



POWER TOWN

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**California's Capital Region Mobilizing to Meet
Growing Demand for Clean Technologies**



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Next 10 is an independent nonpartisan organization that educates, engages and empowers Californians to improve the state’s future.

Next 10 is focused on innovation and the intersection between the economy, the environment, and quality of life issues for all Californians. We provide critical data to help inform the state’s efforts to grow the economy and reduce global warming emissions. Next 10 was founded in 2003 by businessman and philanthropist F. Noel Perry.

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ABOUT THIS REGIONAL CLEAN ECONOMY SERIES

California is a national leader in the clean economy, with companies pushing the envelope developing and deploying clean technologies, spurred by progressive state policies stimulating company growth. As a result, the core clean economy has become an important driver of California's overall economic vitality, employing over 185,000 workers as of January 2014 while protecting the state's natural resources.

California's statewide economy is comprised of regional economies, each with distinct assets and strengths. Regional stakeholders are leveraging their unique assets in innovative ways to develop and expand clean technologies within their region, with potential applications in the broader state

and global market. Across regions, innovation is the key to driving clean economy growth in California.

This report is one in a series of regional clean economy studies that explores the unique assets in California's regions and the role they play in the regional and state economy.

What is the core clean economy?

The "core clean economy" includes businesses that provide the cutting-edge products and services that allow the entire economy to transition away from fossil fuels and use natural resources more efficiently.

- San Joaquin Valley**
Water-Agriculture
Renewable Energy
- San Diego - Imperial**
Smart Grid
Biorenewables
- Los Angeles & Orange**
Advanced Transportation

- San Francisco Bay Area**
Advanced Transportation
Energy Storage
Building Energy Efficiency
- Sacramento**
Electric Vehicles
Building Energy Efficiency & Solar
Waste-to-Energy

