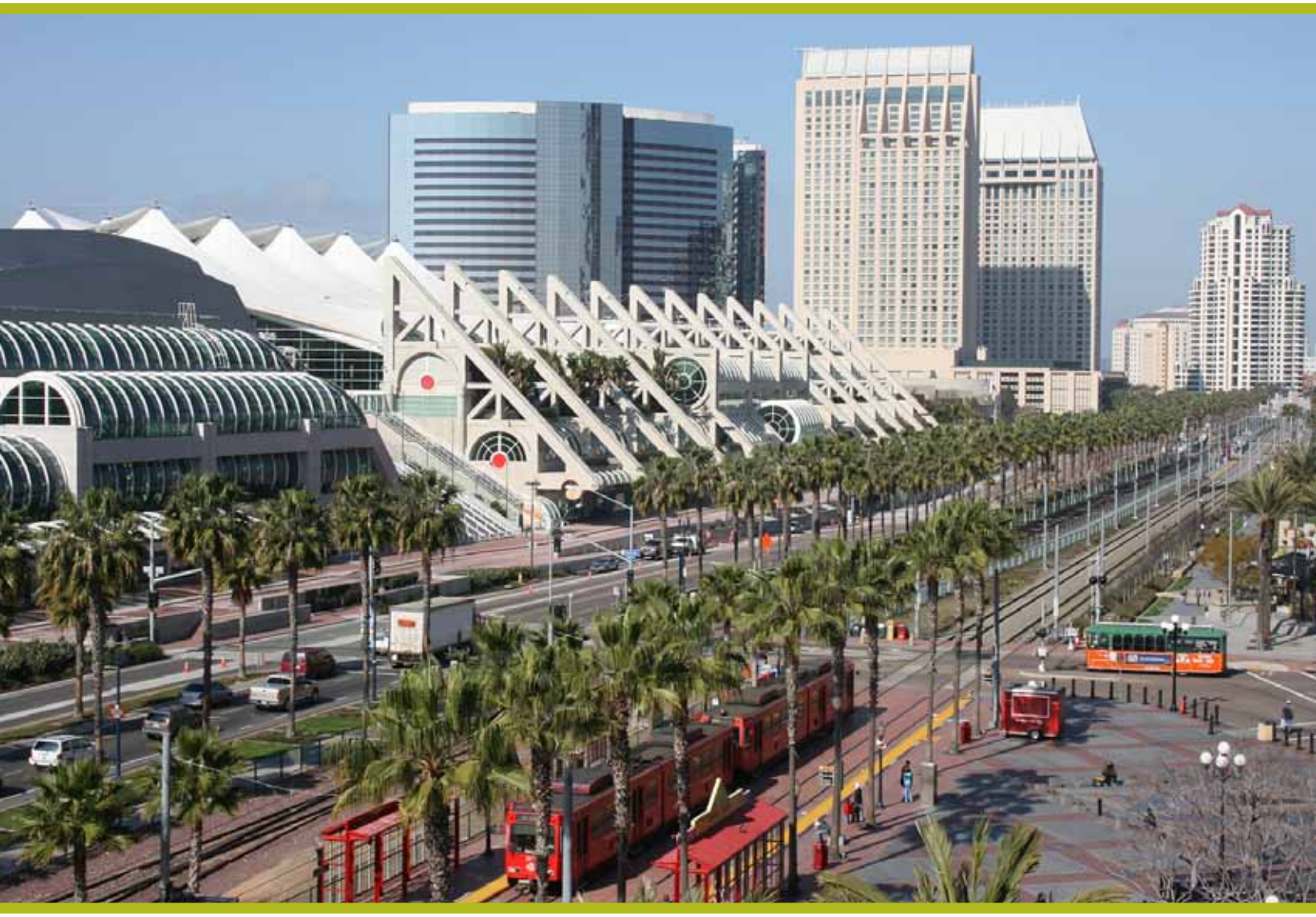
ECONOMIC VITALITY

CLEAN JOBS IN THE SAN DIEGO REGION



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Understanding The San Diego Region
The San Diego Foundation
We must understand. Then we can act.

To All San Diegans

Throughout San Diego County, people have a long and rich history of local community pride and protection of our region's clean air and water, natural resources, and quality of life. We also have a history of solving tough challenges, through discovery, innovation, and leadership. Like others across the world, our region is now at a crossroads, faced with growing concerns about our future economic prosperity, energy and water supplies, and the protection of our spectacular natural landscapes.

Working together, local leaders, industry employers, and communities across our region are charting a course toward a brighter future, investing today in a strong economy and a healthy environment. This is best evidenced in our vibrant and expanding economy in clean jobs, with one in ten jobs linked to industries helping our region to become more energy independent, develop clean and efficient technologies, reduce pollution, and keep our energy costs low. These jobs span a variety of sectors, including renewable energy, energy efficiency, biofuels and farming, water, waste, and wastewater management, and compliance and sustainability planning.

The Economic Vitality: Clean Jobs in the San Diego Region report is intended to highlight how our region has developed as one of the fastest growing in California for clean jobs, attracting $445 million in venture capital in the last five years alone. In addition to significant local venture capital investment, we owe our success to several factors, including state and local leadership in policies that create more opportunities for business development, local demand for installing renewable energy, innovation in energy efficiency technologies, and our mild, sunny climate.

We hope that this report will provide a foundation for community dialogue and action to ensure the expansion of clean energy and technologies in our region, and provide real jobs for real people. Together, we can sustain our quality of life, our clean air and water and our health, and enjoy a vibrant, growing economy, not just for today, but for our children, and all future generations.

Sincerely,

Scott Peters
Chair,
Climate Initiative

Bob Kelly
President & CEO,
The San Diego Foundation

Emily Young, PhD
Senior Director,
Environment Program

Elaine Gaertner
Initiative Director,
Center of Excellence

Laura Coleman
Project Manager,
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About the Report

Despite interest and investment in the green economy, accurate information about the cluster is difficult to obtain, especially at a regional level. Traditional systems that organize and classify industry sectors are not able to capture economic and workforce information on the clean energy economy in a consistent and timely way. As such, it is helpful to take a multi-layered approach that supplements traditional labor market information with investment data, direct employer outreach, and community-based efforts.

The data, analysis and information presented on the following pages would not have been possible without our many industry and education contributors to this study. The authors would like to thank the following for their keen insight and gracious cooperation —

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- Sean Karafin, BW Research, Inc
- Holly Lepre, Clean Tech San Diego
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- Phil Jordan, GreenLMI
- Sean Karafin, BW Research, Inc.

Contents

Economic Vitality: Clean Jobs in the San Diego Region

Executive Summary

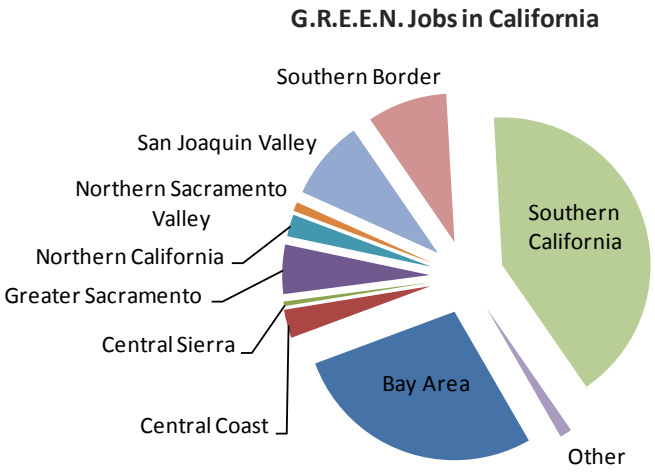
Creating a clean energy economy is not just an environmental priority for California, it is a multi-dimensional strategy that can reduce pollution, make the state more energy independent, create and save jobs, and help keep energy costs low. Responding to the challenge, regional leaders and industry employers across the state have steadfastly pursued developing clean technologies and capturing emerging green markets.

In San Diego, the clean energy economy is an established and vital engine for industry growth. San Diego is one of the largest and fastest growing regions in this type of economic activity. Nationally, the region was recently ranked by Clean Edge as the 7th largest metropolitan area in the nation for green job activity. Though there are many factors that have led to San Diego's leadership position, some of the most vital are:

- A culture of innovation
- Ability to attract talent and capital to the region
- Strong leadership by public officials and industry associations

In a very broad sense, industries related to the clean economy in the San Diego region account for as much as 10% of the current employment.[1] As these industries contain the firms most likely to be engaged in green and clean activities, it is fair to conclude that the clean energy economy will have a direct impact on one out of every 10 jobs in the region.

