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CLEAN ECONOMY CLUSTER: WORKFORCE NEEDS ASSESSMENT

SACRAMENTO CAPITAL REGION

May 2016

Prepared by: Centers of Excellence,
Los Rios Community College District

Valley Vision

Burris Service Group

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INTRODUCTION

Starting in 2008, the six-county Sacramento Capital region (El Dorado, Placer, Sacramento, Sutter, Yolo and Yuba counties) was rocked by the global recession, losing 10 percent of the region's jobs. In response, regional leaders initiated Next Economy, an action plan to accelerate job creation and new investment in six high-growth business (industry) clusters. Valley Vision, a regional civic leadership organization, managed the three-year Next Economy design, research, and implementation process on behalf of a wide range of private and public sector partners.

By the end of 2015, after a lagging recovery, the region's economy finally reached pre-recession job counts, with the unemployment rate decreasing while job growth is accelerating. Valley Vision received funding from the JPMorgan Chase Foundation to better understand how the region's key high growth industry clusters have changed since the original Next Economy research was conducted in 2012, and what new opportunities are emerging. Valley Vision is partnering with the Los Rios Center of Excellence and the Burris Service Group on this effort.

Cluster research is a widely accepted standard of practice for developing regional prosperity strategies to address multiple facets of a region's complex economy. Industry clusters reduce operating costs by shortening supply chains; increasing the flow of information regarding new business opportunities; concentrating workforce training needs in select occupations; and speeding up the identification of gaps in products or services.[1] Firms in identified clusters may also have a reduced risk of failure, as these firms are better supported by the supply chain and can respond more rapidly to shifts in the marketplace.

This report presents findings on the analysis of the Clean Economy cluster. It is one in a series of six reports covering Next Economy-identified clusters. The five other reports include Advanced Manufacturing, Education and Knowledge Creation, Food and Agriculture, Information and Communications Technologies, and Life Sciences and Health Services.[2] Each report, except the Clean Economy study, provides an overview of the cluster; industry trends and economic impact; overview of the top demand occupations in the cluster requiring postsecondary education or training; projected occupational demand; institutions providing related education and training; and possible workforce gaps. Due to data limitations, the Clean Economy does not include economic impact analysis or employment data for occupations that require postsecondary education. The report does include profiles of employers that represent the range of businesses in this evolving cluster. Visit valleyvision.org or coeccc.net to access all of the Next Economy reports.

This research will be used to develop cluster-based workforce action plans. Valley Vision worked alongside regional education, workforce, and economic development partners to convene six cluster-based employer forums, setting priorities and developing strategies to address critical workforce gaps, better align education and workforce development resources to meet employer and workforce needs, and strengthen the regional economy overall.

[1] Cluster Manufacturing: A Supply Chain Perspective.

[2] Sacramento Area Council of Governments (SACOG) is the principal research for the Food and Agriculture Cluster study, which focuses primarily on industry trends.

CLUSTER DEFINITION

According to the Brookings Institute, "The Clean Economy is economic activity—measured in terms of establishments and the jobs associated with them—that produces goods and services with an environmental benefit or adds value to such products using skills or technologies that are uniquely applied to those products." For purposes of this study:

> A **Clean Establishment** is an organization that provides products and/or services that are aimed at utilizing resources more efficiently, providing renewable sources of energy, lowering greenhouse gas emissions, or otherwise minimizing environmental impact.
>
> A **Clean Job** is an occupation that 1) directly works with policies, information, materials, and/or technologies that contribute to minimizing environmental impact, and 2) requires specialized knowledge, skills, training, or experience in these areas.

The Clean Economy cluster comprises the following six subsectors:

Energy and Resource Efficiency includes establishments that focus on making new and existing buildings resource efficient and friendly to the environment. Establishments within this subsector range from the manufacturing of more efficient products and systems, construction of new "greener" buildings and retrofitting of existing ones, as well as installation and repair of energy- and resource-efficient equipment.

Renewable Energy includes establishments that focus on producing, distributing, and installing technologies, which harness, generate, store, and distribute renewable sources of energy. Industries in this subsector include solar, wind, waste-to-energy, biofuels/biomass, hydropower, and geothermal.

Sustainable Agriculture includes establishments that utilize agriculture practices that reduce negative impacts on the environment as well as conserve resources for future generations. Establishments within this subsector include organic farming, natural pesticides, and water conservation consultation.

Advanced Transportation includes establishments that focus on the technology, manufacturing, and servicing of vehicles that run on alternative fuels, as well as the "greening" of transportation infrastructure and logistics processes.

Environmental Compliance includes organizations and governmental agencies that plan, establish, execute, and control environmental quality standards, usually in regards to air, water, land, and other environmental resources. In addition this subsector includes private establishments that provide products or services that support compliance with environmental regulations and mandates.

Recycling and Waste Reduction includes organizations that collect and sort recycled materials, reuse or remanufacture recycled materials, and/or manufacture new products with recycled materials. In addition, the subsector includes establishments that reduce and divert food waste and bio-waste from landfills.

ANALYZING THE CLEAN ECONOMY CLUSTER

The Clean Economy cluster encompasses businesses in six subsectors: Energy and Resource Efficiency, Renewable Energy, Sustainable Agriculture, Advanced Transportation, Environmental Compliance, and Recycling/Waste Reduction. Unfortunately, the North American Industry Classification System (NAICS), commonly used to define cluster activity, does not provide sufficient detail to analyze industry and employment trends in these subsectors. As a result, an adapted version of the Standard Industrial Classification (SIC) system, predecessor of the NAICS system, was used to identify industries within the Clean Economy cluster.

InfoUSA, a private business that maintains business and consumer data for research and marketing purposes, created an expanded SIC code system that can be applied to the classification of emerging industries. Using this expanded SIC code system, industries were selected for inclusion if they can be considered fully part of each subsector. **As such, this data does not represent a complete picture of the Clean Economy cluster, but rather only a small percentage of the total.** This report also relies on secondary research to evaluate the evolving nature of the Clean Economy cluster by assessing changes in the economy, emerging new technologies, environmental concerns, and policy drivers. In addition, this study highlights one organization from each subsector that is making a significant contribution to the region's economy to illustrate facets of this emerging and growing cluster.

ENERGY AND RESOURCE EFFICIENCY

Energy and Resource Efficiency represents one of the greatest total employment opportunities for the Sacramento Capital region. This subsector consists of establishments that make new and existing buildings more resource efficient and friendly to the environment. Because buildings are such a significant consumer of energy and contributor to greenhouse gas emissions, they have become a focal point for potential solutions. In 2008 and 2013, California released building efficiency standards to require buildings to be built more efficiently.

In additional to state mandates, some local home owners have taken steps to lower energy usage by taking part in incentives offered by local utility companies, such as free to low-cost energy audits and rebates for energy-efficient appliances and systems. Energy audits, like the Home Energy Rating System (HERS), are used to identify costly inefficient HVAC systems, ducts/vents, and insulation. In some cases, the cost of fixing energy-inefficient defects is minimal compared to the potential cost savings.

Local businesses have also made substantial investments in retrofitting and building structures that meet stringent energy efficiency standards established by the U.S. Green Building Council. In the Sacramento Capital region, there are more than 560 Leadership in Energy and Environmental Design (LEED) certified buildings.[3] LEED certification recognizes new and existing buildings that meet rigorous energy efficiency, resource efficiency, and recycling standards. As a third-party nationally recognized organization, LEED is one of the most accepted certifying agencies of high performance, green buildings.[4]

Information and Communication Technologies (ICT) is expected to have a significant impact on the Energy and Resource Efficiency subsector. Many businesses and homes in the Sacramento Capital region have smart meters that are communicating energy data and performance information to utility companies. The next evolution is a mass adoption of smart buildings with communicating devices linked to lighting, chillers, fans, pumps, appliances, HVAC systems and other equipment. Cloud computing capabilities will further enhance remotely obtaining field data and enabling management and analysis of building systems to reduce overall energy usage and costs.[5]

[3] U.S. Green Building Council, usgbc.org/projects. Accessed March 3, 2016.