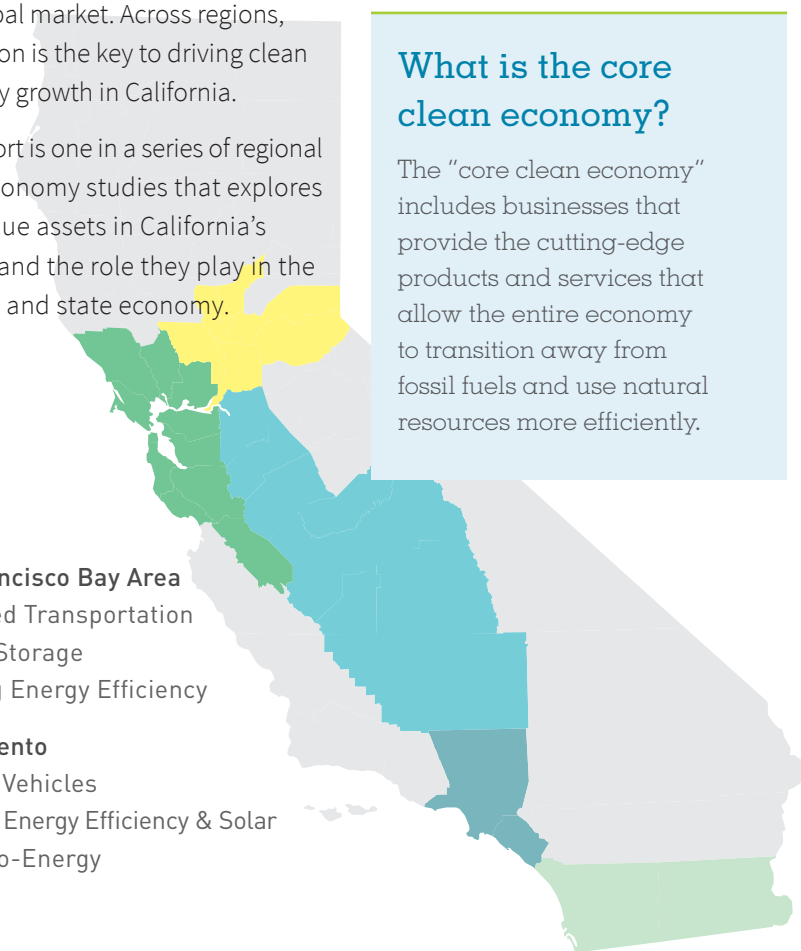


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EXECUTIVE SUMMARY

This report explores clean technology innovations that are driving growth in the Sacramento region's clean economy. These innovations include both new technologies that are being developed in the region as well as strategies for deploying and applying clean technologies. This report is based on new data analysis and interviews with regional stakeholders, who identified electric vehicles, building energy efficiency, solar power, waste to energy, and waste to fuel as the major areas of clean economy innovation in the region.

Highlights of clean economy innovation in the Sacramento region include:

- **The Sacramento region has positioned itself to be at the forefront of the transition to clean energy and clean technologies**, with particular strengths in
 - electric vehicle deployment,
 - installation of energy efficiency technologies and solar panels, and
 - development of waste to energy technologies.
- **The number of electric vehicles (EVs) in the region has grown steadily**, driven in part by the efforts of TakeCharge, a regional collaboration aimed at promoting EV adoption and removing barriers to the installation of EV charging infrastructure. More than 3,000 EVs were registered in the region as of 2013, a 37 percent increase over 2012.
- **With growth in the new home market in the Sacramento region, installation of energy efficiency technologies and solar capacity has been growing steadily**. Residential solar capacity has grown six-fold from 2007 to 2013 in the region. Residential per capita energy efficiency improved six percent between 2006 and 2012, while the state improved only three percent over the same time period.
- **The Sacramento region has a vibrant group of waste to energy companies** that apply biodigestion and gasification technologies to convert different types of waste into electricity, transportation fuel, or pipeline fuel. The region is home to one of the largest commercial-scale anaerobic digester projects in the country, owned and operated by Sacramento-based CleanWorld.
- **The region's publicly owned utility, Sacramento Municipal Utility District, has been a major supporter of clean technology innovation in the region**, investing in research and development, creating incentives for clean technology adoption, and setting ambitious goals for reducing greenhouse gas emissions and increasing the amount of energy generated from renewable sources.
- **The University of California (UC) Davis is a major driver of research and development as well as commercialization of clean technologies**. In addition to partnering with regional companies on research and development of clean technologies, UC Davis prepares students for careers in the region's clean economy, both in existing companies and as entrepreneurs.

INTRODUCTION

The Sacramento region is home to a diverse range of clean technology activities that are stimulating the regional economy while helping achieve regional and state environmental goals. Sacramento's clean economy spans the value chain, from research and development to deployment, and includes a wide range of sectors including solar, advanced transportation, and waste to energy.

Dedicated regional collaborations are helping to strategically drive growth in Sacramento's clean economy, accelerating the shift toward renewable energy and advanced transportation in the region. Led by both the public and private sectors in productive partnerships, these collaborations have helped foster a supportive environment for innovation, stimulate regional demand for clean technologies and connect clean technology companies with the resources they need to grow and thrive in the region. The region is home to the state capital and public agencies that are implementing mandates to increase clean technologies, spurring local clean economy development. In addition, the Sacramento Municipal Utility District (SMUD) has played an important role as a partner to clean technology companies and as a driver of clean technology deployment in the region.

The Sacramento region has been a leader in supporting the development and deployment of clean technologies as a strategy for promoting economic prosperity, not just as an environmental imperative. For example, the regional Next Economy effort, a business-led, volunteer-driven initiative that works to accelerate job growth in the Sacramento region, has targeted clean energy technology as one of the region's six core business clusters. Sacramento Regional Technology Alliance (SARTA)'s CleanStart initiative has also helped to accelerate growth in the sector by facilitating networking among clean technology businesses and connecting entrepreneurs with the training, capital, and connections they need to grow their businesses in the region. The University of California (UC) Davis also plays a key role in research and development of clean technologies as well as training the local workforce.

