Aligning ATRE Regions with the Workforce Training Needs of Rapidly Changing Automotive and Diesel Transportation and Renewable Energy Sectors

Prepared for

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By

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PREFACE

Economic and Workforce Development (EWD) is an integral part of the California Community Colleges and its Doing What Matters for Jobs and the Economy framework, investing funding and resources in industry sectors that are key to California's economic growth. EWD's industry-specific workforce services, such as ATRE (Advanced Transportation and Renewable Energy) are coordinated through a system of sector specialists that align community college and other workforce development resources with the needs of industry sectors and occupational clusters through a regional focus. The goal is to invest in the skills of California's workforce – now and in the future – through partnerships with business and industry that result in highly specialized industry training, technical consulting and business development. The end result is to meet industry's need for skilled workers.

The views and opinions expressed by the authors are those of the authors and do not necessarily reflect those of the ATRE, California Community Colleges Chancellor's Office, or any California Community College or other agency, individual, or company listed in this report.

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ATRE Website: www.atreeducation.org

4Energy Website: www.4NRG.org

Doing What Matters: http://doingwhatmatters.cccco.edu/

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ATRE'S INDUSTRY BASED REGIONAL WORKFORCE TRAINING STRATEGY

Industry wants labor and workers trained to the job requirements and openings of a particular industry sector in particular geographic areas. Because career technical education is expensive, ATRE seeks to meet this goal by selectively investing college resources. When resources are focused on actual needs, the pay-off is both business growth and good paying jobs, both of which benefit local economies.

Regional ATRE sector data presented here aligns with this strategy, offering high-fidelity information for planning and strategizing. A well ground regional workforce training strategy can be developed by supplementing this data with Employment Development Department regional labor market statistics informed by company advice, specialized company surveys, direct meetings with business owners and managers, and formation of sector advisory groups. This highly focused and accountable strategy enables a Regional Sector Navigator (DSN) to bring industry and faculty together around common data driven goals that shape curriculum and properly equip facilities. The result will be to award students with just-in-time training or certificates of achievement that are immediately relevant to technical jobs.

Because technology is a moving target, any strategy must be constantly freshened by comparing current priorities with bench mark data developed at the start of the fiscal year that indicates how industry requirements are evolving. Strategies must be evaluated and adjusted based on company satisfaction with student preparation and resulting increases in productivity. And, of course, strategies must align with student job satisfaction. The Chancellor's Launch Board provides information on college training, number of certificates issued, and other key variables, by college and by region. By carefully aligning statistical and industry-based data with Launch Board data, and including measures of business and student satisfaction, any ambiguity regarding the match between certification and employer needs is reduced and kept coordinated across time.

Time Structures, Inc. (TSI) has produced a number of tools and guidance documents at the request of Peter Davis, ATRE Sector Navigator. These materials are designed to help DSNs evaluate labor market and industry information and develop an overview of how business and workforce industry needs are changing at the community level in each region. These works highlight new technologies and applications and show significant industry and sector changes relevant to a forward looking approach to curriculum and faculty development and training. These analyses can alert DSN's to inquire about industry trends such as, for example, dropping wages when payrolls are up, or causes behind the slowing of biofuels development in regions where it should be growing.

Aligning ATRE Regions with the Workforce Training Needs of Rapidly Changing Automotive and Diesel Transportation and Renewable Energy Sectors is the eighth and final guidance document prepared by TSI to assist DSN's with regional strategy development as they steer the development of services in their

Initiatives. The other seven guidance documents in the series are*:*

- *Advanced Transportation & Renewable Energy Steps Forward! (2013):* This document is oriented to the newly appointed DSNs. It points out key regional and college trends and likely growth drivers in the ATRE arena; it provides methods for helping local colleges identify district businesses by sector size, employment and location; it projects ATRE sector growth by region; and it provides a guided tour of the LMID web site, Cleantech *i3* data, and other industry maps and web based resources relevant to the ATRE sphere of influence. (This data refines and updates Centers for Excellence ATRE regional studies.)[1]
- *Regional and County Statistic Baseline Data on Automotive, Diesel Related Transport, and Clean Energy Employer Sectors (see Attachment 1 for a list and definitions):* This documents provides the most recent statistical picture of ATRE businesses and employment at the county level.
- *Using ZIP Code GIS to Conduct a Cleantech Sector Clusters Analysis to Identify Training Needs (2014)*: The Cleantech *i3* data base (hereafter referred to as *i3*) provides detailed corporate information including their ZIP codes. This tools shows how to use this information to identify an industry cluster around a particular sector that is closer to or in a college's district.
- *How To Use TSI's Regional Analysis Of Automotive Repair Techs And Mechanics, And Number Of Businesses To Find Individual Businesses (2014):* this practical documents uses computer screen shots to guide DSN's through the LMID web site to find ATRE businesses, phone numbers, management names, location maps, and other key outreach information.
- *Using Cleantech Data to Develop an ATRE Regional Renewable Energy Strategy (2013):* Develops clean technology data analysis and strategy skills for DSN's so proprietary corporate data can be used to immediately understand new sector developments and find out how to identify and contact corporate executives to develop an appropriate workforce training curriculum.
- *ATRE'S Future: Velocity, Velocity, Velocity (2014):* This document provides a forward-looking five to ten year vision of developing technologies such as the industrial internet, attendant skill requirements, and new training modalities that fit well with adaptive training strategies, both regional and statewide.
- *Clean Technology Sector Company Date for Ten California Community College DWM Regions (2014):* Here we provide summaries of the Cleantech *i3*. Developed by TSI and presented in quickly understandable formats, this information educates the reader on rapidly growing clean technology companies relevant to the ten California Community Colleges *Doing What Matters Regions.*

EMERGING RENEWABLE ENERGY (CLEAN TECHNOLOGY) AND INTERNET BASED TECHNOLOGIES ARE REDEFINING ATRE

What is being called the "industrial internet" is changing the energy efficiency of homes, vehicles, and logistic systems even as new fuels, engines, and methods for generating and distributing power are becoming ubiquitous (this section is drawn from ATRE'S Future: Velocity, Velocity, Velocity, Koehler, 2014). Regional 2012-2013 data on trucking, automotive, and renewable energy (clean technologies) must be interpreted within this realistic context. Of particular importance is the shortening product design cycle to about two to three years; and the quickening need for new assembly and maintenance

[1] COE has done a number of individual ATRE regional and specialized sector studies: 13 in 2009; 2 in 2010; and 1 in 2011 as shown on. http://www.coeccc.net/ . The above studies provide additional ATRE related references and special studies of California industries.

skills when put in the context of the one to two years that it takes to train faculty, points to the difficulties involved in developing and teaching up-to-date curricula.

Transport and energy generating machines and renewable energy systems are being integrated into the broader regional context of smart city systems. A smart city depends on computerized information collection, analysis and coordination by a network of wireless sensors: to reduce energy consumption, to coordinate health and public safety services, to manage logistics, and to transport people. Information for coordinating and integrating smart cities is developed by: tracking vehicles, vehicle safety systems, vehicle engine performance, trailer tracking, individual container tracking, fleet management, rail management, satellite or cell tower tracking, intelligent cars, aerospace coordination, climate controls for buildings, emergency dispatch and telemedicine, and personal sensors. All of these man-machine-sensor-computing-internet relationships require workers who are trained to assemble, maintain, and service them by interpreting automatically generated data and properly coordinating and integrating components into elements of the broader systems of which they are a part.

For example, automated home energy systems already manage energy from diverse sources like solar panels, geothermal heating/cooling, electric auto charging, and wind. Energy systems feed into or draw from local microgrids and regional grids. California is a leader in developing these grids. On the horizon are plug-in home or municipal car chargers, home energy storage systems including car batteries, and whole buildings regulated by autonomous energy management technologies.

Renewable energy sources -- biofuels, solar, wind, biogas, hydro, and other generation facilities -- are located throughout ATRE Regions:

- 116 wind projects are located in 9 counties in the San Francisco Bay, Inland Empire, and San Diego/Imperial Regions.
- 93 large solar projects are located in 18 counties in the San Diego/Imperial, Inland Empire, and the San Francisco Bay Regions.
- 16 solar thermal projects are located in 3 counties, two of which are in the Inland Empire Region.
- 41 geothermal projects are located in 6 counties, two of which are located in the San Diego/Imperial Region.
- 54 biogas projects are located in 19 counties covered by the San Diego/Imperial, Los Angeles/Orange, San Francisco Bay, and Inland Empire/Desert Regions.
- 44 biomass projects are located in 24 counties cutting across the San Diego/Imperial; Los Angeles/Orange, San Francisco Bay, and Inland Empire/Desert Regions.

Auto and truck product cycles are shortening from 8 to 3 to 4 years. New car introductions are being made year around, no longer in a “new car season.” Rather than updating a car model, a whole new design completely replaces it, even if the old model is selling well. For example, alternative fuel vehicles are introduced as new conventional car models come out. Running changes to interior technologies are made every year. Autonomous Vehicle Systems that replace the need for a human driver are being rapidly introduced. For example, vehicle control is gradually being extended from sole driver control to computer mediated control based on interactions with other cars and the roadway; and truck logistics will depend on similar computer mediated truck steering, autonomous reporting and coordination systems.

It is clear that ATRE training now needs to address this technological integration, requiring new tools, new multi-skilled working groups, and new diagnostic techniques, even as the changing mix of connections continues to unfold.

Trucks and trucking logistic systems are changing rapidly. Multiple improvements to truck engines include new fuels sources and telematics, which will reduce diesel and other fuel consumption. Telematics for mobile connectivity are and will continue to improve logistics and fleet management. Insurance telematics will monitor both vehicle and driver. Mandated engine efficiencies, improved auxiliary systems, and power trains will further reduce fuel costs. ATRE training is continuously shaped by all of these factors as they emerge piecemeal from the trucking industry.

The transportation sector is expected to account for the biggest reduction in California energy costs and emissions. Autos are the primary target, followed by trucks and other transportation sectors, and improvements in airplane emissions and efficiency are fourth. Again, ATRE services contribute directly to these reductions and must be up to date.

