

THE TEXAS SOLAR PV MARKET: A Competitive Analysis

A report comparing Texas against five other leading solar PV states based on Clean Edge's ***U.S. Clean Energy Leadership Index***

CLEAN EDGE

THE CLEAN-TECH MARKET AUTHORITY

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About Clean Edge

Clean Edge, the world's first research and advisory firm devoted to the clean-tech sector, delivers comprehensive clean-tech insights to corporations, investors, governments, entrepreneurs, and other key stakeholders. The company integrates timely clean-tech data from dozens of sources with expert analysis to provide critical insights to its clients and subscribers. The firm's offerings include the *U.S. Clean Energy Leadership Index* and related advisory services, industry-leading sponsored publications including the annual *Clean Energy Trends* report, the annual Clean-Tech Investor Summit conference (coproduced with IBF), and benchmark clean-tech stock indices with NASDAQ. For more information, visit <http://www.cleangedge.com>.

About the U.S. Clean Energy Leadership Index

Clean Edge's *U.S. Clean Energy Leadership Index*, a subscription-based advisory service, provides clients with comprehensive and objective analysis of clean energy in the United States. Using public and private data sources and original Clean Edge metrics and methodology, the *Leadership Index* ranks each state's performance by tracking more than 70 industry indicators related to technology, policy, and capital activity. To learn more about the service, contact Bryce Yonker, Director of Business Development, yonker@cleangedge.com or 503-206-8448.

About This Report

The Texas Solar PV Market: A Competitive Analysis aims to provide insight about solar PV energy in Texas, including market share, overall investments, R&D, job creation, policy landscape, and other key measures. Data and analysis contained in the following pages compares solar activity in Texas against five other leading solar PV states, and is built on research and analysis contained in Clean Edge's *U.S. Clean Energy Leadership Index*. The report was commissioned by a private Clean Edge client.

Solar Energy in Texas

Solar PV is a rapidly expanding global industry, with growth rates comparable to earlier tech revolutions such as telephony, computers, and the Internet. Between 2000 and 2010, for example, the global market for solar PV (including modules, system components, and installations) expanded from \$2.5 billion to \$71.2 billion, representing a compound annual growth rate of 39.8 percent. Within a decade, we project the global market for solar PV will reach \$113.6 billion.

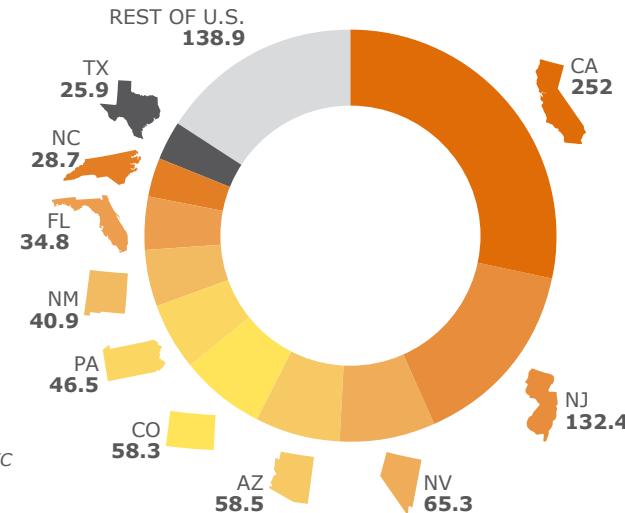
Overall, the U.S. ranked third globally for new solar installations in 2010 with nearly 900 MW installed, trailing only Italy and Germany. Solar growth in the U.S. has been the result of rapidly declining PV prices and strong state policies and programs.

Texas made it into the Top 10 states for solar PV installations in 2010, but just barely. Its 25.9 megawatts (MW) of installations put it in 10th place, far behind such solar leaders as #1 California (252 MW), #2 New Jersey (132.4 MW), and #3 Nevada (65.3 MW).

In this report we look closely at how Texas is competing against five of the top 10 states for solar PV leadership in the U.S.: California, New Jersey, Arizona, Colorado, and New Mexico.

Clean Edge analysis, including a comparative view of solar PV market size, venture data, patent data, policy implementation, and other key indicators, shows that Texas is in the game, but trailing by a significant margin against other top solar states. Texas may be in the race, but it is far from taking full advantage of its abundant solar resources and traditional energy industry expertise, manage-

NEW SOLAR PV INSTALLATIONS: TOP 10 STATES (2010, MW)



Source: IREC

rial knowhow, research infrastructure, and economic resources. In fact, among the six states we reviewed, Texas came in last in four of the five technology and market indicators that we tracked for this report.

