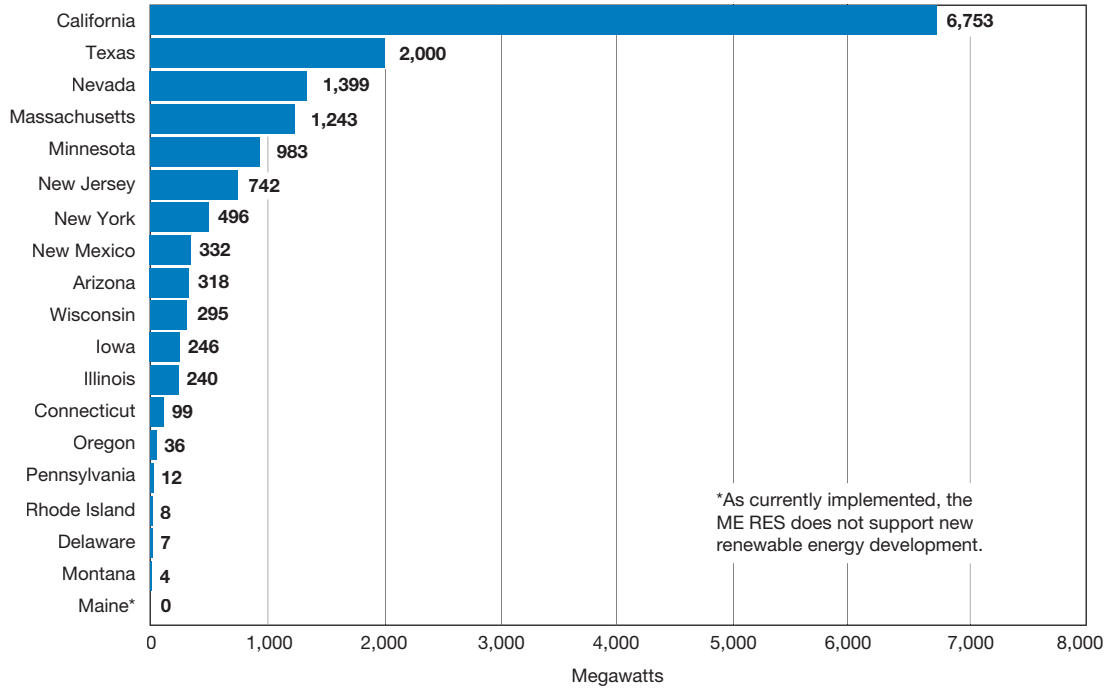
New renewable energy markets also help offset the pollution created by fossil fuel-burning power plants, whose carbon dioxide emissions are the single greatest contributor to climate change. By 2017, new renewable energy development from state

Figure 7
New and Existing Renewable Energy Capacity from State Standards and Funds



*Includes Connecticut, Delaware, Illinois, Montana, Oregon, Pennsylvania, and Rhode Island.
SOURCE: UCS, 2003.

Figure 8
New Renewable Energy Capacity from State Standards and Funds by 2017



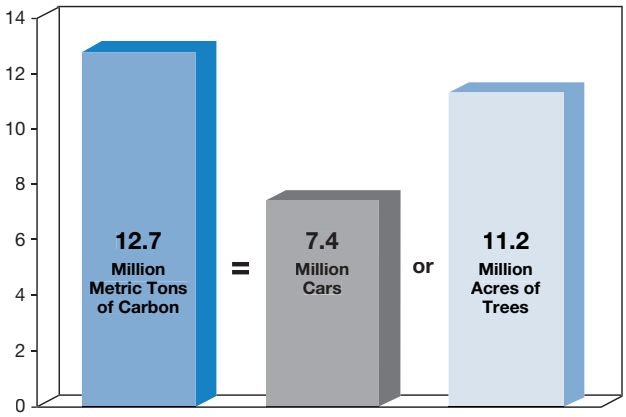
SOURCE: UCS, 2003.

standards and funds will reduce annual carbon emissions from power plants by an estimated 12.7 million metric tons (MMT). As shown in Figure 9, this is equivalent to taking 7.4 million cars off the road or planting 11.2 million acres of trees—an area approximately the size of Maryland and New Jersey combined.

Although these carbon reductions alone are not likely to have a significant impact on slowing climate change, the 19 states whose standards and funds are responsible for these reductions do represent a significant portion of the national economy. Their willingness to support policy solutions to climate change sends an important signal to our nation's capital and the rest of the world.

If the federal government followed state leadership and enacted a national renewable electricity standard of 20 percent by 2020, it would reduce U.S. carbon emissions from power plants by nearly 150 MMT compared with business as usual in 2020 (UCS, 2002b). Implementing a national renewable electricity fund and other policies to promote renewable energy and energy efficiency in addition to an RES would reduce U.S. carbon emissions by more than two-thirds compared with business as usual (Clemmer et al., 2001).

Figure 9 **Carbon Emission Reductions from New Renewable Energy Developed as a Result of State Standards and Funds, 2017**



SOURCE: UCS, 2003.

