

OREGON'S CLEAN ENERGY ECONOMY

A Clean Edge *State Clean
Energy Leadership Index* Report



TABLE OF CONTENTS

02 Introduction

04 Clean Electricity

Utility-Scale Clean Electricity Generation
Installed Wind Energy Capacity
Installed Solar PV Capacity
Clean Electricity - Spotlight & Key Lessons

08 Clean Transportation

EVs & HEVs
EV Charging Stations
Clean Transportation – Spotlight & Key Lessons

11 Energy Intelligence

Green Building
Smart Meters
Energy Intelligence – Spotlight & Key Lessons

14 Financial Capital

Clean Energy Venture Capital
Utility Energy Efficiency Programs
Green Power Purchasing
Financial Capital – Spotlight & Key Lessons

18 Workforce & Innovation

Clean Energy Jobs
Clean Energy Patents
Workforce & Innovation – Spotlight & Key Lessons

21 Clean Energy Policy

Policy Checklist

22 Conclusion

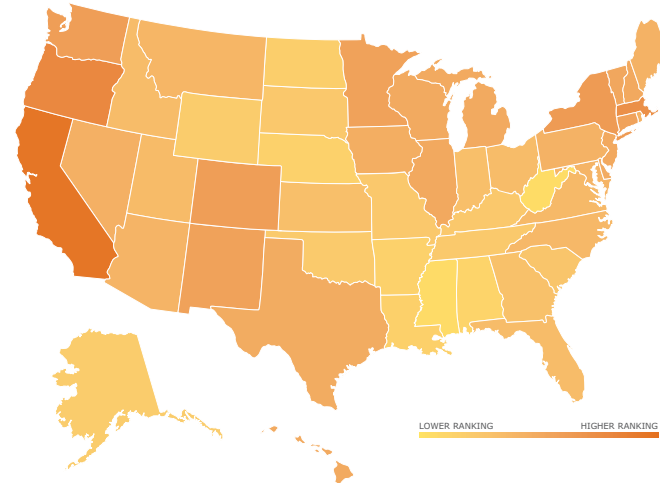
Introduction

As the global clean-energy economy continues on a path of increasingly lower costs and accelerated growth, the U.S. remains an integral industry player—a technology developer, a product manufacturer, and a market for clean-energy technology deployment. But after decades without consistent federal support, America’s clean-energy sector has become geographically fragmented, with states and cities acting as the primary drivers of growth. While some regions made early proactive efforts to attract clean-energy companies, jobs, deployment, and investment, others opted to ignore the sector altogether and are only now beginning to realize the economic benefits of clean-energy pursuits.

This report, sponsored by the Portland Development Commission and Business Oregon, two key economic development agencies within the state, evaluates Oregon’s standing in the U.S. clean-energy economy. The report leverages data from Clean Edge’s 2011 *State Clean Energy Leadership Index*, a subscription-based research service that provides a unique perspective of U.S. clean-energy activity by aggregating and analyzing industry datasets from a variety of public, private, and Clean Edge sources. The index produces annual comprehensive performance scores and rankings for all 50 U.S. states based on activity in three key clean-energy categories: technology, policy, and capital.

The following pages highlight Oregon’s strongest areas of activity and compare the state’s performance against national averages and performances of five other top performing states chosen for their similar characteristics and high frequency of interstate competition: Arizona, California, Colorado, Massachusetts, and Texas. Topics covered include clean electricity, clean transportation, energy

2011 STATE CLEAN ENERGY LEADERSHIP INDEX



RANK	STATE	SCORE	RANK	STATE	SCORE
1	California	95.3	26	Montana	40.3
2	Oregon	79.4	27	North Carolina	38.0
3	Massachusetts	71.8	28	Virginia	36.9
4	New York	63.1	29	Utah	35.9
5	Colorado	60.2	30	Ohio	35.2
6	Washington	60.0	31	Florida	35.0
7	New Mexico	57.0	32	Idaho	34.6
8	Minnesota	57.0	33	Indiana	32.2
9	Connecticut	56.9	34	Kansas	32.1
10	Vermont	53.2	35	Georgia	30.8
11	New Hampshire	51.3	36	South Carolina	26.8
12	Illinois	51.1	37	Missouri	25.3
13	New Jersey	50.8	38	South Dakota	24.7
14	Michigan	50.2	39	Kentucky	24.5
15	Wisconsin	49.9	40	Tennessee	23.8
16	Hawaii	49.7	41	Oklahoma	22.0
17	Delaware	48.7	42	Wyoming	21.2
18	Texas	47.6	43	Alaska	20.3
19	Iowa	46.8	44	North Dakota	19.3
20	Nevada	45.0	45	Louisiana	16.8
21	Rhode Island	43.8	46	Nebraska	16.4
22	Pennsylvania	43.4	47	Arkansas	15.8
23	Maine	42.7	48	Alabama	13.2
24	Arizona	40.7	49	Mississippi	6.9
25	Maryland	40.5	50	West Virginia	6.4

Source: Clean Edge, Inc., 2011

intelligence (green building, smart grid, etc.), financial capital, workforce and innovation, and policy structure.

Oregon's robust industry presence earned it a second-place ranking in the 2011 *State Clean Energy Leadership Index*. Trailing only California's overall score of 95.3 (out of 100), Oregon's score of 79.4 was enough to beat out the next three top performers Massachusetts, New York, and Colorado. Of the states compared against Oregon in this report, California scored highest, followed by Massachusetts at 71.8 (third place), Colorado with 60.2 (fifth), Texas at 47.6 (18th), and finally Arizona at 40.7 (24th). With only six states earning scores higher than 60 and a median U.S. score of 40.4, results of the *State Clean Energy Leadership Index* indicate that while examples of clean-energy activity can be found in every corner of the nation, a clear top tier of states exhibits leadership across a wide variety of clean-energy sectors and activities.

Oregon's significant technology deployment, supportive government policies, and successful track record of capital attraction and job creation have given the state a prominent standing in the U.S. clean-energy industry. But with increased domestic and foreign industry competition, and an overall economic climate that has left most states constrained for capital, business as usual will not guarantee Oregon a lasting competitive edge. This report aims to examine Oregon's successes, compare its performance against other leading states, and uncover lessons which will enable Oregon to continue its leadership into the next era of clean energy.

2011 STATE CLEAN ENERGY LEADERSHIP INDEX

OREGON

OVERALL PERFORMANCE



CATEGORY PERFORMANCE



Clean Electricity

UTILITY-SCALE CLEAN ELECTRICITY GENERATION In the United States, the electric power sector accounts for roughly two fifths of total energy consumption, two fifths of total carbon dioxide emissions, and one third of all greenhouse gas emissions. These facts make electricity generation the frontline in America’s battle to break free of fossil fuels, limit carbon emissions, and develop a clean-energy future.

Oregon’s abundance of low-carbon energy sources—wind, hydroelectric, biomass, solar, and geothermal—gives the state a unique opportunity to establish an electricity supply practically free of fossil fuels. The state’s clean electricity activity is already among the best in the nation, with wind, hydro, biomass, solar, and geothermal making up more than 63 percent of all utility-scale electricity generation in the state. At 55 percent of total generation, hydro is the largest source of Oregon’s low-carbon electricity, although we do not consider large-scale hydroelectric dams to be environmentally neutral. Wind power also plays a substantial role in Oregon, making up more than seven percent of electricity generation in 2010, up from 1.5 percent in 2005..