More specifically, newly released data from California's Employment Development Department (EDD) estimates that the number of green jobs in the San Diego region (or Southern Border) exceeds 37,700 — the third-largest concentration in the state, behind only Southern California (178,550 jobs) and the Bay Area (120,030 jobs). The San Diego region accounts for almost 9% of the total green jobs in California, including close to 13% of the state's renewable energy jobs and 11% of the energy efficiency and green building jobs.[2]



[1] EMSI Complete Employment (Summer 2010). It should be noted that this estimate is derived from employment totals of industries identified as those most likely to be related to the clean economy. This estimate is therefore overly broad, includes green firms as well as traditional firms, and should not be used as a proxy for green employment, www.economicmodeling.com.

[2] *California's Green Economy: Summary of Survey Results*, Employment Development Department, Labor Market Information Division (October 2010), www.labormarketinfo.edd.ca.gov.

Job growth in the San Diego region's clean economy is supported by several key factors.

Investment / There are 16 known firms located in San Diego County that invest in clean technology companies. Despite overall lower investments across all industry sectors, biofuel investments over the last three years exceed $1 billion.

Policy / Locally, the San Diego region was the first to develop a Sustainable Communities Strategy, a required element of the 2050 Regional Transportation Plan (RTP) per Senate Bill 375 (SB 375). The City of San Diego, under Mayor Jerry Sanders, also expects that the passage of AB 32's implementation standards and programs will accelerate the adoption of solar power and energy efficiency technologies in the San Diego region.

Local Demand / In the San Diego region, military spending on solar installations could have a significant effect on energy efficiency and green building job growth. In a survey of the region's specialty trade construction employers, more than 30% of the firms reported having worked on a green building project.

Prepared Workforce / A majority of clean economy jobs require less than two years of education or training, providing numerous and varied opportunities for individuals across and along career ladders. With the success of biotech, wireless communications, and defense industries, and access to multiple higher educational institutions in the region, San Diego maintains a strong workforce with transferable skills and can supply a steady supply of new workers.

In the discussion to follow, investment, policy, industry and occupational employment trends are highlighted, aligning traditional labor market information with independent research and targeting six clean energy or related green subsectors: renewable energy, energy efficiency, biofuels and farming, water, waste, and wastewater management, transportation and alternative fuel vehicles, and compliance and sustainability planning.

Introduction

Few recent trends have so affected the political, social, and economic landscape as "green and clean." Despite even the latest recession, the last several years have brought unprecedented public [3] and private[4] investments in renewable energy, energy efficiency, water and waste management, alternative transportation and fuels, sustainable farming practices, preservation of open spaces, and other elements of the clean economy. Similarly, the general public is increasingly aware of and committed to environmental policy and regulations,[5] and consumers are adopting sustainable products and services at a rapid pace.

In California, a state with both a history of innovative environmental policy and economic challenges, there is mounting evidence that investing in green jobs will help the state rebound. High unemployment rates across the state have become catalysts for a sea of green change — driving state and local policy adoption, creating incentives for consumers and industry alike, and educating the general public on ways they and their communities can save money and benefit from job growth.

As economic regions across California remodel their business environment to leverage the burgeoning clean economy, the San Diego region stands out as an already established leader. San Diego is one of the largest and fastest growing regions in clean economic activity. Nationally, the region was recently ranked by Clean Edge as the 7th largest metropolitan area in the nation for green job activity, boasting critical factors necessary for an innovative economy — world-class research institutions and corresponding talent, the ability to attract investment capital, organized industry representation, growing political and social commitment, and abundant renewable energy resources, such as wind or solar. [6]

San Diego County voters are strong supporters of the region's efforts to foster a clean economy. In a recent public opinion poll, three out of four voters surveyed believe it is possible to have a clean environment and a strong economy at the same time. Additionally, 74% were of the opinion that actions San Diego takes to reduce global warming – including expanding renewable energy and technology and requiring pollution reductions – would result in more jobs or would not affect the number of jobs. To that end, a strong majority (72%) also agreed that the San Diego region should take a statewide leadership position in setting goals for reducing greenhouse gas emissions. [7]

According to a report by the Center for Community Innovation (CCI), Innovating the Green Economy in California Regions, San Diego "despite having a smaller green economy than some of the other regions … offers a high level of diversity across green sectors, balanced between services and manufacturing." [8] The CCI study measures San Diego third behind San Francisco and Los Angeles in absolute number of green jobs (18,820) in 2008, not dissimilar to another report on the same year — Next10's Many

[3] Public Law 111 – 5, American Recovery and Reinvestment Act of 2009, http://www.gpo.gov/fdsys/pkg/PLAW-111publ5/content-detail.html.

[4] Information provided by the CleanTech Database, a proprietary resource, http://cleantech.com.

[5] GfK Roper Public Affairs & Media and the Yale School of Forestry & Environmental Studies, *GfK Roper Yale Survey on Environmental Issues* (Summer 2008), http://environment.research.yale.edu/documents/downloads/a-g/GfK-Roper-Yale-Survey.pdf

[6] Clean Edge Inc., U.S. Clean Energy Leadership Index, http://www.cleanedge.com/leadership/

[7] Key findings from a San Diego County voter survey, "Attitudes toward Climate Change," The San Diego Foundation (September 2010).

[8] Karen Chapple and Malo Hutson, Center for Community Innovation, *Innovating the Green Economy in California Regions* (February 2010), http://communityinnovation.berkeley.edu/reports/cci-ucb_innovating-green-econ-ca-regions_2010.pdf.

Shades of Green report, which ranked the region as California's fourth-largest metro area contributor of green jobs.[9] However, in newly released survey findings from California's Employment Development Department, the total number of green jobs in the San Diego region was estimated to exceed 37,700 for 2009 — again, the third-largest total in the state,[10] behind only Southern California (178,550 jobs) and the Bay Area (120,030 jobs).[11]

From a workforce perspective, the successful biotech, wireless communications, and defense industries have created a strong local workforce with transferable skills — an added benefit for existing local employers and employers considering relocating to the area.[12] With educational institutions such as the University of California at San Diego (UCSD), San Diego State University, in addition to nine community colleges, the region is able to supply students and employers with multiple options for education and technical training to meet the evolving needs of a clean economy.

To better understand the impact of the clean economy in San Diego, this report highlights current and projected employment trends, aligning traditional labor market information with independent research, targeted to six green subsectors: renewable energy, energy efficiency, biofuels and farming, water, waste, and wastewater management, transportation and alternative fuel vehicles, and compliance and sustainability planning.[13]

To inform this analysis, findings from other relevant studies have been incorporated, such as those by the Center for Community Innovation, the Centers of Excellence, Clean Edge, the Employment Development Department's Labor Market Information Division (EDD/LMID), Green LMI Consulting, and the San Diego Workforce Partnership. Investment trends are provided by the Cleantech Database, a proprietary source for tracking investments,[14] as well as from CleanTECH San Diego, a leading industry association for the region. This report is also supplemented by interviews with employers, public officials, and industry associations and experts.

[9] Next10, *Many Shades of Green: Diversity and Distribution of California's Green Jobs* (December 2009), http://nextten.org/index.html.

[10] *California's Green Economy: Summary of Survey Results*, Employment Development Department, Labor Market Information Division (October 2010), www.labormarketinfo.edd.ca.gov.

[11] Throughout the report, employment data from several sources is referenced. The industry definitions and methods for estimating green jobs may differ slightly by source, resulting in varying employment counts.

[12] Ron Pernick, et. al, Clean Edge Inc., Cleantech Job Trends 2010 (October 2010), www.cleanedge.com.

[13] The industry frameworks for the six subsectors are drawn from the Centers of Excellence report, *Understanding the Green Economy in California* (June 2009), www.coeccc.net/green.

[14] The Cleantech Database is a proprietary investment database that tracks all financing activity in the clean technology sector, including more than 8,000 clean technology startups, http://cleantech.com.

San Diego's Clean Economy

Despite interest and investment in the green economy, accurate information about the cluster has been difficult to obtain, especially at a regional level. Traditional systems that organize and classify industry sectors are not able to capture economic and workforce information on the clean energy economy in a consistent and timely way. As such, it is helpful to take a multi-layered approach that supplements traditional labor market information with investment data, direct employer outreach, and community-based efforts.