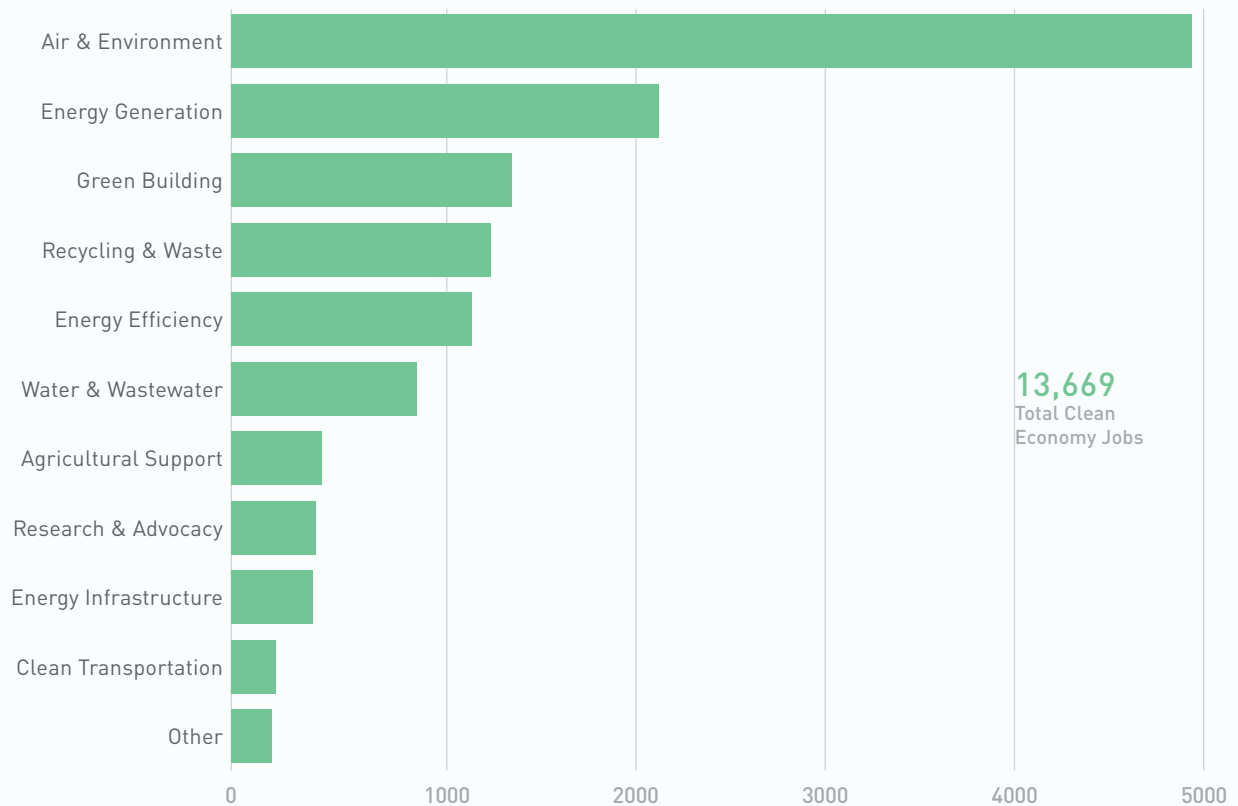
What unique assets drive Sacramento's clean economy?

Growth in Sacramento's clean economy has been bolstered by the supportive role of SMUD, the region's publicly owned utility that has both invested in clean technology R&D in the region and partnered with clean technology companies to implement new technologies. The region is also home to the state capital and public agencies that are pursuing clean technologies and stimulating the local clean economy. State mandates to increase energy efficiency in public buildings, for example, have had a significant economic impact in the region.

The proximity to the capital has also positioned regional stakeholders to effectively collaborate with state partners in leveraging state incentives and mandates to accelerate adoption of clean technologies. UC Davis has also played a key role in fostering the development of new, clean technologies and accelerating commercialization in the region.

While Sacramento is home to a range of clean technology activities, this report focuses on three areas of recent regional innovation: deployment of electric vehicles (EVs), installation of building energy efficiency and solar technologies, and the development of waste to energy technologies.