[4] http://www.usgbc.org/leed. Accessed April 8, 2016.

[5] *How Information and Communications Technologies Will Change the Evaluation, Measurement, and Verification of Energy Efficiency Programs.* December 2015. American Council for an Energy-Efficient Economy (ACEEE).

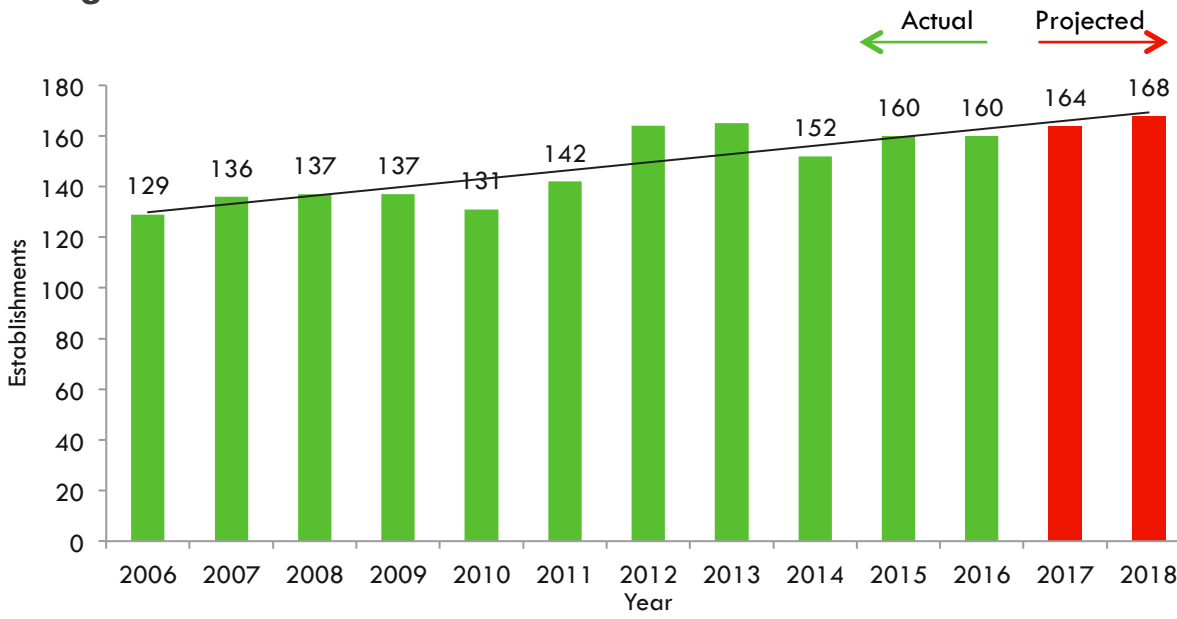
ENERGY AND RESOURCE EFFICIENCY

Exhibit 1 displays establishment and employment data for the Energy and Resource Efficiency industries as classified by the expanded SIC code system developed by InfoUSA. Over the last five years, the region has added 19 new establishments and more than 1,000 new jobs. Most of this projected growth shown in Exhibit 2 may be attributed to the energy management systems and products industry, which is composed of building contractors that specialize in retrofitting or building energy- and resource-efficient structures.

Exhibit 1: Energy and Resource Efficiency, Employment and Establishments, Sacramento Capital Region[6]

	2011 Jobs	2016 Jobs	2011–2016 Job Change	Percent Change	2016 Establishments
Energy Management Systems and Products	207	1,015	808	390%	63
Insulation Contractors-Cold & Heat	376	386	10	3%	27
Controls Control Systems/Regulators (Wholesale)	125	321	196	157%	11
Energy Conservation & Management Consultants	235	171	-64	-27%	34
Energy Conservation Products, Services, & Systems	147	150	3	2%	12
Water Conservation Products & Services	35	125	90	257%	5
Controls Control Systems/Regulators (Manufacturing)	61	43	-18	-30%	5
Energy Raters	2	4	2	100%	1
Leak Detecting Service	5	2	-3	-60%	2
Total	**1,193**	**2,217**	**1,024**	**86%**	**160**

Exhibit 2: Energy and Resource Efficiency, Establishments, Sacramento Capital Region[6]



[6] ReferenceUSA: Business Database, 2016.

ENERGY AND RESOURCE EFFICIENCY

There are a range of occupations that support the Energy and Resource Efficiency subsector. Classified by the Occupational Information Network (O*NET), Exhibit 3 displays the occupations that conduct work activities that directly relate to the Energy and Resource Efficiency subsector. Significant research has been compiled about the tasks, skills, abilities, and knowledge requirements for these occupations. However, little data is available on employment estimates, replacement needs, and projections.

Occupations without O*NET codes associated with Energy and Resource Efficiency businesses include: building performance/retrofitting specialists, Home Energy Rating System (HERS) raters, and acceptance test technicians. In addition, there are several occupations that work both within traditional and energy/resource efficiency establishments. These include: building operators, construction managers, electricians, plumbers, and other specialty trade contractors.

Exhibit 3: Energy and Resource Efficiency Occupations[7]

ONET Code	Title	Description
13-1199.01	Energy Auditors	Conduct energy audits of buildings, building systems, or process systems. May also conduct investment grade audits of buildings or systems.
17-2199.03	**Energy Engineers***	**Design, develop, or evaluate energy-related projects or programs to reduce energy costs or improve energy efficiency during the designing, building, or remodeling stages of construction. May specialize in electrical systems; heating, ventilation, and air-conditioning (HVAC) systems; green buildings; lighting; air quality; or energy procurement.**
49-9021.01	Heating and Air Conditioning Mechanics and Installers	Install, service, or repair heating and air conditioning systems in residences or commercial establishments.
47-4099.03	Weatherization Installers and Technicians	Perform a variety of activities to weatherize homes and make them more energy efficient. Duties include repairing windows, insulating ducts, and performing heating, ventilating, and air-conditioning (HVAC) work. May perform energy audits and advise clients on energy conservation measures.

** Employers who participated in the Clean Economy forum indicated that they have experienced difficulty finding qualified applicants for this occupation.*

[7] Occupation Information Network (O*NET): www.onetonline.org. Accessed March 3, 2016.

ENERGY AND RESOURCE EFFICIENCY

In the Sacramento Capital region, there are seven education institutions that offer training programs that support the Energy and Resource Efficiency subsector, as shown in Exhibit 4.

Exhibit 4: Energy and Resource Efficiency Education Programs, Sacramento Capital Region

College/University/ Training Center	Name of Program	Award(s)
Center for Employment & Training (CET)	HVAC Technician & Green Technology	Certificate
Charles A. Jones Career and Education Center	HVAC&R Maintenance Technology/Technician	Certificate
Cosumnes River College	Construction, Building Performance and Energy Assessment	A.S. Degree, Certificate
Cosumnes River College	Green Buildings: Environmental Design, Energy Management and Performance Based Construction	Certificate
Sacramento City College	Commercial Building Energy Auditing and Commissioning Specialist	Certificate
Sacramento City College	HVAC Systems Design CADD	A.S. Degree, Certificate
Sacramento City College	Mechanical (HVAC/Plumbing Systems)	A.S. Degree, Certificate
San Joaquin Valley College	HVAC Technology	Associate Degree
Sierra College	Energy Technology	A.S. Degree
Sierra College	Energy Technology	Certificate
Twin Rivers Adult School	HVAC&R Maintenance Technology/Technician	Certificate
UC Davis Extension	Green Building and Sustainable Design	Professional Concentration
UC Davis Extension	Sustainability and the Built Environment	Certificate

Business Spotlight: E3 CA, Inc.