In the San Diego region, employment across all industries totals close to 1.9 million jobs. The area's largest employers include government (353,000 jobs), professional and business services (316,000 jobs), and trade, transportation and utilities (278,000 jobs). Through 2014, employment is projected to increase moderately by as much as 8% or 150,000 jobs. Most of the job growth is anticipated in professional and business services and financial activities employment.[15]

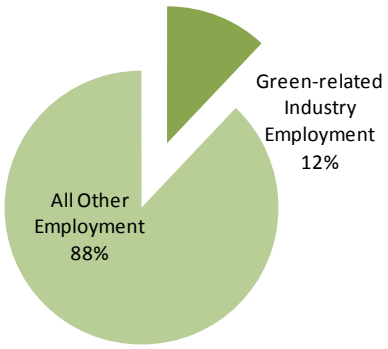
To approximate the potential impact of green employment activities, the industry framework applied below combines employment totals for specific industries considered related to six green subsectors. These employment totals do not accurately represent the clean energy economy as it is not possible that all employment in the relevant industries is green-related. For example, the North American Industry Classification System (NAICS) provides employment data for Plumbing, Heating, and Air-Conditioning Contractors; in this sector, firms that specialize in installing residential solar heating systems may be counted along with traditional plumbing firms; therefore the employment the solar firm represents, and those like it, is not discernible from within the total for the group.

Nevertheless, traditional labor market information is illustrative of broader trends and can be useful when taken in the appropriate context. Included here as one of several methods to understand the range of opportunities in the San Diego region, these totals do identify the segment of the region's employment more likely to be affected by the clean energy economy.

According to this labor market information, the San Diego region's green-related industries account for approximately 10% of the current employment.[16] Since these industries contain the firms most likely to be engaged in green and clean activities, it is fair to conclude that the clean energy economy will have a direct impact on one out of every 10 jobs in the region.

In a 2009 survey of employers, California's Employment Development Department's (EDD) Labor Market Information Division (LMID) estimated that the Southern Border region (combines San Diego and Imperial counties) had the third-largest concentration of green jobs in the state and accounted for more than 37,700 green jobs across five categories — although representing just 3.2% of all jobs in the region.[17]

Figure 1: Potential Impact of the Clean Energy Economy on Employment in the San Diego Region

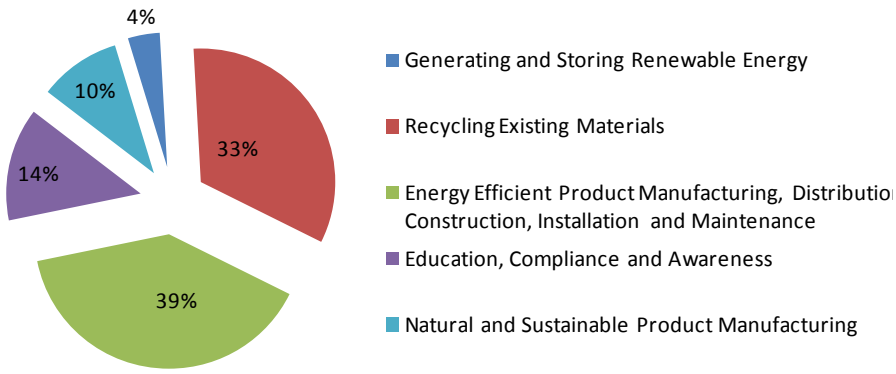


[15]EMSI Complete Employment (Summer 2010), www.economicmodeling.com.

[16]EMSI Complete Employment (Summer 2010). It should be noted that this estimate is derived from employment totals of industries identified as those most likely to be related to the clean economy. This estimate is therefore overly broad, includes green firms as well as traditional firms, and should not be used as a proxy for green employment.

[17]*California's Green Economy: Summary of Survey Results*, Employment Development Department, Labor Market Information

Figure 2: G.R.E.E.N. Employment in the Southern Border Region
(includes San Diego and Imperial counties)



Where the first estimate of employment related to the clean energy economy (10% or 192,500 jobs) is intentionally liberal, LMID's categorical definition of green (referred to by the acronym G.R.E.E.N.) could be considered conservative, as it does not fully incorporate the critical areas of water and alternative transportation. For example, while the LMID definition includes the manufacturing and maintenance of alternative fuel vehicles, it does not provide a categorical assignment for certain types of mass transit systems, such as commuter light rail that typically run on electricity.

Further, the survey was administered during the economic recession of 2009 but before the effects of the ARRA stimulus and other more recent incentive programs were felt, potentially resulting in lower employment numbers reported from firms related to renewable energy, energy efficiency, and green building. As the clean energy economy continues to develop, the impact on employment may become better documented; however, as shown here, the range of employment estimates does provide some general understanding of the approximate number of jobs.

Investment in Clean Technologies and Clean Tech Start Ups

While San Diego already enjoys significant recognition as a clean energy leader and hub for innovation, the Center for Community Innovation (CCI) believes that San Diego could gain an increasing share of the clean technology and green markets in the future.[18] Current investment trends do seem to support this analysis, in that private investments tripled in San Diego last year.[19]

The Cleantech Database, a proprietary subscription service that tracks, among other things, investment trends for clean technology firms and investors, reports that there are 16 known firms located in San Diego County that invest in clean technology companies. Eleven firms are located in the city of San Diego, three are in La Jolla, and one each in the cities of Carlsbad and Solana Beach. Of these firms, 10 are venture capital firms.[20] As classified by the Database, nine firms invest in clean energy (generation, efficiency and storage) companies, four firms invest in clean air and environment companies, three firms invest in clean technology manufacturing companies, three firms invest in clean technology agricultural companies, and two firms invest in clean and renewable materials companies.[21]

Division (October 2010), www.labormarketinfo.edd.ca.gov.

[18]Karen Chapple and Malo Hutson, Center for Community Innovation, *Innovating the Green Economy in California Regions* (February 2010), http://communityinnovation.berkeley.edu/reports/cci-ucb_innovating-green-econ-ca-regions_2010.pdf.

[19]Next10, *Many Shades of Green: Diversity and Distribution of California's Green Jobs* (December 2009), http://nextten.org/index.html.

[20]Cleantech Database, http://cleantech.com.

[21]Corporate Division, Corporate Strategic, Entrepreneurial Company, Investor-Other, Limited Partner, and Private Equity make up

The following are examples of investors who have already committed to San Diego-based clean technology companies:

- Enterprise Partners Venture Capital (EPVC) has a total investment size of fifteen companies that represent the following clean technology sectors; air and environment, training and consulting, manufacturing, water and wastewater, and recycling and waste. Two of EPVC's investees, Enviance, Inc., located in Carlsbad, and Wellspring International Inc., are San Diego-based.
- Shepherd Ventures has a total investment size of one clean technology energy efficiency company, CEYX Technologies, Inc., located in the city of San Diego.
- Hamilton BioVentures has a total investment size of one clean technology manufacturing company, Cold Pack System, located in the city of San Diego.
- HamiltonTech Capital Partners has a total investment size of one clean technology manufacturing company, Daylight Solutions, located in Poway.

According to the Cleantech Database, a total of 26 locally-based firms received more than $445 million in the past five years.

Figure 3: Investment Trends in Clean Technology

Cleantech Concentration	Investment Amount (in millions)
Energy firms (efficiency, generation, infrastructure, storage)	$183.6
Transportation firms	$252.3
Recycling & Waste firms	$1
Agriculture firms	$1.1
Manufacturing firms	$7.5
Total	**$445.5**

These investments clearly illustrate investment growth trends for innovative companies in San Diego, though they may represent only some of the region's potential. San Diego firms also receive significant investments from outside of the region. According to Holly Lepre of CleanTECH San Diego, despite overall lower investments across all industry sectors, biofuel investments over the last three years exceed $1 billion nationally. "The award winning San Diego cluster is attracting start-ups, relocations, international expansions, and existing businesses and today boasts 752 cleantech companies contained in CleanTECH San Diego's cluster database..."[22]

CleanTECH San Diego has emerged as an important leader by organizing, convening, and advocating for the industry. This role has been critical to the growth and development of companies, the attraction of capital, and in shaping strong public policies to support the cluster. Within the past year, five major solar manufacturers have opened locations in San Diego, including Energy Innovations, Kyocera Solar, Siliken Renewable, Vaillant Solar Systems, and Concentrix Solar. Additionally, when companies are asked why they prefer to locate in San Diego, their responses include:

- Wealth of natural resources with which to grow clean technologies
- Intellectual horsepower

the other six firms.

[22]Holly Lepre, Cleantech Sandiego. Cluster database available at http://cleantechsandiego.org/cluster-database.html.

- Vibrant ecosystem to support and nurture the cluster of Cleantech companies
- Region's reputation and leadership as an early adopter of new technologies and desire to bring product closer to the customer
- San Diego Gas and Electric's progressive policies regarding the Renewable Portfolio Standard and securing renewable resources.[23]

Public Policy

California's ambitious plan to reduce greenhouse-gas emissions to 1990 levels by 2020 (through AB 32's implementation standards and programs) has fast-tracked growth in some sectors within the clean economy by creating a market for innovations to help corporations comply with the mandate. In its Climate Change Scoping Plan, the California's Air Resources Board (ARB) prepared several overarching recommendations for reducing greenhouse gas emissions to 1990 levels by 2020. Of particular relevance to industry expansion and job creation, these included:[24]

- Expanding and strengthening existing energy efficiency programs as well as building and appliance standards.
- Achieving a statewide renewable energy mix of 33%.
- Establishing targets for transportation-related greenhouse gas emissions for regions throughout California, and pursuing policies and incentives to achieve those targets.