Chapter 8

Grading State Renewable Commitments

Commitments to renewable energy vary greatly from state to state. For renewable electricity standards, UCS determined the variables that best reflect a state's commitment are the rate at which the renewable target increases over time, ramp-up duration, and the extent to which the standard applies to all electricity suppliers in the states. The commitment represented by state funds varies according to the amount of funds available and how those funds promote the development and generation of a new renewable resource or support existing renewable facilities. Another indication of a state's commitment is how much renewable generation it has previously supported and is still in operation today. We grade future commitments more highly, however, for contributing to continued environmental improvement and supporting the development of new, cleaner, and increasingly efficient technologies.

RES proponents at state, federal, and international levels have long advocated an increase in renewable electricity sales of at least one percentage point per year. Several states, as well as the European Union, have already committed to this rate of increase, which should ensure the sustained orderly development of a mix of renewable energy technologies sufficient to achieve economies of scale and reduce costs. The goal is a gradual but steady transition to a more sustainable energy economy.

The duration of renewable energy commitments is key to establishing the growing market that manufacturers and developers of renewable energy technologies and projects need to make long-term investments and obtain long-term financing. Since renewable energy projects generally have large up-front costs for manufacturing and installation but very low operating costs and often zero fuel costs, the more favorable rates engendered by long-term commitments are critical in determining project costs. A commitment of 10 years or more maximizes opportunities and minimizes costs.

Ideally, renewable electricity standards and funds should cover all electricity suppliers and, thereby, all electricity customers. Standards that apply to all companies and customers will lead to the largest increases in renewable energy and the fairest allocation of renewable energy costs and benefits. Unfortunately, many states have exempted publicly owned utilities (municipal utilities and rural cooperatives), despite the fact that these companies may have excellent renewable resource opportunities and access to financing at more favorable rates than investor-owned utilities or independent generators. Other states have applied their standards to some companies but not to others.

While some subjectivity in grading is unavoidable, the criteria of higher rates of increase, longer ramp-up, and maximum customer coverage represent relatively simple, objective measures that can be used to compare state commitments on a level playing field. Many other criteria could have been used, such as new renewable generation or total renewable generation achieved by a certain date. Factors such as different start and end dates, however, make interpreting these comparisons difficult.

The chosen criteria are likely to produce larger measurable increases in renewable generation over time, but they do not guarantee success. Numerous variables in the implementation of standards and funds will affect actual performance. Some standards

have relatively simple designs that maximize cost-effective renewable generation; others are designed to achieve multiple objectives and will be more difficult to realize. All involve implementation or enforcement decisions that may preclude or limit a state's ability to achieve its projected results. We briefly describe some of the primary implementation challenges for each state in the discussion below. Detailed comparison of state implementation, however, is beyond the scope of this report, particularly since many state efforts are in the early stages.[11]

Passing Grades

Grade A. The highest grade, a straight A, was reserved for states that have standards or funds projected to achieve a rate of increase of one percentage point per year, last at least 10 years, and cover all customers. Unfortunately, no state achieved a straight A. UCS assigned A- grades to two states (California and Nevada) that meet the first two criteria, and apply to at least two-thirds of the electricity sales in each state (Table 10).

It should be noted that both states face many obstacles to successful implementation. California's standard has a particularly complex design that requires a high degree of regulatory oversight to determine the proper allocation of renewable energy costs between regulated utilities and the state's renewable electricity fund. Nevada utilities have been hampered by credit difficulties.

Grade B. UCS assigned B grades to states with standards or funds that achieve a rate of increase of at least 0.5 percent per year, last at least five years, and cover suppliers serving most customers. Three states qualified: New Mexico, Massachusetts, and Minnesota.

New Mexico received a B+ because its standard increases at an average rate of 1.1 percent per

11 For a more detailed discussion of implementation issues, see Nogee et al., 1999. For a detailed comparison of early-stage implementation decisions in Texas, see Wiser and Langniss, 2003.

Table 10 **Renewable Energy Report Card**

State	Grade	Distinction
California	A -	
Nevada	A -	
New Mexico	B+	
Massachusetts	B	
Minnesota	B	
New Jersey	C +	
Alabama	C	
Arizona	C	
Connecticut	C	Most likely to improve
Hawaii	C	
Iowa	C	Most likely to improve
Maine	C	Most likely to improve
New Hampshire	C	
Texas	C	
Vermont	C	
Wisconsin	C	Most likely to improve
Arkansas	D	
Delaware	D	
Florida	D	
Georgia	D	
Idaho	D	
Illinois	D	Most likely to improve
Kansas	D	
Louisiana	D	
Michigan	D	
Mississippi	D	
Montana	D	
New York	D	Most likely to improve
North Carolina	D	
Oregon	D	
Pennsylvania	D	
Rhode Island	D	Most likely to improve
South Carolina	D	
Tennessee	D	
Virginia	D	
Washington	D	Most likely to improve
Wyoming	D	
Alaska	F	
Colorado	F	Most likely to improve
Indiana	F	
Kentucky	F	
Maryland	F	Most likely to improve
Missouri	F	Hall of Shame
Nebraska	F	Hall of Shame
North Dakota	F	Hall of Shame
Ohio	F	
Oklahoma	F	Hall of Shame
South Dakota	F	Hall of Shame
Utah	F	Hall of Shame
West Virginia	F	

year for nine years. Because it was implemented through regulation rather than legislation, it does not cover publicly owned utilities or utilities covered by all-requirements contracts, which account for nearly 40 percent of electricity sales in the state. An additional provision penalizes wind power, which could reduce total new development.[12] Utility companies and industrial customers are still challenging the standard.