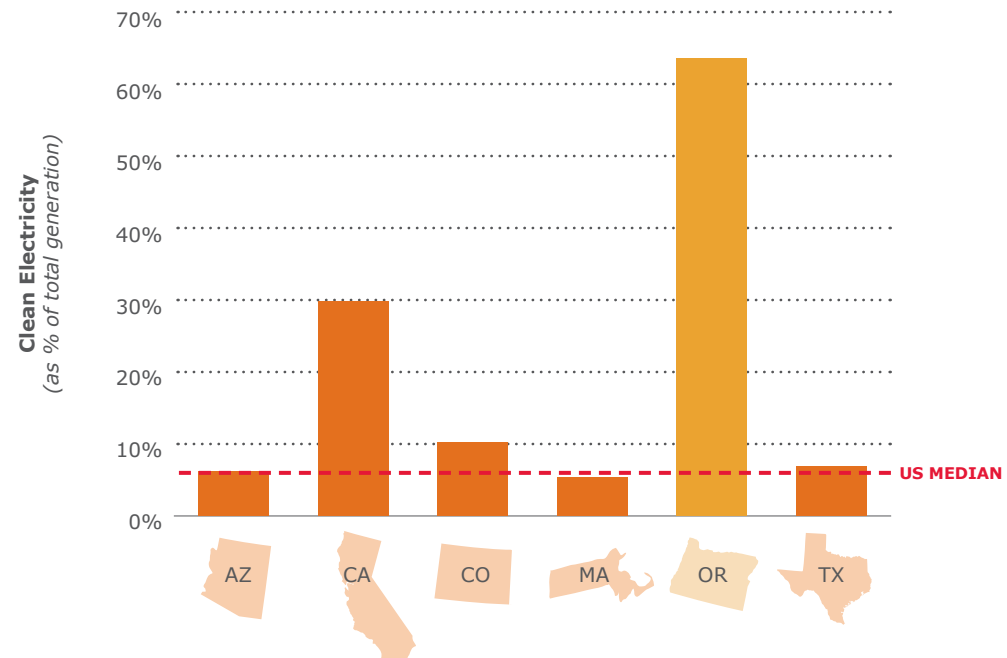
Elsewhere in the nation, electricity remains largely tied to fossil fuels, with coal, oil, and gas providing 70 percent of U.S. electricity in 2010. But with leading clean-energy states implementing increasingly aggressive renewable portfolio standard (RPS) targets—25 percent by 2025 in Oregon, 30 percent by 2020 in Colorado, and 33 percent by 2020 in California—clean energy is transforming much of the U.S. electric grid.

UTILITY-SCALE CLEAN ELECTRICITY GENERATION (2010)

State	Clean Electricity (as % of total generation)	Wind (MWh)	Solar (MWh)	Geothermal (MWh)	Biomass (MWh)	Hydro (MWh)
Arizona	6.2%	119	17	0	161	6,626
California	29.9%	6,614	823	12,958	6,343	33,876
Colorado	10.2%	3,430	33	0	58	1,746
Massachusetts	5.4%	17	0	0	1,265	1,034
Oregon	63.8%	3,919	0	0	949	30,288
Texas	6.9%	26,132	2	0	1,071	1,032

Source: EIA with Clean Edge analysis

see table below



INSTALLED WIND ENERGY CAPACITY With 2,104 MW of wind energy installed by the end of 2010, Oregon ranked sixth in the U.S. in total wind capacity, trailing only Texas, Iowa, California, Minnesota, and Washington. Oregon also placed sixth for wind as a percent of total peak capacity (14.7 percent) and sixth for wind's share of total generation (7.1 percent), best of the six states compared in this report. Iowa, with 25.2 percent of its peak capacity from wind, leads the nation for wind as a share of total capacity, and also leads for wind as a percent of total generation (15.4 percent). Texas may dominate in cumulative wind capacity with 10,085 MW installed through 2010—more than the next three states combined—but the Lone Star state barely cracks the top 10 overall when measuring wind as a percent of peak capacity; it ranks eighth at 9.41 percent.

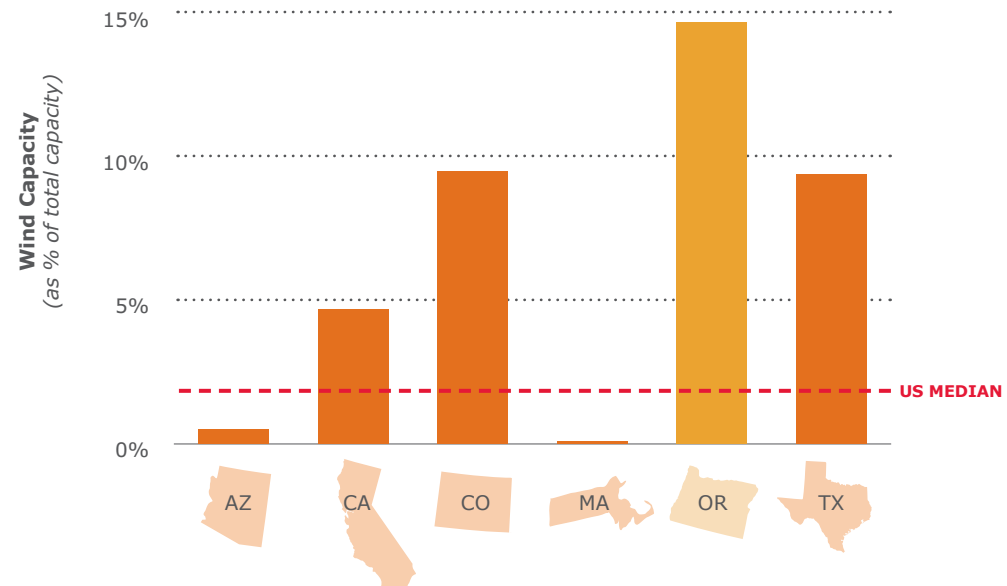
After a lackluster 2010, the U.S. wind industry regained some momentum in 2011. The American Wind Energy Association reports that 2,151 MW of new capacity was brought online in the first half of the year, a 72 percent increase from the first half of 2010. Oregon, although not adding any wind capacity in the first three months of 2011, added 201 MW in the second quarter of the year—second most in the country behind only California's 420 MW of new capacity. Near term prospects for wind energy in Oregon remain promising. The state has rich wind resources, enjoys close proximity to a California market hungry for clean electrons, and is home to many major wind companies including the North American headquarters for both Vestas Wind Systems and Iberdrola Renewables.

INSTALLED WIND CAPACITY (2010)

State	Wind Capacity (as % of total capacity)	Wind Capacity (MW)
Arizona	0.49%	128
California	4.72%	3,177
Colorado	9.48%	1,299
Massachusetts	0.13%	18
Oregon	14.74%	2,104
Texas	9.41%	10,085

Source: AWEA with Clean Edge analysis

see table below



INSTALLED SOLAR PV CAPACITY In the U.S., solar remains a minor source of electric generating capacity—the 2,600 MW of installed solar capacity at the end of 2010 accounted for roughly just 0.25 percent of the nation’s peak capacity. But with rapidly declining costs for solar photovoltaic (PV) technology and a shift of focus from small rooftop installations to utility-scale projects (larger than one MW capacity), the stage is set for major U.S. solar growth. By mid-2011, more than 1,500 MW of utility-scale project capacity was under construction in the U.S., with another 26,000 MW of utility-scale capacity in earlier stages of development, according to the Solar Energy Industries Association.

To date, PV deployment in the U.S. has been concentrated in only a few states, with the top five states accounting for roughly three-fourths of all installed capacity. California, with its favorable climate, supportive government incentives, and large size, is home to nearly half of the nation’s PV capacity. Although trailing well behind California, Arizona and Colorado are also top-tier U.S. solar markets. Colorado ranks third in cumulative PV capacity and fifth for PV as a percent of total capacity, while Arizona ranks fourth and seventh, respectively, for these measures. Although some distance behind the top few states, Oregon also performs fairly strong in installed solar capacity, ranking 12th in terms of solar as a percent of total capacity.

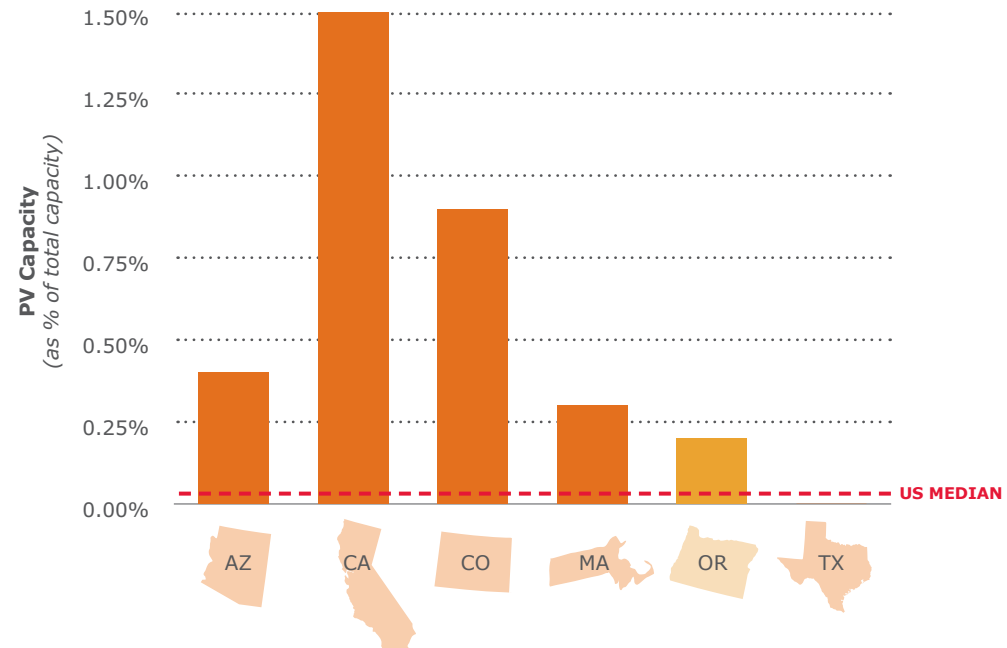
Massachusetts and Oregon are both highly involved in the U.S. solar sector—Oregon as a leading manufacturer and Massachusetts as a technology developer—but neither has yet been able to leverage industry presence to grow the local solar market for deployment. Admittedly, neither state enjoys the near-perpetual sun seen in the American Southwest, but the solar resource of both states exceeds that of Germany, the world’s leading market for PV deployment.