E3 CA, Inc. provides all types of compliance inspections for LEED and other building code programs, as well as commissioning in the design and construction process for new buildings and diagnostic testing for commercial and multifamily/mixed-use buildings. The company has continued to grow since it was founded in 2007 from two to 14 employees today. In the past four years, E3 CA, Inc. has inspected nearly 1,000 buildings and 60,000 units.

According to the President/CEO of E3 CA, Inc., California building codes and standards are driving demand for their services. As California moves to net-zero energy requirements over the next 15 years, E3 CA, Inc. anticipates that there will be a shortage of energy auditors and building performance contractors. The company is eager to partner with the region's community colleges to develop a pipeline of qualified and trained applicants entering the field.[8]

[8] Interview with E3 CA, Inc., Tommy Young, President/CEO. www.e3cainc.com. April 11,2016.

RENEWABLE ENERGY

Renewable Energy represents a substantial number of employment opportunities for the Sacramento Capital region. This subsector comprises establishments that are involved in renewable energy generation including solar, wind, geothermal, hydroelectric, and biomass. Solar is projected to have the largest number of jobs in the region with SolarCity, Sunrun and other solar-related businesses headquartered in the region.

The solar industry has expanded rapidly over the last few years due to the federal Investment Tax Credit (ITC) and improved quality of solar panels. The ITC has largely been responsible for the fast pace of solar installations in both residential and commercial projects. In December 2015, Congress extended the 30 percent ITC for project costs, with a multi-year phase down through 2023. The renewal of this policy is expected to continue to support revenue streams and job creation throughout California and the nation.[9]

New, improved technology for solar panels is producing greater efficiency gains. Many of today's solar panels have an aperture efficiency of 22 percent. In addition, there are prototype solar panels that have shown to be more than 40 percent efficient in a laboratory environment. As these new panels are introduced to the marketplace, the return on investment for commercial and residential consumers will be significantly improved.

Exhibit 5 displays establishment and employment data for Renewable Energy industries as classified by SIC codes at the eight-digit level. Unfortunately, this exhibit does not include data for biomass-related industries as there are not any SIC codes with biomass classification. Over the last five years, the region has added 31 new establishments and 290 new jobs. Most of this growth may be attributed to solar wholesale, solar heating contractors, and solar energy research and development (Exhibit 6).

In addition to a thriving solar industry, the region also has several bio-digesters. One of the largest economic drivers of waste diversion is AB 1826, the California Integrated Waste Management Act. A recent amendment to this bill requires business that generate a specified amount of organic waste per week to arrange for recycling services for that organic waste. This amendment will reduce food waste in landfills as well as create additional market opportunities for bio-digester establishments.

Exhibit 5: Renewable Energy, Employment and Establishments, Sacramento Capital Region[10]

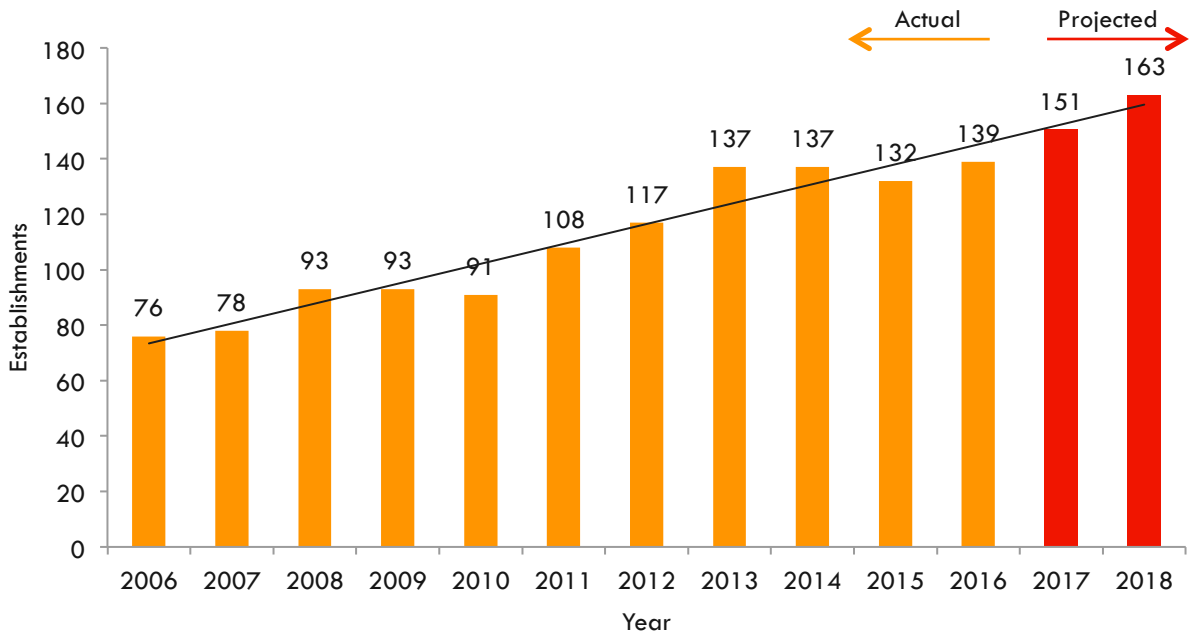
	2011 Jobs	2016 Jobs	2011–2016 Job Change	Percent Change	2016 Establishments
Solar Energy Equipment-Wholesale	246	403	157	64%	64
Energy Conservation & Mgmt Consultants	235	171	-64	-27%	34
Solar Heating Contractors	46	169	123	267%	19
Solar Energy Equipment-Manufacturers	109	102	-7	-6%	5
Solar Energy Research & Development	22	76	54	245%	9
Turbines-Manufacturers	0	27	27	n/a	2
Solar Heating Systems	3	8	5	167%	3
Solar Energy Equip & Systems-Svc & Rpr	0	5	5	n/a	2
Geothermal Htg/ Cooling Equip/Systs-Dlrs	5	1	-4	-80%	1
Wind Energy Systems (Whls)	4	0	-4	-100%	0
Total	**670**	**962**	**292**	**44%**	**139**

[9] California Solar Energy Industries Association, CalSEIA Annual Report 2015. www.calseia.org.

[10] ReferenceUSA: Business Database, 2016.

RENEWABLE ENERGY

Exhibit 6: Renewable Energy, Establishments, Sacramento Capital Region[11]



O*NET has identified 19 renewable energy occupations (Exhibit 7, following page). Occupations that are most in-demand in the Sacramento Capital region include solar energy installation managers, solar photovoltaic installers, and solar sales representatives and assessors.

[11] ReferenceUSA: Business Database, 2016.