An example of the state's progress towards these goals is the development of Title 24's 2010 California Green Building Standards Code (also known as CalGreen), which requires, among other things, that every new building constructed in the state reduce water consumption by 20%, divert 50% of construction waste from landfills and install low pollutant-emitting materials. The California Air Resources Board estimates that the mandatory provisions will reduce greenhouse gas emissions (CO2 equivalent) by 3 million metric tons equivalent in 2020.[25]

Locally, the San Diego region is the first to develop a Sustainable Communities Strategy. Led by the San Diego Association of Governments (SANDAG), the Sustainable Communities Strategy (SCS) is an element of the 2050 Regional Transportation Plan (RTP), required by Senate Bill 375 (SB 375). SB 375 requires that Metropolitan Planning Organizations (MPO) prepare a strategy that demonstrates how the development patterns and the transportation network, policies, and programs can work together to achieve the greenhouse gas (GHG) emission reduction targets for cars and light trucks as established by the California Air Resources Board.[26]

According to the City of San Diego, the clean technology industry has grown in both number of companies and number of jobs since 2006, when Mayor Jerry Sanders launched the Cleantech Initiative to catalyze industry growth in the San Diego region. The city expects that the passage of AB 32's implementation standards and programs will accelerate the adoption of solar power and

[23]Holly Lepre, Cleantech Sandiego. Cluster database available at http://cleantechsandiego.org/cluster-database.html.

[24]California Air Resources Board, *Climate Change Scoping Plan* (December 2008), http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

[25]California Department of General Services, Building Standards Commission (accessed December 3, 2010), http://www.bsc.ca.gov/CALGreen/default.htm

[26]San Diego Association of Governments (accessed December 6, 2010), http://www.sandag.org/index.asp?projectid=360&fuseaction=projects.detail

energy efficiency technologies in San Diego. In anticipation, the city is in the process of implementing a financing program to reduce the upfront cost for the solar and energy efficiency retrofits for commercial and residential buildings.[27]

San Diego Clean Generation / This municipal program allows the city of San Diego to create a financing district and offer low-interest, 20-year loans for solar panels, energy efficiency upgrades and water-efficiency measures for San Diego residents. The loan obligation will transfer with home ownership, removing a major barrier to installation of solar-energy systems. The financing program will fund all upfront costs after applicable tax credits and rebates, and will be available to all residential and small commercial property owners within the city limits.[28]

San Diego Clean Enterprise / The program provides interest-free financing for up to 10 years to fund energy-efficiency improvements for small businesses in the city of San Diego. Businesses can borrow up to $50,000 to fund energy-efficiency improvements such as lighting retrofits, HVAC upgrades, water pumps and food-service equipment replacement. San Diego Gas & Electric (SDG&E) will provide funding for the program, while CleanTECH San Diego will administer the program.[29]

These public strategies and others are bolstered by an active and supportive utility. In addition to the many rebates and incentive programs offered by SDG&E, IDC Energy Insights and Intelligent Utility magazine ranked the utility first in their annual UtiliQ rankings, designed to measure the progress utilities are making on the path to intelligent energy. The UtiliQ ranking uses five criteria to evaluate utilities: operational efficiency, commitment to integrating renewables, smart energy initiatives, demand response/energy efficiency programs, and information technology investments in support of business process improvements, with extra marks for utility companies that regularly report on sustainability or corporate social responsibility, including carbon disclosure.[30] SDG&E received the highest of its five point values for smart energy – measured by smart meter deployment and smart grid projects – and for IT investment – measured by IT spending as a percent of revenue and on a cost per employee basis.

The commitments of the public and private sector, together with strong and committed utilities and organized leadership by CleanTECH San Diego, have provided a strong catalyst for the regional clean economy.

[27]Also referred to as PACE (Property Assessed Clean Energy), in July of 2010, the State of California sued the Federal Housing Administration, Fannie Mae, and Freddie Mac over guidance to lenders that restricted the ability of homeowners to participate in the program. The suit states that the FHA violated California law, and are "severely hampering California's efforts to assist thousands of California homeowners to reduce their energy and water use, help drive the state's green economy, and create significant numbers of skilled, stable and well-paying jobs." This legal uncertainty has led to delays with the program and until these matters become settled, PACE is unlikely to provide the stimulus that many had hoped.

[28]Cleantech Leadership Strategy, Economic Growth Services, Office of the Mayor, City of San Diego (February 2010).

[29]Id.

[30]"2010 UtiliQ rankings: Top 25 Intelligent Utilities," *Intelligent Utility Magazine* (July/August 2010), http://www.intelligentutility.com/magazine/article/2010-utiliq-rankings

Clean Industries in San Diego

The clean economy, as defined in this report, slices across a host of industries; the most recognizable clusters include (1) Renewable Energy, (2) Energy Efficiency and Green Building, (3) Water, Waste, and Wastewater Management, (4) Biofuels and Farming, (5) Transportation and Alternative Fuels, and (6) Compliance and Sustainability Planning. In San Diego, Renewable Energy, Energy Efficiency and Green Building have shown the largest integration into the general economy but contributions from the other green sectors are also vital elements for a successful and sustainable clean economy employment base.

The following sector profiles include labor market data where available as well as examples of employers, educators and other community groups working to grow a clean economy in San Diego.

Creating Jobs for San Diegans

in Renewable Energy

Renewable Energy is one of the fastest growing green sectors in San Diego, primarily dominated by the solar industry.[31] A highly educated workforce, the ability to attract capital, and reasonably high penetration of residential and commercial photovoltaic systems due to ample sunshine and supportive public policies has led to strong growth of the industry in the region. Examples of policy incentives include the 2005 Energy Policy Act (EPAct, effective January 2006) providing significant tax credits for solar installations, and the California Solar Initiative with its $3.35 billion in funding for new systems.

Renewable Energy refers to any energy source that does not require a finite resource for production. Though there are many sources of renewable energy, the industries providing the most employment in the San Diego region are solar, wind, geothermal, and biofuels. For the purposes of this report, the following definitions of each industry were employed:

- Solar Energy – firms engaged in the development, manufacturing, installation and servicing of solar energy technology.
- Wind Energy – firms such as those engaged in the maintenance and operation of wind farms as well as manufacturers of wind turbines.
- Geothermal Power – firms that are developing and manufacturing geothermal power systems as well as geothermal power plants.
- Other Renewable Energy – firms engaged in biofuels development, hydro-electric and other renewable energy services.

In 2009, research by the San Diego Center of Excellence found that in addition to solar, wind, geothermal and biofuels are also important drivers of the renewable energy cluster, as shown by local employers' areas of concentration in Figure 4.[32]

Using traditional industry classifications, employment in those industries related to renewable energy has seen only slight decline since 2005 and projections indicate healthy growth (up 23%) through 2015.[33] According to LMID's 2009 survey, San Diego and Imperial counties are home to 9.3% of all firms in the state that generate and store renewable energy ("G" employment), accounting for direct employment of at least 1,450 jobs.[34]

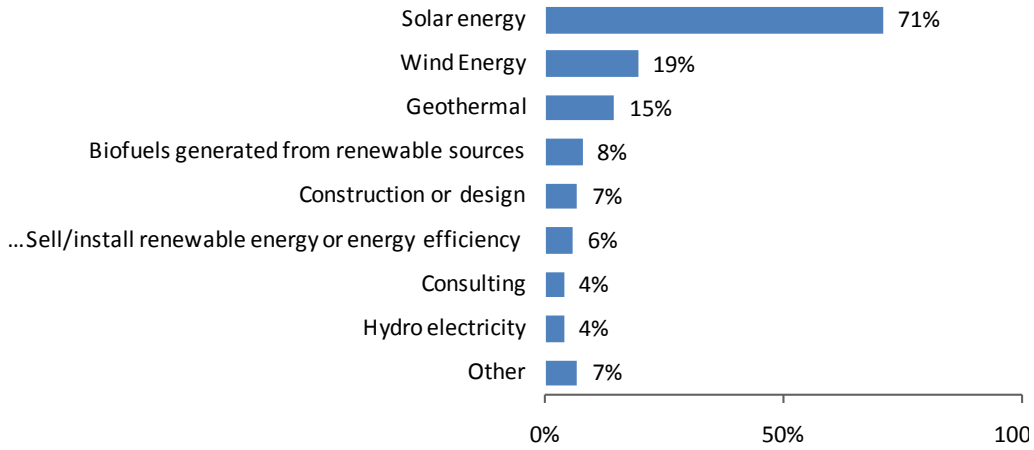
[31] CleanTECH San Diego; Centers of Excellence Employer Survey, San Diego Renewable Energy Employers, 2009.