With its sprawling landscapes across the American Southwest and rich energy history, Texas would appear to be blessed with both a physical and business climate ideal for solar technology. But to capitalize on the significant financial rewards and job creation associated with solar leadership, Texas must leverage both public and private efforts to build a more conducive environment for capturing its share of the solar industry's global expansion. As Germany has proven on the global stage, solar energy growth does not always follow the sun.

U.S. Solar PV Deployment: An Era of High Growth

U.S. grid-connected PV installations grew an astounding 103 percent last year, from 435 MW in 2009 to 882 MW in 2010. Cumulative grid-connected installed PV capacity in the U.S. reached a record 2.1 gigawatts (GW) in 2010. In a world of increasingly low-cost solar and supportive policies in select states, many analysts predict continued high-growth rates in the U.S., with some projecting another doubling of new installed capacity in 2011. However, while Texas added 25.9 MW in 2010, bringing its total installed capacity up to 34.5 MW, it still trails the other states compared in this report, most by significant margins.

Currently, the top 10 states for cumulative installed PV capacity in the U.S. include five of the states evaluated in this report – California (#1), New Jersey (#2), Colorado (#3), Arizona (#4), and New Mexico (#10). Texas doesn't make the top 10 list, coming in at #13.

Another notable national trend in 2010 was the more than tripling of utility-operated PV installations (utility side of the meter) to 242 MW in 2010, up from just 70 MW in 2009, according to SEIA/GTM Research. For the past decade, PV growth has typically been driven by non-utility projects including residential, commercial, non-profit, and public-sector installations (behind the meter). But this is shifting. In Texas and New Mexico, for example, approximately 70 percent or more of their respective PV installations now come from utility-scale projects.

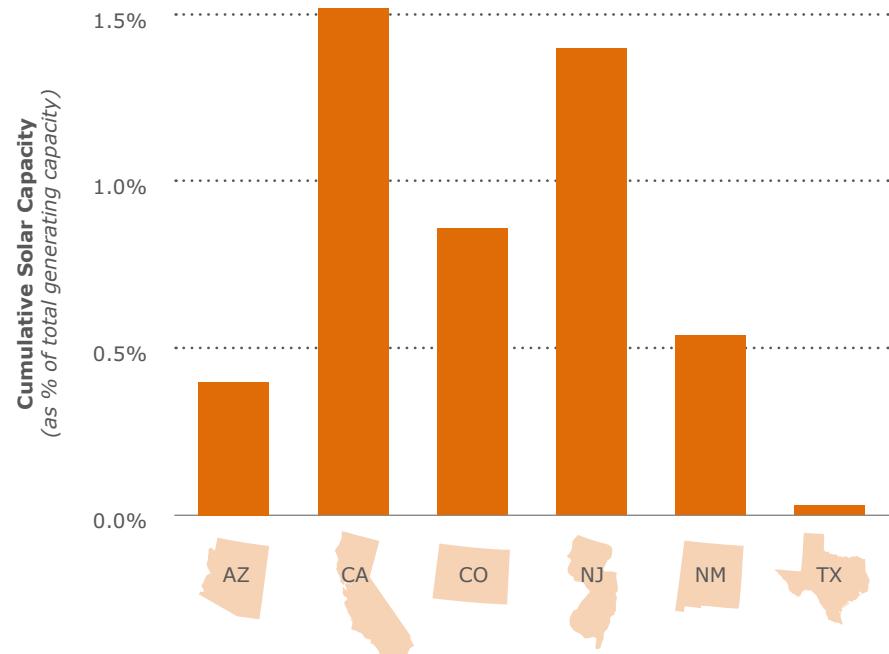
As highlighted in the bar chart to the right, however, Texas still trails the other states in our analysis. Only .03 percent of Texas' net generating capacity (all electricity sources) comes from solar, compared to .40 to 1.52 percent for the five rival states, indicating significant room for growth.

