SELF-GENERATION INCENTIVE PROGRAM

FINAL MARKET CHARACTERIZATION REPORT

Submitted To:

SGIP Working Group

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Report Highlights

The availability of Self-Generation Incentive Program (SGIP) incentives is a key driver of the wind, fuel cell, and advanced energy storage projects in the 30 kW to 5 MW range in California.

Project activity is driven by the industry, not by program marketing.

Strong industry associations are important for developing a favorable market environment.

Many factors can increase project costs or completely undermine projects during the development phase. This is especially true of first entrants into a region.

Financing agents view wind, fuel cells, and advanced energy storage as risky, making obtaining financing difficult in many cases. Moving to a performance-based incentive structure would increase this uncertainty.

Key barriers for the SGIP technologies are:

- Fuel Cells: High project cost, lack of recognition of the value and performance of fuel cells, and difficulty in finding outside financing.
- Wind: Inconsistent or non-existent zoning and permitting rules, high costs and long payback periods, and project siting challenges.
- Combined Heat and Power: Poor project economics, standby charges, demand charges, and other non-bypassable charges, perceived technology risk, and lack of confidence in the accuracy of savings estimates.
- Advanced Energy Storage: Unfamiliarity with energy storage, high capital cost, and lack of good modeling tools.

The SGIP should:

- Provide a forum for addressing interconnection issues;
- Provide funding for pre-development and feasibility studies for wind, fuel cell, and advanced energy storage projects;
- Complete a potential study for SGIP technologies and create reasonable targets based on that potential;
- Maintain a capacity-based incentive structure but add safeguards to support long-term system performance;
- Provide audience-specific education and training on wind, fuel cell, and advanced energy storage technologies;
- Develop tools that assist with the development of wind, fuel cell, and advanced energy storage projects;
- Consider realigning the markets under the SGIP and the California Energy Commission's (CEC's) Emerging Renewables Program (ERP); and
- Consider integrating energy efficiency requirements into the SGIP.

EXECUTIVE SUMMARY

This executive summary highlights the major findings and recommendations from the 2009 Market Characterization SGIP.

The purpose of the 2009 Market Characterization Study (Market Study) is to assess the market for self-generation technologies by analyzing the market within which the program operates and the various market factors that support or undermine the advancement of self-generation technologies and specific project installations. Although the primary focus of the Market Report was SGIP-eligible wind, fuel cell, and advanced energy storage technologies, cogeneration technologies were also addressed, though to a more limited degree.

Evaluation Methods

The evaluation methods used included:

- A review of program participation records and reports submitted to the California Public Utilities Commission (CPUC) through September 2009 from all program administrators (PAs);
- In-depth interviews with staff from each PA, with wind, fuel cell, and combustion technology project developers across the state, and with CPUC and CEC ERP staff;
- Surveys of participating host customers and non-participating customers;
- In-depth interviews with participating host customers and non-participating customers;
- Interviews with program managers of other, similar programs across the United States;
- Review of applicable literature sources, relevant industry documents, and Internet sources;
- A geographic information system analysis of high potential locations for wind projects; and
- In-depth interviews with other market actors: wind, fuel cell, advanced energy storage (AES) manufacturers, and industry associations.

Key Findings

Barriers to Technology Adoption

Barriers to ***fuel cell*** projects include: high project costs, lack of recognition of the value and performance of fuel cells, difficulty in finding outside financing, lack of volume production, and lack of competition between fuel cell manufacturers.

Barriers to ***wind*** projects include: inconsistent or non-existent zoning and permitting rules, high costs and long payback periods, project siting challenges, lack of wind resource, and lack of third-party service providers.

Barriers to ***combined heat and power*** include: poor project economics in the form of volatile natural gas and electricity prices, standby charges, demand charges, and other non-bypassable charges, poor economic conditions, perceived technology risk, and lack of confidence in the accuracy of savings estimates.

Barriers to ***advanced energy storage*** include: Unfamiliarity with energy storage, no federal tax incentive, high capital cost, and lack of good modeling tools.

Characteristics of Successful Projects

Successful ***fuel cell*** projects typically have the following characteristics: an economic benefit, a need for thermal energy (except for all electric fuel cells), need for electricity 24x7, motivated host customer, involved developer, high quality support contracts, and high site power demand.

Successful ***wind*** projects typically have the following characteristics: adequate wind resource, reasonable and certain zoning and permitting requirements, eligibility of SGIP incentives, distance from urban and suburban areas, sufficient site load, a strong project champion, and availability of third-party financing.

Successful ***combined heat and power*** projects typically have the following characteristics: site willingness, suitable electrical and thermal load, opportunity fuels, favorable project siting, and the ability to finance a large upfront cost.

Policy Environment

The SGIP operates within a robust and changing distributed generation policy environment in California:

- The SGIP was recently extended to January 1, 2016 due to the passage of SB 412. In addition, SB 412 expands eligibility in the program to distributed energy resources that the CPUC and State Air Resources Board determine will achieve a reduction in greenhouse gas emissions.
- Many federal policies accelerate market growth for wind systems and fuel cells, though these policies are more limited for AES. The investment tax credit (ITC), production tax credit (PTC), and the renewable energy production incentive (REPI) are a few important federal incentive programs.
- In California, net energy metering (NEM) has been available for wind systems since 1998 and for fuel cells since 2003. Related recent California legislation centers around greenhouse gas emissions limits, feed-in tariffs, renewable energy credits for RPS compliance, and permitting requirements for wind systems.
- Local policies for items such as air quality regulations, zoning restrictions, and building permits can encourage or hinder SGIP eligible system installations due to highly varying requirements for each city and county in California.

Lessons Learned from Other States

The following lessons from other states with similar wind and fuel cell incentives programs can be applied to the SGIP:

- Setting good research-based generation capacity targets is correlated with program success.
- Project activity is primarily driven by industry, not by program marketing.
- Active trade associations foster the development of favorable market conditions.
- Offering incentives for pre-development and feasibility studies can help reduce financial risks for potential participants and increase the number of sites pursuing development.
- Ideal site characteristics and project profiles will become apparent through experience.

- Monitoring system performance is important for accountability and for providing lessons learned for favorable site conditions.

Technology Review

A high level review of technologies with potential for future inclusion in the SGIP was conducted. The majority of the technologies in the review were commercially available in some form, had the ability to be on the customer's side of the meter, and had capacities under the current SGIP 5 MW cap. The technologies reviewed include:

- In-stream hydropower;
- In-conduit hydropower;
- Organic rankine cycle engines;
- Stirling engines;
- Stand-alone advanced energy storage;
- Internal combustion engines;
- Gas turbines;
- Microturbines; and
- Steam turbines.

Recommendations

Provide a forum for addressing interconnection issues. Although not the biggest barrier to wind, fuel cell, AES, and CHP projects, the interconnection process and requirements are an issue. Addressing interconnection issues could shorten project timelines and reduce project costs associated with complying with interconnection requirements.

Provide funding for pre-development and feasibility studies for wind, fuel cell, and advanced energy storage projects. This will reduce the development risk and should encourage more entities to move ahead with exploring development opportunities.

Complete a potential study for SGIP technologies and create reasonable targets based on that potential. Although it won't directly result in additional SGIP projects, setting targets sends a signal to the industry regarding the level of commitment from the state to support the industry. Targets also provide an important benchmark for measuring program progress. Targets can take many forms, such as the percent penetration into a particular market sector. Any targets set must be achievable within the SGIP budgets.

Maintain capacity-based incentive structure but add safeguards to support long-term system performance. Maintaining capacity-based incentives will provide the upfront funds needed to make each project attractive to both financiers and customers while additional program requirements will support long-term system performance. Under this dual approach, the program should not see a drop in applications that might result from a performance-based incentives structure.

Provide audience-specific education and training on wind, fuel cell, and advanced energy storage technologies.

Develop tools that assist with the development of wind, fuel cell, and advanced energy storage projects.

Consider realigning the markets under the SGIP and the CEC's ERP to resolve the inconsistency between the way the wind industry defines small wind projects and SGIP and ERP size limits and to reduce the confusion in the market place over program requirements.

Consider integrating energy efficiency requirements into the SGIP. California's Energy Action Plan identifies energy efficiency as the resource of first choice for meeting California's energy needs. The SGIP can support the Energy Action Plan by requiring that facilities receive an energy efficiency audit prior to receiving an SGIP incentive, similar to the requirement in the California Solar Initiative program.[1] However, the effectiveness of the California Solar Initiative's energy efficiency requirement should be assessed before making any changes to the SGIP.

[1] The California Solar Initiative requires an energy efficiency audit as the first step in the application process. Online audit forms are available from the program administrators: CCSE, PG&E and SCE.

1 INTRODUCTION

The SGIP was first launched in March 2001 by the CPUC to provide incentives for the installation of new, customer-sited self-generation equipment. The SGIP operates in the service areas of Pacific Gas and Electric (PG&E), Southern California Edison (SCE), Southern California Gas (SCG), and the San Diego Gas and Electric Company (SDG&E). The SGIP is administered by PG&E, SCE, and SCG in their respective territories. The California Center for Sustainable Energy (CCSE) administers the SGIP in SDG&E's territory.

The SGIP is overseen by a Working Group consisting of representatives from each of the PAs, as well as representatives from SDG&E, the CEC staff associated with the ERP, and the Energy Division of the CPUC. A Measurement and Evaluation subcommittee (M&E subcommittee) works on behalf of the Working Group to oversee the SGIP evaluation activities.

The purpose of the Market Study is to assess the market for self-generation technologies by analyzing the market within which the program operates and the various market factors that support or undermine the advancement of self-generation technologies and specific project installations. Although the primary focus of the Market Report was SGIP-eligible wind, fuel cell, and advanced energy storage technologies, cogeneration technologies were also addressed, though to a more limited degree. Section 1.3 describes the research objectives in detail.

A combination of primary and secondary research was conducted to inform this study. Surveys and in-depth interviews with participating host customers and non-participants were conducted. In-depth interviews were also conducted with the PAs, the CPUC staff overseeing the SGIP, CEC staff involved with the ERP, participating and non-participating project developers, and market actors. Program records were reviewed as were other sources of publicly available industry reports and market data. Section 2 describes the evaluation approach in detail.

1.1 Program Background

The SGIP was initially approved in Assembly Bill (AB) 970, which passed in September 2000 and was implemented by CPUC Decision 01-03-073 in March 2001. The program was reauthorized in AB 1685 and implemented in CPUC Decision 04-12-045.

As a result of the 2000-2001 energy crisis, the California Legislature passed AB 970 directing the CPUC to create programs to reduce electricity demand and fend off rolling blackouts. Decision 01-03-073 formally created the SGIP to offer financial incentives to customers who install certain types of distributed generation (DG) technologies to meet all or a portion of their energy needs. At that time, the SGIP was designed to complement the CEC's ERP by providing incentive funding to larger renewable and non-renewable self-generation units.

In October of 2003, AB 1685 extended the SGIP beyond 2004 through 2007. This bill required the CPUC, in consultation with the CEC, to administer the SGIP until January 1, 2008 in largely the same form that existed on January 1, 2004. This decision notwithstanding, a number of program modifications were made during the 2004 and 2007 period. For example, with the establishment of the California Solar Initiative (CSI), the SGIP stopped offering incentives for photovoltaic (PV) systems after 2006. AB 2778, approved in September of 2006, continued the SGIP for fuel cells and wind technology until 2012. Other renewable technologies, such as micro-hydropower, were not included, and combustion technologies were eliminated after 2007. However, there are suggestions that allowing combustion technologies in the program may be revisited. Upon enacting AB 2778, Governor Schwarzenegger encouraged parties to revisit the eligibility of the eliminated technologies in the following signing message:

> This bill extends the sunset of the Self Generation Incentive Program to promote distributed generation throughout California. However, the legislation eliminated clean combustion technologies like mircoturbines from the program. I look forward to working with the Legislature to enact legislation that returns the most efficient and cost effective technologies to the program. If clean up legislation is not possible, the California Public Utilities Commission should develop a complimentary program for these technologies.[2]

On October 11, 2009, California's governor approved SB 412, which changes the eligibility of the SGIP to distributed generation technologies that achieve greenhouse gas emissions pursuant to the California Global Warming Solutions Act of 2006.[3] SB 412 will give the CPUC and the PAs the flexibility to add technologies to the SGIP. The bill authorizes the program to operate through 2016 with ratepayer collections to fund the program approved through December 31, 2011. The CPUC issued an administrative law judge ruling on November 13, 2009 requesting parties' comments and noticing a public workshop to solicit suggestions on implementing SB 412.[4] The SB 412 implementation planning was still underway at the time this report was published.

The timeline in Figure 1-1 and Figure 1-2 summarizes key decisions related to the SGIP and details additional program modifications. Following the timeline is a table (Table 1-1) summarizing the key differences among AB 970, AB 1685, AB 2778, and SB 412.

[2] Personal Communication SGIP administrator, Nathalie Osborne, SDREO, November 1, 2006.
[3] California Assembly Bill 32, Approved by Governor September 27, 2006.
[4] CPUC, Administrative Law Judge's Ruling Requesting Comments on the Implementation of Senate Bill 412 and Noticing Workshop, November 13, 2009.

Figure 1-1. SGIP Event Timeline 2000 - 2007

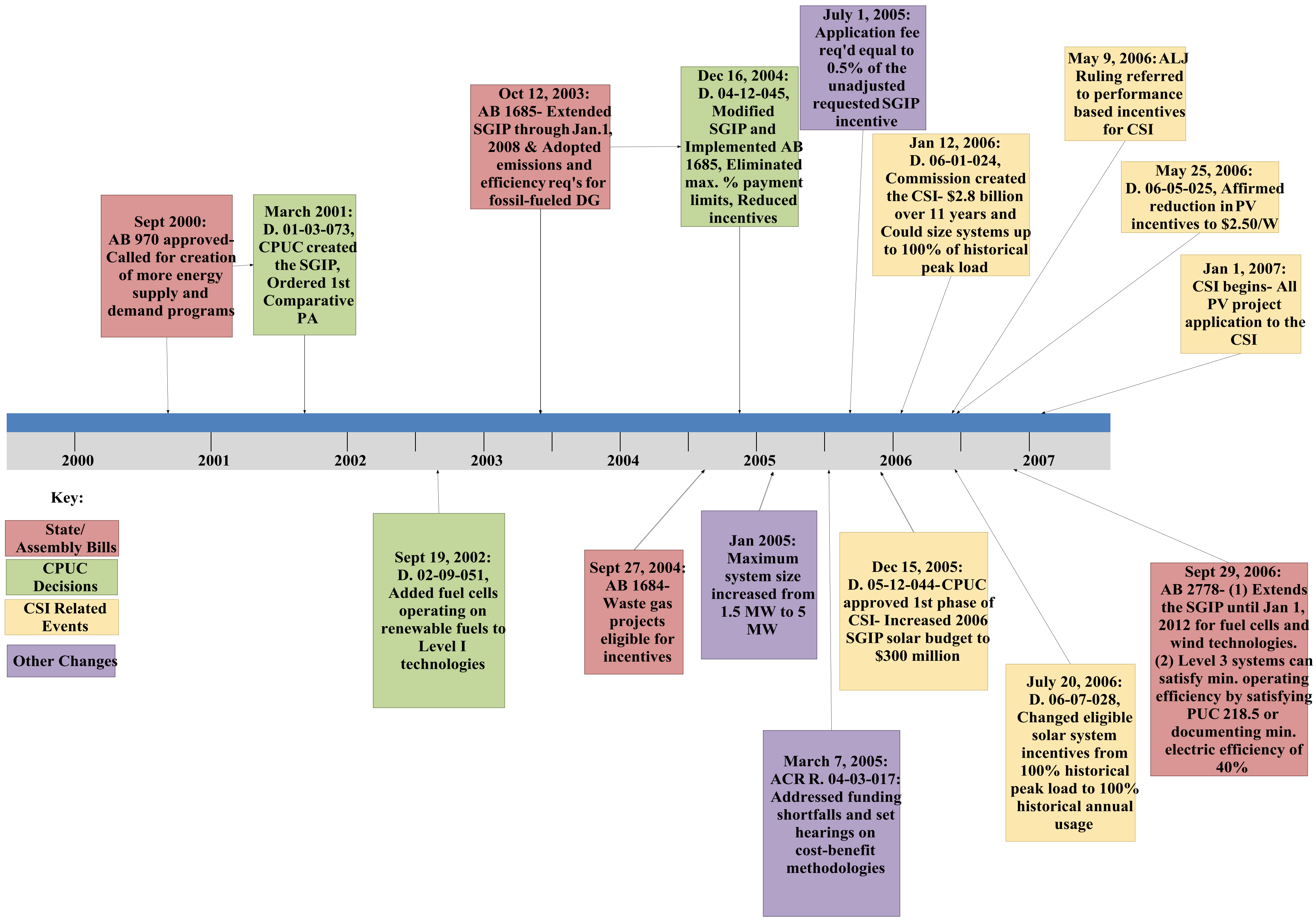

Figure 1-2. SGIP Event Timeline 2007 - 2009

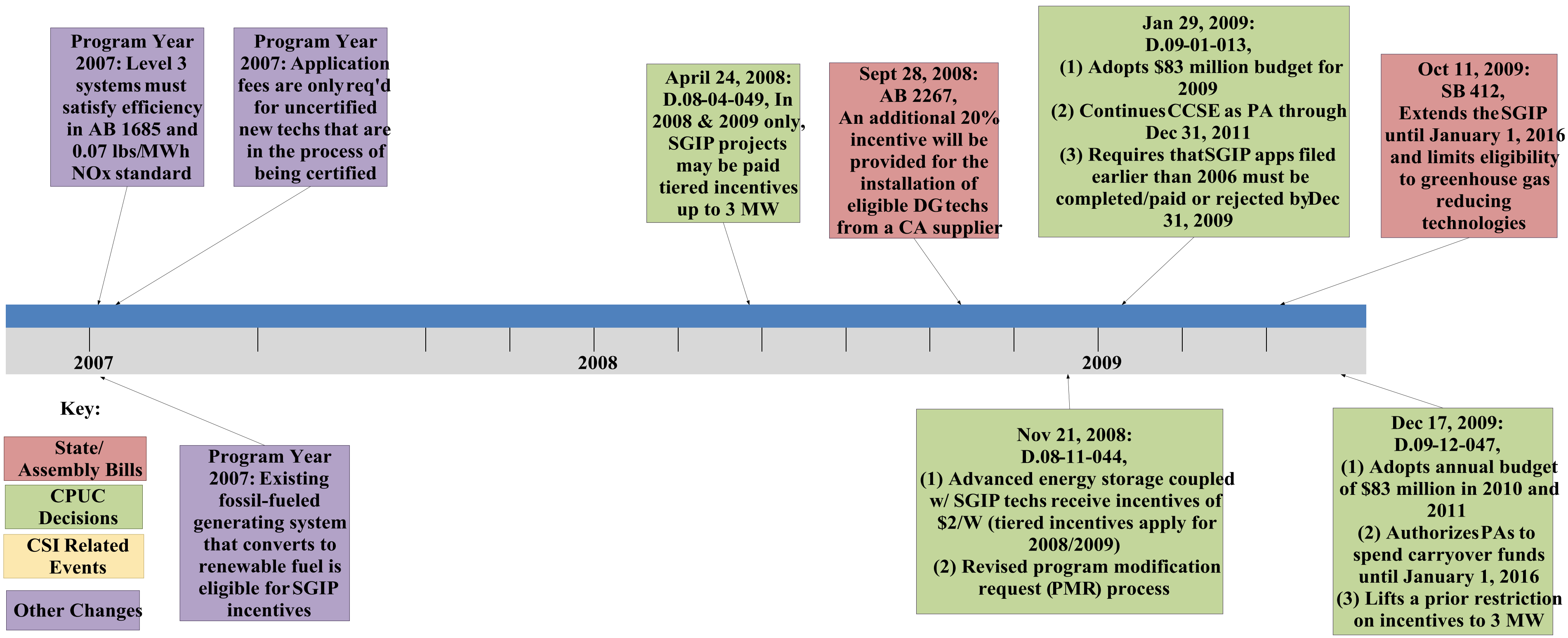

Table 1-1. Comparison of California AB 970, AB 1685, AB 2778, and SB 412.

Comparison	AB 970: Approved Sept. 6, 2000	AB 1685: Approved Oct. 12, 2003	AB 2778: Approved Sept. 29, 2006	SB 412: Approved October 11, 2009
Bill's self stated intent and approach	"This bill would require the Public Utilities Commission to identify and undertake certain actions to reduce or remove constraints on the electrical transmission and distribution system, and adopt specified energy conservation initiatives and undertake efforts to revise, mitigate, or eliminate specified policies or actions of the Independent System Operator for which the Public Utilities Commission or Electricity Oversight Board make a specified finding."	"This bill would require the commission, in consultation with the Energy Commission, to administer, until January 1, 2008, a SGIP for distributed generation resources in the same form that exists on January 1, 2004, but would require that combustion-operated distributed generation projects using fossil fuels commencing January 1, 2005, meet a NOx emission standard, and commencing January 1, 2007, meet a more stringent NOx emission standard and a minimum efficiency standard, to be eligible for incentive rebates under the program. The bill would establish a credit for combined heat and power units that meet a certain efficiency standard. The bill would revise the definition of an ultra-clean and low-emission distributed generation to include electric generation technologies that commence operation prior to December 31, 2008."	"This bill would require the commission, in consultation with the Energy Commission, to administer, until January 1, 2012, a SGIP for distributed generation resources. The program in its currently existing form, would be applicable to all eligible technologies, as determined by the commission, until January 1, 2008, except for solar technologies, which the commission would be required to administer separately, after January 1, 2007, pursuant to the California Solar Initiative. The bill, commencing January 1, 2008, until January 1, 2012, would limit eligibility for nonsolar technologies to fuel cells and wind distributed generation technologies that meet or exceed the emissions standards required under the distributed generation certification program adopted by the State Air Resources Board."	"This bill would limit the eligibility for incentives pursuant to the program to distributed energy resources that the commission, in consultation with the state board, determines will achieve reduction of greenhouse gas emissions pursuant to the California Global Warming Solutions Act of 2006."

Comparison	AB 970: Approved Sept. 6, 2000	AB 1685: Approved Oct. 12, 2003	AB 2778: Approved Sept. 29, 2006	SB 412: Approved October 11, 2009
Changing specificity over time	This bill is general in its statements. It calls for "a response to electricity problems facing the state that will result in significant new investments in new, environmentally superior electricity generation, while also making significant new investments in conservation and demand-side management programs in order to meet the energy needs of the state for the next several years."	This bill is specific in requiring an extension for the SGIP. It also adds that "ultra clean and low emission distributed generation" meet: Jan 1, 2003- Dec 31, 2008- Produces 0 emissions or meets 2007 State Air Resources Board emission limits for DG, except technologies operating by combustion must operate in a CHP application with 60% efficiency. SGIP must meet: Commencing Jan 1, 2005: NOx emissions of 0.14 lbs/MWh, and Commencing Jan 1, 2007: NOx emissions of 0.07 lbs/MWh and 60% min. efficiency.	This bill is specific in requiring an extension of the SGIP until 2012, but the eligible technologies for this period (Jan 1, 2008- Jan 1, 2012) are only fuel cells and wind distributed generation technologies. Technologies must meet the same emission and efficiency standards as outlined in AB 1685, unless the technology operates on waste gas and the air quality management district determines that the project will produce a net air emissions benefit.	This bill is broad in that it limits eligible technologies to those that are determined by the CPUC, in consultation with the State Air Resource Board, as those that reduce greenhouse gas emissions pursuant to the California Global Warming Solutions Act of 2006. However, the bill includes specific requirements for combustion-operated technologies of NOx emissions of 0.07 lbs/MWh and 60% min. efficiency.
Additional areas implicated	Expedited siting of electrical generation. Peak electricity demand programs. Cogeneration. Costs.	Energy conservation demand-side management. Actions to remove constraints from transmission and distribution system. Evaluation of other public policy interests such as rate payers and energy efficiency but also environmental interests.	The commission may adjust the amount of rebates, include other ultraclean and low-emission DG technologies, and evaluate other public policy interests (i.e., ratepayers, energy efficiency, and environmental interests). Costs and benefits.	The commission is authorized to make annual ratepayer collections through December 31, 2011. The administration of the program is extended until January 1, 2016, at which time any unexpended funds collected are to be returned to the ratepayers.

1.1.1 Program Modifications Over Time

Since the creation of the SGIP in March 2001, many changes have shaped the program. Changes to the incentive level structure, the incentive levels themselves, eligible technologies, and other program administrative issues are summarized in Table 1-2, Table 1-3, and Table 1-4, respectively, from information compiled from the SGIP Program Handbooks.

The following summary illustrates how the universe of eligible applicants to the program has changed over time and shows the varying incentive levels and changing requirements for application to the program. Incentive levels were a useful grouping by which to analyze the program in early evaluations; however, since the technologies under each incentive category changed from year to year, comparisons of program data must bear in mind the technologies within each in a given year. For this study, Summit Blue (now Navigant Consulting) will use technology-based grouping for data collection and analysis, despite the incentive level structure in place over the program lifetime.

Table 1-2. SGIP Incentive Level Structure 2004-2009

<table>
<tr><th rowspan="2">Incentive Level</th><th colspan="6">Eligible Technologies by Year</th></tr>
<tr><th>2004</th><th>2005</th><th>2006</th><th>2007</th><th>2008</th><th>2009</th></tr>
<tr><td>Level 1</td><td>PV
Wind turbines
Renewable fuel cells</td><td>PV
Wind turbines
Renewable fuel cells</td><td>PV</td><td></td><td></td><td></td></tr>
<tr><td>Level 2</td><td>Non-renewable fuel cells</td><td>Non-renewable fuel cells</td><td>Wind turbines
Renewable fuel cells
Renewable fuel internal combustion engines and large gas turbines
Renewable fuel microturbines and small gas turbines</td><td>Wind turbines
Renewable fuel cells
Renewable microturbines, internal combustion engines, and gas turbines</td><td>Wind turbines
Renewable fuel cells</td><td>Wind turbines
Renewable fuel cells
Advanced energy storage coupled with eligible renewable technologies</td></tr>
<tr><td>Level 3-R</td><td>Renewable fuel Microturbines
Renewable fuel Internal-combustion engines
Renewable fuel large gas turbines</td><td>Renewable fuel Microturbines
Renewable fuel Internal-combustion engines
Renewable fuel large gas turbines</td><td rowspan="2">Non-renewable fuel cells
Non-renewable and waste gas fuel microturbines and small gas turbines
Non-renewable and waste gas fuel internal combustion engines and large gas turbines</td><td rowspan="2">Non-renewable fuel cells
Non-renewable and waste gas fuel microturbines, internal combustion engines, and gas turbines</td><td rowspan="2">Non-renewable fuel cells</td><td rowspan="2">Non-renewable fuel cells
Advanced energy storage coupled with eligible non-renewable technologies</td></tr>
<tr><td>Level 3-N</td><td>Non-renewable fuel microturbines
Non-renewable fuel internal-combustion engines
Non-renewable fuel small gas turbines</td><td>Non-renewable and waste gas fuel microturbines
Non-renewable and waste gas fuel internal combustion engines and large gas turbines</td></tr>
<tr><td>Notes</td><td></td><td></td><td>Level 1, 2 and 3 only: no R,N</td><td>Level 2, and 3 only</td><td>Level 2, and 3 only</td><td>Level 2, and 3 only</td></tr>
</table>

Source: Self-Generation Incentive Program Handbooks.

SGIP Incentives Offered

As noted above, the amount of the incentives offered has also changed over time. Table 1-3 shows the incentives offered between 2004 and 2009. Incentives are shown as "not applicable" for technologies in some years due to varying program eligibility. Wind turbine incentives fell between 2004 and 2005, but they have stayed constant at $1.50/W since 2005. Incentives for renewable fuel cells and non-renewable fuel cells have stayed constant since 2004 at $4.50/W and $2.50/W, respectively. Advanced energy storage, coupled with eligible technologies, was added to the SGIP in 2009 at $2.00/W. It is important to note that in 2008 and 2009, tiered incentives are offered to projects up to 3 MW, as compared to the previous 1 MW limit.

Table 1-3. SGIP Incentives Offered 2004-2009

	Incentive Offered ($/Watt)					
Eligible Technology	**2004[1]**	**2005**	**2006**	**2007**	**2008**	**2009**
PV	$4.50	$3.50	$2.50	NA	NA	NA
Wind turbines	$4.50	$1.50	$1.50	$1.50	$1.50	$1.50
Renewable fuel cells	$4.50	$4.50	$4.50	$4.50	$4.50	$4.50
Non-renewable fuel cells	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50
Renewable fuel Microturbines/small gas turbines	$1.50	$1.30	$1.30	$1.30	NA	NA
Renewable fuel Internal-combustion engines	$1.50	$1.00	$1.00	$1.00	NA	NA
Renewable fuel large gas turbines	NA	$1.00	$1.00	$1.00	NA	NA
Non-renewable fuel microturbines[2]	$1.00	$0.80	$0.80	$0.80	NA	NA
Non-renewable fuel internal-combustion engines[2]	$1.00	$0.60	$0.60	$0.60	NA	NA
Non-renewable fuel small gas turbines[2]	$1.00	$0.80	$0.80	$0.80	NA	NA
Non-renewable fuel large gas turbines[2]	NA	$0.60	$0.60	$0.60	NA	NA
Advanced Energy Storage[3]	NA	NA	NA	NA	NA	$2.00

[1]The maximum incentive offered was 50%, 40% and 30% of the total project cost for Level 1, Level 2 and 3-R, and Level 3-N projects, respectively.
[2]Approval of waste gas as a non-renewable fuel at the end of 2004.
[3]Coupled with eligible self generation technology and four hour discharge period at rated capacity.
NA= Not Applicable

SGIP Minimum and Maximum Sizing

The minimum size for PV, wind turbines, and renewable fuel cells is 30 kW. There is no minimum size for non-renewable fueled eligible technologies. The maximum size for all technologies was 1.5 MW in 2004, increasing to 5 MW in 2005.

Table 1-4. SGIP Minimum and Maximum Sizing 2004-2009

	Minimum Size						Maximum Size[1]					
Eligible Technology	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
PV	30 kW	30 kW	30 kW	NA	NA	NA	1.5 MW	5 MW	5 MW	NA	NA	NA
Wind turbines	"	"	"	30 kW	30 kW	30 kW	"	"	"	5 MW	5 MW	5 MW
Renewable fuel cells	"	"	"	"	"	"	"	"	"	"	"	"
Non-renewable fuel cells	None	None	None	None	None	None	"	"	"	"	"	"
Renewable fuel microturbines	"	"	"	"	NA	NA	"	"	"	"	NA	NA
Renewable fuel Internal-combustion engines	"	"	"	"	NA	NA	"	"	"	"	NA	NA
Renewable fuel large gas turbines	"	"	"	"	NA	NA	"	"	"	"	NA	NA
Non-renewable fuel microturbines	"	"	"	"	NA	NA	"	"	"	"	NA	NA
Non-renewable fuel internal-combustion engines	"	"	"	"	NA	NA	"	"	"	"	NA	NA
Non-renewable fuel small gas turbines	"	"	"	"	NA	NA	"	"	"	"	NA	NA
Non-renewable fuel large gas turbines	"	"	"	"	NA	NA	"	"	"	"	NA	NA

NA= Not Applicable

" = Same as above

[1]The maximum incentive payout is capped at 1 MW for 2004-2007; there is a tiered incentive structure for 2008 and 2009 as a pilot.

Source: Self-Generation Incentive Program Handbooks.

Project Sizing

Sizing eligibility has also changed over time. Initially, PV and wind turbines could be sized up to 200% greater than the customer site's annual peak demand. As a result of Decision 06-01-024, solar facilities could only size their systems up to 100% of the historical peak load, beginning with applications submitted after January 12, 2006. Since this change resulted in reduction of net metering credits for some solar sites, the ruling was changed in Decision 06-07-028, to allow solar sizing up to 100% of the historical annual electricity usage.[5] Fuel cell projects may be sized up to the host customer's previous 12-month annual peak demand and wind turbine projects may be sized up to 200% of the host customer's previous 12-month annual peak demand. Fuel cells less than 5 kW are exempt from the sizing requirements. Advanced energy storage projects may be sized no larger than the SGIP technology with which they are coupled.

Percentage of Project Cost

Before 2005, the SGIP paid a maximum percentage of the project cost determined by the level of the projects. Level 1 projects were paid a maximum of 50%, Level 2 and Level 3-R projects were paid a maximum of 40%, and Level 3-N projects were paid a maximum of 30% of total project cost. However, the SGIP did not limit payment to a maximum percentage of project cost after 2005.[6]

Application Fee

At the start of the SGIP, no application fee was required. As a consequence, there were many "phantom projects," or projects that would begin but not complete the application process, reserving funds that could be used for viable projects. Other projects would be turned away because of lack of funding, and the "phantom project" would later remove their application from the queue, leaving funding that could have been used for other projects. To address this problem, an application fee was required for all SGIP reservations received as of July 1, 2005. The application fee was equal to 0.5% of the unadjusted requested SGIP incentive.[7] However, the PAs changed the application fee requirement in 2007. Beginning in program year 2007, application fees are only required for uncertified new technologies that are in the process of being certified by a nationally recognized testing laboratory.[8]

1.2 EM&V Background

Decision 01-03-073, which established the SGIP, ordered the PAs to outsource program evaluation to independent consultants and directed the Administrative Law Judge to establish a schedule for the filing of the required evaluation reports (Ordering paragraph 13). Two additional rounds of evaluation studies have been proposed by the PAs and approved by the CPUC. On May 18, 2006, ruling in Rulemaking 06-

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[5] CPUC, Decision 06-078-028, http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/58274.htm.

[6] SCE, SGIP Brochure/Fact Sheet for 2004-2006, http://www.sce.com/RebatesandSavings/SelfGenerationIncentiveProgram/.

[7] SCE, Selfgen Application Fee Implementation Notice, http://www.sce.com/RebatesandSavings/SelfGenerationIncentiveProgram/SGIPModificationsfor20052.htm.

[8] SGIP Handbook. January 1, 2007- Rev.0. It should be noted that one reason to remove the application fee requirement in 2007 when PV systems transfer to the CSI was because these phantom projects were typically PV and will no longer be included in the SGIP.

03-004, the predecessor rulemaking to the original SGIP proceeding, the ALJ approved an M&E plan for the SGIP for 2006 and 2007. On December 4, 2008, PG&E, on behalf of the PAs, filed a motion with the CPUC proposing a schedule of measurement and evaluation reports for program years 2009-2011, including this Market Characterization Study. On February 3, 2009, the CPUC approved the PA's request with minor modifications to the impact studies.

Since the SGIP's inception, the following measurement and evaluation reports have been prepared:

- Impact evaluations have been conducted annually since 2001;
- Renewable fuel use reports, which report on the compliance of SGIP projects using renewable fuels with the renewable fuel use provisions, have been prepared and filed with the CPUC every six months. The first renewable fuel use report was issued for the six-month period ending December 31, 2002;
- A cost-effectiveness framework was published in March 2005, with subsequent cost effectiveness reports published in September 2005 and February 2007;
- Two PA comparative assessments have been conducted, the first was published in September 2003 and the second in April 2007;
- A market characterization study was published in August 2007 and revised in November 2007;
- Three process evaluations have been prepared; the first two were traditional program process evaluations while the last, published in August 2007, was a market-focused process evaluation; and
- A retention study was published in December 2007.

1.3 Research Objectives

The purpose of the Market Study is to provide an assessment of the market for self-generation technologies in California. This was achieved by analyzing the broader market within which the program operates and the various market factors that support or undermine advancement of self-generation technologies and specific project installations. The following ***research objectives*** were developed based on the December 4, 2008 motion, filed jointly by the PAs, and input from the SGIP Working Group and the M&E subcommittee:

- Investigate the current market structure for wind and fuel cell developers;
- Identify socio-economic factors that correlate with program participation and non-participation, with an appreciation for variation in regional market characteristics;
- Determine the importance of price signals to customer system operation;
- Address the legislative concern that this is a "rich person's program"9;
- Develop case studies describing key characteristics of successful and unsuccessful projects, with a focus on fuel cells and wind, but also include microturbines, gas turbines, and internal combustion (IC) engines;

[9] This research objective refers to installations of fuel cells in residential applications. However, as Table 4-4 illustrates, fuel cell applications in the residential sector make up 43% of the total number of applications received from January 2007 through September 2009, they only make up 7% of the system capacity, and 10% of the reserved incentives.

- Identify promising sites/host customers for wind turbines through geographic information system (GIS) techniques and provide the PAs with specific methods for targeting the marketing of SGIP wind projects;
- Identify market barriers relative to the current SGIP program design and provide actionable recommendations to overcome them;
- Summarize lessons other states with fuel cell and/or wind programs have learned from incenting these technologies;
- Review the market context within which the SGIP operates:
    - Identify federal, state, and local policies that will affect the market for and availability and acceptance of any of the SGIP technologies;
    - Discuss new feed-in-tariff style programs that have been developed in the state and at the investor-owned utilities (IOUs) for specific customer classes;
    - California Air Resources Board (CARB) has targeted landfills as an early action measure for AB32, and renewable energy credits (REC) definitions and renewable portfolio standard (RPS) pressures have also evolved to likely effect market beliefs surrounding the value of distributed energy; and
- Recommend whether the SGIP should be extended beyond 2011 and perform a review of other commercially available, non-PV distributed generation technologies that could be included in the program.

2 EVALUATION APPROACH

This section describes the data collection methodologies used to gather information for this report. The data collected through these efforts will also inform the 2009 SGIP Market-Focused Process Evaluation (Process Study) which will be published in May 2010. The evaluation approach included both primary and secondary data collection and largely followed the evaluation approach used for the previous Market and Process Studies conducted in 2007.

2.1 Review of Program Data

SGIP program records, provided by each PA, were the source for information on program participation, including technology type and size, application dates, and project location. These records are prepared by each PA on a monthly basis and include the following two reports:

- The ***Project List*** includes a list of projects by year and a list of cumulative projects to date. For each project, the Project List shows, among other items, the project ID, incentive level received, system type, and fuel type; and
- The ***Budget Status Report*** contains program data on budget allocations, reallocations, program expenditures, program definitions, and rebate amounts. A summary of application statistics by year and incentive level is also included in the Budget Status Reports.

For the purposes of developing the participant and developer sample frames, program records through June 2009 were used. For the purposes of the data analysis for this report, program records through September 2009 were used.

The PAs also provided additional internal program records, where available, on outreach activities, public presentations, and attendance lists. Publicly available program information, including the SGIP Handbook and information on the PAs' Web sites, was also reviewed and referenced.

Several existing reports and other sources of market data were consulted to inform the Market Study. These sources are listed in a bibliography found in Appendix 1.

2.2 Surveys

Surveys were conducted with both participant host customers and non-participants. Surveys were conducted by Ward Research of Honolulu, Hawaii. Supervisor-level surveyors were used for these surveys. In an attempt to reach as many different sites as possible, call attempts were scheduled at a variety of different times during the day. The Ward Research team conformed to Pacific Daylight Time during the survey period.

2.2.1 Sampling Plan

Unique sampling plans were developed for participant host customers and non-participants.

Participant

Projects whose applications were received through 2006 comprised the population for the previous Process and Market Studies conducted in 2007. The population for the 2009 Process and Market studies are projects received in 2007, 2008, and 2009. The cutoff date for the sample frame was June 2009. However, one of the important objectives for these new studies was to update trends since the last studies, many of which were driven by PV participation. Therefore, PV projects with an "active" status prior to 2007 and completed in 2007 were included in the survey population. However, if a projects' participant was surveyed or interviewed for the 2007 studies, these records were removed from the survey population.

In several instances the same host customer had several unique project sites; these were usually chain customers. In some instances, the customer contact was the same for all sites and for others each site had a separate contact. In order not to over represent these customers who, arguably, are operating under the same or similar budget and decision-making structures, we developed the sample frame by unique host customer rather than unique site. In the case where there are different contacts for the sites, the contact at the site with the largest capacity project will be contacted.

The tables (Table 2-1, Table 2-2, and Table 2-3) below present the population data stratified by technology type, PA, and project status. The sample sizes presented are those required to reach 90/10 confident level (+/- ten percentage points at the 90% confidence interval).

Table 2-1. Population Stratified by Technology Type

Technology	Project Population by Site	Number of Unique Host Customers	Sample Size*
Wind Turbines	16	15	12
Fuel Cells (Non-Renewable Fuel)	49	44	27
Fuel Cells (Renewable Fuel)	33	27	20
MT, Gas Turbine, IC Engine (Non-Renewable Fuel)	77	62	33
MT, IC Engine (Renewable Fuel)	17	17	14
Solar PV Population for 2009 Data Collection	227	151	47
Total	**419**	**316**	**153**

*Note- 3 fuel cell projects list "Unknown" as fuel type. One project has an unknown technology type.

Table 2-2. Population Stratified by Program Administrator

Program Administrator	Project Population by Site	Number of Unique Host Customers	Sample Size*
PG&E	221	159	48
SCE	90	65	33
SCG	87	73	35
CCSE	25	20	16
Total	**423**	**317**	**132**

* Four non-solar host customers have applied or have projects in two PA territories. One solar host customer has applied or has projects in two PA territories.

Table 2-3. Population Stratified by Project Status

Project Status	Population by Site	Number of Unique Host Customers	Sample Size*
Active/Completed	319	255	54
Withdrawn/Rejected	104	67	34
Total	**423**	**322**	**88**

* Seven host customers have both active/completed and withdrawn/rejected projects. One host customer has a project with unknown status.

In order to prepare meaningful results at the finest level of detail, the team attempted to complete 153 surveys with participating host customers.

Non-Participant

In addition to the participant surveys, the Summit Blue team sought to conduct approximately 150 telephone surveys with end-users who had not participated in the SGIP process. The non-participants include both residential and non-residential customers and were stratified by customer type and PA as illustrated in Table 2-4.

Residential participants only made up 23% of the non-PV projects entering the SGIP since 2007. However, in order to improve the precision levels for the residential sample, the non-participant sample included equal proportions of residential and non-residential customers.

The non-participant sample was split evenly between each PA with a target of 50 non-participants surveyed from each PA territory. Because the territories for SCE and SCG overlap and because non-participants provided non-PA specific input, the SCE and SCG samples were combined.

Table 2-4. Non-Participant Sample Sizes and Precision Levels

	PA/Territory		
Sector	**PG&E**	**SCE/SCG**	**SDG&E**
Residential	25 (90/17)	25 (90/17)	25 (90/17)
Non-residential	25 (90/17)	25 (90/17)	25 (90/17)

Non-Residential Non-Participant

The specific industry segments targeted by the non-residential non-participant surveys were selected based on an analysis of the demographics of each PA territory and program participants and described in Table 2-5. The sample frame was purchased from a commercially available database.

Table 2-5. Non-Residential Non-Participant Sample Parameters

Variable	SGIP Non-Residential Non-Participant Sample Frame
Industry Segment:	• Industry segments that are well represented among program participants; and • Any additional large/growing industry segments with the technical capacity to adopt self-generation technologies.
Business Size:	Greater than 10,000 feet.
Geography:	Counties with the greatest population density for each PA.

Residential Non-Participant

Residential non-participants were selected into the sample based on geography, household income, and housing type. The sample frame was purchased from a commercially available database.

The residential customers within the SGIP are pursuing 5kW-10kW fuel cell installations. These units typically cost in excess of $60,000 so it is reasonable to assume that the target market for this technology is very affluent. As fuel cells are not portable structures, it is also reasonable to assume that a consumer would not make an investment in a fuel cell unless they own their home. Therefore, the residential non-participant sample will be selected according to the parameters listed in Table 2-6.

Table 2-6. Residential Non-Participant Sample Frame Parameters

Variable	SGIP Residential Non-Participant Sample Frame
Geography:	30 California counties representing the top 60% of counties based on median household income[10]: • The 38 residential SGIP applications are located within these 30 counties.
Income:	Household income from $250K and above.
Household Type:	Homeowners in single family homes.

2.2.2 Survey Pretests

Surveys were pretested prior to the main data collection effort. The surveyors were briefed on the SGIP nomenclature and survey goals prior to making any calls. After approximately five surveys, each instrument was reviewed by Ward Research and the Summit Blue team to identify issues and implement improvements.

Only one substantive change was identified and made to the participating host customer surveys, both active and completed, and withdrawn and rejected. An option for "project financing or cost" was added as a barrier to installing additional onsite power generation. Minor grammatical changes were made to the introductions of all surveys.

During the full deployment, several other issues were identified and the following changes made to the non-participant survey:

- A question regarding the respondent's income was moved from the screening questions to the end of the non-participant survey. Some interviewees became suspicious when this question was asked in the early part of the survey;
- A definition of price signals was added; and
- Respondents were asked if their company had ever participated in the SGIP during the screening. The survey was terminated if the respondent indicated that they had.

2.2.3 Survey Disposition

All survey calls were tracked, and refusals or incomplete responses were recorded. Results of the completed surveys were entered into an electronic database. The data were reviewed by Summit Blue's principal analyst to ensure quality control. At the end of this data collection task, a survey disposition report was prepared to document the outcome of each contact attempt.

[10] Determined from 2005-2007 U.S. Census Bureau, American Community Survey

Participant Survey Disposition

The team completed 94 surveys with host customers that participated in the program in some form. Due to data cleaning, only 91 surveys were included in the final results. The three surveys were not included in the final results due to the following reasons: one project went through the California Solar Initiative, one project was completed in 2006, and one project was rejected with solar PV. None of these project types were included in our original sample. Therefore, the team completed 80 surveys with host customers with active or complete projects and 11 surveys with host customers that had withdrawn or rejected projects. The following tables (Table 2-7, Table 2-8, Table 2-9) indicate the confidence and precision levels reached by technology, PA, and project status, respectively.

Table 2-7. Confidence and precision levels reached by technology

Technology	Sample Size	Survey Completes (not including removals)	Survey Completes (including removals)	Confidence/ Precision Levels
Wind Turbines	12	4	4	90/37
Fuel Cells (Non-Renewable Fuel)	27	8	8	90/27
Fuel Cells (Renewable Fuel)	18	8	8	90/25
MT,Gas Turbine, IC Engine (Non-Renewable Fuel)	32	18	17	90/17
MT, Gas Turbine, IC Engine (Renewable Fuel)	14	7	7	90/25
Solar PV Population for 2009 Data Collection#	46	49	47	90/10
Total	**149**	**94**	**91**	**90/7**

Note that all non-solar PV projects applied in 2007, 2008, or 2009, all solar PV projects completed in 2007, 2008, or 2009.

Table 2-8. Confidence and precision levels reached by PA

Program Administrator	Sample Size	Survey Completes	Confidence/ Precision Levels
PG&E	48	56	90/9
SCE	31	18	90/16
SCG	35	14	90/20
CCSE	14	3	90/45
Total	**128**	91	90/7

Note that all non-solar PV projects applied in 2007, 2008, or 2009, all solar PV projects completed in 2007, 2008, or 2009.

Table 2-9. Confidence and precision levels reached by project status

Project Status*	Sample Size	Survey Completes	Confidence/ Precision Levels
Active/Completed	53	80	90/8
Withdrawn/Rejected	34	11	90/23
Total	**87**	91	90/7

* 7 host customers have both active/completed and withdrawn/rejected projects.

Note that all non-solar PV projects applied in 2007, 2008, or 2009, all solar PV projects completed in 2007, 2008, or 2009.

Because of the wide confidence intervals, care must be taken when interpreting the survey results. To help improve the precision of the technology-level results, the team will combine the renewable and non-renewable fuel categories for both the fuel cell category and microturbine, IC engine, and gas turbine category, as described in Table 2-10. Differences between the experience and opinions of renewable and non-renewable fueled projects will be lost but the team believes that the gains in precision levels outweigh any loss of resolution.

Table 2-10. Confidence and precision levels with combined renewable and non-renewable fuels

Technology	Number of Unique Host Customers	Sample Size*	Survey Completes	Confidence/ Precision Levels
Wind	15	12	4	90/37
Fuel Cell	69	35	16	90/18
Microturbine, IC Engine, Gas Turbine	78	37	24	90/14
Solar PV	141	46	47	90/10
Total	303	56	91	90/7

Non-Participant Survey Disposition

The team completed 128 surveys with non-participants: 75 surveys with residential non-participants and 53 surveys with non-residential non-participants, as illustrated in Table 2-11.

Table 2-11. Non-Participant confidence and precision levels

Sector	PA/Territory			Total
	PG&E	SCE/SCG	CCSE	
Residential	37 (90/14)	28 (90/16)	10 (90/26)	75 (90/10)
Non-residential	17 (90/20)	32 (90/15)	4 (90/41)	53 (90/11)

2.3 In-Depth Interviews

A variety of qualitative, in-depth interviews as well as shorter, less formal informational interviews were conducted to capture data for this study. In-depth interviews were conducted with staff from each PA, project developers, CEC and CPUC staff, host customers, non-participating customers, and market actors.

2.3.1 Working Group and PA Staff Interviews

Summit Blue conducted interviews with each PA between July 21st and 24th. These interviews were conducted at each PA's office. During these same visits, Summit Blue was able to interview a number of non-SGIP utility staff, including interconnection and marketing department staff and account representatives. In some cases, the non-SGIP utility staff was not available at the time of the PA interviews or not in the same location as the SGIP staff. These interviews were conducted via telephone subsequent to the PA interviews.

An interview with the CPUC staff was conducted at the CPUC offices in San Francisco. An interview with the CEC staff involved with the ERP was conducted via telephone. Both of these interviews were conducted in early August 2009.

The interview guides for these interviews can be found in Appendix 2.

2.3.2 Participating Host Customers

Summit Blue conducted 24 in-depth interviews with participating host customers. These interviews were conducted as follow-up discussions with participants who completed a survey. These in-depth, follow-up interviews were conducted by senior-level evaluation team staff and allowed us to probe much more deeply into the role that specific factors played in leading to successful or less successful installations than was possible in the more structured telephone survey. Each follow-up interview focused on the factors identified in the initial telephone survey as most important to the specific installation in question.

Respondents for the follow-up interviews were recruited at the time of the initial telephone survey and were limited to non-PV participants. Each respondent who completed a follow-up interview received $100 in compensation for their time. If the interviewee wasn't able to accept cash compensation, $100 was donated to the charity of their choice.

The breakdown of the participating host customer interviews by technology, PA, and project status is described

Table 2-12. Completed participating host customer interviews by technology

Technology	Interviews Completed
Wind Turbines	3
Fuel Cells (Non-Renewable Fuel)	3
Fuel Cells (Renewable Fuel)	5
MT,Gas Turbine, IC Engine (Non-Renewable Fuel)	9
MT, Gas Turbine, IC Engine (Renewable Fuel)	4
Total	**24**

Table 2-13. Completed participating host customer interviews by PA

Program Administrator	Interviews Competed
PG&E	9
SCE	7
SCG	6
CCSE	2
Total	**24**

Table 2-14. Completed participating host customer interviews by project status

Project Status	Interviews Completed
Active/Completed	18
Withdrawn/Rejected	6
Total	**24**

2.3.3 Non-Participating Customers

The team attempted to conduct 15 in-depth interviews with non-participant utility customers. These interviews were conducted as follow-up discussions with non-participants who completed a survey. These in-depth, follow-up interviews were conducted by senior-level evaluation team staff and allowed us to probe much more deeply into why customers have not pursued self-generation opportunities. Through these interviews, we hoped to understand whether there are some sites or business types for which self-generation is simply not a workable option, or if some non-participants had considered the SGIP but failed to apply and why. Each follow-up interview was tailored to focus on the factors identified in the initial telephone survey.

Respondents were recruited at the time of the initial telephone survey, as part of the closing. Each respondent who completed a follow-up interview received $100 in compensation for their time. If the interviewee wasn't able to accept cash compensation, $100 was donated to the charity of their choice.

Unfortunately, only 5 interviews with non-participants were able to be recruited and completed.

2.3.4 Market Actor Interviews

To better understand and assess the market for wind, fuel cells, and advanced energy storage, the team interviewed 17 different individuals in these industries. the number of interviews with each market actor is presented in Table 2-15.

Table 2-15. Market Actor Interviews Completed

Market Actor Type	Number of Interviews Conducted
Wind Association – 2	2
Wind Manufacturer – 4	4
Wind Industry Expert - 1	1
FC Associations – 3	3
FC Manufacturers – 3	3
AES industry associations – 1	1
AES manufacturers - 3	3
Total	17

Interview guides for these interviews can be found in Appendix 2. Summaries of these interviews can be found in Appendix 3.

Summit Blue also conducted shorter, informal interviews with members of permitting agencies and legislative analysts in order to clarify questions or gain insights into issues.

2.3.5 Project Developer Interviews

The Summit Blue team conducted in-depth interviews with non-PV SGIP project developers. In order to gain a broad range of perspectives, these developers included those that have participated in the SGIP and those who have not.

Participating Developers

Through June 2009, there were 49 different non-PV project developers, representing 89 active or completed non-PV projects and 35 rejected or withdrawn non-PV projects, identified in the SGIP program database. Many of these project developers worked with both renewable and non-renewable fuel cell and micro-turbine, gas turbine, and IC engine technologies. Participating wind developers were involved with wind technologies exclusively. Because PV is no longer included in the SGIP, PV developers were not interviewed.

The goal when developing the participating developer sample was to include both project developers who had worked on projects through the SGIP program many times as well as project developers who had less experience with the program and whose perspectives are newer. It was also desirable to interview project developers across all of the non-PV SGIP technologies with an emphasis on wind and fuel cell developers.

When scheduling the participating developer interviews, the Summit Blue team's goal was to reach:

- The five developers who completed the greatest number of non-PV projects which would have captured developers who represent both renewable and non-renewable fuel cell and micro-turbine, gas turbine, and IC engine technologies;
- Two additional fuel cell developers with only one active SGIP project – one renewable and one non-renewable project;
- A census of the only four wind developers with an active or completed project; and
- One additional wind developer with a rejected or withdrawn project.

The team was successful at conducting interviews with 11 participating non-PV developers. These developers represented:

- Four of the five developers who submitted the greatest number of non-PV projects. In total, these developers represented 59 total non-PV projects across renewable and non-renewable fuel cell and renewable and non-renewable combustion technologies. Of these projects, 44 were still active and two were completed;
- Two additional fuel cell developers, one with an renewable project and one with an active non-renewable project; and
- Four wind developers with active projects11; and
- One wind developer with a rejected project.

Interview guides for these interviews can be found in Appendix 2. Summaries of these interviews can be found in Appendix 3.

Non-Participating Developers

The team was only able to complete one interview with a non-participating wind developer. Non-participating developer names were solicited from a variety of sources, including the market actors that were interviewed. However, when these developers were called upon, we found that they were or had participated in the SGIP for projects that were listed under the customer's name, or they were developers of utility-scale projects. One of the developers interviewed as a participating developer was originally approached as a non-participant.

We believe it was difficult to find non-participating developers in the size range of the SGIP because these projects are dependent on the SGIP incentive to make them financially feasible.

The guides used for this interview can be found in Appendix 2. A summary of this interview can be found in Appendix 3.

[11] One developer was originally contacted as a non-participating developer. However, the firm was the developer on an active project submitted under the host customer's name in the SGIP database. The developer was interviewed as a participating developer.

3 SGIP AND THE MARKET

3.1 Participation Summary

As of September 2009, participating host customers in the SGIP have:

- Completed 1,290 on-site generation projects—886 solar photovoltaic, 347 conventional combined heat and power, 32 renewable-fueled IC engines and microturbines, 23 fuel cell, 1 wind, and 1 wind/PV project
- Developed about 342 MW of expected distributed capacity for California
- Received over $609M in incentives

Figure 3-1 shows SGIP participation in terms of market sector involvement. The figure is split into three time category groups based on the application date: 2001 – 2006, 2007, and 2008 – September 2009. The team chose these groups based on eligible technology changes in the program. For example, solar PV was incented under the California Solar Initiative beginning in 2007 and thus was not eligible to participate in the SGIP. In addition, combined heat and power systems, except fuel cells, were ineligible to participate in the SGIP beginning in 2008. The eligible technologies during each time frame are listed at the top of the figure.

Most market sectors shown in the following figures are at the 2-digit SIC code level. However, due to a noticeable interest in the program from specific market sectors, the figures in this section break up some of the 2-digit level codes for clarity. These market sectors include “Elementary/Secondary Schools” and “College” (which are subsets of “Educational Services”) and “Sanitary Services” (a subset of “Electric, Gas, and Sanitary Services” also referred to as “Utilities”). In this case, the “Sanitary Services” group includes only wastewater treatment plants.

The figure shows the top four market sectors applying to the program in each time frame along with the number of applications. Note that the figure contains all projects that *applied* to the program; while not all of these projects were completed. The red text denotes the top four market sectors in 2001 – 2006, the green text denotes the unique top market sectors in 2007, and the blue text denotes the unique top market sector in 2008 – September 2009. The manufacturing and public administration sectors have been actively participating in the program since its inception. Other sectors, like elementary/secondary schools and retail, were very active in the program when solar PV was an eligible technology, but are currently not very active in the program. Sanitary services (mostly comprised of wastewater services), a subset of utilities, have become a top participating market sector. In the 2008 – September 2009 timeframe, the residential sector is the top participating sector in the program. Commercialization and marketing of a residential fuel cell has led to the large increase in residential projects.

Figure 3-1. Market sectors and the SGIP: Involvement over time

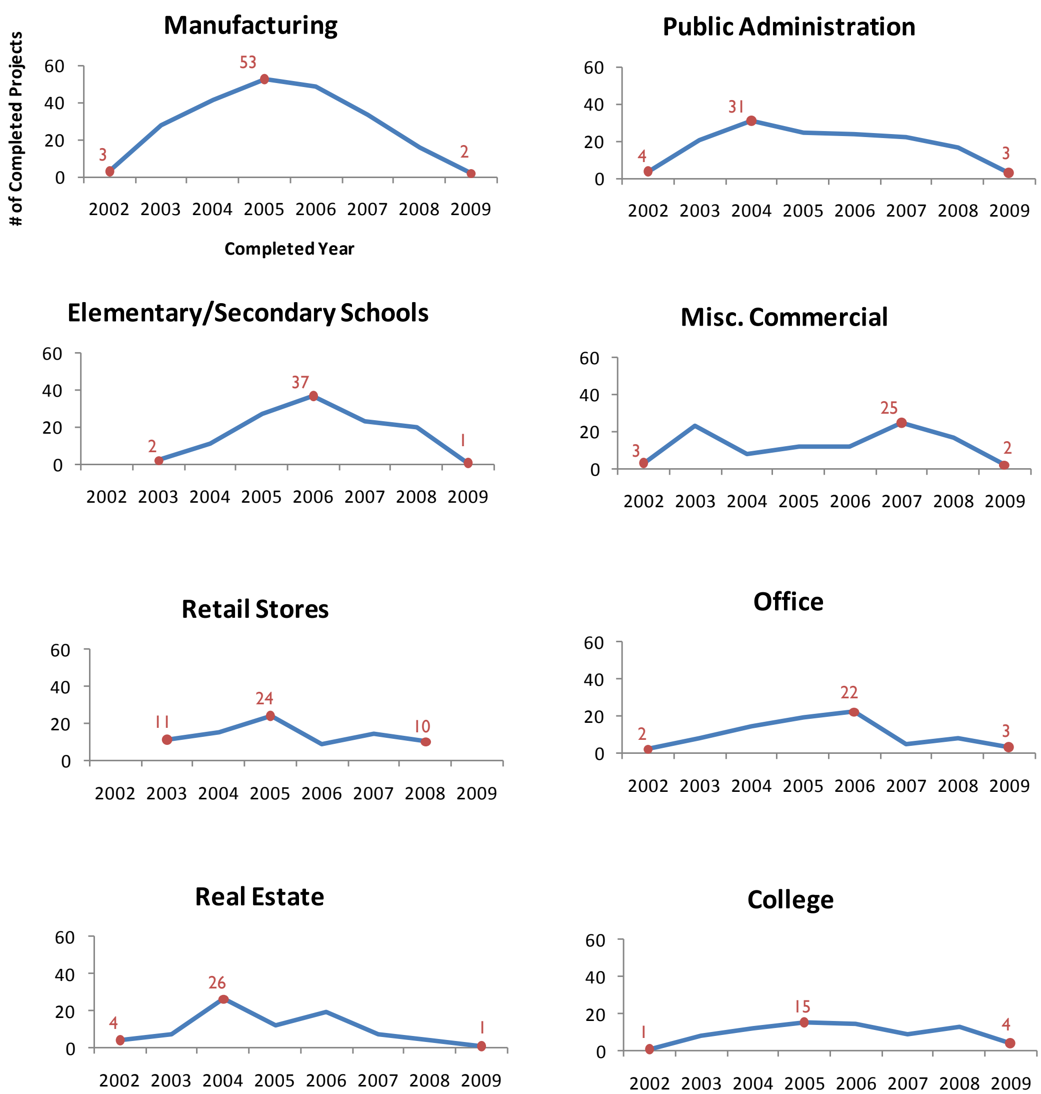
	2001-2006		**2007**		**2008-Sept 2009**	
Eligible Technologies	Solar PV Conventional CHP Renewable-fueled microturbine, internal combustion engine & gas turbine Fuel cells Wind systems		Conventional CHP Renewable-fueled microturbine, internal combustion engine & gas turbine Fuel cells Wind systems		Fuel cells Wind systems Advanced energy storage (combined w/ wind or a fuel cell)	
	Market Sector	**# of Applications**	**Market Sector**	**# of Applications**	**Market Sector**	**# of Applications**
	Manufacturing	**555**	**Manufacturing**	**26**	**Residential**	**41**
	Retail Stores	**372**	**Public Administration**	**16**	**Manufacturing**	**8**
	Public Administration	**356**	**Health Services**	**10**	**Public Administration**	**8**
	Elementary/Secondary Schools	**323**	**Sanitary Services**	**10**	**Sanitary Services**	**5**
	Real Estate	264	Misc. Commercial	7	Misc. Commercial	3
	Office	242	Elementary/Secondary Schools	7	Office	3
	Misc. Commercial	213	College	6	Agriculture	2
	College	153	Agriculture	5	Communication	2
	Utilities (Includes Sanitary Services)	150	Office	5	Retail Stores	2
	Health Services	104	Lodging	4	College	2
	Lodging	98	Mining/Extraction	3	Construction	1
	Agriculture	86	Real Estate	3	Grocery	1
	Wholesale Trade	71	Utilities	2	Health Services	1
	Non-Refr Warehouse	57	Wholesale Trade	2	Mining/Extraction	1
	Grocery	55	Construction	1	National Security	1
	Transportation	45	Grocery	1	Non-Refr Warehouse	1
	Construction	28	National Security	1	Real Estate	1
	National Security	24	Restaurant	1	Transportation	1
	Mining/Extraction	23	Retail Stores	1	Utilities	1
	Communication	21	Transportation	1	Wholesale Trade	1
	U.S. Postal Service	17	Other Educational Services	1	Elementary/Secondary Schools	1
	Restaurant	13	Unknown	3	Unknown	3
	Other Educational Services	12	*Grand Total*	*116*	*Grand Total*	*89*
	Residential	9				
	Refr Warehouse	8				
	Unknown	131				
	Grand Total	*3430*				

Note: A Misc. Commercial project that applied in 2008 has been excluded from this table. It was a CHP project and thus was immediately rejected. Red text is for the top four market sectors in 2001-2006; green text is for new top market sectors in 2007, blue text is for new top market sectors in 2008-September 2009.

Source: SGIP Program Data as of September 2009

Figure 3-2 shows the top eight sectors with completed projects over the lifetime of the SGIP. These sectors represent over 70% of the total completed SGIP projects. Some of these top sectors are also top sectors applying to the program in the 2008 – September 2009 timeframe. However, other sectors have emerged as leaders in the SGIP: residential and sanitary services. It is too soon to tell if the projects that have recently applied under those sectors will complete the program.

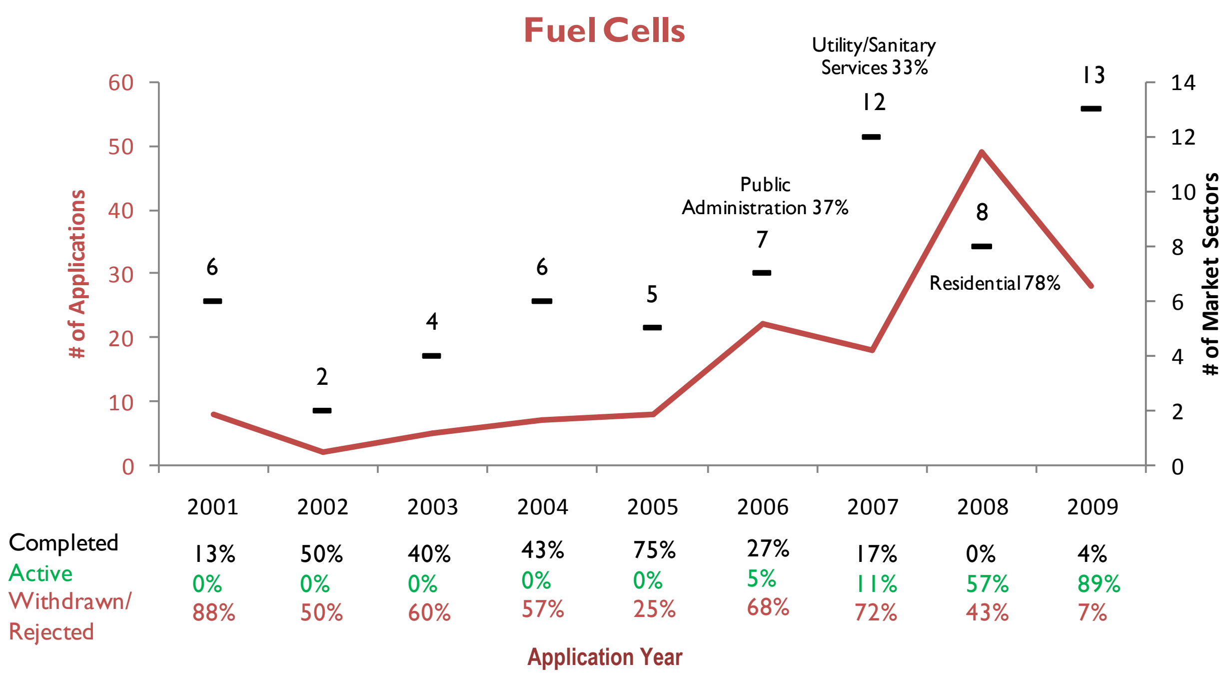
Figure 3-2. Top 8 sectors in terms of completed projects since program inception



Source: SGIP Program Data as of September 2009. Dates shown as 2009 include all data through September 2009.

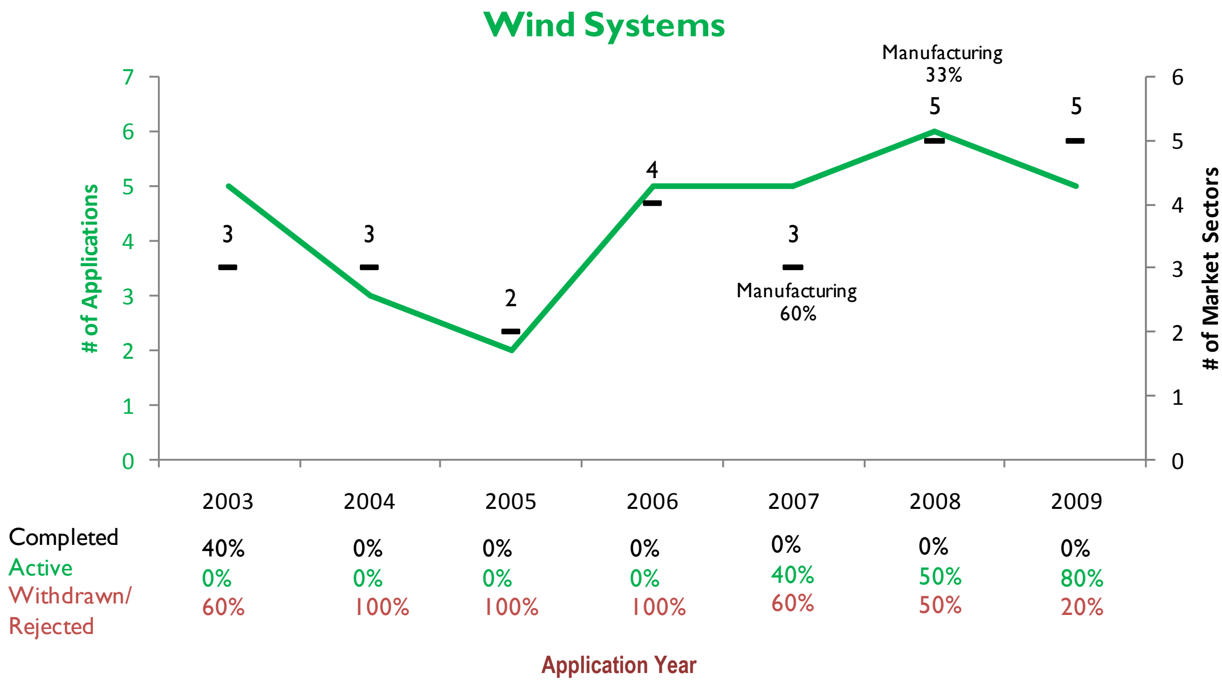
Fuel cells have seen an increasing number of applications since program inception. Following the increase in number of applications is also an increase in the number of market sectors applying to the program (see Figure 3-3, Figure 3-4, and Figure 3-5). In 2006, public administration was the market sector with the highest number of applications to the program (37% of the fuel cell applications), while the utility/sanitary services market had the highest number of applications in 2007 (with 33% of the fuel cell applications). Residential sector fuel cell applications flooded the program in 2008. The drop in the number of market sectors represented in 2008 was partially due to the large number of applications coming from the residential sector. For wind systems, the number of market sectors has remained mostly constant over time, as has the number of applications per year. The market sectors involved with the wind applications have also not changed much over time. Conventional CHP projects and the number of market sectors applying to the program have reduced over time.

Figure 3-3. Number of market sectors and number of applications by technology over time: Fuel Cells



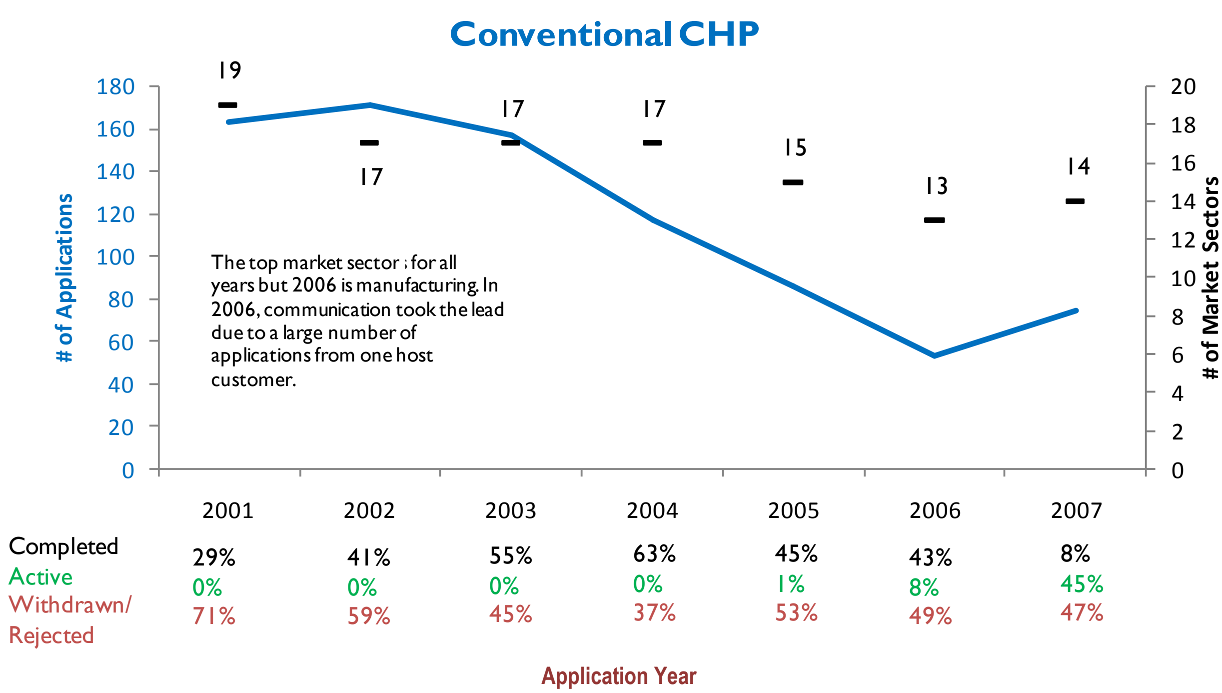
Source: SGIP Program Data as of September 2009. Dates shown as 2009 include all data through September 2009.

Figure 3-4. Number of market sectors and number of applications by technology over time: Wind Systems



Source: SGIP Program Data as of September 2009. Dates shown as 2009 include all data through September 2009.

Figure 3-5. Number of market sectors and number of applications by technology over time: Conventional CHP

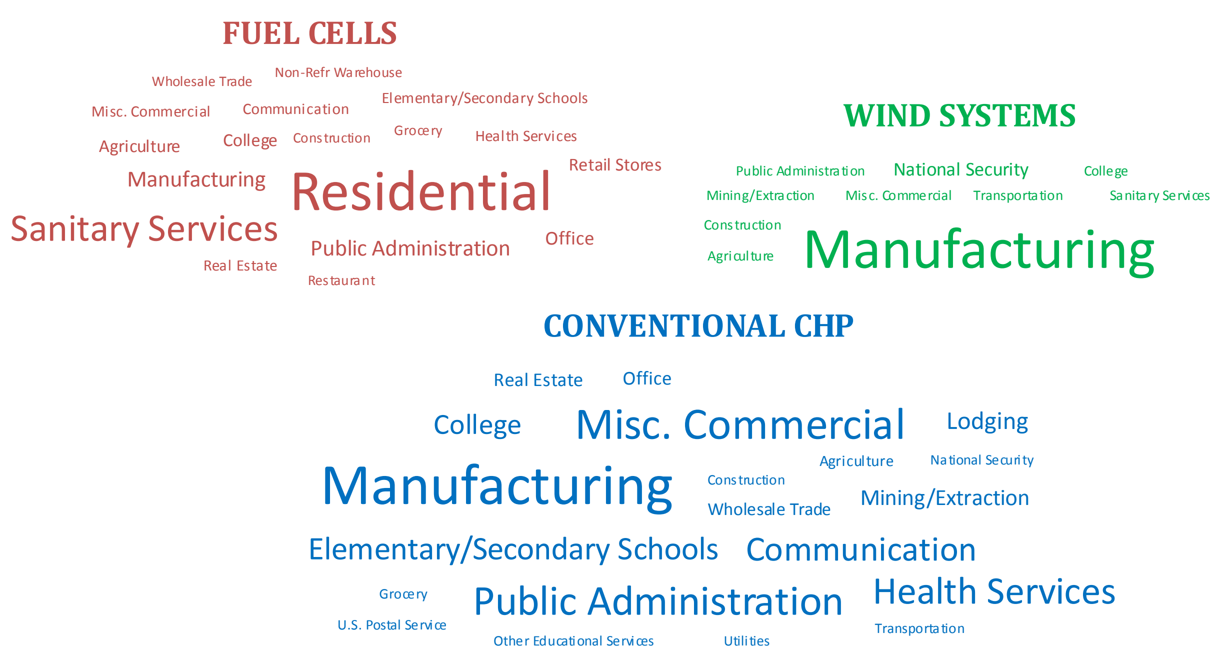


Source: SGIP Program Data as of September 2009. Dates shown as 2009 include all data through September 2009.

Exploring the market sectors by technology leads to some interesting insights. The following word clouds (Figure 3-6) show the market sectors that have applied to the program between 2007 and September 2009 for fuel cells and wind systems, and the market sectors that have applied to the program between 2005 and 2007 for conventional CHP, because conventional CHP was removed from the program in 2008. The text size of the market sector is proportional to the number of applications in the word clouds. The weighting within each of the technology clusters is independent of other clusters. The market sector with the greatest number of applications in each technology group was assigned a 36 point text size, while the market sectors with the least number of applications were assigned a 9 point text size. The other market sectors were then assigned text sizes between those values and proportional to the number of applications. Between 2007 and September 2009, the residential sector was the major market sector applying to the program with fuel cells and the manufacturing sector was the major market sector applying to the program with wind systems. For conventional CHP applications between 2005 – 2007, the manufacturing sector encompassed the major market sector interest, with high interest from the miscellaneous commercial, public administration, and health services sectors.

The weighting within each of the technology clusters is independent of other clusters. The market sector with the greatest number of applications in each technology grouped was assigned a text size of 36 points. The market sectors with the least number of applications were assigned a text size of 9 points. The other market sectors were then assigned text sizes between those value and proportional to the number of applications.

Figure 3-6. Market Sector Word Cloud: Major market sectors by technology



Source: SGIP Program Data as of September 2009

Viewing the application data in terms of system capacity provides additional details on the markets applying to the program. Of the applications received between January 2007 and September 2009, the top 70% of total system capacity applications are represented by six market sectors: manufacturing (25%), public administration (13%), colleges (12%), sanitary services (8%), health services (7%), and national security (5%). These sectors lend themselves well to large capacity projects as they tend to be good for large CHP projects and have large on-site loads (see Table 3-1). In addition, on a capacity basis, manufacturing and national security combined represent over half of the applications for wind systems.

Table 3-1. SGIP Applications January 2007-September 2009 by System Capacity and Market Sector

	System Capacity (kW)					
Market Sector	Wind	Fuel Cell	Conventional CHP	Renewable Gas Turbine, IC Engine or Microturbine	Total kW	% of Total
Manufacturing	10,255	8,600	13,406	130	32,391	25%
Public Administration	5,000	7,300	1,335	3,651	17,286	13%
College	1,000	6,800	7,494	-	15,294	12%
Sanitary Services	244	7,450	348	2,323	10,365	8%
Health Services	-	800	6,413	2,120	9,333	7%
National Security	6,000	-	-	-	6,000	5%
Mining/Extraction	-	-	4,916	-	4,916	4%
Lodging	-	-	3,981	-	3,981	3%
Office	-	1,600	2,273	-	3,873	3%
Misc. Commercial	2,534	100	780	-	3,414	3%
Residential	-	3,190	-	-	3,190	2%
Agriculture	60	1,200	1,480	386	3,126	2%
Transportation	3,000		61	-	3,061	2%
Construction	1,000	820	-	-	1,820	1%
Wholesale Trade	-	300	1,170	-	1,470	1%
Other Educational Services	-	-	1,100	-	1,100	1%

Market Sector	System Capacity (kW)					% of Total
	Wind	Fuel Cell	Conventional CHP	Renewable Gas Turbine, IC Engine or Microturbine	Total kW	
Retail Stores	-	1,100	-	-	1,100	1%
Communication	-	900	-	-	900	1%
Utilities	-	900	-	-	900	1%
Real Estate	-	700	130	-	830	1%
Elementary/Secondary Schools	-	200	518	-	718	1%
Grocery	-	200	-	370	570	0%
Non-Refr Warehouse	-	500	-	-	500	0%
Restaurant[12]	-	-	-	-	-	0%
Unknown	-	2,500	1,120	-	3,620	3%
Total	29,093	45,160	46,525	8,980	129,758	100%

Source: SGIP Program Data as of September 2009

3.2 Market Measures of Program Success

The team asked non-participants about their knowledge of the SGIP and, more generally, about their knowledge of any program in California that provides financial incentives or rebates to businesses/households for installing on-site power generation systems. Results from the non-participant surveys show that 25% of non-residential non-participants and 23% of residential non-participants have heard of the SGIP. In comparison, 33% of non-residential non-participants and 38% of residential non-participants have heard of any program in California that provides financial incentives or rebates to businesses/households for installing on-site power generation systems.

Previous evaluations also revealed non-participants awareness of the SGIP. A 2007 SGIP Market Characterization Report[13] indicated that 26% of non-participants had heard of the program, while a 2003 study[14] indicated that 15% of non-participants were aware of the SGIP.

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[12] One restaurant application was received but the project was withdrawn before information on the proposed system size was submitted.

[13] Cooney, K., Patricia Thompson and Shawn McNulty. "Market Characterization Report." August 30, 2007.

[14] RER. "Self-Generation Incentive Program, Second Year Process Evaluation." April 25, 2003.

3.3 Customers' Payback Thresholds

The technologies currently in the SGIP, wind and fuel cells, require a high up-front cost. Responses from the participant surveys with active/completed projects appear to expect and accept a longer payback period than non-participants (see Figure 3-7). The surveys reveal that nearly one third of participants with active/completed projects are willing to accept a payback period of 11 or more years. Nearly one third of participants with active/completed projects are willing to accept a payback period of six to ten years. Participants with withdrawn projects are also willing to accept long payback periods. Sixty-three percent of these participants are willing to accept a payback period of six to ten years.

Three of the active/completed participants surveyed were residential. These residential respondents had differing expectations for system payback: 3 years, 4 years, and don't know/refused. All of the withdrawn surveys were with non-residential participants.

The picture is much different for non-participants. Non-participant responses ranged from willingness to accept a payback of six months or less to 11 or more years. Both the non-residential and residential non-participant responses are grouped around a one to three year payback acceptance (45% for non-residential respondents and 39% for residential respondents) and a five to ten year payback acceptance (42% for non-residential respondents and 41% for residential respondents). Therefore, there are a group of non-participants that are willing to accept the payback periods required for investment in SGIP-incented technologies.

Figure 3-7. Longest payback period participants and non-participants are willing to accept

Time	Participants: Active/ Completed	Participants: Withdrawn	Non-Participants: Commercial	Non-Participants: Residential
6 months or less			6%	8%
1 year			9%	16%
2 years		18%	21%	12%
3 years	6%	10%	15%	11%
4 years	6%		2%	4%
5 years	12%		23%	24%
6-10 years	31%	63%	19%	17%
11+ years	31%		2%	5%
Don't know/Refused	14%	8%	4%	3%

Source: Summit Blue Consulting surveys with SGIP participants and non-participants
Note: The column totals may not add to 100% due to rounding.

Table 3-2 disaggregates the participant responses by technology type. However, care must be taken when interpreting these responses because the small number of surveys within each technology type results in a wide confidence interval.

Participants with solar PV applications are willing to accept long paybacks (five years or longer). Most participants with microturbines, gas turbines or internal combustion engines are willing to accept a payback of five to ten years. Responses of participants with fuel cells ranged from three to ten years.

Table 3-2. Longest payback period participants are willing to accept - by technology type

	Participants: Active/Completed				Participants: Withdrawn		
Time	**PV**	**Wind**	**Fuel cell**	**Microturbine, internal combustion engine, gas turbine**	**Wind**	**Fuel cell**	**Microturbine, internal combustion engine, gas turbine**
6 months or less	0%	0%	0%	0%	0%	0%	0%
1 year	0%	0%	0%	0%	0%	0%	0%
2 years	0%	0%	0%	0%	0%	20%	20%
3 years	2%	0%	27%	0%	0%	0%	20%
4 years	2%	0%	18%	10%	0%	0%	0%
5 years	9%	50%	9%	30%	0%	0%	0%
6-10 years	32%	0%	27%	40%	100%	60%	60%
11+ years	43%	50%	0%	0%	0%	0%	0%
Don't know/Refused	13%	0%	18%	20%	0%	20%	0%
Precision level/ confidence interval	90/10	90/42	90/22	90/15	90/83	90/34	90/35
Number of surveys	47	3	11	19	1	5	5
Note: The column totals may not add to 100% due to rounding							

4 MARKET DESCRIPTIONS

Describing the market for on-site generation technologies gives insight into the market's interest in the SGIP. This section details the market for technologies currently incented through the SGIP: fuel cells, wind systems and advanced energy storage, as well as a high interest technology group: conventional combined heat and power technologies.

4.1 Fuel Cells

In this section, the team provides a description of the market for SGIP-eligible fuel cell projects. It begins with a description of the market context, including an overview of the relationships among supply chain actors. A description of the market at the national level also helps to frame the issues faced in the California market. The discussion of the California market includes information from the SGIP, a high-level estimate of market potential, and information about project costs. Next, barriers to broader adoption of SGIP-eligible fuel cells in California are discussed. Finally, the section wraps up with an exploration of trends that are anticipated to emerge in the next few years.