U.S. freight railroad demand will increase 88% by 2035 requiring smart rail networks. Rail emission reductions will have to match truck reductions to meet 2050 emission goals. Improved logistics using telematics will require installation of new information technology and sensor systems in cars and on roadbeds. Automated Equipment Identification, RFID tags, trackside sensors to detect "hot boxes," improper wheel impact detection, etc., will track the conditions of cars to improve logistics and safety. Predictive maintenance based on data analysis can reduce accidents and improve performance. Evans and Annunziata (2012) say that "Rail operation costs represent 75% of total train transport costs, or $184 billion per year [and] 2.5% of rail operation costs are the result of system inefficiencies. This amounts to $5.6 billion per year in potential savings" (Evans and Annunziata, (2012*). Industrial Internet: Pushing the Boundaries of Minds and Machines*. General Electric). ATRE will be in the forefront of this dramatic technological revolution as railroads retrain their workforce and bring new workers on board.

Intelligent aircraft systems act like virtual proactive maintenance teams, determining the status of the aircraft and its subsystems in real time. Actionable information predicts failures before they occur, provides immediate guidance for repairs, and an accurate "whole plan" view of aircraft health. These systems provide significant safety, economic, and environmental benefits. In the past, flight inefficiencies boosted costs by an average of 8-22% over an 8-year period in the US. Reduction of fuel costs can reach 5% simply from better flight planning and operational changes associated with the industrial internet, which could save the industry $8.0 billion per year. Commercial jet engine maintenance costs can be reduced by $250 million for every one percent improvement in engine maintenance efficiency due to the industrial internet. There is no question that ATRE-trained service technicians are key to seeing these changes gain traction.

ATRE, like business generally, will face a high degree of uncertainty in its efforts to match workforce training and new certificates of competency to the identified emerging industry developments. Unpredictable market adoptions to the industrial internet should drive the content of a responsive ATRE regional training program. Clearly, rapid innovation produces a large number of new products. The rate of regional growth depends on the market's ability to sift potential products and identify truly valuable ones, a process not in the control of ATRE. Uncertainty necessarily creates a challenge for ATRE workforce training because regional sector technologies are developing and coming to market at different rates in different transportation and clean energy sectors, creating complex mixes of old and

new transportation, clean technology, building and other products. Personal relationships with successful business owners are the only way to track changes and respond in time. In the past ATRE has responded to new markets when they are big enough to sustain job placement and/or a significant number of incumbent upgrades. But now anticipation of such developments -- and a timely response -- will be key to sustaining an effective ATRE program.

The industrial internet also brings special challenges related to the changing boundary between human competency and machine capabilities for manufacturing and services jobs. ATRE training needs to:

- Combine STEM and on the job specialized machine-computer operator training by knowledgeable trainers;
- Teach mastery of creative thinking skills, large-frame pattern recognition, and complex communications to diagnose problems at any point in the computer/machine/operator-supply chain-wholesaler-customer network;
- Teach the skills to evaluate and repair sensors and data processors as well as various kinds of energy generators, alternatively fueled engines, and home and industry renewable energy and/or conservation systems;
- Teach the ability to work in a group with diverse technical skills, using social technology to communicate with owners, suppliers, and users that takes advantage of self-organizing work group problem solving and distributed learning environments;
- Teach the ability to apply problem solutions delivered via the internet to related but different immediate problems;
- Introduce tolerance for continuous monitoring of personal performance by the employer, insurance companies, and selected regulators; and
- Encourage taking advantage of ATRE workforce training to retool and move from job to job to meet new product and service just-in-time requirements.

INDUSTRY DEVELOPMENTS PROVIDE A CONTEXT FOR INTERPRETING ATRE REGIONAL DATA

The following tables report 2012-2013 or 2014 business and workforce changes in ATRE Region 1: San Diego/Imperial; Region 2: Inland Empire/Desert; Region 3: Los Angeles/Orange; and Region 4: San Francisco Bay Area. The automotive and transportation related data is drawn from 2012-13 LMID ES 202 data and US Census County Business Patterns data for 2011. 2014 data on clean technology firms is taken from Cleantech *i3*, a proprietary data base reporting on multiple clean energy sectors.

These data are drawn from three sources: The 2012-13 LMID ES 202 report, the US Census County Business Pattern report for 2011, and data on 2014 from Cleantech *i3*. The Cleantech *i3* material comes from a proprietary data base reporting on multiple clean energy sectors. Unlike LMID or COE data, which attempts to count all automotive, trucking or green technology companies in California, Cleantech *i3* data is generated from a purposive sample of clean technology start-ups, small, medium and large companies who are currently innovating new clean technologies and who are seeking, are or have received, new funding to perfect their ideas and grow. The Cleantech *i3* database is constantly being updated which enhances its validity and relevance to the development of college training. Moreover,

this database is used by investors and companies seeking prominence in clean technology industries. Since these are the companies that are most likely to drive the clean technology sector in each ATRE region, their development and job creation is of special interest to ATRE. In short, knowledge of this data provides high-pay-off for regions interested in a forward looking job training strategy.

Nevertheless, caution should be used when interpreting the numbers. First, these data have been generated to track selected, rapidly growing companies -- not all companies, employment, or investments. Discrimination was used in identifying companies of interest. Second, self-reporting means not all companies reported data in all categories, a problem that leads to differing table totals, such as the number of employees or total investments. These differences can be significant, suggesting that the information may be most useful for discerning broad patterns and changes applicable to fast growing companies, even though specific companies are clearly significant as indicators of the overall economic health of the sector. Also, please note that the dates reported refer to when the data was downloaded by Time Structures, Inc. (See Attachment 1 for Sector Definitions.)

Originally, TSI industry studies were to meant to compare ATRE related automotive and transport sectors in 2012 with 2013. Cleantech sectors were to be compared at the beginning of the 2013-14 fiscal year with the end of the year. Both studies were to identify key business and employment developments. Unavoidable delays meant that only a few months of renewable energy Cleantech *i3* data for early 2014 were available to analyze when this study was prepared. Even so, interesting and relevant changes were identified. Trucking (general freight, bus, school, transit using diesel for the most part) and automotive repair and maintenance business NAICS codes used for this study are listed in Attachment 2.

San Diego/Imperial Region

Trucking: Activity in this sector appears to have dipped from 2012 to 2013 because 2nd quarter 2013 data shows 785 trucking and related establishments, 28 less than in the 4th quarter of 2012. Furthermore, average monthly employment was 9,669 (312 fewer than 2012) with a total quarterly payroll of $87.6 million, $9.7 million less than 2012.

Automotive: However, in 2011 the region had 5,536 non-employer (defined as sole proprietorship) trucking businesses. Adding employer and non-employer totals together, TSI estimates there were at least 6,321 trucking and related establishments in the second quarter of 2013.

Comment: The decrease in average weekly pay and in yearly payroll is a serious development for the region. California's slow economic recovery in hiring and pay, particularly for low and middle-income workers (California Budget Project, 2014) is the environment in which new transportation technologies are taking hold. The rapid market adoption of new automotive, truck, and logistic technologies and fuels may already be affecting business growth, employee hiring and wages and will continue to do so much more drastically in the future. The drop in automotive repair and trucking wages that was caused by wage stagnation can only be made worse with technician training that is out-of-step with the adoption of new, market driven, technologies. To help mitigate these developments, ATRE should closely track the introduction of new automotive and trucking developments so that workforce training can match needs. It may also be possible to identify non-employer businesses who can assist with adopting new technology.

Renewable Energy (Clean Technology): Comparing two snapshots of Cleantech *i3* data, one on 1-14-14 and one on 4-29-14, for the San Diego/Imperial Region for all 18 cleantech sectors we see that:

- The number of companies grew by 32 from 104 to 136;
- Employment grew by 1,387 from 10,636 to 12,023 in 2013; and
- Total firm investment since a reporting firm's founding increased by $166.6 million to $1.946 billion in 2013.

(Remember these companies were hand-picked by Cleantech for analysis.) TSI has analyzed Cleantech *i3* data for companies most likely to drive the sector by dividing them into two groups: companies in the first group are defined by stage of development; companies in the second are defined by which of the 18 cleantech sectors they belong to. The status of each group in 1-14-14 was compared with itself in 4-29-14, showing variations in stage of development or distribution of various factors such as the number of companies, employment or investment by cleantech sector.

The first category of firms was formed by stage of company development defined as: 1. products are widely available to the community; 2. scaling up or piloting the manufacturing process or services; 3. have a prototype and are in the product development stage; and 4. concept development and proto development of product or service. Each of these stages has different job and workforce training requirements. As funding increases the company passes from stage 4 to stage 1 as it gears up to disrupt a market with new products or services, leading again to increased hiring and a need for a different mix of skills including those necessary for product maintenance and services.

Here's what the numbers look like for each stage of development in the San Diego/Imperial Region:

- The number of companies in the wide commercial availability stage increased by 11 to 64 employing 10,630 (up 1,333);
- Those piloting the manufacturing process or developing services increased by 6 to a total of 32 companies, employing 383 (up 25).
- Those in the product development stage increased by 9 to 32 companies employing 975 (up 24);
- Those in the concept development stage increased by 6 to 10 companies, employing 35 (up 5).

Total investment is defined as all of the funding that a company has received since its founding (and again remember that this is self-reported data). Funding by stage of development in the study's reporting period shows that:

- Firms in the shipping product/pilot project stage saw the greatest increase, $76.5 million (31.1%);
- Followed by firms in the wide commercial availability stage, with additional investments of $72.8 million (9.5%).

The second category of companies is by cleantech sector. In 2008, a UC Berkeley study reported that San Diego was a cleantech innovation leader and that its green transportation and recycling/remediation sectors were growing particularly fast (Center for Community Innovation, 2008). The Cleantech *i3* summary of regional data by 18 sectors shows that:

- San Diego biofuels, transportation, and solar are the top investment areas in that order.
- Employment is reported as being highest in solar, followed by agriculture and forestry, and then transportation with transportation and "other cleantech" showing the largest absolute number of new employees.
- The highest total company investments were in biofuels and biochemicals, followed by transportation, and solar.
- Sectors receiving the highest reported increase in investments during the study period were transportation, biofuels and biochemical, and "other cleantech."