The Massachusetts standard ramps up at an average of about 0.6 percent per year for the first seven years (2003–2009), then continues increasing indefinitely by one percentage point per year until a date determined by the Massachusetts Division of Energy Resources. It therefore averages 0.8 percent per year through 2017. Massachusetts perhaps deserves extra credit for having the only state standard with an indefinite one percentage point per year increase, but this increase is less certain than other standards.

Minnesota, as previously described, has a unique standard that covers only one company but still accounts for more than half of the state's electricity sales. While its requirement has been specified in terms of megawatts of capacity, the rate of increase amounts to almost 0.8 percent per year of Xcel's electricity sales for a 12-year period.

Grade C. UCS assigned a C grade to states with projected increases of at least 0.2 percent per year for at least five years, and whose standards cover suppliers serving most customers. States also received a C grade if they did not meet this minimum ramp-up requirement but have a commitment to make new renewable energy more than one percent of total retail sales in 2017. States whose existing renewable resources provide five percent or more of retail sales also received C grades.

Under these criteria, one state—New Jersey—received a grade of C+. The New Jersey standard averages a 0.3 percent per year increase over 10 years, ramping up to 0.5 percent per year in the final six years. Though it does not cover publicly owned utilities, these companies represent an insignificant fraction of electricity sales in the state. Governor McGreevey also supports the recommendation made recently by a Renewable Energy Task Force he commissioned to double the current standard.

Ten states received a straight C. Iowa, Texas, Wisconsin, and Arizona each have qualifying renewable electricity standards. While their ambitions in terms of percentage of sales are relatively low, Texas and Wisconsin have both made excellent starts in implementing their standards, and the Texas standard, because of the size of the market, is particularly important to the industry. Both states have reasonable prospects for increasing their standards in the future, with Wisconsin Governor Doyle having proposed raising the minimum target to 10 percent by 2013. In Iowa, MidAmerican Energy recently headed off a bill for a 10 percent standard by 2010 by announcing plans to build a 310 MW wind farm.

Connecticut received a C because its strong renewable electricity fund will support new renewable energy generation of more than one percent of total electricity sales by 2017. Alabama, Hawaii, Maine, New Hampshire, and Vermont qualified for C grades based on their level of existing renewable energy generation.

Failing Grades

States receiving a grade of D or F do not pass the test of using their available renewable resources today or making commitments to do so in the future. States with a commitment to new renewable energy

12 Under New Mexico's RES, renewable energy developers receive one credit per kilowatt-hour generated by wind power, three credits for solar, and two credits for all other eligible resources.

below one percent of total retail sales in 2017 or with existing renewable generation between one and five percent today received a D grade. States with no commitment to future renewable energy development whatsoever and low levels of existing renewable energy (below one percent of sales) received an F grade.

Special Distinctions

Most Likely to Improve. UCS also identified those states likely to receive a higher grade in the future if a renewable standard has been proposed or improvements to an existing standard are under consideration.

Hall of Shame. Many states that received a failing grade have enough renewable energy potential to generate between 2 and 200 times their current electricity use. These states' lack of commitment to renewable energy through a renewable electricity standard or fund is truly a shame.

Overall, only 16 states received a passing grade of C or better. The great majority of states—34—received a D or F. UCS nominated six of the failing states to its Hall of Shame and recognized 10 states where significant improvement can be expected if proposed development or policies bear fruit.

Chapter 9

Conclusion

By adopting strong commitments to renewable energy, the United States has the potential to promote local economic development, improve our national security by reducing dependence on imports, strengthen the electricity system through diversity, and reduce the environmental and health impacts of our heavy reliance on fossil fuels and nuclear power.

Since the April 2000 publication of the UCS report *Clean Power Surge: Ranking the States*, three additional states have enacted renewable electricity standards: Nevada, California, and New Mexico. Arizona and Delaware have established funds to support renewable energy development, and three states (California, Illinois, and New York) have significantly increased their renewable funding. These commitments are expected to support more than 20,000 MW of renewable energy by 2017.

This year, a number of states are considering new renewable standards, and several others may strengthen existing standards. Individual utilities, municipalities, and customers are making voluntary commitments to renewable energy as well, contributing to robust market growth during the last two years.

Despite this important progress, renewable energy sources such as wind, solar, bioenergy, and geothermal provide less than two percent of our electricity. Much more is needed to clean up the electricity system and create a viable, long-lasting market for renewable energy.