RENEWABLE ENERGY

Exhibit 7: Renewable Energy Occupations[12]

ONET Code	Title	Description
51-8099.01	Biofuels Processing Technicians	Calculate, measure, load, mix, and process refined feedstock with additives in fermentation or reaction process vessels and monitor production process. Perform, and keep records of, plant maintenance, repairs, and safety inspections.
11-3051.03	Biofuels Production Managers	Manage biofuels production and plant operations. Collect and process information on plant production and performance, diagnose problems, and design corrective procedures.
11-9041.01	Biofuels/Biodiesel Technology and Product Development Managers	Define, plan, or execute biofuels/biodiesel research programs that evaluate alternative feedstock and process technologies with near-term commercial potential.
51-8099.03	Biomass Plant Technicians	Control and monitor biomass plant activities and perform maintenance as needed.
11-3051.04	Biomass Power Plant Managers	Manage operations at biomass power generation facilities. Direct work activities at plant, including supervision of operations and maintenance staff.
17-2141.01	Fuel Cell Engineers	Design, evaluate, modify, or construct fuel cell components or systems for transportation, stationary, or portable applications.
17-3029.10	Fuel Cell Technicians	Install, operate, or maintain integrated fuel cell systems in transportation, stationary, or portable applications.
11-3051.02	Geothermal Production Managers	Manage operations at geothermal power generation facilities. Maintain and monitor geothermal plant equipment for efficient and safe plant operations.
51-8099.04	Hydroelectric Plant Technicians	Monitor and control activities associated with hydropower generation. Operate plant equipment, such as turbines, pumps, valves, gates, fans, electric control boards, and battery banks. Monitor equipment operation and performance and make necessary adjustments to ensure optimal performance. Perform equipment maintenance and repair as necessary.
11-3051.06	Hydroelectric Production Managers	Manage operations at hydroelectric power generation facilities. Maintain and monitor hydroelectric plant equipment for efficient and safe plant operations.
47-1011.03	**Solar Energy Installation Managers***	**Direct work crews installing residential or commercial solar photovoltaic or thermal systems.**
17-2199.11	Solar Energy Systems Engineers	Perform site-specific engineering analysis or evaluation of energy efficiency and solar projects involving residential, commercial, or industrial customers. Design solar domestic hot water and space heating systems for new and existing structures, applying knowledge of structural energy requirements, local climates, solar technology, and thermodynamics.
47-2231.00	**Solar Photovoltaic Installers***	**Assemble, install, or maintain solar photovoltaic (PV) systems on roofs or other structures in compliance with site assessment and schematics. May include measuring, cutting, assembling, and bolting structural framing and solar modules. May perform minor electrical work such as current checks.**
41-4011.07	**Solar Sales Representatives and Assessors***	**Contact new or existing customers to determine their solar equipment needs, suggest systems or equipment, or estimate costs.**
47-4099.02	Solar Thermal Installers and Technicians	Install or repair solar energy systems designed to collect, store, and circulate solar-heated water for residential, commercial or industrial use.
17-2199.10	Wind Energy Engineers	Design underground or overhead wind farm collector systems and prepare and develop site specifications.
11-9199.09	Wind Energy Operations Managers	Manage wind field operations, including personnel, maintenance activities, financial activities, and planning.
11-9199.10	Wind Energy Project Managers	Lead or manage the development and evaluation of potential wind energy business opportunities, including environmental studies, permitting, and proposals. May also manage construction of projects.
49-9081.00	Wind Turbine Service Technicians	Inspect, diagnose, adjust, or repair wind turbines. Perform maintenance on wind turbine equipment, including resolving electrical, mechanical, and hydraulic malfunctions.

** Employers who participated in the Clean Economy forum indicated that they have experienced difficulty finding qualified applicants for this occupation.*

[12] Occupation Information Network (O*NET): www.onetonline.org. Accessed March 3, 2016.

RENEWABLE ENERGY

In the Sacramento Capital region, there are three education institutions that offer training programs that support the Renewable Energy subsector. Both provide training for solar-related occupations (Exhibit 8).

Exhibit 8: Renewable Energy Education Programs, Sacramento Capital Region

College/University	Name of Program	Award(s)
American River College	Solar Energy Systems Design, Estimation, and Sales	Certificate
American River College	Solar Energy Technology	Certificate
Sierra College	Solar Photovoltaic	Skills Certificate
Sierra College	Solar Photovoltaic Advanced	Skills Certificate
UC Davis Extension	Renewable Energy	Professional Concentration

Business Spotlight: Sacramento Municipal Utility District (SMUD)

SMUD is a publicly-owned utility providing electricity to Sacramento County and portions of Placer and Yolo Counties. Their power sources include hydropower, natural-gas-fired generators, solar and wind renewable energy, and electricity purchased from the wholesale market. The utility's long-term strategy is to increase the amount of power obtained from renewable energy to ensure a green, sustainable portfolio. Currently, their hydroelectric plants represent a large percentage of their renewable energy production with the lowest production costs.

SMUD is active in research and investments to achieve the state's mandated renewable energy goal: 33% of energy sources produced by renewable energy by 2020 (AB32). The availability of a qualified workforce is key to achieving this goal. SMUD needs workers with knowledge of the integration of energy systems, information technology, and operations. In addition, applicants need strong critical thinking, creativity, collaboration, and communication skills.[13]

[13] Interview with Susan Wheeler, Workforce Pipeline Planning and Education Relations Strategist, Organization and Workforce Development, Sacramento Municipal Utility District (SMUD). www.smud.org. April 13, 2016.

SUSTAINABLE AGRICULTURE

The region's Sustainable Agriculture subsector is largely driven by agricultural philosophies, policies, and practices that promote healthy food production and preserve valuable working lands and natural resources. This subsector includes establishments that utilize agriculture practices that reduce negative impacts on the environment as well as conserve resources for future generations. Along with production, agriculture service providers, such as establishments that produce natural pesticides and safe soils, are included in this category.

Transitioning from conventional farming to sustainable farming practices is a slow and evolving process that requires advocacy, education, and public policy. To assist with this effort, the USDA's Agricultural Marketing Service's National Organic Program offers resources and education tools to growers who want to adopt organic farming practices. Their how-to manuals and support services help farmers understand and implement USDA organic standards, qualify for certification, and prepare for inspection.[14] The California Certified Organic Farmers organization offers additional resources to farmers who are transitioning to organic practices.[15] Farm to Fork, SACOG, California Department of Food and Agriculture, and other organizations are supporting the growth of local food systems which can have environmental benefits

In addition to organic agricultural practices, farms must adapt to changing weather patterns, microclimates, and water availability. In the future, energy producers and farmers may share or compete for the same land and water resources. In many cases, food and energy production will occur in tandem within agricultural centers. As science and technology innovations advance in the Sustainable Agriculture subsector, so will the need for tech-savvy farmers, agricultural workers and service providers.[16] Ecosystem services is another emerging aspect of sustainable agriculture.

Exhibit 9 displays the occupations identified by O*NET that support the Sustainable Agriculture subsector. Occupations without O*NET codes that work in sustainable agriculture include: policy analysts and scientists that conduct research in the area of sustainable farming standards and practices.

Exhibit 9: Sustainable Agriculture Occupations[17]

ONET Code	Title	Description
19-1031.01	Soil and Water Conservationists	Plan or develop coordinated practices for soil erosion control, soil or water conservation, or sound land use.
11-9013.02	Farm and Ranch Managers	Plan, direct, or coordinate the management or operation of farms, ranches, greenhouses, aquacultural operations, nurseries, timber tracts, or other agricultural establishments.

In the Sacramento Capital region, there are three education institutions that offer training programs that support the sustainable agriculture subsector (Exhibit 10).

[14] *New Outreach and Education Tools Available to Support Organic Certification.* March 8, 2016. National Sustainable Agriculture Coalition. http://sustainableagriculture.net/blog/sound-and-sensible/

[15] California Certified Organic Farmers. https://www.ccof.org/

[16] Little data is available through SIC codes on the total employment and establishments of the Sustainable Agriculture subsector.

[17] Occupation Information Network (O*NET): www.onetonline.org. Accessed March 3, 2016.