[32] Id.

[33] EMSI Complete Employment (Summer 2010). It should be noted that these estimates include all employment in renewable energy related sectors, and should not be used as a proxy for direct renewable energy employment.

[34] *California's Green Economy: Summary of Survey Results*, Employment Development Department, Labor Market Information Division (October 2010), www.labormarketinfo.edd.ca.gov.

Figure 4: Renewable Energy Firms – Area of Concentration



The solar energy industry is one of the most rapidly growing emerging industries in the U.S. and in California, and governmental policies and venture capital keep pushing the industry forward. In the San Diego region, employers indicated that the announcement of new military spending on solar installations would have a significant effect on their growth over the coming year.[35] The state and federal incentives and projects, coupled with additional incentives administered by the California Center for Sustainable Energy, support recent reports of exceptional growth in the solar industry and related occupations. This finding was further validated by discussions with CleanTECH San Diego and other regional industry experts interviewed for this report.

Similarly, the findings of the Centers of Excellence survey of renewable energy employers in San Diego and Imperial counties documented significant anticipated growth for occupations directly related to renewable energy.

Figure 5: Occupational Employment in Renewable Energy Firms

Renewable Energy Occupations	2009 Employment Estimate	2009-2010 Projected Growth	Growth Rate
Solar Photovoltaic (PV) installers	340	290	86%
Renewable energy engineers	310	140	43%
Operations and repair technicians	320	100	33%
Customer service representatives	250	100	40%
Sales representatives or solar sales estimators	280	70	27%
Supervisors or managers of technicians & maintenance workers	430	60	15%
Research and development technicians	150	40	26%
Total, All Occupations (totals may not add due to rounding)	2,080	810	

Centers of Excellence Employer Survey, San Diego Renewable Energy Employers, Fall 2009. Wage data not available.

[35]Executive Order (E.O.13514) aims to establish an integrated strategy towards sustainability in the Federal Government and to make reduction of greenhouse gas emissions a priority for Federal agencies. This is an important driver of such military activity, and thus green economy in San Diego where the military is such a high percentage of the entire economy.

The Renewable Energy cluster is clearly an important and growing piece of San Diego's green economy. Renewable energy companies, and particularly solar firms, are involved in all facets of the value chain — from research and development to installation and maintenance — and are therefore providing numerous and varied opportunities for individuals across and along career ladders. The sector shows robust investment activity and solid employment gains, with no indication of slowing down.

Driving Demand

San Diego Community College District practices what they teach. In addition to training a workforce to meet the needs of the employers in the region, the district's three colleges are also consumers of renewable energy products and producers of renewable energy. The district's Solar Initiative resulted in a Power Purchase Agreement with Borrego Solar — generating more than 4.9 million kilowatt hours annually through rooftop and carport solar installations. Additionally, the District supports three separate installations producing another 354,000 kilowatt hours annually.

Doing the Work

Locally owned and headquartered in San Diego, Sullivan Solar Power has installed more than four million watts of solar power systems across Southern California, ranging from small scale residential systems to large scale commercial systems. Sullivan Solar employs state licensed electricians who are proficient with solar power system installation practices, have received over 5,000 hours of classroom related study, are thoroughly versed in jobsite safety and code requirements, and are members of a drug free workforce. The firm expects continued growth over the short-term.

Training a Workforce

At San Diego City College, students can complete a Solar Energy Technician Certificate, earning them college credits and transferrable skills for work as HVAC mechanics, building retrofitting specialists, building controls systems technicians, and solar PV installers. Guided by an industry advisory board, the college also worked closely with Kearny High School's Construction Tech Academy to develop new modules in electrical, solar and HVAC for use at both schools. City College faculty and Kearny instructors worked collaboratively to ensure that students can make a smooth transition from high school to community college.

Creating Jobs for San Diegans

in Energy Efficiency and Green Building

The Energy Efficiency and Green Building cluster is a critically important driver of San Diego's green economy. Thirty nine percent of the total U.S. energy use can be attributed to the construction and operation of residential and commercial buildings. Because buildings are such a significant consumer of energy and contributor to greenhouse gas emissions, they also need to be a focal point for any potential solutions. In a recent study by USD's Energy Policy Initiatives Center, preliminary analysis suggested that five local policies have a high potential to reduce greenhouse gas emissions in the San Diego region: (1) residential and (2) commercial efficiency retrofits in a percentage of all existing buildings, (3) residential photovoltaics in all new homes, (4) solar water heating retrofits in a percentage of all homes, and (5) residential efficiency retrofits that target a percentage of buildings built prior to 1980.[36] Further, current state legislation (such as AB 32's implementation standards and programs and Title 24's 2010 California Green Building Standards Code) requires that buildings become more energy efficient, which is also creating demand for green product manufacturing.

Energy Efficiency and Green Building, including storage technologies, represents perhaps the greatest total employment opportunities and potential for San Diego workers. In addition to positive investment trends, more and more construction firms in San Diego are working on green projects. According to Evan Lovell, a Partner of the Virgin Green Fund, energy efficiency represents about 80% of the opportunity in San Diego. These investments are likely to continue in the future and provide long-term employment opportunities for the regional workforce.

The sector is comprised of industries clustered around making new and existing buildings resource efficient and friendly to the environment. Energy Efficiency, as well as being part of Green Building, also includes private and public agencies responsible for energy planning and management. The energy efficiency and green building industry clusters include product manufacturing, construction, design and construction of new buildings, retrofitting and retro-commissioning of existing structures, deconstruction, building operations and maintenance, landscaping, and energy services (ESCO).

These more traditional industries have seen employment fluctuations since 2005, with the largest declines in construction slightly offset by growth in utilities, real estate, and professional services. It is likely that these figures are heavily influenced by the recent job losses in construction employment. Projections for the near future, however, indicate moderate growth (up 10%) through 2015.[37]

The LMID Green Survey data estimates that the "E" sector (energy efficient product manufacturing, distribution, construction, installation and maintenance) in the Southern Border region accounted for close to 15,000 jobs or 39% of all green jobs in the two-county area, and as much as 12.7% of California's "E" jobs in 2009.[38]

[36] USD's Energy Policy Initiatives Center, http://www.sandiego.edu/epic/ghgpolicy/documents/ES_GHG_Policy_Buildings_FINAL_000.pdf

[37] EMSI Complete Employment (Summer 2010). It should be noted that these estimates include all employment in energy efficiency and green building related sectors, and should not be used as a proxy for direct renewable energy employment.

[38] *California's Green Economy: Summary of Survey Results*, Employment Development Department, Labor Market Information Division (October 2010), www.labormarketinfo.edd.ca.gov.

When combined with research conducted by the Centers of Excellence, the San Diego Workforce Partnership, and Cuyamaca College, it is clear that green practices and principles are having a significant impact on the regional construction industry. In a survey of the region's specialty trade construction employers, more than 30% of the firms reported having worked on a green building project.[39] Previously, research on energy efficiency occupations was completed by the Centers of Excellence (COE) in the spring of 2009.[40] At that time, employers validated the diversification of and demand for eight energy efficiency-related occupations. The following table shows the occupational growth projections from the COE study.

Figure 6: Occupational Employment in Energy Efficiency Firms

Energy Efficiency Occupations	2009 Employment Estimate	3-year Projected Growth	Growth Rate
Project managers for construction or design work	2,910	580	20%
HVAC mechanics, technicians or installers	1,790	440	25%
Building performance or retrofitting specialists	1,550	310	20%
Building operators or building engineers	1,510	260	17%
Building controls systems technicians	1,410	340	24%
Resource conservation or energy efficiency managers	1,160	240	21%
Energy auditors or home energy raters	920	150	17%
Compliance analyst or energy regulation specialists.	540	290	53%
Total, All Occupations (totals may not add due to rounding)	11,780	2,610	

Centers of Excellence Employer Survey, San Diego Energy Efficiency Employers, Spring 2009 (n = 158).

Of the energy efficiency occupations studied in 2009, employers indicated that a combination of education, such as an Associate degree, related certification or coursework, and/or relevant work experience were sufficient qualifications for four of the eight occupations: HVAC mechanics, building performance specialists, building operators, and building controls systems technicians. For the remaining four occupations, employers were still flexible but seemed to prefer applicants that had a Bachelor's degree in the field or in a related field.