INSTALLED SOLAR PV CAPACITY (2010)

State	PV Capacity (as % of total capacity)	PV Capacity (MW)
Arizona	0.40%	104.9
California	1.52%	1021.5
Colorado	0.86%	117.4
Massachusetts	0.27%	37.5
Oregon	0.16%	23.5
Texas	0.03%	34.5

Source: IREC with Clean Edge analysis

see table below



Clean Electricity

SPOTLIGHT

CAITHNESS SHEPHERDS FLAT WIND FACILITY



Shepherds Flat Wind Farm is an 845 MW wind farm currently being developed by Caithness Shepherds Flat, a subsidiary of independent power producer Caithness Energy. The project is expected to be the largest wind farm in the U.S. upon completion, although larger wind farms are expected in coming years. Shepherds Flat is located entirely on private property in parts of both Morrow and Gilliam counties in north-central Oregon, near the town of Arlington in the Columbia River Gorge. The project, once completed, is expected to cost \$2 billion and produce 2 billion kWh each year, enough to power about 235,000 homes.

General Electric is an investor and partner in the project and was awarded the \$1.4 billion contract to provide 338 2.5 MW turbines. Other investors include Google and Japanese trading companies Itochu Corp. and Sumitomo Corp. The project has also received a \$1.3 billion loan guarantee from the U.S. DOE.

State regulators approved the project in 2008 and groundbreaking took place in 2009. All the power generated will be purchased by Southern California Edison and used in California under a 20-year fixed price power purchasing agreement.

KEY LESSONS

- Approximately 64 percent of Oregon's in-state electricity generation comes from utility-scale renewables, biomass, and hydro, making it a national leader. Only three other states generate more of their electricity from these sources.
- Including hydro—and thanks to a deep commitment to energy efficiency—the state could get 75 percent of its generation from renewable sources by 2025.
- The state has an abundance of low-cost electricity, providing a reliable, stable supply of energy. As a result, companies with energy-intensive activities like data centers and solar manufacturing are moving to the state.
- Low-cost electricity makes it more difficult for renewables to compete on a kWh basis, but the state has continued to support market adoption via concerted incentives. PGE's green pricing program has more participants than any program in the nation.
- Oregon's transmission grid will need upgrading to continue exploiting the region's rich renewable energy resources. This is especially important to the state's efforts to export clean electrons to the resource-starved California market.

Clean Transportation

EVS AND HEVS Late 2010 marked the beginning of the electric vehicle (EV) era in the U.S., as the first two mass-produced EVs – the Chevrolet Volt and the Nissan LEAF – hit the retail market. The Volt, a plug-in hybrid EV, was initially made available in California, Washington, D.C, Austin, and New York City, while the all-electric LEAF was released to inaugural markets in California, Arizona, Oregon, Washington state, and Tennessee. Both cars are now available nationally. More EV models are on the way from nearly every major car maker, and the first wave of sales will provide much insight into which markets hold the most promise for America’s EV future.

The geographic concentration of hybrid electric vehicles (HEVs) in the U.S. serves as a valuable indicator of where early EV adopters most likely reside. At the end of 2010, roughly one in four hybrids on the road in the U.S. could be found in California. California’s clean transportation leadership stems from its Zero Emissions Vehicle program, which enforces standards on cars sold in the state. In per capita terms, Oregon and Massachusetts ranked third and sixth, not far behind California.

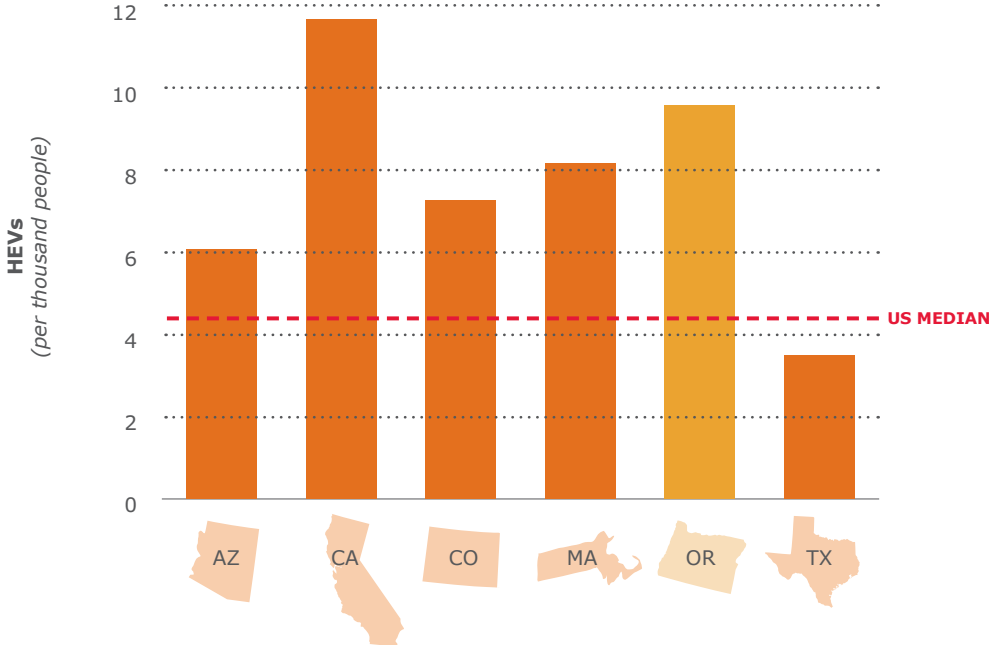
Given EVs’ currently high price tags, purchasing incentives will play an important role in early adoption. The federal government offers a \$7,500 EV purchasing incentive, and this is complemented in many states with additional available funds. Colorado leads all states with a \$6,000 incentive, while California and Oregon follow closely with incentives of up to \$5,000 available. In total, 20 states were offering purchasing incentives for high-efficiency vehicles by the end of 2010.

HYBRID-ELECTRIC VEHICLES (2010)

State	HEVs Per Thousand People	HEVs on the Road
Arizona	6.1	40,495
California	11.7	437,814
Colorado	7.3	37,131
Massachusetts	8.2	54,288
Oregon	9.6	37,167
Texas	3.5	88,115

Source: R.L. Polk with Clean Edge analysis (as of 10/31/2010)

see table below



EV CHARGING STATIONS Establishing a network of charging stations is a crucial step in electrifying America’s automobile fleet. Based on the amount of time vehicles spend in different locations, it’s widely agreed that the home is the most important location for placement of charging infrastructure, followed by the workplace, and finally roadside public charging stations. As a result of efforts to cure consumers’ range anxiety and create clusters of EV-friendly communities around the nation, the number of public charging stations is quickly on the rise. Charging station data shown here, accurate as of mid-2011, indicates progress in the development of regional public charging networks.

The undeniable frontrunner in public EV charging availability is the West Coast, with Oregon, Washington, and California ranking as the top three states for total charging stations as well as charging stations per capita. Arizona, Colorado, Massachusetts, and Texas have some ground to make up if they hope to catch the leaders out west – each state sits at roughly the national average for EV charging station deployment per capita.