Figure 1: Core Clean Economy Jobs, Sacramento Area, 2014



In January 2014, there were nearly 14,000 jobs in the Sacramento Region’s “core” clean economy. These core jobs were in a range of businesses that provide the products and services that allow the entire economy to transition away from fossil fuels and improve efficiencies in the use of natural resources.

Employment in the Sacramento Region’s clean economy is primarily in the Air & Environment, Energy Generation, Green Building, and Recycling & Waste segments, though the region’s clean economy includes a wide range of sectors and activities. This report, however, focuses on the segments of the clean economy that are driving innovation in the region, both in terms of new technologies and deployment strategies. For a more in-depth analysis of employment data in the clean economy, see Next 10’s *California Green Innovation Index*, which tracks the clean economy statewide and includes an analysis of the fifteen segments of the clean economy.

NOTE: Other includes Advanced Materials, Energy Storage, Business Services, and Finance & Investment

SOURCE: National Establishment Time Series, Green Establishments Database

ANALYSIS: Collaborative Economics



ACCELERATING ELECTRIC VEHICLE DEPLOYMENT

Increasing EV adoption is an opportunity for both direct and indirect economic benefits within the region. Growth in EV adoption stimulates markets for charging infrastructure and for EV sales and service, which creates a need for workers and companies to meet this demand. Growth also generates indirect economic benefits, with EV drivers spending less on fuel and therefore able to spend more in other sectors of the regional economy. A recent analysis of EV deployment in California found that, on average, a dollar saved on gas and spent on other goods and services creates 16 times more jobs.¹

EV adoption has grown steadily in the region, and private and public partners in Sacramento are strategically mobilizing to capture the economic benefits of increased EV deployment. More than 3,000 EVs were registered in the region as of 2013, a 37 percent increase over 2012 (Figure 2). The TakeCharge initiative, a regional partnership working to position Sacramento as a leader in EV deployment, estimates that number will grow to approximately 75,000 by 2025, which would represent a fifteen-fold growth in twelve years.

Regional partners are working together to capitalize on the economic potential of the EV industry and ensure that these growing markets create jobs in the

Sacramento region. Businesses, public agencies, and education and training providers are working together to reduce barriers to growth, incentivize adoption and prepare the workforce with the skills they need for the EV sector. While every region in California is working to increase EV adoption to meet the governor's goal of 1.5 million EVs by 2025, Sacramento has developed and implemented multiple innovative strategies for accelerating the transition to EVs.

The TakeCharge initiative, led by the Sacramento Area Council of Governments (SACOG), has been an important driver of EV adoption. Through collaboration with policymakers, local governments, and other regional

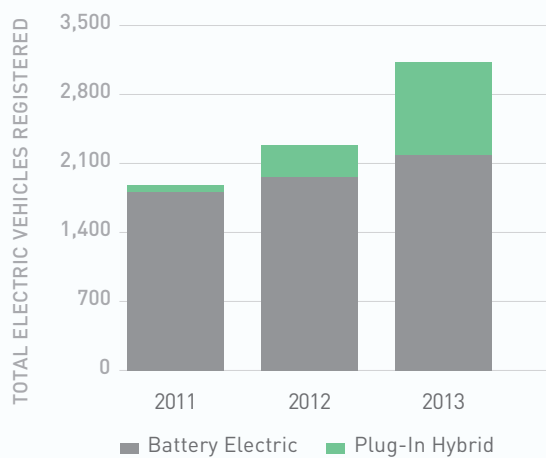
Electric Vehicles in Sacramento

With increasing EV adoption rates among private consumers as well as public sector and business fleets, the EV industry is a growing part of Sacramento's clean economy. Through regional partnerships aimed at increasing EV adoption and installing charging infrastructure, the region has positioned itself for wide-scale adoption.

stakeholders, the initiative has helped to raise awareness of the value of EV adoption and to remove barriers to infrastructure installation. Since wide-scale EV adoption depends on a supportive environment—including both charging infrastructure as well as supportive policies that incentivize EV adoption—this effort to build broad-based public support has been an important foundation for continued growth in EVs.