CUMULATIVE INSTALLED PV CAPACITY

| State | Cumulative Solar PV Capacity (2010, MW) | Cumulative Solar Capacity (as % of total generating capacity) |
|------------|---|---|
| Arizona | 104.9 | 0.40% |
| California | 1,021.5 | 1.52% |
| Colorado | 117.4 | 0.86% |
| New Jersey | 259.9 | 1.40% |
| New Mexico | 43.3 | 0.54% |
| Texas | 34.5 | 0.03% |

Source: IREC and EIA with Clean Edge analysis

see table below



Solar Investment: Total Market Value

In 2010, the total market value for solar PV in the U.S. was just over \$5 billion, accounting for roughly seven percent of the \$71.2 billion global market. This number represents the ultimate value of all newly installed capacity in the nation, including capital costs related to modules, system components, and installation. While the U.S. total market value doesn't reflect monies spent entirely inside the U.S. (the solar PV industry is a global industry), it does provide a good indication of economic activity originating from U.S. solar demand.

State-level PV market valuation is also a useful tool in revealing the project-related investment required to deploy new PV capacity in each state during 2010. PV markets vary widely by state, and deployment dynamics (i.e., portion of demand from utility, commercial, and residential markets) can have a significant impact on a state's installed PV capacity market value. Texas and New Mexico, for example, were driven heavily by utility installations, while California and Arizona were led by residential and commercial-industrial projects.

Ultimately, though, the market values are a reflection (in dollar terms) of each state's installed capacity. California leads the way by a large margin, as its 252 MW of new capacity in 2010 translated into a solar PV market value of more than \$1.5 billion last year.

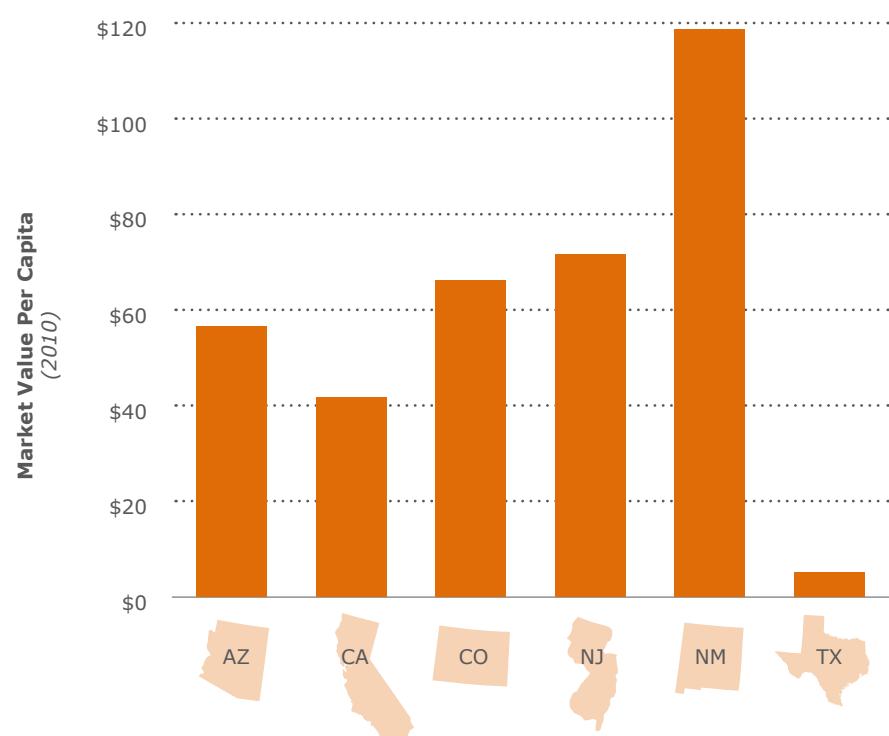
Texas, with its 29.5 MW of new capacity, resulted in a 2010 PV market value of \$128.6 million. This number, already low when compared to other leading states, is further evidenced when reviewed on a per capita basis. At \$5.12, Texas' PV market value per capita is nowhere near any of the other five states in question (see bar chart at right).

2010 PV INSTALLS - TOTAL MARKET VALUE

| State | PV Installs - Total Market Value (\$ Millions, 2010) | Market Value Per Capita (2010) |
|------------|--|--------------------------------|
| Arizona | \$361.8 | \$56.61 |
| California | \$1,558.8 | \$41.84 |
| Colorado | \$333.4 | \$66.29 |
| New Jersey | \$630.3 | \$71.69 |
| New Mexico | \$244.7 | \$118.82 |
| Texas | \$128.6 | \$5.12 |

Source: IREC, SEIA, GTM Research, and U.S. Census Bureau
with Clean Edge analysis

see table below



Solar Investment: Venture Capital

An additional barometer of a state's overall technology leadership comes in the form of venture capital activity, which primarily represents equity investments in early-stage companies. Venture capitalists and their investments play a central role in the gestation of regionally based sectors, nurturing both emerging and growth-stage companies. Clean tech in particular has seen an explosion in interest from the venture community, with solar investments near the top of the list.