Comment: The number of mature companies with widely available products, and the level of funding they are receiving suggests that they will continue to add employees beyond the 10,630 currently employed. The rapid growth in funding for companies with products in the market or entering the market supports this view. The velocity of these developments suggest that the DSN should consider using the Cleantech *i3* data regularly to identify and reach out to companies in these two segments to negotiate the rapid development of training curriculum and instructor contracts.

ATRE should continue to closely follow the transportation, solar, and biofuels and biochemical segments which seem most likely to continue increasing employment. Our industry analysis shows that the San Diego/Imperial Region will continue to be an important center of innovation, manufacturing and services, driving the development and adoption of these new technologies.

Trucking and Diesel Related Sector Data

Region 1, San Diego/Imperial:
Change in the Number of Trucking, Public Transportation, and Related Establishments Employment & Wages from 2012 4th Q to 2013 2nd Q

Sector	Change in # Establishments	Change in Monthly Employment	Change in Reported Quarterly Payroll (x1,000)
Truck Transportation (484)	24	-18	($532)
Transit and Ground Passenger Transportation (485)	5	-275	($8,869)
Scenic and Sightseeing Transportation (487)	-1	-19	($276)
Total	28	-312	($9,677)

Sources: Time Structures, Inc., calculations using LMID ES202 data for 2012 & 13, and US Census County Business Patterns for 2011.

Region 1, San Diego/Imperial:
Estimated Number of Trucking and Related Establishments, Nonemployers, Employees and Wages (2nd Q 2013)

	Major Industry Title (NAICS)	Number of Establishments (ES202)	Average Monthly Employment	Total Quarterly Payroll ($1,000)	Average Weekly Pay
San Diego	Truck transportation (484)	500	4,996	51,165	$788
	Transit and ground passenger transportation (485)	151	3,234	25,007	$595
	Scenic and sightseeing transportation (487)	48	646	4,282	$510
Imperial	Truck transportation (484)	77	695	6,291	$696
	Transit and ground passenger transportation (485)	9	98	856	$667
Total 2013 (ES202)		785	9,669	87,601	
Nonemployers 2011 (US Census County Bus. Pat.)	For the same NAICS Classifications Above	5,536			
Estimated Total Firms and Nonemployers 2nd Q 2013		6,321			

Automotive Repair and Maintenance Sector Data

Region 1, San Diego/Imperial: Estimated Number of Automotive Repair and Maintenance Establishments, Employees and Wages (2nd Q 2013)				
County	Number of Establishments	Average Monthly Employment	Total Annual Payroll (x1,000)	Average Weekly Pay
San Diego	1,453	9,546	$82,515	$665
Imperial	48	209	$1,458	$537
Totals	1,501	9,755	$83,973	

Region 1, San Diego/Imperial: Change in the Number of Automotive Repair and Maintenance Establishments Employment & Wages from 2012 4th Q to 2013 2nd Q						
County	Change in Establishments	Change in Monthly Employment	Percent Change in Montly Employment	Change in Reported Quarterly Payroll (x1,000)	Average Weekly Pay	% Change in Average Weekly Pay
San Diego	23	151	2%	($1,037)	-19	0
Imperial	0	6	3%	$10	-11	0
Region Total	23	157		($1,027)		

Source: Time Structures, Inc. calculations using LMID ES202 data for 2012 & 2013.

Clean Technology Sectors Data

Again, Cleantech *i3* data is a purposive sample of rapidly growing companies and is not a count of all companies. Companies may not report data in certain categories leading to differing table totals. Dates refer to when the data was downloaded by Time Structures, Inc. See Attachment 1 for Sector Definitions.

Region 1, San Diego/Imperial Counties: Number of Companies, Total Company Investment, and Total Employees Compared by Stage of Development 1-14-14 to 4-29-14 using CleanTech i3 Data

Cleantech Companies, Company Investment and Total Employees 1-14-2014				**Cleantech Companies, Company Investment and Total Employees 4-29-2014**				**Growth or Loss in Companies, Total Company Investment or Total Employees Between 1-14-2014 and 4-29-14**			
Stage of Development	Number of Companies	Total Investment	Total Employees	**Stage of Development**	Number of Companies	Total Investment	Total Employees	**Stage of Development**	Number of Companies	Total Investment	Total Employees
Wide Commercial Availability	53	$762,332,052	9,297	Wide Commercial Availability	64	$835,060,867	10,630	Wide Commercial Availability	11	$72,728,815	1,333
Shipping Product/Pilot	24	$245,798,220	358	Shipping Product/Pilot	30	$322,285,922	383	Shipping Product/Pilot	6	$76,487,702	25
Product Development	23	$771,218,260	951	Product Development	32	$779,581,118	975	Product Development	9	$8,362,858	24
Concept	4	$25,000	30	Concept	10	$9,025,000	35	Concept	6	$9,000,000	5
Total	104	$1,779,373,532	10,636	Total	136	$1,945,952,907	12,023	Total	32	$166,579,375	1,387

Region 1: San Diego & Imperial (1-14-14), Number of Cleantech Companies, Employees & Investments by Sector			
Sector	Companies	Employees Reported	Total Investment (Mill)
Advanced Materials	11	180	$66.7
Agriculture and Forestry	8	1,073	$62.2
Air	4	65	$58.0
Biofuels & Biochemical	22	618	$576.6
Biomass	0	0	$0.0
Conventional Fuels	1		$4.9
Energy Efficiency	22	87	$41.8
Energy Storage	8	440	$80.5
Fuel Cells & Hydrogen	0	0	$0.0
Geothermal	0	0	$0.0
Hydro & Marine	3	0	$0.0
Other Cleantech	13	14	$0.6
Recycling & Waste	9	64	$91.3
Smart Grid	5	168	$65.7
Solar	22	7,933	$232.3
Transportation	17	743	$491.9
Water & Wastewater	12	50	$52.6
Wind	8	6	$12.5
Total	165	11,441	$1,837.5

Region 1: San Diego & Imperial (5-6-14), Number of Cleantech Companies, Employees & Investments by Sector			
Sector	Companies	Employees Reported	Total Investment (Mill)
Advanced Materials	10	180	$66.7
Agriculture and Forestry	9	1,073	$62.2
Air	5	65	$58.0
Biofuels & Biochemical	19	588	$622.9
Biomass	1	30	$1.6
Conventional Fuels	1	0	$7.6
Energy Efficiency	24	97	$52.6
Energy Storage	8	440	$80.5
Fuel Cells & Hydrogen	0	0	$0.0
Geothermal	1	25	$0.0
Hydro & Marine	3	0	$0.0
Other Cleantech	18	198	$36.2
Recycling & Waste	9	64	$91.3
Smart Grid	5	168	$73.4
Solar	22	7,933	$263.8
Transportation	18	1,031	$596.0
Water & Wastewater	16	50	$52.6
Wind	10	6	$12.5
Total	179	11,948	$2,077.9

Region 1: San Diego & Imperial (1-14-14 to 5-6-14), Changes in the Number of Cleantech Companies, Employees & Investments by Sector			
Sector	Companies	Employees Reported	Total Investment (Mill)
Advanced Materials	-1	0	$0.0
Agriculture and Forestry	1	0	$0.0
Air	1	0	$0.0
Biofuels & Biochemical	-3	-30	$46.3
Biomass	1	30	$1.6
Conventional Fuels	0	0	$2.7
Energy Efficiency	2	10	$10.8
Energy Storage	0	0	$0.0
Fuel Cells & Hydrogen	0	0	$0.0
Geothermal	1	25	$0.0
Hydro & Marine	0	0	$0.0
Other Cleantech	5	184	$35.6
Recycling & Waste	0	0	$0.0
Smart Grid	0	0	$7.7
Solar	0	0	$31.5
Transportation	1	288	$104.1
Water & Wastewater	4	0	$0.0
Wind	2	0	$0.0
Total	14	507	$240.4

Inland Empire/Desert Region

Trucking: Activity in this sector appears to have increased from 2012 to 2013 because 2nd quarter 2013 data shows 1,259 trucking and related establishments, 51 more than in the 4th quarter of 2012. Furthermore, average monthly employment was 26,464 (312 fewer than 2012) with a total quarterly payroll of $87.6 million, $9.7 million less than 2012. In 2011 the region had 13,499 nonemployer businesses (sole proprietorships) for an estimated total of at least 14,758 trucking and related establishments in 2013.

Automotive: The number of automotive repair and maintenance establishments increased by 54 to 1,703 in 2013, employing 11,034, up 612 over 2012. The 2013 quarterly payroll increased by $3.1 million dollars, with average weekly pay dropping by about $11 to $14.

Comment: The automotive repair and trucking sectors businesses are growing in the Inland Empire/Desert region. The slow economic recovery in pay, particularly for lower and middle income workers, may be one of the reasons that pay dropped.[2] It might also be due to the number of new hires, which would force down the average. The rapid market adoption of new automotive, truck, and logistic technologies and fuels may already be affecting business growth, employee hiring and wages, and will continue to do so much more drastically in the future. The drop in automotive repair and trucking wages that was caused by wage stagnation can only be made worse with technician training that is out-of-step with the adoption of new, market driven, technologies. To help mitigate these developments, ATRE should closely track the introduction of new automotive and trucking developments so that workforce training can match needs.

Renewable Energy (Clean Technology): Comparing self-reported Cleantech *i3* data at two times separated by four months (at 1-14-2014 and again at 4-29-14) for the Inland Empire/Desert Region for all 18 sectors we see that:

- The number of companies grew by 3 from 34 to 37;
- Employment grew by 2,900 from 292 to 3,192 (employment data by stage of development--defined below—differs showing that regional employment grew by 100 to a total of 12,292 in 2013); and
- Total firm investment since a firm's founding did not increase.

(Remember these companies were hand-picked by Cleantech for analysis.) TSI has analyzed Cleantech *i3* data for companies most likely to drive the sector by dividing them into two groups: companies in the first group are defined by stage of development; companies in the second are defined by which of the 18 cleantech sectors they belong to. The status of each group in 1-14-14 was compared with itself in 4-29-14, showing variations in stage of development or distribution of various factors such as the number of companies, employment or investment by cleantech sector. (See attachment 1 for a list of sectors.)

