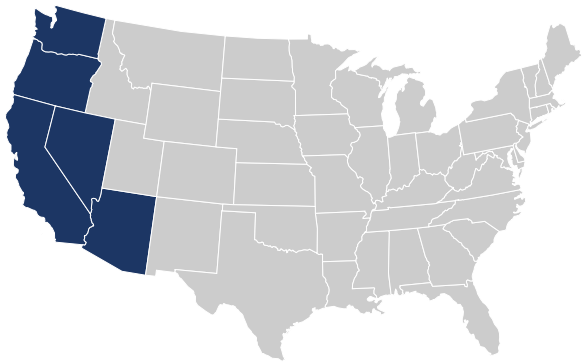
Innovating and installing solar energy on the Pacific Coast and beyond

By Kate Gordon and Calvin Johnson, The Center for the Next Generation



The Pacific Coast and the adjoining western states are famous for their diversity of industry—from Hollywood to Silicon Valley to the farmland of the Central Valley, and beyond—as well as the beauty of their natural landscapes. But to the American Petroleum Institute, the Pacific Coast is only one thing: a giant oil well. Its plan calls for opening up the Pacific Outer Continental Shelf for oil and gas drilling and easing permitting for onshore drilling on public lands. Our vision for this part of the country, on the other hand, builds on the strengths of these states, as well as on the remarkable steps already being taken to establish the region as a national leader in the emerging clean economy.

Recovering oil and natural gas from the Pacific Coast has historically been one piece of this region's energy economy—but it's not and should not be the only one. A dramatic expansion of offshore drilling would threaten the region's robust coastal economy. The natural resources of the Pacific Coast support jobs in multiple industries—including fishing, shipping, tourism, and recreation—in California, Oregon, and Washington. Opening new waters to offshore drilling would undermine the diversity of the current ocean economy, and an oil spill could easily wash away the 570,000 jobs and $34 billion of annual revenue currently supported by these industries.[212]

There's another onshore energy source that's sweeping the region, providing jobs, spurring new industries, and spawning new innovative technologies: solar. The West has a lot of sun, and solar energy is spreading across California, Nevada, and Arizona. Aggressive renewable energy standards coupled with tremendous solar

resources in California, Arizona, and Nevada place the Pacific Coast region in a strong position to build upon its current position as a national leader in solar energy installation and generation. California's far-reaching climate policies will only strengthen the state's position as a solar leader in the region. The aggressive renewable energy standards plus the cap-and-trade program are expected to spur increasing levels of clean-tech investment in solar technology, bringing to market new process and product innovations that will drive efficiency gains and cost reductions.

California is the leader in this region and the "anchor tenant," in a way, in terms of solar innovation and production. Many of the projects have been huge solar arrays—infrastructure projects that create thousands of high-quality local production and construction jobs. Through the first quarter of 2012, California has installed 2025 megawatts of solar energy capacity.[213] Approximately half of this comes from distributed energy sources, and half comes from utility-scale projects. At of the end of 2011, 2.66 gigawatts of utility-scale solar photovoltaic projects were under construction in California, Nevada, and Arizona.

In addition to its leadership in the field of utility-scale projects, California has paved the way for a large increase in distributed power generation. The Go Solar Plan created the California Solar Initiative to provide rebates for customers of the state's largest utilities to install an additional 1,940 megawatts of solar by 2016, along with the New Solar Homes Partnership to incentivize the installation of 360 megawatts of solar power on new homes. The National Renewable Energy Laboratory estimates that California has the technical capacity to generate more than 4,200 gigawatts of solar energy. That is more than 10 times the amount of energy produced by the entire stock of U.S. coal-burning plants—without the carbon emissions and other pollutants.[214]

While California ranks first in the nation for solar capacity and industry employment, Arizona, Nevada, and Oregon are close behind. Arizona, in particular, is embracing solar; nationally, the state ranks second in solar capacity and third in solar employment.[215]

What's most exciting about the solar explosion in these western states is that it's spurring economic growth not just in solar installation, but also across a much wider set of occupations and industries—from innovations in technology, financing, and manufacturing processes to production and commercialization, and finally, to installation. Across all these categories, this region is leading the way. As

demand grows for these low-carbon technologies, the region will continue to play a strong role in the national, and even global, solar industry.

Factors driving solar power growth in the region

Strong state and federal policies have put the Pacific Coast region in a strong position to take advantage of our country's most abundant solar resources. The National Renewable Energy Lab recently identified a region comprised of parts of southeastern California, southern Nevada, and southwestern Arizona as having the strongest solar energy potential in the United States.