U.S.-based venture capital investments in clean technologies increased from \$3.5 billion in 2009 to \$5.1 billion in 2010, according to data provided by the Cleantech Group. Between 2001 and 2010, clean-tech investments expanded from about one percent of the overall VC pie in the U.S. to nearly a quarter of total domestic VC investing. In 2010, solar represented approximately 30 percent of total venture activity in the U.S. In addition, four solar deals were among the top U.S. venture deals of the year, in terms of total dollar amounts.

Of the six states compared in this report, California is the clear solar venture investment leader. Between 2008 and 2010, California-based companies racked up nearly \$4 billion in solar VC investments, reflecting the state's high concentration of solar development and activity. The next closest state, Colorado, came in second with \$264 million in solar venture investments and Texas came in third with \$78 million in venture investments related to solar thin-film manufacturing, advanced cell and module design, and concentrated PV technology development.

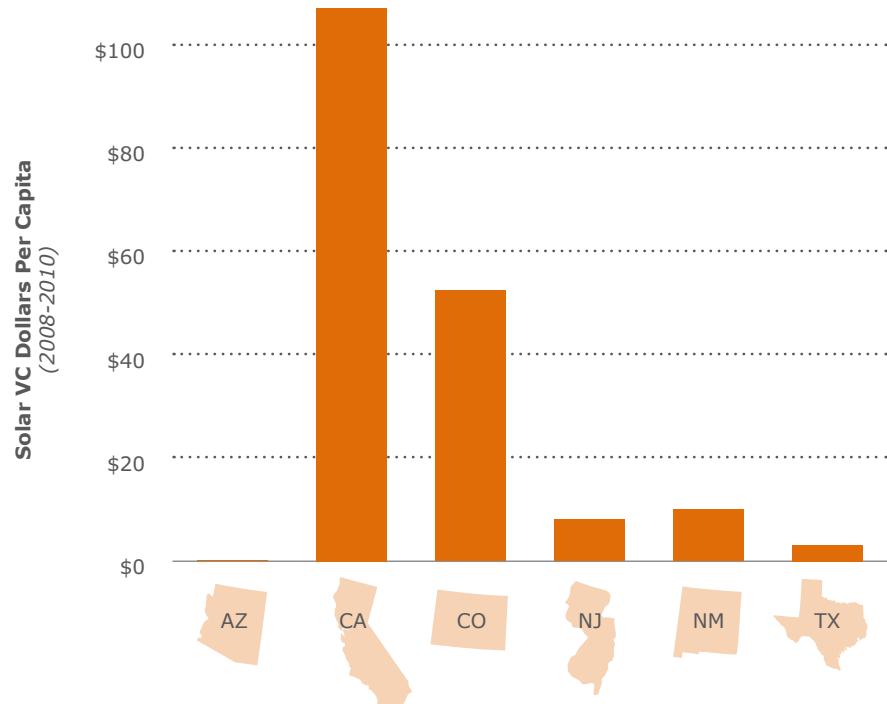
While venture investments only tell part of the overall investment picture, they are a clear indicator of state leadership and competitive economic advantage.

SOLAR VENTURE CAPITAL INVESTMENT (DOLLARS)

| State | Total Solar VC Dollars (2008-2010) | Solar VC Dollars Per Capita (2008-2010) |
|------------|------------------------------------|---|
| Arizona | \$700,000 | \$0.11 |
| California | \$3,997,960,000 | \$107.32 |
| Colorado | \$263,865,000 | \$52.47 |
| New Jersey | \$71,500,000 | \$8.13 |
| New Mexico | \$20,500,000 | \$9.96 |
| Texas | \$78,400,000 | \$3.12 |

Source: Cleantech Group and U.S. Census Bureau with Clean Edge analysis

see table below



Solar Investment: Job Creation

As state governments seek to enhance environments that spur private-sector job creation and foster economic growth, the solar space presents an exciting opportunity for a range of states, including Texas. The Solar Foundation, a Washington, D.C.-based 501(c)(3) non-profit organization focused on solar research and educational outreach, estimates that there were 93,502 solar workers in the U.S. in 2010, approximately double the number of solar workers during the prior year. This growth was a direct result of U.S. solar PV installations increasing from 435 MW in 2009 to 882 MW in 2010, along with the growing presence of PV manufacturing companies and sales, marketing, and installation firms.