SUSTAINABLE AGRICULTURE

Exhibit 10: Sustainable Agriculture Education Programs, Sacramento Capital Region

College/University	Name of Program	Award(s)
Sierra College	Sustainable Agriculture	A.S. Degree; Certificate
UC Davis	Sustainable Agriculture and Food Systems	Bachelor of Science
Woodland College	Environmental Horticulture	A.S. Degree; Certificate
Woodland College	Sustainable Agriculture	Certificate

Business Spotlight: California Safe Soil

California Safe Soil manufactures a certified organic liquid fertilizer and soil amendment made from food waste obtained from supermarkets and farms. The company co-locates with various distribution outlets for recovery of imperfect or unharvested food from farmers and spoilage from grocery retailers. Their products, Harvest-to-Harvest and Harvest-to-Harvest Organic, are made through a process of grinding, heating, and enzymatically digesting the food, then blending it to produce a complete plant-and-soil nutrient that can be used in conventional and organic agricultural crop production to promote soil fertility.

California Safe Soil is currently producing soil nutrients at several plants across the state. With increasing demand for fertilizers that use biological agents rather than chemicals, the company plans to open a new production facility in McClellan Park. To support operations at this facility, California Safe Soil will be recruiting applicants for plumbing and electrical positions, as well as sales and marketing.[18]

[18] Interview with California Safe Soil, Dan Morash, Founder. www.calsafesoil.com. April 12, 2016.

ADVANCED TRANSPORTATION

The Advanced Transportation subsector includes establishments that focus on alternative vehicles, technologies, and fuels with the ultimate goal of reducing petroleum dependence and greenhouse gas emissions. To move forward the Advanced Transportation subsector, Governor Jerry Brown issued an executive order to put 1.5 million zero-emission vehicles (ZEV) on California's road by 2025.

To meet this mandate, California and the Sacramento Capital region need more public charging stations. Currently, there are fewer than 8,000 public charging outlets across the state.[19] While there has been significant growth in the installation of charging stations, the National Renewable Energy Laboratory estimates California will need as many as 51,000 public charging stations and 167,000 workplace charging units to achieve the Governor's goal.

The planning, permitting, and installation of electric vehicle charging stations is a complex process. In an effort to improve the process, the California Energy Commission has provided funding to regional multiagency coordinating councils around the state. In the Sacramento Capital region, the Sacramento Area Council of Governments (SACOG) is leading the effort to develop better ZEV deployment and infrastructure.

In addition to developing a strong electric vehicle infrastructure, the Sacramento Capital region is a major junction for train travel within the continental U.S..[20] Regional transit networks also offer bus, light rail, and streetcar transportation options. However, the Sacramento Regional Transit District has experienced a 20 percent drop in ridership after cuts in routes and an increase in fares during the recession; ridership has not yet recovered.[21] To compensate, the Agency may again raise fares or ask for a half-cent sales tax increase on a ballot measure to pay for transit improvements and alleviate traffic congestion.

In advance of the new sports and entertainment arena opening in October in Sacramento, Regional Transit is hoping to lure new ridership to the downtown area with expanded routes that are more convenient than traffic jams and expensive parking charges.

[19] http://www.evchargernews.com/regions/ch-sac-all.htm. This region includes the following counties: Butte, El Dorado, Fresno, Madera, Nevada, Placer, Sacramento, San Joaquin, Solano (Eastern portion), Sutter, Tulare, and Yolo.

[20] http://www.up.com/index.htm

[21] Sacramento RT Faces Critical Year for Ridership and Revenue. http://www.sacbee.com/news/local/transportation/article65885202.html. March 13, 2016.

ADVANCED TRANSPORTATION

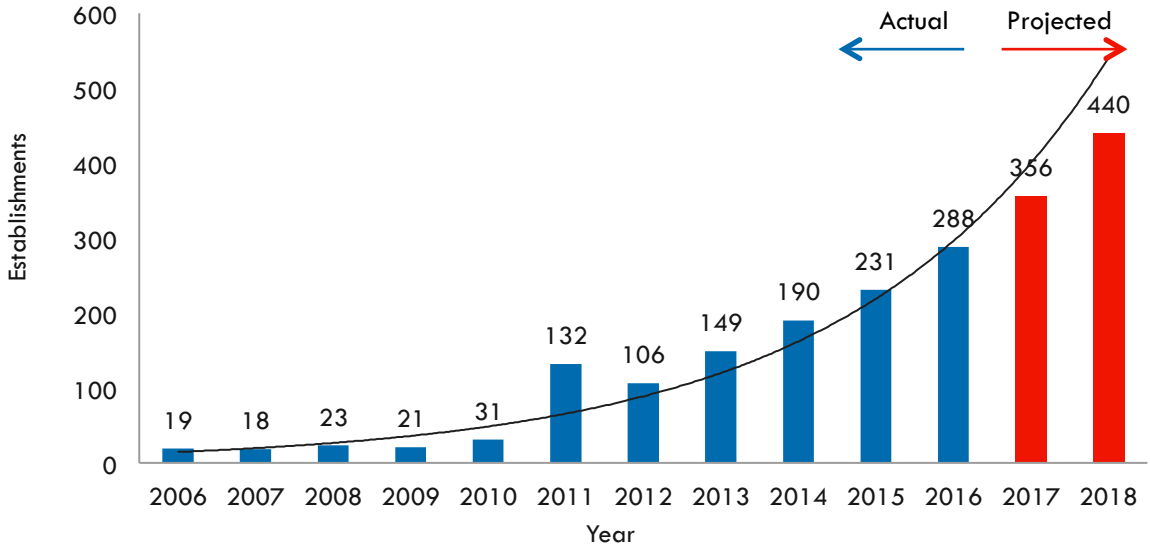
Exhibit 11 displays establishment and employment data for Advanced Transportation industries as classified by SIC codes at the eight-digit level. Over the last five years, the region has added 156 new establishments and 304 new jobs. Establishment growth is being driven by the installation of new public charging stations since each new station is counted as one establishment (Exhibit 12). However, because the stations are not staffed, no new jobs have been created from this exponential growth.

Exhibit 11: Advanced Transportation, Employment and Establishments, Sacramento Capital Region[22]

	2011 Jobs	2016 Jobs	2011–2016 Job Change	Percent Change	2016 Establishments
Electric Cars-Automobile (Mfrs)	12	2	-10	-83%	1
Electric Charging Station	0	0	0	n/a	264
Railroads	148	528	380	257%	12
Trains	4	5	1	25%	1
Transit Lines	302	235	-67	-22%	10
Total	**466**	**770**	**304**	**65%**	**288**

Note. Siemens was not captured in this dataset due to the SIC classification structure. Siemens is an international company that designs and manufactures passenger trains, light rail cars, and high speed trainsets. More than 800 people are employed by Siemens at the South Sacramento facility.

Exhibit 12: Advanced Transportation, Establishments, Sacramento Capital Region[23]



The rise in the number of advanced technology vehicles and alternative fuel vehicles has increased the demand for qualified workers with specialized knowledge and diagnostic skills. As a result, many employers operating fleets, dealerships, and automotive shops are now requiring supplementary certification or training. The planned expansion of the EV infrastructure may also result in additional employment opportunities, such as jobs for workers with knowledge and expertise in charging unit installation and maintenance.

[22] ReferenceUSA: Business Database, 2016.

[23] ReferenceUSA: Business Database, 2016.

ADVANCED TRANSPORTATION

Exhibit 13: Advanced Transportation Occupations[24]

ONET Code	Title	Description
49-3023.02	Automotive Specialty Technicians	Repair only one system or component on a vehicle, such as brakes, suspension, or radiator.

In the Sacramento Capital region, American River College offers several Advanced Transportation training programs (Exhibit 14). There are three programs with a focus on clean diesel and one with a broader focus on alternative fuels and advanced technologies.