The bigger picture is one of inaction and wasted opportunities. The UCS report card on state renewable commitments shows that few states deserve a passing grade. Only two states (Nevada and California) received an A-; both have renewable electricity standards that increase at an average rate of one percent of electricity sales per year for at least 10 years. Just three states (Massachusetts, Minnesota, and New Mexico) received a B+ or a B; their standards increase at average rates of at least 0.5 percent per year for at least five years. Eleven states received a C+ or a C because they either have standards with ramp-ups of at least 0.2 percent a year for at least five years or their existing renewable resources contribute to five percent or more of their electricity mix.

Nearly 70 percent of the states received grades of D or F because of a lack of commitment to future renewable energy development or the lack of renewable electricity generation today. This is unfortunate considering the fact that consumers in these 34 states use two-thirds of all the electricity consumed in the United States. A handful of states have policy proposals and renewable development underway that would improve their grade, while six states (Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Utah) were consigned to the Hall of Shame because they received a failing grade despite having some of the best renewable energy potential in the country.

The Case for a National Renewable Electricity Standard

The poor performance of most states speaks to the need for a renewable electricity standard implemented at the national level. A national standard would address the fact that the majority of states have yet to make any specific commitments to renewable energy either through funds or standards. It would also provide an opportunity to create a more level playing field among states that have already enacted standards, by enforcing a minimum standard that states could still choose to exceed.

Bills proposing a strong national renewable electricity standard were introduced both last year and this year in the U.S. House and Senate. These bills envision a national policy to increase America's use of renewable energy to 20 percent of electricity supplies by 2020 or 2025. UCS found that by increasing our use of renewable energy one percent a year through 2020, the United States can meet a significant portion of its electricity needs with renewable energy while generating substantial economic and environmental benefits (UCS, 2002b).

Such a standard would increase our total homegrown renewable power to more than 170,000 MW by 2020. America's strong winds, significant bioenergy resources, and geothermal energy would power the majority of this development.

In terms of economic benefits, this standard would produce:

- $80 billion in new capital investment[13]
- $5 billion in new property tax revenues for local communities
- $1.2 million in wind power-related lease payments to farmers and rural landowners
- More than double our use of homegrown bioenergy fuels, providing billions in income for farmers

UCS also found that a 20 percent standard by 2020 would reduce long-term energy costs to consumers. Increased competition from renewable energy would result in natural gas prices nine percent lower than business as usual in 2020, which more than offsets the slightly higher costs of generating renewable energy. Thus, total annual consumer energy bills (not including transportation) would be $4.8 billion, or one percent lower, in 2020. The present value of total consumer savings would be $4.5 billion between 2002 and 2020.

In addition, the increased use of renewable energy in the United States would help reduce air pollution. Power plant emissions of carbon dioxide, which fuels global warming, would be 19 percent lower nationwide by 2020 with a national renewable electricity standard. Other pollutants that harm human health would also be reduced, as would the damage to water and land resulting from extraction, transport, and use of fossil fuels.

While neither the Senate nor the House has yet supported a 20 percent standard by 2020, the Senate did pass an energy bill in 2002 that contained the first-ever national renewable electricity standard. This standard would have required major electric companies to increase sales of renewable electricity by an average of 0.6 percent a year starting in 2005 and reaching 10 percent by 2019. UCS analysis found that this standard would have produced the following benefits:

- more than 74,000 MW of renewable power;
- $17 billion in new capital investment;[14]
- $1.2 billion in new property tax revenues for local communities;
- $410 million in wind power-related lease payments to farmers and rural landowners;
- $3.8 billion in annual savings on consumer energy bills in 2020;
- cumulative savings on consumer energy bills of $7.8 billion between 2002 and 2020; and
- reductions of approximately 27 million metric tons of annual carbon emissions by 2020 (UCS, 2002).

13 Results presented are in 1999 dollars. Cumulative results are in net present value using a five percent real discount rate.

14 Results presented are in 2000 dollars. Cumulative results are in net present value using an eight percent real discount rate.

Our findings are similar to those of the U.S. Energy Information Administration's analyses of a 20 percent RES by 2020 and a 10 percent RES by 2020. The EIA found that a 10 percent standard without an end date would create cumulative net present value savings for energy consumers of $13.2 billion through 2020. Increasing the standard to 20 percent by 2020 would result in greater diversity as well as environmental and economic benefits, and would provide consumers with $5.7 billion in total savings through 2020 (EIA, 2002; EIA 2001b).

Most states are making insufficient commitments to renewable energy, leaving far too much of the nation's renewable energy potential untapped. Increasing renewable energy development to the level needed to ensure a clean, diverse, secure, and independent electricity system is *not* a task best left to individuals and a handful of states. We need a strong national policy with specific goals for making renewable energy a key element of the U.S. electricity system, with the flexibility for states and individual consumers to contribute more.

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Appendix A

Methodology and Assumptions

The methodology and assumptions we used to rank states by renewable energy potential, existing renewable energy generation, and the impact of renewable energy standards and funds are described below.