4.1.1 Market Context

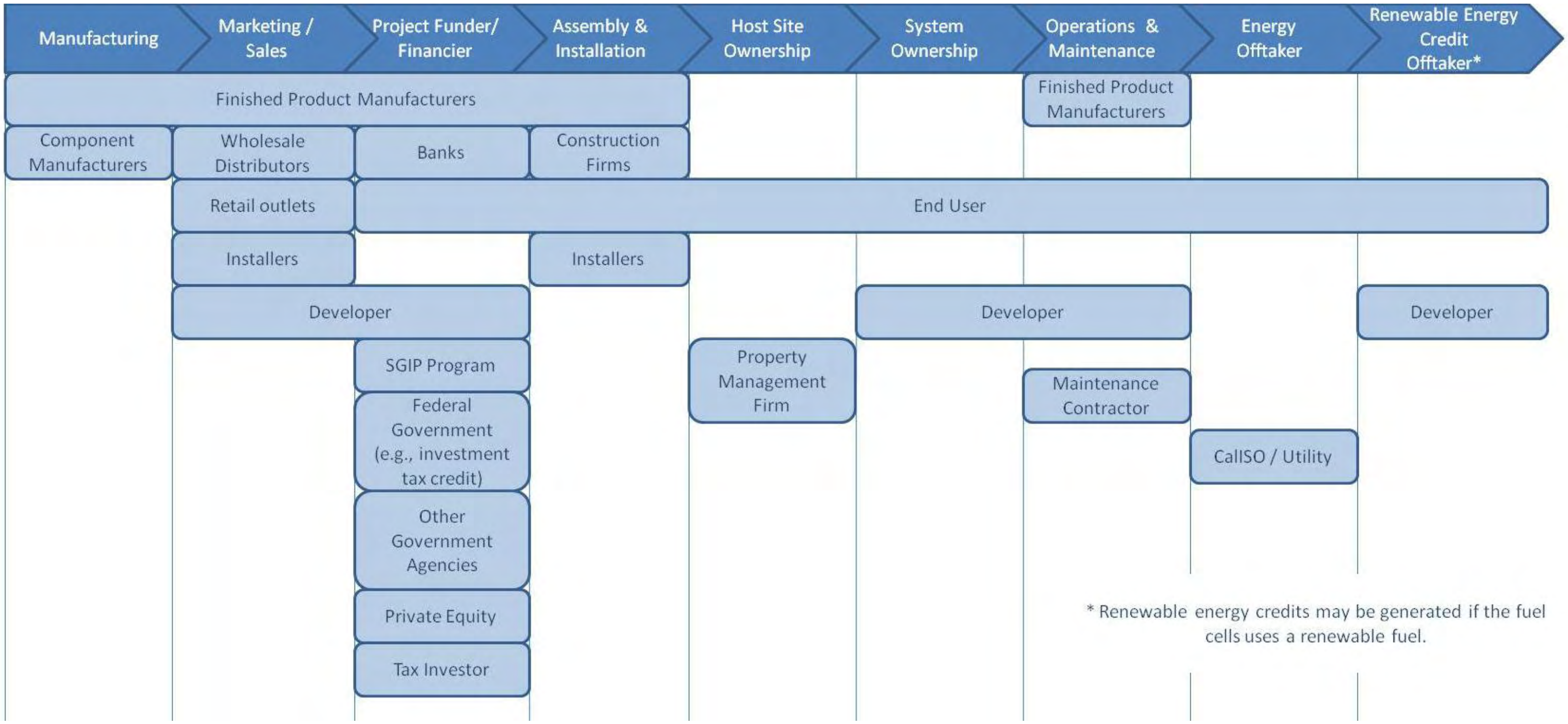
The market for fuel cell projects eligible for SGIP incentives involves many types of actors, many of which can fulfill different roles in the project lifecycle. Understanding how the market actors interact and the roles that they can fulfill provides a starting point for describing the marketplace.

Figure 4-1 is a snapshot of the current supply chain for SGIP-eligible fuel cell projects. The roles needed to bring a project to completion appear across the top of the graphic. The types of organizations that fulfill each role in practice appear in the space below the supply chain. As shown in the graphic, multiple market actors *can* fulfill a given role; which one actually does so in a given project depends on the circumstances of that project.

The market for SGIP-eligible fuel cells is still in its early stages. As shown in Figure 4-1 a few market actors operate across multiple roles. To date, manufacturers of fuel cells have often played a role in the design, development, marketing, sales, installation and maintenance of fuel cells. The highly visible large scale fuel cell manufacturers are Fuel Cell Energy, Bloom Energy, and UTC Power and the highly visible residential/small commercial scale fuel cell manufacturers are ClearEdge Power, Altergy Systems, and Plug Power. Bloom Energy and ClearEdge Power also act as project developers, a role that is also filled by construction firms. In one unique instance, a builder of refrigerated and frozen storage facilities expanded their business model to include fuel cells as a value-added option to their clients because they are a good match with refrigeration systems.

Banks also play a large role in the supply chain because finding financing for fuel cells can be challenging. Banks perceive fuel cell projects as risky due to their limited experience with technology.

Figure 4-1. Market Actors and Their Roles in the Marketplace for SGIP-Eligible Fuel Cell Projects



Source: Summit Blue Consulting interviews with market actors

4.1.2 US Market Description

The California Stationary Fuel Cell Collaborative conducted interviews with major manufacturers of phosphoric acid, molten carbonate, proton exchange membrane, and solid oxide stationary fuel cells in 2008. From the interviews, the production capacity in the U.S. in 2007 was about 80 MW, projected to increase to over 250 MW by 2010. Sales volume in the U.S. in 2007 was estimated at 10 MW with projected sales of 150 MW in 2010. The manufacturers projected this growth in sales for many reasons including a decrease in capital costs, improvements in the technology, and interest in reducing greenhouse gases and criteria pollutants. The authors of the report state that a fuel cell's high efficiency and clean operation is suited to reduce greenhouse gases and criteria pollutants.[15]

4.1.3 California Market Description

This section includes a description of the fuel cell market in California. The team begins the section with a summary of applications and installations through the California incentive programs. The team then discusses the commercially available fuel cells and market potential of fuel cells. The market uptake is dependent on social factors, which is discussed next. Lastly, the team ends the section with a summary of project costs.

California Incentive Program Data

Since program inception, there have been 147 fuel cell applications to the SGIP. As of September 2009, 23 projects were completed and 56 projects were in active stages. Table 4-1 shows the applications to the SGIP between January 2007 and September 2009 in terms of project capacity. The majority of projects by count are for 101 kW- 1 MW units. A close second in terms of high interest fuel cell sizes is the 5 kW capacity group.

Table 4-1. Application date and capacity of fuel cell applications to the SGIP between January 2007 and September 2009

	Application Year			
Fuel Cell Capacity	**2007**	**2008**	**Jan 2009 - Sept 2009**	**Total**
5 kW		34	3	37
10-100 kW		2	1	3
101 kW - 1 MW	13	10	18	41
1.1 MW - 3 MW	4	2	6	12
3.1 MW - 5 MW		1		1
Unknown	1			1
Grand Total	18	49	28	95

Source: SGIP Database as of September 2009

Note: One residential application is 10 kW and four residential applications were neighborhood scale projects for 500 kW and 1 MW systems.

[15] California Stationary Fuel Cell Collaborative. "White Paper Summary of Interviews with Stationary Fuel Cell Manufacturers." September 2008.

Table 4-2 includes the number of applications and capacity by market sector for applications between January 2007 and September 2009. While the residential sector comprises the highest number of applications (43% of total count), this sector makes up only 7% of total applied system capacity. The manufacturing sector has submitted applications with a large amount of capacity (19% of total). Other sectors with large capacity applications include public administration, sanitary services, and colleges.

Table 4-2. Market Sectors, Number of Applications, and System Capacity for Fuel Cell Applications between January 2007 and September 2009

Market Sector	Number of Applications	System Capacity (kW)	% of Total Applications	% of Total System Capacity
Residential	41	3,190	43%	7%
Public Administration	8	7,300	8%	16%
Manufacturing	7	8,600	7%	19%
Sanitary Services	7	7,450	7%	16%
Office	4	1,600	4%	4%
College	3	6,800	3%	15%
Retail Stores	3	1,100	3%	2%
Unknown	3	2,500	3%	6%
Utilities	3	900	3%	2%
Agriculture	2	1,200	2%	3%
Communication	2	900	2%	2%
Elementary/Secondary Schools	2	200	2%	<1%
Health Services	2	800	2%	2%
Real Estate	2	700	2%	2%
Construction	1	820	1%	2%
Grocery	1	200	1%	<1%
Misc. Commercial	1	100	1%	<1%
Non-Refr Warehouse	1	500	1%	1%
Restaurant	1	Value not available	1%	Value not available
Wholesale Trade	1	300	1%	1%
Grand Total	95	45,160	100%	100%

Source: SGIP Database as of September 2009.

The ERP currently incents fuel cells less than 30 kW. However, when the ERP began in 1998, fuel cells had no minimum or maximum size limits. Under the ERP, the electricity production from the system cannot exceed the electrical needs at the site where the system is located. As of early June 2008, the ERP data shows two completed systems through the program.[16] Both systems were completed in 1999. The completed fuel cell projects were 186 kW and 214 kW.[17]

There are only a few major fuel cell manufacturers operating in the California market. As can be seen in Table 4-3, the three major players in the California/SGIP market are ClearEdge Power, Fuel Cell Energy, and Bloom Energy.

Table 4-3. SGIP Applications by Manufacturer from 2007 – September 2009

	Number of Applications			
Manufacturer	**Fuel Cell (Non-Renewable Fuel)**	**Fuel Cell (Renewable Fuel)**	**All Fuel Cells**	**% of Total Applications**
ClearEdge Power Inc.	38	0	38	40%
Fuel Cell Energy Inc.	3	22	25	26%
Bloom Energy	8	8	16	17%
UTC Power	5	1	6	6%
Hydrogenics	0	4	4	4%
Unknown Manufacturer	2	4	6	6%
Total	56	39	95	100%

Source: SGIP Database as of September 2009.

Commercially Available Fuel Cells

Table 4-4 includes commercially available fuel cells that qualify for the SGIP. This table is not meant to be inclusive of all commercial fuel cells, yet it is meant to provide a listing of some of the better known fuel cell suppliers and models.

[16] An interview with the CEC Emerging Renewables Program managers on August 6, 2009 indicated that there was one completed fuel cell project through the program. However, the program data shows two completed projects on the same day in the same zip code.

[17] The California Energy Commission. Emerging Renewables Program Rebates. http://www.energy.ca.gov/renewables/emerging_renewables/index.html (September 14, 2009).

Table 4-4. Commercially available fuel cells that qualify for the SGIP

Company Name	Contact Locations	Example Model and Rated Electrical Power	Fuel Cell Type	Cell Efficiency	Number of Cells	Durability/Lifetime Target
Ballard Power Systems	British Columbia, Canada	FCgen™-1030: 1.2 kW	Proton exchange membrane fuel cell	54-63%	46	Up to 40,000 hours
ClearEdge Power	California and Oregon	**CE5: 5 kW**	Phosphoric acid fuel cell	Up to 85%	NA	NA
Fuel Cell Energy	Connecticut	**DFC 300 MA: 300 kW, DFC 1500MA: 1,400 kW, DFC 3000: 2,800 kW**	Molten carbonate fuel cell	Up to 75%	NA	NA
UTC Power	Connecticut	PureCell® Model 400: 400 kW	Phosphoric acid fuel cell	90%	NA	NA
Hydrogenics	California, Canada, Europe, China, Russia	HyPM™ XR: 4 kW to 12 kW	Proton exchange membrane fuel cell	55%	NA	NA
Altergy Systems	California	5 kW to 30 kW	Proton exchange membrane fuel cell	NA	NA	NA
Bloom Energy	NA					

Notes:
1. Fuel cells in bold have been included in applications to the SGIP.
2. Only manufacturers with a product application of "stationary," "cogeneration," or "stationary micro-CHP" are included "NA" means the information was "not available". UTC Power also produced a PureCell® Model 200, 200 kW fuel cell—production of this model ended in December 2008.

Sources: US Fuel Cell Council, "Commercially Available Fuel Cell and Fuel Cell-Related Products List", Updated August 17, 2009; Company websites; Altergy Systems. www.altergy.com; Ballard Power Systems. www.ballard.com; ClearEdge Power. www.clearedgepower.com; Fuel Cell Energy. www.fuelcellenergy.com/; UTC Power. www.utcpower.com/; Hydrogenics. www.hydrogenics.com/.

Market Potential

According to the California Stationary Fuel Cell Collaborative interviews, sales volumes in California were projected to be less than 10 MW in 2007 and near 40 MW in 2010. The projected growth in sales is due to the following industry expectations: decrease in capital costs, technology improvements, and interest in reducing greenhouse gases and criteria pollutants. In addition, of those interviewed in 2008, nearly 50% of their sales were in California. [18]

Figure 4-2 shows the locations of fuel cell installations in California, according to the National Fuel Cell Research Center. As the map shows, fuel cell installations are spread across the state with the highest concentration in the Los Angeles area.

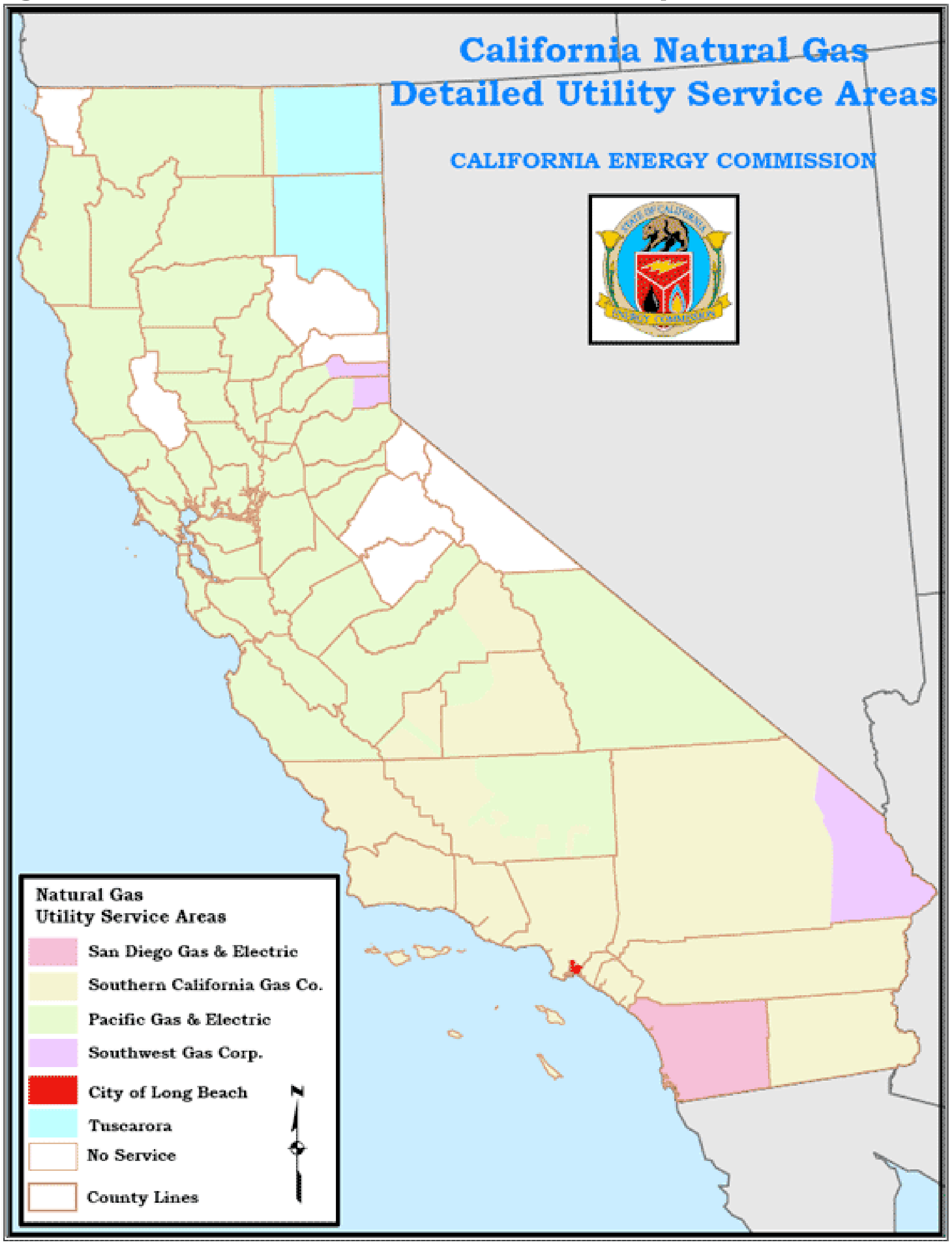
[18] California Stationary Fuel Cell Collaborative. "White Paper Summary of Interviews with Stationary Fuel Cell Manufacturers." September 2008.

Figure 4-2. Locations of Stationary Fuel Cell Installations in California

Source: National Fuel Cell Research Center. California Installations: Stationary Fuel Cell Installations. http://www.nfcrc.uci.edu/2/FUEL_CELL_INFORMATION/California_Installations/INDEX.aspx (accessed October 8, 2009).

The potential for non-renewable-fueled fuel cells is limited by the availability of natural gas service. Therefore, they will likely not be installed in the following counties due to the lack of natural gas service: Lake County, Del Norte County, Plumas County, Sierra County, Alpine County, Mono County, Tuolomne County and Mariposa County (see Figure 4-3). Similarly, the potential for renewable-fueled on-site fuel cells is limited by the availability of on-site fuels. However, CPUC Decision 09-09-049, approved in September 2009, modified the SGIP renewable fuel requirements to allow gas-fired fuel cell projects to qualify for the higher renewable fuel incentive if they use a directed biogas arrangement. Therefore, the renewable fuel would not need to be produced at the same location as the fuel cell.

Figure 4-3. California Natural Gas Detailed Utility Service Areas



Note: Not all shaded areas of each county have natural gas service.

Source: The California Energy Commission. Map Showing Natural Gas Utility Companies' Territories. http://www.energy.ca.gov/maps/gasmap.html (accessed October 9, 2009).

Social Factors Affecting Market Uptake

Residential fuel cell applications to the SGIP have comprised a large portion of the total number of applications in the past few years. Due to the high price of the fuel cell, developers are targeting those customers with high utility bills and large homes (over 5,000 square feet). These customers are generally wealthier and can support the high up front fuel cell cost.

Palm Desert offers low cost loans for energy efficiency improvements, as of August 2008. Fuel cells are applicable for the Palm Desert Energy Independence Loan through the custom measure track. The minimum size of a loan through the program is $5,000; the maximum loan amount is $100,000.[19] Eighteen percent of the residential fuel cell applications received by the SGIP in 2008 were for projects located in Palm Desert, and 84% of the residential fuel cell applications received in 2008 were for projects located in the Desert Cities[20] region.

Project Costs

The high cost of fuel cells is one major barrier to their wide spread deployment. The U.S. Department of Energy estimates that the current costs of fuel cells are around $4,500/kW.[21] According to California Stationary Fuel Cell Collaborative interviews, the average cost of fuel cells was also $4,500/kW in 2007.[22] All manufacturers surveyed provide warranties or service contracts which include the replacement of the fuel cell stack.

Project economics vary for residential versus non-residential and new construction versus existing installations. Other site specific issues can increase or decrease the cost of the installation. The team's interviews with project developers revealed a *high level* breakdown of project costs. The project costs for a typical residential fuel cell installation are shown in Table 4-5 and the project costs for a typical non-residential fuel cell installation are shown in Table 4-6. The residential cost table includes eleven operation years due to additional specifics discussed during the interview.

[19] City of Palm Desert, "Energy Independence Program Report and Administrative Guidelines," June 25, 2009.

[20] Desert Cities includes Cathedral City, Indian Wells, La Quinta, Palm Springs, Rancho Mirage, and Palm Desert.

[21] U.S. Department of Energy. Future Fuel Cells R&D. http://www.fossil.energy.gov/programs/powersystems/fuelcells/ (accessed October 8, 2009).

[22] California Stationary Fuel Cell Collaborative. "White Paper Summary of Interviews with Stationary Fuel Cell Manufacturers." September 2008. Note: this value is taken from the Executive Summary. Figure 2 further details the cost estimates; however, the figure shows the units as $/MW in the version on the website in December 2009. The California Stationary Fuel Cell Collaborative has confirmed that the figure should show $/kW. The summary online will be updated to show a $/kW unit.

Table 4-5. Residential Fuel Cell System Costs

Operation Year	Example Annual Cost ($)	Component Breakout
1	$70,000	Fuel cell: 70% Installation: 20% Sales tax: 10%
2-5	$0	
6	$6,000	Stack replacement: 83% Maintenance: 17%
7	$1,000	Maintenance: 100%
8	$1,000	Maintenance: 100%
9	$1,000	Maintenance: 100%
10	$1,000	Maintenance: 100%
11	$6,000	Stack replacement: 83% Maintenance: 17%

Notes: Assumes a 5 kW system with a maintenance plan included for the first five years. The maintenance and stack replacement costs would continue after the 11th year shown in the table. Stack replacements occur about every five years. The maintenance contract may expire after the first five years of operation, thus the maintenance cost occurs annually beginning on the sixth year.

Source: Summit Blue Consulting interviews with fuel cell developers.

Table 4-6. Non-Residential Fuel Cell System Costs

Operation Year	Example Annual Cost ($)	Component Breakout
1	$3,500,000	Fuel cell: 50-68% Installation: 25-43% Maintenance contract: 7%
2+	$240,000	Maintenance contract: 100%

Notes: Assumes a 600 kW system. If gas treatment is needed, it can add to the total cost of the system and represent about 10-15% of the system cost. Depending on how the contracts are structured, the restacking costs may or may not be included in the maintenance contract. The maintenance contract is assumed to be $400/kW/year.

Source: Summit Blue Consulting interviews with fuel cell developers and PAs.

4.1.4 Barriers to Broad Market Adoption of SGIP-Eligible Fuel Cells in California

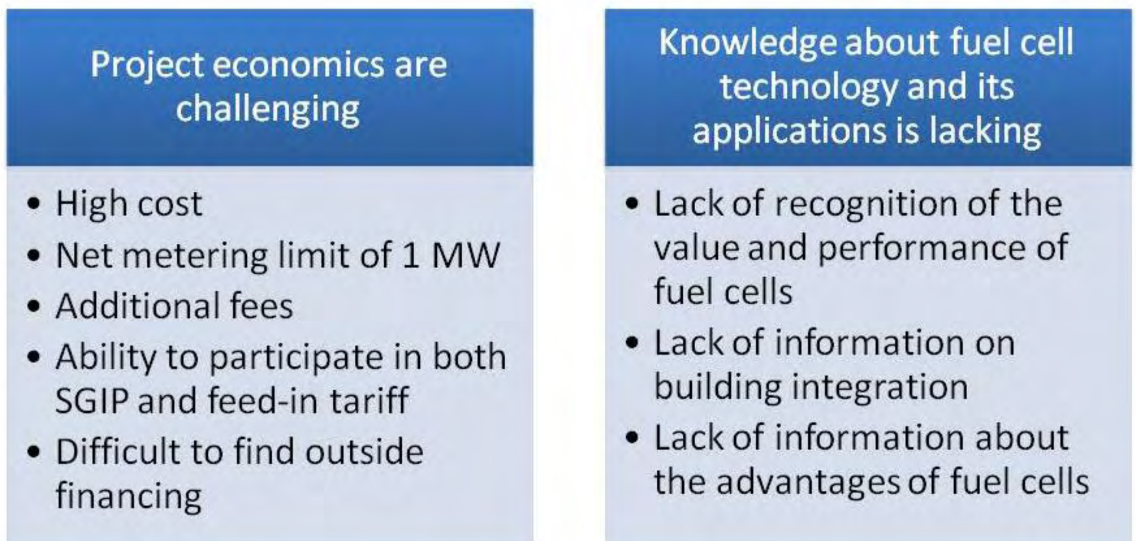
There are two primary categories of barriers to more widespread development of SGIP-eligible fuel cell projects in California:

- Project economics are challenging; and
- Knowledge about fuel cell technology and its applications is lacking.

Unless otherwise noted, the information in this section is based on the project team's interviews with developers and market actors in the fuel cell industry.[23] The project team used the interview results to highlight high-level themes, as described above. Additional detail about the issues associated with each theme is provided in this section, using the specific input from the interviews.

Figure 4-4 summarizes the major issues associated with each of these themes. The themes and associated issues are discussed in more detail in the remainder of this section.

Figure 4-4. Summary of Barriers to More Widespread Development of SGIP-Eligible Fuel Cell Projects



Project Economics are Challenging

The most significant barrier to achieving market potential is the ***high cost*** of the units. However, market actors were confident that the cost of the systems is decreasing. The high cost of the units is due to a range of factors including a lack of volume production. There needs to be an increase in volume of production in order to drive the price down through cheaper manufacturing operations. One market actor noted that the industry is looking for installed cost to drop to $2,000/kW for successful fuel cell implementation. In addition, low competition in the market is prohibiting a reduction in unit costs. A few market actors noted that there are currently two large stationary fuel cell players in the California market—Fuel Cell Energy and UTC Power. Competition can help cause a decrease in the cost of the technology and can increase the services offered to the market. The more competitors a company has, the more likely it is to keep its product prices low and offer great services to its customers so that it may keep its customers from purchasing the product from the competitors.

The ***net metering limit of 1 MW*** degrades the project economics for projects over this size limit. Companies are pursuing fuel cell projects greater than 1 MW, and thus would not be eligible for net-energy metering. In addition, under net-energy metering for fuel cells, the utility cannot charge some of the ***additional fees*** that could be placed on customer-generators like demand charges, standby charges, or

[23] Market actors included manufacturers, fuel cell associations, and a university research center.

minimum monthly charges, if the charges go beyond other customer's charges in their rate class. This waiver is not in place for fuel cells larger than 1 MW. Market actors also said that utility account managers tell customers that these fees can add a significant cost to the project, thus deterring project completion. It should be noted that net metering for fuel cells is generation-component-only net metering, compared to net metering for solar PV which is full retail net metering.

Fuel cells do not have the ***ability to participate in both SGIP and feed-in-tariffs*** and thus cannot receive the additional revenue stream that a feed-in tariff can bring to a project. This issue will likely arise in the future and is a potential barrier. For some customer segments, they may want to receive SGIP funds for a portion of the system and receive a feed-in tariff for another portion of the system. One market actor felt that the regulations seemed to be changing in favor of fuel cells, with the availability of net metering and now an option for feed-in-tariffs.

Lastly, it is currently ***difficult to find outside financing*** for fuel cell projects. The financing sector is not experienced with fuel cells, and thus is hesitant to finance systems. This perceived risk associated with a fuel cell system has limited the amount of financing available and made it difficult to obtain financing.

<u>Knowledge about fuel cell technology and its applications is lacking</u>

A high number of SGIP-eligible fuel cell installations in California and the U.S. do not exist, leading to a lack of knowledge of the technology and a misunderstanding about its uses and applications. Developers note that some customers are cautious of fuel cells because the technology is perceived to be new and uncertain.

Market actors noted that there is a ***lack of recognition of the value and performance of fuel cells***. The market is currently not at the point where customers ask for and insist on fuel cells. With more installations, customers are beginning to learn more about the technology. The market needs to surpass a tipping point for the industry to be sustainable—according to one market actor, there are currently about 28 MW deployed commercially in California. The market actors also noted that the SGIP has been a critical force in allowing the market to advance to where it is today.

Furthermore, fuel cells require integration on a case-by-case basis to ensure efficient use of the electrical and thermal products. Proper integration can be difficult, especially in a retrofit situation, and many developers and architects ***lack the information needed to for successful integration of a fuel cell into its built environment***. If successful integration does not occur, it is more likely that the customer will not be satisfied with the fuel cell. Integration is such an important factor in the success of project, that one manufacturer will not allow installers to install their product unless the manufacturer is involved in the integration.

In addition to information about integration into the built environment, architects and developers ***lack information about the advantages of fuel cells***. This lack of knowledge makes them hesitant to use fuel cells. The knowledge gap can also create a ***lack of ownership*** taken by developers in the project and can lead to an unsuccessful project.

Other knowledge gaps and misconceptions include unfamiliarity by air districts in permitting the gas conditioning unit for renewable-fueled fuel cell projects, misconception about the lifetime of the fuel cell.

The barriers described in this section can lead to competition from other forms of distributed generation or other capital improvement projects. For example, PV systems are well supported through the California Solar Initiative and are more widely recognized and understood by the general population. Customers looking to invest in a distributed generation technology have good reasons to select PV over fuel cells, including lower costs and a free fuel source. In addition, there is a perceived utility opposition within the market. Some market actors felt that the utilities in California do not advocate an increased fuel cell market. Because fuel cells have a narrower application than other distributed generation technologies, like solar, it appears easier for the utilities to discourage market entry of fuel cells.

4.1.5 Future Trends

Market actors provided insights into the future for fuel cells in California and the U.S.[24] The team discusses trends in markets, technology, cost, and manufacturing operations from the interviews and from the team's review of the market in this section.

Markets

- Using biogas as a fuel for fuel cells is gaining popularity with wastewater treatment plants. Other biogas applications that could enter the market include biogas operations in the San Joaquin Valley with dairies installing digesters and using the biogas as a fuel for fuel cells. Another biogas application is the gasification of biomass in the San Joaquin Valley. This application will likely receive more attention under AB 32. The operation of a fuel cell from landfill gas could increase in the future and food processing plants may also be a market sector that begins to install fuel cells.
- Use of renewable fuel will likely increase with fuel cells.
- Natural gas-fueled fuel cells have begun to reach penetration levels in hotels, hospitals, office buildings, and institutions (prisons and universities).
- Electricity prices will likely begin to increase around the country and more states may adopt progressive rate structures where large customers are penalized. Higher costs under these rate structures increase the value proposition of fuel cells.
- The all electric fuel cell with high efficiency may gain higher market share.
- The ability for project to "nominate" renewable fuel for fuel cell projects will likely increase the number of renewable-fueled fuel cell projects completed through the SGIP.

Technology

- An emerging technology is the stationary fuel cell/gas turbine hybrid power generation. This technology has electrical efficiencies that far exceed the simple sum of either technology—the fuel to electrical efficiencies are approaching 70-80%. The hybrid technology allows a gas turbine to exceed the Carnot efficiency limit. Many universities are exploring this technology, including University of California-Irvine and Georgia Institute of Technology. Manufacturing companies that are involved include Fuel Cell Energy and Rolls Royce.
- The technology's lifetime has potential to increase in the future.

Cost

- The market believes that prices will decrease in the next few years. One market actor noted that prices are reducing about 25% per year. Drivers for cost reduction include volume, the learning curve, the competition in the market, technological developments, and emergence of key suppliers for fuel cell parts. Over time, there will be more effective use of technology including recycling and manufacturing.

[24] Summit Blue Consulting fuel cell market actor interviews.

Manufacturing Operations

- Fuel cell manufacturers would like to scale up their manufacturing operations, but they need to demand to do so. Currently, manufacturing facilities are not operating at their maximum capacity.

4.2 Wind Systems

This section provides a description of the market for SGIP-eligible wind projects. It begins with a description of the market context, including an overview of the relationships among supply chain actors. A description of the market at the national level also helps to frame the issues faced in the California market, which is the next topic covered. The discussion of the California market includes a high-level estimate of market potential, information gathered by SGIP, and information about project costs. Next, barriers to broader adoption of SGIP-eligible wind in California are discussed. Finally, the section wraps up with an exploration of trends that are anticipated to emerge in the next few years.

4.2.1 Market Context

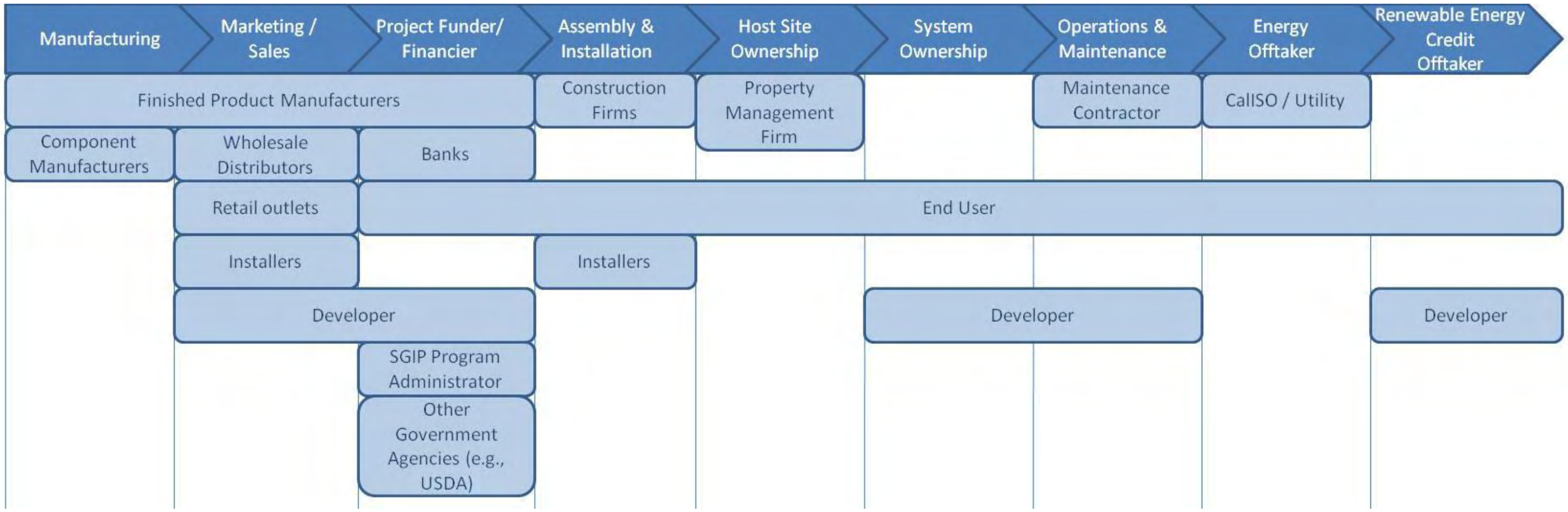
The market for wind projects eligible for SGIP incentives involves many types of actors, many of which can fulfill different roles in the project lifecycle. Understanding how the market actors interact and the roles that they can fulfill provides a starting point for describing the marketplace.

Figure 4-5 captures a snapshot of the current supply chain for SGIP-eligible wind projects. The roles needed to bring a project to completion appear across the top of the graphic. The types of organizations that fulfill each role in practice appear in the space below the supply chain. As shown in the graphic, multiple market actors *can* fulfill a given role; which one actually does so in a given project depends on the circumstances of that project.

The market for SGIP-eligible wind is still in its early stages, featuring a fragmented supply chain and many small companies competing for market share. As shown in Figure 4-5, few market actors operate across multiple roles. End users *can* bring a project from conception to completion, but this is not the norm. Project developers are becoming more common, streamlining the development process; yet, they have not been successful in completing many projects in California. It is still common for manufacturers to work with dealers, which are sometimes also installers, to distribute their products; these dealers leave it to the end user to find financing, which is one of the most significant hurdles in the development process.

More entities are becoming interested in financing SGIP-eligible wind systems. This is a critical component to project success. Public and quasi-public sources of funding support still lay the foundation for making these wind projects attractive investment opportunities; these sources include the SGIP, the federal ITC, and other government agencies, such as the U.S. Department of Agriculture. Private sources of financing are needed to cover the project cost. Banks, private equity funds, and other tax investors are filling this role in some cases; by providing this up-front capital in exchange for payments from the end-user over the life of the system, the hurdle of up-front cost can be overcome. End users still serve as the funder of last resort, however; in these circumstances, the number of potential projects is limited to the number of end users that have capital available to pay for the system upfront.

Figure 4-5. Market Actors and Their Roles in the Marketplace for SGIP-Eligible Wind Projects



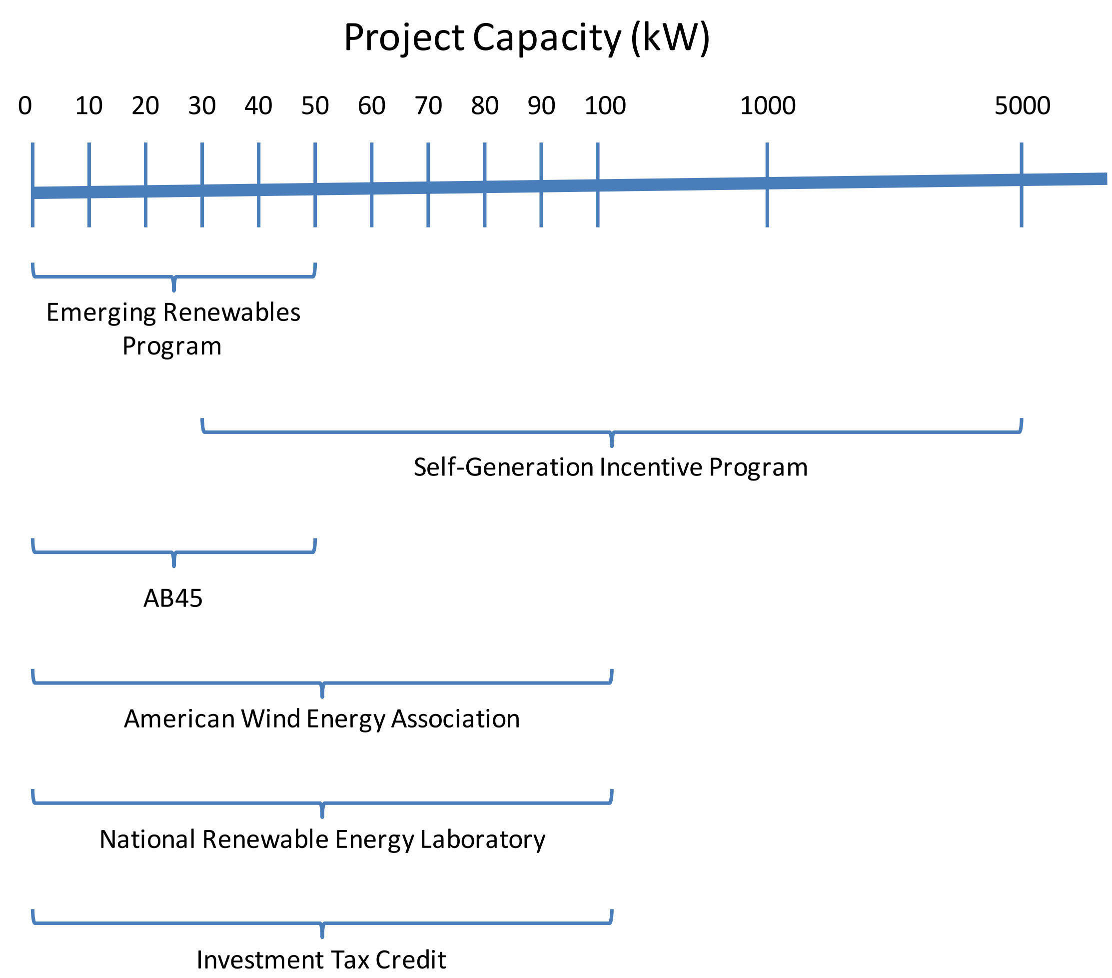
Source: Interviews with market actors and developers.

Defining and describing the market for "small wind" is complicated by a range of definitions of the term. Generally, small wind systems are classified as systems with a capacity less than or equal to 100 kW. The American Wind Energy Association (AWEA), the National Renewable Energy Laboratory (NREL), and the ITC all adhere to this classification, as illustrated in Figure 4-6.

California's incentive programs for wind systems are unique in that they do not follow this definition. The ERP provides incentives for wind systems sized up to 50 kW, though the program calculates the incentive for only the first 30 kW. The SGIP funds systems between 30 kW and 5 MW. The upper bound for incentives is dependent on the year of application; for applications between 2001 and 2007, incentives were given up to 1 MW. For applications in 2008 and 2009, tiered incentives are available for systems up to 3 MW.

This market characterization focuses on systems that are eligible for incentives through SGIP. In some places, the report will focus on "small wind systems," those smaller than 100 kW. AWEA and NREL have conducted previous research on systems in this range. Comparable research for projects in the range of 100 kW to 5 MW is not available because projects in that range are grouped with grid-scale projects; the research for grid-scale projects tends not to address the unique issues associated with these projects.

Figure 4-6. Definitions of Small Wind



4.2.2 United States Market Description

Small wind installations at the national level continued to grow in 2008. The cumulative installed small wind[25] capacity reached 80 MW in the United States at the end of 2008, including 17.3 MW that came online in that year.[26] A few of the highlights of 2008:

- The bulk of the new small wind installed capacity (78%) came in the form of on-grid applications.
- More than half of the units sold were in the 0-0.9 kW range.
- Projects in the 1-10 kW range contributed a larger share (44%) of installed capacity than any of the other size categories.
- The U.S. market for small wind turbines grew 78% in 2008. Increased supply was mainly driven by the availability of capital and inventory. Increased demand was mainly driven by volatile energy prices, state/federal incentives, and state renewable portfolio standard policies.

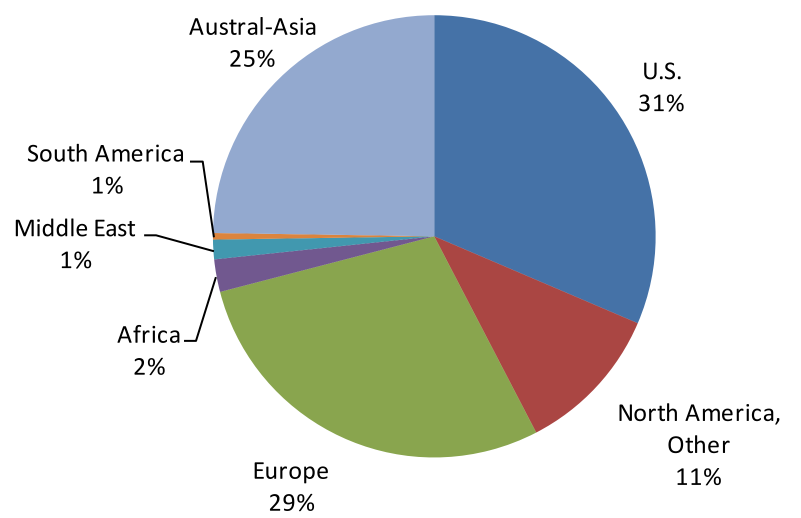
Of the 210 companies that manufactured small wind equipment at the end of 2008, the United States is home to 31% (66), more than any other country or region. Figure 4-7 shows the global distribution of small wind turbine manufacturers. In addition, the United States is also home to the manufacturer responsible for selling the largest capacity of small wind turbines, Southwest Windpower, which sold more than twice as much capacity as the next competitor. Oklahoma-based Bergey Windpower was also among the top five companies in sales of small wind turbine capacity. Another manufacturer with a U.S. presence and strong sales in 2008, Entegrity Wind Systems went bankrupt in October 2009 as a result of a capital crunch; the company ceased manufacture of its 50 kW turbine because of the bankruptcy.[27]

[25] As discussed earlier, small wind in this instance and throughout the report refers to systems with a capacity less than or equal to 100 kW.

[26] Unless otherwise noted, data about the U.S. market for small wind are from the following source: American Wind Energy Association (AWEA), "AWEA Small Wind Turbine Global Market Study: Year Ending 2008," 2009.

[27] Proctor, Cathy. October 27, 2009. "Entegrity is declared bankrupt." *Denver Business Journal.* Available: http://denver.bizjournals.com/denver/stories/2009/10/26/daily26.html

Figure 4-7. Global Distribution of Manufacturing Firms (as of Year-End 2008)



Source: American Wind Energy Association, "Small Wind Turbine Global Market Study: Year Ending 2008."

Commercial-sector customers have found the power purchase agreement (PPA) to be the financing method of choice due to the difficulty in financing larger, more expensive turbines. AWEA expected that the PPA model for wind systems will become increasingly popular in 2009. Due in large part to the credit crunch across the financial markets, however, the PPA model has yet to become a major market model for wind systems.[28]

4.2.3 California Market Description

This section provides a brief overview of the California market for SGIP-eligible wind projects. First, a summary of information about projects for which SGIP and ERP have paid incentives provides a look at the historical development of the market. Then, a review of available literature about the market potential for small wind in California provides a look forward. Social factors that affect development are discussed next, followed by an overview of project costs.

California Incentive Program Data

Information gathered by the SGIP provides additional insight into the market for wind projects that are eligible for SGIP-funded incentives. To date, two wind systems have been completed under SGIP since its inception, comprising 1,574 kW of installed capacity. These two projects applied to the SGIP prior to 2008.

The SGIP received 16 applications for wind systems between January 2007 and September 2009. As of September 2009, seven of the applications have been withdrawn or rejected and nine of the applications are currently in active stages. None of the projects received during this time frame have been completed.

[28] Interviews with wind market actors.

Table 4-7 shows the proposed project capacity by application year. The proposed project capacity ranges from 30 kW to 5 MW.[29] In many cases, the projects involve only one turbine, but there exceptions; this table shows the total proposed project size.

Table 4-7. Proposed Project Capacity of Wind Systems Included in SGIP Applications (January 2007-September 2009)

	Application Year			
Proposed Project Capacity	**2007**	**2008**	**January-September 2009***	**Total**
30 kW - 50 kW	1	0	0	1
51 kW - 100 kW	0	0	1	1
101 kW - 500kW	2	1	0	3
501 kW - 1 MW	1	0	1	2
1.1 MW - 3 MW	1	2	2	5
3.1 MW - 5 MW	0	3	0	3
Total	5	6	5	16
*One of the applications in 2009 has an unknown system size. This application is shown only in the total value.				

Source: SGIP Database as of September 2009.

A revision to the incentives in 2008 and 2009 allowed projects between 1 MW and 3 MW to receive tiered incentives rates, corresponding to 100% from 0 – 1 MW, 50% from >1 MW to 2 MW, and 25% from >2 MW to 3 MW. This revision brought in larger wind turbine applications to the SGIP, as can be seen in Table 4-7, where the majority of applications in 2008 and two out of five of the applications in 2009 were for 1.1 MW-5 MW range.

[29] Note that one application listed the turbine size as 5 kW, which is not eligible under the SGIP. This application was listed as withdrawn.

Eleven distinct market sectors applied to the SGIP with wind systems between 2007 and 2009, as shown in Table 4-8. Food manufacturing accounted for the highest number of applications. Each of the other sectors, except for National Security and International Affairs, submitted one application.

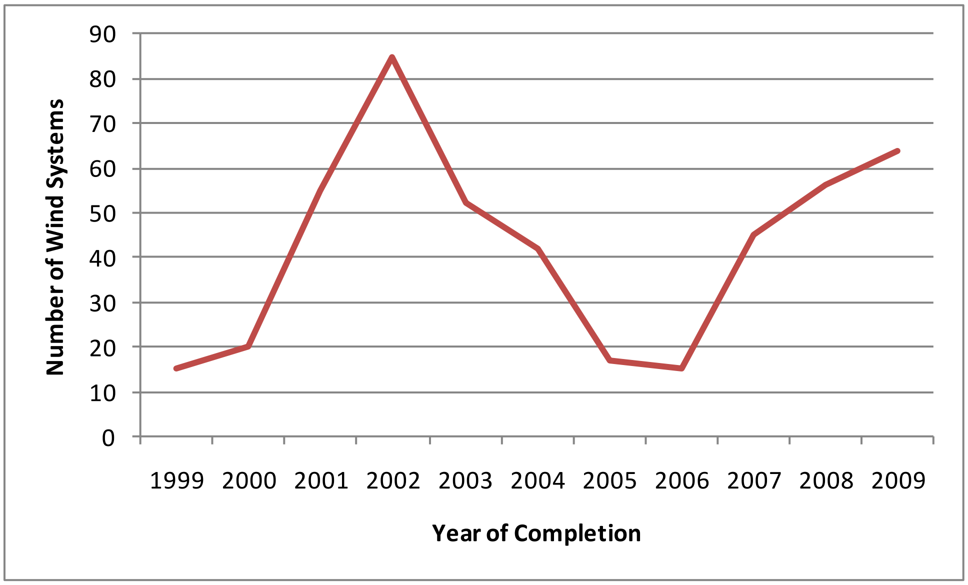
Table 4-8. Number of Applications to the SGIP for Wind Systems by Market Sector

Market Sectors (2-Digit SIC Level)	Number of Applications	System Capacity	% of Total Applications	% of Total System Capacity
Food Manufacturing	5 (2 applications from one company)	5,255	31%	18%
National Security and International Affairs	2	6,000	13%	21%
Federal Government	1	5,000	6%	17%
Chemical Manufacturing	1	5,000	6%	17%
Crop Production	1	60	6%	0.2%
College	1	1,000	6%	3%
Heavy and Civil Engineering Construction	1	1,000	6%	3%
Mining (except Oil and Gas)	1	N/A	6%	NA
Rail Transportation	1	3,000	6%	10%
Amusement, Gambling, and Recreation Industries	1	2,534	6%	9%
Sanitary Services	1	244	6%	1%
Grand Total	16	29,093	100%*	100%*
* The percentages of total applications and total system capacity are rounded in the sector-by-sector breakdown; the Grand Total reflects the sum of the unrounded numbers.				

Source: SGIP Database as of September 2009.

In comparison to SGIP, the ERP has provided funding for a larger number of projects. ERP provides incentives for wind systems sized up to 50 kW, though the program will provide the incentive for only the first 30 kW. The incentives are tiered and are higher for the first 7.5 kW. Through the end of 2009, ERP provided incentives for 466 systems, comprising about 2,900 kW of installed capacity.[30,31]

Figure 4-8. Completed Wind Systems Incented under the Emerging Renewables Program (1999-December 31, 2009)



Source: California Energy Commission, January 5, 2010.

[30] California Energy Commission. January 5, 2010. "Data Showing Approved and Completed Systems after January 1, 2005." Available: http://www.energy.ca.gov/renewables/emerging_renewables/COMPLETED_SYSTEMS.XLS

[31] California Energy Commission. January 5, 2010. "Data Showing Completed Systems before January 1, 2005." Available: http://www.energy.ca.gov/renewables/emerging_renewables/COMPLETED_BEFORE_1-1-05.XLS

Commercially Available Wind Turbines

Applicants to SGIP between January 2007 and September 2009 have planned to use turbines from a variety of manufacturers. Applicants have planned to use only two of the manufacturers, Fuhrlander and General Electric, in more than one project. Table 4-9 lists the manufacturers of wind turbines that have been included in applications to the SGIP.

Table 4-9. Manufacturers of Wind Turbines Planned for Use in Wind Projects Applying to the SGIP (January 2007-September 2009)

Manufacturer	Number of Applications	% of Total Applications
Fuhrlander	4	25%
General Electric	2	13%
Clipper	1	6%
DeWind	1	6%
Nordic Windpower	1	6%
Norwin	1	6%
ReDriven	1	6%
Vensys Energy	1	6%
Southwest Windpower	1	6%
Wind Energy Solutions	1	6%
Vestas	1	6%
Unknown	1	6%
Total	16	

Source: SGIP Database as of September 2009.

Table 4-10 lists many of the companies that manufacturer wind turbines in the SGIP eligible capacity range. This list is not meant to be all inclusive, yet it is meant to showcase the more active turbine manufacturers with turbines eligible for the SGIP.

Table 4-10. Commercially Available Wind Turbines That Qualify for SGIP[32]

Company Name	Contact Locations	Example Turbine Model and Rated Electrical Power	Hub Height	Cut-in wind speed	Cut-out wind speed	Rated Wind Speed
Atlantic Orient Canada	Canada	AOC 15/50: 50 kW	25 m	4.6 m/s	22.4 m/s	11.3 m/s
Northern Power Systems	Vermont	Northwood 110: 100 kW	37 m	3.5 m/s	25 m/s	14.5 m/s
Wind Energy Solutions	The Netherlands	WES[18]mk1: 80 kW, **WES[30]mk1: 250 kW**	18-30-40 m , 31-51 m	< 3 m/s	25 m/s	12 m/s
Vestas	Denmark	V52: 850 kW, **V80: 2.0 MW**	44-74 m, 67-80 m	4 m/s	25 m/s	16 m/s
Fuhrlander	Germany	**FL 1500: 1.5 MW, FL 2500: 2.5 MW**	65-100 m	3 m/s, 3.5 m/s	25 m/s	Not available
Southwest Windpower	Arizona	**Whisper 500: 3 kW**	Not available	3.4 m/s	Not av	10.5 m/s
Clipper Windpower	California	**Liberty: 2.5 MW**	80 m	4 m/s	25 m/s	Not available
DeWind	California	**D8.2: 2 MW**	80-100 m	3 m/s	25 m/s	13.5 m/s
General Electric	Worldwide with locations in the U.S.	**1.5sle, 1.5xle: 1.5 MW**	65-80 m, 80 m	3.5 m/s	25 m/s, 20 m/s	14 m/s, 11.5 m/s
Nordic Windpower	California	**N1000: 1 MW**	70 m	4 m/s	25 m/s	16 m/s
Norwin	Denmark	**29-STALL: 225 kW**	30-40 m	4 m/s	25 m/s	Not available

[32] Note that this is not comprehensive as a group of small turbines can also qualify if the total capacity of the project is $\geq$ 30 kW.

Company Name	Contact Locations	Example Turbine Model and Rated Electrical Power	Hub Height	Cut-in wind speed	Cut-out wind speed	Rated Wind Speed
Vensys Energy	Germany	**Vensys 70, 77: 1.5 MW**	65-85 m	3 m/s	22, 25 m/s	13, 13.5 m/s
ReDriven	Canada	FD 12.0-20K: 20 kW	Not available	2 m/s	Not available	11 m/s

Notes:

3. Turbines in bold have been included in applications to the SGIP.
4. Vestas also offers 1.65 MW and 3.0 MW models. Fuhrlander also offers 30 kW, 100 kW, and 250 kW models. Southwest Windpower also offers 200 W, 900 W, 1 kW, and 2.4 kW models. DeWind also offers a 1.25 MW model. General Electric also offers a 2.5 MW turbine. Norwin also offers a 750 kW model. ReDriven also offer 2 kW, 5 kW, and 10 kW models. Energy Maintenance Services used to sell refurbished Vestas E15 machines.
5. Entegrity Wind Systems is not included in this table, as they are no longer selling turbines.

Sources: Atlantic Orient Canada. http://www.atlanticorientcanada.ca/; Entegrity Wind Systems. http://www.entegritywind.com/; Northern Power Systems. http://www.northernpower.com/; Wind Energy Solutions. http://www.windenergysolutions.nl/; Vestas. http://www.vestas.com/; Fuhrlander. http://www.fuhrlaender.de/; Southwest Windpower. http://www.windenergy.com/index_wind.htm; Clipper Windpower. http://www.clipperwind.com/; DeWind. http://www.dewind.de; General Electric. http://www.gepower.com/businesses/ge_wind_energy/en/index.htm; Nordic Windpower. http://www.nordicwindpower.com/; Norwin. http://www.norwin.dk/; Vensys. http://www.vensys.de/; ReDriven. http://www.redriven.ca/.

California Market Potential

The project team reviewed a range of available sources to estimate wind potential in California. The team sought to determine the amount of capacity that would actually be developed, given technical and economic considerations. The CEC and AWEA provided the most widely known estimates:

- The CEC's Strategic Value Analysis (SVA) provided estimates of anticipated increases in wind development between 2012 and 2020. The SVA estimates a potential of more than 14,000 MW for low-wind-speed and DG applications.33
- AWEA estimates the wind energy potential in California to be 6,770 MW, ranking California 17th in the United States in terms of potential.[34] This estimate, however, includes both small and utility-scale wind.

These two estimates indicate different levels of available wind resource for customer-sited wind applications. A more detailed review of the assumptions behind these estimates may help to determine which one is a better estimate of developable market potential.

4.2.4 Social Factors

Public entities, such as local or federal government buildings, have had the most success in moving forward with wind projects. This is due to different permitting requirements for federal government spaces and increased interest and support from public entities for wind. As of September 2009, of the ten private sector wind applications, 50% were active and 50% were withdrawn. Of the five public entity projects, 80% were active and 20% were withdrawn.

In addition, the presence of a strong internal champion with abundant political capital and financial resources has a positive effect on the success of a project. The development effort at McEvoy Ranch, for example, was sustained for over seven years by the ranch's owner, Nan McEvoy. Ms. McEvoy had been a member of the board of the *San Francisco Chronicle* and had the relationships with local stakeholders and the personal commitment to make the project move forward. Her tenacity throughout the development process reduced the cost for developers, who would have otherwise had to support these efforts on their own.

Project Costs

According to the SGIP database, installed costs range from $1.41/W to $16.67/W for SGIP-eligible wind systems.[35] Developers revealed some information on project costs during the team's interviews. Table 4-11 shows the breakdown in project costs for a wind turbine project.

[33] Yen-Nakafuji, Dora, "California Wind Resources," April 2005, CEC-500-2005-071-D.

[34] American Wind Energy Association. "Small Wind in California," undated. Available: http://www.awea.org/smallwind/california.html

[35] Note that this range does not include one project with no costs listed and two projects with costs outside the normal range: $490/W and $1,860/W.

Table 4-11. Installed Cost of 25kW Wind Turbine

Component	% of Total Cost
Wind Turbine	66%
Installation	28%
Engineers (soil and structural analysis, electrical)	5%
Permitting	1%
Total Cost	$85,000

Notes:
1. Example based on a 25 kW system.
2. County use permits can run from $100 - $10,000 thereby drastically changing the share of the total cost that goes to permitting.
3. Environmental studies and Rule 21 compliance can also significantly add to the cost of a project.

Source: Summit Blue Consulting interviews with developers.

One developer involved with power purchase agreements for wind projects discussed his investment requirements for SGIP-eligible wind projects. He prefers a 12% return on equity excluding the cost of debt. Incorporating incentives and tax credits, the return on investment occurs in the first 5-7 years and investor returns occur in the next 1-2 years.

4.2.5 Barriers to Broad Market Adoption of SGIP-Eligible Wind in California

There are four primary categories of barriers to more widespread development of SGIP-eligible wind projects in California:

- Project economics are challenging;
- The development process is complex and cannot be easily replicated;
- A business model that properly aligns the motivations of the customer with the motivations of providers is not yet prevalent;
- Wind projects in the size range of SGIP-eligible wind projects are overshadowed by utility-scale wind projects.

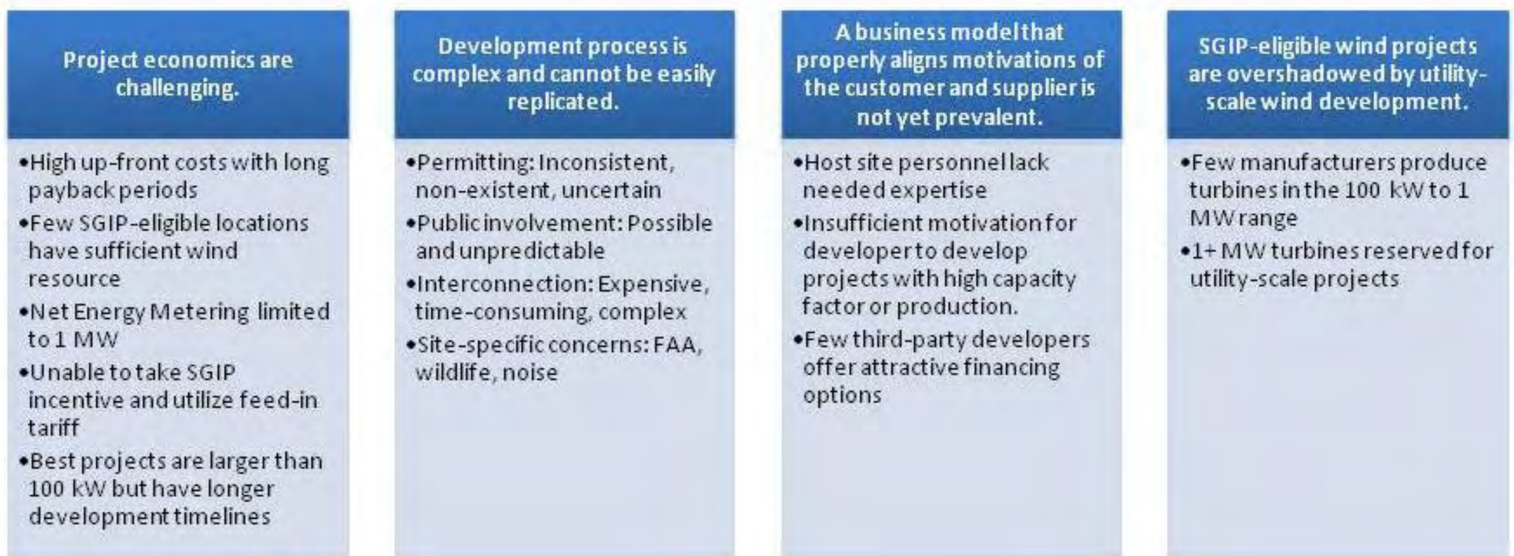
Unless otherwise noted, the information in this section is based on the project team's interviews with developers and market actors in the wind industry.[36] The project team used the interview results to

[36] Market actors included manufacturers, wind associations, and industry experts.

highlight high-level themes, as described above. Additional detail about the issues associated with each theme is provided in this section, using the specific input from the interviews.

Figure 4-9 summarizes the major issues associated with each of these themes. The themes and associated issues are discussed in more detail in the remainder of this section.

Figure 4-9. Summary of Barriers to More Widespread Development of SGIP-Eligible Wind Projects



Project Economics Are Challenging.

The ***up-front cost*** for an SGIP-eligible wind system is substantial, even taking into account all of the government and utility incentives that encourage the installation and use of these systems. In addition, the ***payback periods are also longer*** than the three- to four-year payback periods that most consumers and financiers are seeking. As a result, these systems are still viewed as a "purchase for the conscience" rather than smart business decisions.[37]

All developers indicated that cost, in one form or another, was a major obstacle to the development of wind projects. Project economics are usually tight and cannot accommodate additional or unexpected costs. The developers mentioned the following costs as high or uncertain:

- ***Turbines:*** The wind turbines are generally the most costly component of a project.
- ***Interconnection:*** The cost of the switch gear can be high; costs from $25,000 to $200,000 were given, depending on the requirements. Another developer indicated that they had to hire a consultant to help them interpret the Rule 21 requirements which added $25,000 to the project cost.
- ***Permitting fees:*** Permitting fees in some jurisdictions can be as high as $10,000. A special use permit, if required, can add to this cost.
- ***Environmental studies:*** A negative declaration study generally cost about $25,000 while a full environmental impact statement, if needed, can cost up to $100,000.
- ***Project modeling and wind studies:*** Engineering resources for wind studies and project performance modeling can be significant.

In addition, few SGIP-eligible areas of California have ***sufficient wind resources*** to create favorable investment conditions. California has a limited number of areas with high wind resource (usually noted as NREL wind power class of five or better). Even with available incentives, these wind resources are often insufficient to create a project with reasonable payback periods or return on investment.

Once a project is operating, ***maintenance costs*** can also challenge the financial viability of a project. It is not cost-effective to maintain a small number of turbines larger than 200 kW. There is a high fixed cost associated with such maintenance and a lower variable cost (cost per turbine). Specialized labor is needed to maintain turbines of this size; higher densities of distributed projects would need to be created in order to make the cost of such services more reasonable. If a large wind facility is located near a SGIP-eligible project, it may be possible to leverage that labor base, but the larger facility would receive priority.

In addition, ***regulatory limitations and tariff structures*** can also limit the financial viability of a project:

- The 1 MW limit on the ability to net energy meter (NEM) is a barrier when there is the potential to install a larger turbine.
- The restriction on participating in both the SGIP and the feed-in tariff reduces the ability to secure a reliable income stream for a given project.
- Standby charges can also increase the cost of the project.

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[37] A "purchase for the conscience" is a purchase made to satisfy a non-monetary personal or business priority. Such a purchase may not make financial sense but is still pursued to enable the individual or business to incorporate its values into day-to-day operations.

The best economics are for projects larger than 100 kW, but the development timeline is longer than for smaller projects. For developers, ***time is money.*** The longer the development timeline, the higher the risk involved in the project. As a result, these larger projects must be able to sustain higher profit margins than smaller projects. Identifying viable customers and surviving the development period requires substantial capital resources, which have not been visibly committed to projects in the SGIP-eligible size range.

The Development Process is Complex and Cannot Be Easily Replicated.
SGIP-eligible wind projects require a substantial amount of development effort focused on location-specific issues. Permitting is the most visible of these issues, but interconnection, wind resource assessment, and public involvement can all create hurdles to development. As a result of these location-specific issues, it is difficult to develop a project development template, which reduces the associated costs. In addition, uncertainty increases risk, which increases cost.

Permitting is the prime barrier to development of SGIP-eligible wind projects in California. AWEA estimates that 33% of all potential small wind turbine installations are halted due to poor or absent local permitting practices.[38] Further, a recent CWEC report on a survey of small wind developers finds, "the current permitting challenges would not encourage anyone to go into this business."[39] Eight out of nine respondents to the CWEC survey indicated that they were somewhat or very discouraged with the local permitting process. [40] More specific issues are as follows:

- ***Inconsistent permitting rules.*** Every county in California has jurisdiction over permitting SGIP-eligible wind projects, and each county has a slightly different approach to permitting. As a result, developers must adjust their development model, equipment, and paperwork for each county in which they do business. (Eight out of nine CWEC survey respondents cited this hurdle.) [41]
- ***Non-existent permitting guidance.*** In some counties, permitting guidelines do not even exist for projects that are eligible for SGIP. Some counties wait until a developer proposes a project to develop the permitting guidance. This adds a significant element of uncertainty to the development timeline and budget, discouraging developers from being "the first" in that county. AB 45[42] took the first steps needed to address this issue for projects smaller than 50 kW, but it will not impact most projects that fall under SGIP.

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[38] American Wind Energy Association (AWEA), "AWEA Small Wind Turbine Global Market Study: Year Ending 2008," 2009.

[39] Johnson, Scott and C.P. (Case) van Dam, "Small Wind Permitting Challenges: Findings from a Survey of Small Wind Installers," California Wind Energy Collaborative and University of California, Davis, March 2009, CWEC-2009-001.

[40] *Ibid.*

[41] *Ibid.*

[42] AB 45, which was approved on October 11, 2009, authorizes counties that do not have an ordinance providing for the installation of some small wind systems to adopt one by January 1, 2011. The bill only applies to systems with a capacity less than or equal to 50 kW per customer site. Therefore, this bill does not cover all wind systems incented through the SGIP. AB 45 made initial steps to address some of these issues, but it did not go far enough, according to the interview subjects.

California had previously addressed the permitting issue for ERP-eligible wind energy systems in 2001 with AB1207. This bill authorized local agencies to adopt an ordinance for some small wind energy systems, prohibited more restrictive conditions than as specified in the bill, and required local jurisdictions to approve the application for covered systems system if specified conditions are met. Therefore, a state-mandated local program was imposed. This bill applied to systems with a capacity allowed under the ERP; therefore, the bill did not fully cover turbines allowed under the SGIP. The bill had a sunset date of July 1, 2005.

- ***Uncertain timeline for completing the permitting process.*** The permitting process can go on indefinitely, because there is no limitation on the amount of time that a county can take to reach a decision. It has taken longer than a year for some projects to receive approval, which is a substantial amount of time in the development cycle of an SGIP-eligible wind project: compare this with a total development timeline of about six months for the average 2 MW solar project.[43] This poses a unique challenge for developers, which must finance this process; the delays hurt the project economics substantially. (Six of nine CWEC survey respondents cited this hurdle.) [44]

Table 4-12 includes a county-by-county summary of the types of permits required and the associated permitting fees for wind projects in the SGIP size range. CWEC collected this data in a recent effort.

Some interviewees cited these specific hurdles created by permitting laws:

- Hub height allowed is too short; hub heights need to rise above local structures to avoid turbulence, which impedes production of high quality power.
- Full environmental impact statement required in some cases; these are unnecessary for most SGIP-eligible wind systems and add significant cost to projects that are already challenged from a cost-effectiveness standpoint.
- Required setbacks are too large; in most cases, one turbine length in each direction from the tower is sufficient.

In addition to permitting concerns, ***public involvement is possible and unpredictable.*** In many cases, the public perceives SGIP-eligible and utility-scale wind projects as one and the same. The impact of projects at either end of the size continuum is significantly different, and the market actors believe that the regulations put in place to manage those impacts should reflect those differences. For example, a 50 kW turbine will not have the same type of avian impacts as a 2 MW turbine; some members of the public are not aware of these differences.

The ***interconnection process*** was cited as a barrier by all developers. One developer suggests that wind project schedules should allow a year to get through the interconnection process. Another developer's project required ten to 15 meetings with PG&E's interconnection department in order to determine what was required. As the timing of these meetings was determined by the utility, the developer felt that the process was drawn out longer than necessary. In another project, a required change in the design of the switch gear triggered a second, lengthy design review by the utility interconnection department.

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[43] Conversations with developers of commercial solar facilities.

[44] Johnson, Scott and C.P. (Case) van Dam, "Small Wind Permitting Challenges: Findings from a Survey of Small Wind Installers," California Wind Energy Collaborative and University of California, Davis, March 2009, CWEC-2009-001.

Other ***site-specific issues*** can also create uncertainty:

- ***Noise levels***: Turbine noise must not exceed allowable levels.
- ***Federal Aviation Administration (FAA) restrictions:*** Projects close to airports may be restricted or require FAA approval.
- ***Wildlife habitats:*** Projects near wetlands are viewed as threats to the habitat. California condor critical habitats may also cause barriers to end development.

Table 4-12. Small Wind Permitting Fees

COUNTY	FEE	PERMIT TYPE
Alameda*	Unknown	Conditional use and building permit
Alpine	Unknown	Unknown
Amador	Unknown	Unknown
Butte*	Unknown	Unknown
Calaveras*	$4,764	Conditional use
Colusa	Unknown	Unknown
Contra Costa*	$2,700	Land use
Del Norte	Unknown	Unknown
El Dorado*	Unknown	Unknown
Fresno	Unknown	Unknown
Glenn	$485[#]	Conditional use
Humboldt	Unknown	Unknown
Imperial	Unknown	Conditional use
Inyo*	$1,353	Conditional use
Kern	$960	Small wind energy system permit
Kings	Unknown	Unknown
Lake*	Unknown	Zoning clearance and building permit
Lassen	Unknown	Provisions in code

COUNTY	FEE	PERMIT TYPE
Los Angeles*	$5369-$10,000#	Conditional use
Madera	Unknown	Unknown
Marin*	$1,280	Use for accessory
Mariposa	Unknown	Unknown
Mendocino	Unknown	Unknown
Merced	Unknown	Unknown
Modoc	Unknown	Unknown
Mono	Unknown	Unknown
Monterey*	$6,600	Conditional use
Napa*	$5,735	Conditional use (deposit)
Nevada	Unknown	Unknown
Orange	Unknown	Unknown
Placer*	$3,500	Conditional use (deposit)
Plumas	Unknown	Unknown
Riverside	$1,100	Accessory WECS
Sacramento*	Unknown	Building and conditional use?^
San Benito	Unknown	Unknown
San Bernardino	$495-$995#	Wind energy system
San Diego	$0-$45#	^
San Francisco	Unknown	Unknown
San Joaquin*	Cost dependent	Building permit
San Luis Obispo	$2,332	Minor use permit
San Mateo	Unknown	Unknown
Santa Barbara	Unknown	Minor conditional use

COUNTY	FEE	PERMIT TYPE
Santa Clara	Unknown	Building
Santa Cruz*	Cost dependent	Building
Shasta	$693-$1,200#	Conditional use and building permit
Sierra	Unknown	Unknown
Siskiyou	Unknown	Unknown
Solano*	Cost dependent	Building permit for towers <100 ft
Sonoma*	$467-$965	Zone or use
Stanislaus*	$733	Staff approval
Sutter*	Cost dependent	Building
Tehama	$400#	Building
Trinity	Unknown	Unknown
Tulare	Unknown	Unknown
Tuolumne	Unknown	Unknown
Ventura	Unknown	Unknown
Yolo*	Cost dependent-$5,500#	Building
Yuba	Unknown	Unknown
*Counties were studies for CWEC small wind courses. #Approximate fee provided by installer survey results (Johnson et al., 2009) ^ The information in this table was taken directly from the cited source, including omissions and incomplete information.		

Source: Larwood, Scott, Scott Johnson and C.P. (Case) van Dam. "Permitting Fees for Small Wind Turbines in California Counties." California Wind Energy Collaborative and University of California, Davis. CWEC-2009-002. March 2009.

A Business Model That Properly Aligns Motivations of Customers and Suppliers Is Not Prevalent.

To date, the market for SGIP-eligible wind projects has not developed a business model that matches the needs of customers with the services offered by suppliers. As discussed earlier, wind projects in this size range have been conscience purchases to date. As such, these early projects have been completed, in most cases, because the project host had a personal commitment to clean energy and was willing to take on additional responsibilities to make the projects happen. These early projects have not been financially attractive investments for most project hosts or developers. In order to achieve widespread market adoption, however, the financial metrics for both host and developer will need to be met, and the systems need to require less effort on the part of the site host.

Currently, developers ***are not incented to install systems with optimal (or even high) output***. SGIP and the federal ITC award incentives based on installed capacity rather than on the actual energy produced by the system. The actual capacity factor of a given system is dependent on many factors, including the siting of the facility. As a result, several projects with the same installed capacity may produce very different amounts of energy, though they are all incentivized at the same level. This arrangement does not do enough to promote optimal siting of the facility or to monitor the wind resource prior to project development.

Most organizations that could develop SGIP-eligible wind projects ***lack the internal expertise*** to navigate the development and permitting processes, arrange financing, and maintain the system once it is in operation. Renewable energy development is not the core business of the organizations that have a large enough load to support the system sizes encompassed in SGIP with favorable economics. As a result, the person leading the process is required to learn all of the nuances of the process for the first time; there are rarely follow-up opportunities to leverage the previous experience. In addition, they are often educating themselves on wind technology on their own time.

Very few third-party providers of development and maintenance services offer packages for SGIP-eligible wind projects. As seen with solar development, third-party providers could alleviate the up-front cost and expertise barriers discussed earlier, but very few third-party providers have entered this space at all; AWEA predicted that more entities would fill this role during calendar year 2009, but that did not occur, likely due to capital constraints.

SGIP-Eligible Wind Projects Are Overshadowed by Utility-Scale Wind Projects.

Developers interested in the wind energy space tend to focus on utility-scale projects. There is a "fixed cost" component to developing wind projects – the wind resource monitoring, permitting, environmental studies, and other requirements – that is incurred whether a project is 3 MW or 100 MW. There are other variable costs incurred in larger projects, but the "fixed costs" described take a significant amount of time and effort; as mentioned earlier, that time is money. As a result, developers focus on the larger projects, where larger revenue streams provide better returns on the investment. In addition, these issues are present:

Few manufacturers produce turbines in the 50 kW to 1 MW range. This is an issue of the chicken and the egg. The chicken: the market for these mid-size turbines. The egg: manufacturers of the mid-size turbines. There is a question of whether the manufacturers will drive the market forward or whether the market demand will create the need for more manufacturers. Before the wind boom of 2000-2007, large manufacturers of wind turbines (e.g., Vestas, Siemens) were involved in the production of mid-size turbines. As larger turbines became available, however, these larger manufacturers stopped producing mid-size turbines; it is unlikely that they will manufacture these again in the future. Few new market entrants have filled this void. It is possible that this issue will self-correct as the market demand increases, but it has not been sufficient to do so in the recent past.

There are some Chinese manufacturers producing turbines in this size range, but they are not widely used in the U.S. The market has been reticent to adopt Chinese equipment, and Chinese manufacturers have not made the effort to gain a foothold in the U.S. market.

The availability of products is compounded by the fact that ***manufacturers are confused about program requirements for certifying wind turbines.*** Manufacturers believe that any technologies used under SGIP must be certified by CEC, just as those technologies used under ERP are. They believe that it will take six to 12 months and cost tens of thousands of dollars when they include the cost of labor. The only firms willing to bear the cost of this process are those that believe that the access to California's market will enhance their business proposition substantially. This confusion inhibits organic growth into the California market and is especially problematic for manufacturers located outside of the U.S., which is the origin of most of the mid-size equipment. Better communication about the requirements for certifying wind technology is needed.

Manufacturers of wind towers and turbines ***focus their efforts on the utility-scale projects***. Many tower manufacturers have frame agreements (i.e., long-term supply agreements) with large-scale wind turbine manufacturers and focus their efforts on producing turbines for those customers. In turn, those large-scale wind turbine manufacturers have frame agreements with developers. These large-scale turbines produced in the thousands per year. A request for a single tower or turbine at a smaller scale does not make economic sense to these manufacturers; it produces neither the profit margin nor the opportunity for additional business that the large-scale towers do. As a result, it is difficult to obtain towers and turbines for these mid-scale projects.

4.2.6 Future Trends

According to AWEA, the small wind industry projects a 30-fold growth within as little as five years, with a cumulative U.S. installed capacity of 1,700 MW by 2013.[45] This estimate assumes (1) that the 30 percent federal ITC for small wind systems expires on December 31, 2016, (2) that private equity invests in manufacturing, and (3) equipment manufacturing capabilities are increased.[46] Some developers think that there needs to be fundamental changes to California's market for SGIP-eligible wind if it is to expand over this time period. Others think that there has been a renewed interest in medium-sized wind turbines for community power, which will drive growth in the development of SGIP-eligible wind projects.

The market actor interviews indicate a high level of interest in investment in SGIP-eligible wind projects, coupled with a certain level of reticence. Future trends from these interviews are summarized below by technology, cost and manufacturing operations.

***Technology*:** A variety of changes to *existing* technologies are possible, including the following:

- Increasing reliability (and reducing maintenance costs);
- Making the turbines more "appliance-like" and easier for on-site staff to manage;
- Reducing the cost of towers and foundations through the use of advanced materials; and
- Improving wind resource assessment technologies.

Cost: The success of SGIP-eligible wind projects is dependent on the industry's ability to bring down the cost of the technology.

- Game-changing technologies, such as Pax Streamline's blown wing technology,47 would revolutionize the design of turbines and the associated cost. By making the turbines smaller and easier to manage, the technology would also enable the turbines to be placed in locations that are currently unavailable to large turbines;
- SGIP-eligible wind projects developed in connection with storage or other hybrid approaches would help address the intermittency issues with wind while increasing the project economics by enabling peak demand reduction; and
- Several respondents indicated that they expected to see an increase in production of turbines in the 200 kW to 500 kW range. These mid-sized turbines address the municipal, school, and agriculture markets, which several respondents see as major growth areas for SGIP-eligible wind

[45] American Wind Energy Association (AWEA), "AWEA Small Wind Turbine Global Market Study: Year Ending 2008," 2009.

[46] American Wind Energy Association (AWEA), "AWEA Small Wind Turbine Global Market Study: Year Ending 2008," 2009.

[47] Pax Streamline recently won a $3 million grant from the federal Advanced Research Projects Agency-Energy (ARPA-E) to support the development of the development of the blown wing technology. ARPA-E provides this description of the technology: "Circulation control technology or "Blown Wing" technology creates a virtual airfoil by jetting compressed air out of orifices along a wing and has the potential to radically simplify the manufacture and operation of wind turbines. Unlike a fixed airfoil, a Blown Wing can be dynamically adjusted to maximize power under a wide range of wind conditions, and can be generated from a slotted extruded pipe that can be domestically manufactured at a fraction of the cost." Available: http://arpa-e.energy.gov/FundedProjects.aspx

projects. These respondents anticipate that this gap will be filled by new market entrants rather than by existing players in the large wind manufacturing space.

Manufacturing Operations**:** Two manufacturers have plans to scale up their manufacturing operations. An increase in sales will lead to an increase in both the scale and method of manufacturing operations. Both companies anticipate that 2010 will be a positive year for energy storage.

Building–mounted turbines are gaining in popularity, though the market share of building-mounted turbines in 2008 was about 1% of total sales based on installed capacity. The AWEA study found that ten companies currently manufacture or plan to manufacture building-mounted wind turbine models. Examples of building-mounted turbines include Aerotecture International's Aeroturbine[48] and AeroVironment's Architectural Wind turbines.[49]

4.3 Advanced Energy Storage

The team provides a description of the market for SGIP-eligible advanced energy storage projects in this section. It begins with a description of the market context, including an overview of the relationships among supply chain actors. A description of the market at the national level also helps to frame the issues faced in the California market. The discussion of the California market includes information from the SGIP, a high-level estimate of market potential, and information about project costs. Next, barriers to broader adoption of SGIP-eligible advanced energy storage technologies in California are discussed. Finally, the section wraps up with an exploration of trends that are anticipated to emerge in the next few years.

4.3.1 Market Context

The market for advanced energy storage projects eligible for SGIP incentives involves many types of actors, many of which can fulfill different roles in the project lifecycle. Understanding how the market actors interact and the roles that they can fulfill provides a starting point for describing the marketplace.

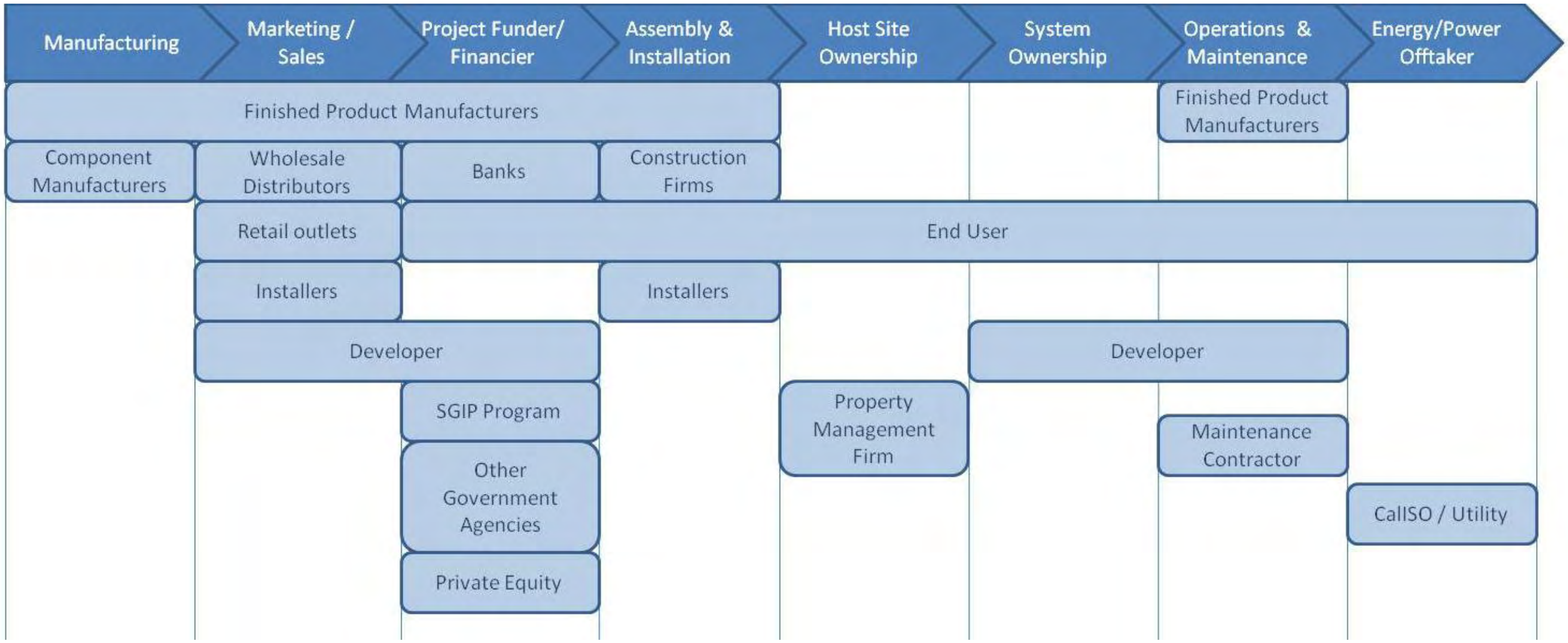
Figure 4-10 is a snapshot of the current supply chain for SGIP-eligible advanced energy storage projects. The roles needed to bring a project to completion appear across the top of the graphic. The types of organizations that fulfill each role in practice appear in the space below the supply chain. As shown in the graphic, multiple market actors *can* fulfill a given role; which one actually does so in a given project depends on the circumstances of that project.