Of this national solar workforce, about 44,000 people work in installation, 25,000 in manufacturing, 12,000 in wholesale trade, and 13,000 in other sub-sectors. The Solar Foundation estimates that these direct solar jobs, defined as workers who spend at least 50 percent of their time supporting solar-related activities, will grow nationally by 26 percent or 24,000 jobs by September 2011.

While solar jobs exist in all 50 states, California is the leader with approximately 36,000 solar jobs (see adjacent table) and more than 1,000 solar companies, or 30 percent of all solar firms in the U.S. Texas ranks third, behind second place Pennsylvania (6,700 jobs), with approximately 6,400 solar jobs. Yet despite its current strong standing, Texas has substantial room for growth. Only .08 percent of the total Texas labor force is currently employed in solar jobs – compared to .30, .29, and .20 percent in California, Colorado, and Arizona respectively. If Texas were to reach par with other leading states in terms of solar jobs market share, thousands of additional Texans could be employed.

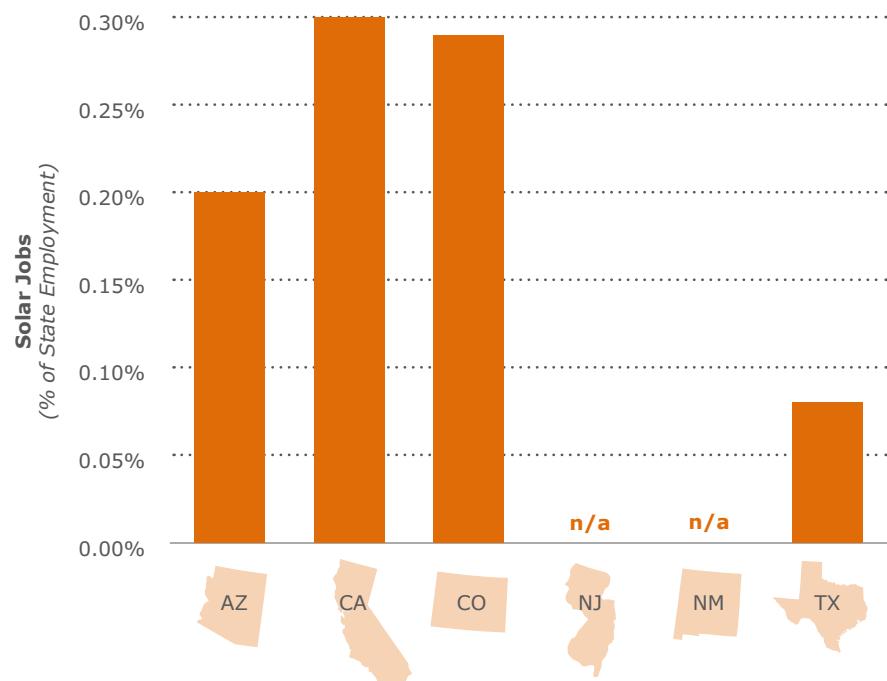
SOLAR JOBS

| State | Solar Jobs (2010) | Solar Jobs (% of State Employment) |
|------------|-------------------|------------------------------------|
| Arizona | 3,800 | 0.20% |
| California | 36,000 | 0.30% |
| Colorado | 5,300 | 0.29% |
| New Jersey | n/a* | n/a* |
| New Mexico | n/a* | n/a* |
| Texas | 6,400 | 0.08% |

Source: The Solar Foundation and U.S. Bureau of Labor Statistics with Clean Edge analysis

see table below

*No state solar job totals are available for NJ or NM because The Solar Foundation did not calculate total solar job estimates for states that did not place in the top 10 of its solar census survey.



Solar Innovation and R&D

Solar PV leadership can also be tracked via a state's patent activity. Patents granted for innovative clean-energy technologies are often the first step in creation of new products, companies, and jobs, making them an important measure of a state's intellectual capital. According to the Clean Energy Patent Growth Index, maintained by intellectual property law firm Heslin Rothenberg Farley & Mesiti, solar patents accounted for 15 percent of all clean-energy patents granted in the U.S. from 2002 to 2010 (1,355 of 9,004).