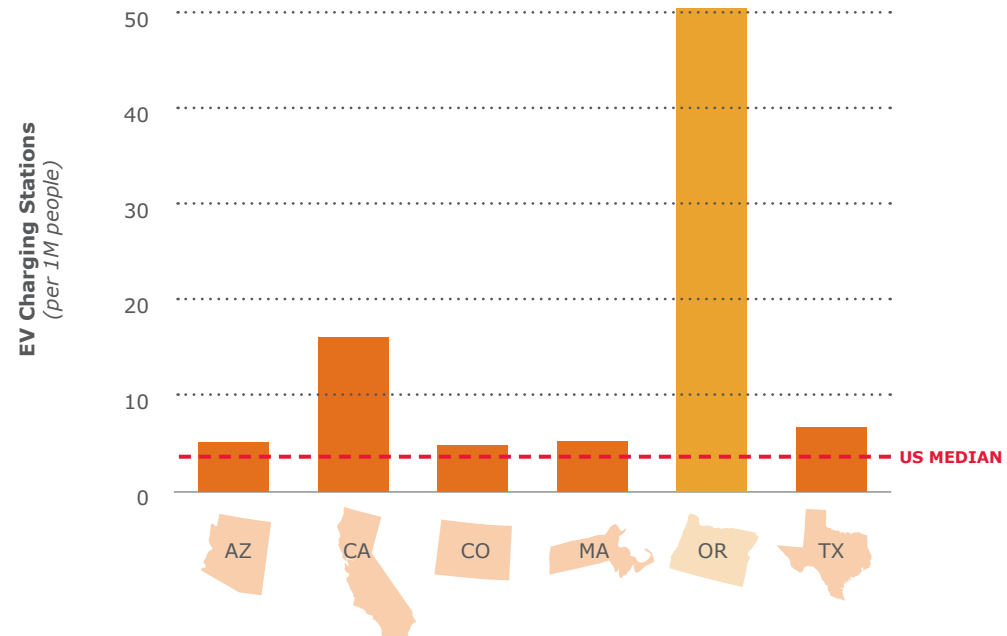
Further deployment of EV charging infrastructure will be led by an assortment of regional and national initiatives. The EV Project, for example, is a \$230 million campaign that will install more than 14,000 chargers across six states and the District of Columbia. Additional regional efforts include – but are not limited to – collections of chargers along I-5 in Oregon, the Route 495 Beltway in Boston, and the 240-mile I-45 corridor between Dallas and Houston.

PUBLIC EV CHARGING STATIONS (2011)

State	EV Charging Stations per 1M People	Total Public EV Charging Stations
Arizona	5.2	35
California	16.2	602
Colorado	4.9	25
Massachusetts	5.3	35
Oregon	50.6	195
Texas	6.7	170

Source: DOE with Clean Edge analysis (as of 6/30/2011)

see table below



Clean Transportation

SPOTLIGHT

PSU/PGE "ELECTRIC AVENUE"



Electric Avenue is a two-year demonstration and research project being facilitated by Portland State University (PSU), Portland General Electric (PGE), and the City of Portland to help Oregon offer more transportation options by allowing EV owners to park and charge their vehicles. The project is showcasing EVs, charging technology, and urban design as well as providing PSU researchers access to real-world data on charging stations. Users pay for parking but the charging is free.

The Electric Avenue is located along SW Montgomery Avenue between Broadway and Sixth in downtown Portland and offers eight parking spaces with charging stations, including a DC quick charger provided by Cleveland-based Eaton Corp. capable of charging most EVs in 20-30 minutes. The Avenue also includes electric bike outlets and Level 2 (240-volt) and Level 1 (120-volt) charging stations capable of full charges in approximately four to six hours and 12 hours, respectively. In addition to Eaton Corp., ECOtality, General Electric, OpConnect, Shorepower Technologies, and SPX have provided charging stations for the project.

KEY LESSONS

- Oregon ranks #3 in the U.S. in hybrid electric vehicle adoption on a per-capita basis, behind only California and Vermont.
- The state is aggressively pursuing the transition to all-electric and plug-in electric vehicles, ranking first in the nation for the number of EV charging stations per capita.
- The market for EVs is just starting to materialize, but the state's green-conscious consumers are likely to drive early adoption of these zero-emissions vehicles.
- Full-vehicle manufacturing for EVs will likely be done in a few select centers, such as Michigan, Tennessee, and Japan. But a number of Oregon companies active in EV energy storage, vehicle components/systems, and charging infrastructure could make a big impact in the sector. The state's EV industry association, Drive Oregon, is supporting the growth and development of the sector.
- Oregon has also become home to an increasing number of one-, two-, and three- wheel EV companies, including Arcimoto, Brammo, Green Lite Motors, and Ryno Motors that could reinvent urban transport.
- The state, with its history in streetcars and light rail vehicles, is home to the only U.S. manufacturer of modern streetcars, United Streetcar.

Energy Intelligence

GREEN BUILDING The last decade witnessed meteoric growth in the green building industry worldwide. In 2000, only a handful of Leadership in Energy and Environmental Design (LEED) certified projects existed, but today more than 10,000 projects span the globe, covering 1.5 billion square feet. And LEED growth remains strong, with more than 81,000 projects registered to be completed in coming years.

Among U.S. states, Oregon was an early mover and remains a LEED building frontrunner. The state is home to one of the three original chapters of the U.S. Green Building Council and a number of prominent leading green developers like Gerding Edlen, SERA Architects, and PAE Engineering. As a result, Oregon ranks first in the nation in LEED-certified projects per capita. At the end of 2010 the state had 231 total projects, including 29 at the Platinum level and 116 rated LEED Gold. While California ranks first in total projects with 1,081, Oregon’s per-capita total is double that of California’s. Colorado and Massachusetts perform similarly to Oregon in total projects, but still trail when measured in per capita.

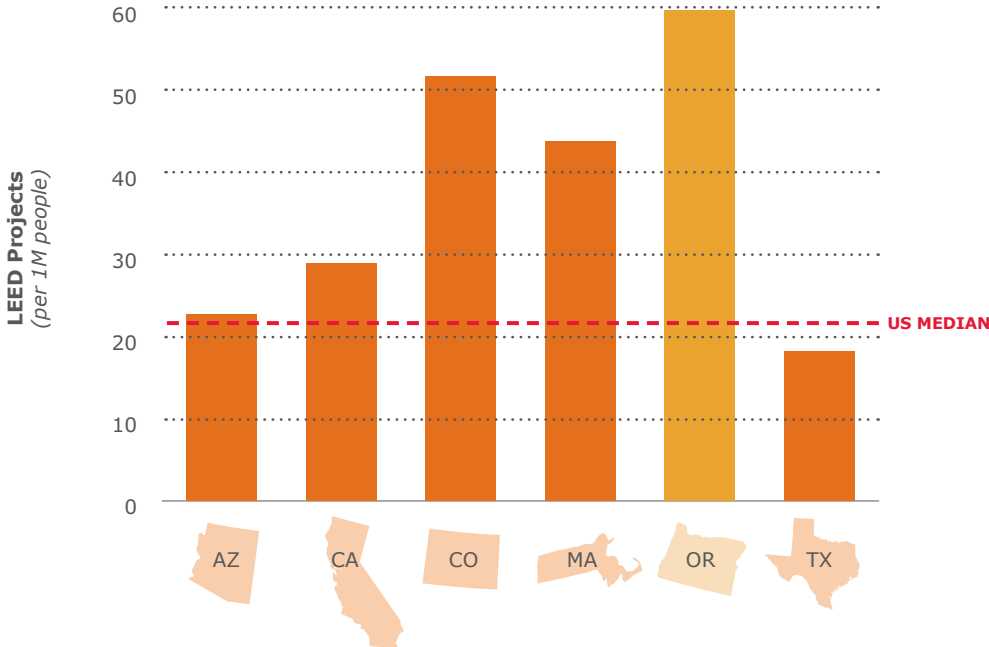
Because building stock is extremely slow to turn over, retrofitting existing structures is perhaps the most impactful step to improving overall energy efficiency. Efforts like Energy Upgrade California, Renew Boston, and Clean Energy Works Oregon are driving efficiency improvements while simultaneously creating much-needed jobs in participating communities. Underemployed, energy-inefficient regions should take note.