Another of the lab's studies confirmed the growth potential for solar capacity in California. That study identified an estimated potential of 111 gigawatts of urban utility-scale photovoltaics, 4,010 gigawatts of rural utility-scale photovoltaics, and 76 gigawatts of rooftop photovoltaics.[216] Combined, this represents a total of nearly 4,200 gigawatts of solar potential in the state of California alone. By comparison, as of 2011 there were only 69 gigawatts of solar power installed across the entire globe, even after a sustained period of exponential growth.[217]

In the past five years, the states of the Pacific Coast region have laid the foundation for a long period of growth in solar power generation. Declining prices for solar modules and favorable policies have enabled these states to tap into the enormous potential for solar energy generation.

The vast potential for solar energy in California

Ultimate achievable energy generation for solar technologies

Urban utility-scale photovoltaics	111 GW
Rural utility-scale	4010 GW
Rooftop photovoltaics	76 GW
Total	**4,196 GW**

Source: National Renewable Energy Laboratory

Renewable Portfolio Standards, also known in some states as Renewable Energy Standards, take the lead in a suite of policies facilitating the installation of solar energy capacity.

- California's new Renewable Portfolio Standard, which was strengthened as part of the California Global Warming Solutions Act of 2006 (also known as AB32), requires that state utilities meet 33 percent of their electricity needs with renewable energy sources by 2020. The state has already met 20 percent of its electricity needs with renewable sources, and lawmakers have discussed increasing the mandate to 40 percent. Solar power figures prominently in this increase of renewable power generation, and Gov. Jerry Brown has proposed a goal of reaching 12 gigawatts of distributed generation, meaning rooftop or other small solar arrays rather than big utility-scale systems, by 2020.

- Arizona passed a Renewable Energy Standard in 2006 requiring that the state's electric utilities meet 15 percent of their energy needs with renewable sources. This standard also includes a mandate requiring solar and distributed energy to cover 4.5 percent of energy needs by 2025.[218]

- In 2009 Nevada passed into law a Renewable Portfolio Standard requiring 25 percent of electricity to come from renewable energy sources by 2025. The Nevada standard also requires solar energy to fulfill 6 percent of the state's electricity needs by 2016.

- Oregon's Renewable Portfolio Standard requires its three largest utilities to deliver 25 percent of its energy from renewable sources by 2025.

- In 2006 Washington state voters approved Ballot Initiative 937 requiring utilities serving 25,000 people or more to provide 15 percent of their energy using renewable sources by 2020.

California has been particularly focused on developing incentives for so-called distributed solar power, meaning power that is not concentrated at large utility-scale solar farms and other large installations, but across homes and businesses. The Go Solar Plan of 2006 created three key programs to increase solar photovoltaic installation. The California Public Utility Commission's California Solar Initiative is the largest solar rebate program in the world. This program consists of $2.2 billion in rebates offered between 2007 and 2016 to install 1,940 megawatts of new solar capacity on existing homes. The New Solar Homes Partnership of the California Energy Commission offers incentives for solar installation on new homes. This $400 million incentive program aims to install 360 megawatts of new solar capacity by 2016.

Not all the support has been from the public sector. The state's publicly owned utilities have committed to spending $784 million by 2016 to install 700 megawatts of solar capacity.[219] Even without the renewable energy standards and other incentives, solar energy makes sense for these companies. California utility Southern California Edison has bought into the value of solar energy. In 2011 the company signed 20-year power purchase agreements for 20 solar projects.[220] Southern California Edison and other utilities are securing access to solar energy as a reliable power source with prices that continue to fall. Solar energy has proven a valuable investment for utilities in California, where high-peak demand, expensive "spinning reserve" power plants that can provide backup power on 10 minutes' notice, and strong solar resources promote the grid-parity of this energy source.

One reason solar energy is so popular in the West is net-metering policies that allow homeowners and businesses with rooftop solar installations to sell excess solar energy back to the grid. California has had net metering since 2006, making it a strong motivator for individual purchasers of solar panels. California was the first state to get to 1 gigawatt of installed rooftop solar photovoltaics.

Strong solar policies and resources point to continued growth in the rooftop solar category. With the Go Solar Plan, California is on pace to reach a goal of 3,000 megawatts of installed rooftop solar by the end of 2016. According to recent reports, these achievements are sure to be surpassed by periods of major growth in this market. A new study by Energy and Environmental Economics for the California Public Utilities Commission indicates that California has the technical potential to add an additional 15 gigawatts of solar-distributed generation by 2020.[221] Furthermore, the National Renewable Energy Laboratory estimates that the state could eventually reach 76 gigawatts of rooftop solar systems.[222] If California stays the course with its rooftop solar agenda, then the state can expect regular growth of the solar industry and the state economy for many years to come.