Of the six states tracked in this report, California by far has the highest number of overall solar patents granted between 2002 and 2010. At 265, it dwarfs the next highest contender, New Mexico, by nearly an order of magnitude. California's prominent research universities, Silicon Valley-driven culture of innovation, and flock of early-stage investors create an environment that attracts individual minds and pioneering companies dedicated to developing technology breakthroughs.

With its small population, New Mexico's 27 solar patents were enough to move the state past California for the lead in solar patents per capita. New Mexico's activity was led by Albuquerque-based Emcore, a developer of technologies for the fiber optic and solar power markets.

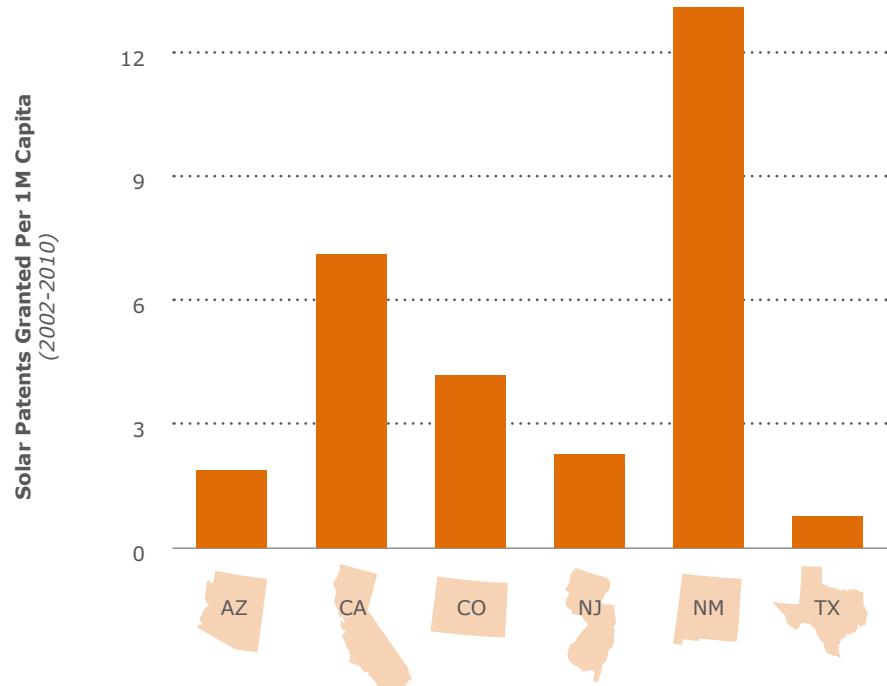
Texas' sheer size puts it behind when viewed from a perspective of both overall ranking and patents per capita, with 19 solar patents granted since 2002. However, R&D could be a strong area of growth for Texas, as it is home to leading universities such as the University of Texas and Rice University, which are demonstrating leadership across the clean-energy and materials sectors. And helping turn ideas into successful businesses, resources like the Austin Technology Incubator have aided clean-energy innovators' entrepreneurial efforts.

SOLAR PATENTS GRANTED

| State | Total Solar Patents Granted (2002-2010) | Solar Patents Granted Per 1M Capita (2002-2010) |
|------------|---|---|
| Arizona | 12 | 1.88 |
| California | 265 | 7.11 |
| Colorado | 21 | 4.18 |
| New Jersey | 20 | 2.27 |
| New Mexico | 27 | 13.11 |
| Texas | 19 | 0.76 |

Source: Heslin Rothenberg Farley & Mesiti P.C. and U.S. Census Bureau with Clean Edge analysis

see table below



Solar Policy Landscape

State-based policy programs include a broad range of regulations and incentives to encourage solar deployment. But it's important to note that not all policies are created equal. RPSs with solar set-asides are a great example. Some states, like Arizona, Colorado, and New Mexico, have established aggressive targets specifically for solar or distributed generation (DG) as part of their RPS goals – 4.5 percent DG in Arizona by 2025, three percent DG in Colorado by 2020, and four percent solar electric in New Mexico by 2020. While Texas passed an RPS for a 500 MW non-wind goal, the law has not been implemented.

