Report

Growing a Solar Industry in the Sacramento Clean Tech Zone

Prepared for:

City of Sacramento

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Prepared by:

Contents

Figures

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This report summarizes CH2M HILL's evaluation and assessment of the Solar America Cities Clean Tech Zone being developed by the City of Sacramento (the City or Sacramento). The report identifies opportunities to capitalize on existing assets, and provides recommendations for the City to bridge gaps. Although the greater vision for the Clean Tech Zone includes a variety of renewable energy and energy efficiency economic development opportunities, the focus of this report is solar and solar supply chain product businesses only. The evaluation and assessment was limited to solar economic development opportunities with the intention that the analysis process and recommendations could be helpful in creating additional opportunities.

Much of the information that supports this document was obtained from existing research, information, and opinions from multiple sources within the Sacramento area including the City, local businesses, local utilities, economic development groups, nonprofit organizations, and academic institutions. While the information is believed to be true and accurately represented, CH2M HILL has not performed an independent verification of this source data. Since the solar products industry is still maturing and constantly changing, the analysis, forecasts, and recommendations included in the report may not be realized in the future. The recommendations included herein are based on the market understanding when the document was developed. If new information becomes available, this report should be reviewed to determine whether revisions are needed. CH2M HILL assumes no legal liability or responsibility for the accuracy, completeness, or usefulness of any information disclosed, or represents that its use would not infringe on privately-owned rights. Company names, logos, and products mentioned herein are trademarks of their respective companies. Reference to any specific company or product is not to be construed as an endorsement of said company or product by CH2M HILL.

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Executive Summary

Project Background

The City of Sacramento, as part of a Solar America Cities grant awarded by the Department of Energy, is developing a Clean Tech Zone with the goal of creating a successful business environment focused on renewable energy and energy efficiency. The City retained CH2M HILL to provide an assessment and evaluation of the Clean Tech Zone area focusing on solar and solar supply chain products as a key energy sector that can serve as an anchor technology and catalyst for the development of the area.

This summary report documents the assessment and evaluation process and results, with conclusions that can be used as guidelines for solar and solar supply chain focused investments.

Clean Tech Zone Overview

The Clean Tech Zone designated by the City includes several areas with different boundaries and designations, including the Power Inn Alliance, Clean Technology Enterprise Zone, Recycling Market Development Zone and Regional Innovation/Technology Zone. This area covers over 5,000 acres and contains more than 2,000 businesses, Sacramento State University, and the SMUD Headquarters Building. While the area has traditionally been one of the City of Sacramento's warehouse and distribution centers, it is also home to several recycling companies.

The Power Inn Alliance and other area stakeholders have begun an effort to transition the area from its historical uses into an integrated, mixed-use area with a focus on Clean Technology. Several recent developments in the area have already begun the transition, including the developments at Granite Park and Depot Park, the City's long range plan for 140 acres of the area as an Innovation/Technology Park, the planned extension of Ramona Ave connecting Sacramento State to the area, and the relocation of SARTA into the area.

A high-level review of the Clean Tech Zone was conducted focusing on solar industry. This review looked at a wide variety of factors including transportation, land and buildings, existing land uses, incentives, general appearance and brand, community support and services, and electric power.

In evaluating Sacramento's options for developing a solar industry cluster, CH2M HILL conducted a series of interviews with representatives from many entities and City partners in the area. These groups were selected by the City and represented the City, higher education and training, businesses, and economic development group, in the Zone.

Those interviewed were generally positive about the area and felt that there were many attributes that could make the Zone successful, including location, City and area business support, availability of land and buildings, ongoing improvement efforts and the involvement of Sacramento State and SMUD. However the City, its partners, and

shareholders also recognize that there is significant work still to be done to realize the City's goals.

Industry Overview

The solar industry in general presents a great opportunity for long term economic development and job growth. However, specific opportunities in various solar sectors have unique characteristics that are best suited for different environments. To be successful in solar economic development, an understanding of the various solar sector characteristics and needs is critical. Once this understanding is developed, Sacramento can use this evaluation and assessment to better position and target its efforts.

Power Inn Clean Tech Zone Evaluation Criteria

Based upon CH2M HILL professional experience, a list of the factors most important to solar companies and their supply chain were compared to the assets and challenges of the Zone and presented in a comparison matrix.

The comparative evaluation indicates that the Clean Tech Zone has several strengths but also faces challenges that need to be overcome to compete in attracting new solar products businesses in certain sectors, particularly in manufacturing. These challenges are not insurmountable but will require investment and effort by the City and its partners to shift criteria evaluated as *Poor* to *Fair* and *Good*.

Conclusions and Opportunities

Findings compiled from interviews, review of published data and information, and CH2M HILL knowledge and experience in the solar industry indicate that the Clean Tech Zone has some key advantages as well as challenges to become a desirable location for various sectors of the solar industry.

As of the completion of this report, CH2M Hill believes that the Clean Tech Zone area has opportunities for development of the solar industry but they are limited in the near term (the next 1 to 3 years) to downstream sectors with lower technology and investment requirements that can leverage the area's construction workforce. Included in this category are small scale solar product assembly operations, and installation and energy generation businesses. Significant changes and substantial investment and incentives are needed to cultivate the conditions required for longer-term opportunities in development of technology intensive manufacturing. Efforts need to include continued improvement of the Zone for the industry, and marketing the attributes of the area as an attractive location.

Product Improvement

The City and its partners have already begun a number of efforts to improve the product and its potential to develop solar industry in the area. Continued focus on both near and long term improvement activities, along with implementation of the recommendations in this report will be required for any solar economic development activities to be successful.

Near term activities should be focused on cleanup activities and improvement in image and identity in the Innovation/Technology Village area and could include:

- Continue to push the project to extend Ramona Avenue and connect Sacramento State, SMUD and other commercial entities with light rail
- Develop an inventory of facilities and available sites
- Build on the coalitions and collaborations that exist in the region
- Leverage successes in recruiting solar businesses to other parts of the Sacramento region.
- Support local existing or start-up solar companies
- Expand or create incentives specific to the Innovation/Technology Village area or to the Clean Tech Zone in general and work to eliminate any disincentives. These incentives need to be focused on lowering capital cost, or the cost of operations for targeted businesses in the solar industry.

Longer term improvement activities should include:

- Continue evaluation of the transportation systems
- Encourage commercial services
- Develop local market for solar products
- Investigate opportunities for applied solar research projects
- Create high visibility solar installations in the area
- Increase connectivity with the San Francisco Bay Area, specifically the solar sector
- Expand the assistance being provided by SARTA and others

Marketing

While initial marketing can be started immediately, resources for a full-scale marketing effort for the area should be engaged after work has occurred to create, improve, and refine specific benefits and advantages in the Clean Tech Zone for sectors in the Solar Industry (improving the product).

Under separate cover, CH2M HILL has contributed to a draft RFP based on current conditions to engage these marketing resources.

Future Opportunities

Development of a Solar and Clean Tech cluster in the area is not a short-term process and will require long-term commitment on the part of the City, its partners, and area businesses. Future opportunities to support and cultivate solar economic development in the Clean Tech Zone could include expanding public transportation, increasing commercial and surrounding residential development, consolidating recycle businesses, and continuing to develop awareness of the Zone as an attractive location for the solar industry, especially in nearby technology cluster like the Bay Area.

SECTION 1

Project Background and Overview

This section provides background and overview information on the Clean Tech Zone project (project or Zone).

1.1 Goals and Scope

In 2008, the City of Sacramento (the City or Sacramento) was announced as one of 12 U.S. cities to receive a Solar America Cities grant from the U.S. Department of Energy. Part of the grant was earmarked to develop the designated Clean Tech Zone into a successful business environment focused on renewable energy and energy efficiency. The City of Sacramento asked that the scope of this project focus on solar and solar supply chain products as a key energy sector that can serve as an anchor technology and catalyst for the development of the area.

The goal of this project is to provide the City with an assessment and evaluation of the Clean Tech Zone. This summary report documents the assessment and evaluation process and results, with conclusions that can be used as guidelines for solar and solar supply chain focused investments. In addition, this report provides the basis for a draft Request for Proposal (RFP) to develop a marketing plan for highlighting Clean Tech Zone attributes.

CH2M HILL is a global design, construction, and program management company with substantial experience working for solar manufacturing companies seeking new production locations and facilities.

CH2M HILL was retained by the Solar America Cities program to provide technical assistance to the City in executing two tasks:

- Assess and evaluate the Clean Tech Zone as a potential location for solar and solar supply chain businesses. Complete a summary assessment and evaluation report to include the following content:
  - Review of existing conditions and information on the Sacramento area and Clean Tech Zone based on research, interviews with stakeholders, and tours of the Clean Tech Zone and surrounding areas.
  - Overview of the solar industry and background relevant to developing the area and marketing the area for this target.
  - Evaluation of the Zone based on a matrix that identifies strengths and weaknesses compared to the requirements of solar and solar supply chain product businesses based on CH2M HILL experience.
  - Strategies for bridging gaps and overcoming barriers.

- Prepare a draft RFP, based in part on the findings of the assessment, to contract a marketing company to create a targeted marketing plan for the area. The RFP draft is a separate document not included in this report.