LEED BUILDING DEPLOYMENT (2010)

State	LEED Projects Per 1M People	Total LEED-Certified Projects
Arizona	22.8	152
California	29.0	1081
Colorado	51.8	264
Massachusetts	43.9	291
Oregon	59.9	231
Texas	18.3	462

Source: USGBC with Clean Edge analysis

▼
see table below



SMART METERS As smart meter projects have worked their way through regulatory and planning processes and started to come to fruition, the replacement of traditional meters with technologically advanced smart meters has rapidly accelerated. Capable of near real-time data gathering, two-way communication between the meter and central system, and other benefits such as power quality monitoring, smart meters enable customers to better manage energy use and utilities to offer peak consumption-curbing services like demand response. And despite some issues with early projects, we expect smart meter penetration to continue to see significant year-over-year growth as states complete existing projects and others start new ones.

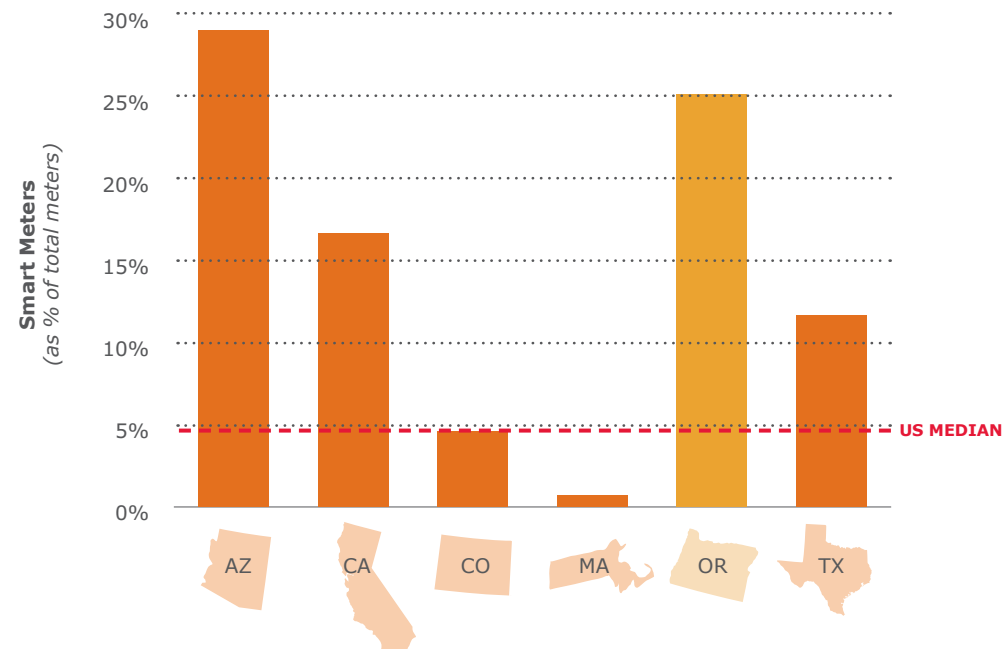
A 2010 Federal Energy Regulatory Commission survey estimated that smart meter penetration in the U.S. has grown to nearly nine percent, increasing from the one percent rate reported in the 2006 survey. But while deployment has been substantial, it has not occurred uniformly across all regions. The top five states report smart meter penetration above 22 percent – Arizona (29.1), Oregon (25.2), Idaho (24.7), Pennsylvania (24.3), and Wisconsin (22.2) – but 28 states have less than five percent and eight, mostly northeastern states, have less than one percent. The scale and pace of states’ deployments is also notable. From 2007 to 2009, California – led by state-backed regulatory programs and the active involvement of many of the state’s public and private utilities – installed an astounding 2.3 million smart meters, vaulting 27 spots to sixth in smart meter penetration. Similarly, Arizona and Oregon rose 17 and 21 places during the same time period to claim first and second place respectively.

SMART METER DEPLOYMENT (2010)

State	Smart Meters (as % of total meters)	Smart Meters
Arizona	29.1%	847,177
California	16.7%	2,475,896
Colorado	4.6%	111,330
Massachusetts	0.7%	20,831
Oregon	25.2%	478,897
Texas	11.7%	1,284,179

Source: FERC with Clean Edge analysis

see table below



Energy Intelligence

SPOTLIGHT

CLEAN ENERGY WORKS OREGON



Clean Energy Works Oregon (CEWO) is a non-profit program established to reduce energy waste by encouraging energy-efficiency investments and retrofits among qualified property owners. The program began in Portland in April 2010 when it was awarded \$20 million from the U.S. DOE and has since expanded to much of the rest of the state. By the end of 2013 the program aims to retrofit 3.5 million square feet of commercial space and 6,000 homes, as well as save more than 300,000 MBTUs of energy and reduce carbon dioxide by 200,000 metric tons.

With CEWO, homeowners can finance up to \$30,000 in energy-efficient upgrades with no money down. Free home energy assessments (worth \$500) are available for qualified applicants, eliminating the guesswork from potential energy savings, and loans typically can be repaid directly on heating bills. In addition to the state and federal departments of energy, the program includes many partners such as the City of Portland, Energy Trust of Oregon, Enterprise Cascadia, PGE, Pacific Power, and NW Natural.

KEY LESSONS

- Oregon ranked #1 among U.S. states in LEED-certified green building projects per capita in 2010, and has a rich history of LEED adoption.
- While Oregon is a clear leader in LEED projects, it fares less well in Energy Star buildings, ranking only in the Top 15 for commercial and residential certifications.
- The state is #2 for smart meter penetration nationwide, with smart meters representing 25 percent of total meters.
- Oregon has an opportunity to lead in the deployment of ultra-efficient, energy neutral buildings. The Pacific Northwest-based International Living Future Institute recently launched the first certification program for net-zero energy buildings.
- Although low-cost energy is a barrier to implementing energy efficiency, the region's Sixth Northwest Conservation and Electric Power Plan includes some of the most aggressive energy efficiency measures in the nation.
- Energy Trust of Oregon offers a model for the rest of the nation, being responsible for about \$100 million of annual dollars provided to Oregon residences and businesses to reduce energy use.

Financial Capital

CLEAN-ENERGY VENTURE CAPITAL With its capital-intensive nature and dependence on government policy, clean tech presents many challenges to venture capital investors. Even so, the sector’s popularity has grown dramatically. In 2010, the \$7.8 billion of global venture investment in clean-tech startups was the highest annual total to date. Another \$4.6 billion was invested globally during the first half of 2011, according to Cleantech Group data. In the U.S., investment in clean-tech startups has grown from less than one percent of the nation’s venture capital activity in 2000 to more than 23 percent of total VC dollars in 2010.

But the geographical distribution of these investments is highly concentrated. From 2008 through 2010, nation-leading California attracted more than \$8.6 billion dollars of clean-energy VC investment, Massachusetts brought home \$1.2 billion, and third-place Colorado raked in \$730 million. These three states alone represented three-fourths of all U.S. clean-energy venture activity over the last three years.

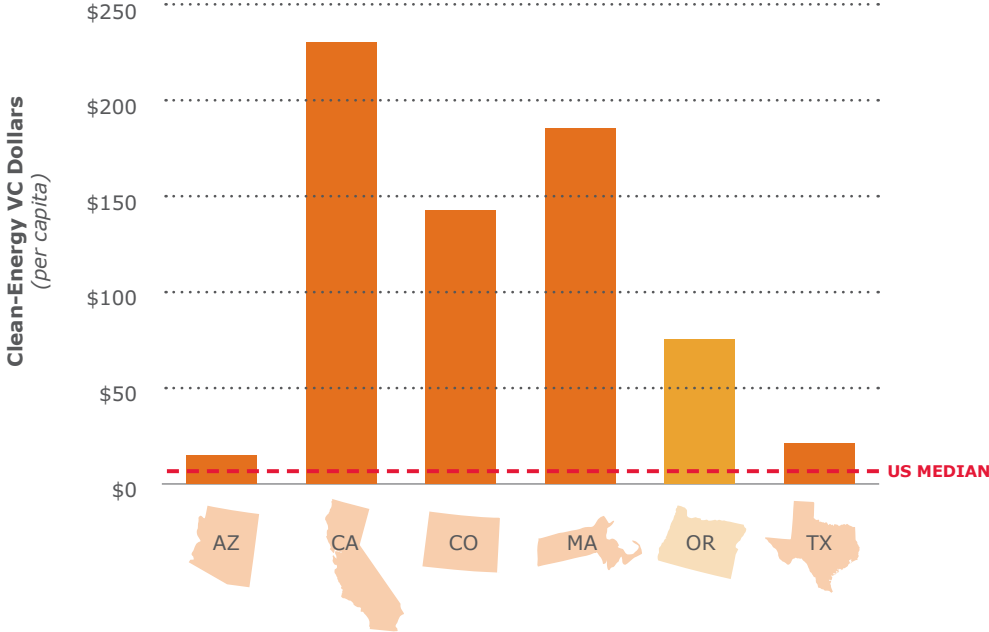
Although still trailing some distance behind the top states, Oregon’s \$291 million of clean-energy venture investment from 2008 through 2010 was the sixth most of any state and good enough for fifth place in investment dollars per capita. With major announcements like fuel cell maker ClearEdge Power’s \$73.5 million financing round in August 2011, Oregon is showing it can still attract serious VC dollars. Since 2008, the state has also seen several exits for startups with a local presence: transformer monitor technology provider Serveron (acquired by BPL Global); silicon producer Solaicx (bought by MEMC Electronic Materials); and solar inverter maker PV Powered (purchased by Advanced Energy Industries).