The market for SGIP-eligible advanced energy storage is in its early stages. The energy storage market is currently not well developed. There is no ready-made channel of installers who are familiar with the technology and with installation practices. Energy services companies (ESCOs) are a rapidly growing market player. They are offering commercial-scale services for integrated renewable power and energy storage hybrid systems.

[48] http://www.aerotecture.com/index.html.

[49] http://www.avinc.com/clean_power/arch_wind/.

Figure 4-10. Market Actors and Their Roles in the Marketplace for SGIP-Eligible Advanced Energy Storage Projects



Source: Interviews with market actors.

4.3.2 US Market Description

Advanced Energy Storage is defined on the PG&E Web site as "technologies that convert electricity into another form of stored energy and then converted back to electricity at another time."[50] The advanced energy storage industry is a nascent one. However, the market for advanced energy storage technologies is likely to grow. American Recovery and Reinvestment Act (ARRA) funding for R&D and interest in energy storage by many parties, including utilities for Smart Grid applications, will lead to more attention on this technology. This section focuses on customer-sited stationary storage applications. Lead acid batteries are the most commercially available technology, though due to their large size and short lifetime may not provide the best solution for grid-connected applications. Improved lead acid batteries and flow batteries will likely be designed for this market. In addition, research and commercialization of electric transportation may drive down the cost of other batteries, such as nickel metal hydride (NiMH) and lithium ion (Li-Ion), to the point of cost-effectiveness for stationary applications.

4.3.3 California Market Description

This section includes a description of the fuel cell market in California. The team begins the section with a summary of applications and installations through California incentive programs. The team then discusses the commercially available advanced energy storage technologies and market potential of advanced energy storage. Lastly, the team ends the section with a summary of project costs.

California Incentive Program Data

Advanced energy storage has been included as an eligible technology for the SGIP since May 2009,[51] if coupled with a wind or fuel cell system. Therefore, there are few systems that have applied to the program to date. According to the September 2009 SGIP program reports, there is one active advanced energy storage project with a 1 MW capacity.

Commercially Available Advanced Energy Storage Systems

Table 4-13 lists many of the companies that manufacturer advanced energy storage units in the SGIP eligible capacity range. This list is not meant to be all inclusive; it is meant to showcase the more active manufacturers with units eligible for the SGIP.

[50] PG&E. SGIP Frequently Asked Questions. http://www.pge.com/mybusiness/energysavingsrebates/selfgenerationincentive/faq/index.shtml (Accessed December 6, 2009).

[51] The February 28, 2009 version of the SGIP Handbook notes that "Advanced Energy Storage applications will not be accepted until the California Public Utilities Commission has approved the SGIP Program Administrator's Advice Letter incorporating Advanced Energy Storage as an eligible technology under the SGIP." The May 8, 2009 version of the SGIP Handbook includes Advanced Energy Storage as an eligible technology.

Table 4-13. Some commercially available large-scale advanced energy storage units

Company Name	Contact Location(s)	Example Model and Rated Electrical Power	Storage Type	Other
ZBB Energy Corporation	Wisconsin, Australia	ZESS 50: 50kWh module, ZESS 500: 10-50kWh modules	Zinc bromide	ZBB views their product as a system
Premium Power	Massachusetts	Not available	Zinc bromide	Have had one demonstration project in CA to date
Prudent Energy	Canada and China	VRB Energy Storage System	Data not accessible	No other information
NGK	Main offices in Japan. Additional offices in the U.S.	Scaled based on need- several MW systems can be constructed	Sodium sulfur (NaS)	No other information

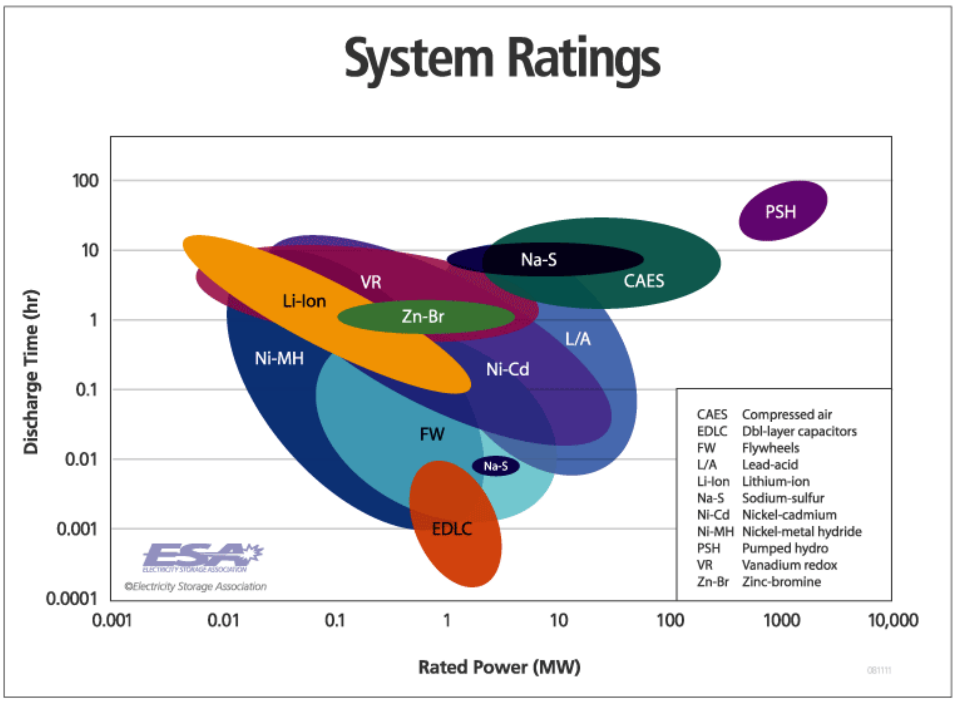
Sources: NGK. www.ngk.co.jp/english/products/power/nas/index.html; ZBB Energy Corporation. www.zbbenergy.com; Premium Power. www.premiumpower.com; Prudent Energy. www.pdenergy.com/; Interviews with market actors.

Market Potential

The market potential for energy storage is limited by the end-user demand and other factors such as cost and product availability. Researchers at Sandia National Laboratories estimated the maximum market potential for customer/end-use applications in California to be 4,005 MW over ten years. This value is based on the state total peak demand from commercial/industrial loads in 2004 and a 1% per year market adoption rate assumptions.[52] Only a portion of the maximum market potential may be realized in the ten-year time frame.

Figures from the Electricity Storage Association reveal the range of energy storage types and energy storage applications. Figure 4-11 shows the rated power (MW) and discharge time (hr) for selected energy storage options. Based on these factors, some of these technologies may be better suited for an SGIP application.

Figure 4-11. Rated power and discharge time for selected energy storage options

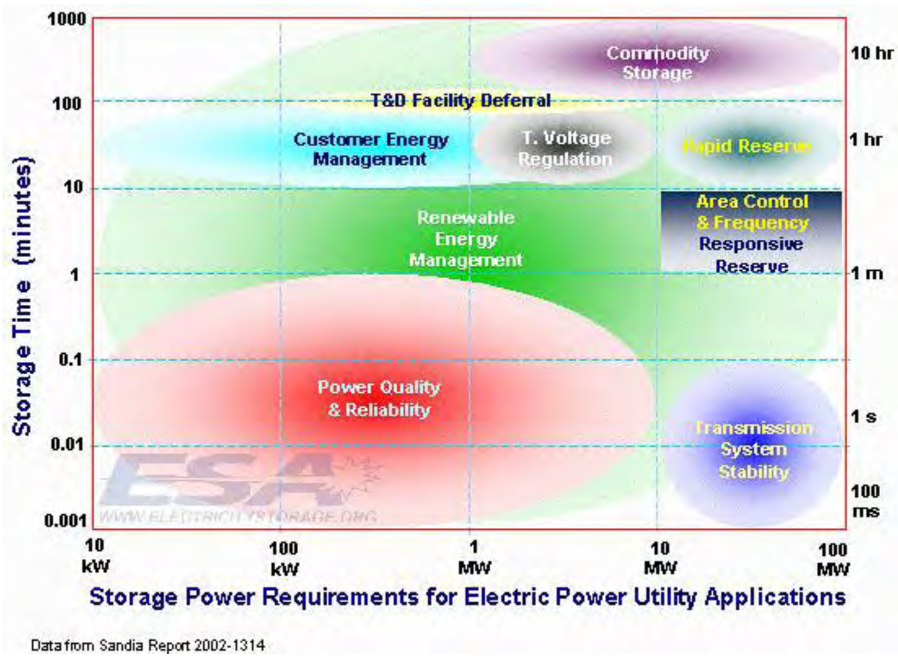


Source: Electricity Storage Association. http://www.electricitystorage.org/site/technologies/. (Accessed December 9, 2009). Reprinted with permission from the Electricity Storage Association.

[52] Eyer, James. M., Joseph L. Iannucci, and Garth P. Corey. "Energy Storage Benefits and Market Analysis Handbook: A Study for the DOE Energy Storage Systems Program." Sandia National Laboratories: SAND2004-6177. December 2004.

Figure 4-12 shows the electric power utility applications in terms of storage time (minutes) and power requirements (kW/MW). Renewable energy management and customer energy management are both SGIP applications.

Figure 4-12. Electric power utility applications

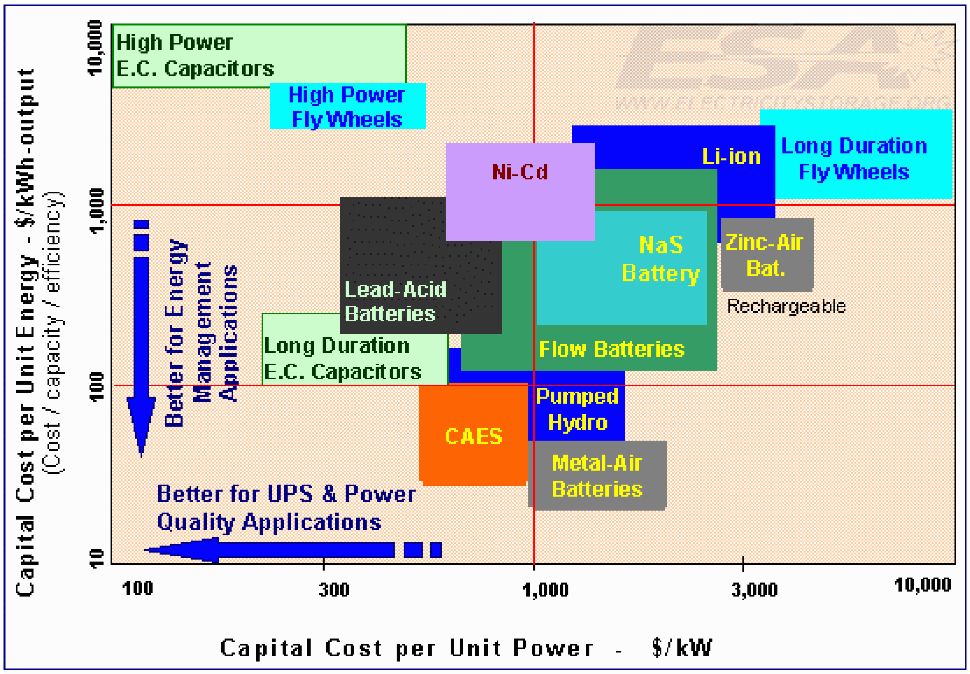


Source: Electricity Storage Association. http://www.electricitystorage.org/site/technologies/. (Accessed December 6, 2009). Reprinted with permission from the Electricity Storage Association.

Project Costs

One of the most significant barriers to electric storage is cost. The project economics vary depending on the type of storage employed and the application for the storage (e.g., with renewable energy). Figure 4-13 shows the capital costs of selected energy storage technologies according to the Electricity Storage Association. Long duration fly wheels have the highest capital cost per unit power, while high power electrochemical (E.C.) capacitors have the highest capital cost per unit energy. Lead-acid batteries, currently used on-site, range in cost between $300/kW and $1,000/kW. Flow batteries, which are likely to increase in market penetration for the on-site market, range in cost between around $500/kW and $3,000/kW.

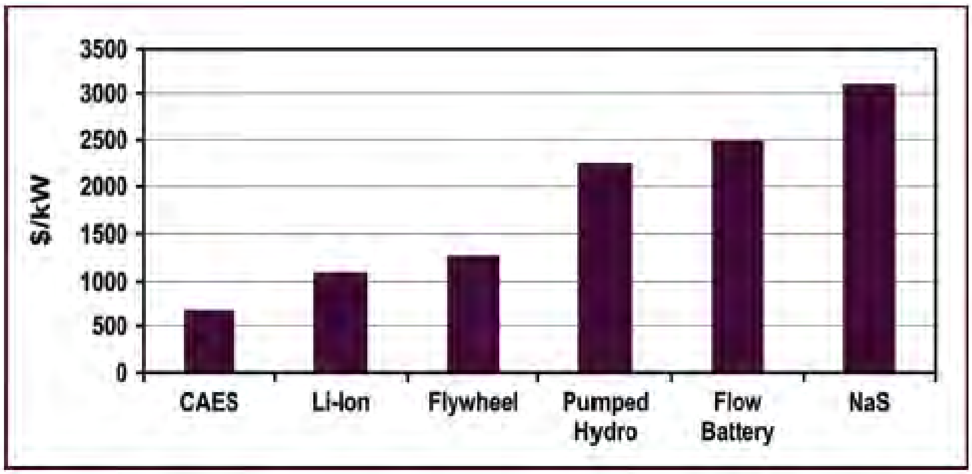
Figure 4-13. Capital costs (per unit energy and per unit power) of selected energy storage technologies



Source: Electricity Storage Association. http://www.electricitystorage.org/site/technologies/. (Accessed December 6, 2009). Reprinted with permission from the Electricity Storage Association.

The U.S. Department of Energy's Electricity Advisory Committee has also provided estimates of capital costs for energy storage technologies (see Figure 4-14). These estimates are in line with those from the Electricity Storage Association.

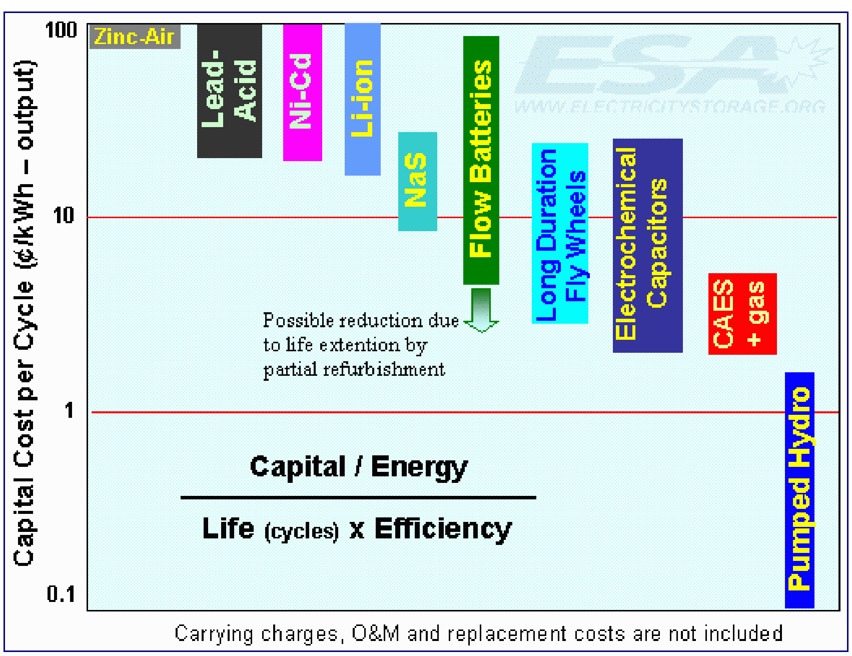
Figure 4-14. Capital costs (per unit power) for selected energy storage technologies



Source: U.S. Department of Energy. Electricity Advisory Committee. "Bottling Electricity: Storage as a Strategic Tool for Managing Variability and Capacity Concerns in the Modern Grid." December 2008.

Figure 4-15 shows an estimated capital cost per cycle in the battery. Pumped hydro has the lowest capital cost per cycle, between 0.1 cents per kWh-output to 1 cents per kWh-output. In comparison, lead-acid batteries have a higher cost, about 40 cents per kWh-output to 100 cents per kWh-output.

Figure 4-15. Capital costs per cycle



Source: Electricity Storage Association. http://www.electricitystorage.org/site/technologies/. (Accessed December 6, 2009). Reprinted with permission from the Electricity Storage Association.

4.3.4 Barriers to Broad Market Adoption of SGIP-Eligible Advanced Energy Storage in California

There are four primary categories of barriers to more widespread development of SGIP-eligible advanced energy storage projects in California:

- Project economics are challenging;
- Knowledge about advanced energy storage technologies and their applications is lacking;
- Ideal site locations, especially under current SGIP requirements are limited; and
- SGIP-scale on-site technology options are few.

Unless otherwise noted, the information in this section is based on the project team's interviews with market actors in the advanced energy storage industry.[53] The project team used the interview results to highlight high-level themes, as described above. Additional detail about the issues associated with each theme is provided in this section, using the specific input from the interviews.

Figure 4-16 summarizes the major issues associated with each of these themes. The themes and associated issues are discussed in more detail in the remainder of this section.

[53] Market actors included manufacturers and advanced energy storage associations.

Figure 4-16. Summary of Barriers to More Widespread Development of SGIP-Eligible Advanced Energy Storage Projects

Project economics are challenging.	Knowledge about advanced energy storage technologies and their applications is lacking.	SGIP-scale on-site technology options are few.	Ideal site locations, especially under current SGIP requirements are limited.
• High capital costs • No federal incentive • Current economic situation is difficult • Uncertainty in future financing	• Unfamiliarity with the technology • Lack of clear interconnection requirements • Lack of modeling tools	• Few manufacturers of SGIP-scale technologies • Few projects designed as a system	• Customers that lease space are not interested • Current SGIP requires energy storage to be cited with a wind or fuel cell project

<u>Project economics are challenging</u>

Project economics for advanced energy storage projects can be challenging due to a variety of reasons described in this section. The ***high capital cost*** of the units is one barrier to their installation. One market actor noted that the current return on investment of a 20kWh system could be five to six years, and most businesses require a two to three year payback.

In addition to the high capital cost of the systems, ***high interconnection fees*** can be a large barrier to projects, especially smaller projects. One market actor noted that the fees in PG&E's territory include an $800 application fee and a $600 interconnection fee, which equates to about 15% of the cost of one manufacturer's system.

Furthermore, there is ***no strong financial incentive from time of day tariff differences in the U.S.*** The current tariff differences between peak and off-peak are not large enough to make an up-front investment in energy storage a viable option in California; however, these tariffs could change in the future. One market actor thought that the only location energy storage for time of day arbitrage makes financial sense is in São Paulo, Brazil because there is a large enough differential between the peak and off peak energy prices.

High federal incentives for customers to install renewable energy technologies (30% federal tax credit) can help the project economics for those technologies. However, there are ***no such federal incentives*** for energy storage. Therefore, the financial case can be more difficult for energy storage than for renewable technologies.

Additionally, the current ***regulatory environment does not compensate storage for its true value***. For example, storage could play a role in frequency regulation. For one independent system operator, conventional generation is allowed to be compensated for providing frequency regulation via an opportunity cost. However, energy storage cannot currently receive that compensation structure.

Project economics are also made challenging because of the ***uncertainty in the amount/availability of future SGIP or other program incentives*.** One market actor felt that a carve-out for energy storage would help demonstrate the advantages of storage.

Lastly, the ***current economic situation*** makes businesses risk adverse, though one market actor felt that the situation was starting to get better in California.

<u>Knowledge about advanced energy storage technologies and their applications is lacking</u>

The main barrier to customer's interest in energy storage is ***unfamiliarity of the technology***. Energy storage as a grid connected application is new and thus there are few success stories to share with customers. Having successful project stories is important for customers to be willing to adopt the technology. In addition, there is not a ready-made channel of installers who are familiar with the technology. This unfamiliarity can lead to customers assigning a high risk to the technology.

In addition, the market ***does not have good information on interconnection, siting, and permitting requirements***. A few market actors noted that it is unclear if interconnection is required for energy storage under Rule 21 for a stand- alone configuration that is not back feeding into the grid because storage is not a generating technology. One market actor also noted that there are not that many projects that have gone through the siting and permitting process, so it may cause issues once more projects need to go through the process.

Finally, ***good modeling tools for energy storage do not exist.*** The industry recognizes the need for good modeling tools to model storage into systems and to model the true value of storage. Models should take into account energy pricing including time of use rates, demand charges, and the locational energy mix on the grid including the amount of renewable technologies feeding the grid. Such modeling tools could allow customers and utilities to better understand the value of the storage system.

Ideal site locations, especially under current SGIP requirements are limited

Energy storage must be combined with a wind system or fuel cell to receive the SGIP incentive. This requirement is limiting on the technology and the market for the technology. Energy storage can be combined with other on-site technologies, such as solar PV, and can also be used in a stand-alone configuration.

In addition, one market actor noted that ***many businesses do not own the property*** where their business is located. If they do not own the property then they are not willing to make a large investment in the property by installing an advanced energy storage system.

SGIP-scale on-site technology options are few

There are currently a ***few technologies available to handle large-scale needs.*** One manufacturing company feels that flow batteries are the best to handle large scale energy storage needs. There are currently four companies in the flow battery space: ZBB Energy Corporation, Prudent Power, Premium Power, and NGK (from Japan).

Finally, energy storage is ideally used as a system, rather than just a battery. ***Energy storage systems are few or are not currently packaged as such***. One market actor stated three reasons for the need of energy storage technology to act like a system: (1) combining renewables and energy storage will go smoother if the storage can act like a system and require only one bi-directional inverter for both the renewable technology and storage technology, (2) an energy storage system could allow the customer to continue to receive energy when the grid is down (conventional inverters for PV and other systems shut down when the grid is down), and (3) the ability to reserve power and have a continuous stream of energy.

4.3.5 Future Trends

The Summit Blue interviews with market actors in the advanced energy storage space revealed that there is currently a huge amount of investment in energy storage. The trends noted through these interviews and secondary research is discussed below by category: technology, cost, and manufacturing operations.

***Technology*:** One respondent noted that there would likely be some performance increases with existing systems and technology in the next two to four years. In addition, the stimulus bill investment will probably aid in demonstration sites for new chemistries; however, the respondent did not think that there would be any new breakthroughs in chemistries in the next two to four years. The stimulus bill investment will also provide for some reasonably sized storage systems over the next few years. These systems could generate more interest and successful project data to the consumers, thus accelerating the adoption of storage technologies. In addition, one respondent thinks that in two to four years, there will be different configurations of the currently available technologies.

As mentioned in the interviews, government funding is providing research opportunities to the advanced energy storage industry. Six of the 37 projects selected by the U.S. Department of Energy's Advanced Research Projects Agency-Energy for ARRA funds are energy storage projects. The energy storage funded projects range from new classes of battery technology to enhanced technology for both on-site and vehicles (see Table 4-14 for a listing of funded projects). The other 31funded projects are within the following topic areas, arranged by "topic (number of projects)": building efficiency (3), carbon capture (5), direct solar fuels (5), biomass energy (5), conventional energy (1), renewable power (4), vehicle technologies (5), waste heat capture (2), and water (1).[54] In addition, six Energy Frontier Research Centers (EFRC) will be established to research energy storage. The 46 total EFRCs will be funded by the U.S. Department of Energy and the ARRA.[55]

Table 4-14. U.S. Department of Energy's Advanced Research Projects Agency-Energy ARRA-Funded Projects

Agency	Amount	Place	Description
Arizona State University (Fluidic Energy, Inc.)	$5,133,150	Tempe, AZ	A new class of metal-air batteries using ionic liquids, with many times the energy density of today's lithium-ion batteries. Could enable long range, low cost plug-in hybrid and all-electric vehicles.
EaglePicher Technologies LLC (Pacific Northwest National Laboratory)	$7,200,000	Joplin, MO	High energy, low cost planar liquid sodium beta batteries for grid scale electrical power storage. Could enable continuous power from renewable resources, like wind and solar, and could support a highly stable and reliable grid.
Envia Systems (Argonne National Laboratory)	$4,000,000	Hayward, CA	High energy density Lithium-ion batteries with 3x better energy density than current batteries. Based on novel nano silicon-carbon composite anodes and manganese composite cathodes discovered at Argonne National Laboratory. Could lower the cost and speed the adoption of plug-in hybrids and electric vehicles.
FastCAP Systems Corporation (MIT)	$5,349,932	Cambridge. MA	A nanotube enhanced ultracapacitor with energy density approaching that of standard batteries, but with many times greater power density and thousands of times the cycle life. Could greatly reduce the cost of hybrid and electric vehicles and of grid-scale storage.
Inorganic Specialists, Inc. (Ultramet, Inc., EaglePicher, Southeast Nonwovens, EMTEC)	$1,999,447	Miamisburg, OH	A silicon-coated carbon nanofiber paper for the anode of next generation Lithium-ion batteries. These low cost, manufacturable batteries could accelerate the deployment of plug-in hybrids and electric vehicles, shifting U.S. transportation energy from imported oil to the grid.

[54] Please refer to the U.S. Department of Energy's Advanced Research Projects Agency- Energy website for additional information. http://arpa-e.energy.gov/FundedProjects.aspx (accessed February 10, 2010).

[55] U.S. Department of Energy. Basic Energy Sciences: Energy Frontier Research Centers. http://www.er.doe.gov/bes/efrc.html (Accessed December 6, 2009).

Massachusetts Institute of Technology	$6,949,624	Cambridge, MA	An all liquid metal grid-scale battery for low cost, large scale storage of electrical energy. This new class of batteries could enable continuous power supply from renewable energy sources, such as wind and solar and a more stable reliable grid.

Source: Sandia National Laboratories. Energy Storage Systems. www.sandia.gov (Accessed December 6, 2009).

***Cost*:** One respondent felt that there would be a significant drop in price because there are a lot of new players and a lot of stimulus money going toward the technology. In addition, the use of lithium ion batteries in vehicles will likely drive the price of that technology down. Another respondent felt that the cost of some energy storage technologies will remain stable for the next few years. In four years, one respondent thinks that there will be a sharp acceleration in the adoption of storage with declines in pricing. In addition, The Advanced Energy Manufacturing Tax Credit provides an ITC of 30% to facilities that manufacturer energy equipment, including batteries.[56]

***Manufacturing Operations*:** From the team's interviews, two manufacturers have plans to scale up their manufacturing operations. An increase in sales will lead to an increase in both the scale and method of manufacturing operations. Both companies anticipate that 2010 will be a positive year for energy storage.

4.4 Conventional Combined Heat and Power

This section provides an overview of the CHP market in California. The material presented in this section is based primarily on the findings from a CHP market assessment commissioned by the CEC and conducted by ICF International in 2009. That assessment is hereinafter referred to as the "2009 CEC CHP study" or "the study."[57] The 2009 CEC CHP study examines both the technical potential of CHP in California, as well as the amount of CHP development that would be economically viable under a variety of scenarios.

The section first presents an overview of the CHP market as a whole, then describes California's CHP market in more detail. The market description includes discussion of SGIP system data, statewide CHP installations (including those systems that have not received CHP incentives), manufacturers, market potential, and project economics. The section closes with a discussion of barriers and future trends.[58]

4.4.1 Market Context

CHP systems produce thermal output in the form of steam and hot water. In the industrial sector, thermal output (sometimes called "waste heat") is used for process heating and space heating. At commercial and institutional sites, it is used for space heating and potable hot water heating. Thermal output can also be converted for use in air conditioning and refrigeration technologies.

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[56] U.S. Department of Energy. Press Release. "Treasury, Energy Announce More Than $2 Billion in Recovery Act Tax Credits for Energy Manufacturers." August 13, 2009.

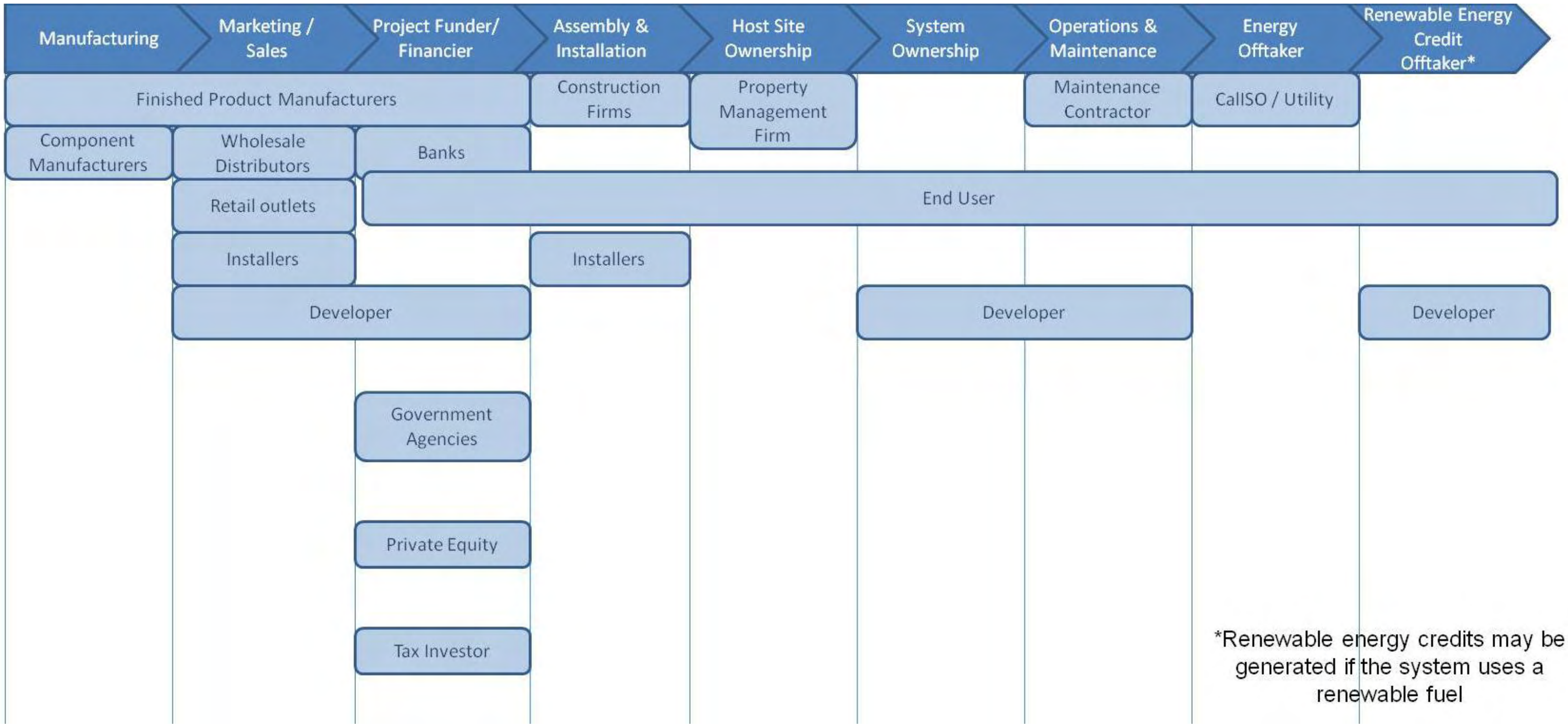
[57] Darrow, Ken, Bruce Hedman, Anne Hampson. 2009. Combined Heat and Power Market Assessment. California Energy Commission, PIER Program. CEC-500-2009-094-D.

[58] Fuel cells are included in the 2009 CEC CHP study. Therefore, any discussion of results from that study does consider fuel cells. However, in general, for the purposes of this SGIP market assessment report, fuel cells are discussed separately from other forms of CHP. Therefore, discussion of SGIP program data included in this section excludes fuel cells.

CHP is best suited to facilities at which the electric and thermal loads are significant, continuous and well matched. Facility types with the most favorable characteristics for CHP include food processing and pulp and paper plants, laundries and health clubs. Other facility types that can also prove economically-viable CHP sites due to their high thermal loads during cooler months include hotels, hospitals, universities, and correctional facilities.

Figure 4-17 illustrates the supply chain for CHP projects. Due to the diversity of CHP technologies and the complex nature of CHP systems, the market is populated by numerous players. Within each market actor type, there are specialists focusing on each of the different CHP technologies, and to some extent, on specific system components. Many CHP systems are maintenance intensive, and the systems affect many elements of a building's systems (i.e., electricity supply, HVAC, and in some cases, industrial processes). Therefore, equipment maintenance and operations contractors play a critical role in the CHP industry. CHP site hosts depend on maintenance staff with specialized skills to keep the CHP systems operating as planned so that broader facility operations will run smoothly. Maintenance services require specialized skills and are often outsourced. The outsourced service providers are often affiliated with major component manufacturers.

Figure 4-17. Market Actors and Their Roles in the Marketplace for CHP Projects



4.4.2 California Market Description

SGIP System Data

A summary of CHP systems that received SGIP program incentives is presented here. SGIP program data show that the greatest number of program applications have been for systems in the 101 kW – 500 kW size range. The 3.1 MW – 5 MW size range has seen the fewest applicants (Table 4-15).

Table 4-15. System Capacity by Number of Applications and Application Year, 2005-2007

	Application Year				
System Capacity	2005	2006	2007	Total	% of Total
50 kW - 100 kW	8	9	22	39	18%
101 kW - 500 kW	46	25	21	92	43%
501 kW - 1 MW	13	9	16	38	18%
1.1 MW - 3 MW	11	8	8	27	13%
3.1 MW - 5 MW	8	2	3	13	6%
Unknown			4	4	2%
Total	86	53	74	213	100%

Source: SGIP database as of September, 2009

The market sectors that have represented the greatest system capacity installed through the SGIP program are manufacturing (40%) and health services (13%).

Table 4-16. Market Sectors by Number of Applications and Capacity, 2005-2007

Market Sector	Number of Applications	System Capacity (kW)	% of Total Applications	% of Total System Capacity
Manufacturing	50	61,118	23%	40%
Misc. Commercial	28	6,575	13%	4%
Public Administration	22	4,818	10%	3%
Health Services	20	19,071	9%	13%
Communication	18	9,780	8%	6%
Elementary/Secondary Schools	16	1,706	8%	1%
College	10	9,989	5%	7%
Lodging	9	10,150	4%	7%

Mining/Extraction	8	7,278	4%	5%
Office	7	6,551	3%	4%
Real Estate	7	3,430	3%	2%
Unknown	3	1,120	1%	1%
Wholesale Trade	3	2,250	1%	1%
Agriculture	2	1,480	1%	1%
Construction	1	1,100	0%	1%
Grocery	1	250	0%	0%
National Security	1	500	0%	0%
Other Educational Services	1	1,100	0%	1%
Transportation	1	61	0%	0%
U.S. Postal Service	1	1,000	0%	1%
Utilities	1	250	0%	0%
Unknown	3	1,476	1%	1%
Grand Total	213	151,053	100%	100%

Source: SGIP database as of September, 2009

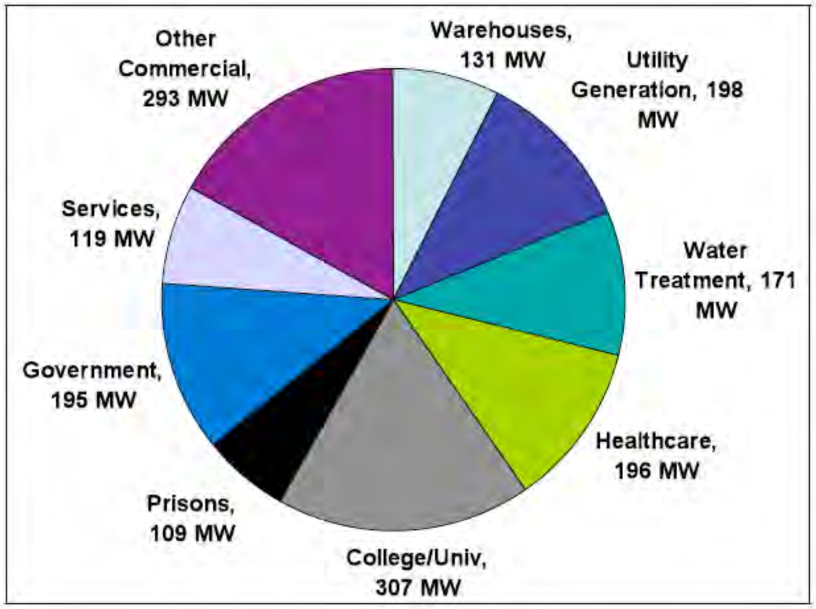
Statewide CHP Data[59]

The existing CHP capacity in California stands at 8,829 MW and is distributed across 1,183 sites. Large systems (≥ 20 MW) account for nearly 90% of this capacity. The state's industrial sector accounts for the greatest amount active CHP capacity (49%), while the commercial sector represents 19.5% of all CHP capacity in the state. Nationwide, this latter segment represents only 11% of the total CHP capacity.

Within the commercial sector the most active categories of CHP sites are colleges/universities, healthcare, government facilities, and utility owned systems (Figure 4-19).

[59] SGIP program data presented in this section excludes data on fuel cell systems installed through the program. Fuel cell data is presented in Section 4.1.

Figure 4-18. Existing Commercial CHP Capacity in California



Source: 2009 CEC CHP study, p. 12.

As noted earlier, CHP systems are currently found in all utility service territories, though PG&E has the largest share due to a concentration of large CHP systems located at oil fields and refineries in its territory.

The majority of systems (84% of total installed capacity) are fueled by natural gas. Coal and oil-fired plants together represent roughly 4.5% of capacity. Renewable fuel is used at 4.5% of CHP capacity in the state. Most of the capacity running on renewable fuels is located at sites in the wood, paper, and food processing industries, and at wastewater treatment facilities.

Large-scale systems (>3,000 MW) tend to be natural gas turbines. Gas-fired reciprocating engines, including lean burn engines and rich burn engines, are typically used for intermediate-size systems (100 kW to 5 MW). Microturbines and fuel cells are used in smaller CHP applications (roughly 10 kW to 1 MW).[60]

Gas turbines account for over 90% of CHP capacity currently installed in California. Reciprocating engines account for roughly 5% of the CHP capacity in the state, though this technology represents the largest number of CHP systems in California (62%). Microturbines and fuel cells represent a small fraction of existing capacity (< 2%), but use of these technologies is on the rise. [61]

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[60] *Clean Distributed Generation and Cost Analysis*, DE Solutions for Oak Ridge National Lab. April 2004. Data on technology applications by system size from the ORNL study are presented in the 2009 CEC CHP study (p. 17) in terms of relative market position.

[61] Capacity percentages by technology are approximated based on data presented in Figure 7 on page 15 of the 2009 CEC CHP study.

Manufacturers

Based on SGIP program data, it is clear that a diverse set of CHP turbine, engine and microturbine manufacturers are active in the state. Twenty-one manufacturers have been active in California's CHP market.[62] An even greater number of CHP manufacturers are active nationally. The number of CHP manufacturers active in the SGIP is just one-third the number of CHP manufacturers active in EPA's Combined Heat and Power Partnership.[63] This may reflect the relatively wide range of technologies that fall under the CHP umbrella. It may also reflect that the CHP market is undergoing continued change including technological advancements, and business expansion and contraction in responses to changing market conditions.

The manufacturer with the single greatest share of installations through the SGIP is Capstone (12% of total), followed by Intelligen Power Systems (11%).

Table 4-17. SGIP Applications by Manufacturer and Technology, 2005-2007

	Number of Applications				
Manufacturer	Gas Turbine (Non-Renewable Fuel)	IC Engine (Non-Renewable Fuel)	Microturbine (Non-Renewable Fuel)	Grand Total	% of Total
Capstone	0	1	25	26	12%
Intelligen Power Systems	0	24	0	24	11%
Ingersoll Rand	1	0	19	20	9%
DTE Energy	1	17	0	18	8%
GE Jenbacher	0	15	0	15	7%
Waukesha	0	14	0	14	7%
Aircogen CHP Solutions	0	13	0	13	6%
Stowell Distributed Power	0	13	0	13	6%
Solar Turbines	11	0	0	11	5%
Hess Microgen	0	9	1	10	5%
Blue Point Energy	0	9	0	9	4%
Caterpillar	0	9	0	9	4%
Tecogen	0	9	0	9	4%
UTC	0	0	7	7	3%

[62] As noted earlier, SGIP program data presented in this section excludes data on fuel cell systems installed through the program. Fuel cell data is presented in Section 4.1.

[63] EPA's Combined Heat and Power Partnership website (http://www.epa.gov/chp/partnership/partners2.html) lists 59 participants in the "manufacturer" category.

Guascor	0	6	0	6	3%
Cummins	0	2	0	2	1%
DG Power Systems	0	2	0	2	1%
Genergy Power Solutions	0	1	0	1	0%
Kohler Power Systems	0	1	0	1	0%
Magellan Aerospace	1	0	0	1	0%
Simson Maxwell	0	1	0	1	0%
Unknown	0	1	0	1	0%
Total	14	147	52	213	100%

Source: SGIP database as of September, 2009

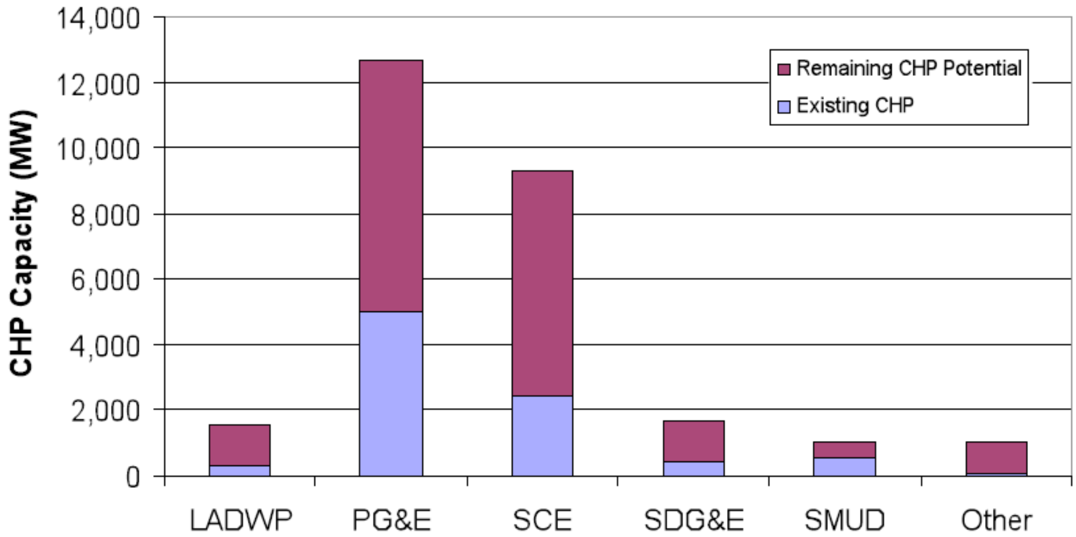
Market Potential in California

For the technical potential component of the 2009 CEC CHP study, the authors examine the electrical and thermal needs of different facility types to calculate the amount of electrical capacity that could be installed at existing and new facilities in the state. Drawing on the results of the technical potential analysis, the authors then estimate the market penetration of CHP technologies under various scenarios.[64] The market penetration analysis factors in market conditions that would affect project economics (e.g., technology costs, avoided energy costs, regulations, and financial incentives).

The 2009 CEC CHP study found a total technical potential of 18,000 MW for California. As shown in Figure 4-19, the largest amount of existing capacity and the largest amount of remaining potential exists in the PG&E service territory. The SCE service territory has the potential for major growth as well.

[64]CHP technologies considered in the 2009 CEC CHP study include reciprocating engines, natural gas turbines, microturbines, and fuel cells. The study also considered the role of absorption chillers in the CHP market.

Figure 4-19. Existing CHP and Remaining Potential



Source: 2009 CEC CHP study, p. 66.

The bulk of California's CHP technical potential exists in commercial facilities. This is contrary to the traditional wisdom about CHP which is that the greatest technical potential is in industrial facilities. The California situation is unique due to the fact that much of the potential for CHP use at industrial facilities in the state has already been realized.

In the commercial market, the greatest amount of technical potential exists in systems sized at or below 5 MW. The study found that the greatest rate of growth in CHP development in commercial facilities is likely to occur at hospitals, nursing homes, big box retail stores, and movie theaters.

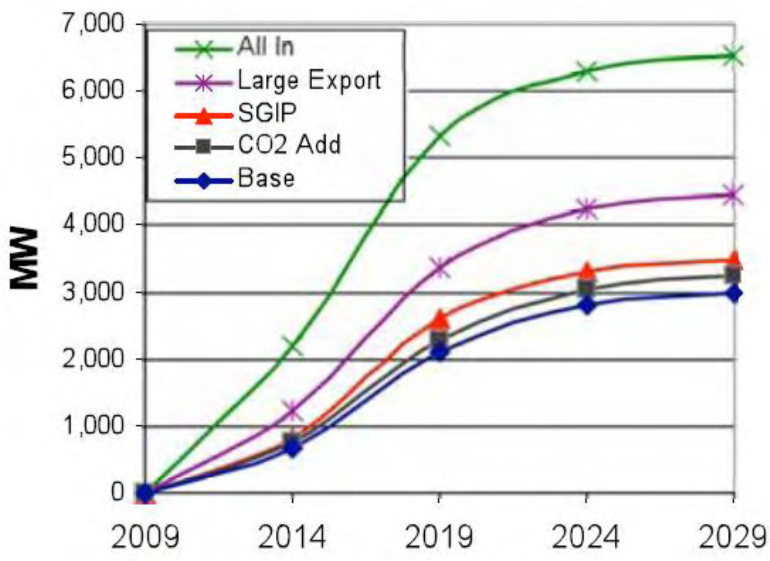
The majority of technical potential at industrial sites exists in the 1 MW to 20 MW system size range. Industrial business types that are likely to see the greatest growth in CHP use include food, textiles, and lumber and wood.

To examine how much of the technical potential is economically viable and thus likely to be developed by 2029, the ICF research team explored five different potential market scenarios:

1. Base Case: assumes a continuation of current market conditions;
2. CO_2 Payments Case: CHP operators receive $50/ton for avoided CO_2 emissions;
3. Restore SGIP: SGIP incentives would be restored for a period of 10 years;
4. CHP Feed-in-Tariff: the feed-in tariffs called for in AB 1613 are in effect for systems under 20 MW;
5. "All-in": includes restoration of SGIP, payment for avoided CO_2 emissions, and favorable pricing assumptions for exported power.

The estimates of statewide CHP market penetration resulting from this analysis range from 3,000 MW under the Base Case scenario, to 6,521 MW under the All-In case. The study finds that under Base Case conditions, the majority of CHP development (65%) will involve the use of CHP systems under 5 MW. The bulk of the capacity installed under Base Case conditions would produce electricity for on-site use (as opposed to exporting power). Under the All In scenario there would be a more even split between the development of smaller (under 20 MW) and larger systems (greater than 20 MW). Given that there would be a greater representation of >20 MW systems in the All In case, this scenario would also result in a more substantial amount of export power coming from CHP systems.

Figure 4-20. Cumulative Market Penetration by Scenario



Source: 2009 CEC CHP study, p. 5.

Project Economics

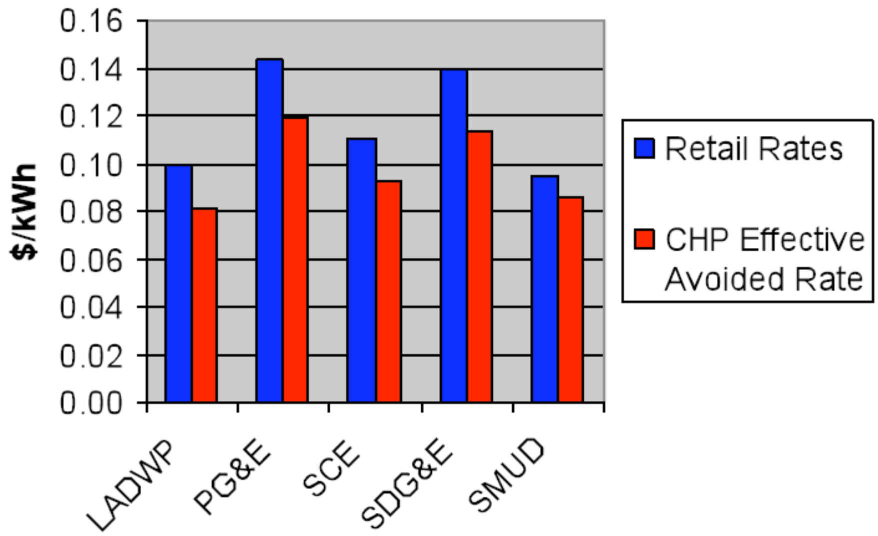
Key economic drivers for CHP projects include the following:

- Installed costs;
- Performance (electrical and thermal output efficiency);
- Electricity and natural gas prices;
- O&M costs;
- Policies, market framework and financial incentives (i.e., standby and backup charges, electricity export pricing, interconnection and net metering policies, federal CHP ITC).

Natural gas prices are particularly important to CHP project economics, as the majority of systems operate on natural gas, and CHP systems typically displace thermal load that would otherwise be served by a natural gas-fired boiler. Natural gas prices are highly volatile, resulting in significant project financial risk. Securing long-term fuel supply contracts is a necessary risk mitigation strategy for many projects.

Electricity prices are also critically important to CHP project economics. As logic dictates, and as shown in Figure 4-21, the utility service territory with the highest retail electricity rates is also the territory with the highest avoided costs from operating a CHP system. In addition to the actual retail electricity rates, other electric utility fees and policies can factor significantly into project economics. When retail electric customers in IOU service territories install a CHP system, they may be required to pay a variety of fees, including departing customer responsibility surcharges, standby demand charges, nuclear decommissioning fees and public purpose program fees. Fee requirements vary depending on the size, efficiency, and emissions characteristics of the system.[65] Export electricity pricing plays an important role in system economics as well.[66]

Figure 4-21. Retail Rates and CHP Effective Avoided Rate – Baseload 50 – 500 kW



Source: 2009 CEC CHP study, p. 37.

Policies, market framework and financial incentives are also critical drivers behind CHP project economics. The period from the early 1980s through the mid-1990s saw the greatest level of CHP installation activity. The Public Utilities Regulatory Policy Act (PURPA) of 1978 was enacted, requiring utilities to provide favorable treatment to energy efficient CHP and renewables. This positive policy environment coincided with an increasing availability of larger, more efficient CHP systems, and a drop in combustion turbine and combined cycle system costs. CHP development activity decreased after the mid-1990s when the wholesale markets for electricity were deregulated. CHP installation decisions were put on hold for many potential system owners due to uncertainty about power prices. The period since 2001 has seen a relatively low level of activity compared with the much more robust level of activity that existed from the mid-1980s through the mid-90s. This low level of CHP market activity happens to coincide with the timeframe during which the SGIP was launched.

[65] System owners in LADWP and SMUD service territories must pay monthly standby demand or service charges based on the rated capacity of the CHP system. System owners in IOU service territories must pay demand charges if their system goes down during peak hours.

[66] PURPA requires utilities to purchase power from CHP system owners at the utility's avoided costs. However, the avoided costs (3 to 3.5 cents per kWh) are too low to support CHP investments and utilities are not entering power purchase contracts with new CHP system owners. AB1613 requires IOUs to establish a CHP feed-in tariff for systems under 20 MW.

4.4.3 Barriers to Broad Market Adoption of CHP in California

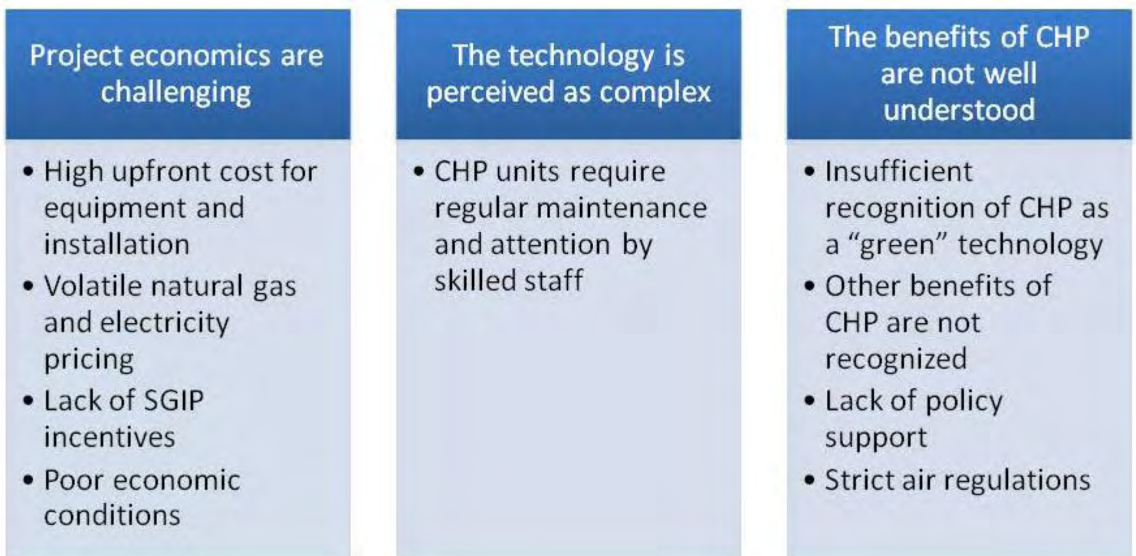
There are three main categories of barriers to more widespread development of CHP projects in California:

- Project economics are challenging;
- The technology is perceived as complex; and
- The benefits of CHP are not well understood.

Unless otherwise noted, the information in this section is based on the project team's interviews with developers and market actors in the fuel cell industry and the 2009 CEC CHP study.[67] The project team used the interview results to highlight high-level themes, as described above. Additional detail about the issues associated with each theme is provided in this section, using the specific input from the interviews.

Figure 4-22 summarizes the major issues associated with each of these themes. The themes and associated issues are discussed in more detail in the remainder of this section.

Figure 4-22. Summary of Barriers to More Widespread Development of CHP Projects



Project economics are challenging.

The installation of CHP projects requires a ***high upfront cost for equipment and installation***. In addition, the costs for interconnection and permitting have increased and become a larger proportion of the total project cost in recent years.

Volatile natural gas and electricity pricing can further contribute to a project's financial risk. The low off peak electricity rates at some utilities make operating off of utility grid power a more attractive

[67] Market actors included manufacturers and project developers.

alternative to CHP. High or volatile natural gas prices can also make utility grid power a more attractive alternative.

The ***lack of SGIP incentives*** has hurt the CHP market in California. When available, these incentives were instrumental in bringing project payback periods. In addition, ***standby charges, demand charges, and other non-bypassable charges*** and fees discourage self-generation by increasing the project costs.

Poor economic conditions may constrain the financial hurdle rate that a CHP investment may need to achieve in order to be approved. The 2009 CEC CHP study found that more than half of customers would reject a return on simple payback of 2 years.

CHP is technology is perceived as complex

CHP units require regular maintenance and attention by skilled staff. System performance can suffer if on site staff do not have the proper training to evaluate performance or are not in the practice of contacting proper staff or contractors immediately when problems arise.

The benefits of CHP are not well understood

There is ***insufficient recognition of CHP as a "green" technology*** compared with as other potential investments that may provide more public relations benefits. Policy makers support solar and wind because they operate on a renewable fuel and assume that CHP units, which are often fueled with fossil fuels, contribute to GHG. There are ***other benefits of CHP which are not recognized***. These include reduced peak demand on the electric grid and improved grid reliability.

Because the benefits of CHP are not well understood, there is a ***lack of policy support***. This could include SGIP incentives to help offset the high first cost of the systems and waiving of standby charges, demand charges, and other non-bypassable charges.

Strict regional air regulations can also halt a potential project. The South Coast Air Quality Management District has called a moratorium on issuance of certain air permits, which has prevented new CHP projects from being installed.

4.4.4 Future Trends

The actual market penetration of CHP that develops in California in the coming decades will depend primarily on developments regarding the key economic drivers in the CHP market. Specifically, installed costs, performance advancements, fuel and electricity prices, and policies and incentives will play a defining role in the future of CHP in California.

As noted earlier, a great deal of the economic potential exists in the smaller systems (i.e., < 5 MW). Microturbine and fuel cell technologies have the potential to play a major role in the market for small systems. However, these technologies' installed costs are currently much higher than those of more conventional CHP technologies. Therefore, a drop in installed costs for microturbines and fuel cells would significantly affect the realization of CHP market potential in California. The market is already seeing an increase in the use of absorption chilling (thermally-activated chilling). Continued growth in the adoption of this technology could increase the economic potential, as it would increase the range of facilities with thermal loads that could make use of the thermal output from CHP systems.

Barriers to growth of the CHP market could be reduced by:

- Increasing awareness about the benefits of the technology;
- Facilitating long-term contracts for electricity and natural gas;
- Minimizing fees associated with generating power on-site;
- Increasing policies and incentives that recognize the benefits provided by CHP systems.

5 POLICY ENVIRONMENT

The policy environment in which a technology incentive program operates is key to the success of the program. The policies influencing a program can often be external to the program, such as the availability of tradable renewable energy credits or federal tax credits. Therefore, the program may have limited control over the policy environment. The policies that affect the SGIP are discussed in the sections below and are organized by federal, state, and local policies. Figure 5-1 shows an overview of the policy environment affecting on-site generation projects, specifically wind and fuel cell projects, in California. While this figure provides a high level overview, each section provides details on the policy environment.

Figure 5-1. Overview of the Policy Environment Affecting On-Site Generation Projects in California

FEDERAL POLICIES

Investment Tax Credit
Credit: 30%
Technologies: Wind and fuel cells

Modified Accelerated Cost-Recovery System (MACRS)
Credit: Class life of 5 years

Rural Energy for America Program (REAP) Grants
Credit: Solicitation based
Technologies: Wind and possibly fuel cells

Production Tax Credit
Credit: 2.1 cents/kWh in 2009
Technologies: Wind

Tribal Energy Program Grant
Credit: Solicitation based
Technologies: Wind and possibly

Renewable Energy Production Incentive (REPI)
Credit: 2.1 cents/kWh in 2009
Technologies: Wind

CALIFORNIA STATE POLICIES

Net Energy Metering: Wind systems and fuel cells up to 1MW in capacity can net energy meter.
Wind: AB 1755 plus subsequent bills
Fuel cells: AB 1214, AB 67, AB 1551

AB 920: compensates the customer-generator for excess generation over a 12 month period or applies to net surplus electricity as a credit toward future electricity needs; the utility would own any renewable energy credit from the purchase of the net surplus electricity to be used toward the California Renewable Portfolio Standard.

Feed-In Tariffs (FiT): California currently offers feed-in tariffs for eligible renewable generation. The tariff is based on the market price referent (MPR). The state is currently reviewing the current program and an additional CHP-specific feed-in tariff.

Renewables FiT: SB 32 (raises eligible size limit from 1.5 MW to 3 MW)

CHP FiT: AB 1613 and AB 2791 (enact the Waste Heat and Carbon Reduction Act; authorized the CPUC to require electrical corporations to purchase excess electricity from a CHP system)

Renewable Energy Credits (RECs): A California Public Utilities Commission rulemaking is currently underway to develop additional methods to implement the California Renewable Portfolio Standard (RPS)(R.06-02-012). The ALJ has released a revised proposed decision authorizing the use of RECs for RPS compliance.

D.08-08-028 defines a REC for compliance with the RPS.

California Global Warming Solutions Act (AB 32): Established a state-wide greenhouse gas emissions cap for 2020, equal to 1990 levels

AB 45: Authorized counties that do not have an ordinance providing for the installation of wind systems (<= 50 kW) to adopt one by Jan. 1, 2011.

California Energy Commission – Energy Efficiency Financing: 1% and 3% low-interest public agency loans available.

LOCAL POLICIES

Air permits have not been a large issue for wind and fuel cell projects. Six of the 35 air quality management districts include text in their rules and regulations that specifically exempt fuel cells from permits.

Building permits: Projects must adhere to the California Building Code.

Public entities also need approval from a variety of separate state organizations. For example, hospitals need to work with the Office of Statewide Health and Planning Development (OSHPOD) and schools may need to work with the Division of State Architects (DSA), among other organizations.

Zoning ordinances: Zoning ordinances often restrict wind turbine development.

SELF-GENERATION INCENTIVE PROGRAM

AB 2267: 20% additional incentive for the installation of eligible technologies from a California supplier

SB 412: Extends the SGIP until Jan. 1, 2016; expands eligibility in the program to distributed energy resources that the CPUC and State Air Resources Board determine will achieve a reduction in greenhouse gas emissions

D.09-09-049: Allows SGIP projects to be eligible for Level 2 incentives if the renewable fuel for the system is obtained from a directed biogas contract and nominated to be delivered via a natural gas pipeline.

D.09-12-047: Adopts an annual budget of $83 million for the SGIP in 2010 and 2011. Funds may be reserved and spent up to January 1, 2016. The decision also allows payments for incentives over 1 MW to come either from carryover funds or the current year's budget. Previously, these funds could only come from

Note: Information accurate as of December 31, 2009.
Sources: Official California Legislative Information. www.leginfo.ca.gov/index.html; Database of State Incentives for Renewables and Efficiency. Federal Incentives/Policies for Renewables and Efficiency. www.dsireusa.org; Summit Blue Consulting 2007 evaluation efforts; California Public Utilities Commission. www.cpuc.ca.gov; The California Energy Commission. Energy Efficiency Financing. http://ww.energy.ca.gov/efficiency/financing/index.html

5.1 Federal

The federal government provides a range of tax credits and grants to stimulate the renewable energy markets. The federal policies that most affect the on-site generation projects are included in this section, though this section is not meant to be inclusive of all federal policies addressing on-site generation projects.

Tax Credits (Private): The Emergency Economic Stabilization Act (EESA) of 2008 combined with the American Recovery and Reinvestment Act (ARRA) of 2009 provides incentives to a wide range of energy efficiency and renewable energy technologies in the form of tax credits. An ITC, equal to 30% of the total installed cost, is available for ***wind*** turbines installed from October 3, 2008 through December 31, 2016. The ARRA removed a credit cap previously included in the 2008 EESA. Businesses can either elect to take the tax credit or receive a grant. Grant applications must be submitted by October 1, 2011. The PTC is available for wind turbines placed in service by December 31, 2012. The PTC is equal to 2.1 cents per kWh in 2009 and is adjusted for inflation. Developers can receive the PTC if the project is placed in service in 2008 or 2009, or if construction ends before 2010 and facilities are placed in service by 2013.[68]

The business energy ITC is also applicable to ***fuel cells***. Like the ITC for wind, the credit is equal to 30% of the total installed cost. The fuel cell must be at least 0.5 kW and have a minimum electricity-only generation efficiency of 30%. The credit is capped at $1,500 per 0.5 kW of capacity and is available to commercial, industrial and utility customers. A separate energy tax credit is available for the installation of fuel cells in residential applications. The residential tax credit is equal to 30% of the total installed costs with a maximum incentive of $500 per 0.5 kW. Similar to the business energy ITC, the fuel cell must have a minimum electricity-only generation efficiency of 30%.[69]

Modified Accelerated Cost-Recovery System (MACRS) (Private)*:* Through the modified accelerated cost-recovery system, businesses may recover investments in defined property through depreciation deductions. The MACRS has established class lives for certain technologies: fuel cells, wind, and CHP have class lives of 5 years. The EESA and the ARRA added a 50% bonus depreciation for tangible property acquired and placed in service during 2008 or 2009 with a recovery period of 20 years or less.[70]

Tribal Energy Program Grant (Public): The Department of Energy's Tribal Energy Program provides financial assistance for the installation of a range of energy generation technologies on tribal lands. The most recent solicitation ended on April 30, 2009.[71] Eligible technologies include photovoltaics, wind, biomass, hydroelectric, geothermal electric, and geothermal heat pumps.[72]

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[68] U.S. Department of the Treasury- American Recovery and Reinvestment Act Website. http://www.treas.gov/recovery/1603.shtml (accessed September 2009) and American Wind Energy Association (AWEA), Legislative affairs. www.awea.org (accessed September 2009).

[69] Database of State Incentives for Renewables and Efficiency. Federal Incentives/Policies for Renewables and Efficiency. www.dsireusa.org (accessed December 2009).

[70] Internal Revenue Service. Department of the Treasury. Instructions for Form 4562. 2009.

[71] U.S. Department of Energy. Tribal Energy Program. Financial Opportunities. apps1.eere.energy.gov/tribalenergy/government_grants.cfm#Tribal (accessed December 2009).

[72] Database of State Incentives for Renewables and Efficiency. Federal Incentives/Policies for Renewables and Efficiency. www.dsireusa.org (accessed December 2009).

Rural Energy for America Program (REAP) Grants (Private and Public): The REAP is designed to assist rural farmers, ranchers and small businesses by providing grants that can be used for a range of purposes, including purchasing equipment and feasibility studies.[73] Grants are awarded on a solicitation basis with the most recent solicitation ending on July 31, 2009. Grants can be up to 25% of the total eligible project cost up to $500,000 for renewable energy systems. Eligible systems include those that use wind, solar, biomass, geothermal, hydro power and hydrogen-based sources to produce electricity.

Renewable Energy Production Incentive (REPI) (Public): The REPI has been widely used by public entities in California and throughout the country since its inception in 1992. Qualifying entities include state and local governments, municipal utilities, rural electric cooperatives and tribal governments. Project owners receive incentive payments of 1.5 cents per kWh for the first ten years that a system is in operation. The incentive amount was set in 1993 dollars and is indexed each year to account for inflation. The 2009 incentive is 2.1 cents per kWh. Although the only eligible SGIP technology is wind, solar thermal electric, photovoltaics, landfill gas, wind, biomass, geothermal electric, anaerobic digestion, tidal energy, wave energy, and ocean thermal energy are also eligible. The system must be online before October 1, 2016.[74]

5.2 California State Policies

SGIP projects must operate within the policy environment in the state of California. This section is split into relevant California assembly and senate bills, recent CPUC decisions, NEM, feed-in tariffs, renewable energy credits and other policy tools that affect the installation of on-site generation in California. Similar to the federal policy section, this section is meant to highlight policies relevant to the SGIP.

California's 2003 Energy Action Plan introduced a loading order to address California's energy needs. The order in which California will satisfy its energy and capacity needs is as follows:[75]

First: energy efficiency and demand response

Second: renewables and distributed generation

Third: clean and efficient fossil-fired generation

Therefore, distributed generation is included in California's loading order after energy efficiency and demand response. Distributed generation in this sense includes combined heat and power. In February 2008, the Energy Action Plan was updated to better meet the greenhouse gas goals defined under Assembly Bill 32 and the CEC's 2007 Integrated Energy Policy Report (IEPR).[76]

[73] U.S. Department of Agriculture. Rural Development. Business and Cooperative Programs. http://www.rurdev.usda.gov/rbs/index.html (accessed December 2009).

[74] Database of State Incentives for Renewables and Efficiency. Federal Incentives/Policies for Renewables and Efficiency. www.dsireusa.org (accessed December 2009).

[75] California Energy Commission and California Public Utilities Commission. "Energy Action Plan II: Implementation Roadmap for Energy Policies." September 21, 2005.

[76] California Energy Commission and California Public Utilities Commission. "Energy Action Plan: 2008 Update." February 2008.

The California Long Term Energy Efficiency Strategic Plan (Strategic Plan)[77] outlines a vision, profile, goals, and strategies for energy efficiency across four market sectors—residential (including low income), commercial, industrial, and agricultural—along with seven cross cutting areas—HVAC systems, DSM coordination and integration, workforce education and training, marketing education and outreach, research and technology, codes and standards and local government. Although the Strategic Plan focuses on energy efficiency, it includes a strategy to develop a statewide marketing brand for demand-side management activities, including energy efficiency, distributed generation, demand response, and advanced metering.

5.2.1 Relevant California Assembly Bills and Senate Bills[78]

SGIP Policy

AB 2267: *Approved September 28, 2008*

This bill requires the Commission to provide an additional incentive of 20% for the installation of eligible technologies from a California supplier in the SGIP program. The bill includes a discussion that California's leadership in greenhouse gas reductions lead to increased economic development in the state and that projects that result in economic benefits in California receive additional consideration, priority or preference.

***Effect on the SGIP*:** Increases the incentive amount for SGIP projects that install technologies from a California supplier.

SB 412: *Approved October 11, 2009*

This bill extends the SGIP until January 1, 2016. It also expands the eligibility in the SGIP to distributed energy resources that the Commission and the State Air Resources Board determine will achieve a reduction in greenhouse gas emissions.

***Effect on the SGIP*:** This bill extends the SGIP to the end of 2015 and expands the eligibility.

AB 1536: *Last amended December 17, 2009*

This bill would change the current SGIP by enacting the following: change the name to the distributed energy resources incentive program, change the purpose to "deploy distributed energy," allow stand-alone storage with a capacity less than or equal to 10 MW, and establish a program budget limit of $83 million. Note: This bill has been completely changed to address seismic faults.

Greenhouse Gas Policy

AB 32: *Approved September 27, 2006*

AB 32, known as the California Global Warming Solutions Act of 2006, establishes a statewide greenhouse gas emissions cap for 2020, equivalent to 1990 levels. It also requires the California State Air Resources Board (CARB) to adopt regulations requiring the reporting and verification of statewide

[77] California Public Utilities Commission. "California Long Term Energy Efficiency Strategic Plan." August 2008.
[78] The majority of the information about each bill is from Official California Legislative Information. http://www.leginfo.ca.gov/index.html.

greenhouse gas emissions, which CARB must monitor and enforce. The bill authorizes the adoption of fees to be paid by regulated greenhouse gas emission sources.

***Effect on the SGIP*:** This bill focuses California's efforts on greenhouse gas reductions.

Net Energy Metering Policy

AB 1755: *Approved September 24, 1998*

This bill expands on the net metering law, which allowed solar electrical generating systems under 10kW to net energy meter. This bill allows wind turbines or hybrid wind/solar systems to net meter. Under this bill, systems may not be greater than 10 kW. Many revisions to the net metering rules in general, and for wind turbines in particular, have occurred.

***Effect on the SGIP*:** NEM is a key to a self-generation project's success. In addition, the waiving of additional fees reduces a project's costs.

AB 1214: *Approved October 2, 2003*

AB 1214 requires electrical corporations to provide net-energy metering to customers with fuel cells and waives some of the additional fees that could be placed on customer-generators like demand charges, standby charges, minimum monthly charges, if the charges go beyond other customer's charges in their rate class. The bill limits the amount of capacity the corporation must accept to 45 MW if the corporation has a peak demand above 10 GW or 22.5 MW if the corporation has a peak demand equal to or below 10 GW. The combined capacity statewide may not exceed 112.5 MW. AB 1214 was in effect until January 1, 2006

AB 67: *Approved October 6, 2005*

This bill extends net-energy metering for fuel cells until January 1, 2010.

AB 1551: *Approved October 11, 2009*

Among other item, this bill extends net-energy metering for fuel cells until January 1, 2014.

***Effect of these three bills on the SGIP*:** NEM is a key to a self-generation project's success. In addition, the waiving of additional fees reduces a project's costs.

AB 560: *Amended on September 4, 2009*

As amended, this bill would raise the NEM limit until the total rated energy capacity of customer-generators reaches 5% of the utility's total peak demand. The current cap is at 2.5%.

***Effect on the SGIP*:** NEM is a key to a self-generation project's success. If the cap is reached by a utility, on-site generation development may be stalled.

AB 920: *Approved October 11, 2009*

Under current NEM rules, customer-generators are not compensated for excess generation produced by their system. AB 920 would require electric utilities to either compensate the customer-generator for excess generation over a 12-month period or to apply to net surplus electricity as a credit toward future electricity needs. The utility would own any renewable energy credit from the purchase of the net surplus electricity to be used toward the California Renewable Portfolio Standard. This bill applies to customer-generators with solar or wind systems not more than 1 MW and, as written, does not appear to include fuel cells.

***Effect on the SGIP*:** This bill has the potential to the make economics more attractive for installing a wind system on-site.

Feed-in Tariff Policy

AB 1613: *Approved October 14, 2007*

AB 1613 enacts the Waste Heat and Carbon Emissions Reduction Act which authorizes the CPUC to require electrical corporations to purchase excess electricity from a CHP system, operating under certain guidelines. The bill requires every electrical corporation to file a standard tariff and requires the CPUC to establish a pay-as-you-save pilot program to finance the up-front costs of a CHP system.

AB 2791: *Approved August 1, 2008*

AB 1613 was amended by AB 2791, which changes the definition of "eligible customer" in Section 2842.4 of the PUC to include federal, state, or local government facilities.

***Effect of these two bills on the SGIP*:** CHP systems were eligible for incentives in the SGIP until January 1, 2008. A feed-in tariff for CHP projects provides for a monetary stream for these projects.

AB 2466: *Approved September 28, 2008*

AB 2466 authorizes local governments to receive a bill credit to a designated benefiting account for electricity exported to the electrical grid by an eligible renewable generating facility. Under AB 2466, the CPUC is required to adopt a rate tariff for the benefiting account.

***Effect on the SGIP*:** Allows eligible entities to "use" electricity produced from an on-site generator at another site.

AB 1106: *Last amended on July 15, 2009*

This bill amends the current feed-in tariff provisions and requires differentiation of tariffs by technology. The latest committee hearing was cancelled at the request of the author.[79]

SB 32: *Approved October 11, 2009*

SB 32 raises the cap of small renewable generators eligible to participate in the current feed-in tariff program from 1.5MW to 3MW and raises the total program cap from 500MW to 750MW. Under this bill, the tariffs are determined by avoided cost (MPR or value-based). This bill will primarily benefit commercial solar PV projects it is considered an incremental improvement for small renewable generators over AB 1969.

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[79] Assembly Bill No. 1106. Status. www.leginfo.ca.gov (accessed December 31, 2009).

***Effect on the SGIP*:** A revised feed-in tariff program may be a competing incentive for installing on-site generation. Depending on how the rules are written, projects may able to receive the SGIP incentive and the feed-in tariff.

General Wind Policy

AB 45: *Approved October 11, 2009*

AB 45 reenacts previous legislation (AB 1207) which sunset on July 1, 2005 by authorizing counties that do not have an ordinance providing for the installation of small wind systems to adopt one by January 1, 2011. The definition of small wind system in the bill is a system with a capacity less than or equal to 50 kW per customer site and therefore does not cover all wind systems incented through the SGIP.

***Effect on the SGIP*:** This bill may ease permitting for wind turbines which is a major barrier to wind turbine installation in California. However, this bill has limited applicability to SGIP as only turbines less than or equal to 50 kW are addressed. Furthermore, under the provisions of AB 45, counties have an opportunity to enact an ordinance of their own design if they do so prior to January 1, 2011.

General Combined Heat and Power Policy

SB 758: *Introduced on February 27, 2009*

This bill would establish incentives for agriculture to install cogeneration and anaerobic digester electrical generation facilities and require the utilities to purchase the excess electricity generated by the system.

AB 1110: *Approved October 11, 2009*

AB 1110 allows "advanced electrical distribution generation technology," defined as, among other items, a generator with an electrical efficiency greater than or equal to 45%, to be treated as cogeneration and prohibit alternative fuel capability requirements. The PA interviews also revealed that this bill may allow these technologies to pay a lower rate for gas.

***Effect on the SGIP*:** Approval of AB 1110 may increase applications to SGIP by by aiding the economics of projects.

Recent CPUC Decisions

Decision 08-08-028: *August 21, 2008*

This decision defines a renewable energy credit (REC) for compliance with the California RPS.

Decision 09-09-049: *September 24, 2009*

Decision 09-09-049 allows SGIP projects to be eligible for Level 2 incentives if the renewable fuel for the system is obtained from a directed biogas contract and nominated to be delivered via a natural gas pipeline.

Decision 09-12-047: *December 17, 2009*

This decision adopts an annual budget of $83 million for the SGIP in 2010 and 2011, though the funds may be reserved and spent up to January 1, 2016. The decision also allows payments for incentives over 1 MW to come either from carryover funds or the current year's budget, lifting a previous restriction that incentives over 1 MW come from carryover funds.

Net Energy Metering

NEM tariffs allow customers to get credit for the excess electricity generated by their system. In addition, facilities that are net energy metered are not required to pay additional fees that could be placed on customer-generators like demand charges, standby charges, and minimum monthly charges, if the charges go beyond other customer's charges in their rate class. PG&E, SCE and SDG&E offer NEM for wind and fuel cell technologies for systems up to 1 MW.

Feed-in Tariffs in California

There are currently two feed-in tariff paths in California: one for renewable generation and one for generation for a combined heat and power (CHP) system. Both of these feed-in tariffs are discussed in this section.

Feed-in Tariffs for Renewable Generation: Feed-in tariffs in California are currently in effect as one aspect of the California Renewables Portfolio Standard (RPS) Program. Assembly Bill 1969 added PU Code Section 399.20, which authorized feed-in tariffs for renewable generation from public water and wastewater facilities. The tariffs were approved, effective date of February 14, 2008, in Resolution E-4137.[80] Decision 07-07-027 expanded the tariffs to non-water and non-wastewater facilities in SCE and PG&E service territories. SDG&E also offers the tariff the non-water and non-wastewater facilities under SB 380.

Customers are eligible to participate in the feed-in tariffs if they are customers of the following utility companies: SCE, PG&E, SDG&E, PacifiCorp, Sierra Pacific Power Company, Bear Valley Electric Service (BVES) Division of Golden State Water Company, and Mountain Utilities. Non-water and non-wastewater facilities are only eligible if they are in SCE, PG&E, or SDG&E's service territory. Eligible technologies are those defined in PU Code Section 399.12 and include biomass, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuel, small hydro ≤ 30 MW, digester gas, municipal solid waste conversion, landfill gas, ocean wave, ocean thermal, and tidal current.

The feed-in tariffs are intended for systems less than or equal to 3 MW, and the entire program is limited to 750 MW statewide.[81] The feed-in tariff is based on the Market Price Referent (MPR)[82] at the time of facility operation and a time of delivery adjustment factor. The tariff terms are for 10, 15, 20, or 25 years. Table 5-1 lists the MPR based on the contract date and the contract length. For example, if a 10 year contract was signed in 2010, the project would receive $0.08448/kWh (adjusted for time of day) for 10 years from the date of contract. The table notes provide information on the time of day adjustment factor.

[80] California Public Utilities Commission, Feed-in Tariff Website. http://www.cpuc.ca.gov/PUC/energy/Renewables/hot/feedintariffs.htm.

[81] California Senate Bill No. 32.

[82]The MPR is the predicted annual average cost of production for a combined cycle natural gas fired base load proxy plant.

Table 5-1. Adopted 2009 Market Price Referents

Adopted 2009 Market Price Referents (Nominal – dollars/kWh)				
Contract Start Date	**10 – Year**	**15 – Year**	**20 – Year**	**25 - Year**
2010	0.08448	0.09066	0.09674	0.10020
2011	0.08843	0.09465	0.10098	0.10442
2012	0.09208	0.09852	0.10507	0.10852
2013	0.09543	0.10223	0.10898	0.11245
2014	0.09872	0.10593	0.11286	0.11636
2015	0.10168	0.10944	0.11647	0.12002
2016	0.10488	0.11313	0.12020	0.12378
2017	0.10834	0.11695	0.12404	0.12766
2018	0.11204	0.12090	0.12800	0.13165
2019	0.11598	0.12499	0.13209	0.13575
2020	0.12018	0.12922	0.13630	0.13994
2021	0.12465	0.13359	0.14064	014424

Notes: To calculate the actual price paid for eligible renewable power under this program, the metered energy production at the point of interconnection is multiplied by the applicable MPR and then by the applicable TOD adjustment factor. So if:

At = kWh of energy distributed onto the utility grid at time “t”
B = MPR fixed at time of actual commercial operation
Ct= TOD adjustment factor for time “t”

then the price paid in $/kWh (Pt) for any given kWh produced and sold to the utility at time “t” would be calculated by the formula

At * B * Ct = Pt

Source: http://www.cpuc.ca.gov/PUC/energy/Renewables/Feed-in+Tariff+Price.htm

In order to be eligible for feed-in tariffs, the system cannot be net metered, the customer cannot receive incentives from other incentive programs like the California Solar Initiative or the SGIP, and the site may not be in an interruptible load program. In addition, the renewable energy credits (RECs) for the energy paid for by the utilities are owned by the utility.

Table 5-2 shows a summary of participation in the feed-in tariff program as of November/December 2009. The majority of projects are within PG&E's service area and landfill gas projects comprise a large number of the projects. Some points to note about the feed-in-tariff participation are that:

- Landfill gas projects comprise 60% of projects by number of 76% of project capacity
- Small hydro projects comprise 25% of projects by number and 9% of project capacity
- 80% of projects by number are in PG&E area
- 69% of project capacity is in PG&E area, 25% is in SDG&E area.

Table 5-2. Summary of the Feed-in Tariff Participation to Date

	PG&E		SCE		SDG&E	
	# of Projects	**Total Capacity (MW) [min-max]**	**# of Projects**	**Total Capacity (MW) [min-max]**	**# of Projects**	**Total Capacity (MW) [min-max]**
Landfill gas	8	8.0 [0.5-1.5]	1	1.1	3	4.5 [1.5 each]
Small hydro	5	1.6 [0.05-0.6]	0	0	0	0
Wind	1	1.5	0	0	0	0
Biogas	1	0.3	0	0	0	0
Biomass	1	0.8	0	0	0	0
Total	16	12.2	0	0	0	0

Sources: PG&E. Standard Contracts for Purchase (Feed-in Tariffs). Existing Executed Feed-in Tariff Contracts: Current Spreadsheet (Rev 11/18/09). http://www.pge.com/b2b/energysupply/wholesaleelectricsuppliersolicitation/standardcontractsforpurchase/; SCE. CREST Program. http://www.sce.com/EnergyProcurement/renewables/crest.htm; SDG&E. Feed-In Tariffs for Small Renewable Generation. Executed Feed-In Tariff Contracts for WATER/CRE spreadsheet (updated 12/02/09). http://www.sdge.com/regulatory/AB1969.shtml.

A CPUC Energy Division staff proposal in March 2009 proposed the following adjustments to the current feed-in tariff program:[83]

- Expanding feed-in tariff eligibility from 1.5 MW to 10 MW per customer;
- Limiting the expansion to 1,000 MW statewide; and
- Including additional terms and conditions in the applicable standard contract.

However, the proposal did not include a change to the way the feed-in tariff was set. Because the price is a key element to the tariff's success, an ALJ ruling was issued calling for additional comments regarding the setting of a feed-in tariff price.[84] Comments were originally due September 17, 2009, but the timeline

[83] Energy Division Staff, "Feed-in Tariffs for Renewable Generators Greater Than 1.5 MW," March 27, 2009.

[84] Administrative Law Judge's Ruling Regarding Pricing Approaches and Structures for a Feed-In Tariff, R.08-08-009, Filed August 27, 2009.

was extended to October 19, 2009.[85] There are no additional decisions on the setting of a feed-in tariff price in this proceeding.[86]

In addition to the ALJ ruling on feed-in tariffs, the Governor approved SB 32 on October 11, 2009. SB 32 raised the cap of small renewable generators eligible to participate in the current feed-in tariff program from 1.5 MW to 3 MW and raised the total program cap from 500MW to 750 MW. SB 32 also required an electrical corporation to file a standard tariff (MPR or value-based). It is considered an incremental improvement for small renewable generators over AB 1969 but will primarily benefit commercial solar PV projects.[87] AB 1106, last amended July 15, 2009, was a similar bill relating to feed-in tariffs and proposed increasing the cap to 10 MW.[88]

Feed-in Tariffs for Generation from CHP: The development of a CHP-specific feed-in tariff is also in progress. The Governor approved AB 1613, also known as the Waste Heat and Carbon Emissions Reduction Act, on October 14, 2007. This act authorizes the CPUC to require electrical corporations to purchase excess electricity from a CHP system, operating under certain guidelines. The bill requires every electrical corporation to file a standard tariff and requires the CPUC to establish a pay-as-you-save pilot program to finance the up-front costs of a CHP system. This bill was amended by AB 2791, which changes the definition of "eligible customer" in Section 2842.4 of the PUC to include federal, state, or local government facilities. The Governor approved AB 2791 on August 1, 2008. An Energy Division staff proposal filed on July 31, 2009 included the following components:

- Separate contracts for CHP systems up to 5 MW and systems 5 MW to 20 MW;
- Two options for the tariff:
    - Option 1: proxy market price based on the costs of a new combined cycle gas turbine. The price includes a fixed and variable component. The fixed component is based on the 2008 MPR, and the variable component is based on citygate gas prices. This option also includes a location bonus of 10%; and
    - Option 2: tariff based on the generation component of the host customer's otherwise applicable tariff, adjusted for time of deliver. This option also includes a location bonus of 10%.