The region has also taken a strategic approach to ramping up the charging infrastructure needed to support wide-scale EV adoption. Working with the UC Davis Electric Vehicle and Hybrid Research Center, TakeCharge identified priority locations for infrastructure to meet the needs of current and future EV drivers by analyzing the driving patterns of both Sacramento residents and those passing through the region along I-80 and I-5. TakeCharge, in partnership with local agencies and

Figure 2: Total Electric Vehicles Registered, Sacramento Region



SOURCE: California Energy Commission
ANALYSIS: Collaborative Economics

governments, has since leveraged this information to install charging stations throughout the region.

The Sacramento region is also home to **ClipperCreek**, a leading EV charging infrastructure company. ClipperCreek designs and manufactures EV chargers in its Auburn facility, targeting both individual consumers and commercial fleets in markets across the country.

In addition to installing charging infrastructure, TakeCharge has worked to remove barriers to future installations. This includes streamlining permitting processes throughout Sacramento regional jurisdictions as well as creating building ordinances that standardize the inclusion of EV charging infrastructure.

Complementing infrastructure development efforts, local governments have worked together to implement local incentive programs to stimulate demand for EVs. These programs build upon state-level incentives, spurring EV adoption in the region by lowering up-front purchase costs. El Dorado County, for example, has worked with the California Air Resources Board to provide a \$1000 incentive

for the purchase of an eligible vehicle, on top of other state incentives.

SMUD has also played a catalyzing role in EV adoption in the region. SMUD’s EV Innovators Pilot Rate program allows EV owners to choose between two electricity pricing plans, making home charging for EV’s more economical. SMUD has also invested in installing its own EV charging infrastructure and recently became the first utility in the state to install a DC fast charger.

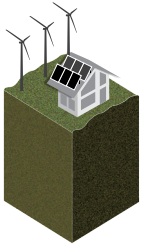
Underpinning the region’s success in EV deployment has been forward-looking leadership. Regional public, private and utility leaders have not only recognized the economic and environmental potential of EVs, they have been building the supportive infrastructure—both physical and policy—that will facilitate the transition to EV’s in the future and retain its benefits within the region.

Sacramento Municipal Utilities District (SMUD) Supporting the Regional Clean Economy

SMUD has been an important catalyst and partner in a growing the region’s clean economy. SMUD is a publicly owned utility with an elected board of governors that prioritized support for clean technologies. As the largest California utility to have 20 percent of its power come from renewable sources, SMUD is a statewide leader in the transition away from fossil fuels.

SMUD fosters research and development, sets ambitious goals for the adoption and deployment of clean technologies, and experiments with implementation of new technologies. For example, SMUD is piloting a \$300 million smart grid project in coordination with the U.S. Department of Energy and regional stakeholders to evaluate consumer behavior and dynamic pricing with new smart grid technologies.

SMUD’s willingness to collaborate with clean technology companies has helped to accelerate the development and deployment of clean technologies in the region. In addition, SMUD’s renewable portfolio standard and other incentives aimed at encouraging renewable energy generation has helped stimulate demand for solar and other renewable energy deployment in the region.



INSTALLING ENERGY EFFICIENCY AND SOLAR TECHNOLOGIES FOR REGIONAL BUILDINGS

Local policies and programs in the Sacramento region have built upon state policies to encourage adoption of energy efficiency and solar energy technology on new and existing homes and buildings. These standards and incentives, combined with a growing new home construction market in the region and innovation assets such as UC Davis, are stimulating growth and innovation in the deployment of energy efficiency and solar technologies.

Installation of Energy Efficiency Technologies and Solar Panels

With the new home construction market starting to rebound after the 2008 recession, Sacramento has seen an increase in new, energy-efficient homes that are solar-ready or solar operational, as mandated by the Title 24 Building Energy Efficiency Program. With consumers increasingly recognizing the economic value of energy efficiency and solar capacity, installation of energy efficiency technologies and solar panels have become more integrated into the mainstream construction market.