Exhibit 14: Advanced Transportation Education Programs, Sacramento Capital Region

College/University	Name of Program	Award(s)
American River College	Alternative Fuels and Green Vehicle Technology	Certificate
American River College	Clean Diesel Hybrid Technology	Certificate
American River College	Clean Diesel Management Systems	Certificate
American River College	Clean Diesel Technology	Certificate

Business Spotlight: Phil Haupt Electric

Phil Haupt Electric offers full commercial and residential electrical services in the Sacramento region. Services include site analysis, engineering, and installation of electric vehicle charging stations at various multi-unit dwellings, commercial, retail, public, government, and residential locations. The company has installed nearly 700 charging stations throughout northern California.

As more electric vehicles with ranges of 200 miles or more become available to consumers, Phil Haupt Electric expects that the demand for EVs will significantly increase. Currently, the company is experiencing difficulty finding qualified workers in the electrical field who meet their minimum standards.[25]

[24] Occupation Information Network (O*NET): www.onetonline.org. Accessed March 3, 2016.

[25] Interview with Phil Haupt Electric, Inc., Becky Haupt, Co-Owner. www.philhauptelectric.com. April 27, 2016.

ENVIRONMENTAL COMPLIANCE

Over the past few decades, state and federal agencies have implemented new laws, regulations, and standards designed to protect air, water, natural resources, wildlife, and public health. One of the primary goals of environmental regulations is to limit greenhouse gases entering the atmosphere.

The Sacramento Capital region is home to a number of government agencies that monitor and regulate environmental mandates and polices. Regulatory efforts include oversight and regulation of peak power usage, alternative storage for and use of chemicals, recycling of manufacturing waste, reducing amounts of hazardous waste, improving wastewater treatment processes, and switching to solid-state lighting, to name a few.

In addition, some companies and public sector institutions have gone further than required by law to reduce their companies' environmental impact. These companies have changed their business practices and systems to preserve natural resources and minimize the environmental impact of their daily activities. In the region, more than 500 organizations have been certified as a "Sustainable Business," a recognition conferred by the Business Environmental Resource Center, an entity established by the Sacramento County Board of Supervisors.[27]

Driven by both legislation and corporate responsibility, many organizations are adopting business practices that reduce their carbon footprint. This shift is driving demand for environmental and ecological consulting services that can provide solutions for business and government clients to comply with and implement sustainability programs.

Exhibit 15 displays establishment and employment data for Environmental Compliance industries as classified by SIC codes at the eight-digit level. Over the last five years, the region has added 32 new establishments and 110 new jobs. Most of the job growth can be attributed to environmental conservation organizations, environmental & ecological services, and state government environmental programs. City and county government programs reduced headcount during this same period.

Exhibit 15: Environmental Compliance, Employment and Establishments, Sacramento Capital Region[26]

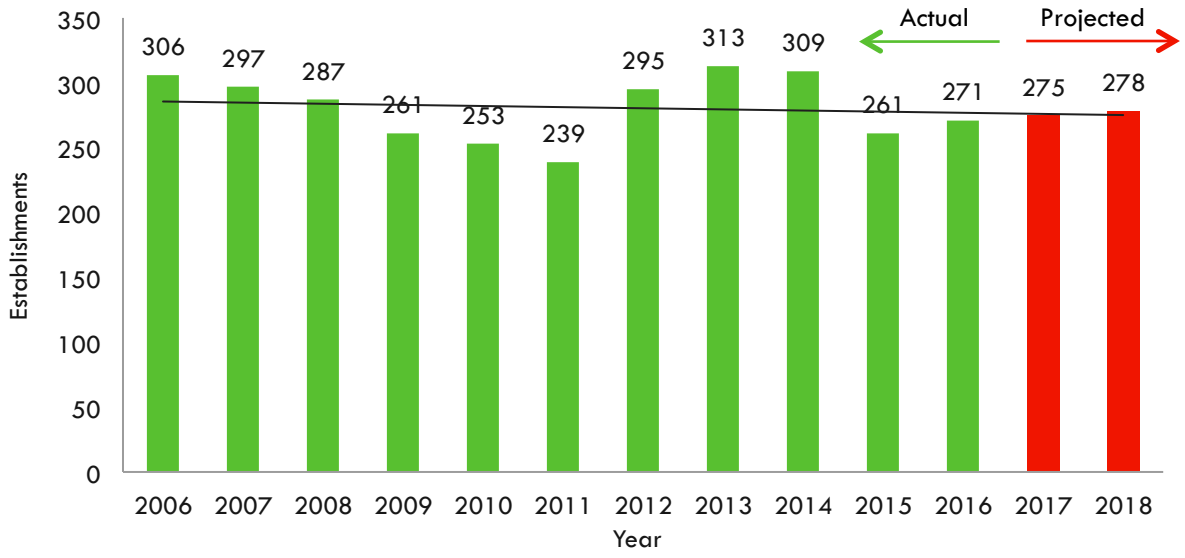
	2011 Jobs	2016 Jobs	2011–2016 Job Change	Percent Change	2016 Establishments
Air Pollution Control	5	3	-2	-40%	1
Air Pollution Measuring Equip (Whls)	4	4	0	0%	1
City Government-Environmental Programs	303	26	-277	-91%	3
County Government-Environmental Programs	222	61	-161	-73%	7
Environmental & Ecological Services	1870	2063	193	10%	206
Environmental Products & Supls (Whls)	19	22	3	16%	6
Environmental Conservation/Ecologcl Org	0	247	247	n/a	36
State Government-Environmental Programs	3959	4018	59	1%	10
Water Pollution Control	2	0	-2	-100%	0
Environmental Analysis Services	0	50	50	n/a	1
Total	**6,384**	**6,494**	**110**	**2%**	**271**

[26] http://www.sacberc.org/

[27] ReferenceUSA: Business Database, 2016.

ENVIRONMENTAL COMPLIANCE

Exhibit 16: Environmental Compliance, Establishments, Sacramento Capital Region[28]



The advancement of clean, sustainable organizations has created demand for skilled employees with knowledge of environmental compliance, sustainability goals, and performance outcomes. Below are some of the occupations that specialize in this area.

[28] ReferenceUSA: Business Database, 2016.

ENVIRONMENTAL COMPLIANCE

Exhibit 17: Environmental Compliance Occupations[29]

ONET Code	Title	Description
11-9199.11	Brownfield Redevelopment Specialists and Site Managers	Plan and direct cleanup and redevelopment of contaminated properties for reuse. Does not include properties sufficiently contaminated to qualify as Superfund sites.
11-1011.03	Chief Sustainability Officers	Communicate and coordinate with management, shareholders, customers, and employees to address sustainability issues. Enact or oversee a corporate sustainability strategy.
19-2041.01	Climate Change Analysts	Research and analyze policy developments related to climate change. Make climate-related recommendations for actions such as legislation, awareness campaigns, or fundraising approaches.
11-9199.02	Compliance Managers	Plan, direct, or coordinate activities of an organization to ensure compliance with ethical or regulatory standards.
13-1041.01	Environmental Compliance Inspectors	Inspect and investigate sources of pollution to protect the public and environment and ensure conformance with federal, state, and local regulations and ordinances.
19-3011.01	Environmental Economists	Conduct economic analysis related to environmental protection and use of the natural environment, such as water, air, land, and renewable energy resources. Evaluate and quantify benefits, costs, incentives, and impacts of alternative options using economic principles and statistical techniques.
17-3025.00	Environmental Engineering Technicians	Apply theory and principles of environmental engineering to modify, test, and operate equipment and devices used in the prevention, control, and remediation of environmental problems, including waste treatment and site remediation, under the direction of engineering staff or scientist. May assist in the development of environmental remediation devices.
17-2081.00	Environmental Engineers	Research, design, plan, or perform engineering duties in the prevention, control, and remediation of environmental hazards using various engineering disciplines. Work may include waste treatment, site remediation, or pollution control technology.
19-4091.00	Environmental Science and Protection Technicians, Including Health	Perform laboratory and field tests to monitor the environment and investigate sources of pollution, including those that affect health, under the direction of an environmental scientist, engineer, or other specialist. May collect samples of gases, soil, water, and other materials for testing.
19-2041.00	Environmental Scientists and Specialists, Including Health	Conduct research or perform investigation for the purpose of identifying, abating, or eliminating sources of pollutants or hazards that affect either the environment or the health of the population. Using knowledge of various scientific disciplines, may collect, synthesize, study, report, and recommend action based on data derived from measurements or observations of air, food, soil, water, and other sources.
13-1041.07	Regulatory Affairs Specialists	Coordinate and document internal regulatory processes, such as internal audits, inspections, license renewals, or registrations. May compile and prepare materials for submission to regulatory agencies.
13-1199.05	Sustainability Specialists	Address organizational sustainability issues, such as waste stream management, green building practices, and green procurement plans.
11-9121.02	Water Resource Specialists	Design or implement programs and strategies related to water resource issues such as supply, quality, and regulatory compliance issues.