More than anything else, these distributed energy systems demonstrate a contrast to the more traditional fossil-fuel-based energy path put forward by the American Petroleum Institute and its supporters. While their plan relies on centralized energy sources such as oil wells and power plants, which are controlled by a handful of companies, distributed solar is owned by individuals and brings economic gain to individuals. It's power for the people and by the people.[223]

As Tom Kenworthy pointed out in his chapter on the Mountain West, the federal government has also played a role in facilitating solar development in this region. The Department of the Interior has a roadmap to accelerate the development of utility-scale solar projects on Bureau of Land Management property. Following a two-year study of this area, the Department of the Interior identified lands with strong solar resources and limited environmental sensitivity that are eligible for solar project development. The intention of this Solar Environmental Impact Statement is to reduce the lengthy approval process for solar projects on federal land. More than half of the land identified in the study—153,627 acres—is located in California; Nevada has the second-largest portion of land identified, with more than 60,000 acres, and Arizona has more than 6,000 acres.[224]

Current and projected solar capacity

The installed solar energy capacity in the Pacific Coast region accounts for the majority of all solar capacity in the United States. Rapid increases in installed capacity and a long list of utility-scale projects currently in development point to a period of high growth in solar energy in the next few years. Utility-scale projects represent the best opportunities for significant increases in solar energy capacity, but the rooftop solar market has also driven expansion.

Utility-scale solar projects

In the arena of utility-scale solar projects, solar photovoltaic is the technology of choice. Falling prices of modules and easier installation are among the reasons why solar photovoltaics accounts for 72 percent of the utility-scale solar market in the United States.[225] At the end of 2011, PV Insider identified 865 megawatts of installed utility-scale photovoltaics nationwide, 2.9 gigawtts under construction, and 19.2 gigawatts under development. The western states dominate each of these categories, with 419 megawatts of installed capacity, 2.66 gigawatts under construction, and 15.3 gigawatts under development.[226] These numbers demonstrate the pioneering role held by the western states and point to a massive period of growth for utility-scale photovoltaics in the next decade.

Solar power shining bright in the West

Breakdown of utility-scale photovoltaics

	Entire United States	Western states
Installed capacity	865 MW	419 MW
Under construction	2.9 GW	2.66 GW
Under development	19.2 GW	15.3 GW

Source: PV Insider

Concentrating solar power systems represent another mode of solar technology gaining strength in the utility-scale market. These systems produce electricity by using sunlight to heat a fluid that spins a turbine and generates electricity. There are currently 503 megawatts of installed utility-scale concentrating solar power system facilities operating in the United States. Of this total, 428 megawatts come from California and Nevada. More than 4 gigawatts of this kind of solar power system are under development in California, Arizona, and Nevada.[227]

Local distributed solar power generation

Smaller solar installations, classified as local distributed power generation, represent another large opportunity for growth in solar energy capacity in California. Distributed generation diverges from the dominant mode of energy transmission

in which energy is produced at large plants and is transmitted over long distances. In distributed generation, smaller and localized sources distribute energy directly to the grid. Solar energy collection lends itself well to distributed generation. Millions of previously untapped rooftops across the state have the potential to produce energy for the grid with small (less than 20 megawatts) solar installations. By the end of 2011 California had reached the major milestone of installing more than 1 gigawatt of rooftop solar—a level of solar penetration that has only been achieved by five countries worldwide.

Economic dividends of solar energy in the western states

Continued growth in solar installations will deliver tremendous economic dividends to these western states. Job gains in a diverse range of categories and California's position of global leadership in clean-tech investments both highlight the economic value of the solar industry along the Pacific Coast and across the western region.

Jobs

The solar industry in California has experienced significant economic growth over the past 15 years. Since 1995 the number of solar businesses grew by 171 percent, and total employment jumped by 166 percent. By contrast, the number of Californian businesses grew 70 percent, and total employment went up by 12 percent.[228] Over the course of 2011, employment in the solar industry increased by 6.8 percent while overall state employment grew at just 0.7 percent.[229] With 25,000 people currently employed in the solar industry, California accounts for a quarter of the country's solar workforce.