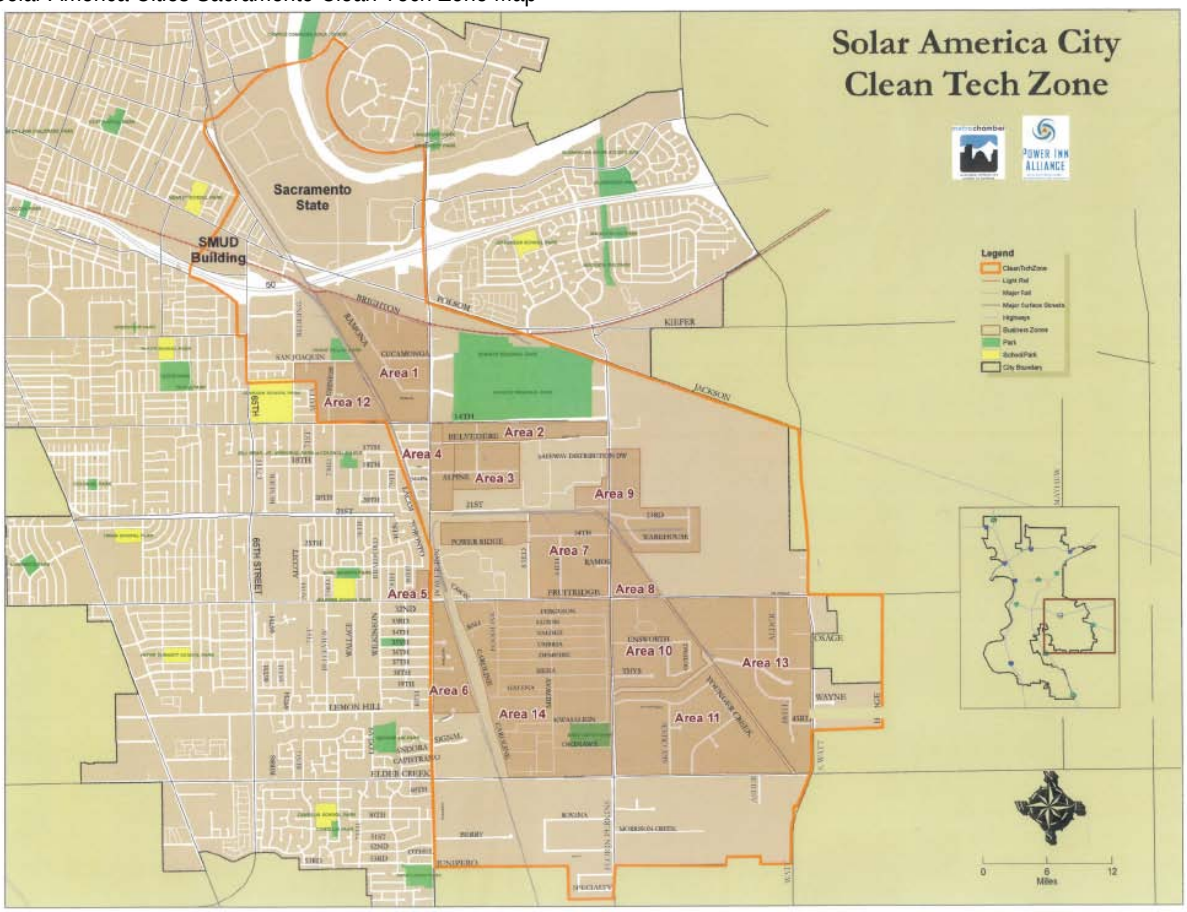
1.2 Approach and Activities

CH2M HILL approached this project from the perspective of solar industry businesses considering expansion or relocation investments. Although the focus of the study is the specific area identified in Figure 1, the Clean Tech Zone, CH2M HILL also considered aspects of the Sacramento region that may affect the Zone's potential, as regional components are often large factors in site investment decisions.

In following this approach, CH2M HILL performed the following general project activities:

- Reviewed relevant existing data and information that has already been developed for the Clean Tech Zone area and the Sacramento region, including multiple California and national "Clean Tech" jobs and other Sacramento specific plans, as well as RFP templates from Sacramento and other cities.
- Visited and toured the Clean Tech Zone to develop an overall sense of the geographic, demographic, economic, and environmental factors in the area.
- Conducted interviews with individuals from private and public entities that have a stake, interest, or unique knowledge in developing the area or of solar businesses to understand nonphysical characteristics of the area.
- Developed a report that provides an evaluation of the area, a comparison matrix of how it compares to industry requirements and suggestions on how to improve the chances for success.
- Developed a draft RFP for a marketing plan for the area based in part on the findings of the report.

FIGURE 1
Solar America Cities Sacramento Clean Tech Zone Map



SECTION 2

Clean Tech Zone Overview

This section provides an overview of the Clean Tech Zone area, stakeholder interview themes, and the general area.

2.1 Area Overview

The Clean Tech Zone designated by the City is shown in Figure 1. The Zone includes several sub-areas with different boundaries and designations, including the Power Inn Alliance, Clean Technology Enterprise Zone, Recycling Market Development Zone and Regional Innovation/Technology Zone. This area covers over 5,000 acres and contains more than 2,000 businesses, Sacramento State University, and the SMUD Headquarters Building. While the area has traditionally been one of the City of Sacramento's warehouse and distribution centers, it is also home to several recycling companies.

Sacramento is the capital of the State of California with over 2.3 million residents making it the 25th largest metropolitan statistical area in the U.S. The economy of the Sacramento area historically has been dependent on employment in government, trade, transportation and utilities, professional and business services, and educational and health services. These sectors make up over 60 percent of the regions employment. The region does not have a large manufacturing base, with manufacturing representing only 6 to 7 percent of employment.

The fastest-growing sectors are in educational and health services and professional and business services. Government has expanded until recently but employment in this sector is expected to decline. In response to many studies forecasting the "Clean Tech" economy as the largest employment and economic development engine of this generation, the Sacramento region has recently developed programs and planning efforts to diversify its economic base in this direction.

An effort by the Power Inn Alliance and other area stakeholders to transition the area from its more traditional uses into an integrated, mixed-use area with a focus on Clean Technology has resulted in the following Vision and set of Guiding Principles:

- Development Goal to become a hub for businesses that support innovation, sustainability and job growth
- Transportation Improvements
- Mixed-Use Development in an Innovation Village
- Maintain a Clean and Sustainable Environment
- Change the Image of the Area

Recent developments have started this transition, including the Granite Park office development and the mixed-use Depot Park. The City and its partners have initiated a long-range development plan for 140 acres in the northern portion of the area to create an Innovation/Technology Village. This plan envisions an integrated development that will reach from the Sacramento State Campus to Granite Park. A key factor will be the extension of Ramona Avenue, which will connect the development area with the University. The plan has just begun but it is anticipated that the area will include technology-based businesses in the clean energy, green technology, biomedical and biotechnology sectors. The area will also provide opportunities for development of housing, general retail, and other goods and services to serve the area. The plan should be completed and adopted in early 2012.

The relocation of SARTA into the Granite Park area and the establishment of a business incubator at the site is also a positive activity.

2.2 General Overview of Area

Although this study is an analysis of the area as a location for the solar products industry, it is important to provide an overall review of the area's general characteristics for industrial purposes.

The following discussion of the Clean Tech Zone is a high-level review of the Clean Tech Zone area on topics relevant to many industrial uses, including solar products.

- The area's designation as an Enterprise Zone is an advantage, providing tax and training incentives.
- Electric power is sufficiently available for most solar industry uses. Preliminary information from SMUD indicated that loads below 3 to 5 MW could be brought in without customer expense, and that loads above 3 to 5 MW would require a new onsite substation at the customer's expense. Either of these ranges could be brought online quickly in utility timescales, reportedly in less than 18 months.
- Electric power in the area is also reasonably priced. Power costs range from 6 to 10 cents per kilowatt-hour (kWh), which is good to mid range compared to other areas in competition for solar product manufacturing. Economic Development incentives for power cost through SMUD are also available.
- As a developed industrial area there is an abundance of vacant warehouse/distribution space. This space may be suitable for some uses associated with the solar industry, but specific buildings need to be evaluated.
- Some vacant industrial properties and buildings in the area could be developed for industrial solar product purposes, however further studies and information on prior uses of each site and building needs to be developed to determine suitability.
- The area serves as a regional distribution hub, leveraging its generally good highway and rail access.

- The Power Inn Alliance is established and represents many of the companies in the area. As a Business Improvement District it has the ability to fund its activities through assessments to area businesses.
- Proximity to SMUD, UC Davis Medical Center, and Sacramento State University are positive aspects that can be further developed into specific and measureable area advantages.
- Sacramento city and regional entities such as the City of Sacramento Economic Development and Planning Departments, SACTO, SARTA, and Valley Vision, are actively engaged in the area and provide a network and method to coordinate future business recruitment and development.
- Proximity to the capitol and state entities was consistently reported as an area advantage.
- Depot Park and Granite Park developments have had some success in developing different uses and are committed to continue.
- The City is completing a Technology Zone-Specific Plan that will be a guiding document for a northern portion of the Clean Tech Zone.
- The planned extension of Ramona Avenue will connect the Zone to Sacramento State and other important uses north of Highway 50. If developed this connection will provide significant advantages.
- Adjacency to the light rail with a stop in the area provides good access for employees in the area.
- Proximity and easy access to the Sacramento International Airport is an advantage. Several other airports in the area can also accommodate large air traffic.
- Area is outside the flood plain and in low seismic zone.
- Some of the area consists of reclaimed landfills creating settling and off-gas issues. These conditions and prior uses are a cause of concern, including the possibility that larger environmental issues remain uncovered that could restrict future development.
- Although the area has good highway access, the internal street system includes many dead end roads and traffic interruptions.
- Much of the area is visually unattractive with many diverse uses interspersed. Lack of a unified identity contributes to the feeling that the Clean Tech Zone is several different disconnected areas. It doesn't have the feel of a well planned industrial park.
- There are currently very limited commercial support facilities for businesses and employees in the area.
- There appears to be a lack of technology or skilled operator/employees currently working in the area. These employees are required to support many solar product industries. While workers can be trained, the area will be competing against areas with experienced workers.