Renewable Energy Technical Potential

We estimated renewable energy potential by resource and state using data from several existing studies completed by the U.S. Department of Energy (DOE) and the national energy laboratories. In some cases, we made adjustments to these data to incorporate more recent information. The assumptions and data sources used in this report to calculate wind, bioenergy, geothermal, and solar energy potential follow.

Solar. We estimated the technical potential for solar power using the same method developed for the *Renewable Energy Atlas of the West* (LWF, 2002). First, we obtained data on average solar insolation by state from the Climatological Solar Radiation (CSR) model developed by NREL (George and Maxwell, 1999; Maxwell et al., 1998). Second, we assumed electricity would be generated from distributed solar photovoltaic (PV) panels installed on rooftops and open spaces covering 0.5 percent of the total land area of each state. Third, we assumed solar panels would occupy 30 percent of the total area, with the remainder taken up by supporting infrastructure. Fourth, we assumed an average system efficiency of 10 percent for converting solar energy to electricity. This is conservative considering the fact that crystalline silicon PV modules have demonstrated efficiencies as high as 22.7 percent under laboratory conditions. However, commercial systems typically have much lower overall efficiencies on average (LWF, 2002).

We did not include the potential from concentrating solar PV or centralized solar thermal systems, which have considerably higher efficiencies than distributed PV and would result in a higher potential. And, like the other renewable resources and technologies discussed above, the potential for solar power represents a theoretical potential using fairly simple constraints, and does not consider the economic viability of installing these systems. A 1996 NREL study found that economic factors such as retail electric rates, tax credits and incentives, financing options, net metering, and correlation to peak demand are important in determining the most cost-effective locations for solar power (NREL, 1997).

Wind. We used data on windy land area by state that was developed by the Pacific Northwest Laboratory (PNL; Elliot et al., 1991) and subsequently revised by the Energy Information Administration (EIA; Doherty, 1995) and NREL. The data, which include windy land area by state for class 3 and higher wind resources within 20 miles of existing transmission lines, are based on PNL's "environmental and moderate land use" scenario. This excludes all urban and environmentally sensitive areas[15], 50 percent of forest land, 30 percent of agricultural land, and 10 percent of range and barren land. We further reduced the windy land area by approximately 40 percent in mountainous states and 20 percent in other states to account for additional siting and land-use restrictions not included in the original data.

15 Includes parks, monuments, U.S. Forest Service lands, wilderness areas, wildlife refuges, and wetlands.

We converted windy land area into wind power capacity by assuming a wind density of 6.7 MW per square kilometer based on data from EIA (EIA, 2002c). We converted capacity into generation using capacity factors for different wind classes based on data from the Electric Power Research Institute (EPRI, 1997).

Studies by EIA, the *Renewable Energy Atlas of the West*, and others have only included class 4 and higher wind resources. We decided to include class 3 resources in this study because the DOE expects these areas could become economically viable in the next 10 to 20 years, as research and development—along with growth in the global market—improves performance and lowers the cost of wind power. In fact, class 3 wind areas are already being developed in Wisconsin and Illinois, as well as in countries such as Germany and Denmark.

Bioenergy. State bioenergy potential is based on data from Oak Ridge National Laboratory (ORNL; Walsh et al., 2000). Bioenergy resources include mill, forest, crop, and urban wood residues and energy crops such as switchgrass, hybrid poplars, and willows. ORNL only includes resources available for less than $50 per dry ton including transportation costs. For mill residues, ORNL only includes residues not currently being used for energy. For forest residues, ORNL only includes logging residues and dead wood, and excludes roadless areas, steep slopes, and small living trees. More than half of the remaining residues are also excluded to ensure sufficient residues remain for forest health and sustainability. For urban wood residues, ORNL excludes contaminated wastes. For crop residues, ORNL only includes corn stover and wheat straw, and assumes 60 to 70 percent of the residues are left on the land to maintain soil quality and prevent erosion. Energy crop production assumes recommended management practices and is limited to areas climatically suited for production and do not require irrigation, which excludes all 11 western states.

We estimated the amount of energy that could be produced from bioenergy using ORNL's standard assumptions about the heating value of different resources. We then calculated the amount of electric capacity and generation using an average heat rate of 10,800 Btu/kWh, assuming bioenergy would be co-fired with coal in existing plants or used in new biomass gasification plants.

Geothermal. State geothermal potential is based on data for 51 specific sites in nine western states included in EIA's National Energy Modeling System (EIA, 2002d). These data only include high-temperature geothermal sites suitable for electric power generation.

Landfill gas. State landfill gas potential is based on data for all landfills included in the U.S. Environmental Protection Agency's Landfill Methane Outreach Program database (EPA, 2002). We estimated the potential for producing electricity at sites in which the EPA did not include a capacity estimate by assuming one megawatt of capacity per million tons of waste in place.