The first category of firms was formed by stage of company development defined as: 1. products are widely available to the community; 2. scaling up or piloting the manufacturing process or services; 3. have a prototype and are in the product development stage; and 4., concept development and proto development of product or service. Each of these stages has different job and workforce training requirements. As funding increases, the company passes from stage 4 to stage 1 as it gears up to disrupt a market with new products or services, leading again to increased hiring and the need for a different mix of skills, including those necessary for product maintenance and services.

Here's what the numbers look like for each stage of development in the Inland Empire/Desert Region:

[2] California Budget Project, 2014.

- The number of companies in the wide commercial availability stage increased by 4 to 16 employing 12,255 (up 100);
- Those piloting the manufacturing process or developing services stage increased by 2 to a total of 7 employing 32 (no increase employment over the earlier period);
- The Cleantech *I3* data identified no companies in the product development stage; and
- Those in the concept development stage increased by 1 to 2 companies employing 5 (no change).

Total investment is defined as all of the funding that a reporting company has received since its founding. Funding did not change for any stage of development in the reporting period.

The second category of companies is by cleantech sector. In 2008, a UC Berkeley study reported that the Inland Empire/Desert region specializes in manufacturing and recycling, and is one of the state's fastest growing regions in all sectors except energy. The Cleantech *i3* summary of regional data by 18 sectors does not report energy related manufacturing as a separate category. It does show that:

- Recycle and waste, followed by "other cleantech" are top investment areas in that order. Only two other sectors—air and solar—show any investment activity.
- Employment is reported as being highest in water and wastewater treatment with one company accounting for 3,100 jobs of the total of 3,192 in the region.
- None of the Cleantech *i3* sectors showed any increase in investment during the reporting period.

Comment: The number of companies identified in the Cleantech *i3* data as selling products or getting ready to are small. Despite the small growth in employment, the lack of investment compared to the other three ATRE regions may suggest relative stagnation in growth at this time. This situation is compounded by lack of companies reported by Cleantech *i3* to be developing products for market or even companies at the concept stage.

It should be firmly kept in mind that other data-bases, such as the COE and LMID Green Economy efforts, report many more companies in the clean energy sector. As noted, differences in the number of employees reported by companies in two different categories is significant. Even so, the 2008 UC Berkeley study ranked this region 8th in innovation at that time. They reported 704 green start-ups and 266 green gazelles. The Cleantech *i3* data which focuses on this segment seems to indicate that despite this promising start, there is a slow rate of development.

The DSN should consider requesting COE to conduct an independent NAICS based study to identify additional renewable energy firms, including their geographic location in the region, and how they are networked with other companies in California. Inland Empire/Desert green business networks identified in the UC Berkeley study could also be used to seek out and connect with firms that are not identified by the Cleantech *i3* data. Finally, ATRE could partner with the DWM Small Business initiative to catalyze start-up and small business growth.

Trucking and Diesel Sector Related Data

Region 2, Inland Empire/Desert: Estimated Number of Trucking and Related Establishments, Nonemployers, Employees and Wages (2nd Q 2013)					
	Major Industry Title (NAICS)	Number of Establishments (ES202)	Average Monthly Employment	Total Quarterly Payroll ($1,000)	Average Weekly Pay
Riverside	Truck transportation (484)	487	4,691	$50,246	$824
	Transit and ground passenger transportation (485)	78	1,409	$8,830	$482
	Scenic and sightseeing transportation (487)	6	32	$169	$403
San Bernardino	Truck transportation (484)	618	18,431	$208,504	$870
	Transit and ground passenger transportation (485)	67	1,863	$11,902	$491
	Scenic and sightseeing transportation (487)	3	38	$284	$570
Total 2013 (ES202)		1,259	26,464	$279,935	
Nonemployers 2011 (US Census County Bus. Pat.)		13,499			
Estimated Total Firms and Nonemployers 2013		14,758			

Region 2, Inland Empire/Desert: Change in the Number of Trucking, Public Transportation, and Related Establishments Employment & Wages from 2012 4th Q to 2013 2nd Q			
Sector (NAICS)	Change in # Establishments	Change in Monthly Employment	Change in Reported Quarterly Payroll (x1,000)
Truck Transportation (484)	51	1,234	$8,839
Transit and Ground Passenger Transportation (485)	6	(163)	($1,076)
Scenic and Sightseeing Transportation (487)	(1)	(3)	($1)
Total	57	1,071	$7,763

Sources: Time Structures, Inc., calculations using LMID ES202 data for 2012 & 13, and US Census County Business Patterns for 2011.

Automotive Repair and Maintenance Sector Data

Region 2, Inland Empire/Desert: Automotive Repair and Maintenance Establishments, Employment and Wages 2013 2nd Q				
County	Number of Establishments	Average Monthly Employment	Total Annual Payroll (x1,000)	Average Weekly Pay
Riverside	839	5,498	$42,192	$590
San Bernardino	864	5,536	$43,431	$603
Totals	1,703	11,034	$85,623	

Region 2, Inland Empire/Desert: Change in the Number of Automotive Repair and Maintenance Establishments Employment & Wages from 2012 4th Q to 2013 2nd Q						
County	Change in Establishments	Change in Monthly Employment	Percent Change in Monthly Employment	Change in Reported Quarterly Payroll (x1000)	Change in Average Weekly Pay	% Change in Average Weekly Pay
Riverside	37	304	6%	$1,422	-14	-2%
San Bernardino	17	308	6%	$1,696	-11	-2%
Region Total	54	612		$3,118		

Source: Time Structures, Inc. calculations using LMID ES202 data for 2012 & 2013.

Clean Technology Sector Data

Cleantech *i3* data is a purposive sample of rapidly growing companies and is not a count of all companies. Companies may not report data in certain categories leading to differing table totals. Dates refer to when the data was downloaded by Time Structures, Inc. See Attachment 1 for Sector Definitions.

Region 2, Inland Empire / Desert: A Comparison of the Number of Clean Tech Companies, Total Company Investment, and Total Employees by Stage of Development on 1-14-2014 with 4-29-14

Cleantech Companies, Company Investment and Total Employees 1-14-2014				Cleantech Companies, Company Investment and Total Employees 4-29-2014				Growth or Loss in Companies, Total Company Investment or Total Employees Between 1-14-2014 and 4-29-14			
Stage of Development	Number of Companies	Total Investment	Total Employees	**Stage of Development**	Number of Companies	Total Investment	Total Employees	**Stage of Development**	Number of Companies	Total Investment	Total Employees
Wide Commercial Availability	12	$72,821,794	12,155	Wide Commercial Availability	16	$72,821,794	12,255	Wide Commercial Availability	4	0	100
Shipping Product/Pilot	5	$2,000,000	32	Shipping Product/Pilot	7	$2,000,000	32	Shipping Product/Pilot	2	0	0
Product Development	0	$0	0	Product Development	0	$0	0	Product Development	0	0	0
Concept	1	$0	5	Concept	2	$0	5	Concept	1	0	0
Total	18	$74,821,794	12,192	Total	25	$74,821,794	12,292	Total	7	0	100

Region 2: Inland Empire/Desert (1-23-14), Number of Clean Technology Companies, Employees and Investments by Sector			
Sector	Companies	Employees Reported	Total Investment (Mill)
Advanced Materials	1	0	$0.0
Agriculture and Forestry	0	0	$0.0
Air	2	30	$6.3
Biofuels & Biochemicals	2	0	$0.0
Biomass			
Conventional Fuels	1	0	$0.0
Energy Efficiency	5	25	$0.0
Energy Storage	1	5	$0.0
Fuel Cells & Hydrogen	1	25	$0.0
Geothermal	0	0	$0.0
Hydro & Marine	0	0	$0.0
Other Cleantech	2		$36.4
Recycling & Waste	1	100	$66.5
Smart Grid	0	0	$0.0
Solar	6	7	$2.0
Transportation	4	0	$0.0
Water & Wastewater	6	100	$0.0
Wind	2	0	$0.0
Total	34	292	$111.2

Region 2: Inland Empire/Desert (4-29-14), Number of Clean Technology Companies, Employees and Investments by Sector			
Sector	Companies	Employees Reported	Total Investment (Mill)
Advanced Materials	1	0	-
Agriculture and Forestry	0	0	-
Air	2	30	6
Biofuels & Biochemicals	2	0	-
Biomass		0	
Conventional Fuels	1	0	-
Energy Efficiency	5	25	-
Energy Storage	1	5	-
Fuel Cells & Hydrogen	1	25	-
Geothermal	0	0	-
Hydro & Marine	0	0	-
Other Cleantech	3	0	36
Recycling & Waste	2	0	67
Smart Grid	0	0	-
Solar	6	7	2
Transportation	4	0	-
Water & Wastewater	7	3,100	-
Wind	2	0	-
Total	37	3,192	111

Region 2: Inland Empire/Desert (1-23-14 to 4-29-14), Changes in the Number of Clean Technology Companies, Employees and Investments by Sector			
Sector	Companies	Employees Reported	Total Investment (Mill)
Advanced Materials	0	0	-
Agriculture and Forestry	0	0	-
Air	0	0	-
Biofuels & Biochemicals	0	0	-
Biomass	0	0	-
Conventional Fuels	0	0	-
Energy Efficiency	0	0	-
Energy Storage	0	0	-
Fuel Cells & Hydrogen	0	0	-
Geothermal	0	0	-
Hydro & Marine	0	0	-
Other Cleantech	1	0	-
Recycling & Waste	1	(100)	-
Smart Grid	0	0	-
Solar	0	0	-
Transportation	0	0	-
Water & Wastewater	1	3,000	-
Wind	0	0	-
Total	3	2,900	-

Los Angeles/Orange Region

Trucking: In 2013 2nd quarter, the Los Angeles/Orange Region had 3,026 trucking and related establishments, an increase of 66 more firms than the 4th quarter of 2012. Average monthly employment was 47,173 (662 more than 2012). The total 2013 2nd quarter payroll of $457.9 million, was $17.4 million less than 2012. In 2011 the region had 35,115 nonemployer businesses for a TSI estimated total of at least 38,141 trucking and related establishments in 2013.