A final decision regarding CHP feed-in tariffs had not been made when this report was completed.

Renewable Energy Credits (RECs) in California

Tradable renewable energy credits (TRECs) are being addressed under CPUC rulemaking 06-02-012. Within this rulemaking, the CPUC has authorized the use of TRECs for RPS compliance[89] and adopted a

[85] Administrative Law Judge's Ruling Granting Extension in Part and Adding Price Structure Example for Comment. R08-08-009. Filed September 11, 2009.

[86] California Public Utilities Commission. Proceeding R08-08-009. http://docs.cpuc.ca.gov/proceedings/R0808009.htm (accessed December 31, 2009).

[87] Senate Bill No. 32. Approved by Governor on October 11, 2009.

[88] Assembly Bill No. 1106. Status. www.leginfo.ca.gov (accessed December 31, 2009).

[89] CPUC. "Proposed Decision Authorizing Use of Renewable Energy Credits for Compliance with the California Renewables Portfolio Standard," March 26, 2009, Rulemaking 06-02-012.

definition for and attributes of RECs for compliance with the California RPS.[90] Most recently, the ALJ filed a revised proposed decision regarding the use of TRECs for RPS compliance.[91] This proposed decision authorizes the use of TRECs for RPS compliance within the following limits:

- For RECs to be available for RPS compliance, they must be recognized in Western Renewable Energy Generation System (WREGIS). Some WREGIS rules may make distributed generation ineligible to participate. For example, WREGIS does not register a system smaller than 1 kW and the energy associated with the REC must be metered to an accuracy of +/- 2%;
- The TRECs must be committed to RPS compliance within three calendar years of the date of generation;
- TRECs can provide no more than 40% of PG&E, SCE and SDG&E's RPS procurement obligations. (Note that this limit is temporary); and
- The decision sets a transitional price cap of $50/TREC.

Renewable energy credits will likely play a larger role in the distributed generation environment in California once the decision on use of TRECs for RPS compliance has been adopted by the CPUC. Revenue from the sale of these credits may help the business proposition for installing wind systems or renewable-fueled fuel cells. The degree of benefit will depend on the ultimate price paid for the TRECs.

Other Policy Tools

The CEC also offers Energy Efficiency Financing. The funding is provided through ARRA and State Energy Program (SEP) funding. Cities, counties, public care institutions, public hospitals, public schools and colleges, and special districts installing energy generation including renewable and combined heat and power projects are eligible. One percent and 3% low-interest public agency loans are available.[92]

Standby charges and departing load charges charged by the utilities act as a barrier by increasing the costs of adopting on-site generation. Standby charges allow the utility to recover the costs for generation and other facilities, like transmission and distribution, and to standby in case the customer is in need of the energy, if the on-site generation does not provide the estimated about of energy. The standby charge is calculated on a capacity basis ($/kW). Departing load charges cover other costs, such as a public purpose charge, a Department of Water Resources bond charge, and a nuclear decommissioning charge. Departing load charges are based on anticipated energy from the on-site generation, either measured from the output of the generator or estimated, and are calculated on a generation basis ($/kWh). Wind and fuel cell systems less than or equal to 1 MW, have the option to NEM, making them exempt from departing load charges.

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[90] CPUC. "Decision on Definition and Attributes of Renewable Energy Credits for Compliance with the California Renewables Portfolio Standard," August 21, 2008, Decision 08-08-028.

[91] Revised proposed decision of ALJ Simon. "Draft Decision Authorizing Renewable Energy Credits for Compliance with the California Renewables Portfolio Standard." Rulemaking 06-02-012. December 23, 2009.

[92] The California Energy Commission. Energy Efficiency Financing. http://www.energy.ca.gov/efficiency/financing/index.html (accessed December 31, 2009).

5.3 Local (City and County)

Local policies can also affect the market uptake of on-site generation systems. This section discusses many of these policies, including air permits, building permits, zoning ordinances, and other oversight agencies.

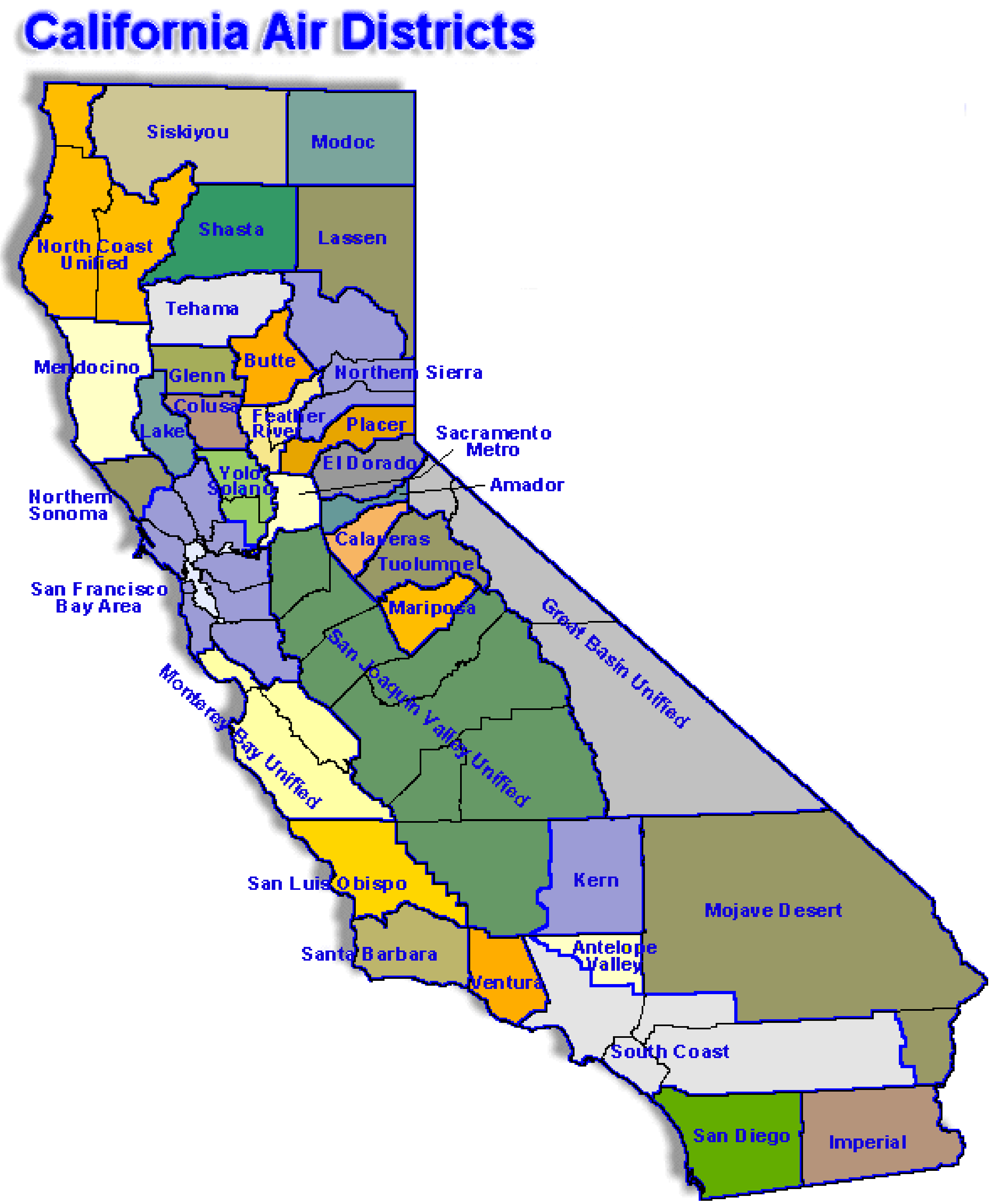
Air Permits

According to the team's discussion with market actors, the currently eligible technologies for SGIP funding—wind turbines, fuel cells, and advanced energy storage systems—do not have air permitting challenges. Wind turbines do not require an air permit and market actors do not think that advanced energy storage systems will require these permits either, though there have not been enough of these systems installed in California to understand this issue. The only challenges discussed were for CHP systems that are still in the SGIP pipeline due to a moratorium on air permits in the South Coast Air Quality Management District.

Some districts have added fuel cells to the list of equipment exempted from district permit requirements. Six of the 35 air quality management districts in California include text in their rules and regulations which specifically exempt fuel cells from permits. These districts are Antelope Valley Air Quality Management District, Bay Area Air Quality Management District, Monterey Bay Unified Air Pollution Control District, Santa Barbara County Air Pollution Control District, South Coast Air Quality Management District, and Ventura County Air Pollution Control District.[93] Figure 5-2 is a map of the California air districts.

[93] California Environmental Protection Agency: Air Resources Board. District Rules Database. www.arb.ca.gov/drdb/drdb.htm (accessed September 2009).

Figure 5-2. California Air Districts



Source: California Environmental Protection Agency: Air Resources Board. California Air District Map for District Rules. http://www.arb.ca.gov/drdb/dismap.htm (accessed December 30, 2009).

As required by Senate Bill 1298, chaptered in September 2000, CARB established the distributed generation certification program which "requires manufacturers of electrical generation technologies that are exempt from district permit requirements to certify their technologies to specific emission standards before they can be sold in California." These technologies include microturbines and fuel cells. These requirements were adopted by CARB on October 19, 2006 and became effective on September 7, 2007.[94]

Building Permits[95]

Building permits are required for all SGIP projects. These permits are issued only after the city or county building departments have determined that:

- The permit package is complete;
- The project complies with all applicable building codes; and
- The project has received all other approvals.

Local jurisdictions enforce the California Code of Regulations (CCR, Title 24),[96] also known as the California Building Standards Code. Codes may differ among jurisdictions. The following parts of the Code are relevant to self-generation installations:[97]

- California Building Code (general building design and construction requirements, include fire-and life-safety and field inspection provisions);
- California Electrical Code (technical requirements for all electrical power supplies);
- California Mechanical Code (mechanical standards for the design, construction, installation, and maintenance of heating, ventilation, cooling and refrigeration systems, incinerators, and other heat-producing appliances);
- California Plumbing Code (requirements for natural gas pipeline additions); and
- California Fire Code (requirements for on-site fuel storage).

Interviews with host customers with fuel cell installations reported that there is still a need to educate local officials in the building and fire departments about safety records of fuel cells.

Zoning Ordinances

Where building permits dictate how a wind turbine is installed, zoning ordinances dictate whether a wind turbine can be installed at all.[98] Zoning ordinance is the local law that identifies the allowable uses for

[94] California Environmental Protection Agency: Air Resources Board. Distributed Generation Program. www.arb.ca.gov/energy/dg/dg.htm (accessed September 2009).

[95] Much of this information is re-purposed from Summit Blue's 2007 SGIP evaluation. Cooney, Kevin and Patricia Thompson. "Self Generation Incentive Program: Program Administrator Comparative Assessment." With Energy Insights and RLW Analytics. April 25, 2007.

[96] Information on the California Building Standards Code can be found at www.bsc.ca.gov/title_24.html.

[97] These points were taken directly from the California Energy Commission's Distributed Energy Resource Guide. www.energy.ca.gov/distgen/permitting/building_permits.html.

[98] Green, Jim. "Overview: Zoning for Small Wind Turbines." ASES Small Wind Division Webinar, January 17, 2008.

each piece of property within a community.[99] When local zoning ordinances do not identify wind turbines as a permitted use, the developer must seek a special use permit.[100] This option requires a more detailed description of the project be submitted to the local planning commission and involves representing the project at a public hearing. Moving a wind project through this process adds to the costs of the project, may take 6 to 9 months to complete, and may ultimately result in a rejection.[101]

Inconsistent regulations between local governments means that wind developers must adjust their development model, equipment, and paperwork for each county where they do business. In addition, when terms are not carefully defined in the local ordinances, it introduces an element of subjectivity by the planners, sometimes within the same county.

Sample wind ordinances have been developed in some states as a guide to counties in developing their own wind ordinance.[102] These sample ordinances address issues such as minimum parcel size, tower height, setbacks from property lines, roads, and structures, and sound levels.

Other Oversight Agencies

Public entities also need approval from a variety of separate state organizations. For example, hospitals need to work with the Office of Statewide Health and Planning Development (OSHPOD) and schools may need to work with the Division of State Architect (DSA), among other organizations. The additional complexity and time spent working with these organizations can add to the project cost and cause time delays.

[99] A Citizen's Guide to Planning, Governor's Office of Planning and Research, State of California.

[100] In the Public Interest, A Guide for State and Local Governments, American Wind Energy Association, September 2008.

[101] Johnson, Scott. "Small Wind Permitting Challenges: Findings from a Survey of Small Wind Installers." California Wind Energy Collaborative, Report number CWEC-2009-001 (March 2009).

[102] Draft Model Small Wind Ordinance for Maryland, March 2008 and Focus on Energy Small Wind Energy System Ordinance.

6 TARGETING POTENTIAL SGIP HOST CUSTOMERS

6.1 Characteristics of Successful Projects

This section describes the characteristics common to successful to fuel cells, wind, and combined heat and power systems.

6.1.1 Fuel Cells[103, 104, 105, and 106]

Successful project installations typically have some of the following characteristics:

Economic benefit: Economic benefit associated with the fuel cell project along with a want to "go green" usually result in a successful project. Economic benefit could come from using on-site waste as fuel and reducing the cost of disposing the waste (see Gills Onions installation description in the text box).

Need for thermal energy:[107] The site should have a use for the thermal energy produced by the fuel cell such as hot water (pools or general hot water needs), space heating, and steam for manufacturing needs.

Need for electrical energy 24x7: Most fuel cells need to run on a 24 hour/7 days a week schedule because ramp up and ramp down times can be significant. Therefore, the site should also have a need for electrical energy on a 24x7 schedule.

Excited host customer: The host customer should be enthusiastic about the deployment of a fuel cell at their site. Customers that take ownership in the project will help bring the project to fruition. In addition, developers should work to keep the host customer involved and excited. Host customers who plan the project in terms of the economics are often more successful. Customers who have experience with other renewable or distributed generation technologies, like solar PV, are also more willing to install fuel cells.

Excited/involved developer: The project developer should also take ownership in the success of the project. This includes designing the installation to ensure high operational efficiency throughout the life of the project and good communication with SGIP PAs.

High-quality contracts: Maintenance contracts should include at least one re-stacking of the fuel cell. Customers who use natural gas should try to obtain a contract for the price of natural gas. In addition, receiving a service contract for gas treatment for fuel cells run on renewable fuel can be advantageous.

High site power demand: Host customers with a base load electrical demand of 250 kW to 3 MW are ideal potential customers.

In addition to some of the above characteristics, ***residences*** with the following characteristics are more likely to be successful:

[103] Gills Onions. "Sustainability Highlights 2009." www.gillsonions.com/sustainability/default.aspx (accessed December 29, 2009).
[104] Sierra Nevada Brewing Company. Our Environment Fuel Cells. www.sierranevada.com/environment/fuelcells.html (accessed December 29, 2009).
[105] Summit Blue Consulting interviews with fuel cell market actors, project developers, and host customers.
[106] Eichman, Josh, Jack Brouwer, and Scott Samuelsen. "Exploration and Prioritization of Fuel Cell Commercialization Barriers for Use in the Development of a Fuel Cell Roadmap and Action Plan for California." Paper presented at the ASME 2009 Seventh International Fuel Cell Science, Engineering and Technology Conference, Newport Beach, USA, June 8-10, 2009.
[107] All electric fuel cells do not have the need for thermal energy.

Customers buying highest tiered rate have a stronger value proposition- residential tier 5 customer or more than 40,000 kWh/year;

A use for the waste heat produced by the fuel cell, such as a pool, spa, radiant floor heating, driveway or other general hot water needs;

Unsuccessful project installations typically have the following characteristic:

High cost: If the project cost is too high for the customer and the project does not meet the required return on investment, the project will likely be unsuccessful.

The following customer types are often good candidates for fuel cells technology:

- Wastewater treatment plants (can utilize a renewable fuel)
- Agribusiness community including dairies (usually requires a digester)
- Hotels/casinos
- Cold storage
- Food industry (e.g., grocery stores, breweries, food processing and storage, cheese plants)
- Manufacturing
- Health care industry
- Colleges and universities
- Foundry industry
- Big box stores
- Data centers
- Residential customers with high electricity rate

Successful Fuel Cell Projects in the News

Sierra Nevada Brewing Co.: Chico, CA

Sierra Nevada Brewing Company has installed four 250 kW co-generation fuel cells. The 1 MW systems provides most of the electrical needs on-site and the waste heat is used to boil the beer and for other heating needs. In addition to the fuel cells, Sierra Nevada Brewing Company has also installed a solar PV system along with other environmental initiatives such as recycling, a heat recovery system, and energy efficiency improvements.

Gills Onions: Oxnard, CA

Gills Onions' Advanced Energy Recovery System converts all of their 150 tons of daily waste into energy and cattle feed. The onion waste ferments in an anaerobic digester to create biogas. The biogas powers two 300 kW fuel cells on-site. The use of the onion waste on-site eliminated the cost to dispose of the waste. In addition the fuel cells, Gills Onions has other sustainability initiatives including energy efficiency and water conservation initiatives.

6.1.2 Wind

Successful project installations typically have some of the following characteristics:[108, 109]

Adequate wind resource: Certain parts of California have robust wind resources while others have a resource that is insufficient to justify investment. Better resources improve the economics of projects.

Reasonable and certain permitting requirements: Permitting requirements that have these four characteristics reduce uncertainty in the development process:

- Favorable to small wind development
- Provide clear guidance on the expected timeline for review
- Are in place at the outset of a project
- Permitting costs less than $10,000

Reducing the uncertainty in the permitting process helps to reduce the cost of capital for a given project, all else being equal.

Eligibility for SGIP incentives: The incentives provided by SGIP are a critical component of project economics. Projects should be located in the geographic boundaries covered by SGIP.

Distance from Urban/Suburban areas: Projects located away from densely populated areas tend to be more successful. Typically, the further a project is located from urban and suburban areas, the better the wind resource and the lower the levels of public opposition.

Site with sufficient load to sustain the project: SGIP requires that the project capacity directly relate to on-site load, and the low-end threshold for qualifying for SGIP typically requires a large commercial or industrial customer. Finding customers with load sufficient to support the project is critical.

Project champion: An internal stakeholder at the customer site must believe in the project and be willing to secure support for it. This person must have sufficient clout within the organization to secure financial and staff resources to bring the project to completion. This person will work closely with the developer to address project needs and to navigate local political sensitivities.

Availability of third-party financier: In limited cases, developers will pay for the up-front costs of a project in exchange for a long-term commitment from the site host to purchase power at a fixed rate from the project. This arrangement helps to overcome one of the major barriers to small wind projects – the high up-front cost.

Together, these project characteristics tend to improve the financial viability of a project, which is the ultimate determinant of project success.

Unsuccessful project installations typically have some the following characteristics:

Environmental impact assessment required: If an environmental impact assessment is required, it can take a year to complete and cost up to $100,000. In addition, projects may be required to implement mitigation strategies. These negotiations can further delay a project and add to the cost.

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[108] Peterson, Karen. Undated. "Powering McEcoy Ranch." Terra Marin. Available: http://www.terra-marin.com/previous/mcevoy.php.

[109] Freedman, Wayne. June 11, 2009. "Wind Turbine Dedicated in Marin County." ABC-7 KGO-TV San Francisco. Available: http://abclocal.go.com/kgo/story?section=news/local/north_bay&id=6859226.

Proximity to wildlife habitats: Monterey County, one of the areas with a better wind resource, is essentially shut down to wind development because the region is a condor habitat. Projects near wetlands are considered a threat to the habitat.

Insufficient tax appetite: Part of the financial incentives for small wind is provided in the form of income tax credits. If the project owner does not have sufficient tax appetite to take advantage of those credits in the first year to two years of operation, project economics are less favorable.

Ineligible for SGIP incentives: Parts of California are not eligible for SGIP incentives; this essentially kills those projects.

Non-existent or unclear permitting process at project outset: In some counties, small wind permitting guidelines do not exist. Some counties wait until a developer proposes a project to develop the permitting guidance. This adds a significant element of uncertainty to the development timeline and budget, deterring developers from being "the first" in that county.

High permitting costs: If permitting costs exceed $10,000, the project is often not viable.

The following customer types are often good candidates for wind turbine projects:

- Wastewater treatment plants
- Agribusiness community
- Manufacturing
- Colleges and universities
- Primary and secondary schools
- Other government buildings
- Businesses situated on large plots of land with substantial open space

Successful Wind Project in the News

McEvoy Ranch: Petaluma, CA

McEvoy Ranch has completed the installation of a 225 kW wind turbine in June 2009. This project provides for all of the organic olive ranch's energy needs, including powering its olive oil mill. The project is built on the ranch's existing commitment to sustainability.

The owner of the ranch, Nan McEvoy, played a significant role in generating support and momentum for the project. As a former member of the board of the San Francisco Chronicle, Ms. McEvoy used her media and political savvy and financial backing to bring the project to completion. It took seven years to complete the project, including securing necessary permits, longer than most developers would have been willing to spend.

6.1.3 Combined Heat and Power

Successful project installations typically have some of the following characteristics:[110]

Site Willingness: CHP projects must begin with the willingness of individuals and an institution to consider a major investment of financial and staff resources to a project that is not a part of their core business and is not the status quo. Typically, a host site will have a small number of internal champions that are willing to do the leg-work to scope-out the proposed project, present their case to the decision-making entities, and ultimately "stick their necks out" for a project to be approved internally.

Loads: A site's electric and thermal loads must be suitable to a CHP system. Thermal loads include space, water, and process heat. Cooling loads can be supported by thermally-activated cooling, i.e., absorption and adsorption chillers and also by dehumidification loads, i.e., desiccant dehumidification. CHP systems are typically sized to meet baseline electric loads to optimize project economics by running the system at a high capacity factor. Characteristic loads of particular business types lend themselves well to CHP, for example, hospitals, industrial laundry facilities, and data centers.

Opportunity Fuels: Natural gas is the predominant CHP fuel; however, other fuels may be available on-site or nearby that can simultaneously reduce fuel costs, reduce the need for waste disposal, and in some cases qualify as a renewable fuel. These opportunity fuels include byproducts of agricultural, forest, and urban/industrial processes. Proximity to a natural gas well might present a similar opportunity.

Siting: Siting should be an early consideration; both regulatory agencies and the host site must be open to the project. Regulatory considerations include the emissions restrictions defined by the regional air quality board, electric grid interconnection rules, local noise regulations, and restrictions on proximity to schools and other public places. The host site must also have the space and willingness to host the CHP system: The site must have the physical, structurally-sound space required for the system and be assured that the visual and aural properties of the system do not interfere with their business model.

Financing: CHP systems incur a large upfront cost in exchange for continuous returns in the form of energy expenditure savings. The availability of suitable financing of these upfront costs is often necessary for a project to be considered.

Unsuccessful projects typically have the following characteristics:

Vulnerability to Uncertainty: CHP systems are long-term investments with high levels of uncertainty in fuel and electricity, the timing and extent of unscheduled outages, and site demand for electricity and heat. Stable costs can make project economics less risky: long-term natural gas contracts and maintenance (scheduled and/or unscheduled) contracts can successfully mitigate risk and uncertainty. While contracts may not be available or attractive for the lifetime of the equipment, they are often available for five years. This exceeds the payback period of most economically compelling projects, and therefore, reduces the significance of uncertainty further out in the project life.

[110] Perea, Dr. Philip M. "An Assessment of Cogeneration for the City of San Francisco." Department of the Environment. City and County of San Francisco. June 2007; College of the Canyons. News Release. Accompanies No. COC-08-052. November 8, 2007.

Another option for sites is to have CHP systems installed under a power purchase agreement, in which a third party owns the equipment and sells power and performance to the site. While this mitigates the site's risk, this risk is transferred to the CHP system owner; again, long-term contracts can mitigate this risk.

Unsupportive Utility: Utilities can have a significant influence on the success of a project, as they administer interconnection regulations, provide tariffs, and can provide design assistance. Interconnection can be a significant portion of project costs, especially for smaller (10s to 100s of kW) projects. Requirements and associated costs include permitting engineering review, and equipment requirements. Even California's Rule 21, which aims to standardize the interconnection rules and process, leaves a fair amount of subjectivity and utility decision-making.

Disengaged Staff: Poor system performance can lead a site to give up on a project; staff need to actively monitor the system to ensure that the CHP system is operating as expected and to catch performance problems early on. System performance can suffer if staff does not have the proper training or accessible, intuitive tools for evaluating performance, or are not in the practice of contacting proper staff or contractors immediately when performance irregularities arise.

The following customer types are often good candidates for CHP projects:

- Wastewater treatment plants (can utilize a renewable fuel)
- Agribusiness community including dairies (usually requires a digester)
- Hotels/casinos
- Cold storage
- Food industry (e.g., grocery stores, breweries, food processing and storage, cheese plants)
- Manufacturing
- Health care industry
- Colleges and universities
- Foundry industry
- Big box stores
- Data centers
- Institutions with opportunity for replicability (e.g., grocery stores, hospitals, data servers, fitness centers with swimming pools, and industrial laundry facilities)

Successful Combined Heat and Power Projects in the News

Ritz-Carlton Hotel: San Francisco, CA

The Ritz-Carlton has installed four 60 kW microturbines. The system provides about 25% of the on-site electrical needs and the heat is used to power an absorption chiller for refrigeration and cooling. The system saves the hotel an average of $13,000 per month.

College of the Canyons: Santa Clarita, CA

The College of the Canyons added cogeneration systems to their central plants as part of their goal for sustainability. The waste heat is used to produce hot and cold water for the central plant operations.

6.2 Geographic Wind Analysis

The team conducted this geographic wind analysis to identify areas with high and low potential for wind projects. The analysis focuses on tower mounted turbines. Building mounted turbines would require a different analysis: they would be located in urban areas and would have a different wind resource. Table 6-1 lists the layers used in the GIS analysis. The color of the text represents the challenge level of each factor included in the geographic analysis. Each layer's map is included in Appendix 4.1.

- Red: Show-stopper. This factor has the potential to completely halt a project.
- Orange: Bump in the road. This factor may cause extra permitting costs or lengthen project timelines.
- Green: Go-ahead. This factor can increase the likelihood of a successful wind installation.

The team also included layers that do not have an effect on the potential for wind development; however, they provide useful context. The text for these layers is black.

The team chose the layers to be included in the analysis based on primary and secondary data collection, including small wind studies and interviews with wind developers, wind market actors, and host customers with wind projects. These layers are meant to cover the major wind market issues; however, some factors that affect the development of wind projects may not be included. In addition, some layers (like the county permitting cost and difficulty layers) are from data collection. Some counties with high permitting costs or difficult permitting process may not be included due to lack of data.

Table 6-1. California geographic wind analysis: GIS layers

Data Layer	Applicability	Source
Estimated Program Administrator (PA) areas	The PA areas allow one to see the eligible regions for the SGIP.	Summit Blue Consulting data and California Energy Commission PDF maps. http://www.energy.ca.gov/maps/index.html. Note that the utility service areas are an approximation based on zip code.
Urban areas in California	Market actors noted the need for large plots of land for wind turbine development.[111] In addition, recent legislation that sets standards for conditional use permits for small wind ≤ 50 kW requires that the turbine is outside an urbanized area (AB 45).[112]	U.S. Census Bureau. 2009 TIGER/Line® Shapefiles. Urban Areas. http://www.census.gov/geo/www/tiger/ (accessed November 25, 2009).
California condor critical habitat	According to market actors, the fine for killing a California condor is high. Fear of this incident occurring has stalled wind projects in these areas.[113]	U.S. Fish and Wildlife Service. Critical Habitat Portal. http://criticalhabitat.fws.gov/ (accessed November 25, 2009).
County permitting costs	Market actors noted that the cost of wind permitting can be a major barrier to installing customer-sited wind in California. The costs are inconsistent across counties.[114]	Larwood, Scott. Scott Johnson and C.P. (Case) van Dam. “Permitting Fees for Small Wind Turbines in California Counties.” California Wind Energy Collaborative. CWEC-2009-002. March 2009; KEMA, “Emerging Renewables Program Small Wind Incentives Study,” July 2009, CEC-300-2009-003.
County permitting difficulty	Market actors noted that the difficulty with permitting small wind and the inconsistent regulations across counties.	Johnson, Scott. “Small Wind Installer Survey: Completed Surveys.” California Wind Energy Collaborative. March 19, 2009; Summit Blue interviews with market actors involved with wind in California; KEMA, “Emerging Renewables Program Small Wind Incentives Study,” July 2009, CEC-300-2009-003.
Military and aerial ranges: Within 1,000 feet of a military installation, within	Recent legislation that sets standards for conditional use permits for small wind ≤ 50 kW states that “if a county	California Natural Resources Agency. Map Server. Military: military_aerial_ranges_and_corridors. http://atlas.resources.ca.gov/ (accessed November 25, 2009).

[111] Summit Blue Consulting interviews with wind market actors.

[112] California Assembly Bill 45. Signed by Governor October 11, 2009.

[113] Summit Blue Consulting interviews with market actors. Johnson, Scott. “Small Wind Installer Survey: Completed Surveys.” California Wind Energy Collaborative. March 19, 2009. The surveys indicate a $6M fine for killing a California condor; the fine for killing an engendered species is up to $100,000 and one year imprisonment. The California condor is on the engendered species list.

[114] The highest cost from interviews by county was inserted into the model. Note that the KEMA study listed two counties that are not applicable: Klamath County was a county between 1851-1874 and Lancaster is listed as a county but is a city in LA county.

Data Layer	Applicability	Source
special use airspace, or beneath a low-level flight path	receives an application to install a small wind energy system on a site that is within 1,000 feet of a military installation, within special use airspace, or beneath a low-level flight path as defined by Section 21098 of the Public Resources Code, then the county shall promptly comply with Section 65944. If the governing authority of any military installation, special use airspace, or low-level flight path provides written comments regarding that application, the county shall consider those comments before acting on the application (AB 45).[115]	
California large conservation areas	Permitting in large conservation areas may require additional environmental impact assessments.	Cal-Atlas Geospatial Clearinghouse. The California Spatial Information Library. http://www.atlas.ca.gov/download.html (accessed November 25, 2009).
Federal lands	Permitting on federal lands can reduce the permitting requirements. Federal lands include Bureau of Land Management, Bureau of Reclamation, Homeland Security, Military, National Park Service, Other Federal, US Fish and Wildlife, US Forest Service.	U.S. Department of the Interior. Bureau of Land Management, California. Geospatial Data Downloads. Land Status. www.blm.gov/ca/gis (accessed December 2009).
Native American lands	Permitting on Native American lands can reduce permitting requirements.	California Department of Transportation. GIS Data Library. Bureau Indian Affairs - Native American Reservations and Rancherias. www.dot.ca.gov/hq/tsip/gis/datalibrary/gisdatalibrary.html.
California wind resource	A good wind resource allows for successful wind system installations. The wind resource has been grouped	NREL. Dynamic Maps, GIS Data, & Analysis Tools. "California Wind High Resolution" file. Wind resource at 50m. www.nrel.gov/gis/data_analysis.html (accessed November 2009).[117]

[115] California Assembly Bill No. 45. Approved by Governor October 11, 2009. Section 65944 of the California Government Code includes the following statement, "any branch of the United States Armed Forces may request consultation with the public agency and the project applicant to discuss the effects of the proposed project on military installations, low-level flight paths, or special use airspace, and potential alternatives and mitigation measures."

Data Layer	Applicability	Source
	into three levels for this study.[116]	
SGIP Wind Applications	Viewing completed projects, active projects and withdrawn/rejected applications will give insight into where the market has been actively pursuing SGIP-eligible wind projects.	SGIP Program Data as of September 2009. One wind project in the database is not included because the associated zip code is not located in California.
Large California cities	The team has included these cities for reference only. Cities shown are San Francisco, Sacramento, Los Angeles, and San Diego.	ArcGIS 9.3. Data files. Major Cities.
California county boundaries	For use with the county permitting costs and the county permitting difficulty information.	Cal-Atlas Geospatial Clearinghouse. The California Spatial Information Library. http://www.atlas.ca.gov/download.html (accessed November 25, 2009).
California zip code areas	To identify areas with SGIP potential. The ArcGIS software shows 1,693 zip codes in California. It should be noted that the USPS does changes zip code areas, though these changes should not affect this task.	ArcGIS 9.3. Data files. U.S. Zip Code Areas (Five-Digit)

[117] Please refer to the National Renewable Energy Laboratory GIS Data Disclaimer Notice in Appendix 4.2.
[116] Group A: wind power class 1; Group B: wind power class 2-3; Group C: wind power class 4-7

Analysis Approach

The team chose to display the results of the analysis in terms of scenarios. The team chose three major scenarios breaking out the wind resource for each scenario[118]:

- Scenario 1: Includes all zip codes *except* for those that fall within "show-stopper" areas. This scenario includes all zip codes within the estimated PA areas, outside of urban areas in California and outside of California condor critical habitat. Zip codes are listed by the wind resource available in that zip code.
- Scenario 2: Includes all zip codes *except* for those that fall within "show-stopper" areas *and* "bump in the road" areas. This scenario includes all zip codes within the estimated PA areas, outside of urban areas in California and outside of California condor critical habitat, outside counties with permitting costs greater than $2,500,[119] outside of counties noted with high permitting difficulty, outside of military and aerial ranges, and outside of California large conservation areas. Zip codes are listed by the wind resource available in that zip code.
- Scenario 3: Includes all zip codes *within* "go-ahead" areas. This scenario includes all zip codes within Department of Defense installations and ranges, federal land status, and Native American lands. This scenario also only includes zip codes within the estimated PA areas. Zip codes are listed by the wind resource available in that zip code.

The center point of each zip code area was used to determine whether a region was included or excluded in the scenarios. For example, all zip codes with their center points outside of the California condor critical habitat are included in Scenario 1.

Each scenario includes results for two wind speed ranges. The wind speeds correspond with the NREL wind power classifications. NREL rates the resource potential of wind speed between 12.5 to 15.7 miles per hour (mph) to be "marginal" or "fair." The wind resource potential of wind speed over 15.7 mph is "good" or better. All ratings are measured at 50 meters.

Results

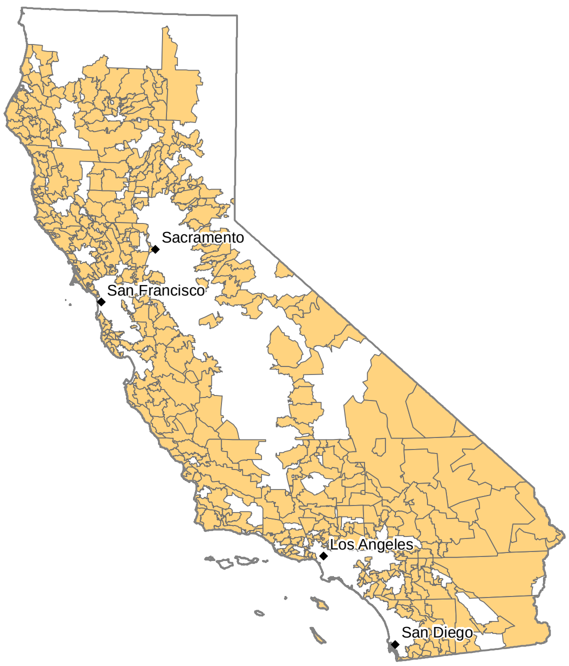
The sections below present the results of the GIS analysis for each scenario. The tables include the number of zip code areas that meet the conditions of each scenario. The specific zip codes that fall within each scenario are included in the Appendix 4. Each table also includes the total population and the total number of establishments in the zip codes that meet the conditions of each scenario. For comparison, the total population estimate in California as of July 1, 2008 is 36,756,666.[120] The total number of establishments in California is 891,997.[121] The team provided the population and number of establishments to give a sense for the resident and business activity in each zip code.

[118] Zip codes are only included if a wind resource of wind power class 2 or higher exists in the estimated zip code area.
[119] The median cost from available data is $2,500. Note that many data for many counties was unavailable.
[120] US Census Bureau, Population Estimates Program.
[121] Source: U.S. Bureau of the Census, 2007 County Business Patterns.

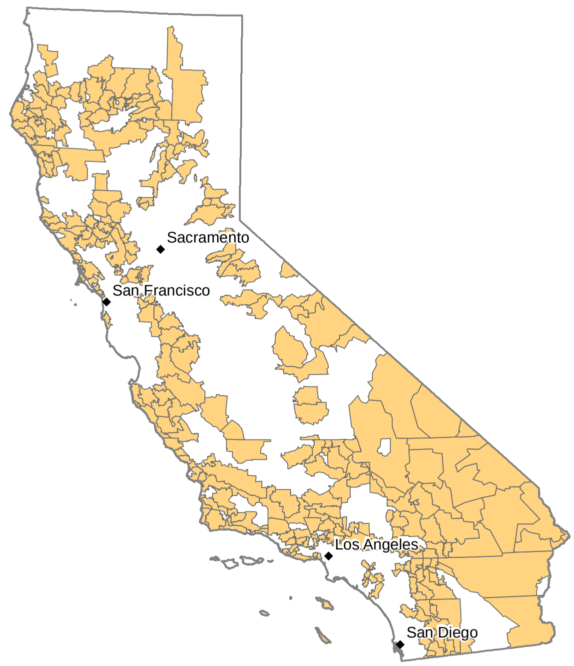
GIS Analysis Results: Scenario 1

Scenario 1 represents the greatest population of potential regions that may be available for SGIP projects. This scenario includes zip codes within the PA areas, outside of the urban areas, and outside of the California condor critical habitat. Therefore, there could be many issues with developing in some of the zip codes shown in this scenario due to the zip codes being located in regions that have difficult permitting guidelines, are within military installations, beneath special use or low-level airspace, or are within conservation areas. However, as more small wind is developed in California, these issues may be less pressing.

Scenario 1 – Wind Speed 12.5-15.7 mph



Scenario 1 – Wind Speed 15.7+ mph



Scenario[122]	Total Number of Zip Code Areas	Total Population	Total Number of Establishments[123]
Scenario 1- Wind Speed 12.5-15.7 mph	489	6,199,175	129,406
Scenario 1- Wind Speed 15.7+ mph	307	3,635,703	75,334

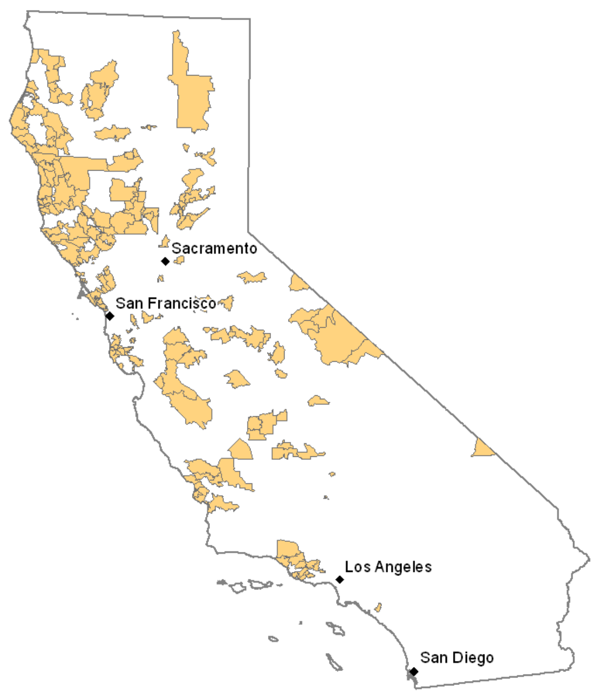
[122] Source: Summit Blue Consulting analysis; ArcGIS 9.3. Data files; U.S. Census Bureau. American FactFinder. 2007 County Business Patterns.

[123] "An establishment is a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. When two or more activities are carried on at a single location under a single ownership, all activities generally are grouped together as a single establishment. The entire establishment is classified on the basis of its major activity and all data are included in that classification." Taken directly from U.S. Census Bureau. American FactFinder. 2007 County Business Patterns.

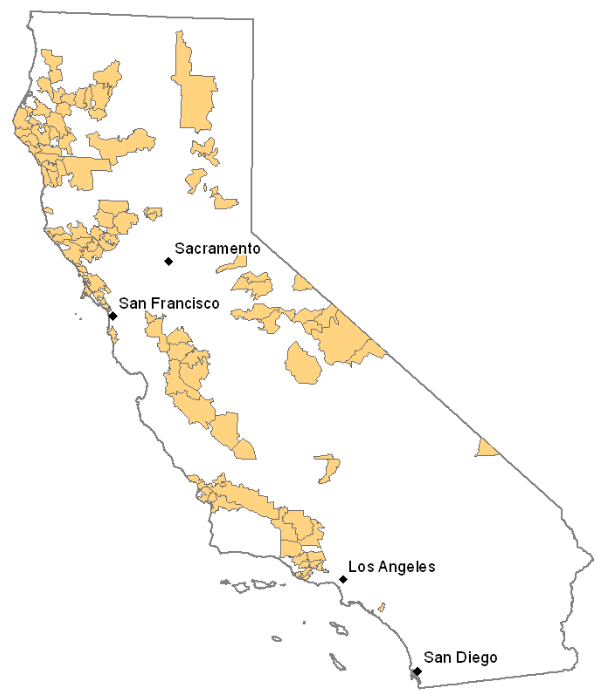
GIS Analysis Results: Scenario 2

The Scenario 2 results provide a smaller population of regions that may be available for SGIP projects; however, the zip codes included in this scenario have a better chance of being amenable to wind development. This scenario includes the zip codes in Scenario 1 that are also outside of counties with high permitting costs or difficult permitting processes, not within 1,000 feet of a military installation or beneath a special use or low-level airspace, or outside of conservation areas. Scenario 2 does not include many zip codes in Southern California due to difficult permitting processes in Los Angeles, San Diego, Imperial, Riverside, and San Bernardino counties. Unfortunately, these counties have a good wind resource. In addition, the military range and special use airspace buffer reduces the available zip codes in the eastern portion of the state.

Scenario 2 – Wind Speed 12.5-15.7 mph



Scenario 2 – Wind Speed 15.7+ mph



Scenario[124]	Total Number of Zip Code Areas	Total Population	Total Number of Establishments[125]
Scenario 2- Wind Speed 12.5-15.7 mph	198	1,800,906	45,055
Scenario 2- Wind Speed 15.7+ mph	115	1,103,019	28,415

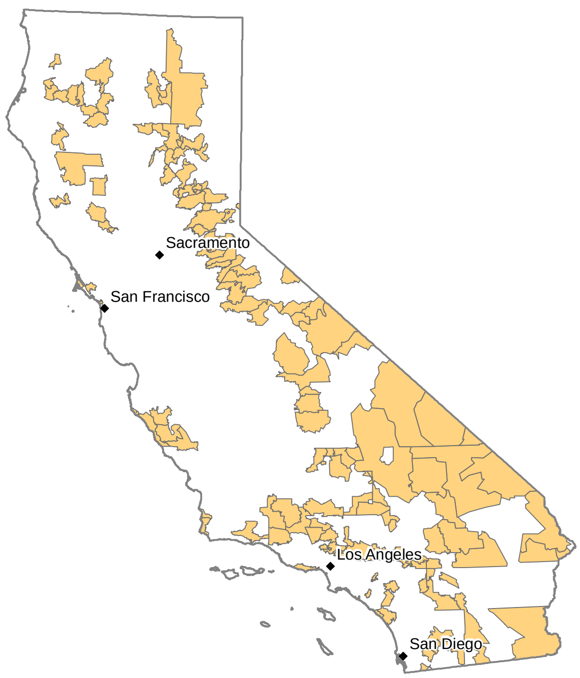
124 Source: Summit Blue Consulting analysis; ArcGIS 9.3. Data files; U.S. Census Bureau. American FactFinder. 2007 County Business Patterns.

125 "An establishment is a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. When two or more activities are carried on at a single location under a single ownership, all activities generally are grouped together as a single establishment. The entire establishment is classified on the basis of its major activity and all data are included in that classification." Taken directly from U.S. Census Bureau. American FactFinder. 2007 County Business Patterns.

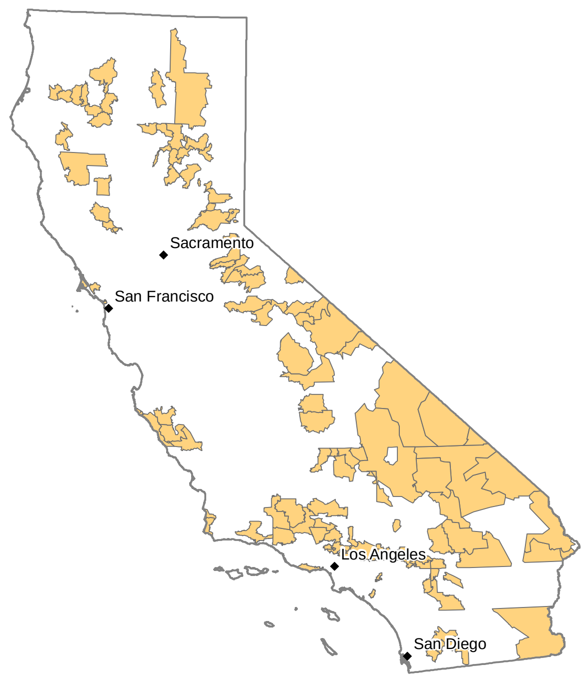
GIS Analysis Results: Scenario 3- Federal Lands

Large clusters of federal lands exist in Northern California and along the eastern portions of the state. Clusters also exist north of Los Angeles. These regions could provide for easier wind development because they do not have to abide by the county permitting requirements. However, there may only be a few sites on federal lands with large enough demand to satisfy the SGIP requirements.

Scenario 3 – Federal Land– Wind Speed 12.5 - 15.7 mph



Scenario 3 – Federal Land– Wind Speed 15.7+ mph



Scenario[126]	Total Number of Zip Code Areas	Total Population[127]	Total Number of Establishments[128]
Scenario 3- Federal Land- Wind Speed 12.5-15.7 mph	150	NA	NA
Scenario 3- Federal Land- Wind Speed 15.7+ mph	118	NA	NA

[126] Source: Summit Blue Consulting analysis; ArcGIS 9.3. Data files; U.S. Census Bureau. American FactFinder. 2007 County Business Patterns.

[127] The population for federal land and Native American land is not available because the zip codes represent the regions where this land is located. However, much of the zip code area shares land with non-federal or non-Native American land.

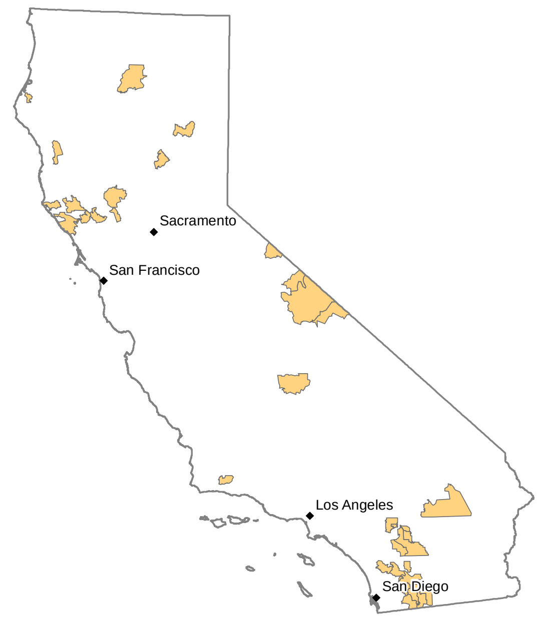
[128] "An establishment is a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. When two or more activities are carried on at a single location under a single ownership, all activities generally are grouped together as a single establishment. The entire establishment is classified on the basis of its major activity and all data are included in that classification." Taken directly from U.S. Census Bureau. American FactFinder. 2007 County Business Patterns.

GIS Analysis Results: Scenario 3- Native American Lands

Native American Lands are scattered throughout the state. These sites may be promising SGIP project sites also due to the different permitting requirements. All zip codes included in this scenario include Native American lands; however, the Native American lands may comprise only a small portion of the zip code area and population. In addition, site demand would need to be evaluated before the site is considered for SGIP involvement.

Scenario 3 – Native American Land– Wind Speed 12.5 - 15.7 mph

Scenario 3 – Native American Land– Wind Speed 15.7+ mph



Scenario[129]	Total Number of Zip Code Areas	Total Population[130]	Total Number of Establishments[131]
Scenario 3- Native American Land- Wind Speed 12.5-15.7 mph	51	NA	NA
Scenario 3- Native American Land- Wind Speed 15.7+ mph	33	NA	NA

[129] Source: Summit Blue Consulting analysis; ArcGIS 9.3. Data files; U.S. Census Bureau. American FactFinder. 2007 County Business Patterns.
[130] The population for federal land and Native American land is not available because the zip codes represent the regions where this land is located. However, much of the zip code area shares land with non-federal or non-Native American land.
[131] "An establishment is a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. When two or more activities are carried on at a single location under a single ownership, all activities generally are grouped together as a single establishment. The entire establishment is classified on the basis of its major activity and all data are included in that classification." Taken directly from U.S. Census Bureau. American FactFinder. 2007 County Business Patterns.

6.3 Target Marketing to Wind Projects

The team recommends two methods to market the SGIP for wind projects: (1) using GIS analysis results combined with the IOU billing databases, and (2) holding SGIP wind project workshops in targeted regions. These methods are discussed in this section.

Combine GIS Analysis Results with IOU Billing Data. The GIS wind analysis indicates geographic areas that are absent of some of the common pitfalls to development of wind projects. Section 12.8 provides a listing of the zip codes that fall within each scenario. Individual high-potential sites can be identified by filtering customers within these areas by site-specific requirements from the IOU billing databases.

Marketing efforts should be targeted to customers with sufficient electrical load to support projects in the 100 kW to 1 MW range. Using a floor of 100 kW filters out smaller sites that may not fit the other criteria (business type and lot size) and that may not be cost effective. The 1 MW cap encompasses projects that are eligible for net metering.

Therefore, the GIS results should be combined with customer billing data to filter for customers with the following characteristics:

- Peak demand between 50 kW (systems can be sized up to 200% of the customer's peak demand) and 1 MW or annual energy consumption of 87,600 kWh to 876,000 kWh (assuming a 10% capacity factor); and
- The following business types: agribusiness, manufacturing, colleges and universities, and primary and secondary schools. These customer types are recognized as being good candidates for wind projects.

Conduct SGIP Wind Project Workshops. A SGIP wind workshop should be held in targeted regions. Local wind developers, wind developers interested in becoming involved in the California markets, and utility account executives should be invited to attend the workshops. The team recommends that the workshops be held in each of the following areas:

- Shasta/Redding
- Mendocino/Lake
- Santa Barbara/San Luis Obispo

These areas represent population centers that are likely to draw a large enough audience to justify a workshop but are surrounded by rural areas with sites large enough to support a wind project.

The purpose of the workshops would be to:

- Educate customers on the basics of wind projects, such as wind system components, project economics, siting, permitting, wind resource assessment, and the advantages of installing a wind system;
- Provide useful information on the SGIP, NEM, and the ITC; and
- Provide an opportunity for customers to network with wind developers.

A direct mail piece should be developed to promote each workshop. The piece should recommend the workshop to customers within the PA territories, who are eligible for the SGIP, and with facilities on lots over one acre.

7 LESSONS LEARNED FROM OTHER STATES

This section provides an overview of the incentive programs in other states and a discussion of the lessons these programs have learned that can be applied to the SGIP. The discussion begins with an overview of the programs across the country that share similarities to the SGIP. Next is a more detailed discussion of the programs in four states: Connecticut, Massachusetts, New Jersey and Vermont. These states were selected for further review based on the number of years they have offered rebate/grant-based incentives for small wind and fuel cells, their program budgets, and the level of activity they have seen. They are among the more active incentive programs in the nation for supporting customer-sited small wind or fuel cell projects. The section closes with an overview of the key lessons learned.

7.1 Overview of Incentive Offerings in Other States

Financial incentives for customer-sited wind or fuel cell systems are available in nearly twenty states in addition to California. Table 7-1 provides a summary of programs sharing similarities with the SGIP program. The programs highlighted offer incentives in the form of rebates or grants to support installation of wind or fuel cell systems at non-residential sites (i.e., commercial, industrial, agricultural, and public sites). SGIP program details are included in the table for comparison purposes. Those states discussed in greater detail later in this section are shown in bold print in the table.

Eighteen small wind incentive programs were identified across fifteen states. Most incentives are formulated as a fixed dollar amount per kW of rated system capacity. Most incentive amounts fall in the range of $2.00 to $4.00 per watt of rated capacity. Programs in Delaware and Tennessee, as well as the federal ITC, formulate incentives as a percentage of project costs. New Jersey offers a unique incentive format in which the incentive amount is paid upfront but is based on the expected system performance rather than the system's rated capacity. Limitations on the incentive amount or project size vary substantially across programs. In states like Maine, Maryland, Oregon and Vermont, small project size or incentive amount limitations mean the program can only support very small systems.

Like small wind programs, most fuel cell programs formulate incentives using either a fixed value per kW of rated capacity, or based on a percentage of project costs. Incentives range from $2.00 to $4.00 per watt of rated capacity, and from 25 to 40% of project costs. Some states offer additional features to encourage higher quality installations, or to tailor project funding to site needs. New York's fuel cell program offers ongoing performance incentives in addition to an upfront rebate. Connecticut's program performs a rigorous economic analysis for each project to ensure that funds are allocated to match the unique needs of each one, within a per-project spending limit.

Table 7-1. Summary of Rebate / Grant Incentive Programs Supporting Small Wind and Fuel Cell Projects in Other States

State / Program Administrator[132]	Program Name	Wind	Fuel Cells	Program Start	Incentive Amount / Formula	Limits on Incentive
California	*Self Generation Incentive Program*	*x*	*x*	*2001*	*Wind: $1.50/W;* *Fuel Cells: $2.50/W for non-renewable and $4.50/W for renewable*	*3 MW, capacities greater than 1 MW receive a fraction of the full incentive rate*
Federal	Investment Tax Credit	x	x	current version 2/09	30% of qualified investment	None specified
Arizona (Arizona Public Service only)	Arizona Public Service	x		2008	$2.50/W up to 50% of the system cost or $75,000; may opt for the PBI	$75,000
Arizona (Tucson Electric Power only)	Tucson Electric Power	x		2008	$2.50/W-AC; or a performance-based incentive ranging from $0.13/kWh to $0.145/kWh depending on the length of the contract	None specified
Colorado	New Energy Econ. Dev. Grant Program	x	x	2009	Varies	None specified
Connecticut (administered by Connecticut Clean Energy Fund)	On-Site Renewable DG Program	x	x	2005	Fuel Cells: recently changed to offer a max of $2.50/W for any projects; 10-year evaluation timeframe. Previously offered up to $4.70/Watt for smaller projects. Small Wind: $3.60 per watt; 15-year evaluation timeframe.	Min 10 kW systems; Maximum individual project award is $4 million
Delaware	Technology and Demonstration Grants	x	x	2003	up to 25% of equipment cost	$200,000 per project

[132] This column is intended to show the state in which a program is offered. Unless otherwise noted, the program is offered statewide. Where specific information is available regarding the entity administering the program (i.e., if the administrator is a state clean energy fund), this information is noted.

State / Program Administrator[132]	Program Name	Wind	Fuel Cells	Program Start	Incentive Amount / Formula	Limits on Incentive
Delaware	Green Energy Program Incentives	x	x	2002	Delmarva: up to 25% of costs; DEC: up to 33.3% of costs for wind, 50% fuel cells; Munis, up to 50% of costs	Fuel Cells: $250,000; Wind: $100,000
Maine	Wind Energy Rebate Program	x		2009	$500 per 500 W up to 4,000 W, but not to exceed $4,000	100 kW max
Maryland	Windswept State Rebate Program	x		2007	$2.50/W capacity	1 kW min size; $10,000 max rebate
Massachusetts (administered by the Massachusetts Technology Collaborative)	Community-Scale Wind Program	x		2009	$2 million available for block 1 funding (June 4, 2009 due date), competitive selection; post block 1, selection based on eligibility.	$400,000 for private and $600,000 for public entities
Michigan	Energy Efficiency Grants	x	x	2000	Varies	None specified
Minnesota (Xcel only)	Renewable Development Fund Grants	x	x	1999	Varies	None specified
New Jersey	Customer-Sited RE Rebates	x	x	2001	Fuel cells: $4/W DC first 10 kW, declining to $0.15/W for systems over 500 kW (1 MW size limit); Wind: $3.20/annual kWh for first 16,000 kWh, $0.50/annual kWh for 16,000 through 750,000 kWh (estimated performance)	Fuel Cells: 30% of installed costs; Wind: 120% of estimated performance

State / Program Administrator[132]	Program Name	Wind	Fuel Cells	Program Start	Incentive Amount / Formula	Limits on Incentive
New York (administered by the New York State Energy Research and Development Authority- "NYSERDA")	Fuel Cell Rebate and Performance Incentive		x	Unknown	< 25 kW systems: \$2,000/kW up to \$20,000 per project site; >25 kW systems: \$500/kW up to \$100,000 per project site. Additional performance incentive: If annual capacity factor ≥50%: \$0.15/kWh up to \$10,000/year for small systems or \$300,000/year for large systems; If annual CF ≤ 50%: \$0.05/kWh up to \$10,000/year for small systems or \$300,000/year for large systems.	<25 kW: \$50,000; >25 kW: \$1 million
New York (administered by NYSERDA)	On-site Small Wind Program	x		2007	Varies by the make and model of the wind turbine, the difference between the standard tower height and the actual tower height, and the classification of the wind turbine owner	System Size: 800 W - 250 kW; Max: \$150,000 per site
Ohio (administered by the Ohio Department of Development's Ohio Energy Office)	Advanced Energy Program Grants - Non-Res. Distributed Energy		x	1999	25% of project costs up to \$100,000	\$100,000; systems up to 25 MW
Oregon (administered by the Energy Trust of Oregon)	Open Solicitation Program		x	2002	All or a portion of "above market costs" funded	None; program plans to support 4-6 projects per year
Oregon (administered by the Energy Trust of Oregon)	Small Wind Incentive Program	x		Unknown	Lesser of \$3,750 per meter of rotor diameter, or \$4,000 per rated kilowatt of the wind turbine	Size: 50 kW; \$60,000

State / Program Administrator[132]	Program Name	Wind	Fuel Cells	Program Start	Incentive Amount / Formula	Limits on Incentive
Rhode Island (administered by the Rhode Island Economic Development Corporation)	Renewable Energy Fund Grants	x	x	2008	varies	$750,000 for C&I projects (per award year)
Tennessee	Tennessee Clean Energy Technology Grant	x	x	2006	40% of cost	$75,000
Vermont	Clean Energy Development Fund Grant Program	x	x	2005	Varies	Fuel cells: $50,000 max; Wind: $250,000 max; $100,000 max for Pre-Project Financing available also
Vermont[133] (administered by the Renewable Energy Resource Center)	Small Scale Renewable Energy Incentive Program	x		2003	$2.50/W - $4/W for businesses (higher if VT-made equipment); $4.50/W DC if owned by schools, farms, or government entities;	$12,500 commercial; lesser of $17,500 or 50% of total installed cost for schools, farms, government and low-income multi-family

Source: Database of State Incentives for Renewables and Efficiency (DSIRE) and program-specific websites. Program summaries for Connecticut, Massachusetts, New Jersey, and Vermont are also based on personal communications with program representatives.

[133] Vermont is rolling out a new feed-in-tariff that will support small wind systems. It is not included in the table because the table highlights grant / rebate programs. Design of Vermont's feed-in-tariff program was not yet finalized at the time this report was prepared.

7.2 Program Highlights and Lessons Learned for Select States

This section discusses program progress and lessons learned from states with some of the more active on-site renewable generation rebate and grant incentive offerings. Findings discussed here are based on data available on program Web sites and the Database of State Incentives for Renewable Energy, as well as interviews with individuals who implement or play a key role in the each state's incentive programs.[134]

7.2.1 Connecticut

Program Overview

Connecticut has offered financial incentives for wind, fuel cell and other renewable energy installations since 2005 under its On-Site Renewable DG Program. Due to a combination of technology-specific stakeholder activities (i.e., a strong fuel cell industry presence), program design elements, and resource availability, fuel cell, solar and biomass projects have been the strongest players in the state's renewable energy markets.

Unlike programs in most other states, the grant amounts offered through the On-Site Renewable DG program are determined based on project-specific economic analyses. A project's incentive amount is based on the difference between the cost of energy the host-site would have purchased in the absence of the system, and the total cost and value of energy to be produced by the system over a ten year evaluation time frame. The program sets specific incentive limits for each project type. The project will receive the lesser of the calculated incentive amount or the incentive limit for that technology.

A subset of funded projects are currently monitored for performance. In the future, performance monitoring requirements will increase substantially.

Connecticut is known for having one of the most active fuel cell markets in the nation. This is due to a few factors. First, Connecticut is home to the nation's two largest fuel cell manufacturers: Fuel Cell Energy and UTC Power. Connecticut companies pioneered the development and application of fuel cell technology, and a strong fuel cell industry presence exists in the state. The Connecticut Hydrogen Fuel Cell Coalition is an industry association with a strong base of members that manufacture fuel cells or fuel cell parts, or work in other areas on the fuel cell supply chain. The University of Connecticut also has its own Global Fuel Cell Center to support industry research and development. Given Connecticut's small size relative to California, the active fuel cell industry plays a defining role in that state's renewable energy market.

Other factors contributing to Connecticut's fuel cell installation activity are: 1) projects do not need to use renewable fuels in order to qualify for financial incentives; and 2) incentive levels have been very high during the last few years. Until recently, a small fuel cell system operating on natural gas could receive up

[134] Interviews were conducted during September and October of 2009. Interviews were conducted with the following individuals: Dale Hedeman of Connecticut's Clean Energy Fund, Tyler Leeds of the Massachusetts Renewable Energy Trust, Charlie Garrison of Honeywell (implementer of New Jersey's Renewable Energy Incentive program), and Lawrence Mott, Chair of Renewable Energy Vermont's business trade group.

to $4.70/W of rated capacity. The program recently reduced the cap on fuel cell incentives to $2.50/W across all size ranges.

The state has offered substantial financial support to foster the growth of the fuel cell industry within its borders. In addition to the direct project-level financial support offered through the On-Site DG program, the state has provided financial support to fuel cell companies, and has required utilities to enter into long-term contracts with renewable energy generators under its "Project 150."[135]

Project 150 required the state's two investor owned utilities to secure 150 MW worth of long-term renewable energy supply contracts at premium rates (up to a 5.5 cent/kWh premium per kWh). Through three rounds of program solicitations, Connecticut made some adjustments to ensure that fuel cells would be a favored resource under the program. As a result, fuel cells have been the second most successful resource under this program, behind wood-based biomass projects.

Fuel cell equipment has increased in capacity, and therefore, become more cost-effective during the past few years. Upfront cost is still the main barrier to achieving more installations. However, most larger projects are projected to have favorable long-term economics. As noted earlier, Connecticut calculates incentives for each fuel cell project based on total value of the fuel cell project to a host site over a ten year time horizon. Based on the formula used for calculating the incentives, the larger systems' economics are such that they typically end up receiving incentive amounts that fall well below the maximum per kW amount available.[136]

Projects are being installed at buildings with significant thermal loads. Two of the largest installations are at commercial bakeries (Pepperidge Farm and Arnold's). Recently, there have been a significant number of installations at grocery stores including Stop and Shop, and Whole Foods. Grocery stores can use the waste heat to drive refrigeration processes.

A representative from Connecticut's On-Site Renewable DG rebate program estimated that 60% of the projects completed through the program are initiated by marketing activity on the part of the fuel cell companies themselves. The other 40% of activity is generated through other means such as people finding CCEF program information on the internet, private developer efforts, and efforts of the Connecticut Center for Advanced Technology.

While the On-Site Renewable DG program does offer incentives for small wind, program marketing is limited to posting available incentives on the website. The program has not taken steps to build a strong community of small wind installers and developers. CCEF cites the state's poor on-shore wind resource as the key reason that more small wind development activity is not occurring in the state.

Lessons Learned

The key advice the PA had for other incentive programs seeking to fund fuel cell or small wind projects is to be patient, and to provide the ongoing communication and support necessary to make projects happen. He explained that many people come to CCEF looking for funds, but even under the best circumstances it

[135] Fuel cells may receive financial support through the On-Site DG program and may participate in Project 150. However, PV and small wind funded projects do have to turn their RECs over to the Connecticut Clean Energy Fund, which means that they can't participate in Project 150.

[136] This limit was $3.20/watt for projects greater than 1000 kW until recently when it was changed to $2.50/watt for all projects.

can take more than a year for all the pieces to fall into place and for a project to move into the construction phase.

Another lesson that can be drawn from the Connecticut fuel cell experience is the importance of providing support for market development from a variety of angles. As noted earlier, Connecticut has provided support for the fuel cell industry in the form of direct support to fuel cell companies, project support, and a requirement for long-term contracts for renewable energy.

A more sophisticated industry can help take the burden off the funding agent and facilitate more rapid development progress. For example, some fuel cell companies are offering power purchase contract structures where they own the equipment and sell energy back to the host site. Anything that the industry can do to help reduce the upfront cost burden can help, as this can make the project approval process simpler and the project as a whole less daunting. Clearly, the growing sophistication and level of fuel cell industry activity in Connecticut are key contributors to the success of this technology, relative to small wind, in the state.

7.2.2 Massachusetts

Program Overview

For the past several years, Massachusetts has made a concerted effort to foster the development of small wind projects in the state. The state has a relatively favorable wind resource (25^{th} in the nation) considering its small size. However, large wind project development (both on-shore and off-shore) has met with significant local opposition. As a result, small wind development is a key area of focus for the manager of the state's renewable energy funds, the Massachusetts Technology Collaborative (MTC). Massachusetts' governor set a goal to develop 2,000 MW of wind in the state by 2020. It is likely that small wind projects (less than a few MW per project) will play a significant role in the state's efforts to achieve this goal.

Massachusetts' Commonwealth Wind program funds projects greater than 100 kW in capacity. The program provides design and construction grants up to $1,400/kW for privately-owned projects. Public projects can secure grants for as much as $2,100/kW. Grant amounts vary depending on project characteristics. Since there are limited funds available, projects can increase their chances of securing funds by applying for less than the maximum grant amount. While projects can sell excess generation back to the grid, at least 50% of the electricity produced by the system must be used on-site in order for a project to be eligible.

A unique feature of the program is that it provides funding for three different stages of project development: 1) high level site assessment (public projects only); 2) feasibility study grants; and 3) design and construction grants. The feasibility grants provide interested parties with an opportunity obtain the data that will be necessary to prove they have a viable project when they later apply for design and construction funding. The program administers grants through periodic solicitations occurring approximately every four months.

In the future, projects will be required to install a data acquisition system. Projects will need to report on system performance on a monthly basis for five years.

Most project activity is generated by the engineering consulting firms and general project management firms that will be responsible for designing and managing project development. MTC effectively lets the consultants act as marketing agents and does little direct marketing of its program. These consultants will sometimes approach entities that have favorable project characteristics. In other cases, entities will come to MTC seeking funding and the agency will provide a list of small wind consultants that are active in the state.

Massachusetts also offers a Micro Wind program that supports projects under 10 kW in capacity and a commercial wind program that supports projects greater than 2 MW in capacity. Projects funded through the commercial wind program must either: 1) serve the wholesale electricity market, or 2) provide electricity for on-site use to an entity that is ineligible for net metering.

For a while, the biggest barrier to small wind development was turbine availability. However, this has now been displaced by permitting challenges. One of the most significant obstacles for developers is that permitting conditions are different in each community. Some communities approve projects immediately while others leave project proponents with uncertainty for several years before coming to a decision. Another problem is FAA approval. With many small airports located in the state, FAA height restrictions and lighting requirements have presented challenges.

Lessons Learned

Like the Connecticut PA, the Massachusetts' PA cites the importance of patience as an incentive program matures. The Massachusetts' program funded about one project per year from 2005-2007. This year, the program will fund 10 to 12 systems. This growth in project activity is due to the fact that: 1) the turnaround time for projects seeking funding is about three years, and several of the projects have been working their way through the development cycle; 2) until 2008, net metering in the state was limited to 60 kW; and 3) the consultant pool in Massachusetts is growing. When the state first started offering wind project grants the pool of expertise in the state was limited. Now that there have been a few years worth of funding for feasibility studies and project design and construction, the community of experts in small wind project development is growing stronger.

The program has also become stricter about only funding projects with a high probability for success. The program requires projects to be located at sites that meet minimum wind speed requirements. Furthermore, when projects apply for a design and construction grant, they must have completed a feasibility study.

The growth and success of Massachusetts' small wind industry is closely tied to the presence of a growing pool of technical expertise in the state. Given the challenges of large project development in Massachusetts, the more sophisticated large project developers have shied away from the state. Instead, a pool of experts in small wind has emerged in response to MTC's funding programs. As noted earlier, companies becoming most active in small wind development are engineering consulting firms and general project management firms.

The MTC has not offered any formal training to small wind industry players. Rather, the agency has highlighted what it considers to be ideal feasibility study and project development characteristics and the industry has responded by achieving MTC's high standards.

7.2.3 New Jersey

Program Overview

New Jersey is best known for offering aggressive solar incentives, but the state has also offered incentives for wind, fuel cells and other renewable energy technologies since 2001 under its Customer On-site Renewable Energy program (CORE). The program has recently undergone changes and is now called the Renewable Energy Incentive Program (REIP).

Since 2001, New Jersey's clean energy incentive programs have provided $3.8 million in direct funding support to 16 wind projects totaling nearly 7.6 MW of capacity. One system, the Jersey Atlantic Wind project accounts for the majority of this installed capacity (~7.5 MW). Excluding this system, the average size of systems installed through the program is between 10 and 20 kW.

REIP offers wind projects incentives based on expected performance during their first year of operation. Projects receive $3.20 per estimated first-year kWh production, up to 16,000 kWh, and $0.50/kWh for additional estimated generation.

Fuel cells receive a $4/W rebate for the first 10 kW of capacity. This incentive declines to $0.15/W for projects larger than 500 kW, and there is a 1 MW limit on project funding.

In contrast to Connecticut, New Jersey has focused little on funding fuel cells to date. In fact, there are plans to remove fuel cells from the list of technologies funded under the REIP. Fuel cells must operate on renewable fuels in order to qualify for funding under the REIP. The most likely source of renewable fuel would be landfill gas or solar. In both cases, it is generally not worth the effort to use the renewable resource for the purpose of supplying a fuel cell. That is, if a landfill can produce methane, the most economically attractive use of that resource is to generate electricity directly rather than using it to provide hydrogen for a fuel cell.

New Jersey does offer incentives for fuel cells operating on natural gas under its standard Combined Heat and Power (CHP) incentive programs. A new program aimed at funding larger scale CHP applications has seen substantial activity in the area of fuel cells.

While the state has made efforts to address barriers to small wind development, it still faces an uphill battle and has seen relatively little development to date.

A key barrier to wind development is the limited number of sites with strong wind development potential, given that the state is small and is the most densely populated state in the nation. There is some hope that new turbine designs will facilitate turbine applications in urban settings, but to date this has not been a viable option.

Permitting is another major barrier for wind development. Each community in the state has its own rules, and projects must obtain approval both from the zoning board and the planning board. In several cases, viable projects have been held up due to local opposition.

Lessons Learned

A PA spoke favorably of New Jersey's choice to base its wind incentives on expected performance. Turbines which are eligible for installation through the program all have well known power curves, and the state loans out anemometers and has robust wind resource data available. This enables the program to tailor rebate amounts to increase the likelihood that the best sites will be developed.

An additional performance incentive comes in the form of RECs. Since the program does not take ownership of RECs generated by funded projects, there is an additional incentive to keep projects operating at optimal performance levels. RECs from wind projects in New Jersey are eligible to be used toward New Jersey's Class I RPS compliance requirements. Class I REC pricing for the 2009 compliance year ranged from $2.50 - $13.00 per REC (1 REC = 1 MWh). Pricing for 2010 compliance year RECs has ranged from $6 - $18 per REC.[137]

The state is working to address permitting and local opposition barriers through the efforts of a small wind collaborative. This group includes industry representatives along with representatives from the state's environmental office, and the public utility commission. It meets monthly to discuss challenges and to develop strategies to address those challenges. The group developed a model wind ordinance for communities to adopt in hopes that this would make permitting conditions more predictable and consistent across communities. Several communities have adopted the ordinance to date.

In the future, the program plans to add funding to support resource assessment and project feasibility studies up to $50,000 per site. This will reduce the development risk and should encourage more entities to move ahead with exploring development opportunities. PAs anticipate funding feasibility studies in a few different regions of the state. The hope is that municipalities within a given region will share the results of their studies, thus limiting the need to conduct multiple studies within a region. The benefits of this sharing approach may be limited, however, given that site-specific conditions have such a bearing on wind speed, and wind speed is such a defining factor in project economics.

New Jersey's program is also considering loosening its requirements to use pre-approved turbines. Now that more turbines are becoming available on the market, the program will likely allow participants to use a variety of different turbines going forward. This increased flexibility will help increase the likelihood for broader participation.

7.2.4 Vermont

Program Overview

Vermont has provided rebates to support the development of small wind projects since 2003. The program had funded nearly 100 small wind systems as of July, 2009.[138] This is an impressive number relative to small wind incentive programs in other states. However, the program limits funding for commercial and residential projects to $12,500, and $20,000 for farms, schools and other public projects. This effectively limits system sizes installed through the program. For commercial and residential projects, program funding limits would only support approximately 4 kW of capacity.[139] In fact, the average size of systems installed through the program to date is just over 3.5 kW. While this is below the

[137] Presentation by Ken Nelson, Element Markets. "REC Standardization: A Market Participant's View." September, 2009. Available at: http://www.cleanenergystates.org/JointProjects/RPS/Nelson_SARPS-8.pdf.

[138] This includes 88 installed systems and 16 reservations for project funding.

[139] This assumes an average installation cost of $3,000/kW, the low end of the range ($3,000/kW to $6,000/kW) referenced by the American Wind Energy Association in its "2009 AWEA Small Wind Turbine Global Market Study," available at: http://www.awea.org/smallwind/pdf/09_AWEA_Small_Wind_Global_Market_Study.pdf. Note that AWEA defines small wind as any turbine under 100 kW of capacity.

size range targeted by the SGIP, Vermont's small wind market experience still provides valuable lessons for California.

Lobbying by a proactive trade association, Renewable Energy Vermont, was instrumental in bringing about the passage of the state's 2009 Renewable Energy and Energy Efficiency Act in May, 2009. This included provisions for a new feed-in-tariff that will likely trigger growth of a much more robust small wind market.

Under the new program, all Vermont retail electricity suppliers are required to purchase renewable energy under long-term contracts. Projects up to 2.2 MW in capacity are eligible for support. In the case of wind systems greater than 15 kW, the purchase price is $0.125/kWh, and the contract term must be between 15 and 20 years. The final rules implementing the program will not go into effect until January 2010. The program, called the Sustainably Priced Energy Enterprise Development program (SPEED), will be managed by the same entity that has administered the rebate program that currently supports small wind projects.

Lessons Learned

Renewable Energy Vermont's role in advancing the state's Energy Act is evidence of the potential impact of a proactive trade association. The group worked closely with a diverse stakeholder group, including state agencies and renewable energy program implementers, to pass the state's Energy Act. The group recognized the potential challenges, and helped tailor the proposed legislation to reflect advancements in the industry (i.e., larger turbine sizes), while remaining sensitive to the state's desire to support community-scale wind projects.

Renewable Energy Vermont has also played a key role in facilitating the introduction of other policies that will advance wind and other renewables development in the state. This includes increasing net metering limits, and enabling projects up to 150 kW to benefit from streamlined permitting. When a potential project owner notifies abutters of plans to install a wind turbine, if the abutters do not oppose the project within 30 days of notification, the project receives a permit.

7.2.5 Summary of Lessons Learned from Other States

Program activity in states with active small wind and fuel cell programs in the nation was conducted. This research included Connecticut's fuel cell program, New Jersey's small wind and fuel cell incentives, and small wind incentive programs in Massachusetts and Vermont. The following lessons can be applied to the SGIP:

- ***Most states have set development targets.*** Development targets, coupled with incentive funds, sends a signal to the industry regarding the level of commitment the state is willing to make to support a technology. Setting targets can trigger more action and involvement on the part of small wind or fuel cell industry. In addition, targets provide an important benchmark for measuring program progress. Targets should be established based on research into achievable development potential. If targets are set without a sound basis, they could have a negative effect, either seeming unrealistically high, or so low that they do not motivate industry action.

- ***Project activity is primarily driven by the industry, not by program marketing.*** As exemplified by Connecticut's fuel cell program and Massachusetts' Commonwealth Wind program, industry players are responsible for initiating the majority of projects. Programs should take advantage of the industry's inherent interest in generating new business, and should foster linkages between project prospects and industry participants. This can come in the form of contractor lists.

- ***Active trade associations foster the development of favorable market conditions.*** When trade associations are at the table for key policy and program decision-making, they can help shape the conditions that will make it possible for markets to grow. This is evidenced in the recent passage of a feed-in-tariff in Vermont, as well as the potential removal of fuel cells from the eligible technology list for New Jersey's Renewable Energy Incentive program.

- ***Offering incentives for pre-development / feasibility studies can help reduce financial risks for potential participants, and increase the number of sites pursuing development.*** This is especially important in areas where there are barriers to the first entrant, such as lack of wind-specific ordinances.

- ***Through experience, ideal site characteristics and project profiles will become apparent.*** For example, Connecticut's fuel cell program has identified grocery stores and bakeries as locations with favorable fuel cell installation characteristics, and New Jersey has identified existing industrial sites as ideal sites for small wind development. Once target sites have been identified, a program can assist in replicating successful project models through education and communications efforts. This can help the industry, and the PAs, more effectively target ideal project candidates in the future.

- ***Monitoring system performance is important for accountability and for providing lessons learned regarding favorable site conditions***.

8 TECHNOLOGY REVIEW

In this section, the Summit Blue team presents a review of potential new clean distributed generation technologies that might be added to the SGIP. The objective of the review was to identify distributed technologies that are:

- Commercially available,
- Non-solar,
- Electricity generating (or displacing), [140] and
- Not energy efficiency or demand response technologies.

With the passage of SB412 on October 11, 2009, this scope was expanded to include greenhouse gas reductions as a criteria.

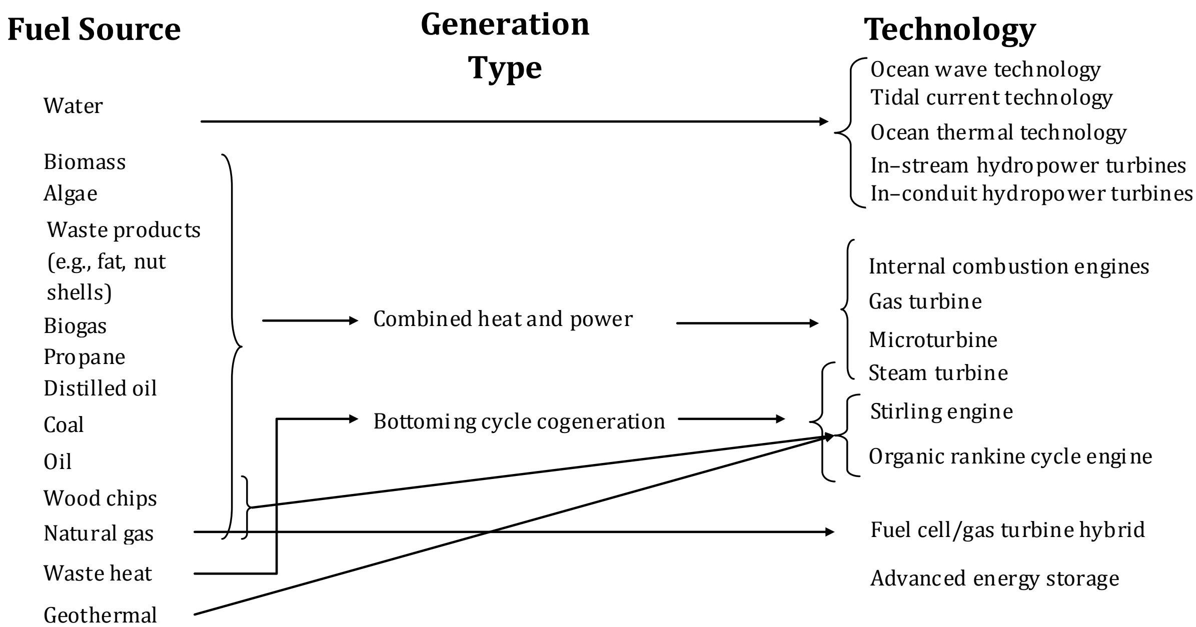
During the in-depth interviews with the SGIP PAs, the CPUC and CEC, market actors, and project developers, the interviewees were asked what additional technologies should be considered for inclusion in the SGIP. These interviews revealed the following list:

- Wave generation
- CHP
- Geothermal
- Bottoming cycle CHP/heat recovery with Stirling engines
- Stand alone energy storage
- Hydropower
- Biomass
- Algae for biofuel
- Use of other waste products like fat, nut shells, salad
- Other Renewable Portfolio Standards (RPS) technologies. Under California's RPS "in-state renewable electricity generating technologies" means a facility that "uses biomass, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuels, small hydroelectric generation of 30 megawatts or less, digester gas, municipal solid waste conversion, landfill gas, ocean wave, ocean thermal, or tidal current, and any additions or enhancements to the facility using that technology" (California Public Utilities Code Section 383.5)
- Emerging technologies

The team supplemented the initial technology list through independent research. Figure 8-1 shows the final list of technologies included in this report and illustrates their relationship to their fuel source and generation type.

[140] The team focused on the electricity generating technologies, rather than electricity displacing technologies.

Figure 8-1. Fuel sources, generation types and technologies for distributed generation



Source: Summit Blue Consulting

In the following sections, the team describes the technologies, their current availability, their installed size ranges, their ability to meet current SGIP requirements, and their peak demand and greenhouse gas reduction potential. Peak demand reduction and greenhouse gas reduction potential are on a low-medium-high scale based on independent research and the team's previous experience with the technologies. Most of the technologies included in the review are commercially available; some technologies have been in the market for many years and are well known (such as gas turbines, microturbines, and internal combustion engines), where others are still emerging (such as Stirling engines and energy storage).

8.1 Technology Discussions

The Technology Discussions appear on the following pages. Note that a "Geothermal Technologies" section is in the technology discussions to highlight the specific use of geothermal energy.

8.1.1 Ocean-Based Technologies

The U.S. Department of Energy Wind and Hydropower Technologies Program maintains a database of marine and hydrokinetic technologies. The database includes information on wave, tidal current and ocean thermal energy systems. The table below summarizes the contents of the database by technology stage. The ocean-based technologies section discusses three technology groups: ocean wave power, tidal current power, and ocean thermal power.

Technology stage of ocean based technologies

Technology Stage	Number of Technologies
Concept design	5
Detailed design	30
Scale model testing- tank testing	23
Scale model testing- sea trials	42
Full scale prototype	28
Commercially Available	1
Note: This summary was completed on August 19, 2009	

Source: U.S. Department of Energy. Wind and Hydropower Technologies Program Database. www1.eere.energy.gov/windandhydro/hydrokinetic/default.aspx (accessed August 20, 2009).