The government studies we used for wind and geothermal energy, which were completed in the late 1980s and early 1990s, are in need of updating. While progress has been made in updating the potential for these technologies in some states, updates have not been completed for all states. For example, a 2002 study by the Land and Water Fund of the Rockies and other groups estimated the renewable energy potential for 11 western states, including new wind resource assessments for seven of the states (LWF, 2002). These new assessments, which used more sophisticated models and different criteria and assumptions for defining potential than the older national assessment, result in a higher potential. The study also used slightly different assumptions for bioenergy and geothermal energy potential, excluding some of the technical potential that the national studies show are available in the West and other states. Since we are ranking the renewable energy potential for all 50 states, we decided to use the comprehensive national assessments identified above so we could apply a consistent methodology across all states.

Existing Renewable Energy Generation

We used data from EIA to identify existing renewable energy generation and capacity by state for the year 2000 (EIA, 2002b). We then updated these data to the year 2001 by making two adjustments. First, we added new wind projects installed in 2001 as reported by the American Wind Energy Association (AWEA, 2003) to account for the record-breaking 66 percent growth in total U.S. installed wind capacity that year. We estimated the generation from these sites by using average capacity factors for different wind classes representative of current projects. Second, we replaced EIA's data that combine landfill gas and municipal solid waste (MSW) incineration with data on landfill gas capacity installed through 2001 from the DOE's Renewable Electric Plant Information System (DOE, 2002) and the EPA's Landfill Methane Outreach Program database (EPA, 2002).

The Impact of Renewable Electricity Standards and Funds

To estimate the effects of renewable electricity standards and funds in each state, we have attempted to reflect state-specific conditions by collecting information from each state's laws and rules and its experience to date. Nonetheless, there are several uncertainties in the estimates. Many states, for example, are in the initial stages of implementing their policies, and it is not clear what the mix of technologies will be, how states will spend their funds, and whether any adjustments will be made to the policies over time. Since most of the standards rely on market-based decisions, the results are impossible to know in advance with precision.

For renewable electricity standards, we calculated expected growth in electricity sales for companies covered by each state's standards. This was done by either using the average annual growth rate over the past 10 years based on data from EIA or forecasts made by state public utility commissions or utilities.

To determine ramp-up rates, we calculated the average annual rate of increase in new renewable energy development from the start date of the ramp-up to either the end date or 2017, whichever was sooner.

To estimate renewable generation in each state, we applied covered electricity sales by state and year to the scheduled increase in renewable energy targets.

To estimate renewable capacity in each state, we used average capacity factors for different technologies where we had information on the actual or expected mix of technologies. For states where we did not have this information, we used an average capacity factor of 50 percent to represent a mix of base load (biomass, landfill gas, and geothermal) and variable output (wind and solar) technologies. Finally, we calculated renewable generation and capacity for both existing and new facilities as defined in each state's standard.

The effects of renewable electricity funds were more difficult to calculate. This is because states may target their funds in different ways, including large-scale auctions, consumer education, green marketing, research and development, venture capital, and emerging technologies. In a few states, where projects have been developed as a result of the funds, we used actual data. In the other states, we assumed that new renewable energy projects would require a long-term above-market payment of two cents per kWh to be competitive. We believe this value is conservative based on actual experience in states such as New York and California that have spent some of their funds. Given the different ways that states may spend their funds, however, we view this value as highly uncertain.

Appendix B

Renewable Energy* Potential Ranking (as a Percent of Total 2001 Electricity Sales)

Rank	State	Percent of Total 2001 Electricity Sales					
		Total	Wind	Biomass	Solar	Geothermal	Landfill Gas
1	North Dakota	18,611%	17,722%	339%	550%		0%
2	South Dakota	16,781%	15,779%	289%	712%		0%
3	Montana	10,977%	9,913%	96%	967%		1%
4	Wyoming	8,432%	7,807%	18%	607%		0%
5	Nebraska	6,247%	5,863%	133%	250%		1%
6	Kansas	5,356%	5,073%	92%	190%		1%
7	Iowa	2,674%	2,438%	128%	107%		1%
8	Oklahoma	2,524%	2,367%	39%	117%		1%
9	New Mexico	2,279%	1,661%	9%	581%	27%	1%
10	Minnesota	1,940%	1,785%	55%	100%		1%
11	Colorado	1,542%	1,283%	13%	202%	41%	4%
12	Idaho	743%	327%	56%	313%	47%	0%
13	Texas	650%	568%	10%	72%		1%
14	Nevada	531%	91%	2%	357%	80%	1%
15	Utah	486%	112%	5%	324%	43%	1%
16	Oregon	374%	125%	37%	166%	46%	1%
17	Vermont	302%	159%	30%	112%		0%
18	Maine	288%	82%	30%	176%		0%
19	Wisconsin	244%	149%	36%	58%		1%
20	Missouri	241%	121%	42%	76%		1%
21	Arkansas	209%	58%	52%	99%		0%
22	Arizona	195%	12%	3%	170%	9%	1%
23	New Hampshire	173%	70%	32%	59%		2%
24	Washington	159%	73%	22%	60%	3%	0%
25	Illinois	154%	84%	37%	30%		2%