- Neither Los Rios Community College, or Sacramento State University have training or degree programs targeted toward manufacturing, one of the largest job creating sectors of the solar products industry.
- Los Rios Community College does have a Green Force Initiative with a focus on clean/ green energy including programs in energy management, energy auditing and green building.
- The area is the home to several recycling businesses and a composting facility which may be perceived as a drawback to companies that prefer to be near companies similar to themselves.
- Utility taxes in the City differ from those in the County, leading to price disincentive in the Clean Tech Zone compared to areas not in Sacramento proper such as McClellan Air Force Base.
- Housing inside the Clean Tech Zone is not compatible with planned industrial uses.

2.3 Stakeholder Interviews

In evaluating Sacramento's options for developing a solar industry cluster, CH2M HILL conducted a series of interviews with representatives from the following groups selected by City representatives with input from CH2M HILL:

- Sacramento Economic Development Department
- Development Department, Long-Range Planning Division
- Sacramento Area Regional Technology Alliance (SARTA)
- Los Rios Community College
- Bagatelos Architectural Glass Systems
- Sacramento Municipal Utility District (SMUD)
- Sacramento Area Commerce and Trade Organization (SACTO)
- Granite Park
- Valley Vision/Green Capital Alliance
- Sacramento State University
- Depot Park
- Power Inn Alliance

2.3.1 Stakeholder Interview Themes

The following themes, in no particular order, appeared in CH2M HILL interviews with stakeholders:

- The extension of Ramona Avenue to connect Sacramento State and the rest of the Clean Tech Zone is critical to the development of the area.
- Sacramento State University and SMUD are both important resources for the Zone, but their specific contributions are as yet undefined.
- McClellan Industrial Park has been successful at attracting clean-tech businesses and is considered by many as a competitor to the Clean Tech Zone.

- Proximity to the state capital, the seat of progressive policy making, was consistently reported as an advantage.
- Proximity to the San Francisco Bay Area is a benefit, but Sacramento needs to improve its reputation and negative perceptions of business climate for technology linked activities.
- Sacramento could benefit from creating a stronger link to solar and other high-tech industries in the Bay Area.
- The Clean Tech Zone area has many vacant buildings and available land for development.
- City support for the area is viewed by most as a strong asset.
- Transportation access is good.
- There is a good cooperative working relationship between all of the private and public entities that are involved or support the areas development.
- Power Inn Alliance has ongoing efforts to improve the area and the participation of over 600 businesses.

SECTION 3

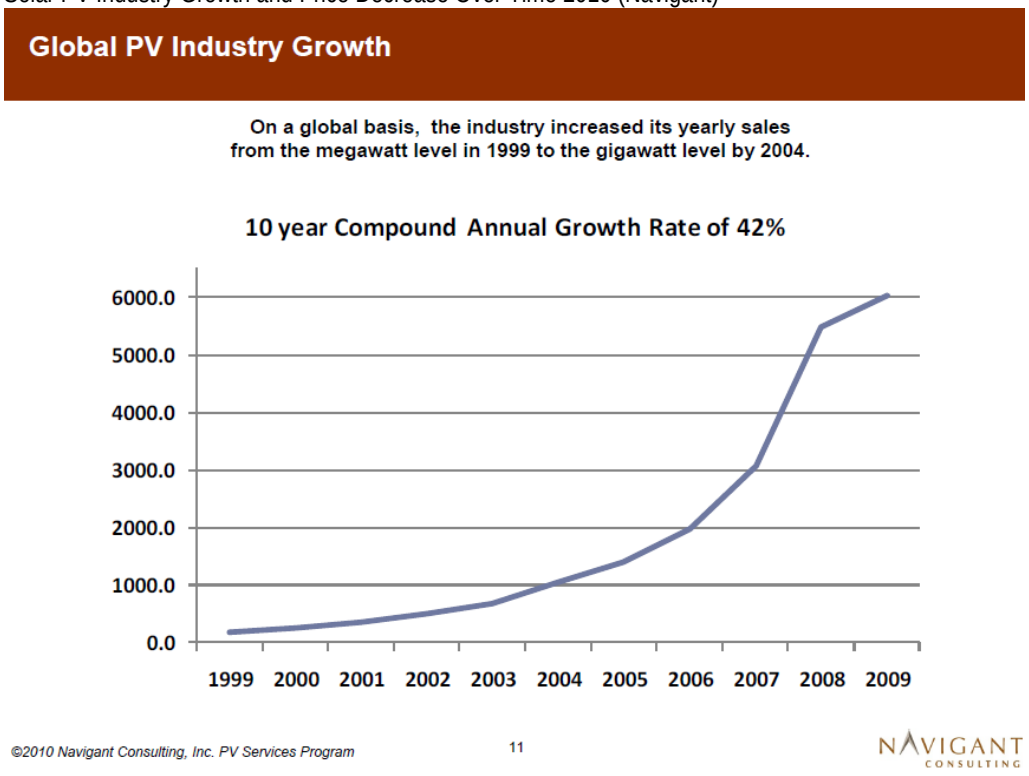
Industry Overview

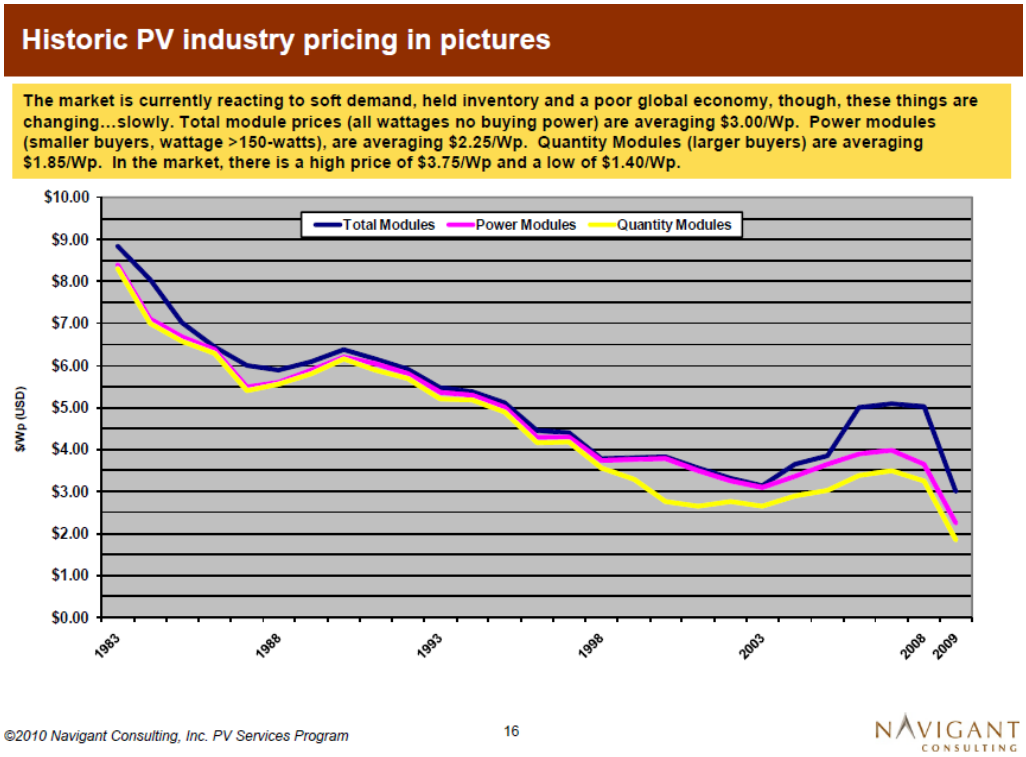
The purpose of this section is to present a basic overview of the solar products industry and its drivers.

3.1 Industry Status

Solar energy generating technologies are a critical component of the future of energy and economic development in the United States and the world. The target of large investments from the U.S. government and private sources, the solar energy industry has huge potential because it uses one of the few viable long-term and predictable energy sources (the sun), has reasonable and regular forecasts for increasing performance and decreasing cost, and has the potential for wide and deep positive economic impacts. Widespread adoption of distributed and centralized solar systems can also replace or delay the need for new conventional energy infrastructure with significantly reduced impact on the environment. Together these factors have led to solar energy technologies driving a range of business and job creating opportunities, including manufacturing, assembly and distribution, and installation of solar products and their various support services. Figure 2 shows solar industry growth and price decreases over time.

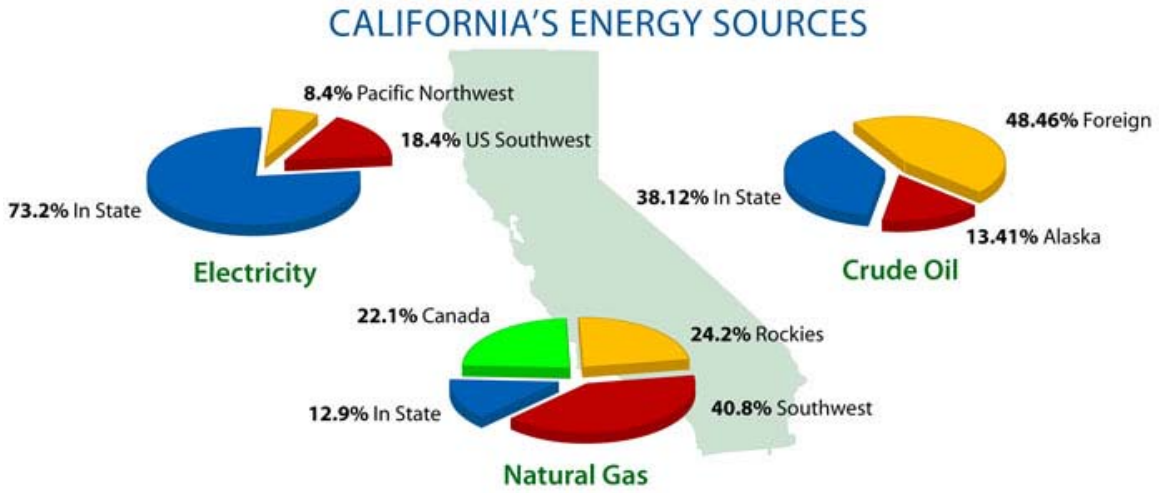
FIGURE 2
Solar PV Industry Growth and Price Decrease Over Time 2010 (Navigant)





California produces most of its energy in-state, primarily from natural gas and coal, as shown in Figures 3 and 4. Despite the recent growth in California's solar energy systems, solar energy does not yet make up a significant portion of the electricity generated or consumed in California. However, this statistic is changing. California has set a very ambitious Renewable Portfolio Standard (RPS) target of 33 percent by 2030, and political and popular will appears to support the investment required to reach it. While some of the renewable energy mandated by the RPS will be generated by wind and other sources, a healthy percentage will come from solar.