Automotive: The number of automotive repair and maintenance establishments increased by 91 to 5,910 in 2013, employing 38,259, up 1,274 over 2012. The 2013 quarterly payroll increased by a little over $5.4 million to $302.1 million, but average weekly pay dropped by about $17.

Comment: The automotive repair and trucking sectors are growing in the Los Angeles/Orange Region. Hiring is picking up, too. California's slow economic recovery in hiring and pay, particularly for low and middle income workers is the environment in which new transportation technologies are taking hold.[3] The rapid market adoption of new automotive, truck, and logistic technologies and fuels may already be affecting business growth, employee hiring and wages, and will continue to do so much more drastically in the future. The drop in automotive repair and trucking wages that was caused by wage stagnation can only be made worse with technician training that is out-of-step with the adoption of new, market driven, technologies. To help mitigate these developments, ATRE should closely track the introduction of new automotive and trucking developments so that workforce training can match needs. It may also be possible to identify non-employer businesses who can assist with adopting new technology.

Renewable Energy (Clean Technology): Comparing self-reported Cleantech *i3* data at two times over four months -- at 1-14-14 and again at 4-29-14 -- for the Los Angeles/Orange Region for all 18 sectors we see that:

- The number of companies grew by 7 from 349 to 356;
- Employment increased by 5,046 from 20,555 to 25,601 in 2013 (note that company reporting by sector shows a decrease); and
- Total firm investment since a firm's founding increased by 22.5 million from $4.01 billion to $4.04 billion.

(Remember these companies were hand-picked by Cleantech for analysis.) TSI has analyzed Cleantech *i3* data for companies most likely to drive the sector by dividing them into two groups: companies in the first group are defined by stage of development; companies in the second are defined by which of the 18 cleantech sectors they belong to. The status of each group in 1-14-14 was compared with itself in 4-29-14, showing variations in stage of development or distribution of various factors such as the number of companies, employment or investment by cleantech sector. (See Attachment 2 for a list of sectors.)

The first category of firms was formed by stage of company development defined as: 1. products are widely available to the community; 2. scaling up or piloting the manufacturing process or services; 3. have a prototype and are in the product development stage; and 4., concept development and proto development of product or service. Each of these stages has different job and workforce training requirements. As funding increases, the company passes from stage 4 to stage 1 as it gears up to disrupt a market with new products or services, leading again to increased hiring and a different mix of skills, including those necessary for product maintenance and services.

Comparing Los Angeles/Orange self-reporting data for the four month period shows that:

[3] California Budget Project, 2014.

- The number of companies in the wide commercial availability stage increased by 27 to 160 employing 23,376 (up 5,471);
- Those piloting the manufacturing process or developing services stage increased by 10 to a total of 64 employing 1,793 (down by 518 employees);
- Those in the product development stage increased by 19 to 49 companies employing 421 (up 88); and
- Those in the concept development stage increased by 4 to 14 companies employing 11 (up 5).

Total investment is defined as all of the funding that a reporting company has received since its founding. Funding by stage of development in the reporting period shows that:

- Firms in the shipping product/pilot project stage saw the largest increase in funding, up $122 million (5%),
- Followed by firms in the wide commercial availability stage seeing additional investments of $72.8 million (9.5%).
- Firms at concept level of development saw a significant investment in 2013 of $19.8 million.

In 2008, a UC Berkeley study reported that Los Angeles has almost as many jobs as Orange County, San Diego, and Riverside-San Bernardino combined. This remains true in 2013. Los Angeles has a diverse green economy, dominated by large firms in transportation and manufacturing, with rapid growth in energy research and services. The Cleantech *i3* summary of regional data by 18 sectors does not report energy related manufacturing as a separate category. It does show that:

- Multiple cleantech sectors have received a substantial amount of investment over the life of listed firms with transportation being first ($1.6 billion), followed in order of level of investment by solar ($773 million), energy storage ($217 million), and biofuels and biochemicals ($265 million).
- Employment is reported as being highest in transportation (4,853 but lost 633 employees during the study period), followed in order by advanced materials (3,938), recycling and waste (2,517), energy efficiency (91,636), and solar (1,251).
- None of the Cleantech *i3* sectors showed any increase in investment during the reporting period even though looking at the data differently, self-reported data by stage of company development, does show that significant investments did occur.

Comment: The number of mature companies with widely available products and the level of investment that they are receiving suggests that they will continue to add employees beyond the 10,630 currently employed in the Los Angeles/Orange Region by companies reporting. The rapid growth in funding for companies with products in the market or entering the market suggests that the sector may grow rapidly. The DSN should consider using the Cleantech *i3* data to identify and reach out to companies in these stages of development to negotiate training curriculum and trainer contracts. ATRE should continue to follow the transportation, solar, energy storage, and biofuels and biochemicals segments. Our industry analysis shows that the Los Angeles/Orange Region will continue to be an important center of innovation, manufacturing and services driving the development and adoption of these new technologies.

Trucking and Diesel Sector Data

Region 3, Los Angeles/Orange: Estimated Number of Trucking, Public Transportation, and Related Establishments, Nonemployers, Employees and Wages (2nd Q 2013)					
	Major Industry Title (NAICS)	**Number of Establishments (ES202)**	**Average Monthly Employment**	**Total Quarterly Payroll ($1,000)**	**Average Weekly Pay**
Los Angeles	Truck transportation (484)	1,945	26,328	$286,662	838
	Transit and ground passenger transportation (485)	561	12,845	$99,217	594
	Scenic and sightseeing transportation (487)	66	651	$4,300	508
Orange	Truck transportation (484)	325	4,048	$42,711	812
	Transit and ground passenger transportation (485)	107	2,992	$23,118	594
	Scenic and sightseeing transportation (487)	22	309	$1,896	471
Total 2013 (ES202)		3,026	47,173	$ 457,904	
Nonemployers 2011 (US Census County Bus. Pat.)		35,115			
Estimated Total Firms and Nonemployers 2013		38,141			

Region 3, Los Angeles/Orange: Change in the Number of Trucking, Public Transportation, and Related Establishments Employment & Wages from 2012 4th Q to 2013 2nd Q			
Sector	Change in # Establishments	Change in Monthly Employment	Change in Reported Quarterly Payroll (x1,000)
Truck Transportation (484)	50.00	174.00	-20401.00
Transit and Ground Passenger Transportation (485)	14.00	546.00	3100.00
Scenic and Sightseeing Transportation (487)	2.00	-58.00	-109.00
Total	66.00	662.00	-17410.00

Sources: Time Structures, Inc., calculations using LMID ES202 data for 2012 & 13, and US Census County Business Patterns for 2011.

Automotive Repair and Maintenance Sector Data

Region 3, Los Angeles/Orange: Estimated Number of Automotive Repair and Maintenance Establishments, Employees and Wages (2nd Q 2013)				
County	Number of Establishments	Average Monthly Employment	Total Annual Payroll (x1,000)	Average Weekly Pay
Los Angeles	4,446	27,956	$214,200	$589
Orange	1,464	10,303	$87,947	$657
Total	5,910	38,259	$302,147	

Region 3: Los Angeles/Orange: Change in the Number of Automotive Repair and Maintenance Establishment's Employment, & Wages from 2012 4th Q to 2013 2nd Q						
County	Change in Establishments	Change in Monthly Employment	Percent Change in Monthly Employment	Change in Reported Quarterly Payroll (x$1,000)	Change in Average Weekly Pay	% Change in Average Weekly Pay
Los Angeles	69	860	3%	$2,645	($12)	-2%
Orange	22	414	4%	$2,801	($5)	-1%
Totals	91	1,274		$5,446	($17)	

Source: Time Structures, Inc. calculations using LMID ES202 data for 2012 & 2013.

Clean Technology Sectors Data

Cleantech *i3* data is a purposive sample of rapidly growing companies and is not a count of all companies. Companies may not report data in certain categories leading to differing table totals. Dates refer to when the data was downloaded by Time Structures, Inc. See Attachment 1 for Sector Definitions.

Table 3: Region 3, Los Angeles/Orange: Number of Companies, Total Company Investment, and Total Employees Compared by Stage of Development 1-14-2014 to 4-29-14

Cleantech Companies, Company Investment and Total Employees 1-14-2014				Cleantech Companies, Company Investment and Total Employees 4-29-2014				Growth or Loss in Companies, Total Company Investment or Total Employees Between 1-14-2014 and 4-29-14			
Stage of Development	Number of Companies	Total Investment	Total Employees	**Stage of Development**	Number of Companies	Total Investment	Total Employees	**Stage of Development**	Number of Companies	Total Investment	Total Employees
Wide Commercial Availability	133	$3,308,903,566	17,905	Wide Commercial Availability	160	$ 3,318,003,566	23,376	Wide Commercial Availability	27	$9,100,000	5,471
Shipping Product/Pilot	54	$2,113,793,255	2,311	Shipping Product/Pilot	64	$ 2,235,849,255	1,793	Shipping Product/Pilot	10	$122,056,000	(518)
Product Development	30	$ 195,761,692	333	Product Development	49	$ 209,386,692	421	Product Development	19	$13,625,000	88
Concept	10	$ -	6	Concept	14	$ 19,775,000	11	Concept	4	$19,775,000	5
Total	227	$5,618,458,513	20,555	Total	287	$ 5,783,014,513	25,601	Total	60	$164,556,000	5,046

Region 3: Los Angeles/Orange (1-23-14), Number of Clean Technology Companies, Employees and Investments by Sector

Sector	Companies	Employees Reported	Total Investment (Mill)
Advanced Materials	29	3,928	$30.1
Agriculture and Forestry	8	43	$3.3
Air	5	165	$34.4
Biofuels & Biochemicals	17	583	$264.7
Biomass	2	150	
Conventional Fuels	4	356	$194.1
Energy Efficiency	65	1,629	$216.5
Energy Storage	17	439	$382.8
Fuel Cells & Hydrogen	7	11	$80.1
Geothermal	1	35	$49.5
Hydro & Marine	2	4	$0.0
Other Cleantech	22	155	$74.9
Recycling & Waste	20	2,507	$78.2
Smart Grid	5	293	$22.0
Solar	47	1,251	$769.8
Transportation	47	5,486	$1,651.2
Water & Wastewater	46	1,145	$166.9
Wind	5	10	$0.0
Total	349	18,190	$4,018.4