Driving Demand

At San Diego Community College District, energy efficiency means big savings. Since 2006, the district's IOU incentives program has completed at least a dozen energy-saving projects to improve efficiency and reduce costs. These projects include installing more efficient exterior lighting controls, replacing inefficient boilers and refrigeration units, and upgrading lighting in parking garages — reducing energy use by more than one million kilowatt hours and saving an estimated $285,000. As part of SDG&E's Savings by Design program, the district estimates another $586,000 have been saved through energy efficiency retrofits.

San Diego's North County Transit District recently completed one of the public transit industry's first Green Data Centers. The data center will reduce the transit district's energy demand by more than 30%

[39]Green Building Study for San Diego (November 2010), preliminary information courtesy of GreenLMI.

[40]Centers of Excellence Employer Survey, Energy Efficiency Occupations, Spring 2009 (n = 158).

annually. For this work, NCTD has registered for and anticipates receiving a Leadership in Energy and Environmental Design (LEED) Silver Certification for Commercial Interior Spaces.[41]

Doing the Work

In 2009, San Diego's Solare Energy was created from the merger of two firms— one specializing in solar panel installation and electrical contracting and the other specializing in energy audits. The newly formed Solare Energy offers a wide variety of services, including energy assessments, integrated solution design, solar hot water and PV, and financing assistance. With a current staff of nine, the company anticipates demand for their services to grow and to grow their workforce proportionally – to as many as 20 employees within the next two to three years.

In 2010, Greenwise Solutions, a San Diego-based energy audit, retrofit and solar panel installation start-up, became fully operational. Greenwise Solutions offers a range of services, from residential energy audits and solar system installation to commercial design and engineering for LEED certifications. The firm currently has 10 employees (including owners) but expects to double the size of their workforce within three years. Additionally, Greenwise Solutions has as many as 20 subcontractors on projects at any given time.[42]

Training a Workforce

Energy efficiency concepts are being taught in multiple programs at San Diego community colleges. Responding to the green movement, Mesa College now offers a "Sustainability for the Built Environment" course. This course is team taught, incorporates an industry advisory board and guest speakers, and focuses on students pursuing four main career paths — Architecture, Landscape Architecture, Interior Design, and Building Construction Technology. Student Lori Lipsman states it best, "It is great to see a community college grow its curriculum with the times. With sustainability classes, we have the opportunity to educate our future leaders in green technology, so we don't get left behind the rest of the world."

[41]"NCTD Sustainability Programs Protect the Environment and Reduce Energy Consumption," North County Transportation District, press release (April 21, 2010), http://www.gonctd.com/about_news.htm

[42]Interview with Soheil Nakhshab, Greenwise Solutions

Creating Jobs for San Diegans

in Water, Wastewater and Waste Management

Water, Wastewater and Waste Management includes the development and operation of systems, connected with treatment and conservation of water, recycling of wastewater, and solid waste management. California is experiencing a severe drought, which has resulted in water rationing, fewer agricultural crops, the loss of thousands of jobs, and an overall decline in the state's economic health. In fact, according to a study by The San Diego Foundation, the San Diego region could face an estimated 18% shortfall in water supplies by the year 2050 despite current plans in place to conserve and augment available water supplies.[43] Further, the demand for water continues to increase as the state's population grows. As such, water conservation and waste management efforts are necessary to ensure that future generations have access to freshwater.

Water, Wastewater and Waste Management represented the core of traditional "environmental jobs" before the green revolution took hold in the new millennium. For decades, workers have been managing water and wastewater systems, and have also been responsible for municipal waste sites. In this way, traditional frameworks do a reasonably good job of estimating current employment — with certain exceptions, particularly in hazardous waste management. In the following table, employment is shown for the most *recognizable* industry sectors within the cluster.[44]

Figure 7: Industry Employment in Traditional Water, Wastewater and Waste Management Sectors

Industry Title	2010 Employment
Water and Sewer Line and Related Structures Construction	1,451
Solid Waste Collection	951
Solid Waste Landfill	709
Hazardous Waste Treatment and Disposal	371
Remediation Services	341
Water Supply and Irrigation Systems	247
Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use	178
Total	4,248

EMSI, Complete Employment, Summer 2010.

Since 2005, only slight increases in employment have been recorded for industries related to water, wastewater and waste management. Projections do indicate healthy growth (up 23%) through 2015. In the last year, two independent studies have refined the current labor market information about this cluster – one focusing on waste management (also referred to as environmental technology) and the other on water and wastewater management. Both studies conducted surveys to gauge the workforce needs and expectations of regional employers.

[43] *Focus 2050 Study:* http://www.sdfoundation.org/GrantsScholarships/Programs/Environment/Climate.aspx.

[44] Industry employment figures shown are not a complete list of water, wastewater and waste management sectors; for the complete cluster definition, go to www.coeccc.net/green.

Waste Management

The American Reinvestment and Recovery Act (ARRA) included billions of dollars for environmental technology projects throughout the country. A few examples from ARRA illustrate the acceleration of projects that require workers in the environmental technology field:

- $7.22 billion for specific programs administered by the Environmental Protection Agency (EPA). The programs relevant for environmental technology occupations include:
  - — $111.9 million ($37.3 million from ARRA and $74.6 million from the EPA Brownfields general program funding) for the Brownfields Recovery Act Plan: Cleaning up former industrial sites for new commercial or community use, and training and placing persons in environmental careers.[45]
  - — $200 million for the Underground Storage Tank Recovery Act Plan: Cleaning up petroleum leaks from underground storage tanks.
- $600 million for the Superfund Recovery Act Plan: Cleaning up uncontrolled hazardous waste sites.[46]
- $6 billion to Environmental Management for Cold War contamination cleanup
- $1 billion to the Forest Service for capital improvements and Wildland Fire Management programs
- $438 million to Department of Energy for environmental cleanup at non-defense federal sites nationwide.
- $5.1 billion nationwide for environmental cleanup at former military installations.[47]

These stimulus funds have already impacted the industry and — due to the large military presence in San Diego — appear to be having a significant impact on employment numbers in San Diego and Imperial counties. According to a 2009 survey of waste management firms in the region, growth rates from 5-20% per year are expected across waste-related occupations, potentially yielding hundreds of new jobs over the next five years.

In late 2009, the Centers of Excellence in San Diego surveyed employers about environmental technology positions in the region, which deal primarily with traditional waste management. According to these employers, traditional labor market information does not accurately reflect their understanding of local industry employment. The 46 firms surveyed represented more than 10,000 employees in San Diego and 1,500 employees in Imperial Valley; these firms anticipated rapid growth by 2015 for six selected occupations: agricultural inspectors, compliance officers, environmental engineering technicians, environmental science and protection technicians, hazardous materials removal workers, and industrial engineering technicians. The three most common answers to explain the rapid increase in employment forecasts were:

1. acceleration and expansion of projects with federal agencies due to increased funding;
2. a cultural shift holding industrial and commercial clients to a higher standard of conduct; and
3. new laws and greater enforcement of existing laws related to hazardous waste and environmental compliance.[48]

[45]See http://www.ffis.org/452501/453785.html

[46]Federal Economic Stimulus Funding Overview, Legislative Analyst's Office, March 17, 2009, available at http://democrats.assembly.ca.gov/members/a01/pdf/StimulusPackageBackground.pdf.

[47]Id.

[48]Centers of Excellence Employer Survey, San Diego-Imperial Environmental Technology, Summer 2009 (n = 46).

Though the survey data from that study are not sufficient to make predictive forecasts for the entire region, they provide an important perspective relative to growth, as indicated in the following table.

Figure 8: Occupational Employment in Environmental Technology Firms[49]

Environmental Technology Occupations	2009 Employment	5-year Projected Growth	Growth Rate
Environmental Science and Protection Technicians	338	353	104%
Hazardous Materials Removal Workers	312	287	92%
Compliance Officers (Environmental)	164	20	23%
Environmental Engineering Technicians	66	25	38%
Industrial Engineering Technicians	43	26	60%
Agricultural Inspectors	11	26	236%
Total	934	767	

Centers of Excellence Employer Survey, San Diego-Imperial Environmental Technology, Summer 2009 (n = 46).
Wage data not available.

For the occupations listed above, most employers require a HAZWOP certification but will also conduct on-the-job training. Engineering technicians generally complete an Associate degree program in Engineering and agriculture inspectors are usually expected to have an Associate degree from a related agricultural program as well.