FIGURE 3
California's Energy Sources 2009 (California Energy Commission)



California is put forward worldwide as a prime economic benefactor of solar energy development for a few key reasons. Aside from having progressive and solar energy focused policy makers and aggressive targets, California is a primary source of solar energy technologies and unique business platforms, and one of the world's largest potential solar product markets because of its generally good solar resources, population distribution, and electric demand profiles.

FIGURE 4
California Electric System Breakdown 2008 (California Energy Commission)

2008 Total California System Power in Gigawatt Hours					
Fuel Type	**In-State Generation**	**Northwest Imports**	**Southwest Imports**	**Total System Power**	**Percent of Total System Power**
Natural Gas	122,216	2,939	15,060	140,215	45.74%
Coal	3,977	8,581	43,271	55,829	18.21%
Nuclear	32,482	747	11,039	44,268	14.44%
Large Hydro	21,040	9,334	3,359	33,733	11.00%
Renewables	28,804	2,344	1,384	32,532	10.61%
Biomass	5,720	654	3	6,377	2.08%
Geotherma	12,907	0	755	13,662	4.46%
Small Hydro	3,729	674	13	4,416	1.44%
Solar	724	0	22	746	0.24%
Wind	5,724	1,016	591	7,331	2.39%
Total	**208,519**	**23,945**	**74,113**	**306,577**	**100.00%**

Most solar industry analysts agree that the long-term case for solar energy growth in California is convincing, however, it is important to realize that solar energy growth will not drive positive economic growth in the same way for all locations. Local economies, geographies, solar resources, demographics, workforce, marketing and outreach, and development strategies will all have important impacts on how and when different regions and cities in California benefit from the pending growth in the larger solar industry.

To effectively drive solar economic development strategy, it is important to understand some basic industry trends in solar technology, markets, and supply.

3.2 Solar Energy Technologies

For the purposes of this report, solar energy technology can be divided into a few broad categories, including photovoltaics (PV), solar hot water (SHW), and concentrating solar power (CSP).

3.2.1 Photovoltaics

Photovoltaic technologies can be applied in centralized power plants or distributed on residential or commercial rooftops. PV panels use the sun's energy to generate electricity directly in a solid state process enabled by semiconductor materials, require maintenance limited to cleaning, and have usable lives of 20 to 30 years.

PV can be used with or without tracking technologies, and with or without optics to concentrated sunlight. While there are advantages and disadvantages to the various PV

options, and as a result many application niches for different PV products, it's key characteristics are reliability, longevity, versatility in application, and scalability.

3.2.2 Solar Hot Water

Solar Hot Water technologies are typically applied in residential or commercial applications, and use the suns energy to generate hot water required by the user (e.g., for personal use, or for commercial processes), or heat for space heating applications. Solar Hot Water systems typically lower utility requirements for electricity or natural gas, and have 20- to 30-year lives and maintenance that varies depending on the system configuration. Unlike PV, SHW systems typically have moving parts like pumps and valves.

Solar Hot Water systems can be flat plate type, or evacuated tube type, each supporting slightly different user needs, and also configured differently to be best suited for different climate zones and user preferences. While each of these SHW niches have advantages and disadvantages, the most important detail to consider is that SHW systems are intended for residential or commercial applications and generate heat and not electricity.

3.2.3 Concentrating Solar Power

Concentrating Solar Power technologies are exclusively applied in large scale power plants because of their economies of scale. In most CSP applications, the sun heats a working fluid that directly or indirectly drives a large central turbine-based power block to produce electricity. In other CSP applications, the core technology is a set of small sterling engines that use closed loop gas systems to drive generators and produce electricity.

Concentrating Solar Power systems can be configured to provide some energy storage, enabling them to continue to produce electric power after sunset, or through cloudy parts of the day. CSP technologies are best suited for areas with consistently clear skies, and also depend on precision tracking devices. The power block used by CSP systems have many of the same constraints as conventional power plants.

Each of these technologies utilizes a different set of materials, requires a different set of core sciences, and is best suited for a different setting.

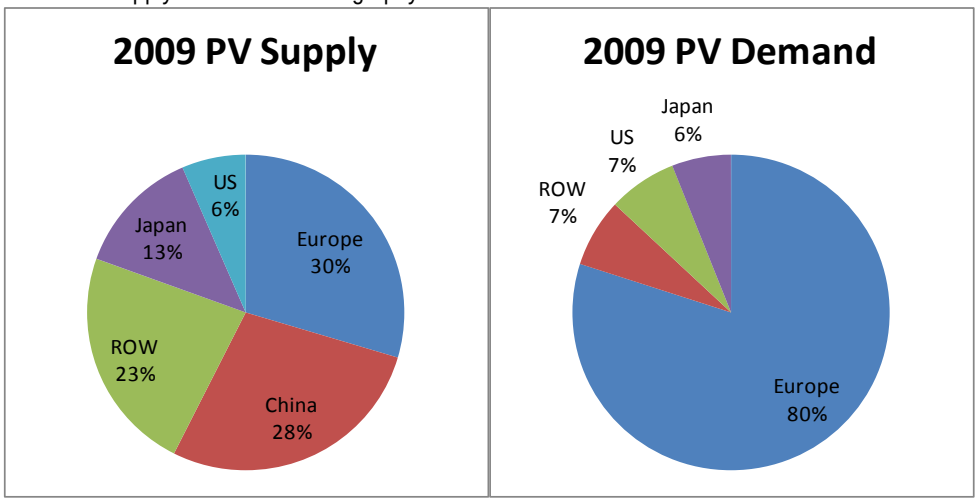
3.3 Solar Energy Markets

The solar energy market has been generally growing very quickly, and also changing. Solar energy applications have become mostly on grid, but grown both in rooftop and central power plant applications in different locations. Different technologies are best suited for different markets, and the solar energy industry is maturing and becoming more sophisticated and differentiated.

New markets are being opened by third-party and community solar arrangements, where incentive structures based on renewable energy credits or tax-based rebates or credits and economies of scale create benefits for parties beyond energy users. Utilities are also participating to different extents, acting in many different roles. As seen in Figure 5, China is supplying a substantial portion of the world's PV solar products (China also supplies a large percentage of the worlds SHW solar products). Notably, the Rest of the World (ROW) category also supplies a healthy portion of the PV product supply. On the demand side,

Europe was a hugely dominant market for PV and other solar products due in part to substantial subsidies. Forecasts show that China will increase its share of production, and that California demand will begin to grow in earnest in the next few years.

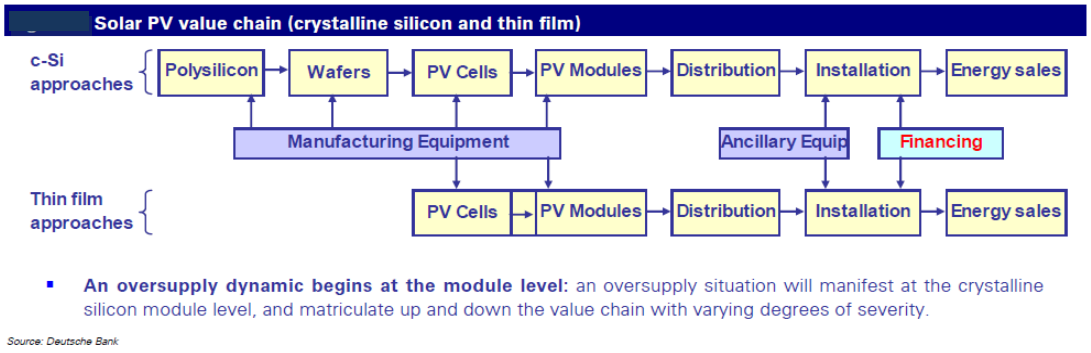
FIGURE 5
Global PV Supply and Demand Geography 2009



3.4 Solar Energy Supply

As previously mentioned, the growth of the solar energy industry overall means the expansion of many separate parts of solar energy product value chain, with different activities having distinct business requirements and drivers of success. Understanding these differences is critical to forming a useful solar energy economic development strategy for Sacramento. Figure 6 shows a graphical representation of the PV value chain. PV is one of the more intricate value chains. While SHW and CSP technologies would have different materials and components, for example optics and mirrors compared to wafers, the right side of Figure 6 should be similar.

FIGURE 6
PV Solar Supply Chain (Deutsche Bank)



For this report, CH2M HILL has divided the solar energy supply chain into a few manageable categories that apply across each of the technologies being discussed.