Appendix B **continued**

Rank	State	Percent of Total 2001 Electricity Sales					
		Total	**Wind**	**Biomass**	**Solar**	**Geothermal**	**Landfill Gas**
26	California	150%	38%	7%	56%	46%	4%
27	Mississippi	150%	0%	64%	85%		0%
28	Michigan	132%	77%	18%	36%		1%
29	West Virginia	120%	38%	22%	60%		0%
30	New York	110%	76%	10%	22%		2%
31	Massachusetts	88%	73%	5%	10%		1%
32	Alabama	88%	0%	36%	52%		1%
33	Pennsylvania	86%	54%	9%	22%		1%
34	Louisiana	70%	0%	24%	45%		1%
35	Indiana	67%	10%	29%	26%		1%
36	Delaware	65%	45%	6%	13%		1%
37	Georgia	63%	1%	22%	40%		0%
38	Virginia	61%	15%	15%	30%		1%
39	Tennessee	61%	3%	25%	33%		1%
40	Kentucky	61%	1%	22%	37%		1%
41	South Carolina	53%	1%	20%	32%		0%
42	North Carolina	53%	5%	15%	32%		1%
43	Connecticut	52%	36%	5%	11%		1%
44	Ohio	43%	4%	19%	18%		1%
45	New Jersey	34%	23%	2%	7%		2%
46	Florida	31%	0%	8%	22%		1%
47	Rhode Island	28%	12%	3%	9%		4%
48	Maryland	27%	10%	5%	11%		1%
U.S. Total		**561%**	**459%**	**24%**	**71%**	**6%**	**1%**

* Renewable energy resources included here are wind, bioenergy, geothermal, landfill gas, and solar photovoltaics. Hydropower resources are not included in this estimate. Data not available for Alaska and Hawaii.

SOURCES: For wind, UCS estimate based on a state breakout of data developed for Doherty, J., "U.S. Wind Energy Potential: The Effect of the Proximity of Wind Resources to Transmission Lines," *Monthly Energy Review*, Energy Information Administration, February 1995. For bioenergy, UCS estimates based on data from Walsh, M. et al., *Biomass Feedstock Availability in the United States: 1999 State Level Analysis*, Oak Ridge National Laboratory (updated 2000), available online at: bioenergy.ornl.gov/pubs/econ_assess. html. For solar, UCS estimate based on solar radiation data from National Renewable Energy Laboratory, 2002, using assumptions in the *Renewable Energy Atlas of the West*, July 2002, available online at: www.energyatlas.org. For geothermal, Energy Information Administration, National Energy Modeling System, 2002. For landfill gas, UCS estimates based on data from the U.S. Environmental Protection Agency, Landfill Methane Outreach Program database, available online at: www.epa.gov/lmop/projects/projects.htm.

Appendix C

State Ranking of Renewable Energy* Generation as a Percent of Total Sales, 2001

Rank	State	Renewable Energy Generation as a Percent of Sales
1	Maine	28.4%
2	Hawaii	11.4%
3	California	10.3%
4	New Hampshire	10.1%
5	Vermont	7.3%
6	Alabama	5.5%
7	Nevada	5.3%
8	Louisiana	4.2%
9	Arkansas	4.1%
10	Mississippi	4.1%
11	Wyoming	3.5%
12	Georgia	2.8%
13	Washington	2.8%
14	Minnesota	2.7%
15	Oregon	2.6%
16	Idaho	2.5%
17	Michigan	2.5%
18	Iowa	2.3%
19	Virginia	2.0%
20	South Carolina	1.9%
21	Florida	1.8%
22	Wisconsin	1.8%
23	North Carolina	1.6%
24	Rhode Island	1.6%
25	Texas	1.5%
26	Tennessee	1.1%
27	Kansas	1.1%
28	Pennsylvania	0.8%
29	New York	0.8%
30	Utah	0.7%
31	Alaska	0.7%
32	Massachusetts	0.6%
33	Colorado	0.6%
34	Montana	0.5%
35	Ohio	0.5%
36	Illinois	0.4%
37	Maryland	0.4%
38	New Jersey	0.4%
39	Oklahoma	0.3%
40	Connecticut	0.2%
41	Nebraska	0.2%
42	South Dakota	0.1%
43	New Mexico	0.1%
44	Indiana	0.1%
45	Arizona	0.1%
46	Delaware	0.04%
47	Kentucky	0.02%
48	North Dakota	0.01%
49	Missouri	0.01%
50	West Virginia	0%

* Renewable energy resources included here are solar, wind, bioenergy, geothermal, and landfill gas. Hydropower is not included in this estimate.
SOURCES: For solar, geothermal, and wood/waste: U.S. Energy Information Administration, *Renewable Energy Annual 2001*, DOE/EIA-0603(2001), November 2002. Available online at: www.eia.doe.gov/cneaf/solar.renewables/page/rea_data/rea_sum.html. For other bioenergy (energy crops/waste sludge), UCS estimate based on U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Renewable Electric Plant Information System (REPIS) Version 6.0, available online at: www.eere.energy.gov/repis. For wind, UCS estimate based on American Wind Energy Association, Wind Project Database, January 2003. Available online at: www.awea.org/projects/index.html.