CLEAN-ENERGY VENTURE CAPITAL INVESTMENT (2008-2010)

State	Clean-Energy VC Dollars Per Capita	Total Clean-Energy VC Investment (\$ Millions)
Arizona	\$15.02	\$100.29
California	\$231.09	\$8,612.04
Colorado	\$143.28	\$730.06
Massachusetts	\$186.03	\$1,233.65
Oregon	\$75.53	\$291.22
Texas	\$21.38	\$539.03

Source: Cleantech Group with Clean Edge analysis

see table below



UTILITY ENERGY EFFICIENCY PROGRAMS Often overlooked as a “source” of clean energy, energy efficiency offers a low-cost way to reduce utility bills, ease peak hour electricity demand, and postpone the need for new generating capacity. Capital flow into energy efficiency is increasing and U.S. ratepayer-funded efficiency program budgets have ballooned from \$2.6 billion in 2006 to \$6.6 billion in 2010, according to the Consortium for Energy Efficiency (CEE).

Similar to the geographical concentration seen in other clean-energy activities, a majority of energy efficiency dollars are spent in a small group of states. Totalling \$2.7 billion in 2010, electric energy efficiency budgets in California, New York, Florida, and Massachusetts made up 50 percent of the U.S. total, says CEE. In terms of actual program expenditures per capita (shown at the right), California, Massachusetts, and Oregon all performed very well, ranking fifth, sixth, and tenth, respectively, out of all states for 2009 expenditures. Arizona, Colorado, and Texas did not crack the top 20.

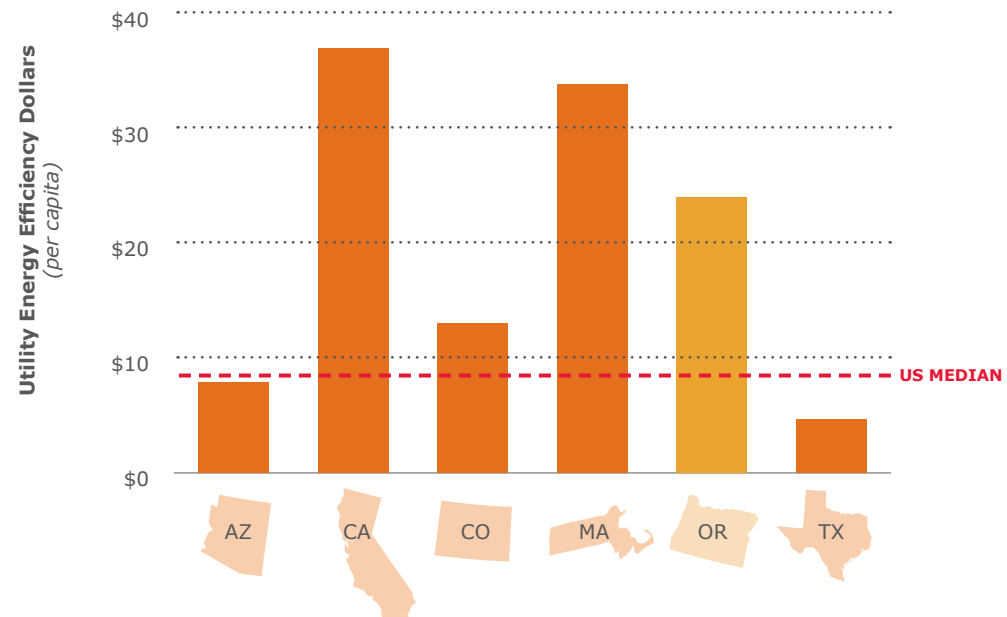
One major challenge for energy efficiency is that utilities are traditionally organized to maximize profit through the sale of more electricity. If energy efficiency reduces electricity sales, it can become a direct threat to the utility’s bottom line. Decoupling, a method of separating profits from electricity sales, exists in some states. But without it, many utilities still battle with a fundamental disincentive to pursue efficiency improvements. By the end of 2010, Arizona, California, Massachusetts, and Oregon each had implemented utility revenue decoupling for both electricity and natural gas. Colorado had decoupling in place for gas, but not electricity. And Texas had yet to enact decoupling for either gas or electricity.

UTILITY ENERGY EFFICIENCY PROGRAM EXPENDITURES (2009)

State	Utility Energy Efficiency Dollars Per Capita	Total Utility Energy Efficiency Expenditures
Arizona	\$7.86	\$51.80
California	\$37.04	\$1,366.50
Colorado	\$13.02	\$65.30
Massachusetts	\$33.89	\$223.40
Oregon	\$24.06	\$92.00
Texas	\$4.70	\$116.30

Source: Consortium for Energy Efficiency with Clean Edge analysis

see table below



GREEN POWER PURCHASING Utility green pricing programs to support clean-energy development offer customers the opportunity to pay premium rates to cover any above-market costs of clean-energy installations. More than 860 utilities, including cooperatives, investor-owned, and municipal utilities, currently offer a green pricing option, according to the U.S. Department of Energy. Given that these are voluntary opt-in programs, green pricing activity offers a great insight into local consumer support for clean-energy development.

In 2010, the top green pricing programs by total kWh sold were those from Austin Energy in Texas, Portland General Electric (PGE) in Oregon, PacifiCorp operating in several western states, Sacramento Municipal Utility District (SMUD) in California, and Xcel Energy, also operating in multiple states. Measured by total program participants, PGE comes out on top, followed by PacifiCorp, Xcel Energy, SMUD, and PECO in Pennsylvania.

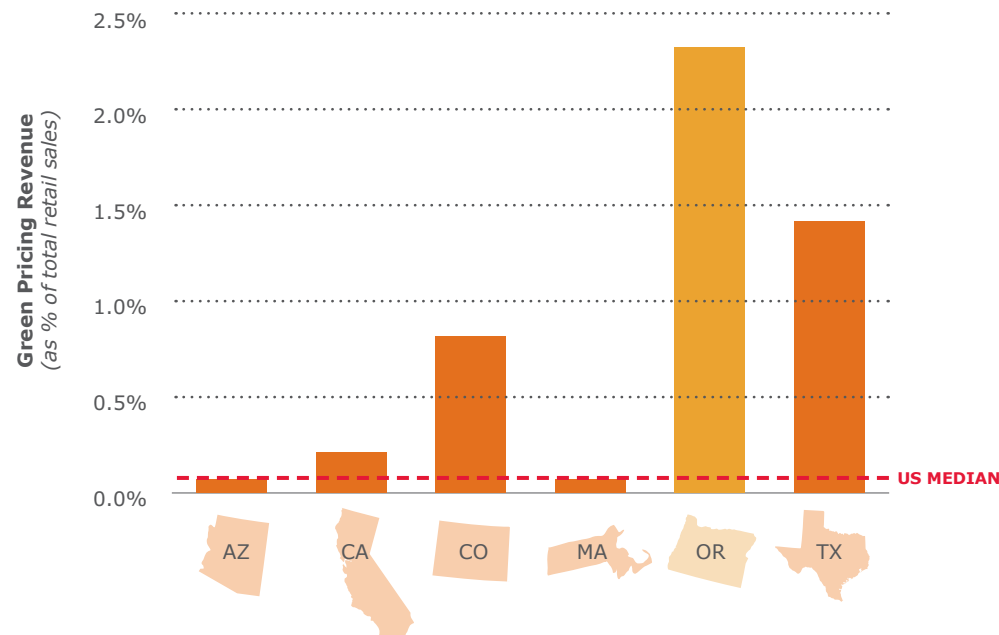
Oregon and Texas, with 2.33 and 1.42 percent of their total electricity revenue coming from green pricing—representing almost \$83 million and \$485 million respectively—lead the nation in green pricing revenue as a percentage of total retail electricity sales. The two states are home to top-performing green electricity programs in Portland and Austin. Only two other states, Delaware and Kentucky, which ranked third and fourth (1.40 and 1.37 percent), had more than one percent of sales from green pricing.