In looking at the policy table to the right, Texas is the only state reviewed that lacks net metering and solar rights provisions. According to DSIRE (Database of State Incentives for Renewables and Efficiency), Texas is also the only state reviewed with an unknown or unclear status for third-party solar PV power purchase agreements (PPAs). Regarding net metering, Texas offers volunteer utility programs, but this is not as strong as the unlimited capacity net metering programs established in Arizona, Colorado, and New Jersey and the 80 MW limit in New Mexico. On the financial incentives side, Texas does provide loans of up to \$5 million for energy-cost-reduction technology deployment, including solar PV, for schools, local governments, state government, and hospitals via its LoanSTAR revolving loan program. Of the six states covered in this report, Colorado is the only other state with a loan program (intended for commercial, industrial, and non-profit organizations).

More than 30 U.S. states offer either a solar PV rebate or tax credit, although programs vary significantly regarding incentive levels, budgets, funding

SOLAR-RELATED POLICY: INCENTIVES & REGULATIONS

| | AZ | CA | CO | NJ | NM | TX |
|--|----|----|----|----|----|----|
| RPS w/ Required Solar or Distributed Generation | ● | | | ● | ● | ● |
| Mandated Net Metering | ● | ● | ● | ● | ● | |
| Interconnection Standards | | ● | ● | ● | ● | ● |
| Public Benefits Funds and/or Direct Cash Incentives for PV | | ● | ● | ● | | |
| Solar Easements Provision | | | ● | ● | ● | ● |
| Solar Rights Provision | ● | ● | ● | ● | ● | ● |
| Solar Contractor Licensing Requirements | ● | ● | | | | |
| 3rd Party Solar PV PPA – Authorized by state | ● | ● | ● | ● | ● | ● |
| State Property Tax Incentives for PV Projects | ● | ● | ● | ● | ● | ● |
| State Sales Tax Incentives for PV Projects | ● | | ● | ● | ● | ● |
| State Tax Credits for Residential and Commercial PV Projects | ● | | | | | ● |
| Solar Industry Recruitment or Support Incentive | ● | ● | ● | ● | ● | ● |
| State Loans for PV Projects | | | | ● | | ● |
| Local/Utility Loans for PV Projects | ● | ● | | | | ● |
| State Rebates for PV Projects | | ● | ● | ● | ● | |
| Local/Utility Rebates for PV Projects | ● | ● | ● | | | ● |
| State Grants for PV Projects | | | | ● | | ● |
| Local/Utility Grants for PV Projects | | | | ● | | |

Source: DSIRE with Clean Edge analysis

sources, eligibility requirements, and other features. Texas is the only state in this review that doesn't offer any form of government rebate or tax credit for solar PV projects. It's also worth noting that many utilities (DSIRE estimates approximately 75 utilities across the U.S.) offer PV rebates and incentives, versus funding directly via a direct government rebate. In Arizona and Colorado, for example, utilities offer nearly state-wide PV rebates as they work to comply with RPS mandates, particularly RPSs with solar or DG set-asides.

Conclusion

The solar PV market is expanding rapidly both globally and nationally. Between 2000 and 2010, the global solar PV market experienced a compound annual growth rate of 39.8 percent and in 2010 the U.S. solar PV market more than doubled in total annual installations over the prior year. Texas is in a strong position to leverage a range of unique assets, including existing technical infrastructure, research expertise, and a rich history of energy leadership. But as witnessed in this report, the state has yet to fully capitalize on the opportunity, and must take strong public and private action to exploit the solar PV opportunity.

RENEWABLE PORTFOLIO STANDARD AND SOLAR/DG TARGETS

| | RPS Targets | Solar/Distributed Generation (DG) Targets |
|-------------------|---|---|
| Arizona | 15% x 2025 | 4.5% DG x 2025 |
| California | 33% x 2020 | n/a |
| Colorado | 30% x 2020 (IOUs); 10% x 2020 (co-ops & large munis) | 3% DG x 2020; 1.5% customer sited x 2020 |
| New Jersey | 22.5% x 2021 | 5,316 GWh solar electric x 2026 |
| New Mexico | 20% x 2020 (IOUs); 10% x 2020 (co-ops) | 4% solar-electric x 2020; 0.6% DG x 2020 |
| Texas | 5,880 MW x 2015 (already reached) | Non-wind goal of 500 MW |

Source: DSIRE and Clean Edge