3.5 Manufacturing and Assembly Activities

Recent economic growth in the U.S. from solar is significantly driven by solar product manufacturing activities, and associated research and development. Figure 6 shows this set of activities, and is specific to PV, which is currently a larger market than SHW in California and in the United States. SHW manufacturing is a simpler product than PV, using generally more available materials. CSP manufacturing activities have some high tech components, but generally also depend more traditional manufacturing materials, including glass, steel, and some specialty metals. Despite these differences, these technologies can be thought of in a similar way for economic development. The primary drivers for manufacturing activities are those that impact facility start up and operating costs and influence the cost of goods sold, or the ability of the business to reduce cost and increase performance over time through technology and manufacturing improvements.

Manufacturing and assembly operations are somewhat centralized, and at production scale, have capacities dictated by economies of scale more than available investment. It is important to note, however, that different technologies and different portions of the value chain in each technology have different economies of scale. To competitively produce PV cells, for example, requires very large investments and annual outputs of more than 100 MW, potentially up to 1,000 MW. Similarly CSP component manufacturing is mostly suited for very large scale and requires large investments. To assemble PV modules for residential rooftops, on the other hand, the investment required is far more modest, and annual outputs could be matched down to 10 MW annual, potentially closer to local area demand. The scale of these opportunities also varies between these different industrial activities.

As would be expected, manufacturing and assembly operations have needs for various support businesses including equipment maintenance, gasses and chemicals supply, warehousing and distribution, legal, financial, and other services. Manufacturing or assembly-related business needs for these services, their general focus, and their specific business drivers change over time, and small start-up companies are different from mature and diversified global players. Figure 7 illustrates how a solar manufacturing company can mature, and how its needs change through this maturity.

FIGURE 7
Solar Industry Maturity Matrix

Solar Site Selection Variables by Solar Manufacturing Company Development Stage	Research and Development	Development/ Prototype and/or First Factory	High Volume Manufacturing
Proximity to Technology, Education and Research	VERY HIGH	HIGH	LOW
Proximity to Funding Source	VERY HIGH	MEDIUM	LOW
Site Availability and Schedule Readiness	VERY HIGH	VERY HIGH	VERY HIGH
Proximity to Markets	HIGH	HIGH	VERY HIGH
Incentives	HIGH	VERY HIGH	VERY HIGH
Labor Costs	HIGH	HIGH	VERY HIGH
Electricity Availability and Costs	HIGH	HIGH	VERY HIGH
Financing and Tax Climate	HIGH	VERY HIGH	MEDIUM*
Leased Building	MEDIUM	VERY HIGH	LOW
Proximity to Suppliers	MEDIUM	MEDIUM	HIGH
Public Policy	LOW	HIGH	VERY HIGH

*Taxes May Remain Important

Relative Importance Scale	
VERY HIGH	A Deal Maker or Breaker
HIGH	Competetive Advantage
MEDIUM	An Attractive Quality
LOW	Nice-to-Have, Not Essential

3.6 Installation and Energy Generation Activities

Installation activities around solar energy will also have a profound effect on solar energy economic development. The primary drivers for installation and energy generation based economic development activity in a specific region is the confluence of high existing energy costs, good solar resources, and incentives and government support.

Installation-related activities can grow around centralized or decentralized solar generation hubs. Installation activity often parallels construction activity. Solar system value is generally split between solar equipment, and installation labor.

As would be expected, installation activities have needs for various support businesses including financial, legal, warehousing and distribution, and other services.

Sacramento is well positioned to participate in the California's host of solar-related economic development opportunities. Sacramento's attributes alongside the site-specific attributes of the Clean Tech Zone sites will drive a set of opportunities. In the following sections, CH2M HILL's analysis will show matches and mismatches for the Clean Tech Zone and the solar industry, contributing insight and strategy into future development.

SECTION 4

Power Inn Clean Tech Zone Evaluation Criteria

This section provides an assessment of the Zone's assets and challenges relative to the needs of the solar manufacturing industry. The evaluation factors analyzed have been identified based on CH2M HILL's professional experience working with solar products companies.

4.1 Solar Industry Requirements

Multiple critical business and operating characteristics are important to solar companies and their supply chain. The following sections review critical location factors for solar industries. A brief discussion of how Sacramento compares to these requirements is included in Section 4.3.

For purposes of this section we have grouped the solar industry into 3 categories.

- Manufacturing
- Assembly
- Installation

In the discussion of the industry requirements we have provided a brief summary of what the requirement means for each of the categories above. Also in some instances we have addressed photovoltaic (PV), Solar Hot Water (SHW), and Concentrating Solar Power (CSP) separately where their requirements are significantly different.

4.1.1 Public Policy Toward Solar and Renewables

The states and regions that have been most successful in developing the solar industry have adopted public policies that target and support the solar PV industry including manufacturing. These include financial incentives as well as Renewable Portfolio Standards (RPS) goals and requirements, solar PV research programs, Feed-in-Tariffs, manufacturing production off-take (guaranteed purchase a portion of a manufacturing company's output) programs, and incentives to encourage installation of commercial and residential solar system. The visible commitment by the public and private sectors in these areas is increasingly playing a factor in selecting a location.

A regulatory environment that is supportive and easy to understand and use is often overlooked by communities but is an important part of creating a supportive environment. Important features of a positive environment can include:

- Public officials and entities that understand the industry and its needs.
- Development permitting processes and rules that are fair, understandable and can be met quickly.

Manufacturing operations are most interested in policy and regulations that support and enable low cost of production. However, policies that affect and encourage the use of solar

products can influence the site selection process, specifically through "Off-Take" agreements. Off take agreements typically mean a commitment by a city or other public body, utility or other entity to purchase more than a small percentage of a facility's output. These commitments are an important factor in site selection decisions. The larger the percentage and length of commitment the better, as it can provide a basis for project financing and facility size. Many companies are requesting off takes as part of an incentive package for locating a new facility.

For assembly and installation companies, public policy and commitment to the solar industry is one of the most important factors in considering a location. Consistent local demand for PV product is the key driver for their business.

4.1.2 Proximity to Research and Technology

Proximity to research and technology centers is particularly important to solar manufacturing companies that have proprietary technology and are looking to build their first or second factory. It can also be important to headquarters operations that include research functions. These companies like to be close to technology centers and want strong relationships and access to higher education and research. Proximity, within a 1 hour drive, is important to be able to meet with, interact, and communicate with other researchers and technologists in similar fields.

Proximity to research and technology is less important to assembly and installation companies, who are much more driven by markets. It is also less critical for companies that have moved to high volume manufacturing.

An additional consideration is that proximity can provide the catalyst for the creation of new companies and more effective technology clusters. In many cases, the potential for creation of new companies is as or more important than the attraction of existing ones.

4.1.3 Education and Training

Education and training resources for a site are particularly important to companies that have proprietary technology or are building their first or second facility. A driving distance of greater than 1 hour could be prohibitive. Driving distances of fewer than 30 minutes are preferred.

Training resources vary depending on technologies and markets. The typical employee in manufacturing and assembly functions differs from the typical employee in installation and energy generation functions, as illustrated in Figure 8.

FIGURE 8
Solar Industry Training Programs and Job Functions

Core Manufacturing and Assembly Jobs	Core Installation and Energy Generation Jobs
• Electrical Engineering • Materials Science • Industrial Engineering • Chemical Engineering • Mechanical Engineering • Equipment Maintenance • Production Operators • Quality Control Technician • Facilities Engineering	• Electricians • Solar System Designers • Building Evaluators/Assessors • Cost Estimators • Construction Managers • Plumbers

4.1.4 Site and Building Availability and Readiness

The availability of appropriate land and buildings is a key requirement for companies looking for a new location. Companies want to have several alternatives to consider in an area and look for land and facilities that can meet their requirements and schedule. Thorough knowledge and certainty of the development process can be critical in convincing companies to develop in an area. This includes permits, ease of transfer, environmental requirements, and infrastructure and incentives negotiation.

Sites for production scale manufacturing facilities, depending on technology and supply chain step, could require the following:

- 20 to 200 acres of useable space
- Readily available electric power capacity of 1 to 15 MW, depending on use
- No environmental restrictions, easements, encumbrances or other regulatory restrictions that will affect the use of the property and future expansion
- Surrounding uses that are compatible

Building reuse is also a priority for solar companies to meet aggressive cost and schedule goals. The highest tech manufacturing companies even consider using existing semiconductor facilities as they usually have the permits, process, and support systems they need. Buildings suitable for highest tech manufacturing functions should meet the following requirements:

- Interior clear heights of at least 20 feet and up to 30 feet would be required for some equipment
- Column spacing of at least 35 feet

- Heavy floor loading
- Adequate utility infrastructure including ability to provide electric capacity
- Ability and space for outside gas and chemical storage
- Ability to occupy without lengthy retrofit or regulatory approval process

Lower technology industrial uses like many product assembly operations also look at existing facilities rather than new Greenfield sites. The requirements for these companies vary widely but in general, are often available.

Facilities for these functions often have the following features:

- High bay warehousing or similar prior use
- Good truck access to the site and building
- Reasonably priced
- Can be occupied quickly without excessive permitting or regulatory processes

Installation and energy generation companies often need very little in the way of facilities, and are typically driven by other site selection factors.

4.1.5 Proximity to Transportation and End Markets

As North American and especially California solar markets grow, having manufacturing and assembly locations in close proximity will become more important. Transportation costs, which have not been a significant driver, will become increasingly important. A significant increase in fuel costs could make being near end markets an opportunity for cost reductions that solar industry companies need to stay competitive. The growth of large utility scale projects in many areas of the west and southwest U.S. could be a major driver in the location of manufacturing facilities.

Installation companies focused on small commercial and residential projects are expanded entirely based on local area market growth.