Water and Wastewater Management

Recently, the San Diego Workforce Partnership published a report of water and wastewater occupations in the region. Regional employers were asked about their current employment, future growth (new jobs), and retirement eligibility (replacement jobs).[50]

The 15 water and wastewater utilities and agencies that responded to the workforce survey collectively employ more than 460 workers in water and wastewater occupations. Already preparing for significant baby boomer retirements, these agencies are also charged with adapting more efficient processes and implementing water-saving programs throughout their districts. From the employer perspective, there may be as many as 100 new and replacement jobs available to qualified workers in the next five years. Figure 9 illustrates the study's occupational findings.[51]

Water and wastewater agencies and/or utilities require industry certification for most positions but do not generally require a specific Associate or Bachelor's degree. However, in the San Diego region, Cuyamaca Community College hosts Project: WaterWorks, an innovative training partnership between education and industry, focusing on water-related coursework to help students and incumbent workers prepare for certification or pursue an Associate degree.

[49]In the table below 2009 employment figures represent the total employment by occupation as reported by firms in the sample only; data do not represent total employment in the two-county region.

[50]Philip Jordan, *San Diego Water and Wastewater Occupations*, San Diego Workforce Partnership, June 2010.

[51]Id.

Figure 9: Occupational Employment in Water and Wastewater Agencies/Utilities[52]

Water and Wastewater Occupations	2009 Employment	5-year Outlook		
		Growth Rate (New Jobs)	% Eligible to Retire (Replacement Rate)	New & Replacement Jobs
Water Treatment Operator	30	7%	30%	9
Water Distribution Operator	96	4%	21%	21
Wastewater Treatment Operator	60	2%	19%	11
Wastewater Collections Operator	56	4%	10%	7
Mechanic/Machinist	35	0%	26%	5
Electrician/Electrician Technician	24	5%	39%	5
Electronic Maintenance Technician/ Instrument Technicians	38	8%	33%	12
Water Quality Analyst (Lab Tech, etc.)	13	8%	33%	3
Welder	5	20%	67%	1
GIS Technician	17	0%	6%	1
Engineer	58	12%	29%	19
Water Conservation/				
Water Resources Specialist	28	0%	58%	10
Total, All Occupations	460			104

San Diego Workforce Partnership Water and Wastewater Study, Winter 2010 (n = 15).

Educating in Sustainable Practices

To engage students and the community in responsible waste management and water usage, San Diego Community College District supports recycling and sustainable landscaping on all its campuses. At San Diego City College, their RecycleMania program netted a the "Recycler of the Year" award; Mesa College has replaced water-guzzling lawns with rock and natural gardens; and Miramar College implemented a stormwater detention and filtration system and smart irrigation system as well as adopting a Water Bottle Resolution.

Training a Workforce

Training for water-related occupations in the region is coordinated through Project: WaterWorks – an industry driven, regional collaborative grant sponsored by the California Community Colleges. Project: WaterWorks is housed at Cuyamaca College and is a joint initiative with Palomar College. Its goals are to foster partnerships with regional community colleges that offer water-related courses, Southern California water agencies, industry vendors, and state and national professional associations to address regional workforce development issues. Both Cuyamaca and Palomar colleges offer Associate degrees and certificates in Water and Wastewater Technology.

[52]In the table below 2009 employment figures represent the total employment by occupation as reported by firms in the sample only; data do not represent total employment in the two-county region.

Creating Jobs for San Diegans

in Biofuels and Farming

Biofuels and Farming is an area associated with producing alternative fuels and/or energy from biological products and waste, as well as incorporating environmentally friendly practices and principles in the overall farming process. There are five biofuels production and farming industry clusters. Biofuels is separated from the Renewable Energy cluster to highlight the relationship among agriculture, farming, and biofuels production. Most biofuels are produced from corn, sugarcane, and palm oil crops, which generate harmful greenhouse emissions and threaten biodiversity. Therefore, it is important to consider environmentally friendly agricultural and farming practices, as well as alternative methods to producing biofuels (such as the use of waste or forest byproducts).

According to CleanTECH San Diego, one of the fastest growing areas of investment and innovation is in the research and development of biofuels. Due to the fact that few biofuels are currently in mass production nationally, employment levels are relatively low. Additionally, given the rapid pace at which the industries are evolving, traditional labor market information has proven difficult to obtain. In the table below are examples of industries *relevant* to biofuels and farming.

Figure 10: Industry Employment in Sectors Related to Biofuels and Farming[53]

Industry Title	2010 Employment
Research and Development in Biotechnology	7,706
Administration of Conservation Programs	1,034
Farm Management Services	595
Farm Labor Contractors and Crew Leaders	578
Soil Preparation, Planting, and Cultivating	189
Support Activities for Forestry	150
Postharvest Crop Activities	138
Total	10,390

EMSI Complete Employment, Summer 2010.

Industries related to biofuels have experienced strong growth since 2005. Projections indicate healthy growth (up 30%) through 2015 for this cluster as well. The expectation for growth in biofuels is echoed by industry employer Tony St. Clair, Manager of Agri Business for MBD Energy, "Out of crisis comes innovation, and business is a long way ahead of government… [One example is] turning waste greenhouse gases into algae, which can be used as value added products."

Sustainable farming and organic products are another area of growing importance within agriculture. Agricultural concerns in San Diego employ just over 14,000 workers and consumers are slowly increasing their demand for sustainably farmed food.[54]

[53]Industry employment figures shown are not a complete list of biofuels and farming sectors; for the complete cluster definition, go to www.coeccc.net/green

[54]EMSI Complete Employment (Summer 2010).

In the LMID employer survey, biofuels employment is grouped with renewable energy ("G") while farming and related falls under "N" (natural and sustainable product manufacturing). For the Southern Border region, "N" employment is estimated to exceed 3,700 jobs – 9.8% of the region's green jobs and 3.6% of the state's natural and sustainable product manufacturing.[55]

Educating in Sustainable Practices

Sustainable practices can take many forms. At San Diego City College, an urban garden and organic groundskeeping efforts have earned the campus a "Smart Growth Award" from the Urban Land Institute. Mesa College students planted a Green Garden on campus with the resulting produce incorporated into instruction at the Culinary Arts laboratory. In turn, Mesa College's gardens benefit from compost supplied by their culinary program and student cafeteria. Miramar College has also incorporated organic gardening and composting into their campus operations.

Doing the Work

New Leaf Biofuel is a San Diego-based biodiesel company focused on transforming the way companies fuel their vehicle fleets. NEW LEAF is partnering with local schools, universities, and other organizations to educate the public about biodiesel and its many benefits. New Leaf collects waste oil and grease from local San Diego restaurants to use as the feedstock for their biodiesel production. The company's development goals target vehicle fleet contracts, expansion into the marine market, as well as providing high quality biodiesel to individual consumers.[56]

San Diego Roots, an urban farming and education nonprofit organization, was formed to "strengthen the local food movement in the San Diego region and to create a sustainable urban-rural partnership." Their goals evolved from a desire to educate about the benefits of a local diet and organic food and cultivate both in a literal sense as well as by creating community leaders. They offer educational programs and workshops using their five-acre farm near downtown San Diego as a living classroom, primarily to local schools. Guided by an eight member board of directors and two full-time staff, San Diego Roots involves approximately 180 volunteers. In addition, the organization has partnered with the University of California at San Diego (UCSD) to operate a campus farm and with the San Diego City College's Seeds at City program. The organization's future plans include doubling paid staff, increasing volunteers, and offering internships.[57]

Training a Workforce

San Diego City College has created a certificate program in Urban Agriculture, also known as the Seeds at City program and is in the process of expanding it to an Associate degree option. Students are learning skills in propagation, composting, water-wise irrigation, soil fertility, and skills in managing small-scale organic urban farms and food gardens. Part of the instruction is to care for a half-acre campus farm and attend field trips around the county – visiting working farms and community gardens. In addition to an active business advisory board (including grocery stores, restaurants, nurseries and landscapers), Seeds at City partners San Diego City College with Roots Sustainable Food Project, San Diego High School and Garfield High School.

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[55] *California's Green Economy: Summary of Survey Results*, Employment Development Department, Labor Market Information Division (October 2010), www.labormarketinfo.edd.ca.gov.

[56] Information courtesy of New Leaf Biofuel, http://www.newleafbiofuel.com/about/

[57] Interview with Lauren Shaw, San Diego Roots

Creating Jobs for San Diegans

in Alternative Transportation

Alternative Transportation focuses on developing the technology, manufacturing and servicing vehicles that run on alternative fuels, and "greening" transportation infrastructure and logistics processes. Growth in this sector is largely driven by legislative policies. Assembly Bill 118 has set aside millions of dollars for research and development of alternative fuels and vehicle technologies with the goal of improving California's air quality. AB 32's implementation standards and programs will also require a change in current vehicle emission standards.