Ocean Wave Power

Technology Description: Wave power uses the motion of the waves to generate electricity. There are three main principles for ocean wave power devices. Overtopping devices contain a ramp over which the water from the wave runs, a basin, and a low head turbine. Buoyant moored devices floats in the water and uses an absorber system. Lastly, the oscillating water column uses a column of water to pump air through a turbine. One wave power technology is commercially available— Pelamis Wave Energy Converter from Pelamis Wave Power. The nameplate capacity of the Pelamis is 750 kW. There are three current projects using this technology; however, they all feed electricity directly into the grid rather than providing electricity for on-site use. One project is located in Portugal, two projects are located in the UK.

Dr. Asfaw Beyene, a professor at San Diego State University, has completed a study of California's ocean wave resources. The results of that study in terms of generation potential and geographic distribution of ocean wave resources are shown in the graphic below. In the study, primary sites are defined as "locations with a reasonable permitting process, excellent wave conditions, and a water depth greater than 50 meters within 10 miles of the coast."

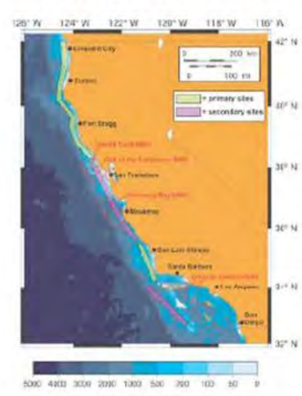
Sonoma County Water District applied for three preliminary permits for wave projects in the spring of 2009. The projects would begin as pilots in the 2-5 MW range. They would be located off Del Mar Landing and Fort Ross. See the "Hydropower Turbines" section for a map of FERC (Federal Energy Regulatory Commission) wave preliminary permits in the U.S.

Ocean Wave Energy Generation Potential

Site Type	Nameplate Capacity (MW)	Annual Energy Production (GWh)
Primary	4318	18,912
Secondary	3142	13,761
Total	7460	32,673

Source (for both figures): Beyene et.al. California Ocean Wave Energy Assessment

Geographic Distribution of Ocean Wave Resources



Note: This figure is enlarged in Figure 8-2.

Characteristic	Description
Fuel source(s)	Water
Commercial availability	According to the U.S. Department of Energy, one wave technology is commercially available
Capacity size ranges	10 kW—11 MW (based on full scale prototypes and commercially available systems)
Ability to meet current SGIP requirements	No technology is currently on the customer side of the meter
Peak demand reduction potential	Low. Energy generated would vary based on the energy in the waves
Greenhouse gas reduction potential	High. Wave power uses the power in the waves to produce electricity, and thus uses a purely renewable fuel

Source: Pelamis Wave Power

Sources: U.S. Department of Energy. Wind and Hydropower Technologies Program Database. www1.eere.energy.gov/windandhydro/hydrokinetic/default.aspx, (accessed August 20, 2009); Pelamis Wave Power. www.pelamiswave.com (accessed October 2009); Kane, Mike. "California Small Hydropower and Ocean Wave Energy Resources." California Energy Commission. April 2005; Beyene et al. "California Ocean Wave Energy Assessment (Draft Report);" California Energy Commission. "Ocean Energy." www.energy.ca.gov/oceanenergy/index.html (accessed November 5, 2009).

Tidal Current Power

Technology Description: Tidal current power uses the flow of water to generate electricity. Marine Current Turbines' (MCT) SeaGen system was installed in 2008 as an experimental installation. The SeaGen is listed in the "full scale prototype" technology stage in the DOE database. The experimental installation is a 1.2 MW system located in Ireland. See the "Hydropower Turbines" section for a map of FERC tidal preliminary permits in the U.S.

Characteristic	Description
Fuel source(s)	Water
Commercial availability	According to the U.S. Department of Energy, no tidal current technologies are commercially available
Capacity size ranges	5 kW—2.2 MW (based on full scale prototypes)
Ability to meet current SGIP requirements	No technology is currently on the customer side of the meter
Peak demand reduction potential	Low. Energy generated would vary based on the tides
Greenhouse gas reduction potential	High. Tidal current power uses the power in the tides to produce electricity, and thus uses a purely renewable fuel

Source: U.S. DOE Wind and Hydropower Technologies Program Database

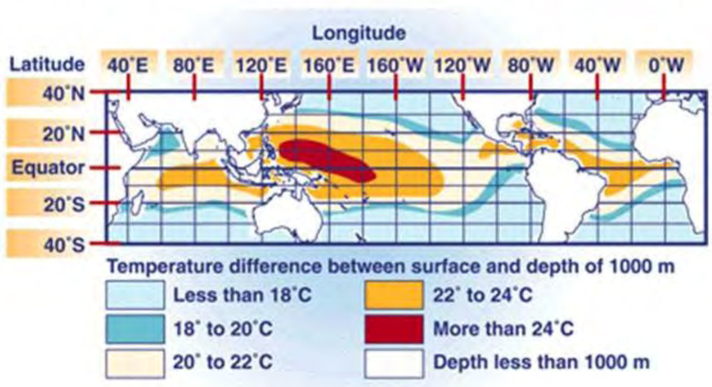
Sources: U.S. Department of Energy. Wind and Hydropower Technologies Program Database. www1.eere.energy.gov/windandhydro/hydrokinetic/default.aspx (accessed August

Ocean Thermal Power

Technology Description: Ocean thermal power uses the temperature differential in the ocean to generate electricity. The figure below shows the temperature difference between the surface and 1,000 meters in the world's oceans. A larger temperature difference allows for a greater market for ocean thermal energy conversion (OTEC). Based on the figure, California does not appear to be an ideal location for OTEC due to the low temperature differential between surface and a depth of 1,000 meters.

The component technology of the OTEC system is commercially available, though there are currently no functioning OTEC plants due to high upfront costs and engineering obstacles (A demonstration 50 kW mini-OTEC plant operated in Hawaii in 1979 for three months. Additional demonstration projects have operated since then). One company, OCEES International, Inc., has a patented ocean thermal energy conversion OTEC design. A commercial project between OCEES and the U.S. Navy is currently underway and could be online as early as 2012.

Ocean temperature differences between the surface and 1,000 meters



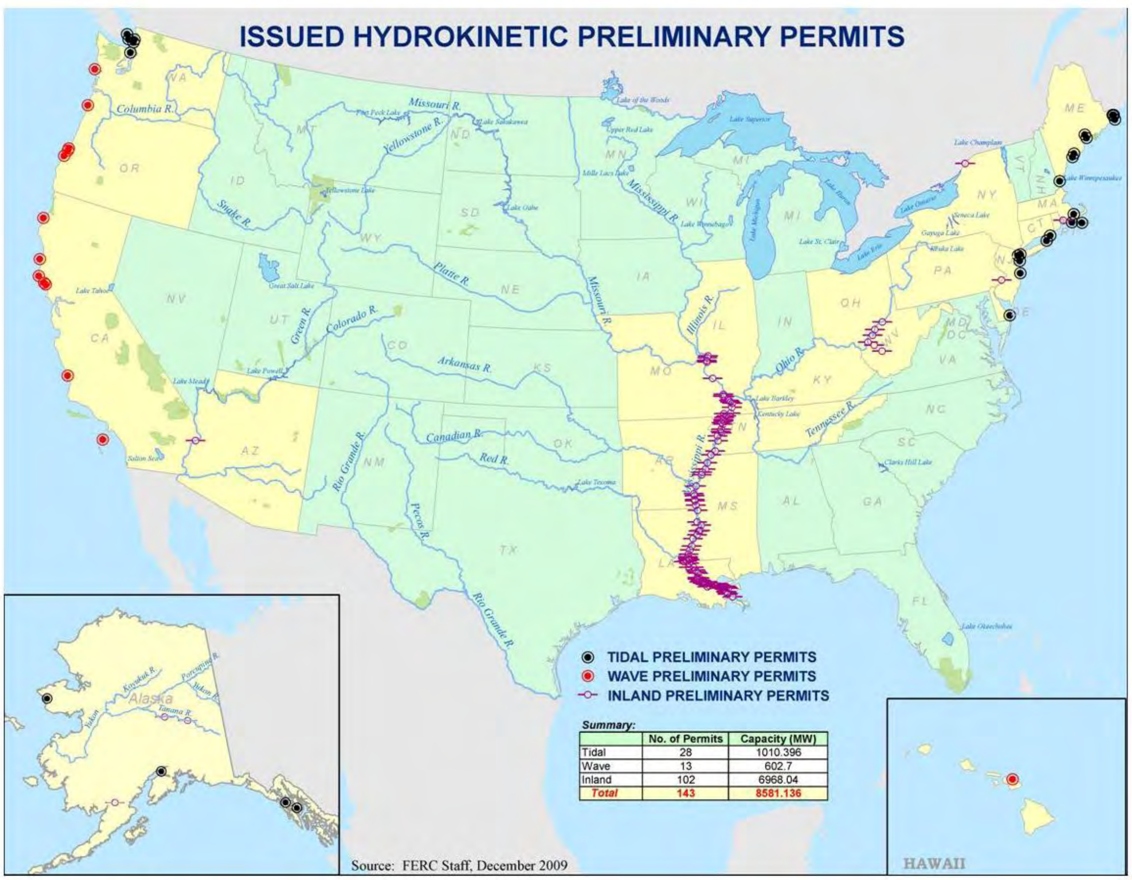
Source: NREL. Ocean Thermal Energy Conversion.

Characteristic	Description
Fuel source(s)	Water
Commercial availability	Components of ocean thermal energy conversion plants are commercially available
Capacity size ranges	Not available
Ability to meet current SGIP requirements	No technology is currently on the customer side of the meter
Peak demand reduction potential	Medium. Energy generated would vary based on the temperature differential
Greenhouse gas reduction potential	High. OTEC uses the temperature differential in the ocean to produce electricity, and thus uses a purely renewable fuel

Sources: U.S. Department of Energy. Wind and Hydropower Technologies Program Database. www1.eere.energy.gov/windandhydro/hydrokinetic/default.aspx (accessed August 20, 2009); OCEES International, Inc. www.ocees.com/ (accessed August 2009); NREL. Ocean Thermal Energy Conversion. www.nrel.gov/otec/what.html (accessed August 2009); Inman, Mason. "Sea Power, Part 2." RenewableEnergyWorld.com. August 5, 2009; State of Hawaii. Department of Business. Economic Development and Tourism. hawaii.gov/dbedt/info/energy/renewable/otec (accessed August

8.1.2 Hydropower Turbines

Technology Description: Historically, hydropower has utilized the potential energy in the water via dams or conduits and the amount of energy available was dependent on the available head. Now available are hydrokinetic power systems which use the kinetic energy in the water to generate electricity. Operations at the first FERC licensed U.S. hydrokinetic power station were initiated on August 20, 2009. The system is located in Minnesota and the electricity is sold to Xcel Energy through a power purchase agreement. The turbine is manufactured by Hydro Green Energy, a Texas based company, and has a rated power of 98 kW at 3.5 m/s. The map below shows the FERC issued hydrokinetic preliminary permits as of December 1, 2009. Preliminary permits are issued for up to three years; they do not authorize construction but they give a developer priority to study feasibility of a project. The FERC defines hydrokinetic projects as "projects that generate electricity from waves or directly from the flow of water in ocean currents, tides, or inland waterways." The inland waterways projects apply most directly to the hydropower turbines discussed in this section. Previous sections discuss ocean power. According to FERC, the majority of inland preliminary permits are for sites on/near the Mississippi River. The Colorado River Indian Tribes also holds a preliminary permit for a site on the Colorado River in Arizona near the California border. Many states are working to make the permitting process for small hydropower easier. The Energy Trust of Oregon recently released small hydroelectric permitting handbooks to ease the permitting process.



Source: FERC 2009

In-stream hydropower

Hydropower can be classified into three groups based on the turbine's power rating. The classifications most applicable to the current SGIP requirements are the micro-hydro and mini-hydro plants.

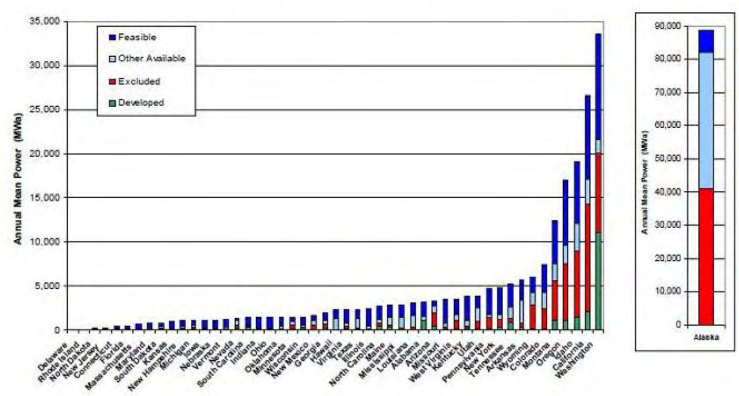
Hydropower Classifications

Classification	Size Range	Typical Use
Micro	100 kW or less	Supply for one or two houses
Mini	100 kW to 1 MW	Supply for a small factory or isolated community
Small	1 MW to 50 MW	Low end of range for supply to a regional or state power grid

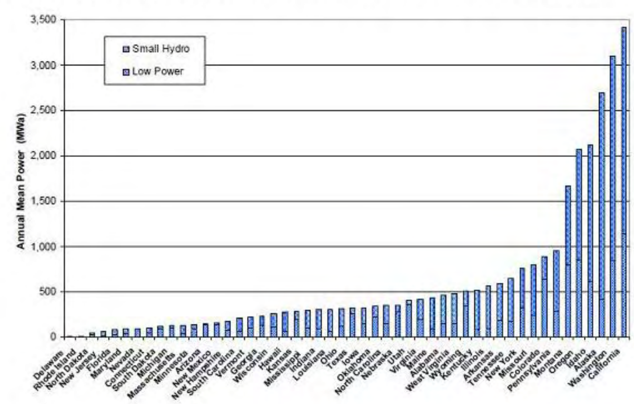
Source: Natural Resources Canada

California has 4,699 MWa of developed hydropower resources and 3,425 MWa of feasible potential hydropower, more feasible potential than any other state in the U.S., according to a 2006 report completed by the Idaho National Laboratory for the U.S. Department of Energy. The feasible potential hydropower is further split into small hydro (between 1 MWa and 30MWa) and low power hydro (less than 1 MWa). California has over 1,000 MWa of feasible low power hydro potential.

Total gross power potential of water energy resources in the U.S.



Total feasible hydropower potential in the U.S.

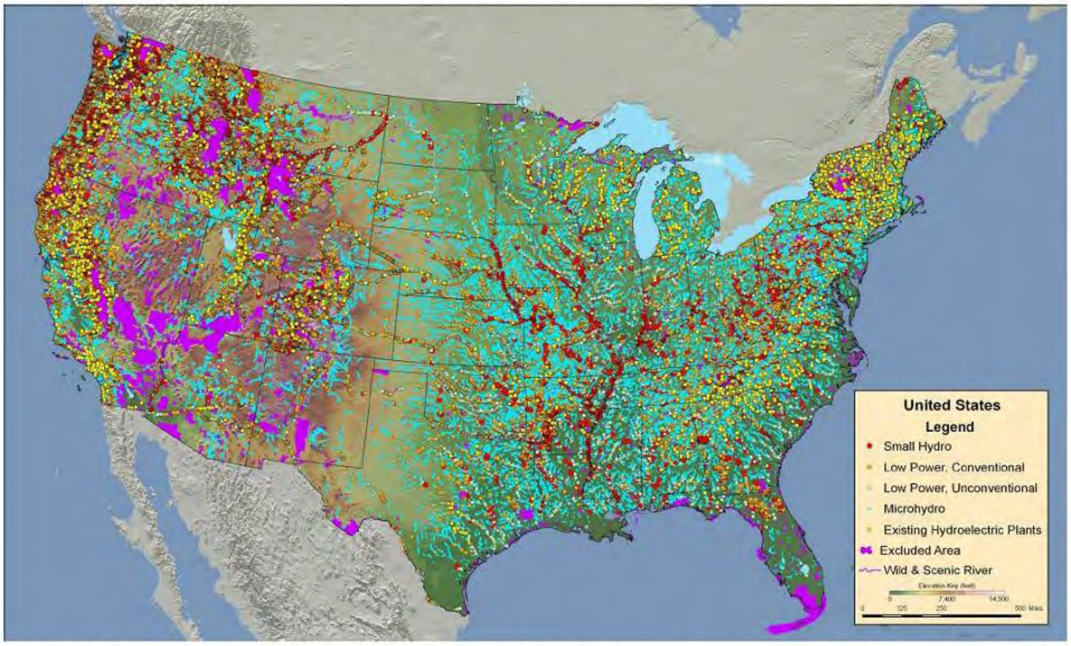


Note: These figures are enlarged in Figure 8-3 and Figure 8-4.

Source: U.S. DOE 2006

The map below shows the location of existing hydroelectric plants and feasible potential projects in the U.S. The potential for micro-hydro in California is visible on this map.

Existing hydroelectric plants and feasible potential hydropower projects in the United States



Source: U.S. DOE 2006

The Idaho National Laboratory also offers a Virtual Hydropower Prospector tool which allows one to map the hydropower resources against other attributes such as transportation, land use and cities. Without further investigation into the location of the resources with regard to the location of businesses and institutions, the availability of on-site hydropower resources is unknown.

Characteristic	Description
Fuel source(s)	Water
Commercial availability	Commercially available
Capacity size ranges	Micro: 100 kW or less Mini: 100 kW—1 MW Small: 1 MW—50 MW Note: Hydrokinetic inland preliminary permits range from 15 kW—253 MW.
Ability to meet current SGIP requirements	Yes
Peak demand reduction potential	Medium. Energy generated could vary based on the water flow and time of year
Greenhouse gas reduction potential	High. Hydropower turbines use the energy in the water to produce electricity, and thus uses a purely renewable fuel

Sources: Salmon, Jane Pater and Patricia Thompson. "Small Hydropower Technology and Market Assessment." Summit Blue Consulting and Golder Associates. Submitted to Energy Trust of Oregon. January 2009; U.S. Department of Energy. "Feasibility Assessment of the Water Energy Resources of the United States for New Low Power and Small Hydro Classes of Hydroelectric Plants." DOE-ID-11263. Office of Energy Efficiency and Renewable Energy. Completed by the Idaho National Laboratory. January 2006; Natural Resources Canada. www.nrcan.gc.ca (accessed 2008). Federal Energy Regulatory Commission (FERC). Hydrokinetic Pro-

In-conduit hydropower

In California, about 19 percent of the state's electricity is used for water-related services. Additional hydropower potential may exist in municipal water systems and wastewater treatment facilities. Pressure reducing values (PRVs) are commonly used in water systems to reduce the pressure of water flowing between zones of the water system, and to reduce pressure to a level appropriate for use by water system customers.

Community Hydro focuses on installing small hydropower at municipalities, schools, businesses and industry, as well as municipal water systems and wastewater treatment facilities. The company specializes in generating electricity from raw or finished water flowing through municipal water supplies and treated effluent from wastewater treatment systems via a proprietary technology called a "generating pressure reducing valve." This technology runs in parallel with existing pressure reducing valves and generates power within existing conduits. Rentricity offers a similar technology that mimics the function of PRVs and converts the pressure into electricity (the diagram below shows a high-level view of the technology). The San Diego Water County Authority has used the pressure control concept and currently has a in-conduit hydropower facility.

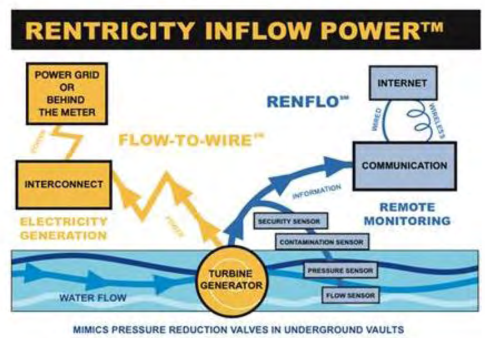
The table below shows the statewide in-conduit hydropower resources for RPS-eligible projects. This table is shown for reference only, as many projects that would go through the SGIP would not go through the RPS program. In addition, hydropower potential from industrial processes such as mining, manufacturing, food processing, and wastewater treatment are not included in the table.

Statewide In-Conduit Small Hydropower Resources by Region and Type

	Coincident Peak Megawatts	Total Nameplate Megawatts	Annual Generation Gigawatt-hours
Statewide	231	255	1131
North	52	52	262
Central	70	73	312
South	110	130	557
Irrigation	120	124	493
Municipal	130	131	638

Source: Navigant. California RPS-Eligible Small Hydropower Potential

In-conduit hydropower diagram from Rentricity



Source: Rentricity Website

Characteristic	Description
Fuel source(s)	Water
Commercial availability	Commercially available
Capacity size ranges	20 kW—300 kW (can be scaled)
Ability to meet current SGIP requirements	Yes, though may have some difficulty being located on the customer side of the meter
Peak demand reduction potential	Medium. Energy generated could vary based on the water flow through the conduits
Greenhouse gas reduction potential	High. Hydropower turbines use the energy in the water to produce electricity, and thus uses a purely renewable fuel

Sources: Salmon, Jane Pater and Patricia Thompson. "Small Hydropower Technology and Market Assessment." Summit Blue Consulting and Golder Associates. Submitted to Energy Trust of Oregon. January 2009; Raucher, Robert S., et.al. Stratus Consulting, Summit Blue Consulting, McGuire/Malcolm Pirnie, Inc., and University of California, Santa Barbara. "Risks and Benefits of Energy Management for Drinking Water Utilities." Awwa Research Foundation. 2008; National Water Research Institute. "2009 Clark Prize Lecture Highlights Technologies to Obtain Renewable Energy from Wastewater." July 10, 2008 Newsletter; Kane, Mike. "California Small Hydropower and Ocean Wave Energy Resources." California Energy Commission. April 2005; Navigant Consulting, Inc.

8.1.3 Geothermal Technologies

Technology Description: California has vast geothermal energy resources. Use of on-site geothermal resources can be grouped into two categories: direct-use and electricity generation. Direct-use geothermal includes space heating, district heating, use in a greenhouse, dehydration of vegetables, aquaculture, spas and pools, pasteurization of milk, industrial processes, and others. Depending on the site, direct-use may offset natural gas, electricity or other fuel use. The California Statewide Residential Appliance Saturation Survey gives a perspective on the types of space and water heating fuels in residences. The primary residential heating fuel in California is natural gas (77.5 percent) with electric heating at 10.7 percent. Natural gas also serves as the primary fuel for residential water heating (78.6 percent), where electric water heating is at 6.9 percent. Because the SGIP does not consider energy offsets, direct-use geothermal is not an ideal candidate for the program.

Recently, companies have developed on-site electricity generation technologies using low-temperature geothermal resources. UTC Power has developed the PureCycle geothermal technology. The PureCycle generates electricity from geothermal energy on the customer side of the meter and can utilize a low temperature geothermal resource. These units have been installed at a hot springs resort in Alaska and at a greenhouse in New Mexico.

The PureCycle Power System

Source: Pratt & Whitney

Characteristic	Description
Fuel source(s)	Geothermal energy
Commercial availability	Commercially available for both electricity generating and energy replacing technologies
Capacity size ranges	280 kW
Ability to meet current SGIP requirements	Yes
Peak demand reduction potential	High. The turbine could run at times of peak demand
Greenhouse gas reduction potential	High. No greenhouse gases are emitted in the process

Note: This map is enlarged in Figure 8-5.

Source: Idaho National Laboratory

Sources: Hansen, Teresa. "Low-temperature Geothermal Technology Expands Clean Energy Research." Utility Automation/Electric Light & Power. www.pennenergy.com; California Energy Commission. "Identifying New Opportunities for Direct-Use Geothermal Development." CEC-500-2005-108. June 2005; Innovative Technical Solutions, Inc. "Geothermal Energy Resource Assessment on Military Lands." NAWS China Lake. October 2003; California Statewide Residential Appliance Saturation Survey. Online database. websafe.kemainc.com/RASSWEB/DesktopDefault.aspx; U.S. Department of Energy. Geothermal Technologies Program. www1.eere.energy.gov/geothermal/; Idaho National Labora-

8.1.4 Internal combustion engine, Gas turbine, Microturbine, and Steam turbine

Technology Description: Internal combustion engines, gas turbines, and microturbines are mature technologies. They can operate on a range of fuels including natural gas, biogas, propane, and distilled oil. Steam turbines have historically been the primary power generation technology for large power plants. Because a steam turbine does not directly convert a fuel into electrical energy, steam must be created via a boiler or a heat recovery steam generator (HRSG). Boilers can accept many fuel types, including coal, oil, natural gas, and agricultural, forest and urban biomass. The Public Interest Energy Research (PIER) program and California Energy Commission Electricity Analysis Office have funded an Industrial Sector Combined Heat and Power Export Market Potential study (May 2009) and the Combined Heat and Power Market Assessment study (October 2009), which was an update to an Assessment of California CHP Market and Policy Options for Increased Penetration conducted in April 2005.

Internal combustion engines, gas turbines, and microturbines were previously included in the SGIP but were ineligible beginning in 2008 per AB 2778.

Characteristic	Description
Fuel source(s)	Ranges depending on technology: natural gas, biogas, propane, distilled oil, coal, oil, agricultural, forest and urban biomass
Commercial availability	Commercially available
Capacity size ranges	Internal combustion engine: few kW to several MW Gas turbine: 500 kW—250 MW Microturbine: 25 kW—250 kW Steam turbine: 50 kW—1,300 MW
Ability to meet current SGIP requirements	Yes. These technologies (except for steam turbines) have been incented under the SGIP in previous years. They are not currently eligible.
Peak demand reduction potential	High. These technologies have the ability to operate during the peak times
Greenhouse gas reduction potential	Medium. When operating in a combined heat and power configuration, these technologies have overall efficiencies up to 80%

Capstone Microturbine

Source: Capstone Turbine Corporation

Sources: Summit Blue Consulting. "Combined Heat and Power in Texas: Status, Potential, and Policies to Foster Investment." Submitted to the Public Utility Commission of Texas. December 10, 2008; U.S. Environmental Protection Agency. "Catalogue of CHP Technologies." Combined Heat and Power Partnership. 2002; Contreras, Jose Luis, David Walls, Erin Palermo, David Feliciano (Navigant Consulting, Inc.). *Advanced Generation Roadmap Background Paper, 2009.* California Energy Commission, PIER Program. CEC-500-2009-086 . Darrow, Ken, Bruce Hedman, Anne Hampson. 2009. *Industrial Sector Combined Heat and Power Export Market Potential*. California Energy Commission, PIER Program. CEC-500—2009-010; Darrow, Ken, Bruce Hedman, Anne Hampson. 2009. *Combined Heat and Power Market Assessment*. California Energy Commission, PIER Program. CEC-500-2009-094-D; Capstone Turbine Corporation. www.capstoneturbine.com (accessed November 2009).

8.1.5 Organic Rankine Cycle Engines

Technology Description: Organic rankine cycle (ORC) engines utilize waste heat from a variety of sources including industrial processes, flare gas, waste hot water, and geothermal sources. Calnetix Power Solutions offers an ORC engine with a gross power output of 125 kW. The waste heat system utilizes the organic rankine cycle (ORC) process. Another company, Ener-G-Rotors is in the process of commercializing a 50kW rankine cycle engine. Note that the PureCycle technology discussed in the Geothermal Technology section also uses the ORC process.

Characteristic	Description
Fuel source(s)	Waste heat, geothermal energy, hot water
Commercial availability	Commercially available
Capacity size ranges	125 kW
Ability to meet current SGIP requirements	Yes
Peak demand reduction potential	Medium to high
Greenhouse gas reduction potential	Medium to high. The reduction potential is highly dependent on the method used to fuel the system

Sources: Calnetix Power Solutions. www.calnetixps.com/ (accessed August 2009). Ener-G-Rotors. www.ener-g-rotors.com (accessed December 2009).

Organic Rankine Cycle Engine

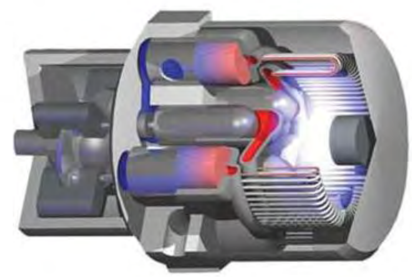
Source: Calnetix Power Solutions

8.1.6 Stirling Engines

Technology Description: A Stirling engine operates in a closed cycle configuration. A fixed amount of gas, called a working fluid (e.g., air, hydrogen, helium), remains inside a chamber while the heating and cooling sources are external to the engine. The external heat source allows for a large range of fuels for operating the Stirling engine. Stirling Biopower has a commercially available 43 kW Stirling engine, called the FleXgen. The unit currently accepts gaseous fuels, and Stirling Biopower is working on a similar unit that also accepts waste heat as a fuel. WhisperGen offers a micro-CHP Stirling engine product. The units are rated at 1kW and are designed to be grid connected. The WhisperGen uses natural gas as a fuel source.

Characteristic	Description
Fuel source(s)	Natural gas and possibly other fuels like waste heat, wood chips, geothermal energy
Commercial availability	Commercially available for gaseous fuels, in testing phases for waste heat as a fuel
Capacity size ranges	1 kW—43 kW
Ability to meet current SGIP requirements	Yes
Peak demand reduction potential	High. Stirling engines have the ability to run during peak times
Greenhouse gas reduction potential	Medium. Dependent on the fuel source

Stirling Biopower's Engine



Source: Stirling Biopower

Sources: Stirling Biopower. www.stirlingbiopower.com (accessed August 2009); WhisperGen. www.whispergen.com (accessed August 2009).

Figure 8-3. Total gross power potential of water energy resources in

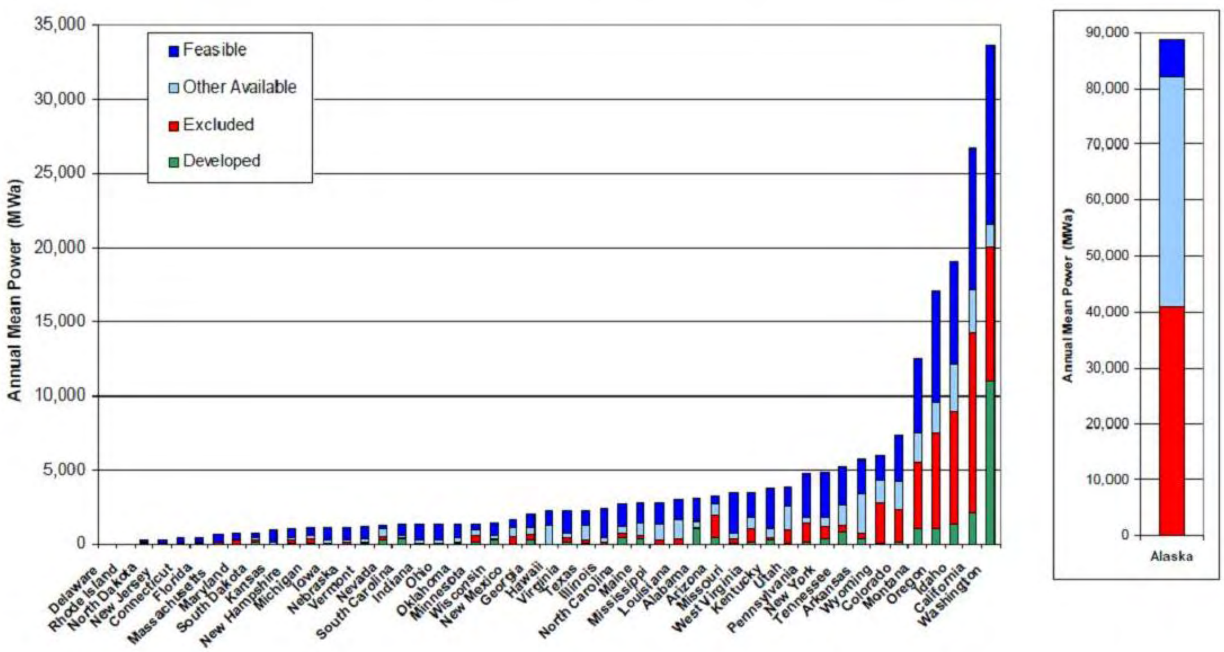
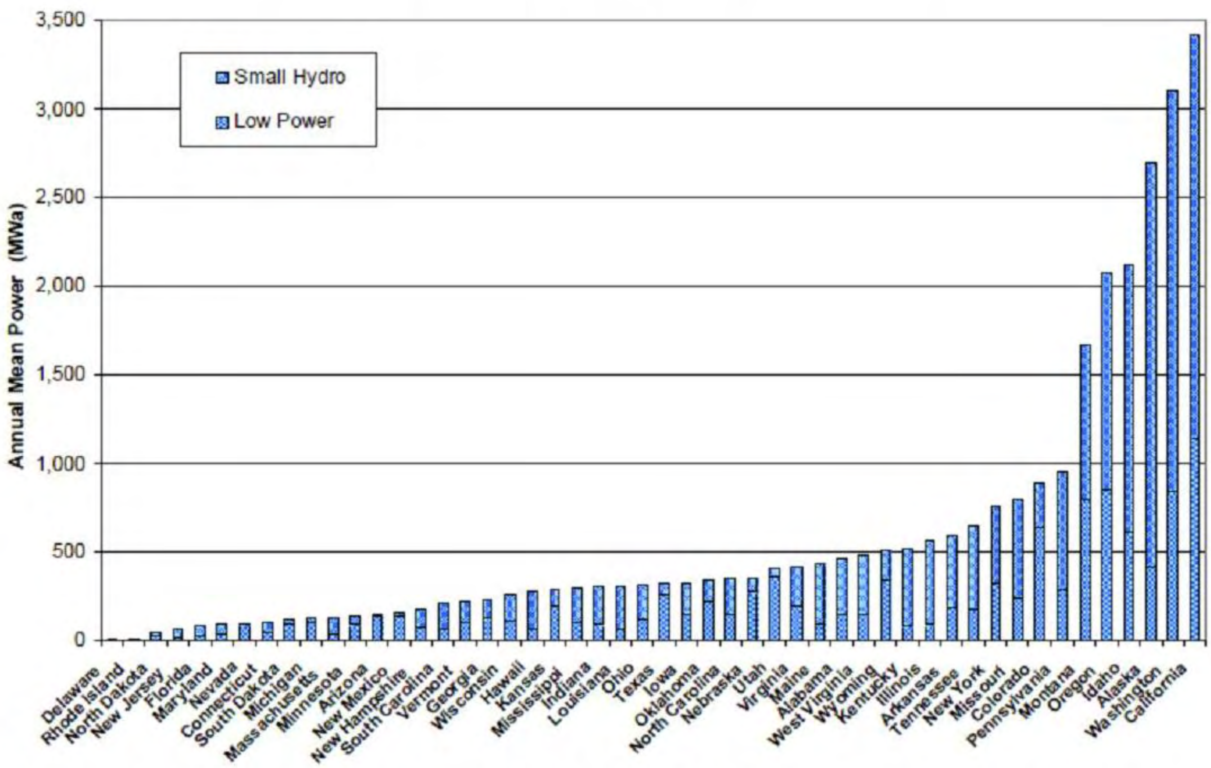


Figure 8-4. Total feasible hydropower potential in the



Source: U.S. Department of Energy. "Feasibility Assessment of the Water Energy Resources of the United States for New Low Power and Small Hydro Classes of Hydroelectric Plants." DOE-ID-11263. Office of Energy Efficiency and Renewable Energy. Completed by the Idaho National

8.1.7 Fuel Cell/Gas Turbine Hybrid

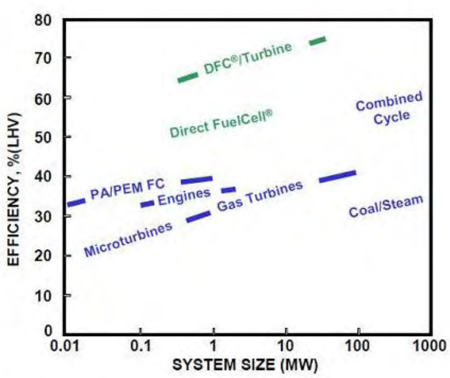
Technology Description: The fuel cell/gas turbine hybrid is an emerging technology. It combines a fuel cell with a gas turbine, resulting in electrical conversion efficiencies that exceed the simple sum of the electrical conversion of either technology alone. Electrical conversion efficiencies for this technology are approaching 70-80 percent. Companies involved in this technology include Fuel Cell Energy, Rolls Royce, GE, and Siemens/Ingersoll-Rand. Universities researching the technology include University of California-Irvine and Georgia Institute of Technology. There have been demonstrations of the technology, including in Montana and California.

Characteristic	Description
Fuel source(s)	Natural gas
Commercial availability	In demonstration phase
Capacity size ranges	Distributed power: 15 kW—50 MW Central power: 100 MW—1,000 MW
Ability to meet current SGIP requirements	Yes
Peak demand reduction potential	High
Greenhouse gas reduction potential	Medium to High. The high efficiency of the system increases the greenhouse gas reduction potential.

Fuel cell/gas turbine hybrid

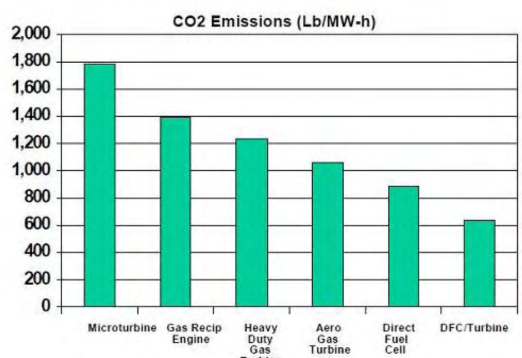
Source: Fuel Cell Energy

Power Generation Efficiency



Source: Fuel Cell Energy

CO2 Emissions by Technology



Source: Fuel Cell Energy

Sources: Summit Blue Consulting market actor interviews; Fuel Cell Energy. "Thrust Area: Hyrbrid Fuel Cell/Turbine Power Systems;" Fuel Cell Energy. "Project Fact Sheet: Direct Fuel Cell/Turbine® Power Plant;" Samuelsen, Scott. "Fuel Cell/Gas Turbine Hybrid Systems." National Fuel Cell Research Center. 2004.

8.1.8 Stand-Alone Advanced Energy Storage

Technology Description: Advanced energy storage is currently incented under the SGIP; however, to be eligible, it must be installed with a currently eligible self generation technology (wind or fuel cells). The most widespread energy storage option currently is batteries. Most PV applications use lead-acid battery technology. Battery storage technologies and non-battery storage technologies available are listed in the tables in this section. Anecdotally, there is a demand for battery storage for other distributed generation technologies not currently in the SGIP, including solar PV. Researchers at Sandia National Laboratories estimated the maximum market potential for customer/end-use applications in California to be 4,005 MW over 10 years in their 2004 "Energy Storage Benefits and Market Analysis Handbook: A Study for the DOE Energy Storage Systems Program."

Some utility companies are also considering battery powered plug-in electric cars as an energy storage mechanism. With the advent of the SmartGrid, the charge and discharge cycles could be managed to optimize the grid. These vehicles were not considered for the report.

Characteristic	Description
Fuel source(s)	Not applicable
Commercial availability	Commercially available
Capacity size ranges	10 kW—1 GW
Ability to meet current SGIP requirements	Advanced energy storage is *currently* not allowed *unless* it is combined with a wind system or a fuel cell system. The technology is currently on the customer-side of the meter
Peak demand reduction potential	High
Greenhouse gas reduction potential	Low– High. The greenhouse gas reduction potential is dependent on the source used to charge the energy storage technology and the source offset by the stored electricity. If a source with low emissions is used to charge the storage and then the stored electricity is used to offset a higher emitting source, there is potential to reduce greenhouse gases.

Sources: Ton, Dan T. et.al. "Solar Energy Grid Integration Systems- Energy Storage (SEGIS-ES)." Sandia National Laboratories. SAND2008-4247. July 2008; Eyer, James M., Joseph J. Iannucci, and Garth P. Corey. "Energy Storage Benefits and Market Analysis Handbook: A Study for the DOE Energy Storage Systems Program." Sandia National Laboratories: SAND2004-6177. December 2004. Electricity Storage Association (ESA). Www.electricitystorage.org (accessed December 2009).

Table 8-1.
Battery technologies for electric energy storage in residential and small commercial applications

Technology	Advantages	Disadvantages	Commercial Status	Current R&D	Applications
Flooded Lead-acid	Cost effective Mature technology Relatively efficient	Low energy density Cycle life depends on battery design and operational strategies when deeply discharged High maintenance Environmentally hazardous materials	Globally commercial Over $40B in all applications Estimated $1B in utility application worldwide	Focused on reducing maintenance requirements and extending operating life.	Motive power (forklifts, carts, etc.) and deep-cycling stationary applications Back-up power Short-duration power quality Short-duration peak reduction
VRLA	Cost effective Mature technology	Traditionally have not cycled well Have not met rated life expectancies	Globally commercial Over $40B in all applications Estimated $1B in utility application worldwide	Improving cycle-life and extending operating life, such as using carbon-enhanced negative electrodes.	Limited motive power applications (*e.g*, electric wheelchairs) Back-up power Short-duration power quality Short-duration peak reduction
NiCd	Good energy density Excellent power delivery Long shelf life Abuse tolerant Low maintenance	Moderately expensive "Memory Effect" Environmentally hazardous materials	Globally commercial Over $1B in all applications Over $50M in utility applications worldwide	None indentified.	Aircraft cranking, aerospace, military and commercial aircraft applications Utility grid support Stationary rail Telecommunications back-up power Low-end consumer goods
NiMH	Good energy density Low environmental impact Good cycle life	Expensive	Globally commercial for small electronics Emerging market for larger applications	Bipolar design.	EVs, HEVs Small, low-current consumer goods
Li-ion	High energy density High efficiency	High production cost Scale-up providing difficult due to safety concerns	50% of global small portable market	Batteries for use in EVs and HEVs are currently being developed.	Small consumer goods
Li-FePO4	Safer than traditional Li-ion High power density Lower cost than traditional Li-ion	Lower energy density than other Li-ion technologies	High-volume production began in 2008	Focused on improving performance and systems.	Small consumer goods and tools EVs, HEVs
Na/S	High energy density No emissions Long calendar life Long cycle life when deeply discharged Low maintenance Integrated thermal and environmental management	Relatively high cost Requires powered thermal management (heaters) Environmentally hazardous materials Rated output available only in 500-kW/600-kWh increments	Recently commercial (2002) in Japan Estimated $0.4B in utility/industrial applications worldwide	Focused on increasing manufacturing yield and reducing cost.	Utility grid-integrated renewable generation support Utility T&D system optimization Commercial/industrial peak shaving Commercial/industrial backup power
Zebra Na/NiCl	High energy density Good cycle life Tolerant of short circuits Low-cost materials	Only one manufacturer High internal resistance Molten sodium electrode High operating temperature	Globally commercial for traction applications	Focused on cost reduction and systems for stationary applications.	EVs, HEVs, and locomotives Peak shaving
Vanadium Redox	Good cycle life Good AC/AC Efficiency Low temperature/low pressure operation Low maintenance Power and energy are independently scaleable	Low energy density	Commercial production since 2007	Focused on cost reduction.	Firming capacity of renewable resources Remote area power systems Load management Peak shifting
Zinc/bromine (Zn/Br)	Low temperature/low pressure operation Low maintenance Power and energy are independently scaleable	Low energy density Requires stripping cycle Medium power density	Emerging commercial products	Focused on system integration.	Back-up power Peak shaving Firming capacity of renewable Remote area power Load management

Acronyms/Glossary

Source: Ton 2008

energy density: the amount of stored energy per unit volume (watt-hours/liter) or per unit weight (watt-hours/kilogram)
EVs: electric vehicles
HEVs: hybrid electric vehicles
memory effect: an observed effect in nickel cadmium batteries where they reduce their ability to hold charge. They lose their maximum energy capacity from repeatedly partially discharging and recharging the battery
power density: the amount of power available per unit volume (watts/liter) or per unit weight (watts/kilogram)

Table 8-2. Non-battery storage technologies for electric energy storage in residential and small commercial applications

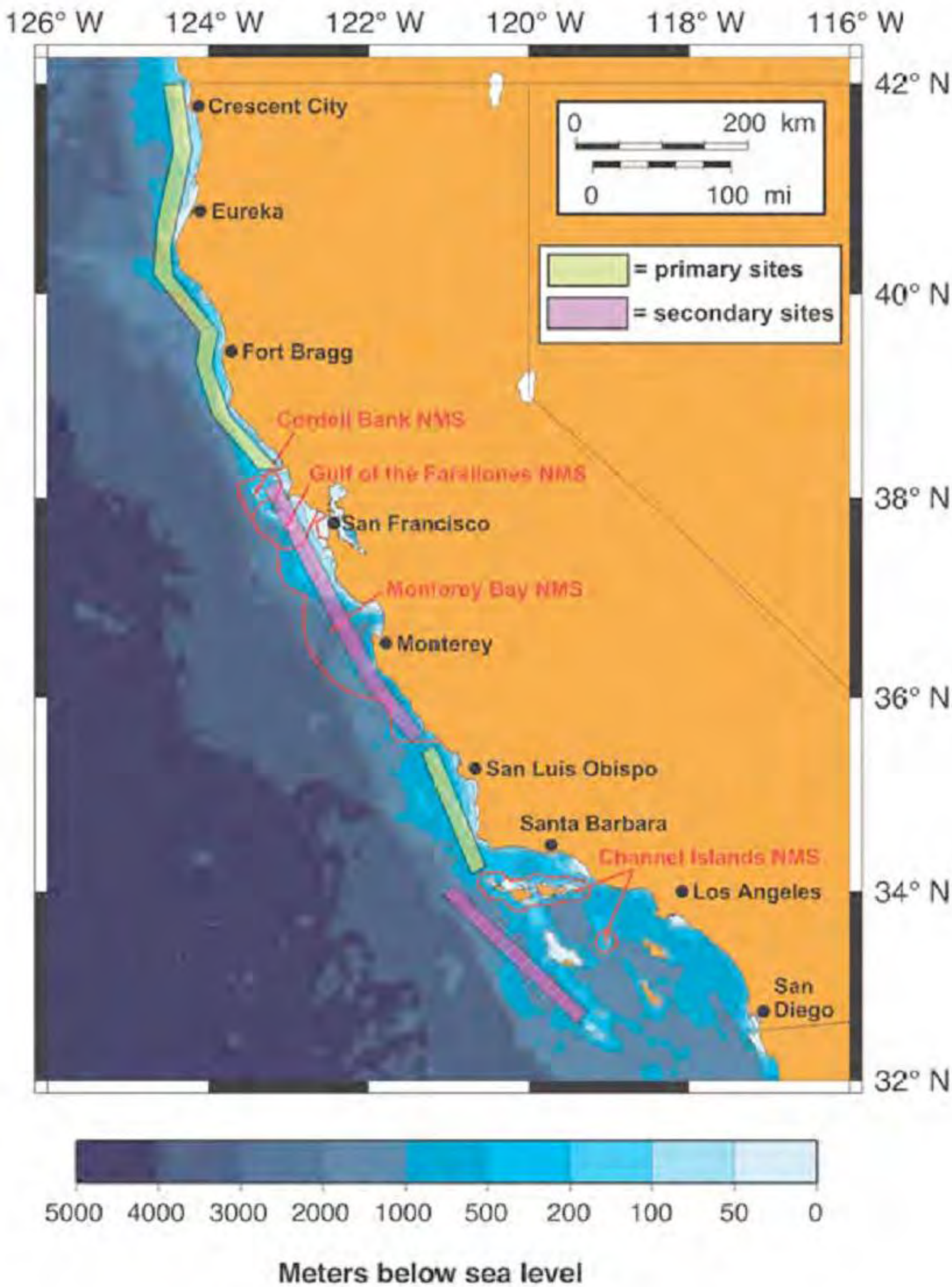
Storage Type	Advantages	Disadvantages	Commercial Status	Current R&D	Applications
Lead-carbon asymmetric capacitors (hybrid)	Rapid recharge Deep discharge High power delivery rates Long cycle life Low maintenance	Lower energy density that batteries Lower power density than other ECs	Non-commercial prototypes	Laboratory prototypes Field demonstration planned FY08 in NY.	Peak shaving Grid buffering
Electrochemical capacitors	Extremely long cycle life High power density	Low energy density Expensive	Commercialized in US, Japan, Russia, and EU, emerging elsewhere Over $30 million in all applications $5 million in utility applications by 2006	Devices with energy densities over 20 kWh/m^3 are under development.	HEVs Portable electronics Utility power quality T&D stability
Flywheels	Low maintenance Long cycle life Environmentally inert	Low energy density High cost	Commercialized in US, Japan, Russia, and EU, emerging elsewhere Projected to sell over 1,000 systems per year, estimated rated capacity of 250 MW Retail value exceeding $50 million by 2006	Focused on low cost commercial flywheel designs for long duration operation.	Utility power quality T&D stability Renewable support UPS Telecommunications

Acronyms/Glossary

energy density: the amount of stored energy per unit volume (watt-hours/liter) or per unit weight (watt-hours/kilogram)
EVs: electric vehicles
HEVs: hybrid electric vehicles
power density: the amount of power available per unit volume (watts/liter) or per unit weight (watts/kilogram)

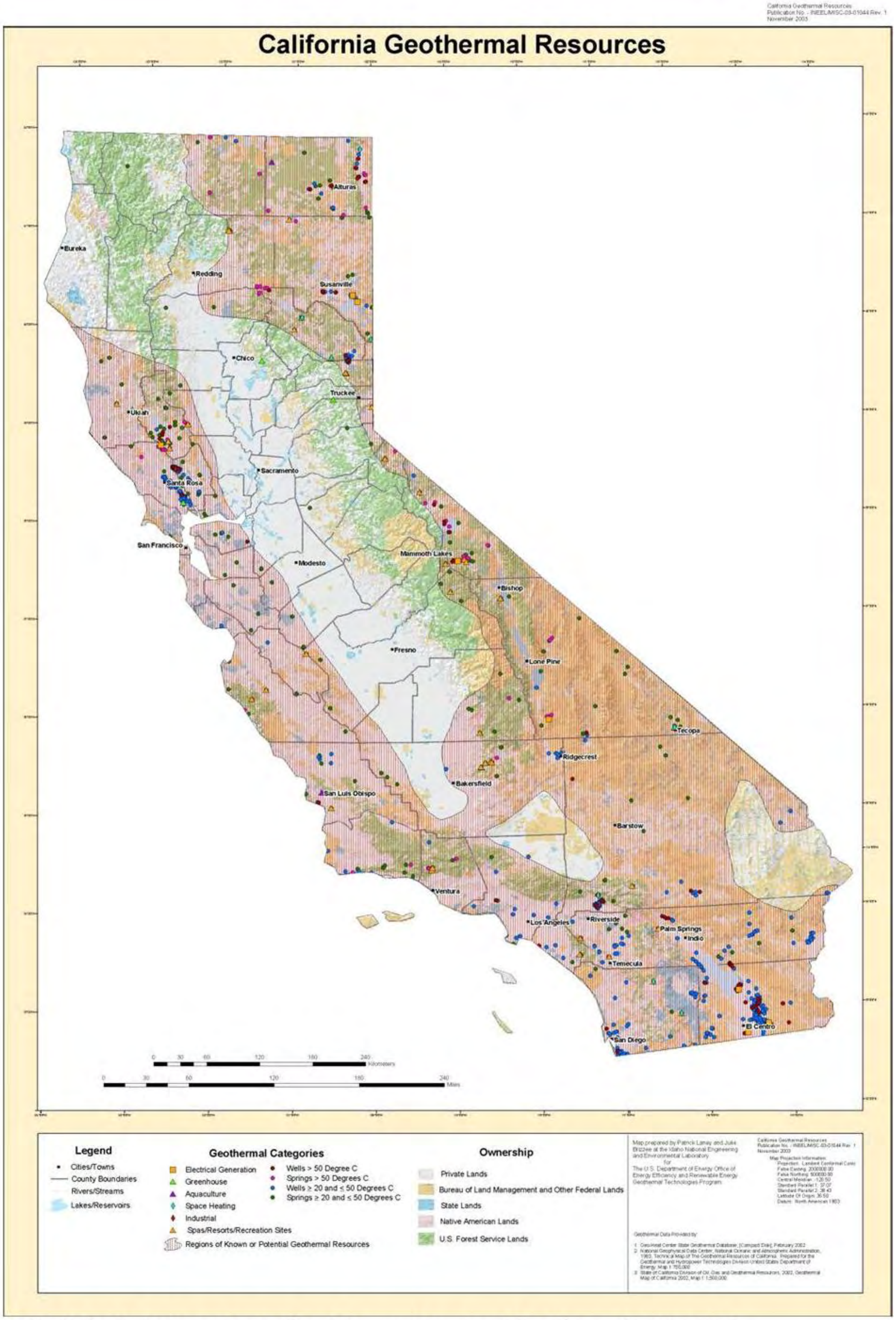
Source: Ton 2008

Figure 8-2. Geographic Distribution of Ocean Wave Resources



Source: Beyene et al. "California Ocean Wave Energy Assessment (Draft Report)."

Figure 8-5. California Geothermal Resources



Source: Idaho National Laboratory. State Geothermal Resource Maps. www.inl.gov/ (accessed October 2009).

9 CONCLUSIONS AND RECOMMENDATIONS

This section presents the conclusions and recommendations resulting from the body of investigation performed for the SGIP Market Characterization Report.

9.1 Conclusions

Over Arching

The availability of SGIP incentives is a key driver of the wind, fuel cell, and advanced energy storage projects in the 30 kW to 5 MW range California. Very few, if any, of the projects installed or in consideration would be financially viable without the SGIP incentive.

Private firms are taking advantage of the federal ITC along with the SGIP incentive for both wind and fuel cell projects. Since the federal ITC was enacted in October of 2008, wind developers have been able to propose more financially feasible projects.

Discussions with project developers and programs in other states indicate that project activity is driven by the industry, not by program marketing.

Strong industry associations are important for developing the market. These associations can effectively lobby on behalf of their members for changes at the state, local government, and utility level.

Key support industries, such as maintenance contractors, are lacking in California. A supportive market and regulatory environment will encourage the entry of more firms into the California wind, fuel cell and advanced energy storage marketplace. This will result in better access to support services which will drive down costs and reduce uncertainty.

Many factors can increase project costs or completely undermine projects during the development phase. This is especially true of first entrants into a region. Inconsistent or non-existent local permitting codes, environmental concerns, and other siting issues are barriers for wind projects. Fuel cell developers have had to educate fire marshals and building departments on the fuel cell technology.

Socio-Economic Factors

The current state of the economy has had a negative impact on the development of self-generation projects.

Participants require that self-generation projects make economic sense in order to implement. Some projects, especially those with international firms, also support corporate sustainability goals. However, there is general consensus that a strong projects' champion is required to support the projects.

Price Signals

Fuel cells do not have the ability to cycle on and off easily but are designed to operate continuously. Wind projects are dependent on the availability of wind in order to generate. Therefore, customers installing these technologies are not able to take advantage of price signals.

When a customer is subject to demand charges, combustion technologies and advanced energy storage systems are being used to shave peak demand. However, the difference between peak and off-peak energy charges alone does not provide a sufficient economic motivator for projects to engage in load shifting.

Incentives

Raising the incentive cap from 1 MW to 3 MW has resulted in a number of larger projects to be developed that otherwise would not have been financially viable.

Financing agents view wind, fuel cells, and advanced energy storage as risky, making obtaining financing difficult in many cases. Moving to a performance-based incentive structure would increase this uncertainty because the upfront cash payment would be removed and the timing and amount of future payments would be uncertain.

Because of the difficulty in securing project financing, a change to a performance-based incentive structure will likely result in fewer projects. However, these projects will likely have better capacity factors because better system design will be required to develop the economic model.

Other States' Programs

In other states' wind and fuel cell incentive programs, setting good research-based targets is correlated with program success.

Active trade associations foster the development of favorable market conditions.

Offering incentives for pre-development and feasibility studies can help promote development.

Wind

For wind projects, conducting the necessary wind studies and modeling to accurately estimate future energy production adds to the already high project costs. Small projects generally cannot carry these additional costs and are not good candidates for performance-based incentives and power purchase agreements where it is necessary to accurately estimate system performance.

Many wind barriers can be overcome through the efforts of a strong industry association. These include standardizing inconsistent local building regulations across the state, representing industry concerns over interconnection procedures and requirements, and lobbying for increases in NEM caps and improvements to feed-in tariff terms.

Other wind barriers, such as the high cost for maintenance service, can be overcome through the development of a strong network of third-party providers.

There is some confusion in the market surrounding the SGIP and the ERP. Wind market actors were under the misimpression that wind turbines had to be certified through the CEC in order to be eligible for an SGIP incentive. The overlapping size limits between the SGIP and CEE do not conform to common industry convention which defines small wind projects at those 100 kW and below.

Fuel Cells

The most significant barrier to the development of fuel cell projects is the high cost of the units.

The feed-in tariff is a tool to overcome many barriers for fuel cells—one being the need for the fuel cell to run continuously. The markets for continuous operation are defined, e.g., wastewater treatment plants, hospitals, hotels. However, there are other businesses that could use a fuel cell, but do not have the 24x7 demand. A feed-in tariff would overcome this barrier by allowing the business to sell the excess electricity when it is not needed.

Because of the gas treatment equipment, renewable fueled projects have higher project costs than non-renewable fuel systems. However, there is an additional economic benefit when customers can reduce the cost of disposing of the waste fuel.

Many barriers to the adoption of fuel cells can be addressed through the efforts of a strong industry association. These include educating building departments and fire marshals on the fuel cell technology, representing industry concerns over interconnection procedures and requirements, and lobbying for increases in NEM caps and improvements to feed-in tariff terms.

Most wind and fuel cell projects already have monitoring equipment installed.

Advanced Energy Storage

Lack of familiarity with the advanced energy storage technology is seen at the primary barrier. Other barriers are the lack of a federal tax credit and quality modeling tools. Market actors have also expressed concerns over the availability of SGIP incentive funds because there is not a separate advanced energy storage "bucket."

Many barriers to the adoption of advanced energy storage technology can be addressed through the efforts of a strong industry association. These include development of a streamlined, state-wide permitting process, establishing reasonable interconnection requirements for energy storage and setting interconnection fees set on a sliding scale based on the size of the system.

9.2 Recommendations

This section presents recommendations that the SGIP PAs and Working Group can pursue to support the advancement of SGIP technologies within the market.

Provide a forum for addressing interconnection issues. Although not the biggest barrier to wind, fuel cell, AES, and CHP projects, the interconnection process and requirements are an issue. Addressing interconnection issues could shorten project timelines and reduce project costs associated with complying with interconnection requirements. Some of the objectives of this forum would be to:

- Revisit interconnection requirements such as redundant disconnect switches to determine whether they are appropriate to each technology type;
- Develop a streamlined process appropriate to smaller scale wind, fuel cells, and advanced energy storage; and
- Consider scaling requirements and fees based on system size.

The CPUC recently formed the Renewable Distributed Energy Collaborative (Re-DEC) to identify and address challenges faced by utility grid operators and renewable distributed generation project developers as increasing volumes of projects interconnect to the grid. The Re-DEC is a working group comprised of utility grid operators, renewable distributed generation project developers and technology experts.[141] Industry associations, project developers and other market actors should actively participate in the Re-DEC to represent their interests.

Provide funding for pre-development and feasibility studies for wind, fuel cell, and advanced energy storage projects**.** This will reduce the development risk and should encourage more entities to move ahead with exploring development opportunities.

Complete a potential study for SGIP technologies and create reasonable targets based on that potential. Although it won't directly result in additional SGIP projects, setting targets sends a signal to the industry regarding the level of commitment from the state to support the industry. Targets also provide an important benchmark for measuring program progress. Targets can take many forms, such as the percent penetration into a particular market sector. Any targets set must be achievable within the SGIP budgets.

Maintain capacity-based incentive structure but add safeguards to support long-term system performance. Maintaining capacity-based incentives will provide the upfront funds needed to make each project attractive to both financiers and customers while additional program requirements will support long-term system performance. Under this dual approach, the program should not see a drop in applications that might result from a performance-based incentives structure. The following program requirements should be added:

- Require five year warranty and maintenance contracts.[142] Warranties should include both scheduled and unscheduled maintenance and protect the customer against defects, failures, breakdowns, or excessive degradation of electrical output;
- Require the installation of monitoring equipment with an interface that is readily accessible and easily understood by the system owner; and
- Require gas purchase agreements for non-renewable fuel cells and combustion technologies (if these technologies are added back into the program.)

Warranty and maintenance contracts and the installation of monitoring equipment are already common practice by many developers and should increase project costs.

Provide audience-specific education and training on wind, fuel cell, and advanced energy storage technologies:

- Run education programs targeted at customers and the community to overcome barriers to awareness and acceptance of technologies. This training should provide general information on the technologies presented in layman's terms and include examples of successful installations in the community;
- Provide training to project developers on the program and its requirements to facilitate their participation as well as training on various topics, such as overcoming siting and permitting barriers for wind projects, to support the industry, reduce project barriers, and improve the quality of the projects. These trainings can provide in-depth information and technical concepts appropriate to project developers; and

[141] CPUC Renewable Distributed Energy Collaborative. http://www.cpuc.ca.gov/PUC/energy/Renewabes/Re-DEC.htm

[142] The SGIP currently requires a five year warranty, but does not require a maintenance contract.

- Provide ongoing classes to architects on integrating fuel cells into a building's design. These classes should provide AIA credits for continuing education.

Educational programs can help increase program participation by increasing the public's awareness of wind, fuel cells, and AES and reducing the misconceptions about technology performance. In addition, when offered by the PAs, training and education programs add legitimacy to the technologies. Programs offered to developers and architects that address common barriers help to streamline the project development process and reduce costs. All education programs should be regularly monitored for attendance and effectiveness.

Develop tools that assist with the development of wind, fuel cell, and advanced energy storage projects. Specifically, the SGIP should initiate the development of:

- A tool to better model the match between the thermal and electrical loads of the host site and the output of fuel cells; and
- An energy storage modeling tool specific to the California market.

Providing better modeling tools will result in better designed and better performing projects.

Consider realigning the markets under the SGIP and the CEC's ERP to resolve the inconsistency between the way the wind industry defines small wind projects and SGIP and ERP size limits and to reduce the confusion in the market place over program requirements. However, any changes would need to be considered in the context of each program's authority and objectives, funding mechanism and budget, and oversight authority. Furthermore, the benefits of making any changes to either program's eligibility or requirements would need to be weighed against the potential for confusion and frustration on the part of the market actors.

Consider integrating energy efficiency requirements into the SGIP. California's Energy Action Plan identifies energy efficiency as the resource of first choice for meeting California's energy needs. The SGIP can support the Energy Action Plan by requiring that facilities receive an energy efficiency audit prior to receiving an SGIP incentive, similar to the requirement in the California Solar Initiative program.[143]

Although incorporating an energy efficiency requirement would support California's policy objectives, it is not likely to result in any additional projects and instead might hinder program participation by creating additional hurdle for project developers to overcome. The effectiveness of the California Solar Initiative's energy efficiency requirement should be assessed before creating a requirement in the SGIP.

[143] The California Solar Initiative requires an energy efficiency audit as the first step in the application process. Online audit forms are available from the program administrators: CCSE, PG&E and SCE.

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APPENDIX 2: SURVEY AND INTERVIEW GUIDES

A.2.1 Program Administrator Interviews

SGIP Program M&E

Program Administrator Interviews

Interview Guide (FINAL 7/20/09)

Interview Date:

General introductory script

Acknowledge past evaluation interviews and related interactions/information provisioning. State that this interview will focus on issues associated with fulfilling the following key research objectives and prospective program improvements related to them:

1. Update the 2007 process evaluation and market characterization work, focusing on market barriers and PA program marketing;
2. Document factors associated with program and project successes and failures and how to address those to improve program and project success in the future; and
3. Identify potential new technologies to add to the program and how they could support the SGIP.

A. Background and Program Experience Since 2007 (previous evaluation)

1. What is your own history with the SGIP effort – please describe your role, tenure, and location.

Interviewee Name:

Interviewee Title:

Interviewee Organization and Dept.:

Interviewee's primary program role:

Interviewee's start date with SGIP PA office/length of tenure in SGIP PA role:

(If interview done with other staff):

Other Interviewee Name/Title/Role/Tenure:

Other Interviewee Name/Title/Role/Tenure:

Other Interviewee Name/Title/Role/Tenure:

2. Is there anyone else who supports the program who is not here? Include marketing department and account executives? Where are they located?

3. Since 2007, briefly summarize how your organization and its approach to the SGIP has evolved in relation to the changes in the program and general market conditions?

4. The SGIP's technology eligibility changes have been a critical factor affecting SGIP's operation. Aside from that and considering the markets and technologies currently eligible for SGIP, briefly summarize in your view what have been the key market, technology and programmatic issues (including changes) in the last two years that most strongly affect SGIP's performance?

    a. Markets:

        1) Host customers

        2) Self-gen trades

        3) Technology

    b. Program:

        1) Program structure/design

        2) PA organization/management

        3) Administration

        4) Regulatory/legislative oversight

B. Program Design

Eligibility

5. What has the change in technology eligibility meant to your organization as a PA, in particular your effectiveness in meeting program goals? *[Re: cogeneration and non-renewable techs not being eligible after 2007, and the advent of the CSI]*

6. Are there other eligibility requirements that cause concerns or constrain the potential within the market, and, if so, what are those concerns?

CSI

7. What effect has the CSI had on the SGIP relative to the following…

    a. Your organization and staffing?

    b. Program budgets and goals?

    c. Program operations?

    d. What about the longer term, beyond next year?

8. Are people more aware of the SGIP because the CSI is so “publicized”? Or has it overshadowed the SGIP?

9. Landfill gas – is lack of on-site load still a problem preventing such projects?

10. What other technologies should be included in SGIP either currently available or on the horizon?

    a. Would the program rules or requirements need to change to accommodate them? (size restrictions, warranty requirements, etc.)

Incentive Structure

11. What has been the effect of the increased size cap for incentives (from 1 MW to 3 MW) on the number of SGIP projects?

    a. The type of project?

    b. The number of projects?

    c. The average size of project?

    d. Are you aware of projects initiated or built in 2008-09 that, because of the previous incentive cap, would not have otherwise?

    e. Do you think reducing the current 3 MW incentive cap back to 1 MW in 2010 will limit applications in the future? To what extent?

    f. What other issues related to size and change in the incentive’s size cap are important to understand?

12. Aside from the increased size cap, have $ levels for currently eligible technologies been high enough?

    a. Do they need to be increased? e.g., higher % of first cost covered by incentives.

    b. How would an increase change the number and kW size of projects participating in the program?

13. Have you received or paid an application that included an additional 20% incentive because the technology was from a California supplier?

    a. How many?

    b. Did you have trouble determining the eligibility of the technology?

    c. Are there other problems with this additional incentive?

    d. What’s the purpose? Reward the existing CA manufacturers or draw manufacturers into CA?

14. [ASK SCE & PG&E] Do you interact with your tariffs department:

    a. To develop or modify tariffs to better support the SGIP?

b. To advise on the best, DG-friendly tariff for program participants?

c. To provide advice to SGIP applicants as to tariff options that could support SGIP project development?

15. [ASK CCES & So Cal Gas] Do you interact with the utility tariffs department:

    a. To develop or modify tariffs to better support the SGIP?

    b. To advise on the best, DG-friendly tariff for program participants?

    c. To provide advice to SGIP applicants as to tariff options that could support SGIP project development?

16. What pros and cons do you see for up-front, sized-based incentives versus some form of downstream performance-based incentive?

    a. Please discuss for wind and fuel cells.

    b. Are developers and host customers warming to the concept of performance-based incentives? [Is the market of self-generation providers becoming less dependent on incentives?] Why or why not?

17. What other concerns or successes have there been regarding incentives, including disbursement and related administration processes?

Application process, including fees

18. Has the application process been a significant barrier to participation and, if so, how?

19. Have you had the need for a waiting list (recently/since PV went to CSI)?

    a. Are there concerns regarding the wait list process?

20. Have you had any projects that needed an application fee (since the change was made/since PV went to CSI)?

    a. Do you think it's been effective at achieving its purpose?

21. Has there been any integration of the program application process with the interconnection application process?

22. Are there other important issues concerning the application process that your organization has encountered?

    a. How have you handled those?

    b. Are these unique to your situation or have you seen them crop up with other PAs?

23. For solar, cogeneration and non-renewable tech projects started prior to CSI and SGIP eligibility changes (solar to CSI, cogeneration and non-renewable techs disqualified), have there been notable problems in getting those projects completed? What have those been?

Project verification and quality assurance process

24. Is there anything unique about your verification requirements that has helped your process be particularly efficient?

25. What percent of projects don't pass the verification on the first inspection?

    a. For which reasons?

    b. What usually is needed to remedy?

26. What other verification or quality assurance process issues have you encountered?

    a. Are these unique to your PA situation and market?

    b. How have you addressed those issues?

27. What could be done to improve the verification process?

Grid interconnection

28. What technical requirements have been problematic? How has your organization handled those problems? Any change in the last two years (for better or worse)?

29. Have you assisted applicants in meeting IC requirements? If so, how would you rate these efforts? Successful, partially successful, unsuccessful? *[Ask for specifics of what they have done, if anything.]*

30. What concerns do you have regarding overlapping interconnection verification requirements with other project verification requirements?

    a. How has your organization handled those concerns?

    b. Any change in the last two years (for better or worse)?

31. What other grid-related issues have been problematic? How have those been resolved by your organization? Any change in the last two years (for better or worse)? *Probe per last evaluation:*

    a. Interconnection process: consistency, gaps and overlaps (e.g., inspection overlaps)

    b. Disconnect switch confusion/redundancy

    c. Inter- and intra company coordination

    d. Sufficient budget for IC process

    e. IC agreements

32. *[ASK PG&E & SCE]* What interactions have you had with your internal interconnection department in resolving SGIP applicant interconnection issues in the last two years? How has this relationship evolved over the last two years? *[Ask for specifics of what they have done.]*

33. *[ASK CCSE & SoCalGas]* How have you worked with the local electric utility's interconnection office to resolve interconnection issues for SGIP applicants? How has this relationship evolved over the last two years? *[Ask for specifics of what they have done.]*

System Performance

34. Let's discuss system performance, including failures and removals. What factors do you see affecting system capacity factor performance?

    a. What are the primary reasons for systems failing?

    b. What are the primary factors affecting systems' capacity factors? (Pertains to evidence that capacity factors are declining)

    c. Are you aware of specific sites where systems are known to have been removed or the system shut down? What are the primary reasons for removals or shutdowns? What might be done to reduce those instances?

35. Do you think metering or monitoring should be required on any/all projects? Which ones?

    a. What would the requirement be? What access would the program have to the output?

    b. What do you think the additional cost would be?

    c. What would the benefits be? To whom?

36. Are there any other changes to the overall program design that are planned for the future years of the program that you think need to be considered?

C. Organization, Cost Drivers and Management

Staffing

37. Has there been a change in program staffing? Did previous SGIP staff migrate to the CSI? Were they replaced?

38. Do you have enough people to effectively administer the program? Why not?

39. Are there functions/departments where closer coordination would be helpful (e.g., legal, interconnection)?

Budget

40. We've noticed a difference in the way administrative and marketing costs are allocated in your budget.

    a. What prompted this change?

b. Are more changes/flexibility needed?

41. How do you allocate your budget amongst labor, marketing and outreach, and administration?

42. What would you do with the money if the budget were to increase? Where would you take it from if the budget were decreased?

43. *[For SDG&E and CCSE…]* How do you split the SGIP budget between SDG&E and CCSE?

    a. To what extent has there been budget duplication to handle overlapping program functions (i.e., project reviews, field support) between CCSE and SDG&E?

    b. How have you coordinated with [SDG&E, CCSE] to minimize your combined costs?

    c. What concerns do you have regarding any duplication of functions and costs between the two organizations?

Cost Drivers

44. What factors make program costs most volatile, that most affect administrative cost/project or cost/kW?

45. How does your organization manage controllable cost drivers to ensure you stay within the program budget?

D. Program Operations

Marketing and Outreach

46. Review materials and plans provided and discuss for each:

    a. Do you think they've been effective/successful?

    b. Are these strategies unique to your organization?

47. Are there marketing and outreach strategies or tactics you would like to use, but have not used to promote the program?

    a. Why have you not yet tried those strategies or tactics?

    b. What other resources would you need to implement these?

48. How has your organization used electric utility account representatives or others in any of the utilities to market/promote the SGIP program? *[Request details on what was done and what worked/didn't work if preceding question is answered positively.]*

49. *[If not mentioned yet]* In what ways do you target particular market segments of project developers, host customers or others in your marketing and outreach efforts?

    a. How successful has this been?

b. Which market segments have been most responsive? Least responsive?

c. Areas for improvement?

50. In what ways do you target particular technologies in your marketing efforts?

    a. How successful has this been?

    b. Areas for improvement?

51. Are you aware of the CPUC's integrated marketing vision?

    a. Does your current marketing strategy support this vision?

    b. What changes could you make to support this vision?

Technical and Program Support

52. What support do you provide to help projects through the program process? (Technical, application process, or training?)

    a. To customers?

    b. To developers?

53. What problems have arisen in your organization's efforts in providing technical or program support to developers and host customers?

    a. How has your organization handled those problems?

    b. Are there particular successes your organization has had in overcoming technical support problems?

Project Developers and Installers

54. What are the most important characteristics of good project developers/installers? What are the most important characteristics of poor developers/installers?

55. What are the key lessons you have learned in dealing with developers and installers?

Administrative Operations

56. What changes have been made to the project advancement requirements or milestones in the last two years?

    a. Why were these changes made?

    b. Have the changes been successful?

57. What current issues do you see concerning project advancement requirements?

    a. Do you see any differences by customer type? State or local government, non-profit, private?

58. Roughly, what fraction of project applications in the last two years have not been completed within their required advancement requirements?

    a. What fraction of those incomplete projects were withdrawn but then re-started as "new" projects subsequently? Why are those being withdrawn?

    b. What fraction have been suspended while various requirements are being satisfied? Why are those being suspended?

    c. Of the projects being rejected, what are the reasons for their being rejected?

    d. *[If not already mentioned]* Are requests for extensions to advancement requirements increasing or decreasing, and to what do you attribute that trend?

        1) *[If increasing numbers of extensions]* What concerns do you have about this trend, and what actions is your organization taking to address the situation?

59. What unique approaches does your organization employ to minimize projects being withdrawn, suspended or rejected? What makes those approaches effective?

60. For projects in your PA territory, what project milestones have been the most problematic for developers and host customers to meet?

    a. In what ways has your organization worked to successfully overcome those milestone difficulties?

    b. Are there intractable difficulties in the project development process that have prevented timely completion of projects? What are those and why do they seem intractable?

61. What difficulties have you had with the incentive disbursement process?

    a. What has your organization done, that's unique, to improve the incentive disbursement process? Why has that been more effective than other solutions?

62. What concerns have you had to address regarding program participation tracking and reporting (including Statewide Program Compliance database to avoid inter-program/utility incentive overlapping, and actions to prevent incentive overlaps)?

    a. What has your organization done, that's unique, to improve the tracking and reporting process?

    b. Why has that been more effective than other solutions?

Program Modification Guidelines

63. How many program modification requests have you received since the most recent changes? From whom and for what? What was the outcome?

    a. Does the process work well for the PAs? (either the old or new)

    b. What are the shortcomings?

c. What works well?

d. What can be improved?

64. How has the PMG process worked for the various market actors, in your opinion? (either the old or new)

    a. Are most aware of the opportunity/process?

65. Has the current definition of Advanced Energy Storage prevented other vendor systems besides VRB from qualifying for the program?

    a. What aspects of the definition are problematic?

    b. What manufacturer(s)?

E. Regulatory and Legislative Oversight

Let's discuss federal, state, and local policies that could affect the market for and availability and acceptance of any of the SGIP technologies in CA.

Feed-inTariffs

66. How are the two feed-in-tariffs (at PG&E it's schedule E-PWF for W&WW facilities and e-SRG for small generators) effecting the SGIP participation:

    a. Are you aware that customers are opting for these FiTs rather than the SGIP?

    b. How many/often? Specific customers?

Permitting and Siting

67. Are you aware of any city and county zoning ordinances or building construction regulations (building codes, construction and operating permits, etc.) within CA that make projects difficult to install?

    a. How many/often? What circumstance?

    b. What jurisdictions?

    c. Were these barriers overcome? How?

    d. Did the PAs have a role in the solution? What can the PAs do in the future to overcome?

    e. Have you heard about solutions outside of your territory or CA?

68. Are you aware of any homeowner association CC&Rs within CA that make projects difficult to install?

    a. How many/often? What circumstances?

b. Where?

c. Were these barriers overcome? How?

d. Did the PAs have a role in the solution? What can the PAs do in the future to overcome?

e. Have you heard about solutions outside of your territory or CA?

Emissions (Fuel Cell and CHP only)

69. Do fuel cells have to meet local permitting requirements or do you have to use CARB-certified fuel cells?

70. Are you aware of issues that applicants have had applicants in meeting local air quality regulations?

    a. How many/how often? What circumstances?

    b. What regulations?

    c. Were these barriers overcome? How?

    d. Did the PAs have a role in the solution? What can the PAs do in the future to overcome?

    e. Have you heard about solutions outside of your territory or CA?

71. Do you have any particular concerns regarding various aspects of CPUC oversight in terms of program design or rule changes [Per last evaluation, CPUC oversight/decision process seen as being a constraint on market and program dynamics (e.g., calendar-year cycle stacks program changes with many other year-end regulatory requirements, yet project schedules don't run on a calendar-year basis.]

Other Functions

72. Do you have any comments on other program functions we haven't discussed that you'd like to offer? (Such as project tracking requirements and how this function has evolved over time.)

F. Other Issues

73. What have you seen as being the most significant barriers to technology adoption?

74. What are the most significant barriers to program participation? (If different than above)

Program Goals

75. Should the SGIP have annual goals or targets?

    a. If so, what would the structure be? Capacity? # of applicants?

    b. One what would the goals be based?

    c. Who should be responsible for setting these goals?

76. What technology trends – costs and availability, including sales and service – do you see over the next several years that could significantly affect the SGIP as it is currently designed and for the technologies it addresses?

[Ask CCSE] – Follow-up to the last evaluation's finding that the organization's identity was being misperceived] In the last two years, how has the perception of the CCSE evolved – are there still misperceptions regarding association with SGG&E or a government agency? Other identity concerns?

77. Are you aware of other similar programs for wind and fuel cells outside of CA? Which ones?

G. Lessons Learned & Conclusion

78. What is your view of whether the SGIP has significantly transformed the energy services market for wind and fuel cells?

    a. For example, has the number and capabilities of energy services companies increased, and are energy service companies who develop SGIP-types of projects becoming less reliant on the program for such projects?

79. In closing, what are the key lessons learned for your in the program, that you think ought to be considered in future program developments?

    a. In particular, are there aspects of your organization and its approach to administering the program that you feel have been uniquely effective in influencing program awareness and participation, and also cost-effectiveness?

    b. Are there particular barriers to applying on a statewide basis any such unique approaches to program administration your organization has employed?

80. Any other last thoughts?

A.2.2 CEC and CPUC Staff Interviews

SGIP Program M&E

CEC/CPUC Staff Interviews

Interview Guide (8/6/2009 FINAL)

Interview Date:

Primary Interviewee Name:

Primary Interviewee Title:

Primary Interviewee Organization and Dept.:

Primary Interviewee's primary program role:

Other CEC or CPUC staff:

Other Interviewee Name/Title/Role:

Other Interviewee Name/Title/Role:

Other Interviewee Name/Title/Role:

Introduction/Background

The interview will take 30 minutes to 1 hour.

The purpose of this interview is to identify the issues, concerns and opportunities CEC/CPUC staff think are important for the SGIP, particularly since 2007. From their perspective as regulatory staff, what has been effective about the program and what hasn't been effective, considering all the dimensions of the program including the various markets the program is trying to influence, the program's design, its operation by the various PAs, how well the regulatory process has worked in overseeing the program and other matters that CEC/CPUC staff think are important to address as the program evolves in relation to other DSM program developments in California. [Note: if same staff interviewed in 2007 evaluation, review the notes from that interview prior to the current interview. Acknowledge previous interview and advise the interviewee to focus on program issues from the regulatory perspective that have been most important in the last two years.]

1. Please describe your history as CEC/CPUC staff with the SGIP:

a. How long have you been assigned to handle it?

b. What's been your role on the Working Group?

c.What has been your level of participation with the Working Group?

d. How well did you develop your knowledge of the program and all the market actors involved, such that you can do your oversight job effectively? (on a 1-5 scale, 1=Not well at all…5=Extremely well)

[CEC only] What is your involvement with the ERP?

How is it going? What has been the volume of applications?

2. Are there any tools or additional information that would help you as a regulator involved with the program?

3. <u>Program Design and PA's Program Planning.</u> In light of your experience with the SGIP, please provide your perspective on the following aspects of the <u>program's design and the various PA's planning to implement</u> it. Specifically consider what strengths and weaknesses do you see that are <u>critical</u> to the program's success or failure, and also, what you think would be appropriate <u>changes</u> that would either improve the program itself in various ways, or improve your effectiveness as regulatory staff?

3.a. <u>Eligibility</u>

What effects has the CSI had on SGIP, aside from the obvious shift of PV technology to CSI? Will there be further changes to the CSI in the next two years, and what will those do to the SGIP?

What strengths, weaknesses and potentially positive changes in eligibility rules have you seen in the last two years?

a) What do you see going forward?

Are there particular eligibility rules that currently are of concern to you as a regulatory staff person, such as project sizing constraints, technology categorizations, etc? What are those and why are they a concern? What resolution do you see that would mitigate the concern?

Are you aware of other technologies that should be included in the SGIP?

3.b. Incentive Structure

In what ways do you think the incentive structure of the program has affected the program's achievements, either positively or negatively, and why do you think that?

Specifically, please discuss your thoughts on the effect of the increased size cap on system rebates, including the partial incentive structure after 1 MW?

Are there any aspects about the program's incentive structure that present problems or have been particularly successful?

What incentive developments would make for more efficient regulatory oversight?

Do you think the SGIP should move to a performance-based incentive structure?

Why or why not?

Would this result in changes to the type or number of projects applying to the program?

On a related matter, do you have a sense as to how has project financing being available (or not) affected SGIP participation?

3.c. Application Process

What, if any, difficulties with the program's application process have you noted from your perspective as a regulatory staff person – does the application process present any major barriers to prospective project developers and customers?

Have you had to deal much with the application process of any of the PAs, in terms of handling complaints or procedural problems that get escalated to the CPUC? If so, has handling those situations been a major or a minor regulatory concern?

3.d. Verification and Quality Assurance

What, if any, difficulties with the program's verification process have you noted from your perspective as a regulatory staff person – does the verification process present any major barriers to project developers and customers?

Has the CPUC had to become involved with any particularly difficult cases where verification was problematic and customers, developers or PAs were at significant odds regarding the procedures or outcome of the verification process? If so, what resolution was achieved and what insights for the future might be gained from the experience?

3.e. Grid Interconnection

What grid interconnection issues have you had to deal with for SGIP projects, and how have those been addressed?

What outstanding interconnection issues are there that still need to be addressed from your regulatory perspective in order to further streamline the program or otherwise help it be more successful?

Are there regulatory overlaps regarding interconnection that you think need to be addressed and, if so, where do those exist and what do you think should be done to address them?

3.f. Developer and Host Customer Relations

As regulatory staff, are you noting any particular PA, developer or host customer relations issues that need to be addressed? What are those and what thoughts do you have about resolving those?

From a regulatory perspective, what are the traits of the better PAs? And those of the better developers and installers?

3.h. PA Staffing

Do you think PAs have staffed the program effectively, or are there areas where you think any of them could improve their staffing – whether organizationally or in professional and technical skills?

3 i. Program Goals

What are the program goals of the SGIP?

Do you think these need to be changed? What should they be?

Should the PAs be given a performance goal for the SGIP?

How would this be structured?

What should be the implications of meeting or not meeting the goal?

4. Program Implementation. Next, let's discuss the program's implementation: PA's marketing and outreach efforts, and their administration of the program. Again in light of your experience with the SGIP, please provide your perspective on those aspects of the program. As with the design and planning discussion, tell me two things about your perspective on the program's implementation: first, what strengths and weaknesses do you see that are critical to the program's success or failure, and second, what you think would be appropriate changes that would either improve the program itself in various ways, or improve your effectiveness as regulatory staff overseeing the program's implementation?