4.1.6 Workforce

Manufacturing facilities require a skilled manufacturing workforce, specifically, skilled equipment operators, process engineers, and maintenance technicians. Labor costs become more important as companies progress through the development stages from R&D/ prototype to high volume manufacturing, as seen in Figure 7. While labor is not the primary driver of operating costs in most solar product businesses, it does have a significant effect on manufacturing competitiveness. Low labor cost areas around the world are competing for these facilities. At smaller scales, especially for processes still being refined and developed, higher labor costs may be tolerated.

Assembly and installation companies are much more tolerant of labor cost differences, especially at small scales, and in these functions retraining coursework through local institutions can provide sufficiently skilled workers.

4.1.7 Electric Power Availability and Cost

Low electrical energy costs and good availability are primary drivers for the front end of the solar value chain. At the back end of the value chain, in installation and energy generation however, high electrical energy prices become a positive driver of solar site selection. As a result of this difference, solar installation and front end manufacturing are often not suited for the same area.

Many states and regions are aggressively targeting large, front-end solar factories and offer electricity as low as $0.03 per kWh. Many locations offer between $0.06 and 0.08 per kWh.

Areas aggressively targeting installation businesses are those with strong solar resources and existing electrical prices between $0.12 and $0.18 per kWh.

Energy costs and availability are not primary driving factors for many other solar supply chain steps, like PV module assembly, SHW collector manufacturing, most CSP component manufacturing, and general component assembly operations. SHW systems can compete with natural gas or electricity price structures in providing heat energy.

4.1.8 Incentives

Overall operating costs are a primary factor in locating nearly all types of solar industry companies. The key cost drivers include taxes, labor costs, utility costs, and building costs. Incentive programs that can meaningfully impact these criteria are critical, and gaining in importance.

Types of programs that have proven to be successful include the following:

- Cash grants and low cost or forgivable loans
- Tax credits that can be monetized to provide investment capital
- Tax holidays and abatements
- Programs that provide cash or cash equivalents that can be used for project development
- Research programs and partnerships for product development and improvement
- Off-take agreements

The provision of such services as infrastructure and employee training are provided by most locations and are expected.

Incentives targeted at increasing installations are important to the middle and end of the solar value chain. Also very supportive of this part of the value chain are reduced interest rate loans, grants, tax credits or refunds, and policies that allow third parties to participate. Regulatory reforms speeding up permit approvals and reducing paperwork and fees for installation activity can also greatly improve area prospects in the last half of the solar value chain.

4.2 Comparison Matrix

Figure 9 is a comparison matrix that summarizes the Clean Tech Zone's competitive position on critical factors compared with the requirements of parts of the solar industry value chain. The criteria used are not a comprehensive site selection list but include key factors that are currently considered important to measure and understand prior to

investment. The meanings of these criteria are discussed in Section 3.1. Poor, Fair, and Good ratings are qualitative, and not based on a standard scoring system, but are based on CH2M HILL knowledge of industry requirements, facilities, and experience in site selection, advanced planning, and business modeling.

FIGURE 9
Solar Industry Sector Evaluation Matrix for Sacramento

Sacramento Solar America Cities Clean Tech Zone Evaluation by Solar Industry Sector	Manufacturing	Assembly	Installation & Energy Genereation
PUBLIC POLICY TOWARD SOLAR AND RENEWABLES	Fair	Good	Good
PROXIMITY TO TECHNOLOGY AND RESEARCH	Poor	Fair	Good
EDUCATION AND TRAINING	Fair	Fair	Good
SITE & BUILDING AVAILABILITY AND READINESS	Fair	Good	Good
PROXIMITY TO END MARKETS AND TRANSPORTATION	Good	Good	Good
WORKFORCE	Poor	Fair	Good
ELECTRIC POWER AVAILABILITY AND COST	Fair	Good	Fair
INCENTIVES	Poor	Fair	Fair

Good
Fair
Poor

4.3 Comparison Matrix Explanation

As shown in Figure 9, the Clean Tech Zone has several strengths but also faces challenges that need to be overcome to compete in attracting new solar products businesses in certain sectors. These challenges are not insurmountable but will require investment and effort by the City and its partners to shift Poor (red) grades to Fair (yellow), and Good (green). Qualitative evaluations are relative to the needs of each sector.

In Figure 9, the "Manufacturing" column heading refers to technically intensive solar product production, including the production of raw materials like silicon, as well as solar product processes such as coating and deposition, etching, or metallization. "Assembly" refers to the set of production activities downstream of "Manufacturing" that include soldering and wiring, laminating, parts assembly, and testing. "Installation and Energy Generation" refers to the set of activities around the application of solar products into energy systems, including wiring or plumbing, constructing, permitting, testing, monitoring or maintaining solar energy systems. Business, financial, and legal structuring services would fit into the category they most closely support.

4.3.1 Public Policy Toward Solar and Renewables

California is recognized as a U.S. leader in policies and public initiatives that support renewable energy, and Sacramento is the seat of that policy-making. Support or incentives for use of PV, SHW, and CSP, will help create a market and demand for solar products and become incentives for manufacturing, assembly, and installation of products in the region.

- California's aggressive RPS program sets a goal for electric corporations to procure 33 percent of electricity from renewable energy sources by 2020.
- The Property Assessed Clean Energy (PACE) program, AB811, encourages consumers to have PV systems installed on their homes by reducing upfront costs and concerns about selling their home before pay-back.
- SMUD's recently announced Feed in Tariffs are also intended to strengthen the demand for PV products, however there is some skepticism about the program.[1] Analysts are concerned that the complexity of the tariff structure and the low rates will not attract as much investment as hoped.
- Solar for City Buildings: The City plans to enter into a solar power purchase agreement (PPA) in 2010 with a third party to install up to 5 megawatts of solar on City facilities.
- Solar PV for Utilities Administration Building: The City intends to install solar photovoltaics (PV) on the City's Utilities Administration Building.
- Solar Farm at 28th Street Landfill: The City is seeking a third party to finance a small scale solar (5 to 10 MW) farm in partnership with the City at the 28th Street Landfill. The request for proposals (RFP) will be circulated by summer 2010. SMUD will be assisting with the RFP and will contract with the successful bidder for power.
- Permit Streamlining: Using the Solar America Cities grant, streamline the permitting process for solar photovoltaic and thermal systems, including fees.

As mentioned in Section 3.1, manufacturers are more concerned with the cost of manufacturing than the local end-user market. As discussed in later sections, the existence of the California Clean Tech Zones and the recent passing of SB 71 are examples of positive public policy towards solar economic development. However, in general Sacramento's public policy towards the solar industry is not particularly distinguishable compared to nearby areas.

Together these factors lead to a relative scoring (see Figure 9) for the Clean Tech Zone of "Fair" for manufacturing, but generally "Good" for the less technically intensive, lower investment, and smaller economy of scale opportunities in Assembly and Installation and Energy Generation.

4.3.2 Proximity to Technology and Research

Sacramento State University's main campus is within the Clean Tech Zone providing a potential advantage to the attractiveness of the area. The University is focused on applied research. However, the University currently does not offer any specific research in the application of solar materials or manufacturing processes. Sacramento State officials did seem aware of this gap, and commented that they believe faculty interest and focus on solar research activities will increase over the next five years. Depending on the need for research

[1] Gipe, Paul. (2009). "SMUD Announces 'Feed-in Tariffs'-- But Can Program Deliver as Promised?" *Renewable Energy World*, August 11, 2009. Retrieved June 2, 2010 from http://www.renewableenergyworld.com/rea/news/article/2009/08/smud-announces-feed-in-tariffs-but-can-program-deliver-as-promised

and development expertise expressed by any potential front end solar manufacturing client, the opportunity for special arrangements with UC Davis could also be an asset.

The following new initiatives are being planned in and around the Clean Tech Zone that could improve its potential:

- Sacramento and the Clean Tech Zone are within 2 hours of one of the most technology- and business intensive solar clusters in the world, Silicon Valley. This proximity is an asset that many areas of the world would like to have, and needs to be developed further, as well as featured in part of any marketing plans.
- Development of the Alternative Power Engineering Degree through the Sacramento State Power Engineering Program would benefit the area's attractiveness for solar companies.
- Development of the Smart Grid Facility on the Sacramento State campus is a very positive step, especially if it could develop a solar specific focus.
- The proposed University Village Innovation Area could provide research space and initiatives to focus on solar.

Together these factors lead to a relative scoring (see Figure 9) for the Clean Tech Zone of "Poor" for manufacturing, but generally "Fair" for Assembly operation because of the level of technology and investment required. The area ranks "Good" for Installation and Energy Generation activities because it appears to a ripe marketplace with good channels and resources like SMUD to develop and distribute installation best practices, energy policy, and unique projects.

4.3.3 Education and Training

Although Sacramento does not appear to have a strong education and training history preparing employees for manufacturing jobs, it does appear to have strength in business, power and power engineering, energy efficiency, solar system design, and construction.

Assembly and installation companies do not require a highly trained workforce. It is likely that operator and technician level training could be developed as needed through the Community College system or through organized on the job training. Having training programs ready if and when local markets experience rapid growth would contribute to the competitiveness of Clean Tech Zone.

Together these factors lead to a relative scoring (see Figure 9) for the Clean Tech Zone of "Fair" for Manufacturing and Assembly functions because operator level employee training programs do not exist, but could be created in a short period of time. The area ranked "Good" for Installation and Energy Generation activities because it appears to have set of training institutions with direct experience working in energy efficiency, distribution, and construction and trade related occupations that are directly applicable.