Appendix D

New Renewable Energy from Green Power Customer Choice

State	Installed (kW)	Planned (kW)
Arizona	5,416	756
California	42,998	50,002
Colorado	65,735	1,860
Connecticut	19	-
Florida	1,557	3,188
Georgia	-	9,000
Hawaii	22	1
Illinois	-	8,000
Indiana	-	3,200
Iowa	3,900	-
Kansas	111,500	-
Kentucky	-	2,400
Massachusetts	1,658	2,400
Michigan	2,455	3,200
Minnesota	13,740	1,900
Nebraska	5,180	-
Nevada	16	-
New Jersey	52	7,500
New Mexico	660	1,320
New York	48,150	-
North Dakota	7,000	40,000
Ohio	28	-
Oklahoma	-	50,000
Oregon	6,563	-
Pennsylvania	34,610	91,230
South Carolina	2,200	-
South Dakota	-	41,650
Tennessee	8,290	28,340
Texas	99,774	80,236
Vermont	-	160
Virginia	-	2,000
Washington	321,455	1,066
West Virginia	66,000	-
Wisconsin	25,592	1,967
Wyoming	107,700	-
Total	**982,270**	**431,376**

SOURCE: Bird and Swezey, 2003.

Plugging In Renewable Energy

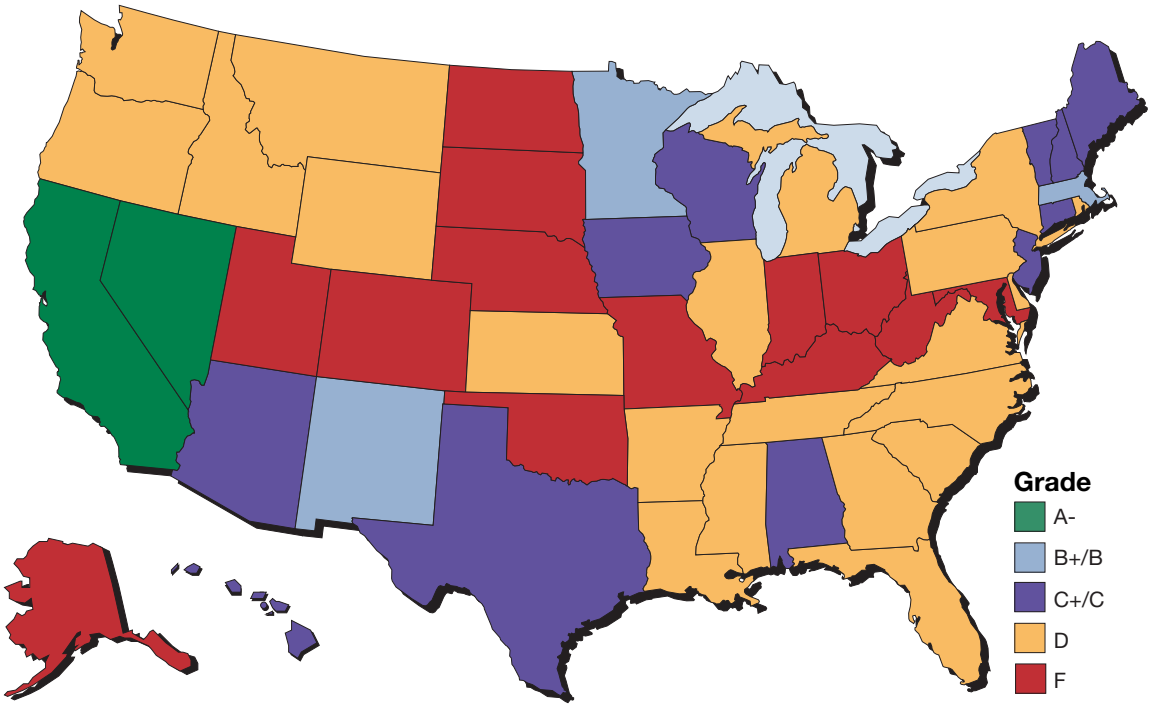
GRADING THE STATES

America's electricity system is dominated by fossil fuels. The result is a system that lacks diversity and security, threatens the health of our citizens, jeopardizes the stability of Earth's climate, and robs future generations of clean air, clean water, and energy independence.

We are leaving far too much of the nation's renewable energy potential untapped. Strong commitments to renewable energy can promote local economic development while reducing the impact of fossil fuels.

This report assesses the renewable energy performance of all 50 states and assigns grades to each. While a few are setting a positive example for other states and the federal government, it is clear that we still have a long way to go to reach the level of renewable energy needed to ensure a clean, diverse, secure, and independent electricity system.

Closing the renewable energy gap is too important a goal to leave to individuals and a handful of states. What America needs is a strong national policy with specific goals for plugging renewable energy into the electricity system.



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