GREEN PRICING PROGRAM REVENUE (2009)

State	Green Pricing Revenue (as % of Total Retail Sales)	Total Green Pricing Program Revenue (\$ Millions)
Arizona	0.07%	\$5.13
California	0.21%	\$72.78
Colorado	0.82%	\$34.98
Massachusetts	0.07%	\$6.23
Oregon	2.33%	\$82.74
Texas	1.42%	\$484.88

Source: EIA with Clean Edge analysis

see table below



Financial Capital

SPOTLIGHT

OREGON DOE STATE ENERGY LOAN PROGRAM (SELP)



Oregon's State Energy Loan Program (SELP) promotes energy conservation and renewable energy development by offering low-interest loans to a broad range of applicants, including individuals, businesses, non-profits, schools, Native American tribes, and other stakeholders. The program was created in 1981 and is administered by the Oregon DOE. As of July 2011 the program had closed 860 loans and committed approximately \$540.9 million.

A recent funding example includes a \$20 million loan to SoloPower, a California-based manufacturer of thin-film solar cells and modules, which will use the funds to finance two manufacturing facilities in North Portland, potentially creating hundreds of jobs for the region. Other recent SELP financing includes a \$7.2 million loan to Earth By Design for a five MW, low-head modular hydro project.

While there is no legal limit, loans usually range between \$20,000 and \$20 million with loan terms from five to 15 years. The program offers loans to projects that save energy, produce energy from renewable resources, use recycled materials to create products, or use alternative fuels.

KEY LESSONS

- Although not considered a financial hub, Oregon ranked in the top five states for total clean-energy venture investments, on a per-capita basis, in both 2010 and between 2008–2010.
- California and Massachusetts, however, are the nation's clear VC leaders in clean tech, with the states representing the bulk of venture capital investments in the U.S. This presents challenges to home-grown Oregon companies as they compete for much-needed funding.
- Several well-funded California startups have brought their monies and deployed them in Oregon to set up advanced manufacturing, including firms like Solaicx (recently acquired by MEMC) and SoloPower. The state should continue to nurture this pipeline of private capital and the companies, projects, and jobs that come with it.
- Oregon consistently ranks in the top 10 for energy efficiency expenditures.
- The state's environmentally conscious consumers have made the state a leader in total green pricing program participants and green pricing electricity sales.

Workforce & Innovation

CLEAN ENERGY JOBS The industry's relative infancy, varying sector definitions and fast-moving changes in employment figures make clean energy jobs surprisingly difficult to track. One-off research endeavors can quickly become obsolete, and all efforts are susceptible to sector definition disputes. And because job classification codes currently fail to identify most clean-energy technology sectors, the U.S. Bureau of Labor Statistics (BLS) is largely ineffective. While the BLS is working to alleviate this job-counting deficit by developing new clean-energy job code classifications, it could take years before the issue is settled and accurate accounting is made possible.

Even with these challenges, two separate reports from the Pew Center on the States and The Brookings Institution provide a decent depiction of America's clean-energy economy. Pew's research, although somewhat dated with 2007 job estimates, found California to be the leading clean-energy employer (125,390 jobs), identified Oregon as the state with the most clean jobs as a percent of the total state economy (1.02 percent), and revealed Oregon and Colorado as the states with largest, fastest growth of clean-energy employment. Brookings' recent 2011 report was met with contention due to some glaring city-specific job omissions, but topline findings remained insightful nonetheless. California again was named top employer (239,064 jobs) and Oregon, with a tally of 50,482 jobs, ranked second for clean economy jobs as a share of total state employment (3.4 percent).

KEY OREGON CLEAN-TECH EMPLOYERS

SOLAR PV MANUFACTURING:



Hillsboro, OR
1,050 employees



Salem, OR
200 employees



Portland, OR
80 employees

WIND ENERGY DEVELOPMENT/OPERATIONS:



Portland, OR
400 employees



Portland, OR
400 employees

SUSTAINABILITY/EFFICIENCY CONSULTING & DESIGN:



Portland, OR
312 employees



Portland, OR
121 employees



Portland, OR
1,000 employees



Portland, OR
104 employees

ENERGY STORAGE:



Hillsboro, OR
225 employees



Beaverton, OR
200 employees

CLEAN ENERGY PATENTS Clean-energy patents are a benchmark of human and intellectual capital, reflecting innovation, research and development, and economic prowess. From 2002 to 2010, the annual number of clean-energy patents granted in the U.S. has grown from 370 to 890 for a total of 4,377 over the last nine years. The 890 patents granted in 2010 were an annual record and an 80.5 percent increase from 2009. Leading the charge has been fuel cells; 2,421 of all the clean-energy patents in the U.S. (55.3 percent) have been fuel cell-related patents. Following fuel cells are patents related to solar, wind, and HEV innovation – since 2002, these three sectors have produced 698, 509, and 431 patents respectively.

Among states, Michigan is the clear leader. With 1,024 total patents since 2002 – 103.1 per million people – the Wolverine State’s leadership is powered by automotive-related patents. In particular, General Motors, which registered more clean-energy patents than any other U.S. company in 2010 with 135, has been a big boost to Michigan. Second in total patents in 2010 is California with 720, followed by New York (535), Connecticut (280), and Illinois (194).

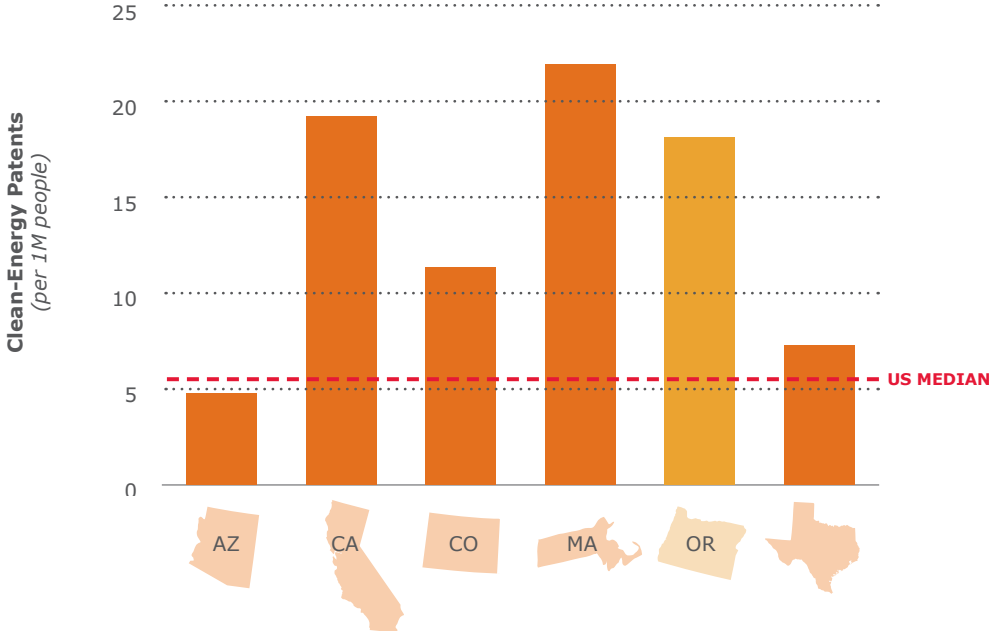
For a smaller state that lacks some of the traditional patent generators of major research universities or energy technology multinationals, Oregon does well to finish ninth, just behind number eight California, on a per-capita basis from 2002-2010. However, Oregon’s patent breakdown is pretty undiversified with 62 of its 70 patents related to fuel cells. Other states in this report come in as low as 28th-ranked Arizona and as high as sixth-ranked Massachusetts, with Colorado placing 15th and Texas 20th.

CLEAN-ENERGY PATENTS GRANTED (2002-2010)

State	Clean-Energy Patents Per 1M People	Total Clean-Energy Patents Granted
Arizona	4.8	32
California	19.3	720
Colorado	11.4	58
Massachusetts	22.0	146
Oregon	18.2	70
Texas	7.3	184

Source: HRFM with Clean Edge analysis

see table below



Workforce & Innovation

SPOTLIGHT

OREGON INNOVATION COUNCIL



The Oregon Innovation Council is a partnership between the private sector, government, and the state's four research universities—Oregon Institute of Technology, University of Oregon, Oregon State University, and PSU—intended to create jobs, incubate companies, and bring outside dollars into Oregon. Founded in 2005, the council is an all-volunteer organization comprised of mostly private-sector leaders and four state legislators. Every two years, the Council reopens a competitive process to identify new industries and encourage innovative ideas focused on developing a technology-based economy.