Region 3: Los Angeles/Orange (4-29-14), Number of Clean Technology Companies, Employees and Investments by Sector

Sector	Companies	Employees Reported	Total Investment (Mill)	Notes
Advanced Materials	30	3,938	50	No Ceram Tech
Agriculture and Forestry	9	18	0	no cyber rain 3m
Air	5	165	34	
Biofuels & Biochemicals	17	590	265	
Biomass	2	150	-	
Conventional Fuels	4	356	194	
Energy Efficiency	65	1,635	217	
Energy Storage	17	439	383	
Fuel Cells & Hydrogen	7	11	80	
Geothermal	1	35	50	
Hydro & Marine	2	4	-	
Other Cleantech	23	155	75	
Recycling & Waste	21	2,517	78	
Smart Grid	6	293	22	
Solar	47	1,251	773	
Transportation	48	4,853	1,651	
Water & Wastewater	47	1,170	170	
Wind	5	10	-	
Total	356	17,590	4,041	

Region 3: Los Angeles/Orange (1-23-14 to 4-29-14), Changes in the Number of Clean Technology Companies, Employees and Investments by Sector

Sector	Companies	Employees Reported	Total Investment (Mill)
Advanced Materials	1	10	$19.40
Agriculture and Forestry	1	(25)	($2.90)
Air	0	0	$0.00
Biofuels & Biochemicals	0	7	$0.00
Biomass	0	0	$0.00
Conventional Fuels	0	0	$0.00
Energy Efficiency	0	6	$0.00
Energy Storage	0	0	$0.00
Fuel Cells & Hydrogen	0	0	$0.00
Geothermal	0	0	$0.00
Hydro & Marine	0	0	$0.00
Other Cleantech	1	0	$0.00
Recycling & Waste	1	10	$0.00
Smart Grid	1	0	$0.00
Solar	0	0	$2.70
Transportation	1	(633)	$0.00
Water & Wastewater	1	25	$3.30
Wind	0	0	$0.00
Total	7	(600)	$22.50

San Francisco Bay Region

Trucking: Activity in this sector appears to have improved from 2012 to 2013 because 2nd quarter 2013 data shows 1,790 trucking and related establishments, 88 more than in the 4th quarter of 2012. Average monthly employment was 9,669 (312 fewer than 2012). However, total quarterly payroll dropped in the 2nd quarter of 2013 being $87.6 million, $9.7 million less than 2012.

Automotive: The number of automotive repair and maintenance establishments also saw an improvement increasing by 94 to 3,830 in 2013. San Francisco Bay Region establishments employed 24,149 in 2013, up 1,014 over 2012. The 2013 quarterly payroll increased by a $629 thousand to $229.6 million. Six counties accounted for the increase; payroll dropped in 5 counties. Average weekly pay dropped by $6 to $157 in 10 counties.

Comment: The automotive repair and trucking sectors are growing in the San Francisco Bay Region. Hiring is picking up too. However, decrease in average weekly pay, despite the modest increase in yearly payroll, is a serious development for the region. The across the board decrease in average weekly pay is important, but the range of variation between counties in the amount of loss suggests that its causes may vary.

California's slow economic recovery in hiring and pay, particularly for low and middle-income workers (California Budget Project, 2014) is the environment in which new automotive and diesel technologies are taking hold. The rapid market adoption of new automotive, truck, and logistic technologies and fuels may already be affecting business growth, employee hiring and wages, and will continue to do so much more drastically in the future. The drop in automotive repair and trucking wages that was caused by wage stagnation can only be made worse with technician training that is out-of-step with the adoption of new, market driven, technologies. To help mitigate these developments, ATRE should closely track the introduction of new automotive and trucking developments so that workforce training can match needs. It may also be possible to identify non-employer businesses who can assist with adopting new technology.

Renewable Energy (Clean Technology): A comparison of Cleantech *i3* data on 1-14-2014 with that on 4-29-14 for the San Francisco Bay Region for all 18 sectors we see that:

- The number of companies grew by 69 from 820 to 889;
- Employment increased by 3,088 from 76,354 to 79,442 in 2013 (note that company reporting by sector shows significantly more employees, 447,433 in the 2nd Q of 2013, an increase of 32,301 with most of the total contributed by 7 very large companies); and
- Total firm investment since a firm's founding increased by $1.88 billion from $16.7 billion to $18.6 billion.

(Remember these companies were hand-picked by Cleantech for analysis.) TSI has analyzed Cleantech *i3* data for companies most likely to drive the sector by dividing them into two groups: companies in the first group are defined by stage of development; companies in the second are defined by which of the 18 cleantech sectors they belong to. The status of each group in 1-14-14 was compared with itself in 4-29-14, showing variations in stage of development or distribution of various factors such as the number of companies, employment or investment by cleantech sector.

The first category of firms was formed by stage of company development defined as: 1. products are widely available to the community; 2. scaling up or piloting the manufacturing process or services; 3. have a prototype and are in the product development stage; and 4. concept development and proto development of product or service. Each of these stages has different job and workforce training requirements. As funding increases, the company passes from stage 4 to stage 1 as it gears up to

disrupt a market with new products or services, leading again to increased hiring and a different mix of skills, including those necessary for product maintenance and services.
Here's what the numbers look like for each stage of development in the San Francisco Bay Region:

- The number of companies in the wide commercial availability stage increased by 44 to 341 employing 438,558 (up 34,514);
- Those in the shipping their product/pilot stage increased by 42 to a total of 196 employing 6,791 (down by 2,364);
- Those in the product development stage increased by 27 to 142 companies employing 1,839 (up 131); and
- Those in the concept development stage increased by 34 to 63 companies employing 245 (up 20).

Total investment is defined as all of the funding that a reporting company has received since its founding. Funding by stage of development in the reporting period shows:

- Firms in the wide commercial availability stage reported $11.94 billion in total investment for 4-29-2014 up $1.35 billion (11.3%).
- Firms in the shipping product/pilot project stage reported $4.47 billion in total investment up $483 million (10.8%),
- Firms at concept level of development reported $661 million in total investment up $77million (11.2%).

The San Francisco Bay Area continues in its statewide leadership role as describe in 2008. A UC Berkeley study reported that Silicon Valley, due to its local expertise, financial capital, labor pool, and institutions, as well as excess capacity in manufacturing, is the green innovation leader in California. Silicon Valley's firms are the most highly networked, particularly with other firms, trade associations, and nonprofits. The East Bay is also a very significant employer.

The Cleantech *i3* summary of regional data by 18 sectors shows that:

- Multiple cleantech sectors have received a substantial amount of investment with solar being first totaling $6.6 billion, an increase of $610 million during our study period, followed in order by energy efficiency at $3.2 billion, an increase of $190 million; biofuels and biochemical at $1.7 billion, an increase of $9.6 million; and transportation totaling $1.6 billion, an increase of $258 million. Over the time period of this study 13 of 18 *i3* failed to show a significant increase in investment.
- Employment is reported as being highest in smart grid at 18,848, followed in order by solar at 17,374 increasing by 163; advanced materials at 9,754; and other clean technology at 9,347 an increase of 75.

Comment: The number of mature companies with widely available products and the level of investment that they are receiving suggests that they will continue to add employees. The total funding for companies with products in the market or entering the market, despite the recent decline, suggests that the companies at this stage may still grow rapidly. The robust investment in companies at the concept stage suggests that the pipeline to new products is open. The DSN should consider using the *Cleantech i3* data to identify and reach out to companies in these stages of development and to multiple sectors (possible less so to wind, Hydro-water, biomass, geothermal and air) to negotiate training curriculum and faculty contracts. It may be prudent and worthwhile, given the size of the San Francisco Bay Region cleantech sector and its rate of the growth, that the Chancellor's office increase ATRE funding for this region to make certain that its workforce training needs are met in a timely way.

Trucking and Diesel Sector Data

Region 4, San Francisco Bay: Estimated Number of Truckingand Related Establishments, Nonemployers, Employees and Wages (2nd Q 2013)					
	Major Industry Title (NAICS)	**Number of Establishments (ES202)**	**Average Monthly Employment**	**Total Quarterly Payroll ($1,000)**	**Average Weekly Pay**
Alameda	Truck transportation (484)	341	5,595	$64,362	$885
	Transit and ground passenger transportation (485)	60	1,916	$15,974	$641
	Scenic and sightseeing transportation (487)	9	87	$696	$610
Contra Costa	Truck transportation (484)	107	935	$10,992	$904
	Transit and ground passenger transportation (485)	44	878	$6,887	$603
Marin	Truck transportation (484)	34	257	$2,277	$682
	Transit and ground passenger transportation (485)	17	184	$1,579	$658
Monterey	Truck transportation (484)	127	1,285	$15,418	$923
	Transit and ground passenger transportation (485)	14	267	$1,920	$553
Napa	Truck transportation (484)	30	533	$6,287	$906
	Transit and ground passenger transportation (485)	14	326	$2,344	$553
	Scenic and sightseeing transportation (487)	7	320	$2,380	$572
Santa Cruz	Truck transportation (484)	32	327	$2,882	$677
	Transit and ground passenger transportation (485)	8	83	$504	$467
	Scenic and sightseeing transportation (487)	6	43	$200	$358
San Francisco	Truck transportation (484)	101	926	$10,041	$834
	Transit and ground passenger transportation (485)	81	1,631	$15,201	$717
	Scenic and sightseeing transportation (487)	27	1,252	$32,062	$1,969
San Mateo	Truck transportation (484)	118	1,112	$10,424	$721
	Transit and ground passenger transportation (485)	79	1,457	$12,819	$676
	Scenic and sightseeing transportation (487)	5	19	$125	$496
Santa Clara	Truck transportation (484)	197	4,414	$48,553	$846
	Transit and ground passenger transportation (485)	89	1,807	$14,297	$609
Solano	Truck transportation (484)	85	1,252	$12,899	$792
	Transit and ground passenger transportation (485)	25	509	$4,271	$645
Sonoma	Truck transportation (484)	111	1,163	$13,452	$890
	Transit and ground passenger transportation (485)	22	872	$7,409	$654
Total 2013 (ES202)		1,790	29,450	$316,255	$19,841
Nonemployers 2011 (US Census County Bus. Pat.)		15,265			
Estimated Total Firms and Nonemployers 2013		17,055			

Region 4, San Francisco Bay: Change in the Number of Trucking, Public Transportation, and Related Establishments Employment and Wages from 2012 4th Q to 2013 2nd Q			
Sector (NAICS)	Change in # Establishments	Change in Monthly employment	Change in Reported Quarterly Payroll (x1,000)
Truck Transportation (484)	28	-185	($6,427)
Transit and Ground Passenger Transportation (485)	64	588	$1,962
Scenic and Sightseeing Transportation (487)	-4	74	$13,259
Total	88	477	$8,794

Sources: Time Structures, Inc., calculations using LMID ES202 data for 2012 & 13, and US Census County Business Patterns for 2011.