New solar installations in the Sacramento region climbed steadily between 2007 and 2012, despite the economic slowdown (Figure 3). The residential sector has been

particularly strong, with installed solar capacity growing six-fold from 2007 to 2013. Energy efficiency in the region has also improved, with residential per capita energy efficiency improving six percent between 2006 and 2012, while the state improved only three percent over the same time period. Similarly, non-residential per capita energy efficiency improved 5.6 percent between 2006 and 2012, compared to 4.2 percent in California as a whole.

With the uptick in demand for solar installation, the region has seen growth in solar technology companies, particularly those focused on installation, sales and marketing. **Paramount Solar**, for example, is a Sacramento-based solar sales and marketing firm that was recently acquired by Solar City for about \$120 million.²

In addition to residential and

commercial buildings, the region is also seeing an increase in energy efficiency and solar installation on state-owned buildings in the region. Through an Executive Order, the Governor called for new or renovated state buildings to achieve the U.S. Green Building Councils' LEED Silver certification or higher, the industry standard for energy efficiency and environmental design. The Executive Order also called for buildings to incorporate on-site power generation such as solar photovoltaic. With the majority of state-owned buildings located in the Sacramento region, this Executive Order has stimulated market growth in the region, attracting energy efficiency and solar installation companies.

Counties and municipalities in the region have also implemented innovative financing tools to help property owners with energy retrofits and solar installations. For example, Placer County voted in 2013 to reinstate its PACE financing program and set aside \$30 million to fund the program. The PACE program helps homeowners finance energy improvements, such as energy-efficient windows, heating and air-conditioning systems, and solar power, through property tax payments.

Building Energy Efficiency and Solar Installations in Sacramento

Driven by a rebounding residential construction market, growing consumer demand for highly efficient buildings, and policies that encourage renewable energy generation and high energy efficiency in public buildings, the Sacramento region has seen considerable growth in the installation of building energy efficiency technologies and solar panels. Building energy efficiency includes technologies such as efficient lighting, heating and air ventilation systems and controls, energy management systems, and efficient windows.

In addition to companies installing these technologies in the region, there are a growing number of Sacramento-based companies developing and manufacturing energy efficiency and solar technologies in the region

Many builders are working to reinvent themselves coming out of the recession. Since the solar industry just kept growing through the downturn, there are huge opportunities for solar installation to become integrated into the mainstream building and construction industry.

– **Todd Lindstrom**, Enable Energy

Local municipalities have also implemented incentives for solar installation. The City of Roseville's Blueprint for Energy Efficiency and Solar Technology (BEST Homes), for example, combines a solar roof system with high efficiency air conditioning, energy efficient appliances, and weatherization to reduce energy bills and lower summer peak energy consumption. The program also creates a more diverse portfolio of power supply, helping Roseville meet the City Council's adopted renewable portfolio standard.

SMUD's solar shares program has also helped stimulate demand for solar energy. The program allows utility customers to select to have a portion of their power produced at a local solar farm. The program has grown steadily as more customers in the region express an interest in using solar energy.