While the program targets a range of technology related industries, the state has made clean tech a specific focus area along with nanotechnology, food innovation, and bioscience. By creating a network of shared labs and research facilities as well as directly investing capital, the program has supported clean-tech companies like Puralytics, MEMC (formerly Solaicx), and SolarWorld. In three years of funding, the program has captured \$197.5 million in federal and private grants for the state, incubated 15 new companies, and its 11 shared labs have been used by more than 227 businesses. The program is on track to generate more than \$7 for every legislatively invested dollar.

KEY LESSONS

- According to reports by both Pew and Brookings, Oregon ranks at or near the top in the percentage of jobs dedicated to the clean economy. Pew put the state at number one, and Brookings put it at number two, for the percentage of jobs in the clean-energy sector.
- The state's workforce spans high-skilled clean-tech engineers and manufacturing line technicians to green builders and energy efficiency installers.
- The state ranks in the top 10 for clean-energy patents, but trails some key leading innovation and manufacturing centers such as Michigan and California.
- While the state lacks a top-ranked research university of the stature of MIT or Caltech, Oregon's universities have collaborated to leverage their respective strengths via such efforts as ONAMI and the Oregon Built Environment and Sustainable Technologies Center (BEST).
- Further collaboration and efforts are needed to bolster the state's clean economy-centric industries and to nurture home-grown businesses.

Clean Energy Policy

The energy industry is driven by government policy. Policies either encourage action with financial incentives or enforce behavior through regulations or mandates. In the U.S., with a lack of clear, consistent support from the federal government, the burden has fallen on states to push policy efforts forward and catalyze clean-energy development. While the strength and effectiveness of policy mechanisms will vary by state, the checklist at the right serves to identify the existence of some of the more important policies.

Probably the most popular state mandate for clean-electricity generation is the renewable portfolio standard (RPS). Each state compared here has enacted an RPS, but not all are created equal, as the chart reveals. Building codes are another important policy mechanism, particularly for driving efficiency. While California, Massachusetts, and Oregon have each adopted nation-leading codes, neither Colorado nor Arizona have adopted codes equivalent to industry standards adopted more recently than 1999, according to the Building Code Assistance Project. (Oregon has enacted stronger residential energy codes since the creation of this checklist, earning the state full credit for this indicator.)

In many ways, incentives can have more influence than regulations on clean-energy development. Incentives speed deployment by improving product and project economics, and business-directed incentives play a major role in a region's success in attracting companies. But, because they necessitate government spending, incentives face severe headwinds in today's economic and political climate. Even so, incentives are crucial to industry development, and have played an important role in establishing clean-energy leadership in states like California, Oregon, and Massachusetts.

POLICY CHECKLIST

	AZ	CA	CO	MA	OR	TX
Regulations & Mandates	Renewable Portfolio Standard	●	●	●	●	●
	Strong RPS: At least 20% by 2020 or 25% by 2025		●	●	●	●
	Smart RPS: No Clean Coal	●	●	●	●	●
	Smart RPS: No Nuclear	●	●	●	●	●
	Smart RPS: No Large Hydro		●		●	
	Energy Efficiency Resource Standard	●	●	●	●	●
	State Renewable Fuel Standard				●	●
	Climate Action Plan	●	●	●	●	●
	GHG Reduction Target	●	●		●	
	Membership in Active Regional Climate Initiative				●	
	Low Carbon Fuel Standard		●		●	●
	State Fleet High Efficiency Vehicle Requirement	●	●	●	●	●
	Mandated Green Power Purchasing Option			●		●
	Interconnection Law/Policy	●	●	●	●	●
	Net Metering Law/Policy	●	●	●	●	●
	Commercial Building Energy Policy	○	●	○	●	●
	Residential Building Energy Policy	○	●	○	●	●
Incentives	Grants - Renewable Energy			●	●	●
	Grants - Energy Efficiency		●	●	●	●
	Loans - Renewable Energy	●	●	●	●	●
	Loans - Energy Efficiency	●	●	●	●	●
	Rebates - Renewable Energy	●	●	●	●	●
	Rebates - Energy Efficiency	●	●	●	●	●
	Bonds - Renewable Energy					
	Bonds - Energy Efficiency					
	Clean-Tech Vehicle Purchasing Incentive		●	●		●
	Utility Revenue Decoupling - Electricity	●	●		●	●
	Utility Revenue Decoupling - Natural Gas	●	●	●	●	●
	Utility Performance Incentives - Electricity	●	●	●	●	●
	Utility Performance Incentives - Natural Gas		●	●	●	
Utility On-Bill Financing		●		●	●	
Total Marks Earned (Out of 31 Possible)	16	25	20	27	23 ^{2/3}	17 ^{1/3}

Conclusion

While California is the frontrunner in Clean Edge's *State Clean Energy Leadership Index*, Oregon is among a handful of states showing clear and definitive leadership. Ranking second overall, Oregon has reaped benefits from its strategy, with an increasingly clean and efficient energy supply and a growing number of clean-tech manufacturers and service providers making the state their home base.

What makes Oregon stand apart in the clean-tech sector? The state enjoys a number of key assets, including:

1. A rich culture of early sustainability adopters
2. Proximity to large, ready markets in both California and Asia
3. World-class high-tech manufacturing and workforce expertise
4. Committed support from local and state government
5. Plentiful low-cost energy enabling strong business attraction

From these competitive advantages, Oregon has established itself as a premier player in the U.S. clean-energy economy. The state has become a leader in clean electricity, where it ranks as a top producer of wind power. Through vast deployment of smart grid technology (ranking second in smart meter penetration) and sustainable buildings (first in LEED projects per capita), Oregon has also demonstrated leadership in the efficient delivery and consumption of electricity.

On the transportation front, the Beaver State is working to leverage its HEV-friendly consumer base into a top market for EV deployment, making the region a hub for transportation electrification.

Not merely a market for technology deployment, Oregon is also home to a growing cadre of clean-tech manufacturers and developers. Top employing clean-tech activities in the state include solar manufacturing, wind energy development/operations, environmental and efficiency consulting, and energy storage technology development. Pew and Brookings put the state in first and second place, respectively, for its percentage of overall clean-economy jobs.

It goes without saying that challenges exist as well. Like most states, Oregon faces extreme budget constraints and has had to refocus and restructure its programs. And while clean energy has clear and strong national-level commitments in countries such as China, Japan, and Germany, the U.S. federal government has no real long-term commitments in place. Among the national programs that do exist, many come up for expiration every year or two, making long-term planning nearly impossible.

But the clean-energy market continues to offer great promise and its growth and expansion far exceeds national boundaries or the latest political brouhaha. That's why companies like Toyota, GE, and Siemens are reinventing themselves to take advantage of this economic shift and many governments are leading as well. Oregon, with its deep technology roots, strong ties to Asia, and innovative and sustainably minded populace, offers a great proving ground for a host of clean energy-focused technology, policy, and capital breakthroughs. If the state's policies and leadership are properly channeled and structured, we believe Oregon can continue to play a top-tier role in enabling faster and cleaner transportation, low-cost net zero-energy buildings, and fossil fuel-competitive renewable power.

About Clean Edge

Clean Edge, Inc., founded in 2000, is the world's first research and advisory firm devoted to the clean-tech sector.

For more than a decade, the firm has delivered timely data, expert analysis, and comprehensive insights to key industry stakeholders. The company offers an unparalleled suite of index, benchmarking, and advisory services. For more information please visit www.cleandedge.com.

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Acknowledgements

The content of this report is based on Clean Edge's 2011 *State Clean Energy Leadership Index*. Data comes from Clean Edge primary research along with content from the following data partners and public sources: American Wind Energy Association, Cleantech Group, Consortium for Energy Efficiency, U.S. Department of Energy, DSIRE (Database of State Incentives for Renewable Energy), U.S. Energy Information Administration, Federal Energy Regulatory Commission, Heslin Rothenberg Farley & Mesiti P.C., Interstate Renewable Energy Council, R.L. Polk, and U.S. Green Building Council.

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