Alternative Transportation does present potential employment opportunities in the San Diego region. Like other clean sectors, the analysis of this cluster is difficult because the traditional categories do not distinguish alternative transportation from less environmentally friendly technologies. The data reports only slight growth in industries related to transportation since 2005. However, near-term projections indicate stronger growth (up 15%) through 2015.[58] There are six transportation and alternative fuels industry clusters: alternative fuel engine designs, alternative vehicle manufacturing, repair and maintenance services, fueling stations, public transit systems, and logistics.

At this stage of development, the bulk of employment for alternative transportation is related to public and/or fleet vehicle transportation, such as San Diego's North County Transportation District's BREEZE buses that operate on compressed natural gas. Employment will likely be located in transit agencies, private company fleets, and auto and truck repair/maintenance providers.

In a recent informal assessment of San Diego fleet managers, it was found that of more than 6,200 fleet vehicles represented, only 500 were alternative fuel vehicles. However, all of the employers indicated they plan to expand their alternative fuel vehicle fleet within the next three to six years. Natural gas and electric vehicles were the most prevalent future options.

Occupations directly impacted by adoption of alternative vehicle transportation include: technicians or vehicle mechanics; station maintenance technicians or mechanics; fuel handlers or fuel technicians; fleet managers/administration staff; and drivers. The employers in the informal assessment were responsible for more than 3,700 workers; of these, at least 430 were directly working with alternative fuels or alternative fuel vehicles.[59]

Most, if not all, of the occupations affected by the transition to alternative fuel fleet vehicles can be prepared for through career technical education, such as automotive programs at San Diego's nine community colleges, or through employer supported training combined with on-the-job experience.

From a residential consumer perspective, car manufacturers are teaming up with local utilities and municipalities to offer incentives for transitioning to alternatively-fueled vehicles. In San Diego, Nissan hopes residents will get a charge from the new Leaf, an all-electric vehicle. Local residents can take advantage of a $7,500 federal electric vehicle tax credit and a $5,000 state incentive. The first one thousand buyers in the region who pre-order a Leaf receive a free charger, contingent on signing up

[58] EMSI Complete Employment (Summer 2010).

[59] Preliminary data from an Informal Needs Assessment provided by the California Community College Chancellor's Office.

for a federal study of how people use their electric cars. The home chargers replenish the batteries while owners sleep and are expected to cost about $2,200. The California Center for Sustainable Energy (CCSE) is coordinating the state rebates and free charger program. According to Mike Ferry, CCSE transportation programs manager, "This means the car is within reach of the average consumer."[60]

Doing the Work

The San Diego Regional Clean Fuels Coalition (CFC) is a network of more than 80 volunteer, community-based coalitions, which develop public/private partnerships to work together as a coalition to:

- Increase the use of alternative fuels and alternative fuel vehicles (AFVs)
- Expand the use of fuel blends (diesel/biodiesel, ethanol/gasoline, and compressed natural gas (CNG)/hydrogen)
- Promote informed consumer choice on fuel economy
- Increase the acquisition of hybrid vehicles by fleets and consumers
- Advance the use of idle reduction technologies in heavy-duty vehicles
- Develop partnerships, investigate opportunities for joint projects, leverage resources, and collaborate on public policy

Through these efforts the Clean Fuels Coalition hopes to meet the program's goal of displacing eight billion gallons of petroleum in the transportation sector by 2020.[61]

Training a Workforce

In the San Diego Community College District, training on alternative vehicles has fueled many regional partnerships. Miramar College is a member of the Southern California Regional Transit Training Consortium (SCRTTC). This organization fosters a cooperative working relationship between community colleges and transit organizations to provide technician training on advanced transportation technologies and alternative fuel vehicles – primarily buses. Working with the South Coast Air Quality Management District, the Advanced Transportation Technology center (ATTE) at Miramar supports curriculum development on alternative fuels and renewable energy technologies. The college's Aviation, Diesel and Automotive training program is directly linked to the San Diego Clean Fuels Coalition, a member organization that use alternative fuel transportation and/or promote their usage.

[60]Soto, Onell R. "Nissan plugs its all-electric Leaf," UNION-TRIBUNE (March 30, 2010)

[61]San Diego Regional Clean Fuels Coalition (CFC), online at http://www.sdcleanfuels.org/board-directors/

Creating Jobs for San Diegans

in Compliance and Sustainability Planning

Compliance and Sustainability Planning is a catch-all category to cover all of the policy, management, and business applications that involve reducing negative environmental impacts but do not fit neatly into any previous category. Compliance and Sustainability Planning contains establishments and governmental agencies that plan, establish, execute and control environmental quality standards, usually in regards to air, water, land, and other environmental resources. These agencies also play a significant role in guiding and shaping the developments of the other five clusters. Because of the general nature of these agencies and related occupations, traditional labor market information is illustrative but can be misleading within individual categories.

In the Southern Border region, education, compliance and awareness employment ("E-2") in 2009 was estimated at more than 5,100 jobs. This is a significant finding as it surpassed the employment estimates for generating and storing renewable energy ("G") and natural and sustainable product manufacturing ("N"). For the region, these jobs make up approximately 13% of the area's green jobs and account for 7% of the state's education, compliance and awareness employment.[62]

Within this cluster, occupational classifications or job titles vary greatly as do the specific knowledge, skills and abilities required. Many are still evolving as was documented in recent study conducted by the University of San Diego Extension in collaboration with *Sustainability: The Journal of Record*. More than 360 U.S.-based employers (corporations, nonprofits and government) were surveyed to find out more about the work, outlook, and wage opportunities for sustainability professionals. Almost half (49%) reported that sustainability issues are the primary or an important, though not central, focus of their jobs. A range of sustainability issues were reported, with environmental, corporate responsibility and energy savings more likely to be the central focus or responsibility.

Many of those surveyed earned salaries exceeding $75,000 annually with those with advanced degrees earning the highest wages. Although just 34% plan to hire sustainability professional staff within the next year, 86% reported that incorporating "green" principles into design and decision-making is happening at their firm more often than in the past – a positive indication that sustainability is taking hold in corporate America.[63]

Doing the Work

The city of San Diego's Clean Tech initiative promotes, fosters and coordinates strategic alliance and collaboration among local, regional, state and federal institutions to develop and execute a clean technology business attraction strategy. Specifically, the initiative focuses on the creation of economic growth and environmental sustainability by developing a clean technology cluster in San Diego. Additionally, the Clean Tech initiative, under the direction of Mayor Jerry Sanders, is assisting in the development of a San Diego Clean Technology Advisory Council to be composed of industry leaders, government officials, educators and consultants and focused on attracting clean technology businesses to San Diego and creating jobs in this emerging sector.[64]

[62] *California's Green Economy: Summary of Survey Results,* Employment Development Department, Labor Market Information Division (October 2010), www.labormarketinfo.edd.ca.gov.

[63] UC San Diego Extension, *Sustainability: The Journal of Record* (October 2010).

[64] Clean Tech Leadership Strategy, Economic Growth Services, Office of the Mayor, City of San Diego (February 2010).

Conclusion

This report finds that San Diego is a national leader in clean technologies and advancing the clean economy. The region contains a diverse set of industries and companies, from research and development of supply- and demand-side energy solutions to manufacturing, sales, and installation and maintenance. As an innovation economy, San Diego has attracted large sums of investment capital, public stimulus dollars, and top talent from research universities both in the region and across the country.

Though all of the green clusters included in the study appear to be growing, it is evident that renewable energy – in particular solar energy and biofuel production – are leading in investment potential, bringing as much as $200 million to $1 billion in investment capital to the region. From an employment perspective, energy efficiency and green building is very important to the stability of the construction sector and are valued contributors to the overall economic health of the region – accounting for four out of 10 green jobs and buoyed by AB 32's implementation standards and programs.

Given the region's arid climate, water, wastewater and waste management will continue to present opportunities for innovative technology in pursuit of reducing the public's use of natural resources and remediation of waste products. An established employment base coupled with well-defined career pathways, this cluster will continue to expand as government funding increases, communities require higher standards and existing laws and regulations are enforced.

Increased access to alternative fuel vehicles and providing the infrastructure to support them will enhance the community's willingness to invest in these new technologies. And in an urban environment like San Diego, employment in compliance and sustainability planning will continue to increase in complexity.

Though there are many factors that have led to San Diego's leadership position, some of the most vital are:

- Ability to attract talent and capital to the region
- Strong leadership by public officials and industry associations
- Abundant natural resources
- A culture of innovation
- Active and supportive utilities
- Workforce partnerships, such as those between education and industry

These components have provided a solid foundation for San Diego's Clean Economy. Legislation at the state and federal level is further incentivizing and/or requiring greater adoption of clean technologies. Due to its position of strength and the continued commitments of leaders in the region, San Diego is poised to continue its leadership and experience expanded opportunities for employment across all of its clean sectors.

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