Sacramento Businesses Developing Energy Efficiency and Solar Technologies

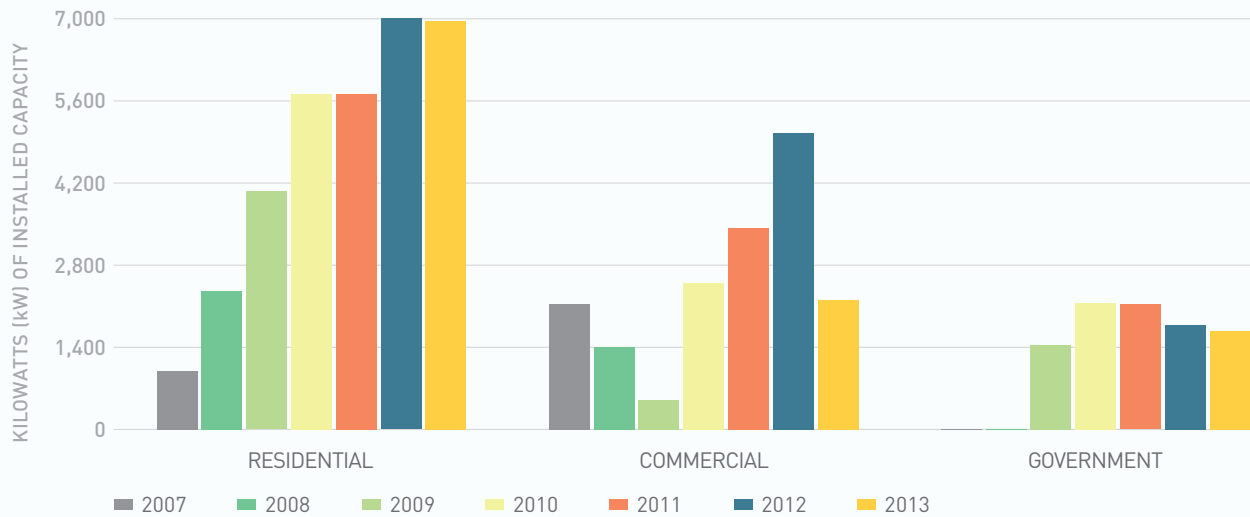
In addition to installation of energy efficient technologies and solar panels, the region is also home to a number of companies developing and commercializing innovative energy efficiency and solar technologies.

Within the solar industry, the region has a cluster of companies developing cutting-edge solar technologies. **Bloo Solar**, a company based on El Dorado Hills with early ties to researchers at UC Davis, developed a high efficiency PV panel. Bloo Solar's technology creates more efficient PV panels with applications in residential, industrial, and utility installations.

The region's concentration of solar companies has also helped to drive innovative solar business development techniques. **Enable Energy**, for example, is a solar startup staffed by a team of solar industry professionals from the region who consult with companies around the country to accelerate the development of new solar technologies and to provide strategy and business development support.

The region is also home to a number of companies developing energy efficiency technologies, many of which were initially developed at UC Davis. The UC Davis Energy Efficiency Center is a leading center of energy efficiency technologies and the first university-based energy

Figure 3: New Solar Installations, Capacity (kw) Installed Through the California Solar Initiative by Sector, Sacramento Region, 2007-2013



SOURCE: California Public Utilities Commission - California Solar Initiative
 ANALYSIS: Collaborative Economics

With the majority of state-owned buildings located in the Sacramento region, the Governor’s Executive Order has stimulated market growth in the region, attracting energy efficiency and solar installation companies.

efficiency center in the country that focuses on transferring technology into the marketplace. Several Sacramento-based energy efficiency companies have ties to UC Davis, including SynapSense, which develops technology to optimize building energy use with a particular focus on data storage centers. SynapSense technology was initially developed by Raju Pandey, a UC Davis Professor in the Department of Computer Science. The company received early venture funding from Sacramento-based firms and then attracted funding from international investors, totaling more than \$43 million. The company was recently acquired by Panduit, an international manufacturer of data center equipment.

RCS Technology is another leading energy efficiency company in the region, based just outside Sacramento. RCS Technology designs and manufactures smart thermostat technologies for residential and light commercial use. The company’s products are gaining market share, with several white-labeled products designed and manufactured by RCS currently being sold at major national retailers.



DEVELOPING WASTE TO ENERGY TECHNOLOGIES

Clean and efficient technologies that convert waste to energy are emerging across the country and worldwide, driven by increases in waste, diminishing space for landfills, and growing concerns about greenhouse gas emissions from waste. The Sacramento region is home to a small but innovative group of waste to energy companies. These companies focus on biodigestion and gasification technologies to convert different types of waste into electricity, transportation fuel, or fuel to pipelines.

Supported by the regional industry clusters of opportunity initiative, which has created an industry-driven partnership to grow Sacramento's waste to energy sector, companies in the region are working together to remove barriers to growth and to prepare a workforce to meet the needs of the sector. The sector has also benefited from SMUD's commitment to supporting innovation in biofuels, including waste to energy technology.