Automotive Repair and Maintenance Sector Data

Region 4, San Francisco Bay: Estimated Number of Automotive Repair and Maintenance Firms, Employees and Wages 2013 2nd Q				
County	**Number of Establishments**	**Average Monthly Employment**	**Total Annual Payroll (x1,000)**	**Average Weekly Pay**
Alameda	791	4,952	$45,941	$714
Contra Costa	397	2,804	$28,213	$774
Marin	166	1,191	$12,063	$779
Monterey	174	878	$7,189	$630
Napa	65	401	$3,684	$706
San Francisco	327	1,965	$19,642	$769
San Mateo	458	2,961	$27,635	$718
Santa Clara	856	5,301	$50,439	$732
Santa Cruz	135	806	$7,867	$751
Solano	193	1,310	$11,614	$682
Sonoma	268	1,580	$15,320	$746
Region Totals	3,830	24,149	229,607	

Source: Time Structures, Inc. calculations using LMID ES202 data for 2012 & 2013.

Region 4, San Francisco Bay: Change in the Number of Automotive Repair and Maintenance Establishments, Employment & Wages from 2012 4th Q to 2013 2nd Q						
County	Change in # Establishments	Change in Monthly Employment	Percent Change in Monthly Employment	Change in Reported Quarterly Payroll (x1,000)	Average Weekly Pay	% Change in Average Weekly Pay
Alameda	6	369	8%	$747	($44)	0
Contra Costa	0	-171	-6%	($2,842)	($29)	0
Marin	4	85	8%	$499	($25)	0
Monterey	1	16	2%	($199)	($29)	0
Napa	-3	-3	-1%	($852)	($157)	0
San Francisco	4	57	3%	($350)	($37)	0
San Mateo	14	154	5%	$431	($27)	0
Santa Clara	31	345	7%	$2,859	($6)	0
Santa Cruz	5	56	7%	$595	$6	0
Solano	10	47	4%	$366	($3)	0
Sonoma	2	59	4%	($625)	($60)	0
Region Totals	74	1,014		$629		

Clean Technology Sectors Data

Cleantech *i3* data is a purposive sample of rapidly growing companies and is not a count of all companies. Companies may not report data in certain categories leading to differing table totals. Dates refer to when the data was downloaded by Time Structures, Inc. See Attachment 1 for Sector Definitions.

Table 4: Region 4, Interior San Francisco Bay: Number of Companies, Total Company Investment, and Total Employees Compared by Stage of Development 1-14-2014 to 4-29-14											
Cleantech Companies, Company Investment and Total Employees 1-14-2014				Cleantech Companies, Company Investment and Total Employees 4-29-2014				Growth or Loss in Companies, Total Company Investment or Total Employees Between 1-14-2014 and 4-29-14			
Stage of Development	Number of Companies	Total Investment	Total Employees	Stage of Development	Number of Companies	Total Investment	Total Employees*	Stage of Development	Number of Companies	Total Investment	Total Employees
Wide Commercial Availability	297	$10,592,542,917	404,044	Wide Commercial Availability	341	$11,942,755,585	438,558	Wide Commercial Availability	44	$1,350,212,668	34,514
Shipping Product/Pilot	154	$ 3,984,484,964	9,155	Shipping Product/Pilot	196	$4,468,089,517	6,791	Shipping Product/Pilot	42	$483,604,553	(2,364)
Product Development	115	$ 1,563,726,313	1,708	Product Development	142	$1,531,558,395	1,839	Product Development	27	($32,167,918)	131
Concept	29	$ 585,169,055	225	Concept	63	$661,949,055	245	Concept	34	$76,780,000	20
Total	595	$16,725,923,249	415,132	Total	742	$18,604,352,552	447,433	Total	147	$1,878,429,303	32,301
*The employee number is an estimate due to the number of companies with over 15,000 employees.											

Region 4: San Francisco Bay (1-23-14), Number of Clean Technology Companies, Employees and Investments by Sector

Sector	Companies	Employees Reported	Total Investment (Mill)
Advanced Materials	59	9,752	845.2
Agriculture and Forestry	31	700	420.7
Air	15	618	354.3
Biofuels & Biochemicals	35	1,936	1,696.5
Biomass	4	2	
Conventional Fuels	8	113	97.5
Energy Efficiency	188	6,643	3,053.2
Energy Storage	43	815	56.4
Fuel Cells & Hydrogen	7	885	130.4
Geothermal	4	161	65.5
Hydro & Marine	4	18	0.4
Other Cleantech	42	9,272	195.6
Recycling & Waste	40	3,581	262.4
Smart Grid	45	18,848	855.4
Solar	182	17,211	6,019.7
Transportation	74	3,153	1,360.3
Water & Wastewater	31	2,546	44.5
Wind	8	100	800.0
Total	820	76,354	17,436.8

Region 4: San Francisco Bay (1-23-14), Number of Clean Technology Companies, Employees and Investments by Sector

Sector	Companies	Employees Reported	Total Investment (Mill)
Advanced Materials	61	9,754	$868.6
Agriculture and Forestry	41	956	$572.3
Air	15	618	$354.3
Biofuels & Biochemicals	49	1,886	$1,706.1
Biomass	4	4	$0.0
Conventional Fuels	9	128	$103.9
Energy Efficiency	195	6,833	$3,203.5
Energy Storage	47	845	$452.9
Fuel Cells & Hydrogen	7	885	$913.7
Geothermal	4	161	$4.0
Hydro & Marine	4	18	$0.4
Other Cleantech	46	9,347	$222.8
Recycling & Waste	41	3,583	$267.4
Smart Grid	46	18,848	$870.8
Solar	190	17,374	$6,630.5
Transportation	83	5,551	$1,618.8
Water & Wastewater	39	2,551	$57.2
Wind	8	100	$800.0
Total	889	79,442	$18,647.2

Region 4: San Francisco Bay (1-23-14 to 4-29-14), Changes in the Number of Clean Technology Companies, Employees and Investments by Sector

Sector	Companies	Employees Reported	Total Investment (Mill)
Advanced Materials	2	2	$23.4
Agriculture and Forestry	10	256	$151.6
Air	0	0	$0.0
Biofuels & Biochemicals	14	(50)	$9.6
Biomass	0	2	$0.0
Conventional Fuels	1	15	$6.4
Energy Efficiency	7	190	$150.3
Energy Storage	4	30	$396.5
Fuel Cells & Hydrogen	0	0	$783.3
Geothermal	0	0	($61.5)
Hydro & Marine	0	0	$0.0
Other Cleantech	4	75	$27.2
Recycling & Waste	1	2	$5.0
Smart Grid	1	0	$15.4
Solar	8	163	$610.8
Transportation	9	2,398	$258.5
Water & Wastewater	8	5	$12.7
Wind	0	0	$0.0
Total	69	3,088	$1,210.4

CLEANTECH *i3* SUMMARY FOR CALIFORNIA

Cleantech i3 Data on Rapidly Growing Companies, Employment, and Total Investment (May 6, 2014)															
	Los Angeles & Orange			San Diego & Imperial			Inland Empire/Desert			San Francisco Bay Area			California Totals		
Sector	Companies	Employees Reported	Total Investment (Mill)	Companies	Employees Reported	Total Investment (Mill)	Companies	Employees Reported	Total Investment	Companies	Employees Reported	Total Investment (Mill)	Total Companies	Total Employees Reported	Total Investment (Mill)
Advanced Materials	30	3,938	$ 49.5	10	180	$ 66.7	-	-	-	61	9,754	$ 868.6	101	13,872	$ 984.8
Agriculture and Forestry	9	18	$ 0.4	9	1,073	$ 62.2	-	-	-	41	956	$ 572.3	59	2,047	$ 634.9
Air	5	165	$ 34.4	5	65	$ 58.0	-	-	-	15	618	$ 354.3	25	848	$ 446.7
Biofuels & Biochemicals	17	590	$ 264.7	19	588	$ 622.9	-	-	-	49	1,886	$ 1,706.1	85	3,064	$ 2,593.7
Biomass	2	150	$ -	1	30	$ 1.6	-	-	-	4	4	$ -	7	184	$ 1.6
Conventional Fuels	4	356	$ 194.1	1	-	$ 7.6	-	-	-	9	128	$ 103.9	14	484	$ 305.6
Energy Efficiency	65	1,635	$ 216.5	24	97	$ 52.6	-	-	-	195	6,833	$ 3,203.5	284	8,565	$ 3,472.6
Energy Storage	17	439	$ 382.8	8	440	$ 80.5	-	-	-	47	845	$ 452.9	72	1,724	$ 916.2
Fuel Cells & Hydrogen	7	11	$ 80.1	-	-	$ -	-	-	-	7	885	$ 913.7	14	896	$ 993.8
Geothermal	1	35	$ 49.5	1	25	$ -	-	-	-	4	161	$ 4.0	6	221	$ 53.5
Hydro & Marine	2	4	$ -	3	-	$ -	-	-	-	4	18	$ 0.4	9	22	$ 0.4
Other Cleantech	23	155	$ 74.9	18	198	$ 36.2	1	-	-	46	9,347	$ 222.8	88	9,700	$ 333.9
Recycling & Waste	21	2,517	$ 78.2	9	64	$ 91.3	1	(100)	-	41	3,583	$ 267.4	72	6,064	$ 436.9
Smart Grid	6	293	$ 22.0	5	168	$ 73.4	-	-	-	46	18,848	$ 870.8	57	19,309	$ 966.2
Solar	47	1,251	$ 772.5	22	7,933	$ 263.8	-	-	-	190	17,374	$ 6,630.5	259	26,558	$ 7,666.8
Transportation	48	4,853	$ 1,651.2	18	1,031	$ 596.0	-	-	-	83	5,551	$ 1,618.8	149	11,435	$ 3,866.0
Water & Wastewater	47	1,170	$ 170.2	16	50	$ 52.6	1	3,000	-	39	2,551	$ 57.2	103	6,771	$ 280.0
Wind	5	10	$ -	10	6	$ 12.5	-	-	-	8	100	$ 800.0	23	116	$ 812.5
Total	356	17,590	$ 4,041.0	179	11,948	$ 2,077.9	3	2,900	-	889	79,442	$ 18,647.2	1,427	111,880	$ 24,766.1

Attachment 1: Cleantech Sector Definitions

Below is a list of Cleantech *i3* data sectors. Further definitions of terminology, applications, market share, investments, companies, and other information is available at: http://research.Cleantech.com/tags/

Advanced Materials: Advanced Materials includes materials that improve durability and efficiency as well as decrease toxicity including: metals/alloys, semiconductors, composites, polymers, nanomaterial, ceramics, fibers, and various chemicals.