4.3.4 Site Availability and Schedule Readiness

One clear attribute of the Clean Tech Zone area is availability of vacant land and buildings. Although there are numerous development opportunities, it is not clear how many, or

which of these assets are most appropriate for the different requirements of varying sectors in the solar supply chain.

Touring the area, it appears that most of the buildings were previously used in warehouse or distribution function. Preliminarily, these types of structures are best matched with solar product assembly, or lower tech solar businesses at the back end of the solar supply chain. A more thorough analysis of the building inventory would be required to determine which sites and building would be most appropriate.

In today's business environment, the availability of land and buildings is only a limited advantage and most cities and regions have abundant space available. A realistic analysis and inventory of the sites and buildings within the Clean Tech Zone would be valuable to understand which sites are ready and which buildings are the best suited for reuse in various parts of the solar supply chain.

For front end solar supply chain activities including technology intensive manufacturing, the 25 acre site owned by the University in the proposed Innovation Village has high potential. The Granite Park development also has sites that may be appropriate.

Elsewhere in the Clean Tech Zone, it appears that there are numerous land parcels and buildings that may be suitable for assembly and installation companies. Facility requirements in these sectors can usually be met by existing warehouse type facilities. Depot Park offers readily-available building space that could be suitable for these sectors and there appears to be other existing buildings for sale or lease that could be utilized.

Related issues in the Clean Tech Zone that will affect the use of the sites and buildings that need to be addressed include the following:

- Lack of commercial support services for employees and businesses
- Traffic congestion at peak travel times
- Image and identity of the area
- Real or perceived crime and security issues

Together these factors lead to a relative scoring (see Figure 9) for the Clean Tech Zone of "Fair" for Manufacturing because of the large inventory of available sites and buildings, despite the lack of history and area experience in manufacturing operations. For Assembly functions, the area ranked "Good" because of the general alignment on site and building requirements and inventory for Assembly operations. The area also ranked "Good" for Installation and Energy Generation activities because it appears to have accessible distribution lines, good solar resources, a supportive utility, and a local energy load profile amenable to solar production.

4.3.5 Proximity to Transportation and End Markets

California is and will be one of the largest solar product markets in the U.S., and potentially the world. Sacramento has easy access to population centers and strong solar resource centers in California through highway, port, and rail connections. The Sacramento region also has strong market potential from residential and commercial installations and local utility scale developments considered by SMUD and other solar developers.

These factors lead to a relative scoring (see Figure 9) for the Clean Tech Zone of "Good" for Manufacturing, Assembly, and Installation and Energy Generation. These attributes of the Sacramento area and the Clean Tech Zone, while of varying importance to different solar sectors, are competitive with other locations.

4.3.6 Workforce

Sacramento is not a traditional manufacturing economy and the Clean Tech Zone does not have many manufacturing companies or an experienced manufacturing labor force. Operator level manufacturing labor could likely be locally trained, but professional level workforce might need to be imported. Proximity to the San Francisco Bay area could provide a ready supply of skilled high-technology professionals needed, especially if operation include headquarters or R&D centers.

To attract solar manufacturing or assembly businesses, the cost of labor will have to be competitive with other markets in the U.S. Competitive markets have a labor costs for operators and maintenance specialists in the $28,000 to $30,000 per year range, with production operators in the $22,000 to $26,000 range. Asian markets can provide labor at a much lower cost, contributing to the rapid expansion of the solar industry in that part of the world.

These factors lead to a relative scoring (see Figure 9) for the Clean Tech Zone of "Poor" for Manufacturing, mostly because of existing skill-sets, but also because of cost. Assembly operations, having lower skill requirements for operators, scored a "Fair," and Installation and Energy Generation, based in construction and trade skills where Sacramento has direct experience, scores "Good."

4.3.7 Electric Power Availability and Cost

The area is well served with electric power by SMUD and has the capacity to provide up to 5 MW of power to most sites in the Clean Tech Zone without having to expand lines or sub stations. Large Industrial loads range between 6.8 cents per kWh (winter off-peak) and 14.7 cents per kWh (summer on-peak) with some economic development incentive rates available. This range of rates is comparatively low for California but is in the higher end of the range for companies considering locations elsewhere in the United States. Although the actual electric rate is somewhat competitive the City of Sacramento has a range of Utility taxes that create a disincentive between the City of Sacramento and the Clean Tech Zone and nearby county locations such as McClellan Park. Front-end solar manufacturing companies can be large power users making this additional cost potentially significant for this sector.

SMUD appears to be one of the most progressive and advanced solar utilities in the nation. Unfortunately, many of the other more advanced solar utilities are also in California. SMUD's presence in the area is a definite advantage in the city's ability to attract businesses to the Clean Tech Zone. However, both the City and SMUD need to work together to better define and plan the specific benefits and contributions that are possible.

These factors lead to a relative scoring (see Figure 9) for the Clean Tech Zone of "Fair" for Manufacturing when compared to competing locations with significantly cheaper industrial electricity rates. Assembly operations, having lower power requirements than

manufacturing, scored "Good" because within California electric power in the Clean Tech Zone is relatively inexpensive. Finally, the Zone scored a "Fair" for Installation and Energy Generation, based primarily on the more expensive energy in the rest of the state providing better relative competitive environment as close as West Sacramento.

4.3.8 Incentives

There are several incentive programs that can be provided to businesses considering expanding or locating within the Zone. The following programs are among those available on a City-wide or state-wide basis and are not specific to the Zone:

- Small business loan funds and loan guarantees
- Job training and employee support and recruitment
- SB71 Sales and Use Tax Exclusion for renewable energy manufacturing projects. This program has been adopted by the legislature and rules are currently being developed.

The following specific incentives are available in the City and Sacramento County on a case-by-case basis for new businesses that construct or expand facilities resulting in the creation of at least 50 full-time jobs with an average annual salary in excess of $25,000:

- Rebate of unsecured property Tax for a fixed number of years
- Tax exempt financing (industrial development bonds and other programs)
- Accelerated and individualized permit processing
- Tax increment financing
- Employment and training services
- Construction of offsite improvements
- Use of redevelopment dollars where appropriate
- Capital costs for wastewater pretreatment investments
- Fee rebates or fee deferrals for certain capital impact fees associated with new construction which creates permanent jobs. Fee deferrals would be "interest free" for targeted companies.

While all of these incentives are beneficial, they do not appear to provide unique advantages to the Clean Tech Zone. The availability of small business loans may be useful for installation and in some cases assembly operations but they are unlikely to provide much benefit to large manufacturing projects. SB71 will be more beneficial to manufacturing but actual benefit will not be clear until rules are adopted.

The most significant incentives specific to the Zone are provided by the Clean Tech Enterprise Zone designation. This program provides benefits that can be financially significant to a project through tax credits for employee hiring, sales tax credits, and favorable tax treatment for some expenses.

In addition to direct incentives, the city and state are providing incentives and policy direction to assist consumers of solar products which indirectly assists businesses in the solar supply chain by creating more market. These include the PACE program, loans and grants, RPS standards, feed in tariffs and incentives provided by SMUD.

Although the incentives available provide positive benefits they are not as significant or aggressive as those being offered through other state programs in more focused on the development of the solar industry. States and regions that are most active in recruiting solar investments are providing large cash incentives, tax credits that can be monetized, production off-takes, tax exemption, electricity rate reductions, targeted research services and partnerships, and tax holidays. Incentives focused on job training and infrastructure improvements are expected and not a differentiator. The recession has caused state and local governments to revaluate their business incentive programs, and many are in flux. Some areas have or are considering limiting incentives, while others are increasing incentives to stimulate the economy and create more jobs especially in the clean tech industries.

These factors lead to a relative scoring (see Figure 9) for the Clean Tech Zone of "Poor" for Manufacturing when compared to competing locations who have significantly more cash or cash equivalent offerings. Assembly operations, requiring lower investment capital, smaller economies of scale, and a more local orientation that manufacturing scored "Fair." Finally, the Zone also scored a "Fair" for Installation and Energy Generation, based primarily on the more or less equivalent incentives available elsewhere in the region and in the state.

SECTION 5

Conclusions and Opportunities

This section summarizes analysis findings compiled from interviews, review of published data and information, and CH2M HILL knowledge and experience in the solar industry. These findings are not listed in order of importance.

5.1 Key Advantages for Solar in the Sacramento Clean Tech Zone

Key advantages for solar development in the Zone are summarized below. Before these advantages are included in marketing plans or messages, CH2M HILL suggests that they be further developed, expanded, or refined, and that the specific benefits be measured from a solar business perspective.

- The City of Sacramento and local area businesses and partners appear to be committed to growing the Clean Tech Zone area as a home for solar businesses.
- The Sacramento region appears to be a strong marketplace for solar products, and a reasonable location for businesses driven by proximity to strong markets to locate.
- The Innovation Village plan appears to be a solid first step towards developing the Clean Tech Zone area towards higher value economic activities including the solar industry.
- The plan to extend Ramona Avenue between the planned Innovation Village and the Sacramento State University appears to be well thought out and crucial to the success of the area. It appears likely that this extension will occur, however the timeliness of the connection may influence the immediate attractiveness of the area.
- University Innovation/Technology Zone planning which will include improved access to University by extending Ramona Ave.
- The State of California and the City of Sacramento appear to have current and future plans for progressive and encouraging policy around the development of solar businesses throughout the solar supply chain.
- The State of California and the City of Sacramento appear to have current and future plans for progressive and encouraging policies supporting the market for solar products in both small distributed residential applications and large centralized power plants.
- Progressive California solar policies are often templates adopted or considered for many other locations in the U.S., so policy advantages, unique business structures, plans, or strategies that leverage them in California can progress smoothly to other markets as they develop. This provides an early mover advantage to businesses located in the State, and the benefits of being in a progressive cluster.