4.a. PA Marketing and Outreach

Do you think the PAs are effectively marketing the SGIP?

Do you think it's the PA's role to actively market the SGIP?

What marketing and outreach strategies either are not being utilized that should be, or are being used that should be changed or stopped? Why is that?

How might PAs better intervene in the market to facilitate project developments?

5. Regulatory Issues Considering the discussion so far, I'd like to explore the key regulatory issues associated with the program, whether at the legislative level, the CEC/CPUC level or other regulatory contexts such as emissions regulations and project permitting.

What regulatory issues have had the greatest impact on the program historically?

What regulatory issues do you see being critical to the program's success or failure in the future, and why do you think those are critical?

How has the CSI affected regulatory oversight of SGIP?

What do you see the direction of future legislative and regulatory directives, including continuation of the CSI, being such that SGIP would be significantly affected?

What are the key national, regional or local regulatory issues you see that have impeded the SGIP in the past or could do so in the future?

Probe specifically on: CA feed-in tariffs, latest CARB, AB32 and REC developments.

How do you think they have affected SGIP in the last two years?

How do you see them affecting SGIP in the next two years?

[If not yet mentioned] What about emissions regulations and permitting: what issues in the past two years have arisen, and how resolved? Issues seen for the next two years?

[If not yet mentioned] And for self-generation construction and operational permitting: what issues in the past two years have arisen, and how resolved? Issues seen for the next two years?

[If not yet mentioned] Reliability compliance requirements (CHP projects in particular): what issues in the past two years have arisen, and how resolved? Issues seen for the next two years?

Please describe your thoughts regarding the Program Modification Guideline process: has it worked as intended?

What aspects of the PMG process work well, and how is they work well?

What aspects of the PMG process need improvement, and in what ways might they best be improved?

What about PMG accommodation for innovative technologies such as advanced energy storage – what are your thoughts on how the PMG should evolve to address future technical and market developments?

What changes ought to be made to improve the regulatory process for programs like SGIP?

Has SGIP required a relatively greater or lesser effort from you as a regulatory staffer than other programs, considering the programs' size, budget, etc?

How has the CSI affected your organization in relation to SGIP, and has that changed significantly since 2007?

What do you see as being the key regulatory lessons learned from oversight of the SGIP?

6. General Market Developments. Stepping back from the program's implementation and regulatory perspective, let's talk about general market developments – the broader context within which the program has operated and which affects the program in various ways, and how the market should be characterized.

SGIP to some customers may seem like going into the utility business, which they don't see being appropriate to their business. Thus, they may have an aversion to the program from that perspective: "It's not my business to produce electricity; that's what utilities are for." Do you see this issue being a significant barrier to program participation? In what ways do you think so, or not, and what importance do you think this issue has for the program's future market potential?

Is the self-generation market transforming yet, such that manufacturers, equipment suppliers and contractors, energy service companies and host customers are beginning to understand and participate in the self-generation market without the sort of program SGIP has been historically?

If not, where do you see the market at this point with regard to its transformation to support a self-generation industry?

Are there geographic or other regional differences that affect SGIP that should be addressed but are not being adequately addressed at this time?

What are those and how should such differences be addressed in the program's regulatory oversight?

Are there any other general market developments (barriers or opportunities) you see affecting SGIP's program structure or participation (vs. program-specific developments)?

What are those and from a regulatory perspective, how might the barriers be minimized and opportunities be exploited?

[Probe: technical including installation barriers, economic barriers, business/risk barriers]

7. Other Issues/Close

What are your expectations for SGIP's future?

Are you aware of other programs in other jurisdictions that are similar to the SGIP?

Do you have any closing thoughts on issues we haven't discussed here?

A.2.3 Participant Survey Active

PG&E SGIP Program M&E

Host Customer Survey (Active/Completed Projects)

Survey Guide (08/29/2009)

SGIP ID:

a. Respondent's name

b. Respondent's title (if a business)

c. Firm/Organization name (if a business)

d. Phone No.

	Date	Time	Contacted			Comments
1						
2						
3						
4						
5						
6						
7						

Num of Calls _____________Num of Contacts: _____________

*Comments:*____

INTRODUCTION

Hello, this is __________ and I'm calling from **[Name of Survey Firm]**. We are have been hired to help evaluate California's Self-Generation Incentive Program. We understand you submitted an application to this program, and we would like to ask you some questions about your participation. May I please speak with ___**[CONTACT NAME]**________________?

If [CONTACT NAME] no longer works for the organization *[if residential,* no longer lives there*]* or will not be available during the survey period:

Could I please speak with a person such as the facility manager, building manager, operations manager or chief engineer ***[if residential,*** the person***]*** who would be knowledgeable about your ***[if a business,*** organization's***]*** participation in the Self-Generation Incentive Program?

Once contact is on the phone:

S1. **Repeat Intro (above)**

Are you the person most familiar with your ***[if a business***, organization's***]*** participation in the program? I'd like to obtain your views on the Program based on your experience to date. This survey is for research purposes only, and will not affect your application status in the program or the incentive you will receive.

Yes ________ **(CONTINUE)**

No _________ **(ASK FOR APPROPRIATE PERSON; RECORD NAME, TITLE, AND PHONE NUMBER; AND REPEAT S1)**

NOTE: IF RESPONDENT QUESTIONS THE LEGITIMACY OF THE SURVEY, YOU MAY GIVE THEM THE PROGRAM ADMINISTRATOR'S EMAIL ADDRESS. ALSO SEND THE PROGRAM ADMINISTRATOR AN EMAIL WITH THE NAME AND ORGANIZATION OF THE PERSON WHO MAY BE CONTACTING THEM.

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CCSE:
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S2. **[IF RESPONDENT STILL REFUSES SURVEY, ASK IF YOU MAY HAVE THE REASON FOR REFUSAL – TO DOCUMENT NON-RESPONSE BIAS, THANK AND TERMINATE]**

____

Background

Q1. First, I'd like to confirm some basic information regarding your application. **[Pre-fill fields from project database wherever possible and then confirm.]**

a. Respondent's name____

b. Respondent's title [if a business] ____

c. Firm/Organization name [if a business] ____

d. Physical address where project is located_______________________________________

e. Primary business activity at this site [if a business] ____________________________________

f. Technology employed___ [1. PV, 2. wind, 3. fuel cell, 4. microturbine, 5. reciprocating or internal combustion engine, 6. gas turbine, 7. advanced energy storage]

g. Does the system use ___ renewable or ___ nonrenewable fuel?

h. Applicant (if different than host customer)

i. Electric utility ______________________________

j. Natural gas utility __________________________________

k. Program administrator ____

l. Zip code where project is located: ____

Note that all references to the Program in this survey refer to the Self-Generation Incentive Program.

Q2. Is your self-generation program administrator and your electric supplier one and the same?

Yes 1

No 2

Don't know 3

Program Awareness, Satisfaction, and Process

Q3. How did you first learn about the incentives that were available to you through the program? (ASK OPEN ENDED; PROMPT WITH LIST IF NECESSARY; RECORD ALL THAT APPLY)

a. Utility representative 1

b. Regional Energy Office 2

c. Equipment/system dealer/vendor 3

d. Other users of on-site generation systems 4

e. Magazine or newspaper article 5

f. Other media (e.g., TV, news press releases) 6

g. Professional publications 7

h. Government agency (CPUC, CEC, or DOE) 8

i. Internet search/web site 9

(Specify:_____________)

j. E-mail notice or advertisement 10

(Specify:______________)

k. Other 11

(Specify:______________)

Don't Know or Can't Recall/Refused 88/99

Q4. On a scale of 1 to 5, with 5 meaning "Very important," 1 meaning "Not at all important," and 3 meaning "Neutral," how important was the availability of rebates from the program in deciding whether to go forward with this project?

Not at all Important				Very Important
1	2	3	4	5

Q6. Which of the following three scenarios best describes your involvement in the project?

We complete and submitted all forms ourselves, and have direct contact with the program administrators 1

An energy service company, contractor, or some other party is completing and submitting forms, but we are closely involved with the project application. 2

An energy service company, contractor, or some other party is completing and submitting forms without much help from us 3

Q7. Please rate your overall satisfaction with the program on a scale of 1 to 5, with 5 being "very satisfied," and 1 being "very dissatisfied."

Very Dissatisfied		Neutral		Very Satisfied
1	2	3	4	5

Q8. For the next couple of questions we would like to learn more about the level of ease associated with the application process and the on-site generation project itself. Please rate each aspect where "5" means "Very Easy" and "1" means "Very Difficult." If you cannot rate an aspect, either because you have not reached that stage of the project yet or because a contractor or 3rd party handled that aspect for you, please say "Not Applicable." **[ASK a-q FOR ALL TECHNOLOGIES. ASK (r) for all projects EXCEPT PV. ASK (s) for ONLY non-renewable fueled technologies.**

START | RATING

a. Identifying the right end-use or process energy application for on-site power generation at your facility (e.g., have process heat requirements or want to reduce billing demand with on-site self-generation)...______ N/A

b. [If business] Making the business case/[If residential] Justifying the project...............______ N/A

c. Choosing the technology that best fits in with your facility [if residential, your home's] operations (e.g., waste heat utilization from cogeneration, or using PV to offset purchased utility power) ______ N/A

d. Choosing an energy services company or contractor ....______ N/A

e. Financing the project...______ N/A

f. Submitting a reservation application ....______ N/A

g. Obtaining the equipment from the manufacturer ....______ N/A

h. Submitting proof of project milestone to the program ....______ N/A

i. Obtaining any necessary building or siting permits...______ N/A

j. Obtaining the necessary insurance..______ N/A

k. Installing the equipment..______ N/A

l. Achieving reliable operation...______ N/A

m. Working with the electric utility to connect your unit to the utility grid ...._____ N/A

n. Submitting a claim incentive payment ...._____ N/A

o. Scheduling with the program administrator for the program's on-site inspection.........._____ N/A

p. Obtaining approval based on the program's on-site inspection ...._____ N/A

q. Obtaining the incentive payment from the program ...._____ N/A

ASK (r) for all projects EXCEPT PV

r. Obtaining any necessary air quality permits ...._____ N/A

ASK (s) for ONLY non-renewable fueled technologies

s. Meeting the waste heat requirements for the project ...._____ N/A

Ask Q9 for anything rated 1 or 2 on Q8

Q9a to Q9s. What made **[INSERT APPROPRIATE a-s ITEM FROM Q8]** difficult?

____

____

____

____

Q10. Were there any unnecessary delays in the on-site generation project or the program application process?

Yes 1

No..2 **SKIP TO Q13**

Q11. At what part of the process did this delay occur? Any other parts of the process? **[Prompt with stages from Q8 as necessary. Record all that apply.]**

Ask Q12 for delays identified in Q11

Q12a to Q12s. In your view, who was primarily responsible for this delay (these delays)? **[DO NOT READ LIST; probe for each process delay cited]**

The program administrator 1

Your energy services company or contractor 2

Your firm or organization 3

The equipment manufacturer 4

The electric utility's interconnection department5

The permitting agencies (air, building, etc.) 6

Other 7

(Specify:_____________________)

Don't Know/Refused..88/99

Economics, Status, Performance, and Success of Self-Gen Project

READ: Throughout the remainder of the interview, any reference to "the equipment" refers to the on-site generation equipment installed (or being installed) under the program.

Q13. Who owns the equipment or will own it once/(now that) it is operational?

Self/Customer 1
Installation contractor / ESCO / maintenance firm 2
Other.. 3
Vendor until system is paid off 4

(Specify:_____________________)

Q14. Who will handle maintenance and repair for the equipment once it's completed (or who DOES handle it, for completed projects)?

Self/Customer 1
Installation contractor 2
Maintenance firm 3
Other.. 4

(Specify:_____________________)

Q15. How long do you expect it to take this system to pay for itself?

6 months or less... 1
1 year... 2

2 years 3
3 years 4
4 years 5
5 years 6
6 – 10 years 7
More than 10 years.. 8
Don’t Know/Refused 88/99

Q16. Has the on-site generation unit for which you applied to the program begun operating?
Yes 1
No...2 **SKIP TO Q19**

Q17. Has it operated reliably?
Yes 1
No.. 2
(1) **[If NO]** What problems have arisen?______________)

Q18. How has the output of the unit, in kWh per month, compared to your initial expectations for the system?
Below expectations 1
Meets expectations.. 2
Above expectations.. 3
Don’t know 4

Q19. How has the amount of time actually spent on operations and maintenance of the equipment compared to your initial expectations for the system?
Below expectations 1
Meets expectations.. 2
Above expectations.. 3
Don’t know 4

Q20. Did you experience any unexpected problems upon system start-up?
Yes 1
(Specify:_____________________)
No.. 2

Q21. Have you experienced any unexpected maintenance problems with this system?

Yes 1

(Specify:____________________)

No.. 2

Q22. How frequently is (or will be) routine maintenance conducted on this system?

Weekly..1

Monthly.. 2

Bi-monthly.. 3

Semi-annually.. 4

Annually.. 5

Other.. 6

(Specify:) _______________

Drivers and Barriers to Self-Generation

Q23. Please indicate on a scale of 1 to 5, where 5 is very influential, how much each of the following factors influenced your decision to purchase and use the on-site generation technology you chose. **(Rotate response options. Record one response for each factor)**

Factor	Rating				
a. Wanted to reduce utility bills	1	2	3	4	5
b. Wanted to reduce our peak demand	1	2	3	4	5
c. Wanted a backup system to improve the overall reliability of our electricity supply	1	2	3	4	5
d. Concern for the environment **[ask d.1) immediately after d]**	1	2	3	4	5
1) And more specifically, concern about **climate change**	1	2	3	4	5
e. Energy supply independence	1	2	3	4	5
f. Improve our image in the community— green marketing	1	2	3	4	5

g. Provide technical demonstration 1 2 3 4 5

Q24. **[Ask only for PV projects]** In 2007 and beyond PV systems over 30kW have been funded through the California Solar Initiative (CSI). Based on what you have heard about the CSI, do you think the CSI program will be an improvement on the prior program for PV?

a. Yes…..…………………………………………………………………………..1
(1) Why do you think so?) ______________________
b. No.. 2
(Why do you think not?) ______________________
c. Don't know.. 3

Q25. **[Ask only for PV projects]** Why did you not shift your project to the CSI?

____

Q26. Which of the following would be significant barriers to your organization installing additional on-site power generation? **(Read list; choose all that apply)**

No additional loads to be served 1
Natural gas prices.. 2
Equipment prices... 3
Experience with the current system 4
No more space/room for generation.. 5
Environmental concerns.. 6
Difficulty in working with utility.. 7
Other 8
(Specify :__________________________)

[ONLY RECRUIT NON-PV PARTICIPANTS FOR IN-DEPTH INTERVIEWS]

This concludes all the questions that I have we want to thank you for your time and consideration. We would like to invite you to participate in a more in-depth, follow-up interview that would be more like a conversation than a formal survey. This interview would last about 25 minutes and it will be conducted by an analyst with Summit Blue Consulting, one of the firms participating in this research. It would be conducted in the next few weeks at your convenience. In recognition of the additional time commitment, we'd provide $100 in compensation once the interview is complete. [If they indicate that they are not able to take monetary compensation, indicate that we would provide a $100 donation to the charity of your choice.]

May we schedule you for this follow-on interview?

Yes 1
No... 2 **Thank and terminate**

Yes, but I can’t commit to day & time 3

THANK RESPONDENT FOR THEIR TIME TODAY AND THEIR AGREEMENT TO DO AN IN-DEPTH INTERVIEW

Schedule appointment for interview. Verify:

Date and time (PDT),__________ Phone No.________________ & Email address_____________

A.2.4 Participant Survey Rejected

PG&E SGIP Program M&E

Host Customer Survey (Withdrawn/Rejected Projects)

Survey Guide (08/29/2009)

SGIP ID:

a. Respondent’s name

b. Respondent’s title (if a business)

c. Firm/Organization name (if a business)

d. Phone No.

	Date	Time	Contacted			Comments
1						
2						
3						
4						
5						
6						
7						

Num of Calls _____________Num of Contacts: _____________

*Comments:*____
____

Introduction

Hello, this is __________ and I'm calling from [Name of Survey Firm]. We are have been hired to help evaluate California's Self-Generation Incentive Program. We understand you began to participate in this program but that the project submitted was either withdrawn or rejected. We would like to ask some questions about your participation. May I please speak with **___[CONTACT NAME]________________**, the person we show as being the contact for the program and your project?

If [CONTACT NAME] no longer works for the organization [if residential, no longer lives there] or will not be available during the survey period:

Could I please speak with a person such as the facility manager, building manager, operations manager or chief engineer ***[if residential,*** the person***]*** who would be knowledgeable about your ***[if a business,*** organization's***]***participation in the Self-Generation Incentive Program?

Once contact is on the phone:

S1. **Repeat Intro (above)**

Are you the person most familiar with your ***[if a business,*** organization's***]*** participation in the program? I'd like to obtain your views on the Program based on your experience to date. This survey is for research purposes only, and will not affect your status in the program.

Yes ________ **(CONTINUE)**

No _________ **(ASK FOR APPROPRIATE PERSON; RECORD NAME, TITLE, AND PHONE NUMBER; AND REPEAT S1)**

NOTE: IF RESPONDENT QUESTIONS THE LEGITIMACY OF THE SURVEY, YOU MAY GIVE THEM THE PROGRAM ADMINISTRATOR'S EMAIL ADDRESS. ALSO SEND THE PROGRAM ADMINISTRATOR AN EMAIL WITH THE NAME AND ORGANIZATION OF THE PERSON WHO MAY BE CONTACTING THEM.

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CCSE:
Ryan Amador
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858-244-7283

S2. **[IF RESPONDENT STILL REFUSES SURVEY, ASK IF YOU MAY HAVE THE REASON FOR REFUSAL – TO DOCUMENT NON-RESPONSE BIAS, THANK AND TERMINATE]**
____

Background and Nature of Withdrawal/Rejection

Q1. First, I'd like to confirm some basic information regarding your application. **[Pre-fill fields from project database wherever possible and then confirm.]**

a. Respondent's name [if a business]
____

b. Respondent's title [if a business]
____

c. Firm/Organization name [if a business]
____

d. Physical address where project is located_______________________________________

e. Primary business activity at this site [if a business] ____________________________________

f. Technology employed___[1. PV, 2. wind, 3. fuel cell, 4. microturbine, 5. reciprocating or internal combustion engine, 6. gas turbine, 7. advanced energy storage]

g. Does the system use 1)___ renewable or 2)___ nonrenewable fuel?

h. Applicant (if different than host customer)_____________________________________

i. Electric utility____

j. Natural gas utility____

k. Program administrator____

l. Zip code where project is located: ____

Note that all references to the Program in this survey refer to the Self-Generation Incentive Program.

Q2. Were the program administrator and your electric utility one and the same?

Yes 1
No.. 2
Don't know...3

Q3. Our records indicate that [you withdrew from the program / your application was rejected]. Is this correct?

Yes 1

No **(Clarify which category they believe they fall into, and ask remaining questions based on that)** 2

Q4. What parts of the application process did you complete before the *[withdrawal/rejection]*? Did you…?

a. Submit a Reservation Request (but didn't receive confirmation of reservation) 1

b. Receive a Conditional Reservation Notice Letter from Administrator 2

c. Submit Proof of Project Milestone (but was not approved by Administrator) 3

d. Submit Proof of Project Milestone (which was approved by Administrator) 4

e. Submit claim for incentive payment; were awaiting on-site verification 5

f. On-site inspection/verification was conducted 6

g. Other 7

(Specify:______________)

h. Don't Know/Refused 88/99

Q5. **[WITHDRAWALS ONLY]** Why did you withdraw your application? **(Ask open-ended; record all that apply)**

a. System cost too high, even with incentive 1

b. Permitting issues 2

(Specify:_________________)

c. Problems in obtaining or installing equipment 3

(Specify:_________________)

d. Problems in obtaining project financing 4

e. Problems with the application process 5

(Specify:_________________)

f. Changes in the program 6

(Specify:_________________)

g. My system did not qualify for the program 7

(1) Why not?____________)

h. My system was only for emergency backup generation 8

i. The internal priorities of my organization [if residential, our household] changed 9

j. To avoid the hassle of owning, operating, or maintaining the DG system 10

k. We were wait listed and ultimately concluded funding would not be available 11

l. Increased uncertainty of the investment 12

(1) What changed to increase the uncertainty?___________)

m. Insufficient price signal to trigger operation or provide sufficient payback 13

n. Other.. 14

(1) specify:______________)

o. Don't Know/Refused 88/99

Q6. **[WITHDRAWALS ONLY – Ask if multiple responses to Q5]** What was the **primary** reason that you withdrew? **(Read options chosen in Q5; record one best response)**

Q7. **[REJECTIONS ONLY]** Our records show that your application was rejected. What reason did the program administrator give you for the rejection? (Ask open-ended; record all that apply)

a. System size was too large for the program.. 1

b. System size was too small for the program 2

c. Couldn't obtain permits.. 3

(Which?:______________)

d. Couldn't meet waste heat standards (Non-renewable fuels only)..................................... 4

e. System was to be used solely for backup generation 5

f. Missed deadlines (Which?_________________).. 6

g. Other.. 7

(Specify:______________)

h. Don't Know/Refused 88/99

Q8. Are you still planning on installing the system anyway, despite the fact that your application has been *[withdrawn/rejected]*?

Yes 1

No 2

Don't know 3

Q9. **[If "yes" on Q8]** Please rate the likelihood that your project will be completed on a scale of 1 to 5, with 5 meaning "Very likely to be completed" and 1 meaning "Very unlikely to be completed." **(If already installed, enter "6.")**

Very Unlikely				Very Likely	Already Installed
1	2	3	4	5	6

Program Awareness, Satisfaction, and Process

Q10. How did you first learn about the incentives that were available to you through the program? **(Ask open ended; prompt with list if necessary; record all that apply)**

a. Utility representative 1

b. Regional Energy Office 2

c. Equipment/system dealer/vendor.. 3

d. Other users of on-site generation systems 4

e. Magazine or newspaper article 5

f. Other media (e.g., TV, news press releases) 6

g. Professional publications... 7

h. Government agency (CPUC, CEC, or DOE) 8

i. Internet search/web site 9

(Specify:___________)

j. E-mail notice or advertisement.. 10

(Specify:______________)

k. Other...11

(Specify:______________)

Don't Know or Can't Recall/Refused 88/99

Q11. On a scale of 1 to 5, with 5 meaning "Very important," 1 meaning "Not at all important," and 3 meaning "Neutral," how important was the availability of rebates from the program in your initial decision to go forward with this project?

Not at all Important				Very Important
1	2	3	4	5

Q12. Please tell me which of the following three scenarios most closely describes your [if business, your organization's] involvement in the application process:

We are completing and submitting all the application forms ourselves, and have direct contact with the program administrators .... …1

An energy service company, contractor, or some other party is completing and submitting the application forms, but we are closely involved with the project application. 2

An energy service company, contractor, or some other party is completing and submitting the application forms without much help from us 3

Q13. Please rate your overall satisfaction with the program on a scale of 1 to 5, with 5 being "very satisfied," and 1 being "very dissatisfied."

Very Dissatisfied				Very Satisfied
1	2	3	4	5

Q14. For the next couple of questions we would like to learn more about the level of ease associated with the application process and the on-site generation project itself. Please rate each aspect where "5" means "Very Easy" and "1" means "Very Difficult." If you cannot rate an aspect, either because you have not reached that stage of the project yet or because a contractor or 3rd party handled that aspect for you, please say "Not Applicable." **[ASK a-q FOR ALL TECHNOLOGIES. ASK (r) for all projects EXCEPT PV. ASK (s) for ONLY non-renewable fueled technologies.**

START RATING

a. Identifying the right end-use or process energy application for on-site power generation at your facility (e.g., have process heat requirements or want to reduce billing demand with on-site self-generation)..______ N/A

b. [If business] Making the business case/[If residential] Justifying the project...............______ N/A

c. Choosing the technology that best fits in with your facility [if residential, your home's] operations (e.g., waste heat utilization from cogeneration, or using PV to offset purchased utility power) ______ N/A

d. Choosing an energy services company or contractor ....______ N/A

e. Financing the project...______ N/A

f. Submitting a reservation application.. ______ N/A

g. Obtaining the equipment from the manufacturer...______ N/A

h. Submitting proof of project milestone to the program...______ N/A

i. Obtaining any necessary building or siting permits..______ N/A

j. Obtaining the necessary insurance...______ N/A

k. Installing the equipment...______ N/A

l. Achieving reliable operation..______ N/A

m. Working with the electric utility to connect your unit to the utility grid ....______ N/A

n. Submitting a claim incentive payment..______ N/A

o. Scheduling with the program administrator for the program's on-site inspection.........______ N/A

p. Obtaining approval based on the program's on-site inspection ....______ N/A

q. Obtaining the incentive payment from the program ....______ N/A

ASK (r) for all projects EXCEPT PV

r. Obtaining any necessary air quality permits ...._____ N/A

ASK (s) for ONLY non-renewable fueled technologies

s. Meeting the waste heat requirements for the project ...._____ N/A

Ask Q15a-s for anything rated 1 or 2 on Q14

Q15a to Q15s. What made **[INSERT APPROPRIATE a-s ITEM FROM Q14]** difficult?

____
____
____
____

Q16. Were there any unnecessary delays in the on-site generation project or the program application process?

Yes 1

No.. 2 **SKIP TO Q19**

Q17. At what part of the process did this delay occur? Any other parts of the process? **[Prompt with stages from Q14 as necessary. Record all that apply.]**

Ask Q18 for any delays identified in Q17

Q18a to Q18s. In your view, who was primarily responsible for this delay (these delays)? **[DO NOT READ LIST; probe for each process delay cited]**

The program administrator 1

Your energy services company or contractor 2

Your firm or organization 3

The equipment manufacturer 4

The electric utility's interconnection department ...5

The permitting agencies (air, building, etc.) 6

Other 7

(Specify:_____________________)

Don't Know/Refused..88/99

Economics and Success of Self-Gen Project

READ: Throughout the remainder of the interview, any reference to “this on-site generation equipment” refers to the equipment that was to have been installed under the program.

Q19. Who would have owned this on-site generation equipment once it was operational?

Self/Customer 1
Installation contractor / ESCO / maintenance firm......... 2
Other 3
(Specify:____________________)

Q20. Who would have handled maintenance and repair for your system, once it was completed?

Self/Customer 1
Installation contractor 2
Maintenance firm.. 3
Other 4
(Specify:____________________)

Q21. How long did you originally expect it to take this system to pay for itself? (Read list; record one response. If respondent cannot answer the payback question, try to get them to answer Q21a.)

6 months or less 1
1 year.. 2
2 years 3
3 years 4
4 years 5
5 years 6
6 – 10 years 7
More than 10 years 8

AskQ21a only if no response to Q21

Q21a. What percentage of your electric bill did you originally expect to be offset by this on-site generation system in a typical month? (Approximations are fine.)

_______________ % or 88 (Don't Know) or 99 (Refused)

Drivers and Barriers to Self-Generation

Q22. Please indicate on a scale of 1 to 5, where 5 is very influential, how much each of the following factors influenced your decision to purchase and use the on-site generation technology you chose. **(Rotate response options. Record one response for each factor)**

Factor	Rating				
a. Wanted to reduce utility bills	1	2	3	4	5
b. Wanted to reduce our peak demand	1	2	3	4	5
c. Wanted a backup system to improve the overall reliability of our electricity supply	1	2	3	4	5
d. Concern for the environment **[ask d.1) immediately after d]**	1	2	3	4	5
1) And more specifically, concern about **climate change**	1	2	3	4	5
e. Energy supply independence	1	2	3	4	5
f. Improve our image in the community— green marketing	1	2	3	4	5
g. Provide technical demonstration	1	2	3	4	5

Q23. **[Ask only for PV projects]** In 2007 and beyond PV systems over 30kW have been funded through the California Solar Initiative (CSI). Based on what you have heard about the CSI, do you think the CSI program will be an improvement on the prior program for PV?

a. Yes..1

(1) Why do you think so?) ______________________

b. No..2

(1) Why do you think not?) ______________________

c. Don't know..3

Q24. **[Ask only for PV projects]** Did you shift your project to the CSI?

a. Yes

b. No

(1) Why not?) ____

Q25. On a scale of 1 to 5, where 5 means “Very likely to install” and 1 means “Not at all likely to install,” how likely is it that your organization will install other on-site power generation equipment for this facility in the next five years? Please do not count generation equipment that would be used solely for backup or emergency power.

Very Likely to Install.. 5
4 4
3 3
2 2
Not At All Likely to Install.. 1

Q26. If you were to install additional on-site power generation (other than backup or emergency generation) in the next five years, how influential would each of the following factors be in making that decision? Please rate the influence of each factor on a scale of 1 to 5, with 5 being “very influential,” and 1 being “not influential at all.” **(Record one response for each factor – NOTE that this question is the same as Q22 above, but is to be asked PROSPECTIVELY, about FUTURE installations)**

Factor	**Rating**				
a. Want to reduce utility bills	1	2	3	4	5
b. Want to reduce our peak demand	1	2	3	4	5
c. Want a backup system to improve the overall reliability of our electricity supply	1	2	3	4	5
d. Concern for the environment/ [PROBE:] And more specifically, concern about global climate change?	1/ 1	2/ 2	3/ 3	4/ 4	5/ 5
e. Energy supply independence	1	2	3	4	5
f. Improve our image in the community— green marketing	1	2	3	4	5
g. Provide technical demonstration	1	2	3	4	5
h. Other: (Specify:) ____________________	1	2	3	4	5

Q27. If you were to install additional on-site power generation (other than backup or emergency generation) in the next five years, what is the longest payback period you would be willing to accept? **(READ LIST – RECORD ONE RESPONSE)**

6 months or less 1

1 year...2
2 years...3
3 years...4
4 years...5
5 years...6
6 – 10 years..7
More than 10 years 8
Don't Know/Refused..88/99

Q28. Which of the following would be significant barriers to your organization installing additional on-site power generation? **(Read list; choose all that apply)**

No additional loads to be served....................................1
Natural gas prices..2
Equipment prices 3
Experience with the prior project/application.................4
No more space/room for generation 5
Environmental concerns 6
Difficulty in working with utility...................................7
Other 8
(Specify:__________________________)

Q29. **[Ask if multiple answers on Q28]** For those barriers you have previously mentioned, which barrier would be **the most** significant? **(If necessary, read options chosen in Q28; choose one)**

No additional loads to be served....................................1
Natural gas prices..2
Equipment prices 3
Experience with the prior project/application.................4
No more space/room for generation 5
Environmental concerns 6
Difficulty in working with utility...................................7
Other (specify:__________________________) 8

Q30. How important would the availability of rebates such as the one you are receiving under the program be in deciding whether to install additional on-site generation in the future? Rating on a scale of 1 to 5 where 5 is very important.

Not at all Important				Very Important
1	2	3	4	5

[ONLY RECRUIT NON-PV PARTICIPANTS FOR IN-DEPTH INTERVIEWS]

We appreciate your time and cooperation today. Because understanding the role that various factors play in making on-site generation projects successful is so important, we invite you to participate in a more in-depth, follow-up interview to be scheduled in the next few weeks. This interview would last between 20 and 30 minutes. It will be conducted by a senior analyst with Summit Blue Consulting, one of the firms participating in this research. It would be structured less like a formal survey and more like a conversation about your experiences with the program. In recognition of the additional time commitment, we'd provide $100 in compensation once the interview is complete. [If they indicate that they are not able to take monetary compensation, indicate that we would provide a $100 donation to the charity of your choice]

May we schedule you for this follow-on interview?

Yes 1

No..2 **Thank and terminate**

Schedule appointment for interview. Verify:

- Date and time (PDT)
- Phone number to call
- Email address (for reminder email the day before the interview)

THANK RESPONDENT FOR THEIR TIME TODAY AND THEIR AGREEMENT TO DO AN IN-DEPTH INTERVIEW.

A.2.5 Participant Interview Active

PG&E SGIP Program M&E

Host Customer Interview (Active/Completed)

Interview Guide (8/29/2009)

SGIP Project number: ______________________________

Respondent name: ______________________________

____

Respondent title [if a business]: ____

Company name [if a business]: ____

Date and time of interview: ____

Interviewer: ____

Technology: ____

Taped? (circle one) **YES** **NO**

Notes to interviewers

This topic guide is designed to help you to complete an approximately 30-minute in-depth interview (IDI). As you know, the qualitative research process is about *discovery*, not coverage. As such, we expect you to cover all areas of investigation, but, if necessary, to focus on those questions that seem most relevant to each respondent or those that develop new and/or useful information. Additionally, you are not required to ask questions in the order they are given herein; based on your experience in qualitative interviewing, allow the flow of the conversation to dictate the order in which you ask them.

Background

Summit Blue Consulting is evaluating the California SGIP. The evaluation is focused on systems installed under the SGIP in the service areas of PG&E, SCE, SCG, and SDG&E. A Working Group (consisting of representatives from the Program Administrators, SDG&E, and the CEC staff associated with the Emerging Renewable Program, and the Energy Division of the CPUC) is charged with the evaluation of the program through their M&E subcommittee led by PG&E.

Interview Recording

If you record the interview, you must obtain explicit permission from the respondent.

Confidentiality

If respondents ask, tell them yes, their answers will remain confidential.

Introduction

[NOTE: The survey house will have already qualified the respondent for this IDI prior to this point. Please have those survey responses in front of the interviewer so that we can simply confirm and probe for more detail. Many of these questions are addressed in the survey.]

Hello, my name is ______________________ and I work for Summit Blue Consulting. I am calling on behalf of the California Public Utilities Commission. We are conducting interviews to follow up on some of the issues raised in the survey on the Self-Generation Incentive Program you recently completed. This interview is for research purposes, and will not affect the application status of the project(s) you are involved with.

NOTE: IF RESPONDENT QUESTIONS THE LEGITIMACY OF THE SURVEY, YOU MAY GIVE THEM THE PROGRAM ADMINISTRATOR'S EMAIL ADDRESS. ALSO SEND THE PROGRAM ADMINISTRATOR AN EMAIL WITH THE NAME AND ORGANIZATION OF THE PERSON WHO MAY BE CONTACTING THEM.

SCG:
Dale Smet
dsmet@semprautilities.com
213-244-3777

PG&E:
Matt Heling
Mgh9@pge.com
415-973-6996

SCE:
Jim Stevenson
James.stevenson@sce.com
626-633-4888

CCSE:
Ryan Amador
Ryan.amador@energycenter.org
858-244-7283

Interview Recording (optional)

With your permission, I'll record the interview to avoid slowing down our conversation by taking all written notes. I will not use the recording for anything other than note taking and analysis. *(NOTE TO INTERVIEWER: Recording is optional, but you must obtain consent before doing so.)*

I. Process Questions

First I would like to discuss the process of the Self-Generation Incentive Program.

ELIGIBILITY

1. When considering whether to participate in SGIP, did anyone at your business [if residential, in your household] have initial concerns about eligibility for the program?
    1.1 **[If yes]** What were those concerns?
    1.2 How were those concerns addressed?

2. Are there other technologies that you think would make a good fit for the SGIP that are not currently eligible?

3. **[Ask for any aspects of the project that they rated as 1 or 2 (very difficult or difficult) on survey Q8 – also note and probe on any comments made in survey Q9. Probe further in questions below regarding various aspects of the program process]**

   1.1 What made this difficult?

   1.2 What would have helped or made it easier?

   1.3 Are there things the Program Administrator could have done to make this easier?

4. **[Ask for any unnecessary delays the respondent attributed to the PA on survey Q10 and Q11]**

   2.1 Tell me more about this (these) delay(s). What happened?

   2.2 What could have been done to avoid the delay(s) or resolve it/them sooner?

5. In your case, do you think the initial (60, 90 or 240-day, depending on PY and public entity) deadline provided sufficient time for providing proof of project milestone?

6. Which requirement(s) of the proof of project milestone made it difficult to meet the deadline? **[SELECT ALL THAT APPLY; DO NOT READ OPTIONS]**

- ☐ Submitting an air pollution permit application
- ☐ Submitting an electrical interconnection application
- ☐ Ordering the generating equipment
- ☐ Obtaining proof of insurance
- ☐ Providing waste heat recovery calculations
- ☐ Providing project cost breakdown
- ☐ Other: (specify) ___________________________

7. Do you think the 1-year (or 18 months, depending on PY and public entity) deadline is sufficient for completing the installation of your system or a system similar to yours?

   7.1 **[If no]** Why was the deadline hard to meet? **[SELECT ALL THAT APPLY; DO NOT READ OPTIONS]**

- ☐ Takes long time for manufacturer to ship equipment
- ☐ Type of equipment impacted by long lead times
- ☐ Installation delays by the contractor
- ☐ Air pollution permitting issues
- ☐ Other local permit issues (Conditional Use Permit, Negative Declaration, etc.)
- ☐ Building Permit issues

- ☐ Meeting waste heat requirements
- ☐ Interconnection with utility
- ☐ Financing the purchase/installation of equipment
- ☐ Other (specify) ____

8. **[If public entity]** Did you find the process too complex for a public entity?

   8.1 **[If yes]** What part of the process was/has been the most difficult?

9. **[If private entity]** Did you find the process too complex for a businesses like yours?

   9.1 **[If yes]** What part of the process was/has been the most difficult?

APPLICATION FEE

10. **[If participant applied after July 2005 and before December 31, 2006]** Do you have any issues with the application fee?

11. Do you think the application fee stops others from applying for funding through the SGIP?

COGEN **[Ask of participants that installed a cogen system (any non-renewable system)]**

12. Did natural gas prices affect your decision to apply to the program?

13. Do natural gas prices today affect the operating hours of your system and, if so, in what ways?

14. When applying to the program, did you encounter difficulty in meeting the waste heat and/or overall system efficiency requirements?

    14.1 Do you currently have any (or have you previously had any) problems with waste heat utilization after the system became operational?

    14.1a **[If yes]** Please elaborate.

15. Have you had any heat exchanger failures?

16. Would any current market factors affect your decision to install a cogen system? How about other people's decision to install a cogen system?

PRICE SIGNALS [Ask of PV and Renewable Fuel Systems]

17. In the survey you recently completed for us, you mentioned that reducing utility bills was [**INSERT ANSWER FROM Q23**] in your decision to purchase use the on-site generation technology. Do you operate your system to respond to utility rates or other price signals? Please elaborate. [**Probe for price structure – how prices are designed, as well as price level – to what extent are price signals high enough]**

PERFORMANCE BASED INCENTIVES/RENEWABLE ENERGY CREDITS

18. Imagine that, instead of a set incentive amount provided up front, you were offered an incentive based on the performance of your system that would be greater than the current up-front incentives (assuming the project performed as expected), but that you would not receive the incentive until after the project was installed and operating. Would you prefer that greater performance incentive rather than an up-front dollar-per-watt-installed incentive? Why or why not?

    18.1 How might such a performance-based incentive change how you operate the system, and the resulting performance of the system?

19. Did you include the potential value of renewable energy credits (also called green tags) associated with your SGIP project(s) in your contracts or negotiations with any parties involved?

    19.1 **[If yes]** Did you keep the RECs or did you sign them over to your developer?

    19.2 **[If they kept the RECs]** Do you plan to participate in WREGIS (Western Renewable Energy Generation Information System launched in June 2007)?

20. Which tax credits, if any, did you receive for the project?

ECONOMIC FACTORS: INCENTIVE LEVELS AND EQUIPMENT COSTS

21. In the survey you recently completed for us, you mentioned that it would likely take **[INSERT ANSWER FROM SURVEY Q15]** for your system to pay for itself. Do you feel that the current incentive levels adequately cover enough of the equipment costs in order for the pay back period to be reasonable for your company/organization/household]?

22. Do you feel like equipment cost is increasing or decreasing over time, and to the extent you see that change in cost, how do you see it affecting customers like you adding self-generation equipment?

23. Would a declining incentive amount over the next several years for all the technologies in the program affect your participation in future projects? In what way? (e.g., deciding to not participate; accelerating projects to get a better incentive; increasing the size of the project to maximize the incentive.)

24. How has the recent economic recession affected your completion and (if operational) initial operation of your self-generation system?

25. Do you know where the SGIP incentive funds come from? [If don't know, indicate source as being part of the overall funding for energy efficiency and renewable energy programs that customers like them fund through a nominal charge on their monthly bills. Then ask 25.1 below.]

    25.1 Do you think such incentives are a wise way to spend customers' program funding dollars, and why/why not?

    25.2 Knowing the incentives are funded by customers through their monthly bills, how does that affect the future likelihood of your company/organization/household participating in the Self-Generation Incentive Program?

APPLICATION MATERIALS AND OTHER

26. If you reviewed the program application materials, were these materials and instructions clear?

26.1 Please explain anything that wasn't clear to you.

26.2 Do you have any suggestions for making them better?

27. Have you looked at the Program Handbook?

27.1 **[If yes]** Was it helpful?

27.2 Please explain anything that wasn't clear to you.

27.3 Do you have any suggestions for making it better?

28. Did you experience any delays with the utility interconnection process?

28.1 **[If yes]** please describe.

29. **[For all project types EXCEPT PV and wind]** Were you aware that your system might be assessed nonbypassable charges for departing load?

[*Nonbypassable charges involve costs that have historically been included in bundled service bills but are now separately listed as line items, and include charges for items such as public purpose programs. A customer's date of departure and the size and type of technology installed determine whether or not the customer will be exempt from nonbypassable charges.*]

29.1 **[If yes]** Have you received your first bill?

29.1a **[If yes]** Is it what you expected?

[If no] Please describe the difference.

II. Market Study Questions

Now I would like to focus on your reasons for installing an on-site generation project and the overall market for on-site generation.

30. What prompted you to first consider this on-site generation project?

31. What were the primary drivers for this project (refer back to survey answers in Q23 as needed, but try to capture in their own words).

31.1. Why did you choose this particular technology?

31.2 Did the specific application in some sense dictate the technology? How or why?

31.3 Please describe your thoughts about how environmental considerations – climate change in particular – influenced the project decision. **[Probe for how those considerations compare to economic and other considerations.]**

32. In the survey you completed for us, you indicated that the amount of time actually spent on operations and maintenance of the equipment, compared to your initial expectations for the system, was ____ ***[insert response from Q19 of the survey: Below/Meets/Above Expectations or DK]***. About how many hours per month did your organization [if residential, your household] expect to spend on O&M when you decided to install the system, and how many hours per month have you actually spent since the system went into operation?

33. Do you think this project has been successful? Cost-effective?

34. If so, what made it succeed or be cost-effective? What factors did you have going in your favor on this project? If not, what prevented it from succeeding or being cost-effective?

35. Has your experience with this project made you more or less likely to do additional on-site generation projects? Why?

36. What would you do differently next time (or if you had the chance to do this project over from the beginning)?

    36.1. Would your expectations be different next time? How so?

37. What advice would you have for a business like yours that was considering on-site power generation?

[Ask Q38 if respondent has completed or attempted projects at different sites in California.]

38.1 If you have completed or tried to complete more than one project, are there any regional issues that affected these project in different ways? (e.g., air emissions regulations, labor or materials costs, availability of knowledgeable contracting help.)

38.2 How did these regional issues affect the project? [e.g., project costs, timing, etc.]

39. Lastly, are you the person who initiated or championed the system and participating in the program?

    39.1 [If that person] What was it like being the one to champion the system and participating in the program?

    39.2 [If NOT that person] How has the transition from another person to you being the leader affected the project's planning and installation, and also system operations and performance?

Closing

Thank you very much for your time today. As the survey interviewer mentioned when they asked if you would be willing to do this follow up interview, we would send you $100 as a token of our appreciation for your help with this research. To whom should we make out the check? [NOTE THAT THEY MAY DESIGNATE A CHARITY IF THEY ARE NOT ABLE TO ACCEPT THE $100 THEMSELVES]

Make check to: ____

Address:____

City/State/Zip:____

Finally, If I have a clarification question as I'm reviewing my notes, is it alright to call you back or email you?

- Yes

- No

Thanks again, and have a great day.

A.2.6 Participant Interviews Rejected

PG&E SGIP Program M&E
Host Customer Interviews (Withdrawn/Rejected)
Interview Guide (8/29/2009)

SGIP Project number: ______________________________

Respondent name: ______________________________

Respondent title [if a business]: ______________________________

Company name [if a business]: ______________________________

Date and time of interview: ______________________________

Interviewer: ______________________________

Technology: ______________________________

Taped? (circle one) **YES** **NO**

Notes to interviewers

This topic guide is designed to help you to complete an approximately 30-minute in-depth interview (IDI). As you know, the qualitative research process is about *discovery*, not coverage. As such, we expect you to cover all areas of investigation, but, if necessary, to focus on those questions that seem most relevant to each respondent or those that develop new and/or useful information. Additionally, you are not required to ask questions in the order they are given herein; based on your experience in qualitative interviewing, allow the flow of the conversation to dictate the order in which you ask them.

Background

The Summit Blue Consulting team is evaluating the California SGIP. The evaluation is focused on systems initially applied for but then either withdrawn or rejected under the SGIP in the service areas of PG&E, SCE, SCG, and SDG&E. A Working Group (consisting of representatives from the Program Administrators, SDG&E, and the CEC staff associated with the Emerging Renewable Program, and the Energy Division of the CPUC) is charged with the evaluation of the program through their M&E subcommittee led by PG&E.

Interview Recording

If you record the interview, you must obtain explicit permission from the respondent.

Confidentiality

If respondents ask, tell them yes, their answers will remain confidential.

Introduction

[NOTE: The survey house will have already qualified the respondent for this IDI prior to this point. Please have those survey responses in front of the interviewer so that we can simply confirm and probe for more detail. Many of these questions are addressed in the survey.]

Hello, my name is ______________________ and I work for Summit Blue Consulting. I am calling on behalf of the California Public Utilities Commission. We are conducting interviews to follow up on some of the issues raised in the survey on the Self-Generation Incentive Program you recently completed. This interview is for research purposes, and will not affect the application status of any project(s) you may still be involved with.

NOTE: IF RESPONDENT QUESTIONS THE LEGITIMACY OF THE SURVEY, YOU MAY GIVE THEM THE PROGRAM ADMINISTRATOR'S EMAIL ADDRESS. ALSO SEND THE PROGRAM ADMINISTRATOR AN EMAIL WITH THE NAME AND ORGANIZATION OF THE PERSON WHO MAY BE CONTACTING THEM.

SCG:
dsmet@semprautilities.com
213-244-3777

PG&E:
TBD

SCE:
TBD

CCSE:
TBD

Interview Recording (optional)

With your permission, I'll record the interview to avoid slowing down our conversation by taking all written notes. I will not use the recording for anything other than note taking and analysis. **(NOTE TO INTERVIEWER: Recording is optional, but you must obtain consent before doing so.)**

I. Confirm Project Status

Before beginning, make sure you understand the reason the project was withdrawn or rejected; and whether or not the customer continued with the project without SGIP funding. Summarize your understanding from their survey responses, and give them a chance to verify, correct, or comment.

II. Process Questions

Next I would like to discuss the process of the Self-Generation Incentive Program.

ELIGIBILITY

1. When considering whether to participate in SGIP, did anyone at your business [if residential, in your household] have initial concerns about eligibility for the program?

    1.1 **[If yes]** What were those concerns?

    1.2 How were those concerns addressed?

2. Are there other technologies that you think would make a good fit for the SGIP that are not currently eligible?

3. **[Ask for any aspects of the project that they rated as 1 or 2 (very difficult or difficult) on survey Q14 - also note and probe on any comments made in survey Q15. Probe further in questions below regarding various aspects of the program process]**

    3.1 What made this difficult?

    3.2 What would have helped or made it easier?

    3.3 Are there things the Program Administrator could have done to make this easier?

4. **[Ask about any unnecessary delays the respondent attributed to the PA on survey Q17 and Q18]**

    4.1 Tell me more about this (these) delay(s). What happened?

    4.2 What could have been done to avoid the delay(s) or resolve it/them sooner?

[For the remaining questions in this section, determine what stage of the application or project they achieved before withdrawal/suspension/rejection (based on survey responses) and only ask the questions relevant to that or earlier stages]

5. In your case, do you think the initial (60, 90 or 240-day, depending on PY and if respondent is a public entity) deadline provided sufficient time for providing proof of project milestone?

6. Which requirement(s) of the proof of project milestone made it difficult to meet the deadline? **[SELECT ALL THAT APPLY; DO NOT READ OPTIONS]**

- ☐ Submitting an air pollution permit application
- ☐ Submitting an electrical interconnection application
- ☐ Ordering the generating equipment
- ☐ Obtaining proof of insurance

- ☐ Providing waste heat recovery calculations
- ☐ Providing project cost breakdown
- ☐ Other

7. Do you think the 1-year (or 18 months, depending on PY and public entity) deadline is sufficient for completing the installation of your system or a system similar to yours?

   7.1 [If no] Why was the deadline hard to meet? **[SELECT ALL THAT APPLY; DO NOT READ OPTIONS]**

- ☐ Takes long time for manufacturer to ship equipment
- ☐ Type of equipment impacted by long lead times
- ☐ Installation delays by the contractor
- ☐ Air pollution permitting issues
- ☐ Other local permit issues (Conditional Use Permit, Negative Declaration, etc.)
- ☐ Building Permit issues
- ☐ Meeting waste heat requirements
- ☐ Interconnection with utility
- ☐ Financing the purchase/installation of equipment
- ☐ Other (specify) ____

8. **[If public entity or residence]** Did you find the process too complex for a public entity/residence?

   8.1 **[If yes]** What part of the process was the most difficult?

9. **[If private entity]** Did you find the process too complex for a businesses like yours?

   9.1 **[If yes]** What part of the process was the most difficult?

APPLICATION FEE

10. **[If participant applied after July 2005 and before December 31, 2006]** Do you have any issues with the application fee?

11. Do you think the application fee stops others from applying for funding through the SGIP?

COGEN **[Ask of participants that would have installed a cogen system (any non-renewable system)]**

12. Did natural gas prices affect your decision to apply to the program?

13. Do natural gas prices today affect the operating hours that would have been expected of your system and, if so, in what ways?

14. When applying to the program, did you encounter difficulty in meeting the waste heat and/or overall system efficiency requirements?

    14.1 Do you currently have any (or have you previously had any) problems with waste heat utilization once the system would have become operational?

        14.1a **[If yes]** Please elaborate.

15. Did any current market factors affect your company's/household's decision to install a cogen system? How about other people's decision to install a cogen system?

    15.1 **[If project was withdrawn]** Did any current market factors lead directly to you withdrawing your application? Please describe.

PRICE SIGNALS [Ask of PV and Renewable Fuel Systems]

16. In the survey you recently completed for us, you mentioned that reducing utility bills was [**INSERT ANSWER FROM Q22.a**] in your decision to purchase use the on-site generation technology. Do you operate your system to respond to utility rates or other price signals? Please elaborate. [**Probe for price structure – how prices are designed, as well as price level – to what extent are price signals high enough]**

PERFORMANCE BASED INCENTIVES/RENEWABLE ENERGY CREDITS

17. Imagine that, instead of a set incentive amount provided up front, you were offered an incentive based on the performance of your system that would be greater than the current up-front incentives (assuming the project performed as expected), but that you would not receive the incentive until after the project was installed and operating. Would you prefer that greater performance incentive rather than an up-front dollar-per-watt-installed incentive? Why or why not?

    17.1. **[If project was withdrawn]** Would a performance-based incentive being available kept you from withdrawing the project?17.2. How might such a performance-based incentive change how you would have operated the system, and the resulting performance of the system, were you to have gone ahead with the project?

18. Did you include the potential value of renewable energy credits (also called green tags) associated with your SGIP project(s) in your contracts or negotiations with any parties involved?

19. Which tax credits, if any, did you apply for on the project?

ECONOMIC FACTORS: INCENTIVE LEVELS AND EQUIPMENT COSTS

20. In the survey you recently completed for us, you mentioned that it would likely take **[INSERT ANSWER FROM SURVEY Q21]** for your system to pay for itself. Do you feel that the current incentive levels adequately cover enough of the equipment costs in order for the pay back period to be reasonable for your company/organization/household? **[If Q21a asked instead of Q21 in survey, base discussion on Q21a response]**

21. Do you feel like equipment cost is increasing or decreasing over time, and to the extent you see that change in cost, how do you see it affecting you adding self-generation equipment in the future?

    21.1 **[If project withdrawn]** How did your view of such cost changes affect your withdrawing the project?

22. Would a declining incentive amount over the next several years for all the technologies in the program affect your participation in future projects? In what way? (e.g., deciding to not participate; accelerating projects to get a better incentive; increasing the size of the project to maximize the incentive.)

23. How has the recent economic recession affected the status of your self-generation system?

24. Do you know where the SGIP incentive funds for the program come from? [If don’t know, indicate source as being part of the overall funding for energy efficiency and renewable energy programs that customers like them fund through a nominal charge on their monthly bills. Then ask 24.1 below.]

    24.1 Do you think such incentives are a wise way to spend customers’ program funding dollars, and why/why not?

    24.2 Knowing the incentives are funded by customers through their monthly bills, how does that affect the future likelihood of your company/organization/household] participating in the Self-Generation Incentive Program?

APPLICATION MATERIALS AND OTHER

25. If you reviewed the program application materials, were these materials and instructions clear?

    25.1 Please explain anything that wasn't clear to you.

    25.2 Do you have any suggestions for making them better?

26. Have you looked at the Program Handbook?

    26.1 **[If yes]** Was it helpful?

    26.2 Please explain anything that wasn't clear to you.

    26.3 Do you have any suggestions for making it better?

27. Did you experience any delays with the utility interconnection process?

    27.1 **[If yes]** please describe.

III. Market Study Questions

Now I would like to focus on your reasons for installing an on-site generation project and the overall market for on-site generation.

28. What prompted you to first consider this on-site generation project?

29. What were the primary drivers for this project **(refer back to survey answers in Q22 as needed, but try to capture in their own words)**.

    29.1. Why did you choose this particular technology?

    29.2 Did the specific application in some sense dictate the technology? How or why?

    29.3 Please describe your thoughts about how environmental considerations – climate change in particular – influenced the project decision. **[Probe for how those considerations compare to economic and other considerations.]**

30. Do you think this project has been successful? Cost-effective?

31. If so, what made it succeed or be cost-effective? What factors did you have going in your favor on this project? If not, what prevented it from succeeding or being cost-effective?

32. Has your experience with this project made you more or less likely to do additional on-site generation projects? Why?

32.1. What would you do differently next time (or if you had the chance to do this project over from the beginning)?

32.2. Would your expectations be different next time? How so?

33. What advice would you have for a business/home like yours that was considering on-site power generation?

[Ask Q34 if respondent has completed or attempted projects at different sites in California.]

34.1 If you have completed or tried to complete more than one project, are there any regional issues that affected these project in different ways? (e.g., air emissions regulations, labor or materials costs, availability of knowledgeable contracting help.)

34.2 How did these regional issues affect the project? [e.g., project costs, timing, etc.]

35. Lastly, are you the person who initiated or championed the system and participating in the program?

35.1 [If that person] What was it like being the one to champion the system and participating in the program?

35.2 [If NOT that person] How has the transition from another person to you being the leader affected the status of the project, in particular regarding the decision to withdraw the system [if project was withdrawn] or it being rejected [if project was rejected]?

Closing

Thank you very much for your time today. As the survey interviewer mentioned when they asked if you would be willing to do this follow up interview, we would like to send you $100 as a token of our appreciation for your help with this research. To whom should we make out the check? [NOTE THAT THEY MAY DESIGNATE A CHARITY IF THEY ARE NOT ABLE TO ACCEPT THE $100 THEMSELVES]

Make check to: ____

Address:____

City/State/Zip:____

Finally, If I have a clarification question as I'm reviewing my notes, is it alright to call you back or email you?

- Yes
- No

Thanks again, and have a great day.

A.2.7 Non-Participant Survey

PG&E SGIP Program M&E
Non-Participant Survey
Survey Guide (/08/29/2009)

NOTE: Non-Participants defined as customers who have not been contacted by the SGIP program, so no prior awareness or knowledge of SGIP is to be assumed.

SGIP ID:

a. Respondent's name

b. Respondent's title (if a business)

c. Firm/Organization name (if a business)

d. Phone No.

	Date	Time	Contacted			Comments
1						
2						
3						
4						
5						
6						
7						

Num of Calls ____________Num of Contacts: ____________

*Comments:*____

____

____

____

INTRODUCTION

S1. Hello, this is __________ and I'm calling from [CALL CENTER NAME], a national survey research center. We are conducting a study sponsored by the California Public Utilities Commission. Have I reached [CONTACT NAME] [***if business****:*] at [BUSINESS NAME]?

1 YES (*CONTINUE*)

2 NO __________ (*CLARIFY BUSINESS NAME OR ADDRESS FOR RESIDENTIAL AND CONTINUE*)

RESPONDENT SCREENING

S2. Are you knowledgeable about the day-to-day operations and energy requirements for your business facility/home located at [*ADDRESS*]?

Yes ________ (*CONTINUE*)

No _________ (*ASK FOR APPROPRIATE PERSON AND REPEAT S2*)

S3. Would you be involved in significant energy equipment and energy purchasing decisions?

Yes ________ (*CONTINUE*)

No _________ (*ASK FOR APPROPRIATE PERSON AND BEGIN SCREENING WITH S3*)

[**If asked about the purpose of the call:** We are conducting a survey of California businesses/homes concerning their energy use and familiarity with on-site power generation technologies. We are seeking only the opinions of selected professionals/homeowners and all individual responses will be kept confidential.]

NOTE: IF RESPONDENT QUESTIONS THE LEGITIMACY OF THE SURVEY, YOU MAY GIVE THEM THE PROGRAM ADMINISTRATOR'S EMAIL ADDRESS. ALSO SEND THE PROGRAM ADMINISTRATOR AN EMAIL WITH THE NAME AND ORGANIZATION OF THE PERSON WHO MAY BE CONTACTING THEM.

SCG:
Dale Smet
dsmet@semprautilities.com
213-244-3777

PG&E:
Matt Heling
Mgh9@pge.com
415-973-6996

SCE:
Jim Stevenson
James.stevenson@sce.com
626-633-4888

CCSE:
Ryan Amador
Ryan.amador@energycenter.org
858-244-7283

S4. **[IF RESPONDENT STILL REFUSES SURVEY, ASK IF YOU MAY HAVE THE REASON FOR REFUSAL – TO DOCUMENT NON-RESPONSE BIAS, THANK AND TERMINATE]** _______________________________________

FACILITY SCREENING

S5. Our firm is conducting a study to help utility companies and energy service providers develop energy-related products and services that better meet your needs. I'd like to ask a few questions about your business/home. Please answer for the facility/residence located at [*ADDRESS*]. Does your business own or lease this facility [if residential, do you own this residence]?

Own 1

Lease/rent 2
(TERMINATE)

S6. [If business] According to the information I have, your business is primarily involved in [SIC description] at this location. Is this correct?

Yes 1 (SKIP TO S7)

No 2 (PROCEED TO S6.1)

S6.1. [If business] How would you describe your business? **(Make sure that they respond for the LOCATION. Wait for respondent to answer. If necessary, prompt with the following list of choices, then select appropriate category. Verify category or read list of choices if necessary.)**

Agriculture, Forestry, & Fishing 1

Mining 2

Construction 3

Manufacturing – Primary Metals 4

Manufacturing – Stone/Clay/Glass products 5

Manufacturing – Lumber products 6

Manufacturing – Petroleum Refining 7

Manufacturing – Chemicals or Pharmaceuticals 8

Manufacturing – Paper products 9

Manufacturing – Food products	10
Manufacturing – Industrial Machinery	11
Manufacturing – Electronics	12
Manufacturing – Transportation Equipment	13
Manufacturing – Other	14
Transportation or Communications	15
Water or wastewater treatment plant	16
Wholesale Trade/Warehouse	17
Restaurants, eating and drinking establishments	18
Grocery stores/supermarkets	19
Retail Trade (excludes groceries, eating & drinking establishments)	20
Hospital/nursing home	21
Hotel/motel	22
Office building (includes banks, doctor's office, professional services, etc.)	23
Schools, colleges or universities	24
Other Private Sector Services (non-manufacturing)	25
Public Administration/Government	26
Non-Profit Organization	27
Other (specify): ___________________________________	28

(Re-classify into one of the categories above if possible.)

S7. [If business] Approximately how many full-time employees or full-time equivalent positions are there who work for your company **at this location**?

____________________ **Thank and terminate if < 10 for manufacturing (IF Q6.1=4-14) or < 25 for non-manufacturing (If q6.1=1-3,15-27)**

S8. [If residential] In which of the following categories is your annual household income? [Reassure that this information will be kept strictly confidential]

Under $60,000	1
$60,000 to $99,999	2
$100,000 to $249,999	3
$250,000 to $499,999	4

$500,000 or above	5
Don't know	88
Refused	99

S9. And to confirm, is your electric utility [INSERT SCE, SDG&E, OR PG&E BASED ON ZIP CODE]?

Yes 1
No 2

S10. Do you have natural gas service at this address?

Yes 1
No .... 2 **(SKIP S11)**

S11. Is your natural gas utility [INSERT SCG, SDG&E, OR PG&E BASED ON ZIP CODE]?

Yes 1
No 2

If NEITHER S9 NOR S10 = 1, OR if S9 = 2 AND S10 = 1 AND S11 = 2, thank and terminate.

Read: For the remainder of the survey, I'll be referring to "on-site generation." On-site generation refers to any of the following technologies:

[If residential, read:] Residential list: Photovoltaic, wind turbines, or fuel cells

[If business, read:] Commercial list: Photovoltaic, wind turbines, fuel cells, microturbines, internal combustion engines, gas turbines, reciprocating engines

(UNLESS OTHERWISE SPECIFIED RECORD ALL DON'T KNOW's AS 88 AND REFUSED AS 99)

Q1. Does your company/household have either of the following two types of on-site power systems installed at this facility/home? **(READ LIST. RECORD ALL THAT APPLY)**

An on-site power system that is used *only* during blackouts (emergency, standby, or back up generators) 1

An on-site power system that *regularly* generates power at your facility (not just during outages or blackouts) 2

Neither of the above .... 3 **(SKIP TO Q5)**

Don't Know/Refused .... 88/99 **(SKIP TO Q5)**

Q2. **[If Q1 = 1 or 2]** Approximately what percentage of your facility's/home's total electrical load is currently covered by . . .? **(READ EACH ITEM AND RECORD PERCENTAGE*)***

Percent of Load Covered

[Only ask if Q1 = 1]

3a. A standby or backup generator ______________ %

[Only ask if Q1 = 2]

3b. An on-site power system that regularly generates power at your facility/home ______________ %

[IF Q1 = 1 <u>and</u> 2] Read: For the rest of the questions in this survey, "on-site generation" refers only to systems that regularly generate power. Please do not include systems that only provide backup power for outages in your responses.

Q3. Which of the following on-site generation technologies do you have installed at this facility/home? **(Read list; record all that apply)**

3.a. Reciprocating or internal combustion engine1

3.a.1. What Fuel is used?

Natural gas 1

Other 2

(specify): _________________)

3.b. Microturbine 2

3.b.1. What Fuel is used?

Natural gas 1

Other 2

(specify): _________________)

3.c. Turbine 3

3.c.1. What Fuel is used?

Natural gas 1

Other 2

(specify): _________________)

3.d. Fuel cell.. 4

3.d.1. What Fuel is used?

Natural gas 1
Other 2
(specify): ________________)

3.e. Wind turbine 5
3.f. Photovoltaic cells.. 6
3.g. Other (specify): ________________) 7

3.g.1. What Fuel is used?

Natural gas 1
Other 2
(specify): ________________)

Q4. In what year was the on-site generation system at this facility/home installed? If you have more than one system, please answer for the one <u>most recently</u> installed. __________________

Q5. Before today, had you heard of the California Self-Generation Incentive Program?

Yes 1
No... 2 **(SKIP to Q7)**
Don't know/not sure .... 3 **(SKIP to Q7)**

Q6. How did you first learn about the incentives that were available to you through the program? **(Ask open ended; prompt with list if necessary; record all that apply)**

a. Utility representative 1
b. Regional Energy Office 2
c. Equipment/system dealer/vendor.. 3
d. Other users of on-site generation systems 4
e. Magazine or newspaper article 5
f. Other media (e.g., TV, news press releases) 6
g. Professional publications... 7
h. Government agency (CPUC, CEC, or DOE) 8
i. Internet search/web site 9
(Specify: _____________)
j. E-mail notice or advertisement.. 10
(Specify: ________________)

k. Other..11
(Specify:______________)

l. Don’t Know or Can’t Recall/Refused 88/99

6a. What do you recall specifically that was appealing about the program when you first heard about it or thoughts since then? Anything else? **(ASK OPEN ENDED, PROMPT FOR ADDITIONAL REASONS & RECORD UNAIDED RESPONSES PER LIST BELOW; RECORD ALL THAT APPLY)**

Don’t recall specific information – just a general recollection......................................1
Financial incentives available to defray system cost……………………….……….....2
Opportunity to become more energy self-reliant….………………………..………3
Opportunity to contribute to environmental protection..4
Opportunity to show alternative energy technology leadership in the community......5
Reduce energy costs…………………………………………………………………..6
Other #1 (specify:_________________)...7
Other #2 (specify:_________________)...8
Nothing I heard about or have thought of appealed to me about the program – my focus is on other issues, not generating power 9

[Skip to Q8]

Q7. Are you aware of any programs in California that provide financial incentives or rebates to businesses/households for installing on-site power generation systems?

Yes 1
No...2

Q8. On a scale of 1 to 10, where 10 means “Very likely to install” and 1 means “Not at all likely to install,” how likely is it that your organization/household will install [**if Q1 = 2, add “additional”]** on-site power generation equipment for this facility/home **in the next five years**? **Please do not count generation equipment that would be used solely for backup or emergency power**.

Very Likely to Install..10 **(SKIP TO Q9)**
9 ....9 **(SKIP TO Q9)**
8 ....8 **(SKIP TO Q9)**
7 7
6 6
5 5
4 4
3 3
2 2
Not At All Likely to Install.. 1

8a. (If Q8 response = 7 or less) What concerns do you have that would prevent you installing on-site generation other than an emergency backup system? **(ASK OPEN ENDED, PROMPT FOR ADDITIONAL REASONS & RECORD UNAIDED RESPONSES PER LIST BELOW; RECORD ALL THAT APPLY)**

Don't have specific concerns – just a general feeling that it's not a good idea for us...1

It's the utility industry's job to provide power – it's not our business (if a business)/not my responsibility (if residential or institutional)...2

Our priorities are on our business and doing a good job with that, not running a generating system 3

We're interested but don't know anything about the technologies available and/or how they might apply to our situation 4

We don't have time/resources to investigate self-generation 5

We're concerned about having to operate and maintain a self-generation system – no technical ability… 6

We don't know if a self-generation system would make economic sense (to reduce energy bills)……… 7

Other #1 (Specify: _______________________) 8

Other #2 (Specify: _______________________)… 9

8b. What information, resources or other factors would help overcome the concerns you just told me about? **(Revisit each concern stated in Q8a and probe for factors that would help overcome each stated concern. Record all factors stated.)**

Nothing – it's not my business/responsibility to be generating power 1

More information about available technologies – how they work, costs, etc 2

More information about how on-site generation would make us more energy self-reliant and/or reduce environmental impacts...3

Technical assistance to identify and design an on-site generation system that works best for us..4

Technical assistance to operate and maintain a system (third party operator/maintenance services)...5

Financial or economic analysis assistance to determine if a system would provide a reasonable return on the investment 6

Financial incentives to make a system economically viable...7

Other #1 (Specify: __________________________)...8

Other #2 (Specify: __________________________)...9

Q9. **If you were** to install additional on-site power generation (other than backup or emergency generation) in the next five years, how influential would each of the following factors be in making that decision? Please rate the influence of each factor on a scale of 1 to 5, with 5 being "very influential," and 1 being "not influential at all." **(Record one response for each factor)**

Factor	**Rating**				
a. Want to reduce utility bills	1	2	3	4	5
b. Want to reduce our peak demand	1	2	3	4	5
c. Want a backup system to improve the overall reliability of our electricity supply	1	2	3	4	5
d. Concern for the environment **[ask d.1) immediately after d]**	1	2	3	4	5
d.1. And more specifically, concern about **climate change**	1	2	3	4	5
e. Energy supply independence	1	2	3	4	5
f. Improve our image in the community — green marketing	1	2	3	4	5
g. Provide technical demonstration	1	2	3	4	5
h. Other:____________________	1	2	3	4	5

Q10. **If you were** to install additional on-site power generation (other than backup or emergency generation) in the next five years, what is the longest payback period you would be willing to accept? **(READ LIST – RECORD ONE RESPONSE)**

6 months or less 1
1 year.. 2
2 years 3
3 years 4
4 years 5
5 years 6
6 – 10 years 7
More than 10 years 8

Read: Next, I'm going to ask several questions about factors that may influence whether to install on-site generation or not. Please rate each factor on a scale of 1 to 5, where 5 is very important and 1 is not at all important.

Q11. How important would the availability of rebates be in deciding whether to install on-site generation in the future? Please rate on a scale of 1 to 5 where 5 is very important and 1 is not at all important.

Not at all Important				Very Important
1	2	3	4	5

11a. How important would it be in deciding whether to install on-site generation to have the system have a basic payback of less than 5 years? Again, please rate on a scale of 1 to 5 where 5 is very important and 1 is not at all important.

Not at all Important   Very Important

1 2 3 4 5

11b. How important would technical assistance to identify and design an on-site generation system be in deciding whether to install on-site generation in the future? [Prompt again as needed: Please rate on a scale of 1 to 5 where 5 is very important and 1 is not at all important.]

Not at all Important   Very Important

1 2 3 4 5

11c. How important would it be in deciding whether to install on-site generation to have a trustworthy provider of operation and maintenance services? [Prompt again as needed: Please rate on a scale of 1 to 5 where 5 is very important and 1 is not at all important.]

Not at all Important   Very Important

1 2 3 4 5

11d. How important would it be in deciding whether to install on-site generation to have the system's operation not be noticeable to you? [Prompt again as needed: Please rate on a scale of 1 to 5 where 5 is very important and 1 is not at all important.]

Not at all Important					Very Important
1	2	3	4	5	

Q12. Finally, on a scale of 1 to 5, with 5 meaning "Very important," 1 meaning "Not at all important," and 3 meaning "Neutral," how important would having a reasonable or sufficient price signal for operating the system be in deciding whether to install a self-generation system?

Not at all Important				Very Important
1	2	3	4	5

Q13. **[ONLY RECRUIT FOR AN INTERVIEW IF THEIR RESPONSE TO Q1 WAS A 1 OR 2]** We appreciate your time and cooperation today. Because understanding the role that various factors play in making on-site generation projects successful is so important, we invite you to participate in a more in-depth, follow-up interview to be scheduled in the next few weeks. This interview would last about 20 to 30 minutes. It will be conducted by a senior analyst with Summit Blue Consulting, one of the firms participating in this research. It would be structured less like a formal survey and more like a conversation. In recognition of the additional time commitment, we'd provide $100 in compensation once the interview is complete. [If they indicate that they are not able to take monetary compensation, indicate that we would provide a $100 donation to the charity of your choice]

May we schedule you for this follow-on interview?

Yes 1

No.. 2 **Thank and terminate**

Schedule appointment for interview. Verify:

Date and time (PDT)

Phone number to call

Email address (for reminder email the day before the interview)

THANK RESPONDENT FOR THEIR TIME TODAY AND THEIR AGREEMENT TO DO AN IN-DEPTH INTERVIEW

A.2.8 Non-Participant Interviews

PG&E SGIP Program M&E
Non-Participant Interviews
Interview Guide (08/29/2009)

Respondent name: ______________________

Respondent title [if a business]: ______________________

Company name [if a business]: ______________________

Date and time of interview: ______________________

Interviewer: ______________________

Taped? (circle one) **YES** **NO**

Notes to interviewers

This topic guide is designed to help you to complete an approximately 30-minute in-depth interview (IDI). As you know, the qualitative research process is about *discovery*, not coverage. As such, we expect you to cover all areas of investigation, but, if necessary, to focus on those questions that seem most relevant to each respondent or those that develop new and/or useful information. Additionally, you are not required to ask questions in the order they are given herein; based on your experience in qualitative interviewing, allow the flow of the conversation to dictate the order in which you ask them.

Background

The Summit Blue Consulting team is evaluating the California SGIP. The evaluation is focused on systems installed under the SGIP in the service areas of PG&E, SCE, SCG, and SDG&E. A Working Group (consisting of representatives from the Program Administrators, SDG&E, and the CEC staff associated with the Emerging Renewable Program, and the Energy Division of the CPUC) is charged with the evaluation of the program through their M&E subcommittee led by PG&E.

Interview Recording

If you record the interview, you must obtain explicit permission from the respondent.

Confidentiality

If respondents ask, tell them yes, their answers will remain confidential, and we will not reveal identities to anyone outside our research team, including utility company employees

Introduction

[NOTE: The survey house will have already qualified the respondent for this IDI prior to this point. Please have those survey responses in front of the interviewer so that we can simply confirm and probe for more detail. Many of these questions are addressed in the survey.]

Hello, my name is ____________________ and I work for Summit Blue Consulting. I am calling on behalf of the California Public Utilities Commission. We are conducting interviews to follow up on some of the issues raised in the survey on on-site power generation that you recently completed. This interview is for research purposes, and your participation will not result in marketing or sales calls.

NOTE: IF RESPONDENT QUESTIONS THE LEGITIMACY OF THE SURVEY, YOU MAY GIVE THEM THE PROGRAM ADMINISTRATOR'S EMAIL ADDRESS. ALSO SEND THE PROGRAM ADMINISTRATOR AN EMAIL WITH THE NAME AND ORGANIZATION OF THE PERSON WHO MAY BE CONTACTING THEM.

SCG:
Dale Smet
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PG&E:
Matt Heling
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415-973-6996

SCE:
Jim Stevenson
James.stevenson@sce.com
626-633-4888

CCSE:
Ryan Amador
Ryan.amador@energycenter.org
858-244-7283

Interview Recording (optional)

With your permission, I'll record the interview to avoid slowing down our conversation by taking all written notes. I will not use the recording for anything other than note taking and analysis. *(NOTE TO INTERVIEWER: Recording is optional, but you must obtain consent before doing so.)*

I. Confirm On-Site Generation Status and Awareness of SGIP

Before beginning, make sure you understand whether the respondent has installed on-site generation (other than standby), what technologies they have installed, when they were installed, and whether the respondent was familiar with SGIP, before proceeding with the interview. Summarize your understanding from their survey responses, and give them a chance to verify, correct, or comment.

II. Reasons for not Applying to SGIP

Q1. **[Ask Q1 only of those who installed on-site generation (other than standby) since 2000]** Our records indicate that you did not apply for funding through the Self-Generation Incentive Program for the on-site generation system you installed in **[insert year from survey Q4]**. Why not? **Probe for:**

- Unaware of the program at the time
- Believed our project would not qualify (why not?)
- Had heard negative things about the program (what? From whom?)
- Other (specify)?

Q2. If you were to install additional on-site generation in the future, would you be likely to apply to SGIP? Why or why not?

Q3. Are there other technologies that you think would make a good fit for the SGIP that are not currently eligible?

III. Market Study Questions [Ask only of those who installed on-site generation (other than standby generation) since 2000]

You indicated that you've installed a [**Note their response from survey Q3**]. Now I would like to focus on your reasons for installing an on-site generation project and the overall market for on-site generation.

Q4. What prompted you to first consider this on-site generation project?

Q5. What were the primary drivers for this project (refer back to survey Q8a answers as needed and as they apply to the current on-site system, but try to capture in their own words).

5.1. Why did you choose this particular technology?

5.2 Did the specific application in some sense dictate the technology?
How or why?

Q6. Do you think this project has been successful? Cost-effective?

Q7. If so, what made it succeed or be cost-effective? What factors did you have going in your favor on this project? If not, what prevented it from succeeding or being cost-effective?

Q8. Has your experience with this project made you more or less likely to do additional on-site generation projects? Why? [Review response to survey Q8 and 8a for perspective, refer to survey responses to help probe]

8.1. What would you do differently next time (or if you had the chance to do this project over from the beginning)?

8.2. Would your expectations be different next time? How so?

Q9. What advice would you have for a business/household like yours that was considering on-site power generation?

[Ask Q10 and 10.1 if respondent has completed or attempted projects at different sites in California.]

Q10. If you have completed or tried to complete more than one project, are there any regional issues that affected these project in different ways? (e.g., air emissions regulations, labor or materials costs, availability of knowledgeable contracting help.)

10.1 How did these regional issues affect the project? [e.g., project costs, timing, etc.]

IV. Program Features

PERFORMANCE BASED INCENTIVES/RENEWABLE ENERGY CREDITS

Q11. The SGIP provides an up-front financial incentive, with the amount based on the size of the system (i.e., $/watt). Imagine that, instead, you were offered an incentive based on the performance of your system that would be greater than the current up-front incentives (assuming the project performed as expected), but that you would not receive the incentive until after the project was installed and operating. Would you prefer that greater performance incentive rather than an up-front dollar-per-watt-installed incentive? Why?

INCENTIVE LEVELS AND EQUIPMENT COSTS

Q12. In the previous survey, you mentioned that if you were to install on-site generation in the future, it would need to pay for itself within _[Insert answer from survey Q10]_____ years. Do you feel that the current incentive levels adequately cover enough of the equipment costs in order for the pay back period to be reasonable for your company/organization?

Q13. Do you feel like equipment cost is increasing or decreasing over time?

Q14. Would a declining incentive amount over the next several years for all the technologies in the program affect your participation in future projects? In what way? (e.g., deciding to not participate; accelerating projects to get a better incentive; increasing the size of the project to maximize the incentive.)

V. Increasing Awareness and Education (SGIP and on-site generation)

Q15. If the CPUC wants to increase awareness and knowledge of the SGIP among businesses/household such as yours, how would you suggest they go about doing that? What would be the most effective ways to reach businesses such as yours? **Probe for:**

- Equipment suppliers/project developers as channels, versus utilities
- Utilities as channels, versus equipment suppliers/project developers
- Utility bill inserts versus direct mail
- Specific professional publications or professional associations
- Mass media campaigns (print versus radio versus television)
- Non-profit environmental or energy organizations
- Other (specify)

Q16. On a scale from 1 to 5, where 5 means “very interested” and 1 means “not at all interested,” how interested are you in learning more about on-site generation and the financial incentives available to support such projects?

Not at all interested				Very interested
1	2	3	4	5

Q17. Information about on-site generation technologies, available incentives, and overall project economics could come from a variety of sources such as equipment manufacturers, project developers, electric or gas utilities, non-profit environmental or energy organizations, or state agencies such as the CPUC or CEC. What sources would you find most (or least) credible for information on:

17.1 On-site generation technologies

17.2 Available incentives

17.3 Overall project economics

VI. Closing

Thank you very much for your time today. As the survey interviewer mentioned when they asked if you would be willing to do this follow up interview, we would like to send you $100 as a token of our appreciation for your help with this research. To whom should we make out the check? [NOTE THAT THEY MAY DESIGNATE A CHARITY IF THEY ARE NOT ABLE TO ACCEPT THE $100 THEMSELVES]

Make check to: ____

Address:____

City/State/Zip:____

Finally, if I have a clarification question as I'm reviewing my notes, is it alright to call you back or email you?

- Yes
- No

Thanks again, and have a great day!

A.2.9 Participating Developer

SGIP Program M&E

Participating Project Developer Interviews

Interview Guide (10/24/2009 FINAL)

Respondent identification number: ______________________________

Respondent name: ______________________________

Respondent title: ______________________________

Company name: ______________________________

Date and time of interview: ______________________________

Interviewer: ______________________________

Type of Developer: ______________________________

Primary Technology ______________________________

Taped? (circle one) **YES** **NO**

Notes to interviewers

This topic guide is designed to help you to complete an approximately 30-40 minute interview. Remember, the qualitative research process is about discovery, not coverage. As such, try to cover all areas of investigation but, if necessary, focus on those questions that seem most relevant to each respondent or those that develop new and/or useful information. Additionally, you are not required to ask questions in the order they are given herein; allow the flow of the conversation to dictate the order in which you ask them.

Background

Summit Blue Consulting team is evaluating the California SGIP. The evaluation is focused on systems installed under the SGIP in the service areas of PG&E, SCE, SCG, and SDG&E. A Working Group consisting of representatives from the Program Administrators, SDG&E, and the CEC staff associated with the Emerging Renewable Program, and the Energy Division of the CPUC is charged with the evaluation of the program through their M&E subcommittee led by Betsy Wilkins, a consultant to PG&E.

Taping

If you tape the interview, you must obtain explicit permission from the respondent.

Confidentiality

If respondents ask, tell them yes, their answers will remain anonymous.

Introduction

Hello, my name is _____________________ and I work for Summit Blue Consulting. I am calling on behalf of the California Public Utilities Commission. We are conducting an evaluation of the State of California's Self-Generation Incentive Program, and we are aware that your company has been involved as a project developer with at least one project that has applied for funding through this Program. We're conducting a survey to obtain your views on the Program, based on your experience to date. This survey is for research purposes, and will not affect the application status of the project(s) you are involved with.

NOTE: IF RESPONDENT QUESTIONS THE LEGITIMACY OF THE SURVEY, YOU MAY GIVE THEM THE BETSY'S CONTACT INFORMATION:

Betsy Wilkins

Consultant to Pacific Gas & Electric Company

bawilkins@sbcglobal.com

Taping (optional)

With your permission, I'll record the interview to avoid slowing down our conversation by taking all written notes. I will not use the tapes for anything other than note taking and analysis. (NOTE TO INTERVIEWER: Taping is optional, but you must obtain consent before doing so.)

I. Background

First, I'd like to get some background information about yourself and your company, just to provide some context for our discussion.

1.1 How long has your company been in business? Within California?

_____ Number of years in business

_____ Number of years in business in California

1.2 In what year were your [PRIMARY TECHNOLOGY] systems first installed for customers in California?

1.3 Outside of the SGIP, have you received, or are you receiving additional financial assistance or funding of any kind for any of the SGIP projects you've installed (e.g., grants, tax credits, or buydowns/rebates)?

IF YES → What percent of your projects in the last two years have received additional funding?

From what types of financial sources?

1.4 What percent (or total kW) of all of your self-generation projects in California in the last two years went through the SGIP process?

1.5 In the last two years, were there any self-generation projects that you tried to get through SGIP but weren't eligible?

IF YES → Why weren't they eligible?

1.6 Have you ever seen a self-generation project that would have been eligible for SGIP go forward without applying for the SGIP?

IF YES → Do you know why the project(s) did not go through the SGIP? How often have you seen this happen? Even though such projects didn't go through the program, did the program have any influence on the project, such as educating the host customer on self-generation or some other influence?

IF YES → Please describe the program influence you noticed on those projects.

1.7 What % of your SGIP projects would have been completed even without the SGIP's incentive?

1.8 Do you ever maintain ownership of the SGIP-funded equipment?

IF YES → What percent of your projects do you maintain ownership for? Do these installations experience any different operational experiences (e.g., reliability, lifetime, etc.)?

II. SGIP Process Experiences

[NOTE TO INTERVIEWERS: The purpose of this section is to find out the respondent's role in the application process, their opinions on program design issues, how the administrator(s) handled the application(s), and their knowledge of other programs that may overlap or dovetail with the SGIP.]

[NOTE: IF the company is also the host customer, SKIP TO 2.2.]

In order to provide suggestions on how to improve the SGIP process, I'd like your feedback on your experiences in dealing with each of the Program Administrator(s). But first I'd like to know how involved your host customer(s) are in the application process.

2.1 Please tell me which of these two scenarios most closely describes your host customer's involvement in the application process:

a. The host customer is actively involved in each stage of the application process and reviews all application materials before they're sent out.

b. The host customer essentially takes a hands-off approach to the application process, leaving your company to make most of the decisions.