Agriculture and Food: Technologies and services that make the production of food more efficient and effective including: crops, livestock, food transportation, food packaging, food storage, food processing, supply chain tracking, food safety, quality monitoring, local food sourcing, and protein replacements.

Air: technologies, services, and related business models dedicated to removing active pollutants and greenhouse gases (GHG) from the air, after their release into the air: oxidation, filters, catalytic converters, carbon capture, and flue gas treatment.

Biofuels and Biochemical: This sector includes biomass deconstruction and biofuel conversion.

Biomass Generation: This sector includes anaerobic digestion, gasification, pyrolysis, combustion, combined heat and power, biomass boilers and torrefaction.

Conventional Fuels: This sector includes technologies, services, and related business models designed to improve the efficiency or generally lower the environmental impact of incumbent natural resource and energy industries including oil, natural gas, and coal including gasification, liquefaction, carbon capture, and clean coal.

Energy Efficiency: Our Energy Efficiency sector includes technologies, services, and related business models designed to improve energy efficiency in buildings, data centers, built infrastructure, appliances, and consumer electronics. It includes energy services (efficient design and building, financing, energy audits, commissioning, efficiency education, energy procurement, bill management, green certification, and utility programs), smart homes (in-home displays, energy analytics, efficient devices, smart plugs, smart thermostats, home automation, and lighting), commercial buildings (building envelope, efficient heating and cooling systems, enterprise energy, efficient devices, and lighting), data centers, industrial (advanced motor controls, efficient motors and waste heat recovery) and electronics (semiconductors and power management).

Energy Storage: This sector includes technologies enabling the storage of energy, generally in mechanical, electrical, chemical, thermal, or potential (gravity) forms, over time for the later application to productive work including mechanical/electrical (CAES, flywheels, capacitors, pumped storage hydro, SMES, and gravity storage), electrochemical storage (batteries and flow batteries), thermal storage (molten salt, and ice storage), and energy storage systems.

Fuel Cells and Hydrogen: This sector includes companies and business models dedicated to the proliferation of fuel cells as a power source and hydrogen as a fuel including fuel cells (PEM fuel cells, sold oxide fuel cells, phosphoric acid fuel cells, molten carbonate fuel cells, alkaline fuel cells, and zinc-based fuels cells), hydrogen production and storage.

Geothermal: Our Geothermal sector includes technologies, services, and related business models dedicated to the harvest of geothermal energy for heating and electric power production including power generation (dry steam, flash steam, binary cycle, enhanced geothermal and waste heat recovery), and heating and cooling (residential heating and cooling and commercial heating and cooling).

Hydro and Marine Power: Systems used to harvest energy from water, either as kinetic energy from moving water, thermal energy from temperature gradients, or through osmosis capitalizing on salinity differentials, and conversion of that energy into electric power including wave power, tidal power, run of river hydro, hydroelectric dams, ocean thermal energy, osmotic power and conduit hydro.

Recycling and Waste: This sector includes technologies, services, and related business models contributing to the reduction, reuse, or recycling of waste streams including collection, buy-back, reprocessing technologies, single stream recycling, sorting technologies, and wholesale/waste), web based recycling, waste to energy (biochemical and thermodynamic process), waste management (plasma destruction and biological breakdown).

Smart Grid: This sector includes technologies and services aimed at bringing a century-old electric grid into the information age; typically through the introduction of communications, monitoring, and control infrastructure to do things like increase system reliability and efficiency, enable active participation by utility customers, and integrate more diverse generation and energy storage assets with existing grid infrastructure including HAN (various wireless or other communication systems), smart meters, grid networking (PLC, BPL, cellular networking, RF, WIFI, satellite, Ethernet, and network management), meter data management, utility applications, demand response (user control of energy), grid integration (electric vehicles, distributed generation, and energy storage), grid optimization (transmission, distribution automation, and power electronics), and grid security.

Solar: Our Solar sector includes technologies, materials, services, and related business models enabling the harvest of solar energy for heating, lighting, or electric power production including photovoltaic (conventional PV, building integrated with other systems, concentrating (dish, linear Fresnel, parabolic trough, luminescent solar, low concentration, and high concentration), organic photovoltaic, PV consumer products, photovoltaic thermal, upstream PV, midstream PV, downstream PV, balance of systems, ground-mounted PV, rooftop PV, PV thin film and PV materials recycling), solar thermal (concentrating solar, photovoltaic thermal, solar water heating, solar thermal air conditioning, solar thermal processes, and balance systems), and passive solar lighting.

Transportation: This sector includes technologies, services, and related business models that enable the utilization of more sustainable transport options for people and goods including engine conversion, internal combustion engines, electric vehicles, hybrid electric vehicles, plug-in hybrid, fuel cell, alternative fuel (hydrogen, biomass, alcohol, vegetable oil, and CNG among other) involving passenger cars, motorcycles, scooters, bicycles, buses, light-weight trucks, heavy-duty trucks, industrial trucks and equipment, trains, shipping and watercraft, and airplanes and aviation. It also includes services such as car sharing, ride sharing, marketplace systems, logistics providers, shipping service providers, car rental, and taxi/private car services, charge stations, battery switching stations, EV charging and management, NGV refueling, vehicle grid, and rail infrastructures. The sector includes vehicle components such as engines, engine/motor sensors, batteries, metals, composites and glass and various software associated with EV charging and management, driver behavior, traffic monitoring, fleet tracking, monitoring and control, parking management, vehicles on a transportation grid, and congestion monitoring.

Water and Wastewater: This sector includes technologies, services, and related business models that reduce the strains placed on the hydrologic cycle while ensuring reliable access to clean water for domestic or industrial use including smart metering and control, smart irrigation, desalination, wastewater treatment, crop or other condition assessment, filtration/separation, water conservation, storm water management, contamination detection and disinfection (chemical, UV, ozone, thermal/waste heating, oxidation, ultrasound treatment, electric current, and biological treatment), and the capture of moisture in the air and its conversion to water.

Wind: Our Wind sector includes technologies, services, and related business models that enable the harvest of wind energy for electric power production including the following turbines: conventional horizontal axis wind, two-blade, co-axial multi-rotor, diffuser-augmented, counter rotating, Giromill, Darrieus, And Savonius.

Attachment 2: Truck and Automotive NAICS Codes used in this Study

US Census 2011 County Business Patterns NAICS Codes Identifying Trucking, Bus, Limousine, School, Transit Services and Related Establishements and Nonemployers Reported in this Study	
NAICS code	Description
484	Truck transportation
4841	General freight trucking
48411	General freight trucking, local
484110	General freight trucking, local
48412	General freight trucking, long-distance
484121	General freight trucking, long-distance, truckload
484122	General freight trucking, long-distance, less than truckload
4842	Specialized freight trucking
48421	Used household and office goods moving
484210	Used household and office goods moving
48422	Specialized freight (except used goods) trucking, local
484220	Specialized freight (except used goods) trucking, local
48423	Specialized freight (except used goods) trucking, long-distance
484230	Specialized freight (except used goods) trucking, long-distance
485	Transit and ground passenger transportation
4851	Urban transit systems
48511	Urban transit systems
485113	Bus and other motor vehicle transit systems
485119	Other Urban Transit Systems
4852	Interurban and rural bus transportation
48521	Interurban and rural bus transportation
485210	Interurban and rural bus transportation
4853	Taxi and limousine service
48531	Taxi service
485310	Taxi service
48532	Limousine service
485320	Limousine service
4854	School and employee bus transportation
48541	School and employee bus transportation
485410	School and employee bus transportation
4855	Charter bus industry
48551	Charter bus industry
485510	Charter bus industry
4859	Other transit and ground passenger transportation
48599	Other transit and ground passenger transportation
485991	Special needs transportation
485999	All other transit and ground passenger transportation
487	Scenic and sightseeing transportation
4871	Scenic and sightseeing transportation, land
48711	Scenic and sightseeing transportation, land
487110	Scenic and sightseeing transportation, land
4872	Scenic/Sightseeing Transportation, Water
48721	Scenic/Sightseeing Transportation, Water
487210	Scenic/Sightseeing Transportation, Water
4879	Scenic and sightseeing transportation, other
48799	Scenic and sightseeing transportation, other
487990	Scenic and sightseeing transportation, other

Employment Development Department, Labor Market Information Division NAICS codes Identifying Number of Automotive Repair and Maintenance Establishments, Employees and Wages (4th Q 2012) Reported in this Study	
8111	Automotive Repair and Maintenance
81111	Automotive Mechanical Repair/Maintenance
811111	General Automotive Repair
811112	Automotive Exhaust System Repair
811113	Automotive Transmission Repair
811118	Other Automotive Mechanical Repair
81112	Automotive Body, Interior & Glass Repair
811121	Automotive Body and Interior Repair
811122	Automotive Glass Replacement Shops
81119	Other Automotive Repair and Maintenance
811191	Automotive Oil Change/Lubrication Shops
811192	Car Washes
811198	All Other Automotive Repair/Maintenance