California's solar boom

Comparing the growth of the solar industry with the overall economy in California

	Growth in number of businesses in California since 1995	Total employment growth in California since 1995	Employment growth in California in 2011
Overall economy	70%	12%	0.7%
Solar industry	171%	166%	6.8%

Solar photovoltaic installations are a proven job generator. Studies have found that each megawatt of solar photovoltaic capacity generates approximately 7 to 11 jobs over the lifetime of the facility.[230] California's goal is to install 1 million rooftop solar systems by 2020, growing the Californian economy by close to $30 billion and adding 20,000 jobs each year.[231]

The solar energy industry in California encompasses a range of economic activities and provides a diverse set of employment opportunities. Beyond the manufacturing of solar panels, jobs abound in installation, material feedstock supply, research and development, sales and distribution, solar system-design consulting, solar plant operations, and solar system-component manufacture, among others. According to the U.S. Solar Energy Trade Assessment 2011, site preparation, labor, permitting, financing, and other industry "soft costs" provided close to 50 percent of total solar revenue in 2010.[232] In 2010, 75 cents of every dollar spent on domestic solar installations stayed in the United States, producing a total domestic revenue of $4.4 billion.

Despite China's rise as a solar manufacturer, the United States retains a leadership role in several important segments of the solar manufacturing supply chain. In particular, we are competitive in the manufacture of the component parts that are critical to the final assembly of large solar arrays. This makes sense: Assembly of these large systems is most easily done near their installation, and, as we've discussed, the western region is a leader in installed solar capacity.

In particular, the United States remains strong in the manufacture of installed inverters (45 percent of those used domestically are produced domestically), mounting structures to anchor the solar panels (94 percent produced domestically), and combiner boxes and other miscellaneous electrical components (59 percent produced domestically).[233] These numbers tell an important story for this region and for American manufacturing more generally—where there is consistent demand for a highly engineered and innovative product, conditions are good for the local manufacture of that product.

One challenge facing the region's solar industry is the lack of skilled workers prepared to enter the huge range of mid- and high-skill jobs that make up this sector. Employers in the solar industry have identified issues with a lack of solar-specific training in the labor force. The Solar Foundation finds that more than 50 percent of solar industry employers encountered difficulty hiring qualified solar designers, solar installation managers, sales representatives, and solar photovoltaic technicians.[234] Accordingly, vocational programs would do well to incorporate solar training to their

programs to increase the qualifications of the potential solar workforce. Currently 54 community colleges in California offer some type of solar training. Increased knowledge of basic solar energy production and solar plant management in these programs will increase the qualifications of solar industry applicants.[235]

Clean technology and the economy of innovation

Growth in the global solar market is driving significant venture capital deployment in the clean-tech field. The United States is a proven world leader in this arena. In 2011 more than 90 percent of global solar venture capital funding came from our country, with half of these investments coming straight from California.[236] Our companies and public labs and universities also put significant resources into solar innovation: Half of worldwide investment in solar research and development came from U.S. public and private sources in 2011, totaling $1.1 billion.[237] This research is resulting in real projects. California registered a total of 105 patents in 2010 for solar technologies and holds 45 percent of all U.S. solar patents and 24 percent of the entire world's solar patents.[238]

In a positive feedback loop, these investments in new solar innovations help drive down the cost of solar system installation and increase the market for solar products. They've also kept the United States—and California in particular—at the leading edge of the global solar marketplace. Even as traditional solar technologies such as the solar photovoltaic panel become mass-marketed, and production moves overseas, California and other strong solar states are inventing new products and processes that are bringing down the cost of solar power and making it available for new markets and applications, driving a new wave of innovation and manufacturing here at home.

There is no doubt that solar energy is contributing to the robust growth of renewable energy generation in the Pacific Coast region. Increasing levels of solar capacity enable California's economy to grow while decreasing carbon levels, and the state and surrounding region are able to stay on the leading edge of new solar technology development. That translates to the ideal assembly line of progress for the 21st century—moving from brainpower to innovation, new technologies, more jobs, and a safer environment.

About the Center for American Progress

The Center for American Progress is a nonpartisan research and educational institute dedicated to promoting a strong, just, and free America that ensures opportunity for all. We believe that Americans are bound together by a common commitment to these values and we aspire to ensure that our national policies reflect these values. We work to find progressive and pragmatic solutions to significant domestic and international problems and develop policy proposals that foster a government that is "of the people, by the people, and for the people."

Center for American Progress

About the Center for the Next Generation

The Center for the Next Generation works to shape national dialogue around two major challenges that affect the prospects of America's Next Generation—advancing a sustainable energy future and improving opportunities for children and families. As a nonpartisan organization, the Center generates original strategies that advance these goals through research, policy development, and strategic communications. In our home state of California, the Center works to create ground-tested solutions that demonstrate success to the rest of the nation.

THE CENTER FOR THE NEXT GENERATION

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