- Sacramento has strong solar resources compared to many regions in the U.S., and appears to have strong transmission access to large solar energy markets in the rest of the California.
- The Clean Tech Zone is in close proximity to Sacramento State, SMUD, and other key proponents and knowledge centers in the solar industry.
- The Clean Tech Zone appears well served by local utilities that could supply the needs of any solar industry users.
- The Clean Tech Zone appears to have excellent transportation access to the rest of California and to more distant markets via highway, air, and local ports.
- The Clean Tech Zone has the potential for light rail connectivity to Sacramento State and city center.
- Sacramento is a unique location for solar businesses who could benefit from close exposure to policy and rule making, standards development, or other regulatory issues for the State of California such as headquarters or industry associations.
- Available land and buildings provide opportunity for accelerated schedules and potentially reduced start up costs for some solar industry sectors.

5.2 Key Challenges for Solar in the Sacramento Clean Tech Zone

Key challenges for solar development in the Zone are as follows:

- Sacramento has a limited history of manufacturing, and limited available workforce and regulatory processes knowledgeable of manufacturing operations, permitting, and business drivers.
- The Clean Tech Zone does not have many unique advantages, and many advantages of the area also exist in nearby locations such as McClellan Park.
- Sacramento has a set of city utility taxes that create a competitive disadvantage compared to locations outside of the city.
- The Clean Tech Zone does not have a unified identity or look and feel of an industrial area.
- The Sacramento area currently does not have substantial research and development staff or equipment dedicated to any solar specific activities.
- Various places in the Clean Tech Zone have unattractive surroundings or strong odors from neighboring uses. These factors and illegal dumping and security problems create perceived risks to potential tenants.
- Portions of the Clean Tech Zone have been improperly filled creating settling and off-gassing, creating perceived building and environmental risk to development.

- Portions of the Clean Tech Zone are reportedly congested with auto and truck traffic during rush hours.
- The Clean Tech Zone does not have many commercial services that could support increased solar industry activity in the area.
- No large cash incentives available.
- Recycle and compost facilities are scattered, increasing the perception of trash and strong smells in the area.
- Reported crime and security concerns, and illegal dumping.

Based upon the findings summarized above, CH2M Hill believes that the Clean Tech Zone has the potential to be a good location for the solar manufacturing and solar products industry if the City and its partners continue to make improvements to the area and actively market the area as a location for the solar industry. Both of these activities need to be pursued but the primary emphasis in the near term should be improvements in the area to make it a product that meets the needs and requirements of the solar industry. Initial marketing activities should be focused on identification of potential companies and making them aware of the current and planned opportunities in the area with more aggressive target marketing increasing as the area is improved. Having a good product is critical and can't be overcome with marketing alone. The next section will outline recommendations and activities that can be undertaken to make the Zone a good location for the solar industry.

SECTION 6

Recommendations and Next Steps

As of the completion of this report, the Clean Tech Zone area has limited opportunities in the near term (the next 1 to 3 years) to become a high tech solar manufacturing center. Significant changes and substantial investment and incentives are needed to cultivate the conditions required for longer-term opportunities. In the short term, the Clean Tech Zone provides immediate opportunity as a location for lower tech, smaller scale, solar product assembly operations, and installation and energy generation businesses.

Recommendations and next steps are best categorized into two serial activities:

- Improve Clean Tech Zone product, and make key changes to tailor the area to the solar industry
- Market the Clean Tech Zone to the solar industry

6.1 Improve Clean Tech Zone Product

The City and its partners have already begun a number of efforts to improve the potential to develop solar industry in the area. Continued focus on improvement activities, along with strong implementation of the recommendations in this report will be required for any solar economic development activities to be successful. This report, and other parallel work, can create more common understanding of the requirements and needs of various solar industry sectors. Such understanding is the first step toward creating the advantages needed to be successful.

6.1.1 Recommended Near-Term Improvement Activities

- Continue to push the project to extend Ramona Avenue across Highway 50 into the zone, and include the light rail as an additional critical connection to the area from Sacramento State, SMUD, and other commercial entities.
- Refine the focus of the Clean Tech Zone in the near term to the north portion of the area surrounding the Innovation/Technology Village Specific Plan. Work to complete this plan, steer it in any way possible towards the solar industry, and implement it as soon as possible. The Innovation Village concept can provide a vision and example for the area and also provide a positive impetus for the development of nearby Clean Tech Zone areas over the longer term. Clear and relevant examples in the area that have addressed critical issues of access, infrastructure, public support, business planning, and visibility are very important to companies looking to invest.
- Focus efforts on cleanup and image and identity improvement on the Innovation/ Technology Village area first. Focus on creating and presenting a prosperous, well planned, and unified area that is a viable location for solar businesses.

- Develop an inventory of facilities and available sites in the area that are or may be suitable for various sectors of the solar industry, and select a few champion sites for different solar uses that are ready for promotion.
- Build on the coalitions and collaborations that exist in the region, including SARTA, the City, Sacramento State University, the Power Inn Alliance, SACTO etc. This group of stakeholders is knowledgeable and committed and can provide a good platform to create and implement plans for the area.
- Utilize any success of other parts of the Sacramento region to promote the Clean Tech Zone as a place to invest. Areas such as McClellan and developments in Roseville may be competitors for individual projects, but their success in developing opportunities for solar industry companies should be viewed as contributing to the regional solar cluster, making the potential market larger, and providing more opportunities for the Clean Tech Zone.
- Keep an eye focused on local existing or start-up solar companies, or local people who have solar industry experience, and support these businesses as much as possible. Existing local businesses already have business and personal ties to Sacramento, and can be the best opportunities if well supported. Continue to guide these businesses to SARTA, and include Sacramento State, SMUD, and other local groups that can help. Grow business incubator concepts and work to attract and provide financing mechanisms for growth.
- Expand or create incentives specific to the Innovation/Technology Village area or to the Clean Tech Zone in general. Eliminate any disincentives, for example the increased utility taxes of the Clean Tech Zone relative to locations not in the City of Sacramento.

6.1.2 Recommended Longer-Term Improvement Activities

- Continue to evaluate and improve the internal transportation systems within the area, reduce congestion, and improve traffic flow during commuting hours.
- Continue to encourage commercial services that bring activity to the area serving, and also independent of local businesses, and that operate outside of standard working hours.
- Work to develop a strong Sacramento and regional market for residential solar products including PV and SHW. Strong local demand can be used to support possible production off-take incentives to manufacturing or assembly. Seek out and learn from examples in the other Solar America Cities on similar efforts including PACE programs, community solar programs, neighborhood based volume purchasing, solar on public buildings, etc.
- Create, promote, or encourage high visibility solar installations in the area to associate solar energy with the Clean Tech Zone and specifically the Innovation Village Plan. It appears that Granite Park is proposing a solar field on its parking lot, Bagatelos Architectural Glass has existing systems, and Depot Park is considering a large PV

installation. All of these are opportunities to associate solar with the Clean Tech Zone publically, and there may be others.

- Work with Sacramento State and others to investigate opportunities for applied research on solar projects with local partners. Sacramento state may have access to funding mechanisms attractive to local entrepreneurs.
- Increase connectivity with the San Francisco Bay Area, specifically in the solar sector. Support and expand the assistance being provided by SARTA and others in accessing capital, technology, and expertise locally and from Bay Area.

6.2 Market the Clean Tech Zone to the Solar Industry

While initial marketing can be done immediately, resources for a full-scale marketing effort for the area should be engaged after work has occurred to create, improve, and refine specific benefits and advantages in the Clean Tech Zone for sectors in the Solar Industry, as suggested in Sections 5.1 and 5.2. After improvements to the area and benefits become real, it is recommended that a cohesive marketing plan be created for the area based on existing and near-term area benefits and local and solar industry technology, business, and political conditions.

Very likely, the marketing plan will include activities like solar industry trade shows, promotion in site selection and economic development publications, and other standard marketing activities. However, CH2M HILL also recommends that it include close and ongoing contact and promotion in the Bay Area solar industry, including industry associations, universities and labs doing basic and applied solar research, venture and other sources of capital, solar related legal services, utilities, and local government.

Under separate cover, CH2M HILL has contributed to a draft RFP based on current conditions to engage these marketing resources, however the scope and contents of this draft RFP should be reexamined and updated in the future after area improvements have been made, and marketing activities are justified.

6.3 Next Steps and Future Opportunities

To continue efforts and success in solar economic development, the Clean Tech Zone must be thought of as a long-term project. Sacramento must support the development by continuing to make improvements, and adapting to changes and local conditions. Development of a Solar and Clean Tech cluster in the area is not a short-term process and will require long-term commitment on the part of the City, its partners, and area businesses. While many of the improvements suggested in Section 5.1 have ongoing and longer-term components, the following are future opportunities to support and cultivate solar economic development in the Clean Tech Zone:

- Expand public transportation within the zone from the potential new light rail stop, and from other public access points including proposed Ramona Ave extension. There is currently a commuter shuttle that takes people from the light rail throughout Granite

Park. This shuttle service should be expanded to cover new businesses as they locate elsewhere in the Clean Tech Zone.

- Increase onsite commercial and residential development. The city should encourage retail and residential development and improvements around the Clean Tech Zone to support and encourage incoming businesses and make the area more self sufficient.
- Consolidate recycle businesses. While recycling industries are an important component of Clean Technology, they have some potential disadvantages to their neighbors. Consolidating these activities within a subset of the Clean Tech Zone would minimize this effect, and could make other areas more attractive.
- Develop a marketing and awareness program to educate potential companies about the area and its potential. However, before an effort of this type is fully initiated there has to be a clear understanding of the product and how it meets or plans to meet the customer's needs.