2.2 Okay, now let's talk about the SGIP process, and in particular, any issues or problems that may have come up along the way. [NOTE: Probe on any of the following mentioned below.] What about…

a. the clarity of the Program application materials and instructions?

b. the responsiveness of the Program Administrator (e.g., did they contact you enough)? [NOTE: If the respondent dealt with more than one Program Administrator, probe for differences among them.]

c. the 90-day deadline for Proof of Project Advancement? [NOTE: If there were issues, probe on issues such as the air pollution permit application submission, the electrical interconnection application submission, ordering the generating equipment, obtaining proof of insurance, providing waste heat recovery calculations, providing project cost breakdowns, etc. Inquire how/if the Program Administrator assisted them in any way in overcoming these issues.]

d. the 1-year deadline for completing the installation? (NOTE: If there were issues, probe on issues such as air pollution permitting, local permitting, meeting waste heat recovery requirements, utility interconnection, financing, etc. Inquire how/if the Program Administrator assisted them in any way in overcoming these issues.]

2.3 What is the primary source of SGIP program information for you? How do you get clarification of information when you need help?

2.5 Have you developed SGIP projects for both public and private entity customers? If YES → What percent have been for public entities?

2.4 [ASK OF RESPONDENTS WHO DEALT WITH BOTH PUBLIC AND PRIVATE ENTITIES.] For you as a developer, what are the key differences between public and private entities in developing and building self-generation projects?

a. How does the process differ for these two groups?

b. What does it take to successfully engage with a public entity on an SGIP project?

c. In what ways has the SGIP been able to effectively attract and build self-generation projects given those differences? Are there areas where the program has not adequately addressed these key differences, such that projects have been hindered in some way?

2.5 [ASK OF RESPONDENTS WHO DEALT WITH PUBLIC ENTITIES – (refer to data sheet)]

a. What about the extended amount of time now allowed for public entities to complete projects? Has this been beneficial for the public entity organizations, or is more a case of "if you provide more time, they'll take more time"?

2.6 What percent of host customers with whom you have helped developed projects already knew about SGIP before you became involved with them (the customer)?

2.7 Do you find that prospective host customers understand the SGIP eligibility requirements? Does this differ by segment (e.g., public vs. private, commercial, industrial, size, etc.)?

2.8 Have you experienced any unnecessary project delays caused by host customers? IF YES → What were they?

III. Marketing and Outreach

3.1 Are you aware of any SGIP marketing or outreach activities? Which ones? Are they effective?

3.2 What market activities could the PA conduct that would be most effective?

3.3 Has your organization incorporated information with reference to the SGIP into any of their marketing and promotional materials? IF YES → How? (For example, as part of presenting case studies to trade groups such as BOMA or other industry associations, etc.)

IV. Program Changes

4.1 Since January 2007, what program changes – incentives, program processes, eligibility requirements or performance requirements including emissions – have had the most significant impact on your role as a project developer?

PROBE ON:

Renewable CHP, fossil-fuel based DG NOx emissions standard of 0.14 lbs/MWH that was effective in January 2005, and NOx emissions of 0.07 lbs/MWh and 60% minimum efficiency beginning January 1, 2007,

Increase of the incentive cap from 1MW to 3MW

4.2 Should the incentive cap increase be made permanent?

4.3 How much of an impact did each change have on project timelines? The number of projects applying and the number of projects completed? [NOTE: Probe for any other impact these changes might have had.]

4.5 Are you aware of the 20% additional incentive available for CA suppliers? Are you a CA supplier? Is this bonus sufficient to motivate you to open CA operations?

4.6 What would be the effect of a performance-based incentive structure on SGIP participation? Would you continue to pursue projects under a PBI structure?

4.7 Do you have any other issues or concerns with the incentive structure?

V. System Performance

5.1 In general, do your customer's systems meet their system performance and reliability expectations? Why or why not?

5.2 What factors do you see affecting a system's performance and reliability? What could be done to improve? What could the SGIP do to support?

5.3 What steps does your company take to ensure the reliability and continued availability of the self-generation equipment after it's installed?

5.4 What effect(s) would it have on your projects if the SGIP required monitoring and reporting on all systems? How much would it increase the costs?

VI. Market Dynamics

[NOTE TO INTERVIEWERS: This section will focus on the technologies themselves and the respondent's views of the current and future markets for each technology.]

6.1 What are the most significant barriers to the adoption of small wind/fuel cell? [PROBE FOR: Customer barriers, technology barriers, regulations.

6.2 What needs to happen before these barriers can be overcome?

6.3 What market trends to you see in the next 2-4 years? [PROBE FOR: technology advancements, changes in price]

6.4 Have you tailored your approach for the different California markets you work in? [NOTE: "Different markets" could mean different Program Administrator territories, different geographies and associated environmental and other market constraints, different technologies, etc.] If YES → How? What challenges does this present?

VII. Project Development Process

7.1 In your opinion, what are the most important factors that lead to successful SGIP projects? That is, how do you define a successful project? Does that vary when working on public vs. private entities? Is continued operation of the installation an element of success?

7.2 What factors regularly undermine projects?

7.3 What about leased systems? Are there unique problems/issues with developing leased systems through the current SGIP? IF YES → What types of problems/issues?

7.4 On a scale of 1 to 5 please rate the impact of the Program on the market development needs of the energy services industry, where 1 means no impact and 5 means a significant impact.

1 2 3 4 5

7.5 In your opinion, has the Program provided support for the energy services industry to market the Program? IF YES → How has this support been provided?

7.6 In your opinion, has the Program made a contribution to host customer education with respect to self-generation technology? IF YES → How?

7.7 Have you experienced any difficulties with… (Circle all that apply) [NOTE: probe if yes to any of the below.]

1 connecting distributed generation system projects to the grid?

2 [For Wind] obtaining information about net metering? Installing and managing net metering equipment?

3 the inspection and approval of your system by the utility?

4 receiving adequate Local Building Department support/information regarding the installation of distributed energy systems? [NOTE: probe on issues like permitting/building code requirements and safety inspection/approval.]

IF YES → What type(s) of difficulties did you have?

7.8 In the absence of the SGIP, would the current development of the energy services industry in California be any different than what it is today? IF YES → How so?

7.9 Please rate your overall satisfaction of the SGIP on a scale of 1 to 5, with 1 being very dissatisfied and 5 being very satisfied.

1 2 3 4 5

7.10 Is there any support/information you need from the SGIP or its Program Administrators, that you don't already receive, that would help to overcome customer barriers to [PRIMARY TECHOLOGY] adoption? IF YES → Please describe.

7.11 What other technologies should be eligible under the SGIP? What program rules or requirements would need to be changed to accommodate them?

7.12 Have you installed any projects outside of California? IF YES → Is it easier or harder to install projects outside of California? What are the major differences?

7.13 Have you or your customers participated in other programs to incent or support wind or fuel cells besides the SGIP? IF YES → Who is the program administrator? What features of these programs are more effective than the SGIP?

VIII. Program Modifications Guidelines

8.1 Are you aware of the SGIP program modifications guidelines? IF YES → Are the guidelines clear and reasonable?

8.2 Have you requested a program modification in the last year? IF YES →Was the process reasonable? Was the desired outcome achieved? What changes should be made to improve?

IX. Conclusion

I've got just one more question, and then we'll wrap things up.

9.1 What was your approximate sales volume in California in each of the past two years, in terms of the number of [TECHNOLOGY TYPE] units (modules/wind turbines/fuel cells/small or micro-gas turbines/IC engines) and total kW (or total $, if available)?

_____ Total number of units in 2007 _____ kW sold in 2007

_____ Total number of units in 2008 _____ kW sold in 2008

9.2 Is there anything I haven't asked you about on which you'd like to comment? Any other Program changes/things that worked well that we didn't cover?

I want to thank you again for your participation in this SGIP evaluation. We really appreciate it.

A.2.10 Non-Participating Developer Interview Guide

FINAL

Respondent name:	________________________________
Respondent title:	________________________________
Company name:	________________________________
Date and time of interview:	________________________________
Interviewer:	________________________________
Type of Market Actor:	________________________________
Primary Technology:	________________________________

Taped? (circle one) **YES** **NO**

Notes to interviewers

This topic guide is designed to help you to complete an approximately 20 minute interview. Remember, the qualitative research process is about discovery, not coverage. As such, try to cover all areas of investigation but, if necessary, focus on those questions that seem most relevant to each respondent or those that develop new and/or useful information. Additionally, you are not required to ask questions in the order they are given herein; allow the flow of the conversation to dictate the order in which you ask them.

Background

A Summit Blue Consulting team is evaluating the California SGIP. The evaluation is focused on systems installed under the SGIP in the service areas of PG&E, SCE, SCG, and SDG&E. A Working Group consisting of representatives from the Program Administrators, SDG&E, and the

CEC staff associated with the Emerging Renewable Program, and the Energy Division of the CPUC is charged with the evaluation of the program through their M&E subcommittee led by Betsy Wilkins, a consultant to PG&E.

(NOTE TO INTERVIEWER: the CCSE administers the program in SDG&E territory)

Taping

If you tape the interview, you must obtain explicit permission from the respondent.

Confidentiality

If respondents ask, tell them yes, their answers will remain anonymous.

Introduction

Hello, my name is ______________________ and I work for Summit Blue Consulting. I am calling on behalf of the California Public Utilities Commission. We are conducting an evaluation of the State of California's Self-Generation Incentive Program, and we are conducting a survey to obtain your views on the wind/fuel cell industry. This survey is for research purposes only.

NOTE: IF RESPONDENT QUESTIONS THE LEGITIMACY OF THE SURVEY, YOU MAY GIVE THEM THE BETSY'S CONTACT INFORMATION:

Betsy Wilkins

Consultant to Pacific Gas & Electric Company

bawilkins@sbcglobal.com

Taping (optional)

With your permission, I'll record the interview to avoid slowing down our conversation by taking all written notes. I will not use the tapes for anything other than note taking and analysis. (NOTE TO INTERVIEWER: Taping is optional, but you must obtain consent before doing so.)

Background

1. How are you/is your organization involved with wind/fuel cell technology?
2. What is your role/title within your organization?
3. How long have you been with your organization?
4. How long has your organization been in business/existence?

_______ Number of years in business

_______ Number of years in business in California

5. In what year were your [PRIMARY TECHNOLOGY] systems first installed for customers in California?
6. In the last two years, were there any [PRIMARY TECHOLOGY] projects that you tried to get through SGIP but weren't eligible?

   IF YES → Why weren't they eligible?

Marketing and Outreach

7. Are you aware of any SGIP marketing or outreach activities? Which ones? Are they effective?
8. What market activities could the Program Administrators conduct that would be most effective?

Market Barriers

9. What are the most significant barriers to the adoption of [PRIMARY TECHNOLOGY]? Probe for:

   Customer barriers

   Technology barriers

   Regulations
10. For each barrier:

    What needs to happen before these barriers can be overcome?

    Who is the appropriate party to address this?

Barrier	What can be done to overcome this barrier?	Who should take action?

11. Have you tailored your approach for the different California markets you work in? [NOTE: “Different markets” could mean different utility service territories, different geographies and associated environmental and other market constraints, different technologies, etc.]

If YES → How? What challenges does this present?

12. Have you installed any projects outside of California?

If YES →Is it easier or harder to install projects outside of California? What are the major differences?

Permitting and Siting (Wind Developers only)

12. Were there city or county zoning ordinances or building codes within CA that make projects difficult to install the project(s)?
    - ***a.*** Describe the circumstances. What city/county?
    - ***b.*** What were your strategies for overcoming these obstacles? How effective were they?
    - ***c.*** Have you heard of other solutions, even outside of CA, to this type of obstacle?
    - ***d.*** What could be done to permanently remove these obstacles in the California market?

Emissions (Fuel Cell Developers only)

12. Have you had trouble meeting local air board emissions requirements for fuel cells?
    - ***a.*** Describe the circumstances? What regulation was involved?
    - ***b.*** How were the barriers overcome?
    - ***c.*** Have you heard of other solutions to these obstacles, even outside of CA?

Project Characteristics

13. Are there key characteristics or circumstances that typically result in a successful project installation?
    - ***a.*** What are they?
14. What are the factors that typically undermine a project?
15. Are there particular industries or customer types better suited to [PRIMARY TECHOLOGY] projects?
    - ***a.*** Please describe.

16. IF NOT ALREADY ADDRESSED:
    Are there internal infrastructure or attributes that a customer needs to have to support a wind/fuel cell project?

17. Have you experienced any difficulties with… (Circle all that apply) [NOTE: probe if yes to any of the below.]
    a. connecting distributed generation system projects to the grid?
    b. [For Wind] obtaining information about net metering? Installing and managing net metering equipment?
    c. the inspection and approval of your system by the utility?
    d. receiving adequate Local Building Department support/information regarding the installation of distributed energy systems? [NOTE: probe on issues like permitting/building code requirements and safety inspection/approval.]

   IF YES → What type(s) of difficulties did you have?

System Performance

18. In general, do your customer's systems meet their system performance and reliability expectations? Why or why not?
19. What factors do you see affecting a system's performance and reliability? What could be done to improve?
20. What steps does your company take to ensure the reliability and continued availability of the self-generation equipment after it's installed?

Other Programs

21. Are you aware of any programs that incent or support the installation of customer sited wind/fuel cells?
    [NOTE TO INTERVIEWER: This doesn't have to be an incentive program; it could be a loan, grant, or information program.]

IF YES:

22. What features of the program make it most effective at promoting wind technology?

IF SGIP AND ANOTHER PROGRAM ARE MENTIONED, ASK:

23. Which program do you think is most effective at supporting the installation of wind projects?

24. What features make it/them more effective than the SGIP? (or SGIP more effective than it/them)

Industry Structure

25. Does your company offer financing for these projects?
26. Do you partner with other entities (e.g., banks) that do provide financing for these projects?
27. Have you seen any innovations in financing these types of projects?

28. In your opinion, has the SGIP provided support for the energy services industry to market the Program?

IF YES → How has this support been provided?

29. In your opinion, has the SGIP made a contribution to host customer education with respect to self-generation technology?

IF YES → How?

30. In the absence of the SGIP, would the current energy services industry in California be any different than what it is today?

IF YES → How so?

Market Trends

31. What market trends to you see in the next 2-4 years?
    Probe for:
    Technology advancements or changes
    Trends in equipment, component, or installation price
    Equipment or component availability

A.2.11 Wind Market Actor Interview Guide

FINAL

Respondent name: ____

Respondent title: ____

Company name: ____

Date and time of interview: ____

Interviewer: ____

Type of Market Actor: ____

Taped? (circle one) **YES** **NO**

Notes to interviewers

This topic guide is designed to help you to complete an approximately 20 minute interview. Remember, the qualitative research process is about discovery, not coverage. As such, try to cover all areas of investigation but, if necessary, focus on those questions that seem most relevant to each respondent or those that develop new and/or useful information. Additionally, you are not required to ask questions in the order they are given herein; allow the flow of the conversation to dictate the order in which you ask them.

Background

A Summit Blue Consulting team is evaluating the California SGIP. The evaluation is focused on systems installed under the SGIP in the service areas of PG&E, SCE, SCG, and SDG&E. A Working Group consisting of representatives from the Program Administrators, SDG&E, and the CEC staff associated with the Emerging Renewable Program, and the Energy Division of the CPUC is charged with the evaluation of the program through their M&E subcommittee led by Betsy Wilkins, a consultant to PG&E.

(NOTE TO INTERVIEWER: the CCSE administers the program in SDG&E territory)

Taping

If you tape the interview, you must obtain explicit permission from the respondent.

Confidentiality

If respondents ask, tell them yes, their answers will remain anonymous.

Introduction

Hello, my name is ____________________ and I work for Summit Blue Consulting. I am calling on behalf of the California Public Utilities Commission. We are conducting an evaluation of the State of California's Self-Generation Incentive Program, and we are conducting a survey to obtain your views on the wind industry. This survey is for research purposes only.

NOTE: IF RESPONDENT QUESTIONS THE LEGITIMACY OF THE SURVEY, YOU MAY GIVE THEM THE BETSY'S CONTACT INFORMATION:

Betsy Wilkins

Consultant to Pacific Gas & Electric Company

bawilkins@sbcglobal.com

Taping (optional)

With your permission, I'll record the interview to avoid slowing down our conversation by taking all written notes. I will not use the tapes for anything other than note taking and analysis. (NOTE TO INTERVIEWER: Taping is optional, but you must obtain consent before doing so.)

Background

13. How is your organization involved with wind technology?
    [Interviewer will answer this question in advance of the interview and confirm with respondent that this is the entire breadth of their involvement in the industry.]
14. How long has your organization been in business/existence?
    [Interviewer will answer this question in advance of the interview and confirm with respondent that this is the entire breadth of their involvement in the industry.]
15. What is your role/title within your organization?
16. How long have you been with your organization?

Market Barriers

17. What are the most significant barriers to the adoption of small wind?
    [NOTE TO INTERVIEWER: Define wind as systems sized 30kW to 5MW]
    Probe for:

    Customer barriers

    Technology barriers

    Regulations
18. For each barrier:

What needs to happen before these barriers can be overcome?

Who is the appropriate party to address this?

Barrier	What can be done to overcome this barrier?	Who should take action?

Permitting and Siting (Associations and Industry Experts only)

19. Have you been involved with any projects installed in California?

IF YES:

20. Were there city or county zoning ordinances or building codes within CA that make projects difficult to install the project(s)?
    - ***a.*** Describe the circumstances. What city/county?
    - ***b.*** What were your strategies for overcoming these obstacles? How effective were they?
    - ***c.*** Have you heard of other solutions, even outside of CA, to this type of obstacle?
    - ***d.*** What could be done to permanently remove these obstacles in the California market?

IF NO:

21. Are you aware/have you encountered any city or county ordinances or building codes in other areas that made it difficult to install small wind projects anywhere in the US?
    - ***a.*** Describe the circumstances. What city/county?
    - ***b.*** Were you effective in overcoming these obstacles? How?
    - ***c.*** Have you heard of other solutions, even outside of CA, to this type of obstacle?
    - ***d.*** What could be done to permanently remove these obstacles?

Project Characteristics (Industry Experts only)

22. Are there key characteristics or circumstances that typically result in a successful project installation?
    - ***a.*** What are they?
23. What are the factors that typically undermine a project?
24. Are there particular industries or customer types better suited to wind projects?
    - ***a.*** Please describe.
25. IF NOT ALREADY ADDRESSED:
    Are there internal infrastructure or attributes that a customer needs to have to support a wind or fuel cell project?

Other Programs (Associations and Industry Experts only)

26. Are you aware of any programs that incent or support the installation of customer sited wind?
    [NOTE TO INTERVIEWER: This doesn't have to be an incentive program; it could be a loan, grant, or information program.]

IF YES:

27. What features of the program make it most effective at promoting wind technology?

IF SGIP AND ANOTHER PROGRAM ARE MENTIONED, ASK:

28. Which program do you think is most effective at supporting the installation of wind projects?
29. What features make it/them more effective than the SGIP? (or SGIP more effective than it/them)

Industry Structure

30. Does your company offer financing for these projects?
31. Do you partner with other entities (e.g., banks) that do provide financing for these projects?
32. Have you seen any innovations in financing these types of projects?
33. Do you partner with any other entities to promote your product?

34. What channels do you use to distribute your technology?

Market Trends

35. What market trends to you see in the next 2-4 years?
    Probe for:
    Technology advancements or changes
    Trends in equipment, component, or installation price
    Equipment or component availability
36. Do you foresee your costs increasing or decreasing over time?
    - ***a.*** What are the key drivers of cost?
37. Do you see your market-facing prices increasing over time?
    - ***b.*** What are the key drivers of market-facing price?
38. Do you have plans to scale up your manufacturing operations?
    - ***c.*** How much?
    - ***d.*** When?
    - ***e.*** Where?

A.2.12 Fuel Cell and AES Market Actor Interview Guide

FINAL

Respondent name: ______________________________

Respondent title: ______________________________

Company name: ______________________________

Date and time of interview: ______________________________

Interviewer: ______________________________

Type of Market Actor: ______________________________

Taped? (circle one) **YES** **NO**

Notes to interviewers

This topic guide is designed to help you to complete an approximately 20 minute interview. Remember, the qualitative research process is about discovery, not coverage. As such, try to cover all areas of investigation but, if necessary, focus on those questions that seem most relevant to each respondent or those that develop new and/or useful information. Additionally, you are not required to ask questions in the order they are given herein; allow the flow of the conversation to dictate the order in which you ask them.

Background

Summit Blue Consulting team is evaluating the California SGIP. The evaluation is focused on systems installed under the SGIP in the service areas of PG&E, SCE, SCG, and SDG&E. A Working Group consisting of representatives from the Program Administrators, SDG&E, and the CEC staff associated with the Emerging Renewable Program, and the Energy Division of the CPUC is charged with the evaluation of the program through their M&E subcommittee led by Betsy Wilkins, a consultant to PG&E.

(NOTE TO INTERVIEWER: the CCSE administers the program in SDG&E territory)

Taping

If you tape the interview, you must obtain explicit permission from the respondent.

Confidentiality

If respondents ask, tell them yes, their answers will remain anonymous.

Introduction

Hello, my name is _____________________ and I work for Summit Blue Consulting. I am calling on behalf of the California Public Utilities Commission. We are conducting an evaluation of the State of California's Self-Generation Incentive Program, and we are conducting a survey to obtain your views on the wind industry. This survey is for research purposes only.

NOTE: IF RESPONDENT QUESTIONS THE LEGITIMACY OF THE SURVEY, YOU MAY GIVE THEM THE BETSY'S CONTACT INFORMATION:

Betsy Wilkins

Consultant to Pacific Gas & Electric Company

bawilkins@sbcglobal.com

Taping (optional)

With your permission, I'll record the interview to avoid slowing down our conversation by taking all written notes. I will not use the tapes for anything other than note taking and analysis. (NOTE TO INTERVIEWER: Taping is optional, but you must obtain consent before doing so.)

Background

1. How is your organization involved with fuel cell/AES technology?

   [Interviewer will answer this question in advance of the interview and confirm with respondent that this is the entire breadth of their involvement in the industry.]

2. How long has your organization been in business/existence?

   [Interviewer will answer this question in advance of the interview and confirm with respondent that this is the entire breadth of their involvement in the industry.]

3. What is your role/title within your organization?
4. How long have you been with your organization?

Market Barriers

5. What are the most significant barriers to the adoption of fuel cells/AEC?

   (NOTE TO INTERVIEWER: Define systems sized 30kW to 5MW)

   Probe for:

   Customer barriers

   Technology barriers

   Regulations

For each barrier ask:

- ***a.*** What needs to happen before these barriers can be overcome?
- ***b.*** Who is the appropriate party to address this?

Barrier	What can be done to overcome this barrier?	Who should take action?

Emissions (Associations and Industry Experts only)

6. Have you been involved with any projects installed in California?

IF YES:

7. Have you had trouble meeting local air board emissions requirements for fuel cells?
    - ***a.*** Describe the circumstances? What regulation was involved?
    - ***b.*** How were the barriers overcome?
    - ***c.*** Have you heard of other solutions to these obstacles, even outside of CA?

IF NO:

8. Are you aware of/have you encountered trouble meeting local air board emissions requirements for fuel cells?
    - ***a.*** Describe the circumstances? What regulation was involved?
    - ***b.*** How were the barriers overcome?
    - ***c.*** Have you heard of other solutions to these obstacles?

Project Characteristics (Industry Experts only)

9. Are there key characteristics or circumstances that typically result in a successful project installation?
    - ***a.*** What are they?

10. What are the factors that typically undermine a project?

11. Are there particular industries or customer types better suited to a fuel cell/AES project?
    - ***a.*** Please describe.

IF NOT ALREADY ADDRESSED:

12. Are there internal infrastructure or attributes that a customer needs to have to support a fuel cell/AES project?

Other Programs (Associations or Industry Experts only)

13. Are you aware of any programs to incent or support the installation of customer sited fuel cells?

(NOTE TO INTERVIEWER: This doesn't have to be an incentive program; it could be a loan, grant, or information program.)

IF YES:

14. What features of the program make it most effective at promoting fuel cell/AES technology?

IF SGIP AND ANOTHER PROGRAM ARE MENTIONED, ASK:

15. Which program do you think is most effective at supporting the installation of fuel cell/AES projects?
16. What features make it/them more effective than the SGIP? (or SGIP more effective than it/them)

Market Trends

17. What market trends to you see in the next 2-4 years?

    Probe for:

    Technology advancements or changes

    Trends in equipment, component, or installation price

    Equipment or component availability

18. Do you foresee your costs increasing or decreasing over time?
    f. What are the key drivers of cost?
19. Do you see your market-facing prices increasing over time?
    g. What are the key drivers of market-facing price?

20. Do you have plans to scale up your manufacturing operations?
    - ***h.*** How much?
    - ***i.*** When?
    - ***j.*** Where?

Program Modification Guidelines

21. Are you aware of the SGIP program modifications guidelines?

IF YES:

22. Are the guidelines clear and reasonable?

23. Have you requested a program modification or participating in the PMG process in the last year? [NOTE: submitting comments qualifies as participating in the PMG process]

IF YES:

24. Was the process reasonable?
    - ***a.*** Was the desired outcome achieved?
    - ***b.*** What changes should be made to improve?

APPENDIX 3: INTERVIEW SUMMARIES

A.3.1 Participant and Non-Participant Host Customers

The Summit Blue team interviewed a total of 29 SGIP participants and nonparticipants in the fall of 2009. Interview candidates were identified, recruited and scheduled through a separately administered survey. Interviews were conducted by telephone using senior staff that had reviewed the interview subjects' survey responses. The interviewers used an interview guide developed by Summit Blue and approved by the Self-Generation Incentive Program M&E subcommittee. While attempts were made to achieve a good distribution of SGIP technology types and PAs, the relatively small number participants and survey completions for some technology types and the greater willingness of some public entity participants did create some skew in respondent types. For instance, a relatively high number (n=5) of interviews were conducted with municipal customers. Also it was relatively difficult to locate and recruit non-participants. In the future, calling energy service companies or technology vendors may be a better channel for locating those, apparently few, market actors that install projects of this scale without SGIP incentives.

Table A.3-1. Number of Interviews by Technology and SGIP Status

Technology	Internal Combustion Engine (ICE)	Micro-turbine	Fuel Cell	Wind	Total Completed
Participant – Active/Complete	10	2	5	2	19
Participant - Withdrawn/Rejected	2	0	3	1	6
Non-Participant	N/A	N/A	N/A	N/A	5

Findings

The results from the interviews are summarized below. In general the SGIP is a mature program that appears to be running well. A few areas for improvement are noted, but most of these relate to the current difficult economy or frustrations held by those that proposed relatively complex projects.

Economics

- Unsurprisingly, the state of the economy was top of mind for many participants as well as withdrawn customers.
- Multiple iterations, particularly in design build-contracts appeared to drive participation costs up for several respondents.

- Some of these iterations could have been avoided through better upfront technology selection[144]
- Iterations were also driven by lack of knowledge about "moving regulatory targets" under CARB 2007 and in which jurisdictions these regulations apply.

- Several interviews yielded comments about funding barriers.
  - Some reported that investors expressed concern about California's fiscal difficulties indicating confusion about the commitment and availability of ratepayer funds as opposed to taxpayer funded activities.
  - Installations were seen by some as a zero-sum game. If one piece of the project failed to come together, all of the risk rests with either the developer or site owner. While this risk has existed in prior years, in the current economy only the most bankable projects move forward, potentially at the cost of innovative new projects.
  - Making bridge monies or feasibility study funds available was seen as a viable backstop by some.

Technology Related Observations

- For cogeneration projects: sites with their own distribution and transfer switch report that they are good candidates. They have no election to net energy meter and have sufficient demand to utilize all generation.

- Several of the internal combustion engine projects reported delays (due to local permitting moratoriums – the apparent result of a pending litigation in Los Angeles) and "just getting in" under the wire of local air board rule changes.

- Interviewees who had installed microturbines were surprised to find out that they were responsible for paying departing load charges, more so than those who had installed other technologies. However given the relatively few microturbine interviews it is difficult to know what significance to attach to this observation.

- Fuel cell projects:
  - Report needing to educate local officials (building, fire) about safety records of fuel cells. In smaller scale fuel cells, e.g., those in the high-end residential market; some report contracting around the "spec" risk, e.g., if a customer does not want the fuel cell, the vendor agrees to take it back;
  - Appear to have more difficulty with delay and lead time for equipment; and
  - Have concerns about incentive break points not matching the typical sizing that systems are delivered in, e.g., systems are available at 300, 1400, 2800 kW, while incentives are capped at 1 MW,[145] as well as sufficiency of overall incentive amounts.

Program Experiences

- With a few notable exceptions, experiences with PAs are positive.

- Larger projects can still experience delays with interconnection, where reported, attributed to slow dialog with interconnection and SGIP group.

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[144] For example a shift in technology preference from original bid (whether due to qualified bidders or shifting regulatory constraints on emissions) can change the design parameters of a project. A project may have begun with little demand for excess heat, but over the projects iterations, and technology change outs the heat demand for optimal design may shift.

[145] Incentives are now capped at 3MW with a declining incentive between 1MW and 3MW.

- One participant reported recruiting a utility customer care representative to be an ombudsman to "own the process." This person recruited all utility stakeholders to a face-to-face meeting that assisted in resolving a stalemate over interconnection. It may be advisable to require "sit downs" of this sort to avoid negative surprise about process needs, timing, etc., particularly for relatively large or complex projects.
- There is broad but not uniform support for using ratepayer monies for this program.
- It appears that less fully commercialized technologies (fuel cells) or those new to this scale (wind), or used in newer configurations (waste streams as fuel) may need more support. The program works best with "plug and play" installations as it is not an R&D program. However, the market is working on taking advantage of innovative configurations e.g., using waste streams as renewable fuel. As a result a number of participants expressed concern about funding feasibility studies and the zero sum aspect mentioned above of risk allocation in developing an SGIP project.
- Experience with the SGIP and appropriate sizing and specification of distributed systems is helpful to having a successful experience. In some cases, participants now specify that vendors have experience and success working with the SGIP as a prequalification to bidding on a construction contract. Similarly, those who had not gone through SGIP had slightly more difficulty specifying technology and managing the process and suggested that an available "roaming" engineer or online tutorial could have provided supporting direction.
- The time frames allotted to develop and complete projects appear to be aggressive, with fuel cell projects (due to equipment delay) and internal combustion projects (due to air permitting) reporting the most difficulty. Particularly where equipment must be ordered from outside the US, there is some concern about timing to procure, and install consistent with the SGIP timeframes. Interestingly some report that the recession has led to increasing job responsibilities and thus relative overburden and delay on the part of on-site personnel, while others (particularly public entities) indicate that during a recession, construction is relatively more affordable and responsive, as vendors and suppliers are relatively less constrained.

Market Insights and Shifts from Prior Process Research

- Compared to previous years, there appeared to be a "back to basics" mentality in approaching due diligence, with more support for "tried and true" technologies, such as internal combustion engines, run in a cogen configuration using renewable fuel. Several participants called prior participants to check on appropriate configurations asking, "will this technology stand up to my specific needs?" as well as to obtain reports on potential vendors and partners. These participants were connected with the prior participants through word of mouth within industries, bulletins circulated via industry or sustainability e-mail lists, and through their developers. Road shows were employed by several vendors to leverage installations in other areas, and "make it real" to applicants. Word-of-mouth was still a significant channel for project inception and promotion. Several participants, notably in the waste water treatment customer segment expressed business drivers that included sentiments of thrift (e.g., why throw away or flare a resource that could provide a fuel for electricity and generate heat as well).
- Many did not support shifting to a performance based business model arguing that the upfront cash incentive was critical in this economy, particularly to smaller boutique installer/vendors that could be driven out of business by larger firms with better access to capital. Those who were more favorable to the concept, believed that creating a performance based incentive model would create strong drivers for vendors to keep systems running particularly where projects are

structured as power purchase agreements. Some suggested a hybrid system of support for some upfront costs with payouts overtime for performance.

- Few participants appear to be interested in holding the renewable energy credits generated by the projects. Though awareness of the financial value appears to be growing it remains relatively unsophisticated. For projects owned by a federal entity there are reports of being unable to sell the RECs due to federal status.
- Despite the increasing focus on peak pricing in California, few participants or non-participants were willing to consider running in a peaking configuration. Reasons given for this were technology based. Fuel cells are designed to run continuously and wind turbines operate when the wind resource is available. There is also a concern that one outage on a critical day might set their demand ratchet (their peak demand for the year) and negate all prior savings.
- A significant value was attributed to being able to reduce air board regulatory burden (e.g., if a waste could be utilized as fuel, this would have the effect of reducing discharge and therefore regulatory burden from the air board).
- Selling distributed generation is becoming more sophisticated, and increasingly involves the executive team in addition to the energy manager or facilities director. Where firms are international in footprint, this can have the effect of providing direction and support for sustainability initiatives. Similarly several interview subjects reported corporate goals for green power or sustainability initiatives as a key business driver, while others were very clear that money and then environment was the order of priority for their business.
- Surprisingly, none of the respondents expressed much concern about the future price of natural gas. Many appear to have longer term contracts for gas and are thus somewhat insulated from variations.

A.3.2 Participating Developer

The team completed interviews with project developers who have had projects in the SGIP. The goal of these interviews was to obtain the developer's views on the SGIP, the PAs, barriers to project development, and their respective markets.

The interviews addressed the following topic areas:

- SGIP Process
- SGIP Incentives
- SGIP Marketing and Outreach
- Project Development Process
- System Performance
- Project Characteristics
- Market Barriers
- Market Trends

Because of time constraints, not all of the developers were asked every question. Also, some developers opted not to comment on certain questions.

Wind Developers

Background on Interviewees

The developers of five SGIP wind projects were interviewed in November and December of 2009. Three of the developers have been involved with completed SGIP wind projects, although two of them were with different firms when they worked on those projects. Four of the developers have SGIP projects that are still in development. All of the interviewees are project developers only and not involved with wind turbine manufacturing. Three of the developers have also been involved with other technologies such as solar and microhydro.

SGIP Process

Application Process

The majority of wind developers believe that the SGIP application process is “fairly straightforward” and in line with other, similar rebate programs. However, one developer noted that it takes a “rocket scientist to get anything through” the process. Two developers pointed out that, for wind projects, which tend to be complicated; the rebate application process is “the least of their problems.”

The wind developers generally viewed the Program Administrators favorably, calling them “accessible and helpful” and “very responsive.” One PG&E SGIP staff member was mentioned by name as someone who worked “diligently” and sends reminders when the various project milestones are approaching.

All wind project developers handle the SGIP application process for their customers. One indicates that their customers typically review and approve the various program documents, while the remaining developers say their customers take a hands-off approach. While the application process was reasonable for the project developers to navigate, one developer commented that they “couldn’t imagine an owner trying to get through.”

Program Timelines

All developers agree that the program timelines are not appropriate for wind projects. Specifically, the 60 day limit for private entities to demonstrate Proof of Project Milestone (PPM) is inadequate for wind projects that have complex project development cycles. Some projects require wind studies and performance modeling. Depending on the specific location, environmental studies may need to be conducted, with negotiations on environmental mitigation often being required, as well. If a county building department determines that the project requires a special use permit, then public hearings and community approval may be required. One developer believes that the timeframe to demonstrate proof of project advancement should be *at least* six months and another suggested a year.

Other developers felt that the sequencing of the various milestones results in a chicken and egg situation with the financing agents. The contracts with the manufacturer and the customer (a requirement of the PPM) can’t be executed until the financing is finalized. However, some financing agents aren’t comfortable approving project financing with a conditional reservation and require the reservation confirmation.

One developer commented that the SGIP timelines were developed around solar projects when these were the dominant technology in the program and do not take into consideration the project development process for wind projects. Wind projects are very site-specific and may require extensive wind studies and modeling to forecast the system performance. Solar projects are more plug-and-play in contrast and don't require the same level of planning or modeling as a wind project.

Some developers believe that the 18 months allowed for public entities to complete their projects should be extended to all applicants, regardless of business type. More private companies are requiring all capital projects to be put through a solicitation process in order to comply with the Sarbanes-Oxley Act of 2002. Most wind turbines are custom-ordered and take six months to a year to be built and delivered. One developer had a situation where the negotiations with the county zoning department required that the size of the turbine be reduced, which meant that they had to renegotiate their contract with the turbine manufacturer, further delaying the project installation.

Program Eligibility

Most developers did not express any concern over the program eligibility. However, one developer believes that certain aspects of program eligibility should be modified. This developer expressed the desire that the program be expanded to customers who have contracts for distributed generation services as these customers are typically larger and better candidates for wind turbine projects. They also feel that the requirement to exclude portions of a customer's curtailable load is a complex and unreasonable burden.

Although not related to program eligibility, one developer believes that net metering for wind should be open to projects up to 3 MW because standard turbine sizing is in the 1.5 MW to 2 MW range.

Program Materials

Even developers who found the SGIP application process straightforward admitted to having to call their Program Administrator for clarification on certain program requirements.

One developer made several specific suggestions to the program rules and handbook:

- The applicants should be able to hand-deliver their program materials to the Program Administrator. The requirement that they be mailed reduces each deadline by several days;
- The SGIP handbook should indicate what, if any, information submitted in the program applications will remain confidential. This developer has a proprietary project strategy and would like assurances that their application materials will remain confidential;
- The handbook should be clear on what documentation is required to receive incentives for technologies from a California supplier. This developer developed a package of materials that they thought was appropriate. The application was approved, but they may have put more time into the effort than was necessary; and
- Be specific about what documents are acceptable to satisfy the requirements and where they are available. For instance, a customer tried to provide an internal utility cost tracking spreadsheet as the 12-month load documentation.

SGIP Incentives

Project developers indicate that their wind projects require either the SGIP or CEC Emerging Renewables Program (ERP) incentives to make them financially feasible. In addition, all developers with active SGIP wind projects indicate that their projects with private entity customers are taking advantage of the federal

ITC as well, one indicating that their customer will likely take the grant in lieu of the tax credit. Another developer opined that customer-sited wind projects were not financially viable until the Emergency Economic Stabilization Act extended the ITC to wind projects. They also pointed out that it will be some time before the benefits of the ITC are fully realized because it wasn't enacted until February of 2009 and the project developers have limited time to market with it.

Only one developer indicated that they have had four or five projects that did not go through the SGIP or CEC ERP programs because the projects were designed to be off grid and therefore did not qualify for these incentives.

Only two developers commented on the SGIP incentive levels. One developer indicated that the current levels are adequate but that the diminishing incentives for larger projects should be remedied because there is not economy of scale as project size increases. The second would like to see the incentives levels increased. This developer feels that non-capital costs, such as securing permits, complying with interconnection requirements, and conducting various studies should be factored when setting incentive levels.

One developer indicated that they take advantage of the CEC's ERP for their smaller wind projects and another developer is aware of the availability of grants from the U.S. Department of Agriculture for wind turbines in agricultural applications.

The following incentive programs outside of California were mentioned by the developers:

- Hawaii has a state ITC on top of the Federal ITC;
- Ohio is believed to have a program with very attractive wind incentives; and
- Oregon has the Business Energy Tax Credit.

Performance-Based Incentives

All but one wind developer was asked what effect changing to a performance-based incentive (PBI) structure would have on SGIP participation. The general consensus was that it would have a dampening effect on participation but the reasons given had nuanced differences. One was concerned that the uncertainty in the incentive amount and timing under a PBI structure would make it difficult to secure project financing. Another expressed that a PBI structure would undermine smaller projects because in order to secure financing under a PBI structure, extensive modeling would need to be performed to estimate the system performance to the satisfaction of the financing agents. Small projects are not able to carry these additional costs and remain financially feasible. The remaining two indicate that the incentive needs to be paid up front in order to sell the projects.

One developer specifically stated that the incentive structure should not be based on the project cost or payback. This was tried in the program in the past and was problematic because of disagreements over eligible costs.

SGIP Marketing and Outreach

Four of the five wind developers commented on the SGIP marketing. None were aware of any efforts by the Program Administrators to market the SGIP. One developer believes that it's the project developers' role to market the program and educate the customers and does not want program funds spent on marketing and advertising. Another feels that the Program Administrators should market the program so that interested parties are aware of the incentives available. Educational efforts targeted toward the agricultural sector to clear up misconceptions about the limitations of wind applications were suggested by one developer. Specifically, this developer indicated that the farming community believes that wind turbines need to be sited on top of a pass to be feasible. Lastly, one developer feels that the utilities could better support the wind industry by not undermining distributed generation, in general, through adverse policies (such as limitations on NEM and standby charges).

Project Development Process

The developers were asked to describe the project development process. Although they expressed that each project is unique, three developers described the following major milestones in the project development process:

- Permitting and environmental studies – A review of the local building codes should be conducted early on to determine the land use requirements. If the county determines the project is a special use, lengthy council or public hearings may be required. An environmental impact report may also be required which is lengthy and costly.
- Engineering/Site Analysis – This process can take up to a year and involves geotechnical studies and determining where the turbine will be interconnected.
- Construction – The construction must be carefully planned. Building the foundation is one of the first steps and should not begin until the building permit is received. After it is poured, the foundation takes a month to dry.
- Commissioning – The true commissioning happens after the first major wind event.

One developer stated that making the ITC available for wind projects shortened the project timeline by eliminating the need to conduct a lengthy wind study. This is because the ITC is granted based on the project cost rather than the system's production.

Two developers regularly propose their wind projects as power purchase agreements and are basing their business models on this approach. However, their current SGIP projects have not used this approach.

One developer pointed out that projects installed on government property, like a school, need to go through the Department of State Architect and those developed on the coast need to involve the Coastal Commission. Under both circumstances, the local ordinances also apply. Similarly, projects on tribal lands avoid local building department involvement, but working with the Tribal Council can present its own set of challenges.

System Performance

The feedback on system performance was limited because only two of the developers' SGIP wind projects have been completed. A third developer has had completed wind projects through the CEC's ERP.

In the opinion of one developer, forecasting the system performance is a function of the amount of modeling that is done during project development. Careful modeling results in accurate estimates and realistic customer expectations on performance. This developer also points out that thorough modeling is only feasible for larger projects as small systems can't carry the cost of modeling and remain cost-effective.

A second developer is careful to be very clear in their materials about the amount of load that the project will offset and never makes any estimates before seeing the client's energy bills. Some customers are quick to believe that a wind turbine will satisfy all of their energy needs and are disappointed when they still have utility energy use.

Regular maintenance is viewed by one developer as the key to maintaining turbine performance, who recommends servicing them one to two times per year. Maintenance contracts are common for medium to large projects, but can be cost prohibitive for smaller systems where the cost of a maintenance contract is significant relative to the turbine cost. Another developer points out that the CEC ERP requires annual maintenance as a program requirement.

Project Characteristics

Four of the developers described key project characteristics that can support or undermine a successful project:

Wind resource. Residential projects that can take advantage of NEM on retail residential rates, need an average annual wind speed of at least 10 miles per hour. Commercial projects need an average annual wind speed of at least 14 miles per hour.

Neighborhood or community support. Gaining the support of neighbors early on can help facilitate a project's development. Public hearings can be triggered by the county land use requirements or by complaints from nearby neighbors.

Project financing. Customers with small projects have to have access to financing. Medium to large projects are candidates for a PPA. Developers sponsoring PPAs have to conduct significant site analysis to determine the project output. The lower costs of small turbine projects don't support this level of modeling.

Sufficient electric load. Customers must have sufficient load that will be offset by the wind turbine. One developer looks for customers with annual consumption greater than 200,000 kWh per year.

Project champion. Successful projects usually involve a project champion within the customer organization. This individual takes a personal interest in moving the project to completion.

Site characteristics. Individual sites need adequate acreage to be feasible. It is recommended that the project site be 3 acres or more. Close proximity to trees and buildings can create turbulence and shading.

Geography. Most developers agree that rural locations, away from residential developments are better candidates for medium- to large-sized project. Projects near airports or military bases may interfere with radar systems.

Market Barriers

The developers mentioned a number of barriers to developing wind projects. These are described in the sections below.

Cost

All developers indicated that cost, in one form or another, was a major obstacle to the development of wind projects. Project economics are usually tight and cannot accommodate additional or unexpected costs. The developers mentioned the following costs as high or uncertain:

- Turbines: The wind turbines are generally the most costly component of a project.
- Interconnection: The cost of the switch gear itself is a barrier as well as the time necessary to work through the interconnection process itself.
- Permitting fees: Permitting fees in some jurisdictions can be as high as $10,000. A special use permit, if required, can add to this cost.
- Environmental studies: A Negative Declaration Study generally cost about $25,000 while a full Environmental Impact Statement, if needed, can cost up to $100,000.
- Project modeling and wind studies: Engineering resources for wind studies and project performance modeling can be significant.

Lack of Sufficient Wind Resource

California has a limited number of areas with high wind resource (usually noted as NREL wind power class of 5 or better). The availability of incentives also improves project economics if the wind resource isn't sufficient on its own.

Project Siting

The developers indicated that they've encountered the following site-specific issues:

- Noise levels: Turbine noise must not exceed allowable levels.
- FAA restrictions: Projects close to airports may be restricted or require FAA approval.
- Wildlife habitats: Monterey County, one of the areas in the state with better wind resource, is essentially shut down to wind development because the region is a condor habitat. Projects near wetlands are seen as a threat to the habitat.

Permitting

Developers noted several barriers in the permitting process. These include high fees, inconsistent regulations, and uncertain or long permit processing times.

Environmental Studies

If an environmental impact report is required, it can take up to a year to complete and cost up to $100,000. In addition, projects may be required to implement mitigation strategies. These negotiations can further delay a project.

Interconnection

Interconnection is still viewed as a significant challenge by all the developers interviewed. Generally, the issues fall into two categories:

- Cost of compliance: The cost of the switch gear can be high; costs from $25,000 to $200K were given, depending on the requirements. Another developer indicated that they had to hire a consultant to help them interpret the Rule 21 requirements which added $25,000 to the project cost.
- The interconnection process: One developer suggests that wind project schedules should allow a year to get through the interconnection process. Another developer's project required 10 to 15 meetings with PG&E's interconnection department in order to determine what was required. As the timing of these meetings was determined by PG&E, the developer felt that the process was drawn out longer than necessary. A required change in the design of the switch gear triggered a second, lengthy design review by the Program Administrator in one project.

Tariff and Regulatory Limitations

The 1 MW limit on the ability to net energy meter is a barrier when there is the potential to install a larger turbine. Developers also mentioned frustration over the restriction on participating in both the SGIP and the feed-in tariff.

Market Trends

Because of time constraints, only three wind developers were asked to comment on future market trends. One does not expect the next four years to be any different than the last four years unless fundamental issues regarding NEM limits are addressed. Another sees the interest in medium-sized wind projects for community power increasing. The last looks to the American Wind Energy Association forecasts that there will be a growth in the small wind industry in the coming years.

Fuel Cell Developers

Background on Interviewees

Five developers of SGIP fuel cell projects were interviewed in November of 2009. Two of the developers are also manufacturers of fuel cells while two are project developers who worked with technologies other than fuel cells. The fifth firm's main business is constructing cold storage units. They began offering fuel cells as an option to their clients because it is a good fit with refrigeration systems. All of the developers but one has worked exclusively with commercial, industrial, or municipal customers.

The developers represented have worked with both renewable and non-renewable fuel projects.

SGIP Process

Application Process

The developers concurred that navigating the SGIP process is driven by the vendors.

Most of the developers indicated that the SGIP "process is all right", all of the developers noted areas where they felt the process should be improved:

- One developer commented on the number of steps in the process. This developer has indicated that it's already "difficult" to coordinate the timing of the various milestones for the several dozen projects they currently have in various stages of development and is concerned that it will become unmanageable with additional projects.
- One developer mentioned concerns over their understanding that the carry over funds are only available for projects over 1 MW.
- The length of time it takes to receive the incentive check was a concern for one developer. They indicated that the SGIP Handbook indicates 30 days but their experience has been closer to 90 days. This is problem because the customers need to use that money to pay off their construction loans and get the final financing in place and the delay in receiving the rebate check delays this process. They speculated that the delays were caused by the third-party verification inspectors.
- The amount of time it takes to receive a response from the PAs after the program forms are submitted is an issue for another developer. The customers want to know that their incentive is guaranteed before they agree to proceed with the projects. The developer notes that the handbook gives specific time limits for the various stages but does not impose time limits on the PAs themselves.
- Another developer commented that the interconnection requirements that the disconnect switch be visible was not necessary because, for the new fuel cells, when the grid shuts down, the fuel cell also shuts down. This developer also noted that the support from the PG&E customer account manager was "fantastic" and that they appreciated his efforts to facilitate the interconnection process.
- One developer would like to be able to submit the program documents electronically.

The majority of the fuel cell developers indicated that the PAs were "terrific" and "responsive." However, one developer mentioned that sometimes the PAs are responsive and sometimes "they're fighting you the whole way." It was also noted that PA staff turnover is an issue. It takes each new person time to come up to speed on the program and during that time it's difficult to get questions answered.

Another interviewee would like for each PA to assign a point person for each developer. This person would know the history of each project and how the developer's systems operate so they wouldn't have to re-explain it every time they contact the PA.

Several recent program changes were mentioned by the developers as being particularly beneficial:

- Streamlining the reservation requirements by removing requirements like site maps and taxpayer IDs at early stages of the project;
- Removing the requirement for tax ID numbers for the contractors;
- Adding advanced energy storage broadens the options that they can evaluate for their clients;
- Raising the incentive cap from 1 MW to 3 MW made larger projects financially feasible. This is especially important as fuel cell manufacturers offer better prices for larger systems; and
- Adding the ability to qualify for renewable fueled incentives using directed biogas.

Only one developer had experience with both public and private entities. They noted that projects at waste-water treatment plants have a number of factors that cause for a long project cycle:

1. They're all renewable fuel projects which take longer because of the fuel cleaning systems;
2. They're public entities which usually have to go out to bid; and
3. The projects need to be approved by the water board.

They also noted that projects at water- and waste-water treatment faculties are usually initiated by the engineering firm that works with the plant on an ongoing basis.

Program Timelines

Two developers indicated that the program timelines worked fine for them. Another indicated that the 240 day milestone for public agencies to demonstrate proof of project milestones was difficult because most agencies are reluctant to sign a contract until they get grant funding and board approval, two processes that can take significant time.

Another developer would like the time allowed to submit the incentive claim form to be 18 months for both public and private entities. They explained that renewable fuel projects are really like two projects, one for the fuel cell and one for the fuel cleaning system. There are two aspects of the fuel cleaning system that cause delays. They require more extensive design at the front end because you have to test the gas, determine if you'll be able to clean it to the fuel cell specifications, then find the right cleaning equipment. The commissioning process takes longer on the back end because the two systems need to be tested and tuned, which is a complex and iterative process.

Program Eligibility

Most developers did not express concerns over the program's eligibility with the following exceptions:

- One developer believes that non-grid tied projects should be eligible for the SGIP; and
- Another would like the restriction that system size be limited to a site's maximum demand be removed. The SGIP incentive should be capped at the site's maximum demand and the remaining capacity put back into the grid through a feed-in-tariff.

Program Materials

Comments about the clarity of the program materials ranged from "they're fine" to "I've read the handbook so many times that I'm very familiar with it." Only one developer gave specific feedback over their initial confusion over hybrid systems that use both renewable and non-renewable fuel. This confusion has since been resolved but they point out that the amount of renewable fuel available for use dictates the size of the fuel cell that you can install and still meet the 75% renewable fuel use requirement but that sometimes it's more economical for a customer to buy a larger fuel cell.

SGIP Incentives

Four of the five fuel cell developers indicated that all of their fuel cell projects have gone through, or will go through, the SGIP. The fifth developer indicated that all of their projects, except for one field trial and a possible off-grid project, have received SGIP incentives. The developers speculated on whether their customers would have installed the fuel cells without the SGIP incentive. Two gave a definitive “no” while the others said that it would be highly unlikely.

All of developers indicated that their SGIP projects also applied for the ITC, although one developer said that their future projects will opt for the grant instead of the tax credit. This same developer has had fuel cell projects that received grant money from the Department of Defense. Another developer has had a public project, that couldn’t receive the ITC, apply for American Recovery and Reinvestment Act funding.

The developers expressed a range of opinions about the current incentive rate and structure. One developer felt that the tiered incentives are appropriate while another expressed frustration over the diminishing incentives for larger projects. Two developers had no specific concerns but one of them stated that the market for fuel cells in California wouldn’t exist without the SGIP incentives. Lastly, one developer would like the rebates classified as grants. For tax purposes, rebates are considered income, and are therefore taxable. Some grants are not taxable which would raise the value of them by the customer’s tax rate.

Performance-Based Incentives

The fuel cell developers also expressed a range of opinions about a performance-based incentive structure. One indicated that the number of projects would definitely be reduced because it would be harder to get financing without the payment up front. Another expressed that residential customers would require a clear and definite plan for their payments. One developer felt that performance-based incentives would work fine under a PPA but customers need the upfront payment when they own the equipment. Lastly, one developer believes that the success of a performance-based incentive structure depends on what the performance parameters are and where the bar is set.

SGIP Marketing and Outreach

The majority of the developers were not aware of any marketing or outreach activities conducted by the PAs. One has been to classes at PG&E’s Pacific Energy Center where information about the SGIP was presented. Another mentioned workshops and Web tools sponsored by CCSE, and the PAs participation at a solar convention.

The developers gave the following mixed responses when asked what activities the PAs should be conducting:

- Marketing activities should be conducted by the project developers and not by the PAs;
- Targeting marketing activities to end use customers and city building departments would help to educate them on the fuel cells and legitimize the technology;
- Marketing activities should be targeted to large customers in the appropriate industries, like waste water treatment plants, dairies, hotels, cold storage, and food processing; and

- The PA energy centers should have fuel cell demonstration displays and conduct seminars and training sessions for building officials, architects, and end use customers to educate them on fuel cells.

Project Development Process

The developers were asked to describe the project development process. Although they expressed that each project is unique, some of the major milestones in the project development process are:

- Project planning – Engaging building departments, utility interconnection departments, and regulatory agencies, if appropriate, should begin early in the process.
- Project financing – Securing the SGIP incentive is usually necessary before the financing agents will approve financing.
- Order equipment - The equipment is generally ordered once it is certain that the project is going forward. Larger units take eight to 12 months to manufacture and deliver.
- Construction – Laying foundations and hooking up gas lines can occur prior to the delivery of the fuel cells.
- Commissioning – Can take 4-6 weeks to test and tune the equipment, more for renewable fuel projects.

None of the developers indicated that they've needed to get air permits for their projects. This is because all of the technologies installed have been CARB-certified and are therefore exempt from air permitting.

All but one developer have had projects that required building permits. Most indicated that the building departments weren't familiar with the fuel cell technology initially; one encountered a building inspector who believed it to be a hydrogen bomb after an internet search. However, all the developers felt that educating the building departments was a realistic aspect of the project development process and didn't express any major concerns.

Two developers indicated that some air districts require that the gas treatment systems be included on the customers overall air permit. Sometimes this can require a little extra effort but that it wasn't a real issue.

A situation unique to the residential sector is that the households who install fuel cells often employ personal assistants who make it difficult to reach the homeowner to secure signatures and utility information. In these circumstances, it would be beneficial to have a process in place where the customer could sign a release so the developer could secure this information directly.

Interconnection also poses unique challenges in the residential sector because the interconnection forms used for residential projects are the same as those used for commercial and industrial projects. They are overly complex for a residential project and require unnecessary and expensive engineering resources to complete.

None of the developers maintained ownership of the SGIP fuel cells. One developer indicated that they are developing a few projects currently under ownership of the units. Another developer indicated that PPAs for fuel cells are trickier that for other technologies because the financing agents feel that fuel cells are riskier than wind or solar.

System Performance

Only three developers worked with systems that have been installed for any length of time (the rest have projects that are still in the construction or commissioning phase). These developers indicate that their customers are pleased with the performance. Some of their comments were:

- The systems are monitored over the internet. Disruptions to the internet impede their ability to monitor the systems;
- Disturbances to the electrical grid can trip a fuel cell system off line; and
- Maintenance contracts are effective at ensuring that the systems run reliably. Customers should negotiate a restack as part of their maintenance contract.

One developer indicated that renewable projects are inherently less reliable than non-renewable systems because the gas treatment system adds another variable to the project. It's important for them to be properly maintained to be reliable and that they're seeing higher system availability as the gas treatment systems are improving. One developer indicates that it's common for customers to have service contracts for the gas treatment systems. This is especially important for the first year of operation.

All of the developers indicated that their fuel cells already include monitoring equipment and don't have concerns over making it a program requirement. However, two expressed concerns: the first indicates that many customers, such as water treatment plans, already have many burdensome reporting requirements; and the second believes that customers would be concerned that their rebate could be at risk.

Project Characteristics

Several developers indicated that certain customer characteristics are the most important aspect of a successful project. These include:

- Customers with the ability to purchase or finance the fuel cells;
- Early adopters or those whose culture supports change and advancement;
- A project champion who takes a personal interest in seeing the project succeed; and
- Customers who stay engaged and communicate regularly.

Several facility-related characteristics were also mentioned:

- Around the clock and around the year operations;
- A base load demand of 250 kW to 3 MW;
- A use for the waste heat; and
- A medium pressure natural gas connection, water, and electrical grid connection.

Market Barriers

By far the biggest barrier cited by the developers is the cost of the fuel cells. Two developers also mention that some customers are cautious because the fuel cell technology is perceived to be new and uncertain. A third points out that organizations always put capital improvement projects over projects such as fuel cells.

Market Trends

All developers gave predictions for future market trends. They were:

- Costs will drop from some combination of increased volumes and technology advances;
- They are going to become more scalable; and
- The ability to nominate directed biogas to qualify as a renewable fueled project will have a significant impact on the market.

A.3.3 Non-Participating Developers

The team completed an interview with a wind project developer who has not participated in the SGIP. The goal of this interview was to obtain the developer's views on their perception of the SGIP, barriers to project development, and the wind market.

Because of time constraints, the interview only addressed the following topic areas:

- SGIP Marketing and Outreach
- Market Barriers
- Permitting and Siting
- Project Characteristics

Background

The non-participating developer interviewed is a project developer of both wind and hydro projects. They installed their first wind system in California about five years ago and have installed 15-20 since then. They've installed approximately 45 additional nation-wide.

The developer indicated that they do not participate in the SGIP because it can't be used with a feed-in-tariff. This developer has not worked through the CEC's Emerging Renewables Program either. Some of their past projects have been net metered and some power purchase agreements with the utilities.

SGIP Marketing and Outreach

The developer indicates that they have tried to take advantage of some of the utilities SGIP workshops but felt that they did not provide much substance. They are a minority business and would like for the program to require that a certain percentage of projects be developed by minority or small businesses.

Market Barriers

The environmental barrier is the biggest barrier to wind projects, especially the area along the coast between Half Moon Bay and Santa Barbara. Radar constraints (from Travis Air Force Base) in the San Francisco Bay delta are also a barrier. The second biggest barrier is transmission line constraints and the ability to more electricity from the areas of wind resource to areas where it can be used.

This developer feels that nothing can be done about the environmental barriers but that the CPUC should require the utilities to upgrade their transmission lines to resolve the transmission constraints.

The developer also notes that different utilities have different interconnection requirements but that this is true across the United States and not particularly problematic in California.

Permitting and Siting

The area from the San Francisco bay area to Santa Barbara has zoning ordinances that make it difficult to install wind projects. These are mostly environmental or visual impact issues. The biggest challenge isn't the particular requirements but that the requirements are different each time you work in a different jurisdiction.

Project Characteristics

Projects on federal lands have much red tape to overcome. Projects on Tribal lands bypass the federal and local requirements but that dealing with the Tribal laws presents its own set of challenges. The developer also points out that it's not possible to finance projects on Tribal lands because you can't lien the equipment. However, many of these projects are self-financed by the Tribe or use Bureau of Indian Affairs monies.

Another project characteristic is that the customer has to have the ability to accept the substantial capacity generated by the turbine.

The site terrain often undermines projects and intermittent load problems are also common.

A.3.4 Combustion Technology Developers

The team completed interviews with project developers of combustion technologies. The goal of these interviews was to obtain the developer's views on the SGIP, the PAs, barriers to project development, and their respective markets.

The interviews addressed the following topic areas:

- SGIP Process
- SGIP Incentives
- SGIP Marketing and Outreach
- Project Development Process
- System Performance
- Project Characteristics
- Market Barriers
- Market Trends

However, because combustion technologies are not currently in the program, not all of the developers were able to address program-specific questions. Also, because of time constraints, not all of the developers were asked every question. Lastly, some developers opted not to comment on certain questions.

Background on Interviewees

Interviews were conducted with four project developers who work with combustion technologies. The developers work with internal combustion (IC) engines and microturbines. One of the developer's firms is also a manufacturer. Another developer also works with fuel cell technologies.

SGIP Process

For the most part, the developers handle the SGIP application process for their customers.

Public entity customers are usually aware of the SGIP prior to working with the project developers because these customers talk with their peers, some of whom have already completed similar projects. This is particularly true of schools, cities and counties.

Application Process

One developer experienced some delays on their first renewable-fueled project. They had several rounds of back and forth with the third-party reviewer but eventually worked through the issues. The situation delayed the process and was frustrating, but now they have a better idea as to what documentation is required so they can provide a complete package to begin with.

Program Timelines

For combustion technologies, the 90 day deadline for demonstrating project advancement was reasonable. One developer indicated that it is useful to instill a sense of urgency in the customer to move them forward and the program deadlines support this. However, one indicated that demonstrating a future council meeting date was problematic.

Issues with air quality boards or utility interconnection has caused some projects to require an extension for completing their projects. One developer indicated that it is reasonable to allow 18 months for public entities because things move more slowly in these organizations.

One developer suggests a different SGIP process for hospitals. Hospitals experience significant delays because the projects must be approved by the Office of Statewide Health Planning and Development. This process can delay a project by six months. Schools experience similar delays because they have to be approved by the Division of the State Architect.

Program Eligibility

The developers agreed on several points about cogeneration's eligibility in the SGIP:

- The technology was removed from the program because of a lack of understanding about the benefits of combined heat and power (CHP). Legislative staff favor renewable technologies over those that burn fossil fuels.
- Efficient CHP systems are cleaner that grid-supplied power;
- CHP has a better green-house gas profile that wind or solar because it can supply power 24/7 while wind and solar provide renewable power for only part of the day then revert back to grid power the rest of the time.
- A good match between the electrical and thermal load is the key to an efficient CHP system.

One developer points out the change in emissions requirements in the last year that combustion technologies were allowed in the program. These changes made several of the typical equipment manufacturers' products ineligible.

One developer requested that, at a minimum, the SGIP should allow combustion technologies operating on renewable fuels to be added back to the program.

Program Materials

Generally, the program materials are clear. One developer acknowledges that it's not realistic to anticipate every possible scenario. When an interpretation is required, they contact the program administrator.

SGIP Incentives

One developer currently has a project under consideration that will not receive an SGIP incentive if approved.

One developer commented on the program increasing the incentive cap from 1 MW to 3 MW. They indicated that this change did not affect them because they do not have systems in this size range.

Performance-Based Incentives

Because of the amount of tuning required during the initial stages of project commissioning, the combustion technologies would not provided a good return for the first year under a performance-based incentive structure.

SGIP Marketing and Outreach

The developers weren't aware of SGIP marketing and outreach efforts. They recommend that the SGIP target end users that are good candidates for combustion technologies. An office building with no heat load wouldn't be a good candidate but customers with year-round heat requirements, such as hospitals, juvenile halls, and high schools and colleges with swimming pools, are good candidates.

They also recommend marketing to the associations and organizations that candidate customers are involved with, such as the Society of Healthcare Engineers. They also recommend that the SGIP partner with the developers when making presentations to these organizations.

The developers incorporate the SGIP incentive into the financial analysis in their proposals to customers and mention the SGIP when making presentations to their customers and other organizations.

Project Development Process

All of the developers report being impacted by the removal of combustion technologies from the SGIP. Most are pursuing new projects but find that it is very difficult to make a good business case for them. Many customers are small, nursing homes, high schools, YMCAs, and apartment buildings, and don't have large budgets. One developer indicated that without the SGIP incentive, paybacks average around six years which is unacceptable to most customers. The SGIP incentive brought the paybacks closer to four years which is much more reasonable.

One developer has had no new projects but is working to complete the projects that were applied for prior to the removal. Another developer is focusing on developing projects with other technologies. A third is also a large maintenance provider in California but is focusing new installations on the east coast.

One developer pointed out that many projects were installed in the 1980s without any incentive but that the project costs were much lower so they could offer paybacks down to four years without any incentive. Since that time, interconnection costs, permitting (mostly air but sometimes building), and installation costs have all gotten more expensive. The unit used to make up about half of the total installed costs, but now it's closer to a third of the total cost.

System Performance

The developers indicate that, for the most part, their systems meet the customers' performance expectations. When the project is first installed, they have to work out some of the "tweaks" so there is more downtime in the beginning. If the system is commissioned properly and monitored over the first year, it usually runs well after that.

However, one developer believes that some customers have an expectation that IC engines are plug and play and, therefore, don't always know what to do when something goes wrong. One described a situation where there was an issue with the unit and a communication breakdown within the organization so the information didn't reach the proper person to be fixed.

Some energy services companies offer performance guarantees based on production or up time. The performance guarantees are like insurance policies and some customers feel that they don't need it. Some customers have staff that can perform the necessary maintenance.

One developer indicates that they put monitoring equipment on all of their systems. If the system shuts down, there is a paging system that notifies the individuals responsible for maintenance. Production and status can also be viewed over the internet. This developer feels that this is a good practice.

Project Characteristics

Constant, year round heat load and spark spread are the key success factors indicated. In house maintenance staff isn't a requirement because this function can easily be outsourced.

Many projects are public entities are currently on hold because of budget cuts and staff layoffs.

Market Barriers

Lack of SGIP incentives was the primary market barrier described by all the developers. CHP project compete against other capital projects for funding. When dealing with a school or government, these projects are often viewed as competing for funding for teacher and staff salaries.

One developer described the barriers to CHP as "death by duck bites" because there isn't a single major barrier. Interconnection requirements, departing load charges, standby charges, and unfavorable NEM terms for CHP were examples given.

The stringent requirements of the Air Quality Management Districts in southern California make developing new projects there unfeasible but the other air districts in California are most others are more reasonable and consistent.

Lack of sufficient heat load at the customer site is another significant barriers to the adoption of combustion technologies.

Low off peak utility rates make it more advantageous to use grid power during the off peak times, undermining the project economics of CHP systems.

Market Trends

One developer opined about market trends but didn't have any insights on combustion technologies. They did indicate that the time span between fuel cell restacks is expected to extend to 10 years from the current three to five.

A.3.5 Wind Market Actors

The team completed interviews with market actors in the small wind space. The goal of these interviews was to obtain the market's views on the small wind industries.

The team discusses the market through seven topic areas:

- Background on interviewees
- Market barriers
- Emissions issues/Permitting issues
- Project characteristics
- Other programs
- Market trends
- Program modification guidelines

Background on Interviewees

The team completed seven interviews with market actors in the small wind industry. The team interviewed staff at four manufacturing companies, at two small wind associations; in addition, one industry expert participated. The staff held positions with the following titles: director, partner, vice president, and sales director.

Market Barriers

Market barriers are broken into three main categories for the small wind industry: customer barriers, technology barriers, and other barriers. This section outlines the issues within each of these three categories.

Customer Barriers

High up-front cost, long payback periods. The up-front cost for a small wind system is substantial, even after all of the government and utility incentives that encourage the installation and use of these systems.

Consequently, the payback periods are also longer than the three- to four-year payback periods that most consumers and financiers are seeking. As a result, these systems are still viewed as a purchase for the conscience rather than a smart business decision.

Lack of expertise. Most organizations that could develop small wind projects lack the internal expertise to navigate the development and permitting processes, arrange financing, and maintain the system once it is in operation. Renewable energy development is not the core business of the organizations that have a large enough load to support the system sizes encompassed in SGIP. As a result, the person leading the process is required to learn all of the nuances of the process for the first time; there are rarely follow-on opportunities to leverage the previous experience. In addition, these staff are often doing it on their own time

Lack of third-party providers. Very few third-party providers of development and maintenance services offer packages for small wind projects. As seen with solar development, third-party providers could alleviate the up-front cost and expertise barriers discussed earlier, but very few third-party providers have entered this space at all; AWEA predicted that more entities would fill this role during calendar year 2009, but that has not occurred, likely due to capital constraints.

Technology Barriers

Lack of manufacturers and turbines in the 50 kW to 1 MW range. This is an issue of a chicken and an egg. The chicken: the market for these mid-size turbines. The egg: manufacturers of the mid-size turbines. There is a question of whether the manufacturers will drive the market forward or whether the market demand will create the need for more manufacturers. Before the wind boom of the first decade of twenty first century, large manufacturers of wind turbines (e.g., Vestas, Siemens) were involved in the production of mid-size turbines. As larger turbines became available, however, these larger manufacturers stopped producing mid-size turbines; it is unlikely that they will manufacture these again in the future. Few new market entrants have filled this void. It is possible that this issue will self-correct as the market demand increases, but it has not been sufficient to do so in the recent past.

There are some Chinese manufacturers producing turbines in this size range, but they are not widely used in the U.S. The market has been reticent to adopt Chinese equipment, and Chinese manufacturers have not made the effort to gain a foothold in the U.S. market.

Relatively high maintenance costs. It is not cost-effective to maintain a small number of turbines larger than 200 kW. There is a high fixed cost associated with such maintenance and a lower variable cost (cost per turbine). For customers that install a single or a couple of mid-size turbines, the maintenance costs can challenge the financial viability of the project. Specialized labor is needed to maintain turbines of this size; higher densities of distributed projects would need to be created in order to make the cost of such services more reasonable. If a large wind facility is located near to a distributed project, it may be possible to leverage that labor base, but the larger facility would receive priority.

Difficult to secure towers. Manufacturers of wind towers focus their efforts on the large-scale towers. Many turbine manufacturers have frame agreements (i.e., long-term supply agreements) with large-scale wind turbine manufacturers and focus their efforts on producing turbines for those customers. These are turbines produced in the hundreds and thousands per year. A request for a single tower at a smaller scale does not make economic sense to these manufacturers; it produces neither the profit margin nor the opportunity for additional business that the large-scale towers do. As a result, it is difficult to obtain traditional towers for these mid-scale projects.

Regulation/Program/Other Barriers

Insufficient customer load. SGIP's project sizing requirement limits the pool of potential projects. Few customers have a load[146] large enough to support a small wind project that is larger than 100 kW under current SGIP rules, and those that do are not always located in areas with appropriate permitting requirements. If projects were allowed to have a capacity larger than the current limitation, the pool of potential projects would increase. Projects larger than 100 kW start to achieve economies of scale.

Incentive focuses on capacity factor more than actual energy production. SGIP awards incentives based on installed capacity rather than on the actual energy produced by the system. The actual capacity factor of a given system is dependent on many factors, including the siting of the facility. As a result, several projects with the same installed capacity may produce very different amounts of energy, though they are all incented at the same level. This arrangement does not do enough to promote optimal siting of the facility.

Manufacturers are confused about program requirements for certifying small wind technologies. Manufacturers believe that any technologies used under the SGIP must be certified by the CEC, just as those technologies used under the ERP are. They believe that t will take six to 12 months and cost tens of thousands of dollars when they include the cost of labor. The only firms willing to bear the cost of this process are those that believe that the access to California's market will enhance their business proposition substantially. This confusion inhibits organic growth into the California market and is especially problematic for manufacturers located outside of the U.S., which is the origin of most of the mid-size equipment. Better communication about the requirements for certifying small wind technology is needed.

Fractured certification process. The CEC certification process fails to recognize certification processes that other government entities have put in place. Manufacturers that are certified by other agencies (e.g., U.S. Department of Agriculture or New York State Energy Research and Development Authority) have to repeat the process in California. Some see this as another Professional Engineer approving equipment that has already been approved by one or more other Professional Engineers.

Small wind is not on the same regulatory footing as solar. The combined set of government incentives for solar tends to be more attractive than that for wind, given the relative energy output of the two technologies.

Emissions Issues/Permitting Issues

"Permitting, permitting, permitting. That is *the* barrier for small wind."

Permitting is the prime barrier to development of small wind in California. AB 45 made initial steps to address some of these issues, but it did not go far enough, according to the interview subjects. The primary issues highlighted are as follows:

Inconsistent permitting rules. Every county in California has jurisdiction over permitting small wind projects, and each county has a slightly different approach to permitting. As a result, developers must adjust their development model, equipment, and paperwork for each county in which they do business.

[146] The relevant load qualification for SGIP is that the project be sized no larger than 200% of the host customer's previous 12-month annual peak demand

Non-existent permitting guidance. In some counties, small wind permitting guidelines do not even exist. Some counties wait until a developer proposes a project to develop the permitting guidance. This adds a significant element of uncertainty to the development timeline and budget, deterring developers from being "the first" in that county. AB45 took the first steps needed to address this issue for projects smaller than 50 kW, but it will not impact most projects that fall under SGIP.

Uncertain timeline for completing the permitting process. The permitting process can go on indefinitely because there is no limitation on the amount of time that a county can take to reach a decision. It has taken longer than a year for some projects to receive approval, which is a substantial amount of time in the development cycle of a small wind project; compare this with a total development timeline of about a month for the average distributed solar project. This poses a unique challenge for developers, which must finance this process; the delays hurt the project economics substantially.

Public perception challenges. In many cases, the public perceives small and large wind projects as one and the same. The impact of projects at either end of the size continuum is significantly different, and the market actors believe that the regulations put in place to manage those impacts should be the same. For example, a 50 kW turbine will not have the same type of avian impacts as a 2 MW turbine; some members of the public are not aware of these differences.

Some interviewees cited these specific hurdles created by permitting laws:

- Hub height allowed is too short; hub heights need to rise above local structures to avoid turbulence, which impedes production of high quality power.
- Full Environmental Impact Statement (EIS) required; these are unnecessary for most small wind systems and add significant cost to projects that are already challenged from a cost-effectiveness standpoint;
- Required setbacks are too large; in most cases, one turbine length in each direction from the tower is sufficient.

The respondents did not discuss any emissions issues.

Project Characteristics

There are six main project features that must co-exist to produce successful small wind projects:

4. Adequate wind resource: Certain parts of California have robust wind resources; these locations improve the economics of projects substantially.
5. Reasonable and certain permitting requirements: Permitting requirements that facilitate small wind development and that provide clear guidance on the expected timeline for review reduce uncertainty in the development process.
6. Eligibility for SGIP incentives: Parts of California are not eligible for SGIP incentives; this essentially kills those projects.
7. Distance from Urban/Suburban areas: Urban and suburban areas tend to have lower quality wind resources and higher levels of public opposition; few projects succeed in those areas.
8. Site with sufficient load to sustain the project: SGIP requires that the energy produced by its projects serve the on-site load; finding customers with load sufficient to support the project is critical.

9. Project champion: An internal stakeholder at the customer site must believe in the project and be willing to secure support for it.

Projects with these six characteristics have a significantly higher likelihood of success than those that lack even one of them.

Other Programs

Due to limited interview time, this question was not asked of all respondents. One respondent listed several different rebate or production-based incentive programs of which he was aware, including Massachusetts, New Jersey, Maryland, New York, Ohio, Wisconsin, Washington, and Oregon. Specific advantages of each program were not mentioned.

Generally speaking, however, the following criteria were identified as relevant to a program's ability to create small wind development:

- Rebates and grants rather than tax credits
- Allows systems of at least 100 kW
- Application process minimizes red tape
- Incentives cover at least 30% of project cost
- Incentives create a level playing field for small wind and distributed solar.

Two other types of incentive programs were cited:

- The City of Berkeley's Berkeley FIRST program allows residents to finance solar projects on the property tax bill. This program could be expanded to include small wind.
- Marin County's Community Choice Aggregation pilot allows municipalities and the county to join together to issue bonds, which could be used to finance small wind according to this person. The cost of capital through this program is as low as 4-5%.

Market Trends

The interviews indicate a high level of interest in small wind investment coupled with a certain level of reticence.

Cost: The success of small wind is dependent on the industry's ability to bring down the cost of the technology.

- Game-changing technologies, such as Pax Streamline's blown wing technology, would revolutionize the design of turbines and the associated cost. By making the turbines smaller and easier to manage, the technology would also enable the turbines to be placed in locations that are currently unavailable to large turbines.
- Small wind projects developed in connection with storage or other hybrid approaches would help address the intermittency issues with wind while increasing the project economics by enabling peak demand reduction.
- Several respondents indicated that they expected to see an increase in production of turbines in the 200 kW to 500 kW range. These mid-sized turbines address the municipal, school, and agriculture

markets, which several respondents see as major growth areas for small wind. These respondents anticipate that this gap will be filled by new market entrants rather than by existing players in the large wind manufacturing space.

Technology: In addition to Pax Streamline's blown wing technology, a variety of changes to *existing* technologies are possible, including the following:

- Increasing reliability (and reducing maintenance costs);
- Making the turbines more "appliance-like" and easier for on-site staff to manage;
- Reducing the cost of towers and foundations through the use of advanced materials;
- Improving wind resource assessment technologies.

The innovation of advanced materials is a critical component to the manufacturers' ability to deliver on these cost reductions.

Manufacturing Operations: Two of the three manufacturers that were interviewed have plans to scale up their production of wind turbines in the size range that would be applicable for SGIP. One of the two is run by a team of executives with experience building companies from the ground up to millions of dollars in sales. The other manufacturer is a smaller shop.

Program Modification Guidelines

This was not discussed during the interviews with the small wind market actors because the market actors are not familiar with the SGIP program modification process.

A.3.6 Fuel Cell Market Actors

The team completed interviews with market actors in the fuel cell space. The goal of these interviews was to obtain the market's views on the fuel cell industry.

The team discusses the market through seven topic areas:

- Background on interviewees
- Market barriers
- Emissions issues/Permitting issues
- Project characteristics
- Other programs
- Market trends
- Program modification guidelines

Background on Interviewees

The team completed four formal interviews and one informal interview with market actors in the fuel cell industry. The team interviewed staff at two manufacturing companies, two fuel cell associations, and one university research center. The staff held positions with the following titles: senior policy advisor, business development and sales director, director of governmental affairs, director/co-chair and manager of external relations.

Market Barriers

Customer Barriers

Lack of recognition of the value and performance of fuel cells: Multiple respondents noted that there is a lack of recognition of the value and performance of fuel cells. The market is currently not at the point where customers ask for and insist on fuel cells. With more installations, customers are beginning to learn more about the market. One respondent felt that the market needs to surpass a certain point for the industry to be sustainable—there are currently about 28 MW deployed commercially in California. The respondents also noted that the SGIP has been a critical force in allowing the market to be where it is today.

Importance of integrating fuel cells into the built environment: Fuel cells require integration on a case-by-case basis to ensure efficient use of the electrical and thermal products. Respondents mentioned that if successful integration does not occur, it is more likely that the customer will not be satisfied with the fuel cell. Integration is such an important factor in the success of project, that one manufacturer will not allow installers to install their product unless the manufacturer is involved in the integration. One respondent noted that this integration can be more difficult in a retrofit situation.

Lack of education and ownership from architects and developers: There is still a need for educating the market on fuel cells and their advantages. Many architects and developers are not familiar with the technology, and thus are hesitant to use it. The industry needs more architectural and developer firms to become involved with fuel cells. For example, LPA advertises themselves as being one of the leading sustainable design firms in the nation. Firms leading the way on fuel cell development are also needed.

Difficulty in finding outside financing: One respondent noted that the financing sector is not experienced with fuel cells, and thus is hesitant to finance systems. This perceived risk attached to a fuel cell system has limited the amount of financing available and made it difficult to obtain financing.

Cost of fuel cells: Two respondents noted that the cost of fuel cells is a barrier. One felt that it is not the top barrier and another felt that the cost is coming down.

Technology Barriers

Lack of volume production: Respondents noted the need for an increase in volume of production in order to drive the price down through cheaper manufacturing operations. One respondent noted that the industry is looking for a $2,000/kW installed cost for successful fuel cell implementation.

Use of waste gas requires pre-cleaning before it enters the fuel cell: One respondent noted that for most fuel cells a gas conditioning unit is required for waste gas. The gas conditioning unit cleans the gas before it enters the fuel cell. Fuel cells have exemptions from some air quality management districts, like the South Coast Air Quality Management District; however, air districts require permitting for the gas conditioning unit. One respondent noted that air districts are unclear on how to issue a permit for these systems. Another respondent noted that this issue had been addressed in the South Coast Air Quality Management District in the past year.

Lifetime of the fuel cell: One respondent discussed misconceptions about the lifetime of the fuel cell. Fuel cell technology has improved in this area and will continue to improve.

Little competition: A few respondents noted that there are currently two large stationary fuel cell players in the California market—Fuel Cell Energy and UTC Power. Therefore, there is little competition, but more market players will increase competition.

Regulation/Program/Other Barriers

Utility opposition: Some respondents felt that the utilities in California do not advocate an increased fuel cell market. Because fuel cells have a narrower application than other distributed generation technologies, like solar, it appears easier for the utilities to fight market entry of fuel cells.

Net metering limit of 1 MW: One respondent noted two points with regard to the net metering limit of 1 MW. First, companies are starting to pursue fuel cell projects greater than 1 MW, and thus would not be eligible for net-energy metering. Second, under net-energy metering for fuel cells, the utility cannot charge some of the additional fees that could be placed on customer-generators like demand charges, standby charges, minimum monthly charges, if the charges go beyond other customer's charges in their rate class. This waiver is not in place for fuel cells larger than 1 MW. Account managers tell customers that these fees will add a significant cost to the project, thus deterring project completion.

Ability to participate in both SGIP and net-metering: This issue will likely arise in the future and is a potential barrier. Some customer segments may want to receive SGIP funds for a portion of the system and a feed-in tariff for another.

Emissions Issues/Permitting Issues

Respondents noted that some air quality management districts, such as the South Coast Air Quality Management District (SCAQMD), provide exemptions for air permits for fuel cells (Rule 219 in SCAQMD). In addition, technologies that are exempt must certify their technologies to specific emission standards under the CARB distributed generation certification program[147].

Another permitting issue cited by participants is with building departments in cities, specifically the fire marshals. The California Stationary Fuel Cell Collaborative has been working with the state fire marshal office to educate the office on fuel cells and alleviate any issues with permitting. However, one respondent noted that there have still been some issues with local fire departments.

Project Characteristics

Respondents noted a few project characteristics of successful fuel cell installations:

10. There must be some economic benefit associated with the fuel cell installation. For example, the fuel cell could use on-site waste as fuel and reduce the cost of disposing the waste.
11. There must be a need for the thermal energy.
12. There must be a need for energy and heat 24x7 or the project needs to utilize a feed-in tariff program.
13. The host customer needs to be enthusiastic about the deployment of a fuel cell at their site.
14. The installer/manufacturer/contractor takes ownership in the success of the project.

[147] http://www.arb.ca.gov/energy/dg/dg.htm.

15. The design of the installation is well thought out to ensure high operational efficiency throughout the life of the project.

Some target markets listed include

- Agribusiness community (high target with a lot of promise)
- Wastewater treatment plants
- College campuses
- Food industry (grocery stores, breweries)
- Hotels
- Home use
- Big box stores
- Data centers

It is also becoming popular to use fuel cells to power forklifts.

Other Programs

Respondents noted that the SGIP program is the leading fuel cell incentive program—other states look to the SGIP to see its progress. One respondent noted that Texas, New York and Ohio have had programs for fuel cells in the past, though is not aware of the current status of those programs.

Market Trends

Markets

- Using biogas as a fuel for fuel cells is successfully taking off in the market specifically with wastewater treatment plants. Other biogas applications that could enter the market include biogas operations in the San Joaquin Valley with dairies installing digesters and using the biogas as a fuel for fuel cells. Food processing plants may also be a market sector that begins to install fuel cells. Another biogas application is the gasification of biomass in the San Joaquin Valley. This application will likely receive more attention under AB 32. Lastly, the operation of a fuel cell from landfill gas could increase in the future.
- Another respondent also felt that use of renewable fuel will increase with fuel cells.
- The market for natural gas fueled fuel cells has begun to reach penetration levels in hotels, hospitals, office buildings, and institutions (prisons and universities), and has started to climb the curve to being able to stand on its own.