[29] Occupation Information Network (O*NET): www.onetonline.org. Accessed March 3, 2016.

ENVIRONMENTAL COMPLIANCE

In the Sacramento Capital region, there are six education institutions offering training programs that support the Environmental Compliance subsector (Exhibit 18).

Exhibit 18: Environmental Compliance Education Programs, Sacramento Capital Region

College/University	Name of Program	Award(s)
American River College	Environmental Conservation	A.S. Degree; Certificate
CSU Sacramento	Civil Engineering: Environmental/Water Quality Engineering	Master of Science
CSU Sacramento	Civil Engineering: Water Resources Engineering	Master of Science
CSU Sacramento	Environmental Studies	Bachelor of Science; Bachelor of Arts
CSU Sacramento	Water Quality	Certificate
CSU Sacramento	Water Resources Planning	Certificate
Folsom Lake College	Water Management	Certificate
Sierra College	Environmental Studies and Sustainability	A.S. Degree
UC Davis	Ecological Management and Restoration	Bachelor of Science
UC Davis	Environmental Policy Analysis and Planning	Bachelor of Science
UC Davis	Environmental Science and Management	Bachelor of Science
UC Davis	Environmental Toxicology	Bachelor of Science
UC Davis	Sustainable Environmental Design	Bachelor of Science
UC Davis	Civil and Environmental Engineering	Master of Science; PhD
William Jessup University	Environmental Science	Bachelor of Science; Bachelor of Arts

Business Spotlight: California Air Resources Board (CARB)

The California Air Resources Board (CARB) is one of the lead regulatory agencies overseeing the Global Warming Solutions Act of 2016 (AB32). One of its key roles as a lead organization is the coordination of state agencies to establish and engage in efforts that reduce greenhouse gas emissions. As a member of the state's Climate Action Team, the CARB is working with more than 18 agencies to plan, direct, and measure state efforts to achieve the AB32 milestone goals required by 2020 through to 2050.

To ensure environmental compliance for organizations under AB32 regulations, the CARB has established a system of reporting, verifying, monitoring, and enforcement. To facilitate business compliance, CARB holds regular community meetings, provides information and processes written clearly and in simple language, and offers resources about incentives for early compliance and loans.

With the drive toward achieving the goals of 2030 climate stabilization, CARB is pressed to find qualified workers who have excellent project management, critical thinking, and communication skills, as well as the ability to collaboratively identify and solve problems. Knowledge of atmospheric and GIS systems are also highly valued.[30]

[30] Interview with California Air Resources Board (ARB), La Rhonda Bowen, ARB Ombudsman. www.arb.ca.gov. April 12, 2016.

RECYCLING AND WASTE REDUCTION

Recycling and Waste Reduction encompasses a wide range of industries defined by a set of activities that involve collecting and sorting recycled materials, reusing or remanufacturing recycled materials, and/or manufacturing new products with recycled materials.

Businesses involved in recycling and the management of waste reduction often specialize in different areas. Some firms may focus on one particular process, such as cleaning, collecting, sorting, or preparing products for manufacturing or reuse. Others may manage the complete lifecycle of a product. Firms that oversee product lifecycles may collect and sort recycled materials, combine the recycled materials with other materials, and manufacture new products. They may also sell materials not needed for manufacturing to a broker.

In addition, many corporations and businesses are adopting sustainable practices to reduce production waste, create eco-friendly products, and embrace product stewardship that benefit consumers, businesses, and the planet's ecosystems. Some of the most common trends in recycling and waste reduction include:

- **Zero waste:** A philosophy that supports the elimination of all waste by recycling or reusing 100 percent of materials used in the production process. Zero waste not only has a positive impact on the environment, but it also contributes to the economy when it's used as a resource to support employment and business opportunities. Zero waste goals pose a wide range of implementation challenges to organizations and businesses. Composite materials and plastics found in commercial products and consumer packaging can make recycling difficult to separate and also jam sorting equipment. In the meantime, industry associations and recycling groups are trying to address these problems and find solutions to promote zero waste goals as a viable operating method for reducing operating costs and minimizing impacts on the environment.[31]
- **Circular economy:** The principles of the circular economy redefine recycling in terms of materials management, which involves the design of products and packaging, maximizing recycling and reuse objectives. Materials management includes the design, manufacture, and use of recycled and compostable packaging and materials, as opposed to wasteful one-time-use packaging. For example, Mushroom's Materials produce wine shipping materials made from agricultural waste and mushrooms. Their custom-designed and molded material is fully compostable and cost competitive with plastic foams.[32]
- **Product stewardship:** One of the major trends of product stewardship is better dissemination of information about disposal of hazardous waste, especially battery and e-waste recovery and recycling. This includes providing greater clarity about where to dispose waste and entry points into the waste management system. Through public campaigns, service announcements provide compelling information on the need to recycle and dispose of hazardous waste in a way that minimizes impacts to the environment.

Exhibit 19 displays establishment and employment data for Recycling and Waste Reduction industries as classified by SIC codes at the eight-digit level. Over the last five years, this subsector declined by 2 percent, losing about 80 jobs. Most of the job decline can be attributed to a decrease in recycling centers and waste reduction establishments (Exhibit 20).

[31] *Three Headaches for the Recycling Industry.* The New York Times. March 25, 2016. http://www.nytimes.com/2016/03/29/science/three-headaches-for-the-recycling-industry.html?_r=0

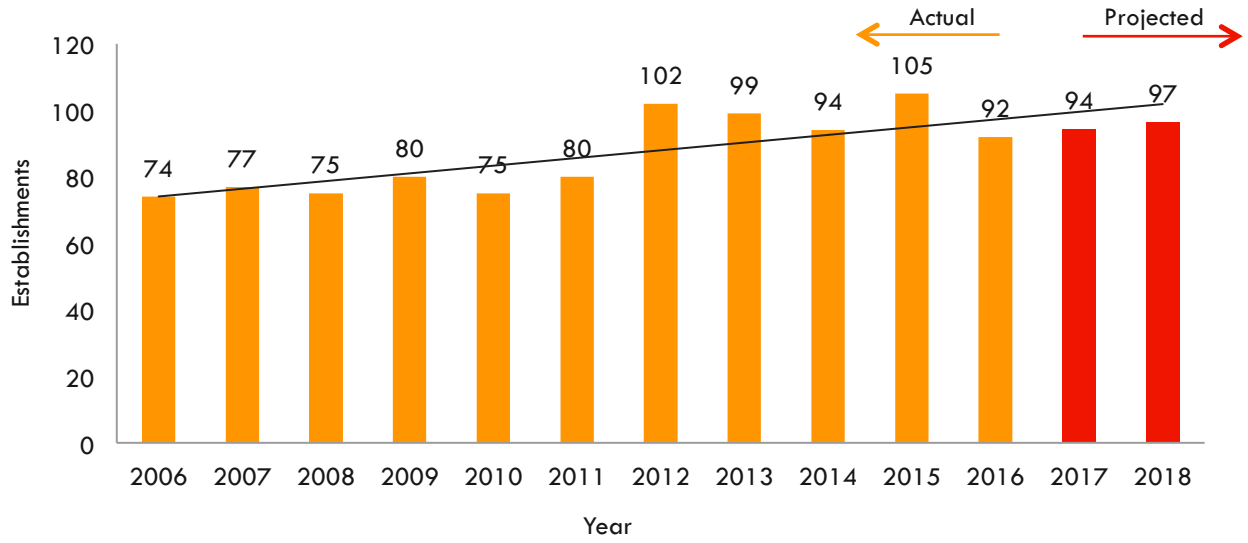
[32] http://www.ecovativedesign.com/

RECYCLING AND WASTE REDUCTION

Exhibit 19: Recycling and Waste Reduction, Employment and Establishments, Sacramento Capital Region[33]