With few examples of successful commercial applications of waste to energy technology worldwide, Sacramento is home to some promising examples of waste to energy projects operating at commercial scale that have garnered national and international attention. Sacramento is home to the first-of-its-kind in the United States closed loop organic waste

project that generates natural gas, electricity, and fertilizer from up to 100 tons of food waste per day. The project is located at the Sacramento South Area Transfer Station, where an anaerobic digester developed by a Sacramento-based company, **CleanWorld**, converts organic waste from restaurants, food processing companies, and grocery stores throughout region into natural gas, electricity, and fertilizer. The renewable natural gas is used to power **Atlas Disposal's** fleet of refuse trucks. This facility recently expanded to handle 100 tons of waste per day, making it one of the largest projects of its kind. CleanWorld's anaerobic digestion technology was developed by Dr. Ruihong Zhang, a professor of biological and agricultural engineering at UC Davis.³

Waste to Energy in Sacramento

Sacramento's waste to energy sector includes a range of companies that convert waste into electricity, transportation fuels, or pipeline fuel. These companies are developing and commercializing technologies that have the potential to convert different types of waste streams—both organic and inorganic—into energy, with minimal environmental impact.

Globally, there are few examples of cost-effective waste to energy technologies operating at a commercial scale. The Sacramento region, however, is home to a number of companies developing and demonstrating innovative technologies that have attracted worldwide attention.

Sacramento is home to promising examples of waste to energy projects operating at commercial scale that have garnered national and international attention.

Another regional company working to capture and reprocess waste – creating an agricultural fertilizer rather than energy – is [California Safe Soil](#). This company uses an enzymatic digestion technology to rapidly digest food waste and convert it to a high-quality fertilizer. This fertilizer also helps growers address the state’s new nitrate-runoff regulations. The company will be opening a production-scale facility in McClellan, CA, expanding from its pilot facility in West Sacramento.

Some of the region’s waste to energy companies are generating energy from non-organic waste. [Sierra Energy](#) uses gasification technology to convert any kind of trash to energy by heating it to extreme temperatures without combustion. The result is synthetic natural gas that can either generate electricity or create ethanol or diesel fuel. While the technology is still in the early stages of development, Sierra Energy recently won a major contract with the U.S. Army, which is looking for ways to reduce its oil consumption.

SMUD has been an important supporter of the waste to energy sector in the region. Since scaling waste to energy technologies often depends on effectively linking biogas to fossil natural gas infrastructure—for example, ensuring that biogas can be transported through natural gas pipelines—SMUD’s support has been particularly helpful in growing the sector. More than 60 percent of the utility’s renewable energy comes from biomass, which includes energy produced from waste in landfills, wastewater treatment plants, and dairies as well as the direct combustion of solid biomass. SMUD has been particularly focused on increasing energy output from dairy digesters through its Dairy Digester Program which provides assistance to dairies installing digesters, applying for grants, and streamlining the permitting process.

CONCLUSION

Through regional collaboration among business, local government, universities, and other stakeholders, the region has fostered an environment that supports innovation in the development and deployment of clean technology. In particular, SMUD has played an important role in helping to stimulate the region's clean economy. The region has already seen considerable growth in the number of jobs in the clean economy as well as adoption of clean technology. With ongoing efforts aimed at stimulating EV adoption, building energy efficiency and solar panel installation, as well as waste to energy development and commercialization, the region is expected to see continued and accelerated growth.

Endnotes

1. David Roland-Host. UC Berkeley Department of Agricultural and Resource Economics. September 2012. "Plug-In Electric Vehicle Deployment in California: An Economic Assessment." Accessed from: http://are.berkeley.edu/~dwrh/CERES_Web/Docs/ETC_PEV_RH_Final120920.pdf
2. "SolarCity Buys Paramount Solar to Boost Homeowner Outreach." Forbes. August, 2013. Accessed from: <http://www.forbes.com/sites/uciliawang/2013/08/13/solarcity-buys-paramount-solar-to-boost-homeowner-outreach/>
3. CleanWorld website. <http://www.cleanworld.com/news/cleanworld-turns-uc-davis-campus-waste-into-campus-energy/>