	2011 Jobs	2016 Jobs	2011–2016 Job Change	Percent Change	2016 Establishments
Automobile Dismantling/Recycling (Whls)	16	21	5	31%	2
Recycling Centers (Whls)	926	867	-59	-6%	77
CalRecycling (State Government)	2,000	2,000	0	0%	1
Recycling Equipment & Systems	65	73	8	12%	6
Scrap Metals-Processing/Recycling (Whls)	35	35	0	0%	1
Waste Rdctn Dspsl/Recycle Svc-Ind (Whls)	81	6	-75	-93%	2
Waste Reduction & Disposal Equip-Ind	79	120	41	52%	3
Total	**3,202**	**3,122**	**-80**	**-2%**	**92**

Exhibit 20: Recycling and Waste Reduction, Establishments, Sacramento Capital Region[33]



[33] ReferenceUSA: Business Database, 2016.

RECYCLING AND WASTE REDUCTION

Exhibit 21: Recycling and Waste Reduction Occupations[34]

ONET Code	Title	Description
19-2041.03	Industrial Ecologists	Apply principles and processes of natural ecosystems to develop models for efficient industrial systems. Use knowledge from the physical and social sciences to maximize effective use of natural resources in the production and use of goods and services. Examine societal issues and their relationship with both technical systems and the environment.
51-9199.01	Recycling and Reclamation Workers	Prepare and sort materials or products for recycling. Identify and remove hazardous substances. Dismantle components of products such as appliances.
53-1021.01	Recycling Coordinators	Supervise curbside and drop-off recycling programs for municipal governments or private firms.

In the Sacramento Capital region, there is one training program that supports the Recycling and Waste Reduction subsector (Exhibit 22).

Exhibit 22: Recycling & Waste Reduction Education Programs, Sacramento Capital Region

College/University	Name of Program	Award(s)
CSU Sacramento	Issues in Natural Resource Management	Certificate

Business Spotlight: PackageOne

PackageOne manufactures corrugated packaging material that is produced from recyclable paper and renewable materials. Made from natural, plant-based materials, every product produced is recyclable. Their boxes and packaging are designed for and sold to the industrial wholesale market for displays, food service, agriculture, and shipping. The company also operates a bio-digester.

PackageOne expects to add as many as 70 new positions over the next few years to assist with collection, equipment operation, as well as research and development. Sought after skills include knowledge of electronic maintenance, knowledge of organic chemistry, and a solid understanding of good manufacturing practices.[35]

[34] Occupation Information Network (O*NET): www.onetonline.org. Accessed March 3, 2016.

[35] Interview with Package One, Tom Kandris, CEO. www.package1.com. April 13, 2016.

SUMMARY

The Bureau of Labor Statistic's current coding system does not provide sufficient detail to analyze industry trends in the Clean Economy cluster. As such, the data contained in this study is based on a private database of organizations. Because of inadequacies with the private database, the total number of establishments and jobs is likely undercounted.

Even with these inadequacies, this study paints a compelling picture of growth and opportunity in the Clean Economy cluster. Between 2011 and early 2016, the Clean Economy grew by 35 percent, adding more than 250 new organizations in the Sacramento Capital region. Job growth also has been aggressive with the addition of 1,700 new jobs over the last five years.

Within the cluster, employment in the Energy and Resource Efficiency, Renewable Energy, and Advanced Transportation subsectors has grown substantially, while Environmental Compliance and Recycling/Waste Reduction have experienced flat growth. There are several environmental, regulatory, and market trends that have impacted the stability and growth of each subsector in this cluster. These trends include:

- **Energy and Resource Efficiency** – Local businesses have made substantial investments to retrofit and build structures that meet stringent energy efficiency standards established by the U.S. Green Building Council. In the Sacramento Capital region, there are more than 560 Leadership in Energy and Environmental Design (LEED) certified buildings.
- **Renewable Energy** – The federal Investment Tax Credit (ITC) and improved solar panel efficiency is driving growth in residential and commercial solar markets. Incentives and greater efficiency gains improve the return on investment and give businesses and homeowners sufficient justification to invest.
- **Sustainable Agriculture** – Transitioning from conventional farming to sustainable farming practices is a slow and evolving process that requires education and policy support. To help with the transition and assist with the adoption, industry associations offer resources and education tools to answer questions and streamline processes.
- **Advanced Transportation** – In 2012, Governor Jerry Brown issued an executive order to put 1.5 million zero-emission vehicles (ZEV) on California's roadways by 2025. To accomplish this goal, the Sacramento Capital region will need to install thousands of public charging stations.
- **Environmental Compliance** – The Sacramento Capital region is home to a number of government agencies that monitor and regulate environmental mandates and polices. In addition to government mandates, many organizations are voluntarily adopting business practices that reduce their carbon footprint.
- **Recycling/Waste Reduction** – Zero waste is the goal to recycle or reuse 100 percent of all operating and production materials. Businesses that adopt this philosophy often experience both economic benefits as well as minimize their impact on the environment. New legislation is requiring the reduction of food waste into landfills which will further drive changes in recycling and waste reduction practices.

The overall intent of this research was to track the progress of the Clean Economy in the Sacramento Capital region and serve as a foundation for future research. In the next research phase, the goal is to develop a more robust estimate of establishments and employment. Valley Vision will also convene Clean Economy employers to identify next steps for identifying and validating the demand for high priority occupations and skills gaps that can be addressed through a concerted cluster workforce action plan.

MORE ABOUT...

More About The Centers of Excellence

The Centers of Excellence (COE) for Labor Market Research deliver regional workforce research and technical expertise to California community colleges for program decision making and resource development. This information has proven valuable to colleges in beginning, revising, or updating economic development and Career Technical Education (CTE) programs, strengthening grant applications, assisting in the accreditation process, and in supporting strategic planning efforts.

The Centers of Excellence Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The Centers aspire to be the leading source of regional workforce information and insight for California community colleges. More information about the Centers of Excellence is available at **www.coeccc.net**.

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More About Valley Vision

Since 1994, Valley Vision's work has driven transformative change and improved lives across Northern California. An independent social impact and civic leadership organization headquartered in Sacramento, Valley Vision strengthens our communities through unbiased research, boundary-crossing collaboration and change leadership. Our work improves overall quality of life and creates the conditions for economic prosperity and community health and vitality.

More About Burris Service Group

The Burris Service Group (BSG) is a full-service consulting practice providing expertise in economic development, strategic economic research, real estate site strategy, management, and institutional growth. The company was established based on the clear need that advisory services be delivered in an "action-oriented" form. The founder of BSG, Robert Burris, brings to his clients an active local and international network of professionals, as well as 20 years of experience in economic development, market and economic analysis, commercial real estate information, corporate sales, and consulting.

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