Technology

- An emerging technology is the stationary fuel cell/gas turbine hybrid power generation. This technology has electrical efficiencies that far exceed the simple sum of either technology—the fuel to electrical efficiencies are approaching 70-80%. The hybrid technology allows a gas turbine to exceed the Carnot efficiency limit. Many universities are exploring this technology including University of California-Irvine and Georgia Institute of Technology. Manufacturing companies that are involved include Fuel Cell Energy and Rolls Royce.
- One respondent believes that the technology’s lifetime will increase in the future.

Cost

- All respondents indicated that prices will decrease in the next few years. Another respondent noted that prices are reducing about 25% per year. Drivers for cost reduction include volume, the competition in the market, and technological developments.

Manufacturing Operations

- Both respondents with manufacturing operations indicated that their companies do have plans to scale up their manufacturing operations, but that volume is needed to support an increase. Both respondents noted that their current manufacturing needs are not meeting the maximum capacity of their manufacturing operations—One respondent noted that their current operations can accommodate about 100MW a year and they are producing about 25MW a year. Another respondent noted that the current operations can produce a few thousand units a year and they are producing a few hundred units per year. In addition, an assembly plant in California would reduce costs because shipping costs are high.

Program Modification Guidelines

One respondent noted that the program modification process is well defined, but the CPUC can still get held up the requests. However, it seems like the CPUC has been trying to rectify that issue.

A.3.7 Advanced Energy Storage Market Actors

The team completed interviews with market actors in the advanced energy storage space. The goal of these interviews was to obtain the market's views on the advanced energy storage industry.

The team discusses the market through seven topic areas:

- Background on interviewees
- Market barriers
- Emissions issues/Permitting issues
- Project characteristics
- Other programs
- Market trends
- Program modification guidelines

Background on Interviewees

The team completed four interviews with market actors in the advanced energy storage industry. The team interviewed staff at three manufacturing companies and one advanced energy storage association. The staff held positions with the following titles: sales, founder, and director.

Market Barriers

Customer Barriers

Unfamiliarity of energy storage: The main customer barrier cited by respondents is unfamiliarity of energy storage. Energy storage as a grid connected application is new and thus there are few success stories to share with customers. A few respondents noted the importance of having history and successful project stories for customers to be willing to adopt the technology. In addition, there is not a ready-made channel of installers who are familiar with the technology. This unfamiliarity can lead to customers assigning a high risk to the technology.

Difficulty in placing technology if customer leases the building space: One respondent noted that many businesses do not own the property where their business is located.

No federal incentive: Though there are high federal incentives for customers to install renewable energy technologies (30% federal tax credit), there are no such incentives for energy storage. Therefore, the financial case is more difficult for energy storage than for renewable technologies. This barrier can also be classified as a regulatory barrier.

Good modeling tools for energy storage do not exist: The industry recognizes the need for good modeling tools to model storage into systems and to model the true value of storage. Models should take into account energy pricing including time of use rates, demand charges, and the locational energy mix on the grid including the amount of renewable technologies feeding the grid. Such modeling tools could allow customers and utilities to better understand the value of the storage system.

High capital cost: One respondent noted that the current return on investment of a 20kWh system could be 5-6 years, and most businesses require a 2-3 year payback.

General economic situation: The current economic situation makes businesses risk adverse. One respondent felt that the situation was starting to get better in California.

Technology Barriers

Few technologies available to handle large-scale needs: One manufacturing company feels that flow batteries are the best to handle large scale energy storage needs. There are currently four companies in the flow battery space: ZBB Energy Corporation, Prudent Power, Premium Power, and NGK (from Japan).

Need ability to use energy storage as a system, rather than just a battery: Another barrier cited was the ability to use energy storage in a system, rather than just a battery. The respondents states three reasons for the need of energy storage technology to act like a system: (1) combining renewables and energy storage will go smoother if the storage can act like a system and require only one bi-directional inverter for both the renewable technology and storage technology, (2) an energy storage system could allow the customer to continue to receive energy when the grid is down (conventional inverters for PV and other systems shut down when the grid is down) (3) the ability to reserve power and have a continuous stream of energy.

Regulation/Program/Other Barriers

Regulatory structure does not compensate storage for its true value: The current regulatory environment does not compensate storage for its true value. For example, storage could play a role in frequency regulation. Under one independent system operator, conventional generation is compensated for providing frequency regulation via an opportunity cost. However, energy storage projects are not currently eligible to for frequency regulation compensation in California.

Energy storage must be combined with a wind system or fuel cell to receive the SGIP incentive: Most interviewees noted that in order to receive the SGIP incentive for energy storage technology, the storage must be combined with a wind system or fuel cell. This requirement is limiting on the technology and the market for the technology.

No strong financial incentive from time of day tariff differences in the U.S.: Two respondents noted that energy storage for commercial customers for time of day arbitrage does not make financial sense in California. The current tariff differences between peak and off-peak are not large enough to make an up-front investment in energy storage are viable option. In addition, one respondent noted that these tariffs could change in the future, so there is no guarantee of what the difference will be in the future. Another respondent thought that the only location energy storage for time of day arbitrage makes financial sense is in São Paulo, Brazil because there is a large enough differential between the peak and off peak energy prices.

Uncertainty in the amount/availability of future SGIP or other program incentives: One respondent felt that a carve-out for energy storage would help demonstrate the advantages of storage.

Unclear interconnection requirements: A few respondents noted that it is unclear if interconnection is required for energy storage under Rule 21, because storage is not a generating technology, for a stand-alone configuration that is not back feeding into the grid.

High interconnection fees: Respondents mentioned that the high interconnection fees can be a large barrier to projects, especially smaller projects. One respondent noted that the fees in PG&E's territory include an $800 application fee and a $600 interconnection fee. This equates to about 15% of the cost of one manufacturer's system.

Potential siting and permitting barrier: One respondent noted that there are not that many projects that have gone through the siting and permitting process. Issues may be uncovered as more projects go through the permitting process.

Emissions Issues/Permitting Issues

The respondents did not discuss any emissions issues. Respondents noted that there are not many projects that have gone through the permitting process. Issues may be uncovered as more projects request permits.

Project Characteristics

Respondents have seen interest in advanced energy storage from many different market sectors including universities, wineries, military bases and manufacturing plants. A few specific project characteristics that lead to successful installations of energy storage are listed below:

16. Customer has demand charges on their electric bill: storage is currently not cost effective in a load shifting environment due to lack of large enough differential between on-peak and off-peak energy rates.
17. Need a high degree of volatility in the load on the customer premise.
18. Load with high peak demand during the day and low demand at night.
19. Under current rules, customer needs to own the property.
20. A customer with renewable energy or interest in installing renewable energy.

Other Programs

Due to limited interview time, this question was not asked of all respondents. One respondent noted that they were not aware of other programs to incent or support the installation of customer sited energy storage, except for a CEC PIER grant under the emerging technologies group.

Market Trends

The interviews revealed that there is currently a huge amount of investment in energy storage.

Technology: One respondent noted that there would likely be some performance increases with existing systems and technology in the next 2-4 years. In addition, the stimulus bill investment will probably aid in demonstration sites for new chemistries; however, the respondent did not think that there would be any new breakthroughs in chemistries in the next 2-4 years. The stimulus bill investment will also provide for some reasonably sized storage systems over the next few years. These systems could generate more interest and successful project data to the consumers, thus accelerating the adoption of storage technologies. In addition, one respondent thinks that in 2-4 years, there will be different configurations of the currently available technologies.

Cost: One respondent felt that there would be a significant drop in price because there are a lot of new players and a lot of stimulus money going toward the technology. In addition, the use of lithium ion batteries in vehicles will likely force the price of that technology down. Another respondent felt that the cost of some energy storage technologies will remain stable for the next few years. In four years, one respondent thinks that there will be a sharp acceleration in the adoption of storage with declines in pricing.

Manufacturing Operations: Two manufacturers have plans to scale up their manufacturing operations. An increase in sales will lead to an increase in both the scale and method of manufacturing operations. Both companies anticipate that 2010 will be a positive year for energy storage.

Program Modification Guidelines

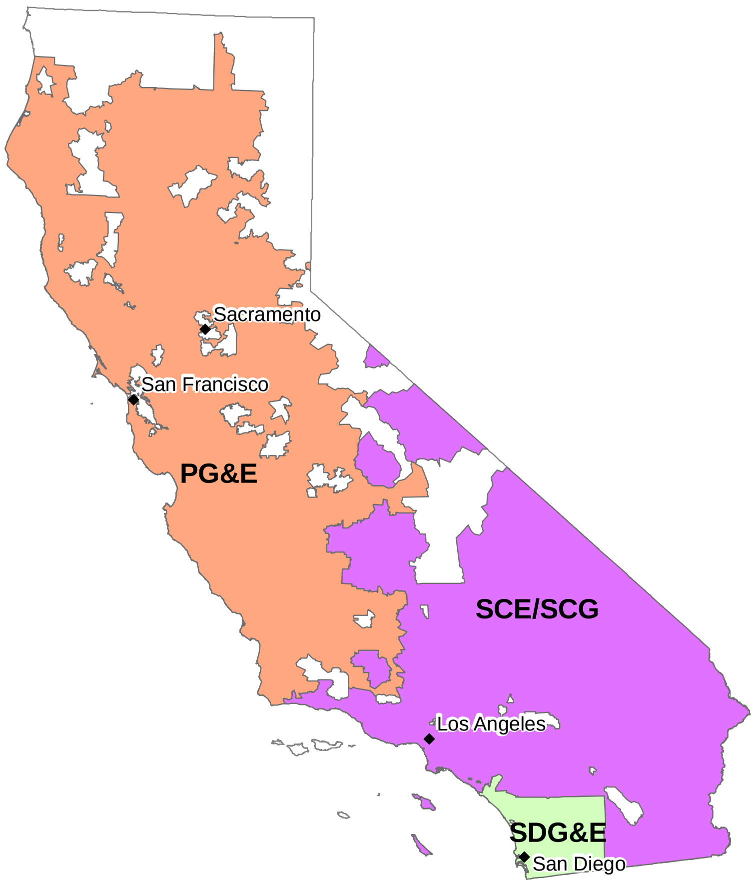
One respondent has been through the program modification process a few times. The respondent noted that they have been simplified somewhat and cited no further issues with the process.

APPENDIX 4: GIS ANALYSIS

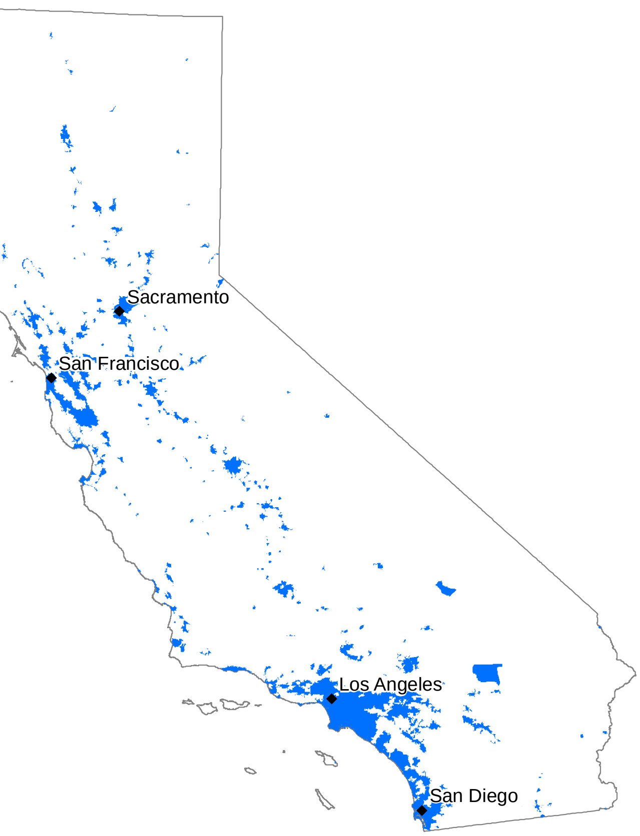
Appendix 4.1: Layer Maps and Zip Code Details

The maps in this section correspond to the layers used in the Geographic Wind Analysis (Section 6.2). These layers were used to identify areas with high and low potential for wind projects.

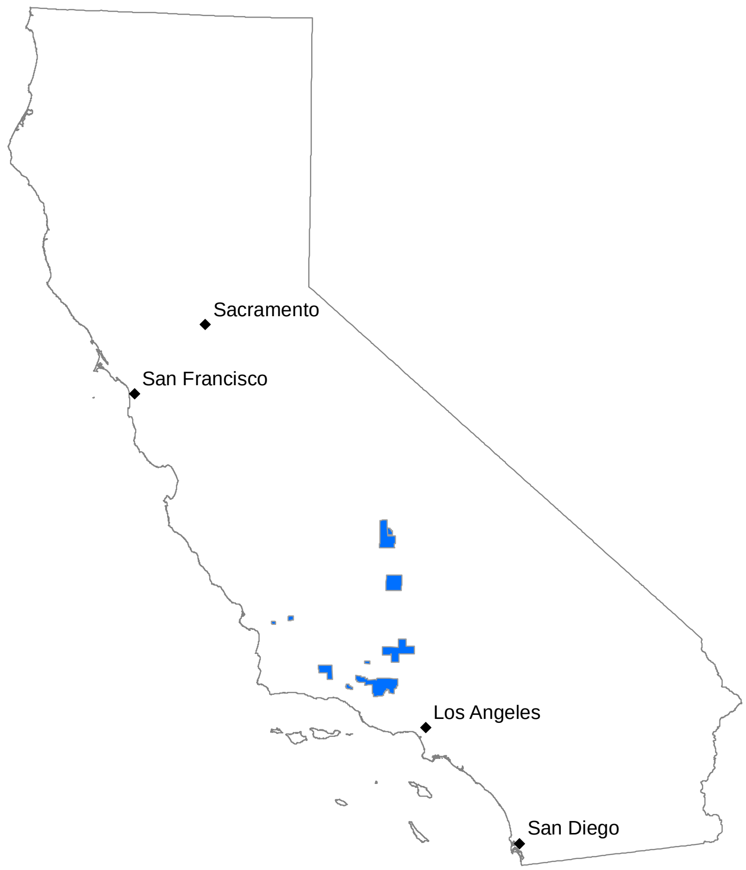
Estimated Program Administrator (PA) Areas



Urban Areas in California

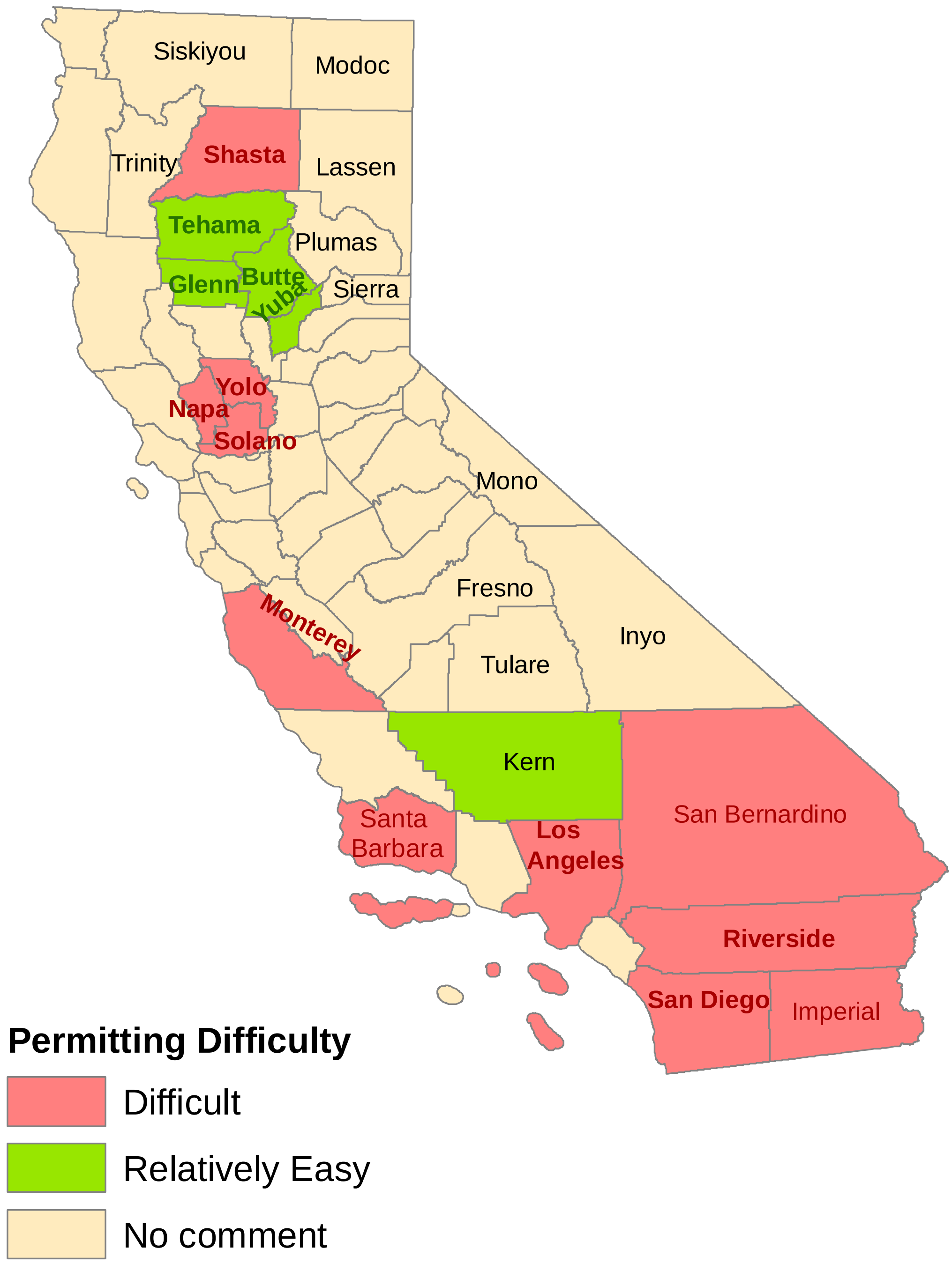


California Condor Critical Habitat

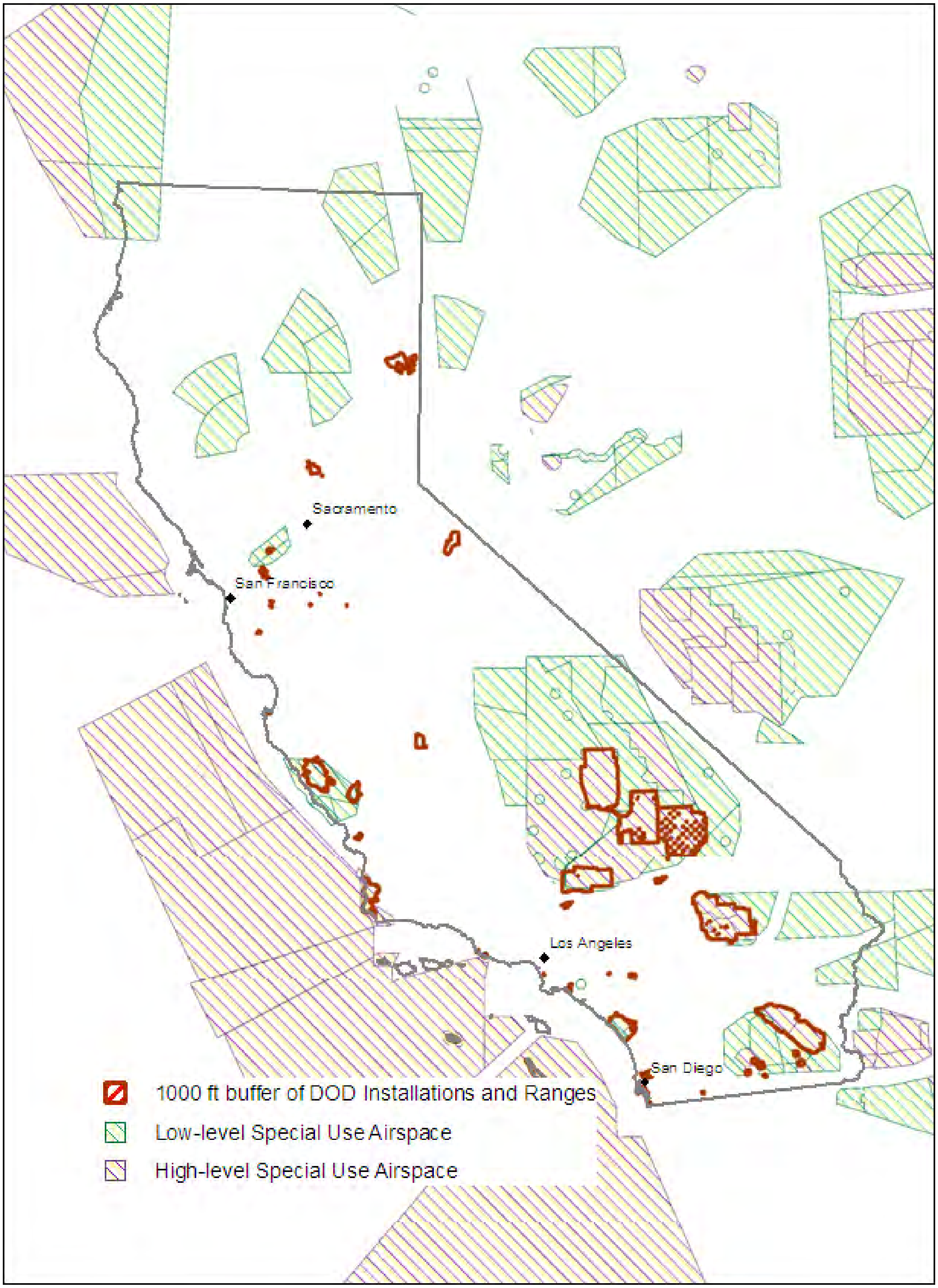


County Permitting Costs

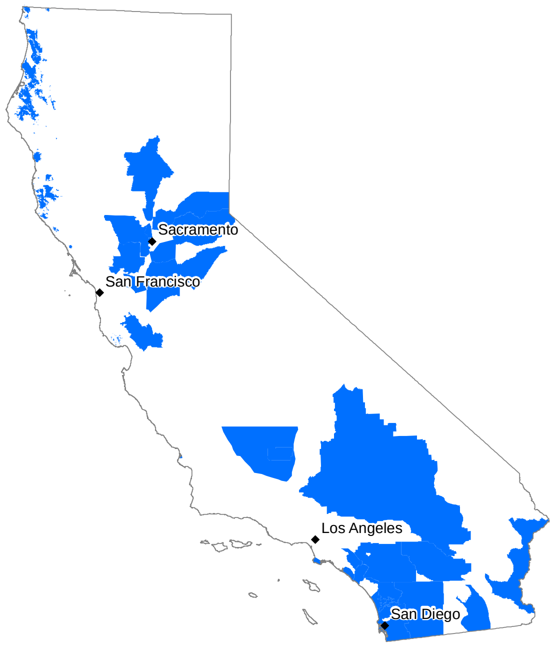
County Permitting Difficulty



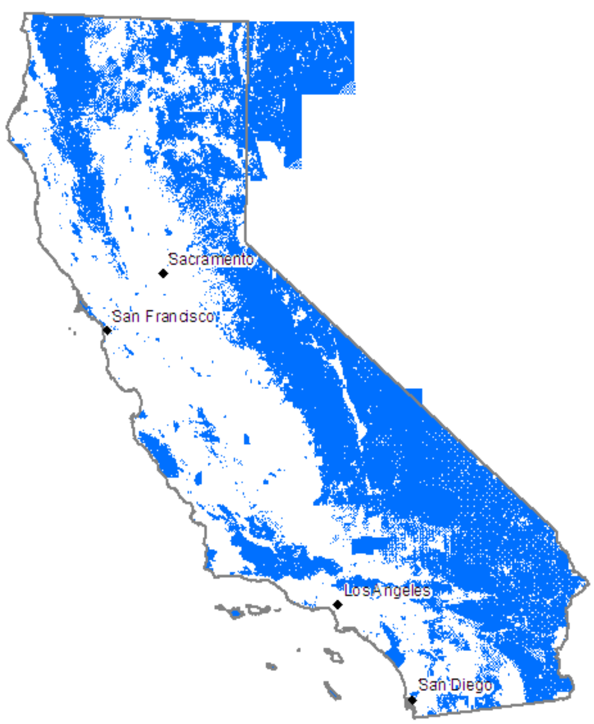
Military and Aerial Ranges



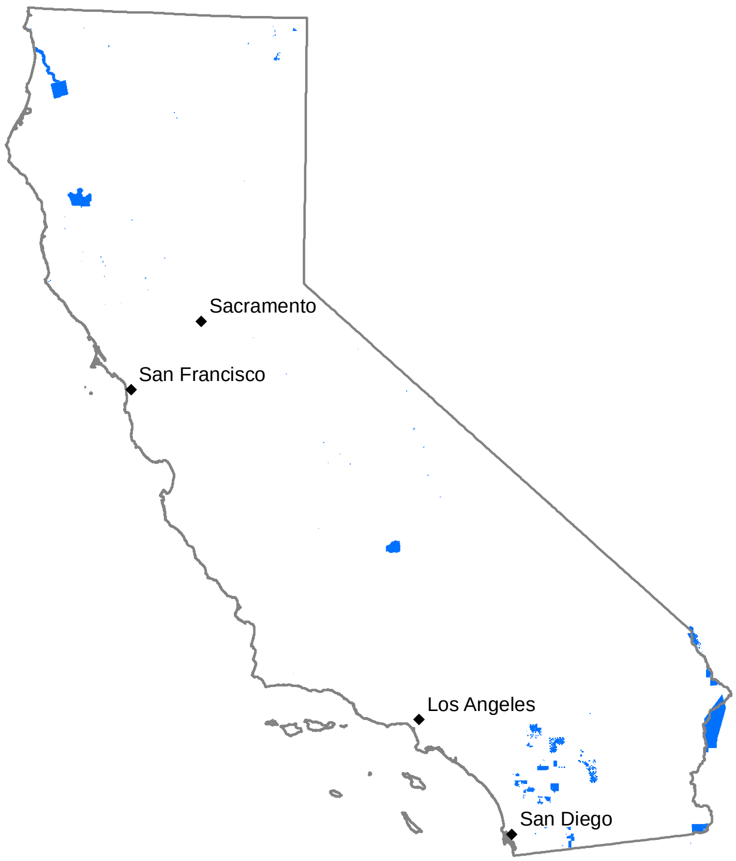
California Large Conservation Areas



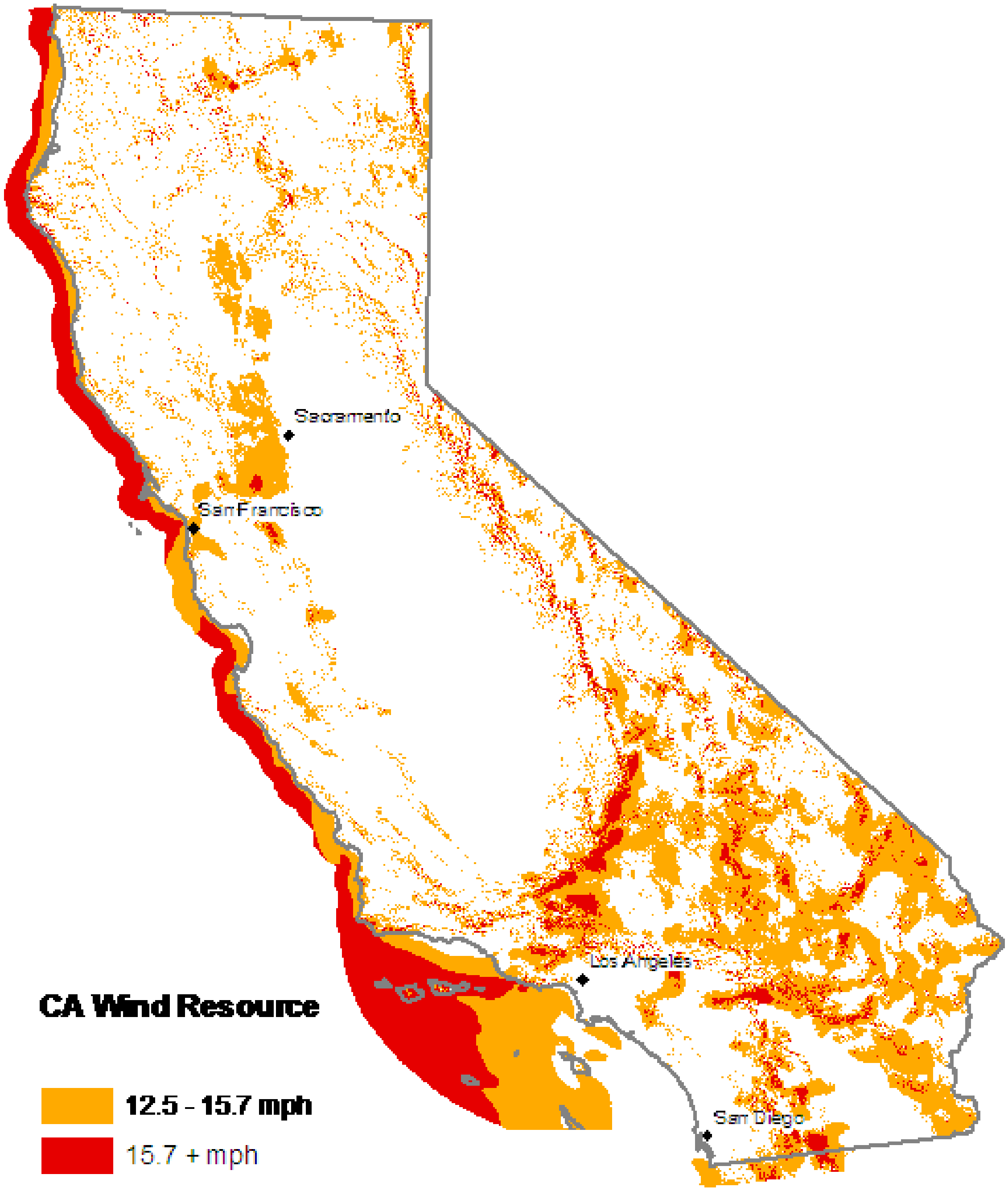
Land Status- Federal Land



Native American Lands



California Wind Resource

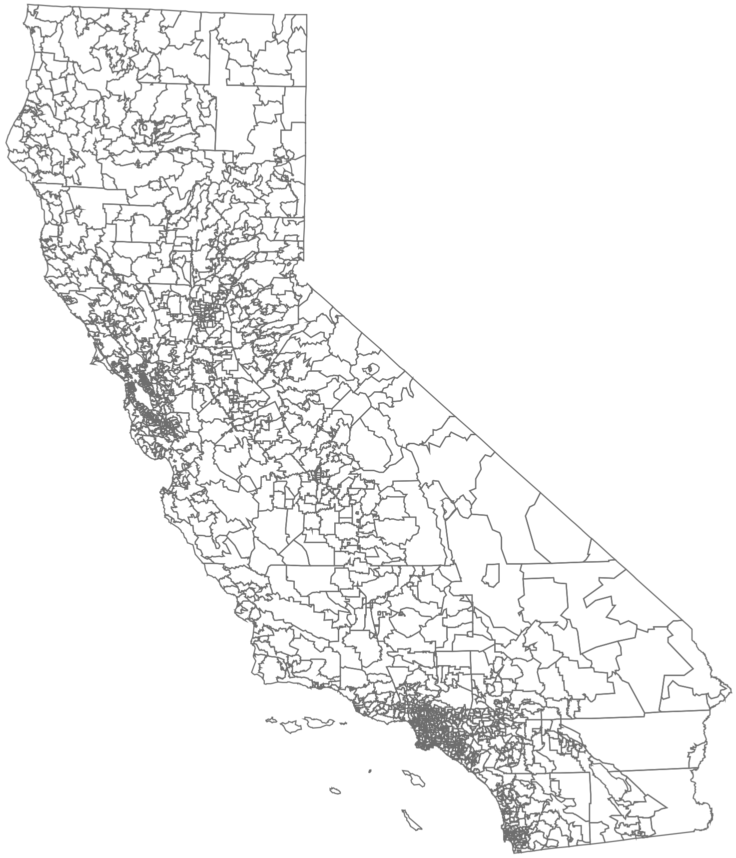


SGIP Wind Applications

Large California Cities

California County Boundaries

California Zip Code Areas



Tables of Wind GIS Analysis Scenarios Listing All Zip Codes by Scenario

The tables in this section detail the results of the Geographic Wind Analysis (Section 6.2). Each table corresponds to a scenario and wind speed. The tables include all zip codes that fall into the scenario, the zip code area name, the population in 2007, the population in 2007 per square mile, the area of the zip code in square miles, the estimated IOU region, and the number of establishments in each zip code area.

Sources for this section: Summit Blue GIS Analysis [zip codes and IOU region]; ArcGIS data [population in 2007, population in 2007 per square mile, and area of zip code]; U.S. Census Bureau. American FactFinder. 2007 County Business Patterns. [number of establishments]

Table A.4-1. GIS Analysis Results: Scenario 1 Wind Speed 12.5-15.7 mph

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
90265	Malibu	20094	212.4	94.60	SCE	961
90272	Pacific Palisades	24144	976.7	24.72	SCG	876
90290	Topanga	6545	349.3	18.74	SCE	228
90704	Avalon	3852	29.1	132.56	SCE	225
91011	La Canada Flintridge	21201	341.3	62.12	SCE	640
91042	Tujunga	27441	896.2	30.62	SCG	299
91207	Glendale	10532	2264.9	4.65	SCG	175
91302	Calabasas	27457	1056.4	25.99	SCE	1461
91307	West Hills	24522	1737.9	14.11	SCG	641
91311	Chatsworth	36461	1166.4	31.26	SCG	2132
91320	Newbury Park	41837	1059.2	39.50	SCE	1138
91321	Newhall	34243	858.9	39.87	SCG	799
91342	Sylmar	88942	702.2	126.66	SCG	991
91352	Sun Valley	49037	3426.8	14.31	SCG	1297
91361	Westlake Village	20864	862.5	24.19	SCE	1365
91381	Stevenson Ranch	13803	447.6	30.84	SCG	393

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
91384	Castaic	21491	110.4	194.73	SCG	252
91387	Canyon Country	38806	2003.4	19.37	SCG	305
91390	Santa Clarita	20973	130.6	160.64	SCG	225
91501	Burbank	21294	4501.9	4.73	SCG	246
91709	Chino Hills	76356	1727.5	44.20	SCE	1005
91759	Mt Baldy	576	6.8	85.05	SCE	13
91761	Ontario	61121	2114.9	28.90	SCE	2324
91901	Alpine	17502	174.8	100.13	SDG&E	437
91905	Boulevard	1604	12.2	131.04	SDG&E	15
91906	Campo	3748	23.6	158.67	SDG&E	27
91916	Descanso	2382	18.0	132.57	SDG&E	37
91917	Dulzura	706	17.1	41.25	SDG&E	8
91934	Jacumba	856	34.2	25.00	SDG&E	9
91935	Jamul	10350	80.1	129.18	SDG&E	162
91962	Pine Valley	2127	18.8	112.94	SDG&E	36
91963	Potrero	1144	25.9	44.22	SDG&E	3
91978	Spring Valley	11584	772.8	14.99	SDG&E	151
91980	Tecate	248	12.5	19.86	SDG&E	30
92004	Borrego Springs	3056	4.1	743.96	SDG&E	96
92028	Fallbrook	47176	375.9	125.50	SDG&E	917
92036	Julian	3773	8.9	421.92	SDG&E	119
92059	Pala	1773	22.3	79.36	SDG&E	14
92061	Pauma Valley	2244	63.4	35.38	SDG&E	27

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
92066	Ranchita	425	6.2	68.34	SDG&E	7
92070	Santa Ysabel	1343	9.2	146.63	SDG&E	28
92082	Valley Center	18902	138.8	136.16	SDG&E	407
92086	Warner Springs	1170	6.1	192.36	SDG&E	21
92154	San Diego	83147	2207.2	37.67	SDG&E	1265
92210	Indian Wells	5296	406.4	13.03	SCE	237
92220	Banning	30669	217.0	141.36	SCG	405
92223	Beaumont	30040	540.1	55.62	SCE	420
92227	Brawley	25783	66.6	386.86	SCG	378
92230	Cabazon	2962	153.3	19.32	SCE	158
92239	Desert Center	10326	2.7	3802.80	SCE	4
92240	Desert Hot Springs	33913	490.6	69.12	SCE	248
92241	Desert Hot Springs	7041	62.0	113.61	SCE	69
92242	Earp	1910	22.5	84.73	SCE	17
92252	Joshua Tree	9329	91.8	101.61	SCE	89
92254	Mecca	11968	138.3	86.51	SCG	25
92256	Morongo Valley	4301	34.1	126.05	SCE	46
92259	Ocotillo	480	2.7	179.22		7
92260	Palm Desert	34532	863.5	39.99	SCE	1654
92262	Palm Springs	30345	742.1	40.89	SCE	1189
92264	Palm Springs	20226	229.5	88.14	SCE	514
92267	Parker Dam	133	2.4	55.08	SCE	9
92274	Thermal	30580	35.1	870.04		102

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
92277	Twentynine Palms	29015	28.2	1029.73	SCE	184
92278	Twentynine Palms	5809	6.4	908.18	SCE	25
92280	Vidal	50	0.1	582.24	SCE	6
92282	White Water	1184	15.8	75.11	SCE	13
92283	Winterhaven	4743	2.2	2116.00		16
92284	Yucca Valley	25236	141.1	178.79	SCE	503
92285	Landers	2540	5.6	450.98	SCE	11
92301	Adelanto	31909	114.8	277.96	SCE	159
92304	Amboy	24	0.0	497.60	SCE	5
92305	Angelus Oaks	204	1.9	109.29	SCE	17
92307	Apple Valley	37205	178.3	208.62	SCE	612
92308	Apple Valley	38418	383.4	100.21	SCE	345
92309	Baker	1374	0.5	2736.48	SCE	25
92310	Fort Irwin	9972	8.5	1172.57	SCE	45
92311	Barstow	33416	100.3	333.13	SCE	557
92321	Cedar Glen	1469	573.8	2.56	SCE	42
92322	Cedarpines Park	998	166.3	6.00	SCE	11
92327	Daggett	266	12.9	20.62	SCE	8
92328	Death Valley	359	0.1	2800.80	SCE	27
92332	Essex	88	0.0	2213.77	SCE	3
92338	Ludlow	79	0.1	638.16	SCE	8
92339	Forest Falls	1459	15.7	93.17	SCE	13
92342	Helendale	5981	46.8	127.88	SCE	56

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
92347	Hinkley	2405	7.5	321.98	SCE	7
92356	Lucerne Valley	6300	14.0	451.28	SCE	53
92358	Lytle Creek	830	33.2	25.01	SCE	11
92359	Mentone	8330	158.2	52.65	SCE	86
92363	Needles	6446	5.0	1287.13		123
92364	Nipton	251	0.1	1696.72	SCE	5
92365	Newberry Springs	5127	8.8	582.32	SCE	24
92368	Oro Grande	1123	16.4	68.50	SCE	16
92371	Phelan	15772	122.0	129.27	SCE	158
92372	Pinon Hills	4710	249.2	18.90	SCE	48
92382	Running Springs	2896	190.7	15.19	SCE	98
92384	Shoshone	195	0.1	1694.76	SCE	8
92389	Tecopa	82	0.4	212.39	SCE	3
92392	Victorville	50884	1384.2	36.76	SCE	1062
92394	Victorville	26846	976.6	27.49	SCE	102
92397	Wrightwood	5383	157.6	34.16	SCE	73
92399	Yucaipa	51590	1135.1	45.45	SCE	733
92404	San Bernardino	60476	2737.7	22.09	SCE	524
92407	San Bernardino	64098	358.4	178.85	SCE	380
92530	Lake Elsinore	46368	396.3	116.99	SCE	775
92536	Aguanga	3022	31.6	95.58	SCE	45
92539	Anza	4651	30.1	154.60	SCG	66
92544	Hemet	44213	403.8	109.48	SCE	459

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
92549	Idyllwild	4716	49.5	95.30	SCE	145
92555	Moreno Valley	25805	439.0	58.78	SCE	199
92561	Mountain Center	1700	3.9	431.66	SCE	36
92562	Murrieta	57253	978.2	58.53	SCE	1402
92567	Nuevo	10550	318.9	33.08	SCE	98
92570	Perris	43901	426.5	102.93	SCE	412
92571	Perris	44254	1343.5	32.94	SCE	289
92583	San Jacinto	27752	907.8	30.57	SCE	256
92590	Temecula	4087	81.6	50.07	SCE	1326
92592	Temecula	70797	585.2	120.98	SCE	919
92602	Irvine	8365	728.0	11.49	SCE	386
92610	Foothill Ranch	11423	997.6	11.45	SCE	418
92618	Irvine	9330	332.9	28.03	SCE	2723
92675	San Juan Capistrano	64208	580.2	110.66	SDG&E	1248
92676	Silverado	1890	38.4	49.20	SCE	53
92823	Brea	1827	171.2	10.67	SCE	75
92862	Orange	19	0.6	32.89	SCE	7
92880	Corona	50867	1952.7	26.05	SCE	908
92881	Corona	31125	1293.6	24.06	SCE	622
92883	Corona	24585	436.9	56.27	SCE	326
93001	Ventura	34261	394.9	86.76	SCE	1045
93012	Camarillo	32978	683.5	48.25	SCE	883
93015	Fillmore	19253	138.3	139.23	SCE	223

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
93021	Moorpark	37965	612.8	61.95	SCE	712
93023	Ojai	22922	74.0	309.77	SCE	630
93033	Oxnard	80125	2327.9	34.42	SCE	590
93060	Santa Paula	33708	294.4	114.51	SCE	490
93065	Simi Valley	70305	1662.1	42.30	SCE	1895
93066	Somis	3258	56.2	57.99	SCE	98
93105	Santa Barbara	26959	93.1	289.45	SCE	1090
93108	Santa Barbara	14383	326.1	44.11	SCE	562
93117	Goleta	49540	338.6	146.32	SCE	1090
93203	Arvin	17550	85.3	205.73	PG&E	105
93204	Avenal	17041	55.8	305.18	PG&E	50
93205	Bodfish	2205	148.4	14.86	SCE	5
93210	Coalinga	20404	28.3	719.77	PG&E	169
93224	Fellows	405	5.1	79.10	PG&E	16
93225	Frazier Park	7714	15.0	512.94	SCE	85
93226	Glennville	280	7.3	38.13	SCE	2
93238	Kernville	1059	18.1	58.39	SCE	69
93240	Lake Isabella	6442	135.0	47.73	SCE	139
93243	Lebec	824	2.7	310.94	PG&E	60
93249	Lost Hills	2955	4.0	748.02	PG&E	38
93251	MC Kittrick	232	0.8	290.22	PG&E	16
93252	Maricopa	3388	8.5	399.12	PG&E	15
93254	New Cuyama	747	3.6	204.95	PG&E	11

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93255	Onyx	394	1.8	214.43	SCE	4
93257	Porterville	74933	231.6	323.53	SCE	952
93260	Posey	275	4.4	62.02	SCE	4
93262	Sequoia National Park	39	0.4	110.33	PG&E	52
93265	Springville	5283	9.3	565.90	SCE	67
93271	Three Rivers	2662	6.9	383.21	SCE	17
93283	Weldon	2447	7.0	349.57	SCE	31
93285	Wofford Heights	3909	18.3	214.08	SCE	676
93307	Bakersfield	75156	363.6	206.69	PG&E	1451
93308	Bakersfield	54377	135.1	402.43	PG&E	2059
93401	San Luis Obispo	28108	447.8	62.77	PG&E	287
93402	Los Osos	14843	461.0	32.20	PG&E	389
93405	San Luis Obispo	32988	279.7	117.92	PG&E	817
93420	Arroyo Grande	27946	108.3	257.93	PG&E	21
93426	Bradley	1507	4.7	322.28	PG&E	218
93427	Buellton	6306	152.0	41.48	PG&E	246
93428	Cambria	6825	94.3	72.37	PG&E	2
93429	Casmalia	1	0.0	48.08	PG&E	95
93430	Cayucos	3281	42.3	77.51	PG&E	26
93432	Creston	1270	13.7	92.43	PG&E	53
93434	Guadalupe	6483	345.2	18.78	PG&E	728
93436	Lompoc	54804	180.6	303.42	PG&E	51
93437	Lompoc	6159	59.8	102.95	PG&E	

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93441	Los Olivos	1170	19.8	59.20	PG&E	97
93442	Morro Bay	11129	258.9	42.98	PG&E	420
93446	Paso Robles	44069	129.5	340.42	PG&E	1291
93450	San Ardo	876	2.5	351.29	PG&E	14
93451	San Miguel	2075	4.7	441.60	PG&E	69
93452	San Simeon	557	3.2	173.43	PG&E	27
93453	Santa Margarita	2801	2.6	1095.54	PG&E	45
93454	Santa Maria	32080	96.0	334.05	PG&E	1223
93455	Santa Maria	40109	244.6	163.96	PG&E	870
93460	Santa Ynez	5846	52.0	112.52	PG&E	207
93461	Shandon	1446	2.9	493.59	PG&E	9
93463	Solvang	8313	267.1	31.12	PG&E	358
93465	Templeton	9104	97.4	93.45	PG&E	285
93501	Mojave	5319	14.5	366.88	SCE	113
93505	California City	12775	58.2	219.45	SCE	90
93510	Acton	8438	91.5	92.20	SCE	146
93512	Benton	194	0.7	291.34	SCE	5
93513	Big Pine	1856	4.7	397.62	SCE	24
93514	Bishop	14955	9.3	1605.21	SCE	468
93516	Boron	2109	130.3	16.19	SCE	24
93517	Bridgeport	376	2.0	190.08	SCE	36
93518	Caliente	1093	2.2	489.24	SCE	11
93519	Cantil	145	0.5	284.90	SCE	1

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93523	Edwards	8191	34.4	238.34	SCE	32
93524	Edwards	29	0.1	348.20	SCE	39
93527	Inyokern	2339	13.9	168.25	SCE	24
93528	Johannesburg	204	7.0	29.33	SCE	
93529	June Lake	623	2.5	251.33	SCE	36
93531	Keene	283	44.9	6.30	SCE	16
93532	Lake Hughes	3033	22.7	133.44	SCE	37
93535	Lancaster	66476	206.2	322.37	SCE	513
93536	Lancaster	65605	230.6	284.52	SCE	540
93543	Littlerock	12409	166.1	74.69	SCE	87
93544	Llano	1406	11.9	118.28	SCE	10
93546	Mammoth Lakes	7625	46.6	163.73	SCE	492
93550	Palmdale	72083	707.3	101.91	SCE	793
93551	Palmdale	49393	632.1	78.14	SCE	791
93553	Pearblossom	1494	79.1	18.89	SCE	16
93554	Randsburg	55	2.7	20.71	SCE	4
93555	Ridgecrest	32039	8.9	3603.88	SCE	514
93560	Rosamond	18683	41.5	450.07	SCE	140
93562	Trona	2122	12.3	173.14	SCE	20
93563	Valyermo	821	2.2	365.46	SCE	4
93622	Firebaugh	10778	23.4	460.06	PG&E	100
93633	Kings Canyon National Park	199	0.3	685.44	PG&E	14
93635		41510	74.3	558.48	PG&E	467

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93640	Los Banos	10163	23.7	428.80	PG&E	64
93664	Mendota	1056	1.2	907.73	SCE	51
93908	Shaver Lake	16176	61.5	262.98	PG&E	294
93920	Salinas	1385	5.0	276.41	PG&E	54
93923	Big sur	16899	98.7	171.22	PG&E	560
93924	Carmel	6795	29.3	232.25	PG&E	241
93925	Carmel Valley	84	4.8	17.41	PG&E	15
93926	Chualar	9199	125.0	73.57	PG&E	83
93927	Gonzales	16311	71.4	228.56	PG&E	117
93930	Greenfield	15465	47.4	326.29	PG&E	227
93932	King City	1011	3.1	322.42	PG&E	3
93960	Lockwood	29008	134.7	215.32	PG&E	149
94019	Soledad	18984	256.7	73.96	PG&E	438
94020	Half Moon Bay	1157	22.1	52.46	PG&E	25
94021	La Honda	435	20.0	21.78	PG&E	8
94038	Loma Mar	5640	815.0	6.92	PG&E	48
94060	Moss Beach	1731	30.3	57.16	PG&E	57
94062	Pescadero	26568	334.8	79.36	PG&E	666
94074	Redwood City	103	8.0	12.87	PG&E	11
94503	San Gregorio	14076	451.6	31.17	PG&E	255
94508	American Canyon	4190	109.0	38.45	PG&E	62
94510	Angwin	27633	622.2	44.41	PG&E	903
94512	Benicia	56	2.5	22.21	PG&E	2

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94514	Birds Landing	14353	179.4	80.02	PG&E	161
94515	Byron	7269	103.3	70.34	PG&E	277
94517	Calistoga	15040	299.5	50.21	PG&E	196
94521	Clayton	42795	2179.0	19.64	PG&E	587
94550	Concord	45604	120.0	379.95	PG&E	1467
94551	Livermore	38245	514.8	74.29	PG&E	748
94552	Livermore	14279	338.8	42.14	PG&E	173
94553	Castro Valley	48771	703.3	69.35	PG&E	1099
94558	Martinez	68391	153.6	445.19	PG&E	1731
94559	Napa	29006	687.3	42.20	PG&E	1045
94567	Napa	785	11.9	65.93	PG&E	22
94569	Pope Valley	243	172.3	1.41	PG&E	9
94571	Port Costa	7276	44.0	165.51	PG&E	160
94574	Rio Vista	10067	93.6	107.58	PG&E	558
94585	Saint Helena	27768	182.6	152.09	PG&E	326
94586	Suisun City	1040	42.4	24.53	PG&E	38
94708	Sunol	11217	3348.4	3.35	PG&E	153
94922	Berkeley	179	23.3	7.69	PG&E	15
94923	Bodega	1770	95.2	18.60	PG&E	60
94924	Bodega Bay	1527	168.5	9.06	PG&E	48
94929	Bolinas	341	72.1	4.73	PG&E	10
94930	Dillon Beach	8479	295.1	28.73	PG&E	246
94937	Fairfax	1397	23.4	59.72	PG&E	46

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94940	Inverness	122	10.4	11.68	PG&E	16
94941	Marshall	29698	1113.1	26.68	PG&E	1117
94945	Mill Valley	16922	625.1	27.07	PG&E	742
94946	Novato	1023	16.4	62.52	PG&E	34
94947	Nicasio	24809	1225.7	20.24	PG&E	491
94952	Novato	32702	151.8	215.43	PG&E	1263
94954	Petaluma	37766	531.9	71.00	PG&E	941
94956	Petaluma	1374	37.9	36.28	PG&E	89
94963	Point Reyes Station	776	130.9	5.93	PG&E	20
94965	San Geronimo	10639	934.1	11.39	PG&E	769
94970	Sausalito	763	136.3	5.60	PG&E	38
94971	Stinson Beach	287	25.7	11.17	PG&E	8
94973	Tomales	1655	475.6	3.48	PG&E	33
95006	Woodacre	9611	173.9	55.27	PG&E	168
95014	Boulder Creek	55933	1687.3	33.15	PG&E	1591
95017	Cupertino	449	23.4	19.17	PG&E	13
95020	Davenport	56434	366.6	153.92	PG&E	1403
95023	Gilroy	51696	86.8	595.40	PG&E	856
95033	Hollister	9278	95.0	97.71	PG&E	151
95037	Los Gatos	45309	199.2	227.51	PG&E	1208
95043	Morgan Hill	776	0.9	875.18	PG&E	16
95060	Paicines	45639	479.0	95.28	PG&E	1522
95132	Santa Cruz	41360	3201.2	12.92	PG&E	363

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95140	San Jose	253	2.7	93.10	PG&E	10
95219	Mount Hamilton	23477	706.3	33.24	PG&E	477
95222	Stockton	5790	51.6	112.17	PG&E	141
95223	Angels Camp	6979	33.9	206.17	PG&E	177
95242	Arnold	29361	221.1	132.78	PG&E	468
95245	Lodi	3575	29.0	123.45	PG&E	20
95255	Mokelumne Hill	2358	21.8	107.97	PG&E	26
95304	West Point	17008	130.3	130.55	PG&E	427
95321	Tracy	4042	9.9	409.10	PG&E	100
95322	Groveland	9476	36.3	261.06	PG&E	108
95335	Gustine	709	1.6	437.17	PG&E	17
95346	Long Barn	1144	3.2	353.71	PG&E	37
95360	MI Wuk Village	11662	35.7	326.48	PG&E	120
95363	Newman	26978	107.2	251.55	PG&E	229
95364	Patterson	2	0.0	170.72	PG&E	13
95369	Pinecrest	1359	7.1	192.02	PG&E	11
95377	Snelling	26250	211.3	124.25	PG&E	254
95389	Tracy	1569	4.3	367.45	PG&E	58
95409	Yosemite National Park	26029	695.2	37.44	PG&E	374
95410	Santa Rosa	1098	26.2	41.89	PG&E	28
95412	Albion	369	9.2	40.27	PG&E	13
95415	Annapolis	1435	43.4	33.05	PG&E	45
95417	Boonville	252	2.3	111.61	PG&E	3

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95420	Branscomb	344	88.4	3.89	PG&E	15
95421	Caspar	2063	6.8	303.87	PG&E	48
95422	Cazadero	15274	771.8	19.79	PG&E	217
95423	Clearlake	4418	18.1	244.55	PG&E	48
95425	Clearlake Oaks	10523	81.6	129.02	PG&E	215
95427	Cloverdale	476	3.8	126.91	PG&E	15
95428	Comptche	2566	2.7	948.13	PG&E	31
95429	Covelo	79	2.0	39.83	PG&E	3
95432	Dos Rios	187	16.1	11.64	PG&E	18
95437	Elk	14965	108.4	138.07	PG&E	527
95441	Fort Bragg	2904	26.6	109.07	PG&E	66
95442	Geyserville	4555	179.9	25.32	PG&E	107
95443	Glen Ellen	192	2.4	81.14	PG&E	4
95445	Glenhaven	2095	16.1	130.34	PG&E	140
95446	Gualala	5586	203.8	27.41	PG&E	100
95448	Guerneville	18470	97.9	188.71	PG&E	766
95449	Healdsburg	1936	8.9	217.24	PG&E	39
95450	Hopland	255	14.3	17.88	PG&E	15
95451	Jenner	13309	118.9	111.90	PG&E	168
95452	Kelseyville	1561	110.7	14.10	PG&E	59
95453	Kenwood	12546	89.2	140.72	PG&E	417
95454	Lakeport	2372	15.1	157.21	PG&E	50
95456	Laytonville	1213	82.7	14.66	PG&E	28

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95457	Littleriver	4109	39.6	103.86	PG&E	87
95458	Lower Lake	3027	578.8	5.23	PG&E	25
95459	Lucerne	594	7.4	79.80	PG&E	13
95460	Manchester	2096	50.5	41.50	PG&E	167
95461	Mendocino	3955	29.9	132.15	PG&E	127
95462	Middletown	1536	297.7	5.16	PG&E	31
95465	Monte Rio	2538	50.3	50.46	PG&E	54
95466	Occidental	1403	11.5	121.59	PG&E	45
95468	Philo	1460	13.3	110.10	PG&E	50
95469	Point Arena	1834	9.5	193.50	PG&E	34
95470	Potter Valley	6497	48.9	132.90	PG&E	110
95476	Redwood Valley	36083	334.5	107.88	PG&E	1147
95485	Sonoma	2964	31.1	95.27	PG&E	43
95488	Upper Lake	342	3.0	114.66	PG&E	10
95490	Westport	14181	37.4	379.10	PG&E	320
95494	Willits	162	4.1	39.57	PG&E	8
95497	Yorkville	1159	100.9	11.49	PG&E	30
95503	The Sea Ranch	25447	228.3	111.44	PG&E	373
95511	Eureka	313	5.1	61.48	PG&E	3
95514	Alderpoint	165	1.7	99.64	PG&E	2
95519	Blocksburg	17201	285.8	60.19	PG&E	277
95525	McKinleyville	500	2.7	186.51	PG&E	36
95526	Blue Lake	772	2.6	292.84	PG&E	13

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95527	Bridgeville	362	2.8	129.36	PG&E	4
95528	Burnt Ranch	937	11.4	82.20	PG&E	11
95536	Carlotta	3101	12.8	242.08	PG&E	84
95540	Ferndale	13398	289.4	46.29	PG&E	358
95542	Fortuna	2455	7.9	311.66	PG&E	108
95546	Garberville	3362	9.0	371.95	PG&E	20
95547	Hoopa	1274	216.7	5.88	PG&E	17
95549	Hydesville	427	2.3	185.60	PG&E	14
95550	Kneeland	201	1.1	190.74	PG&E	3
95551	Korbel	1354	48.9	27.71	PG&E	21
95554	Loleta	3078	12.8	239.81	PG&E	7
95555	Myers Flat	457	5.2	88.51	PG&E	14
95556	Orick	529	7.2	73.73	PG&E	10
95558	Orleans	287	2.6	108.80	PG&E	10
95560	Petrolia	534	83.6	6.39	PG&E	67
95562	Redway	3321	210.9	15.75	PG&E	36
95563	Rio Dell	925	7.3	126.70	PG&E	9
95565	Salyer	1135	19.7	57.50	PG&E	14
95569	Scotia	731	19.2	38.04	PG&E	5
95570	Redcrest	2533	18.2	139.40	PG&E	55
95573	Trinidad	1686	27.1	62.29	PG&E	50
95585	Willow Creek	435	4.6	93.78	PG&E	10
95587	Leggett	350	1.9	188.66	PG&E	6

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95589	Piercy	799	7.6	105.79	PG&E	23
95595	Whitethorn	491	2.3	215.49	PG&E	
95606	Zenia	292	4.0	72.81	PG&E	6
95607	Brooks	334	6.0	55.69	PG&E	6
95620	Capay	20365	87.5	232.62	PG&E	402
95627	Dixon	2652	55.4	47.87	PG&E	26
95631	Esparto	6730	13.8	488.61	PG&E	94
95634	Foresthill	2778	21.7	128.07	PG&E	67
95636	Georgetown	740	16.0	46.14	PG&E	9
95641	Grizzly Flats	2310	50.7	45.56	PG&E	57
95645	Isleton	1912	15.5	123.07	PG&E	21
95666	Knights Landing	6285	25.7	244.21	PG&E	82
95679	Pioneer	18	0.7	25.41	PG&E	1
95684	Rumsey	3575	19.9	179.39	PG&E	47
95687	Somerset	68082	1543.1	44.12	PG&E	771
95688	Vacaville	34232	378.0	90.56	PG&E	922
95691	Vacaville	30337	713.3	42.53	PG&E	930
95694	West Sacramento	9209	66.7	138.15	PG&E	156
95695	Winters	39343	277.0	142.05	PG&E	795
95698	Woodland	272	7.2	37.66	PG&E	9
95701	Zamora	1016	32.8	30.94	PG&E	13
95715	Alta	46	0.8	58.78	PG&E	6
95717	Emigrant Gap	212	27.4	7.74	PG&E	6

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
95720	Gold Run	202	1.4	142.04	PG&E	4
95721	Kyburz	67	4.0	16.59	PG&E	2
95724	Echo Lake	157	1.7	90.59	PG&E	8
95726	Norden	9387	52.4	179.02	PG&E	139
95728	Pollock Pines	106	0.5	212.71	PG&E	39
95910	Soda Springs	87	8.9	9.78	PG&E	4
95912	Alleghany	5245	22.9	228.68	PG&E	50
95915	Arbuckle	28	0.2	133.25	PG&E	3
95916	Belden	1382	8.5	163.24	PG&E	13
95917	Berry Creek	3237	42.9	75.44	PG&E	32
95919	Biggs	1108	49.4	22.42	PG&E	20
95920	Brownsville	324	4.5	72.12	PG&E	3
95922	Butte City	672	4.5	147.74	PG&E	10
95923	Camptonville	29	1.0	27.83	PG&E	7
95925	Canyon Dam	375	9.5	39.37	PG&E	6
95928	Challenge	36271	280.5	129.31	PG&E	1223
95932	Chico	8334	44.9	185.60	PG&E	182
95934	Colusa	236	11.9	19.89	PG&E	8
95936	Crescent Mills	186	14.2	13.14	PG&E	14
95937	Downieville	1332	9.8	135.82	PG&E	17
95938	Dunnigan	3927	42.9	91.45	PG&E	79
95939	Durham	378	1.7	220.00	PG&E	2
95941	Elk Creek	780	8.3	93.87	PG&E	6

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
95942	Forbestown	1491	19.3	77.23	PG&E	24
95944	Forest Ranch	132	3.1	41.94	PG&E	2
95945	Goodyears Bar	25817	300.5	85.91	PG&E	1167
95947	Grass Valley	2523	11.5	218.79	PG&E	51
95951	Greenville	2325	483.4	4.81	PG&E	13
95953	Hamilton City	10464	116.1	90.10	PG&E	99
95954	Live Oak	11808	89.3	132.25	PG&E	86
95956	Magalia	84	3.4	24.98	PG&E	6
95959	Meadow Valley	19823	65.6	302.33	PG&E	582
95960	Nevada City	617	16.8	36.66	PG&E	16
95963	North San Juan	15883	38.6	411.13	PG&E	268
95965	Orland	20165	50.4	400.11	PG&E	430
95966	Oroville	30857	157.8	195.58	PG&E	387
95969	Oroville	28628	510.6	56.07	PG&E	598
95973	Paradise	33112	135.5	244.32	PG&E	753
95979	Chico	887	2.8	318.94	PG&E	7
95981	Stonyford	170	0.7	242.93	PG&E	3
95982	Strawberry Valley	3692	51.5	71.75	PG&E	44
95983	Sutter	356	3.3	107.31	PG&E	18
95984	Taylorsville	113	1.0	111.16	PG&E	1
95987	Twain	5490	15.8	347.34	PG&E	91
95988	Williams	9223	22.5	409.11	PG&E	205
96001	Willows	35643	333.5	106.89	PG&E	1325

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
96002	Redding	34591	1130.8	30.59	PG&E	1215
96003	Redding	43267	346.0	125.05	PG&E	985
96008	Redding	1360	20.1	67.56	PG&E	21
96010	Bella Vista	198	1.1	175.13	PG&E	6
96013	Big Bar	4806	14.3	336.02	PG&E	128
96016	Burney	514	9.3	55.26	PG&E	8
96020	Cassel	2840	9.1	312.86	PG&E	147
96021	Chester	16194	42.1	384.81	PG&E	219
96022	Corning	14971	48.5	308.96	PG&E	184
96024	Cottonwood	890	6.2	142.72	PG&E	11
96028	Douglas City	2118	15.6	135.84	PG&E	50
96033	Fall River Mills	384	1.8	215.91	PG&E	5
96040	French Gulch	365	2.3	159.41	PG&E	6
96046	Hat Creek	270	1.7	156.62	PG&E	4
96047	Hyampom	876	4.1	215.58	PG&E	7
96048	Igo	756	6.0	126.45	PG&E	12
96051	Junction City	1736	3.5	496.93	PG&E	23
96052	Lakehead	2644	7.3	360.57	PG&E	30
96055	Lewiston	4112	127.7	32.21	PG&E	43
96056	Los Molinos	2773	1.3	2151.60	PG&E	35
96062	McArthur	1110	17.9	61.89	PG&E	20
96063	Millville	200	1.7	120.93	PG&E	6
96065	Mineral	880	1.5	585.05	PG&E	4

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
96069	Montgomery Creek	1570	10.1	156.13	PG&E	14
96071	Oak Run	186	0.7	279.19	PG&E	5
96075	Old Station	496	3.6	138.13	PG&E	2
96076	Paynes Creek	175	1.1	155.69	PG&E	4
96080	Platina	30330	27.3	1111.19	PG&E	734
96088	Red Bluff	5069	19.9	255.35	PG&E	63
96091	Shingletown	599	1.3	448.40	PG&E	27
96096	Trinity Center	999	5.7	175.97	PG&E	18
96125	Whitmore	351	8.4	41.92	PG&E	11
96142	Sierra City	1740	186.9	9.31	PG&E	29
96143	Tahoma	5881	324.6	18.12	PG&E	122
96145	Kings Beach	7146	85.7	83.37	PG&E	410
96146	Tahoe City	263	72.3	3.64	PG&E	120
	Olympic Valley					

Table A.4-2. GIS Analysis Results: Scenario 1 Wind Speed 15.7+ mph

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
90265	Malibu	20094	212.4	94.60	SCE	961
90272	Pacific Palisades	24144	976.7	24.72	SCG	876
90290	Topanga	6545	349.3	18.74	SCE	228
90704	Avalon	3852	29.1	132.56	SCE	225
91011	La Canada Flintridge	21201	341.3	62.12	SCE	640
91042	Tujunga	27441	896.2	30.62	SCG	299
91307	West Hills	24522	1737.9	14.11	SCG	641
91311	Chatsworth	36461	1166.4	31.26	SCG	2132
91320	Newbury Park	41837	1059.2	39.50	SCE	1138
91321	Newhall	34243	858.9	39.87	SCG	799
91342	Sylmar	88942	702.2	126.66	SCG	991
91381	Stevenson Ranch	13803	447.6	30.84	SCG	393
91384	Castaic	21491	110.4	194.73	SCG	252
91387	Canyon Country	38806	2003.4	19.37	SCG	305
91390	Santa Clarita	20973	130.6	160.64	SCG	225
91709	Chino Hills	76356	1727.5	44.20	SCE	1005
91759	Mt Baldy	576	6.8	85.05	SCE	13
91901	Alpine	17502	174.8	100.13	SDG&E	437
91905	Boulevard	1604	12.2	131.04	SDG&E	15
91906	Campo	3748	23.6	158.67	SDG&E	27
91916	Descanso	2382	18.0	132.57	SDG&E	37

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
91934	Jacumba	856	34.2	25.00	SDG&E	9
91962	Pine Valley	2127	18.8	112.94	SDG&E	36
91963	Potrero	1144	25.9	44.22	SDG&E	3
91980	Tecate	248	12.5	19.86	SDG&E	30
92004	Borrego Springs	3056	4.1	743.96	SDG&E	96
92036	Julian	3773	8.9	421.92	SDG&E	119
92066	Ranchita	425	6.2	68.34	SDG&E	7
92070	Santa Ysabel	1343	9.2	146.63	SDG&E	28
92082	Valley Center	18902	138.8	136.16	SDG&E	407
92086	Warner Springs	1170	6.1	192.36	SDG&E	21
92220	Banning	30669	217.0	141.36	SCG	405
92223	Beaumont	30040	540.1	55.62	SCE	420
92230	Cabazon	2962	153.3	19.32	SCE	158
92239	Desert Center	10326	2.7	3802.80	SCE	4
92240	Desert Hot Springs	33913	490.6	69.12	SCE	248
92241	Desert Hot Springs	7041	62.0	113.61	SCE	69
92242	Earp	1910	22.5	84.73	SCE	17
92252	Joshua Tree	9329	91.8	101.61	SCE	89
92256	Morongo Valley	4301	34.1	126.05	SCE	46
92259	Ocotillo	480	2.7	179.22		7
92260	Palm Desert	34532	863.5	39.99	SCE	1654
92262	Palm Springs	30345	742.1	40.89	SCE	1189
92264	Palm Springs	20226	229.5	88.14	SCE	514

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
92267	Parker Dam	133	2.4	55.08	SCE	9
92277	Twentynine Palms	29015	28.2	1029.73	SCE	184
92278	Twentynine Palms	5809	6.4	908.18	SCE	25
92280	Vidal	50	0.1	582.24	SCE	6
92282	White Water	1184	15.8	75.11	SCE	13
92283	Winterhaven	4743	2.2	2116.00	SCE	16
92284	Yucca Valley	25236	141.1	178.79	SCE	503
92285	Landers	2540	5.6	450.98	SCE	11
92304	Amboy	24	0.0	497.60	SCE	5
92305	Angelus Oaks	204	1.9	109.29	SCE	17
92307	Apple Valley	37205	178.3	208.62	SCE	612
92308	Apple Valley	38418	383.4	100.21	SCE	345
92309	Baker	1374	0.5	2736.48	SCE	25
92310	Fort Irwin	9972	8.5	1172.57	SCE	45
92311	Barstow	33416	100.3	333.13	SCE	557
92322	Cedarpines Park	998	166.3	6.00	SCE	11
92327	Daggett	266	12.9	20.62	SCE	8
92328	Death Valley	359	0.1	2800.80	SCE	27
92332	Essex	88	0.0	2213.77	SCE	3
92338	Ludlow	79	0.1	638.16	SCE	8
92339	Forest Falls	1459	15.7	93.17	SCE	13
92347	Hinkley	2405	7.5	321.98	SCE	7
92356	Lucerne Valley	6300	14.0	451.28	SCE	53

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
92358	Lytle Creek	830	33.2	25.01	SCE	11
92359	Mentone	8330	158.2	52.65	SCE	86
92363	Needles	6446	5.0	1287.13		123
92364	Nipton	251	0.1	1696.72	SCE	5
92365	Newberry Springs	5127	8.8	582.32	SCE	24
92368	Oro Grande	1123	16.4	68.50	SCE	16
92382	Running Springs	2896	190.7	15.19	SCE	98
92384	Shoshone	195	0.1	1694.76	SCE	8
92389	Tecopa	82	0.4	212.39	SCE	3
92397	Wrightwood	5383	157.6	34.16	SCE	73
92404	San Bernardino	60476	2737.7	22.09	SCE	524
92407	San Bernardino	64098	358.4	178.85	SCE	380
92536	Aguanga	3022	31.6	95.58	SCE	45
92539	Anza	4651	30.1	154.60	SCG	66
92544	Hemet	44213	403.8	109.48	SCE	459
92549	Idyllwild	4716	49.5	95.30	SCE	145
92555	Moreno Valley	25805	439.0	58.78	SCE	199
92561	Mountain Center	1700	3.9	431.66	SCE	36
92571	Perris	44254	1343.5	32.94	SCE	289
92583	San Jacinto	27752	907.8	30.57	SCE	256
92602	Irvine	8365	728.0	11.49	SCE	386
92618	Irvine	9330	332.9	28.03	SCE	2723
92675	San Juan Capistrano	64208	580.2	110.66	SDG&E	1248

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
92676	Silverado	1890	38.4	49.20	SCE	53
92862	Orange	19	0.6	32.89	SCE	7
92880	Corona	50867	1952.7	26.05	SCE	908
92883	Corona	24585	436.9	56.27	SCE	326
93012	Camarillo	32978	683.5	48.25	SCE	883
93015	Fillmore	19253	138.3	139.23	SCE	223
93021	Moorpark	37965	612.8	61.95	SCE	712
93023	Ojai	22922	74.0	309.77	SCE	630
93033	Oxnard	80125	2327.9	34.42	SCE	590
93060	Santa Paula	33708	294.4	114.51	SCE	490
93065	Simi Valley	70305	1662.1	42.30	SCE	1895
93066	Somis	3258	56.2	57.99	SCE	98
93105	Santa Barbara	26959	93.1	289.45	SCE	1090
93108	Santa Barbara	14383	326.1	44.11	SCE	562
93117	Goleta	49540	338.6	146.32	SCE	1090
93204	Avenal	17041	55.8	305.18	PG&E	50
93210	Coalinga	20404	28.3	719.77	PG&E	169
93225	Frazier Park	7714	15.0	512.94	SCE	85
93238	Kernville	1059	18.1	58.39	SCE	69
93240	Lake Isabella	6442	135.0	47.73	SCE	139
93243	Lebec	824	2.7	310.94	PG&E	60
93249	Lost Hills	2955	4.0	748.02	PG&E	38
93252	Maricopa	3388	8.5	399.12	PG&E	15

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
93254	New Cuyama	747	3.6	204.95	PG&E	11
93255	Onyx	394	1.8	214.43	SCE	4
93260	Posey	275	4.4	62.02	SCE	
93265	Springville	5283	9.3	565.90	SCE	52
93271	Three Rivers	2662	6.9	383.21	SCE	67
93283	Weldon	2447	7.0	349.57	SCE	17
93285	Wofford Heights	3909	18.3	214.08	SCE	31
93308	Bakersfield	54377	135.1	402.43	PG&E	1451
93401	San Luis Obispo	28108	447.8	62.77	PG&E	2059
93405	San Luis Obispo	32988	279.7	117.92	PG&E	389
93420	Arroyo Grande	27946	108.3	257.93	PG&E	817
93426	Bradley	1507	4.7	322.28	PG&E	21
93428	Cambria	6825	94.3	72.37	PG&E	246
93429	Casmalia	1	0.0	48.08	PG&E	2
93430	Cayucos	3281	42.3	77.51	PG&E	95
93432	Creston	1270	13.7	92.43	PG&E	26
93434	Guadalupe	6483	345.2	18.78	PG&E	53
93436	Lompoc	54804	180.6	303.42	PG&E	728
93437	Lompoc	6159	59.8	102.95	PG&E	51
93441	Los Olivos	1170	19.8	59.20	PG&E	97
93442	Morro Bay	11129	258.9	42.98	PG&E	420
93452	San Simeon	557	3.2	173.43	PG&E	27
93453	Santa Margarita	2801	2.6	1095.54	PG&E	45

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
93454	Santa Maria	32080	96.0	334.05	PG&E	1223
93455	Santa Maria	40109	244.6	163.96	PG&E	870
93460	Santa Ynez	5846	52.0	112.52	PG&E	207
93463	Solvang	8313	267.1	31.12	PG&E	358
93501	Mojave	5319	14.5	366.88	SCE	113
93505	California City	12775	58.2	219.45	SCE	90
93510	Acton	8438	91.5	92.20	SCE	146
93512	Benton	194	0.7	291.34	SCE	5
93513	Big Pine	1856	4.7	397.62	SCE	24
93514	Bishop	14955	9.3	1605.21	SCE	468
93517	Bridgeport	376	2.0	190.08	SCE	36
93518	Caliente	1093	2.2	489.24	SCE	11
93519	Cantil	145	0.5	284.90	SCE	1
93527	Inyokern	2339	13.9	168.25	SCE	24
93528	Johannesburg	204	7.0	29.33	SCE	
93529	June Lake	623	2.5	251.33	SCE	36
93532	Lake Hughes	3033	22.7	133.44	SCE	37
93536	Lancaster	65605	230.6	284.52	SCE	540
93543	Littlerock	12409	166.1	74.69	SCE	87
93544	Llano	1406	11.9	118.28	SCE	10
93546	Mammoth Lakes	7625	46.6	163.73	SCE	492
93550	Palmdale	72083	707.3	101.91	SCE	793
93551	Palmdale	49393	632.1	78.14	SCE	791

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
93554	Randsburg	55	2.7	20.71	SCE	4
93555	Ridgecrest	32039	8.9	3603.88	SCE	514
93560	Rosamond	18683	41.5	450.07	SCE	140
93563	Valyermo	821	2.2	365.46	SCE	4
93633	Kings Canyon National Park	199	0.3	685.44	PG&E	14
93635	Los Banos	41510	74.3	558.48	PG&E	467
93664	Shaver Lake	1056	1.2	907.73	SCE	51
93920	Big sur	1385	5.0	276.41	PG&E	54
93923	Carmel	16899	98.7	171.22	PG&E	560
93924	Carmel Valley	6795	29.3	232.25	PG&E	241
93926	Gonzales	9199	125.0	73.57	PG&E	83
93927	Greenfield	16311	71.4	228.56	PG&E	117
93930	King City	15465	47.4	326.29	PG&E	227
93932	Lockwood	1011	3.1	322.42	PG&E	3
93960	Soledad	29008	134.7	215.32	PG&E	149
94019	Half Moon Bay	18984	256.7	73.96	PG&E	438
94038	Moss Beach	5640	815.0	6.92	PG&E	48
94503	American Canyon	14076	451.6	31.17	PG&E	255
94510	Benicia	27633	622.2	44.41	PG&E	903
94512	Birds Landing	56	2.5	22.21	PG&E	2
94514	Byron	14353	179.4	80.02	PG&E	161
94515	Calistoga	7269	103.3	70.34	PG&E	277
94517		15040	299.5	50.21	PG&E	196

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
94521	Clayton	42795	2179.0	19.64	PG&E	587
94550	Concord	45604	120.0	379.95	PG&E	1467
94551	Livermore	38245	514.8	74.29	PG&E	748
94558	Livermore	68391	153.6	445.19	PG&E	1731
94567	Napa	785	11.9	65.93	PG&E	22
94571	Pope Valley	7276	44.0	165.51	PG&E	160
94585	Rio Vista	27768	182.6	152.09	PG&E	326
94923	Suisun City	1770	95.2	18.60	PG&E	60
94929	Bodega Bay	341	72.1	4.73	PG&E	10
94930	Dillon Beach	8479	295.1	28.73	PG&E	246
94937	Fairfax	1397	23.4	59.72	PG&E	46
94940	Inverness	122	10.4	11.68	PG&E	16
94941	Marshall	29698	1113.1	26.68	PG&E	1117
94945	Mill Valley	16922	625.1	27.07	PG&E	742
94946	Novato	1023	16.4	62.52	PG&E	34
94952	Nicasio	32702	151.8	215.43	PG&E	1263
94965	Petaluma	10639	934.1	11.39	PG&E	769
94971	Sausalito	287	25.7	11.17	PG&E	8
95023	Tomales	51696	86.8	595.40	PG&E	856
95043	Hollister	776	0.9	875.18	PG&E	16
95223	Paicines	6979	33.9	206.17	PG&E	177
95255	Arnold	2358	21.8	107.97	PG&E	26
95321	West Point	4042	9.9	409.10	PG&E	100

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
95322	Groveland	9476	36.3	261.06	PG&E	108
95335	Gustine	709	1.6	437.17	PG&E	17
95360	Long Barn	11662	35.7	326.48	PG&E	120
95363	Newman	26978	107.2	251.55	PG&E	229
95364	Patterson	2	0.0	170.72	PG&E	13
95377	Pinecrest	26250	211.3	124.25	PG&E	254
95389	Tracy	1569	4.3	367.45	PG&E	58
95391	Yosemite National Park	2593	171.6	15.11	PG&E	27
95410	Tracy	1098	26.2	41.89	PG&E	28
95417	Albion	252	2.3	111.61	PG&E	3
95421	Branscomb	2063	6.8	303.87	PG&E	48
95423	Cazadero	4418	18.1	244.55	PG&E	48
95425	Clearlake Oaks	10523	81.6	129.02	PG&E	215
95428	Cloverdale	2566	2.7	948.13	PG&E	31
95441	Covelo	2904	26.6	109.07	PG&E	66
95443	Geyserville	192	2.4	81.14	PG&E	4
95445	Glenhaven	2095	16.1	130.34	PG&E	140
95448	Gualala	18470	97.9	188.71	PG&E	766
95449	Healdsburg	1936	8.9	217.24	PG&E	39
95450	Hopland	255	14.3	17.88	PG&E	15
95451	Jenner	13309	118.9	111.90	PG&E	168
95454	Kelseyville	2372	15.1	157.21	PG&E	50
95457		4109	39.6	103.86	PG&E	87

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
95459	Laytonville	594	7.4	79.80	PG&E	13
95461	Lower Lake	3955	29.9	132.15	PG&E	127
95465	Manchester	2538	50.3	50.46	PG&E	54
95468	Middletown	1460	13.3	110.10	PG&E	50
95488	Occidental	342	3.0	114.66	PG&E	10
95514	Point Arena	165	1.7	99.64	PG&E	2
95525	Westport	500	2.7	186.51	PG&E	36
95526	Blocksburg	772	2.6	292.84	PG&E	13
95527	Blue Lake	362	2.8	129.36	PG&E	4
95528	Bridgeville	937	11.4	82.20	PG&E	11
95536	Burnt Ranch	3101	12.8	242.08	PG&E	84
95540	Carlotta	13398	289.4	46.29	PG&E	358
95542	Ferndale	2455	7.9	311.66	PG&E	108
95546	Fortuna	3362	9.0	371.95	PG&E	20
95549	Garberville	427	2.3	185.60	PG&E	14
95550	Hoopa	201	1.1	190.74	PG&E	3
95554	Kneeland	3078	12.8	239.81	PG&E	7
95558	Korbel	287	2.6	108.80	PG&E	10
95563	Myers Flat	925	7.3	126.70	PG&E	9
95565	Petrolia	1135	19.7	57.50	PG&E	14
95569	Salyer	731	19.2	38.04	PG&E	5
95585	Scotia	435	4.6	93.78	PG&E	10
95587	Redcrest	350	1.9	188.66	PG&E	6

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
95589	Leggett	799	7.6	105.79	PG&E	23
95595	Piercy	491	2.3	215.49	PG&E	
95606	Whitethorn	292	4.0	72.81	PG&E	6
95607	Zenia	334	6.0	55.69	PG&E	6
95631	Brooks	6730	13.8	488.61	PG&E	94
95666	Capay	6285	25.7	244.21	PG&E	82
95679	Foresthill	18	0.7	25.41	PG&E	1
95688	Pioneer	34232	378.0	90.56	PG&E	922
95694	Rumsey	9209	66.7	138.15	PG&E	156
95715	Vacaville	46	0.8	58.78	PG&E	6
95720	Winters	202	1.4	142.04	PG&E	4
95721	Emigrant Gap	67	4.0	16.59	PG&E	2
95724	Kyburz	157	1.7	90.59	PG&E	8
95728	Echo Lake	106	0.5	212.71	PG&E	39
95915	Norden	28	0.2	133.25	PG&E	3
95916	Soda Springs	1382	8.5	163.24	PG&E	13
95934	Belden	236	11.9	19.89	PG&E	8
95936	Berry Creek	186	14.2	13.14	PG&E	14
95939	Crescent Mills	378	1.7	220.00	PG&E	2
95942	Downieville	1491	19.3	77.23	PG&E	24
95947	Elk Creek	2523	11.5	218.79	PG&E	51
95953	Forest Ranch	10464	116.1	90.10	PG&E	99
95965	Greenville	20165	50.4	400.11	PG&E	430

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
95979	Live Oak	887	2.8	318.94	PG&E	7
95981	Oroville	170	0.7	242.93	PG&E	3
95982	Stonyford	3692	51.5	71.75	PG&E	44
95983	Strawberry Valley	356	3.3	107.31	PG&E	18
95984	Sutter	113	1.0	111.16	PG&E	1
95987	Taylorsville	5490	15.8	347.34	PG&E	91
96001	Twain	35643	333.5	106.89	PG&E	1325
96003	Williams	43267	346.0	125.05	PG&E	985
96008	Redding	1360	20.1	67.56	PG&E	21
96010	Redding	198	1.1	175.13	PG&E	6
96013	Bella Vista	4806	14.3	336.02	PG&E	128
96020	Big Bar	2840	9.1	312.86	PG&E	147
96024	Burney	890	6.2	142.72	PG&E	11
96033	Chester	384	1.8	215.91	PG&E	5
96046	Douglas City	270	1.7	156.62	PG&E	4
96047	French Gulch	876	4.1	215.58	PG&E	7
96048	Hyampom	756	6.0	126.45	PG&E	12
96051	Igo	1736	3.5	496.93	PG&E	23
96052	Junction City	2644	7.3	360.57	PG&E	30
96056	Lakehead	2773	1.3	2151.60	PG&E	35
96063	Lewiston	200	1.7	120.93	PG&E	6
96065	McArthur	880	1.5	585.05	PG&E	4
96069	Mineral	1570	10.1	156.13	PG&E	14

Zip Code	Zip Code Area Name	Populatio n in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
96071	Montgomery Creek	186	0.7	279.19	PG&E	5
96075	Oak Run	496	3.6	138.13	PG&E	2
96076	Old Station	175	1.1	155.69	PG&E	4
96080	Paynes Creek	30330	27.3	1111.19	PG&E	734
96088	Platina	5069	19.9	255.35	PG&E	63
96091	Red Bluff	599	1.3	448.40	PG&E	27
96096	Shingletown	999	5.7	175.97	PG&E	18
96125	Trinity Center	351	8.4	41.92	PG&E	11
96142	Whitmore	1740	186.9	9.31	PG&E	29
96145	Sierra City	7146	85.7	83.37	PG&E	410
	Tahoma					
	Tahoe City					

Table A.4-3. GIS Analysis Results: Scenario 2 Wind Speed 12.5-15.7 mph

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
91307	West Hills	24522	1737.9	14.11	SCG	641
91320	Newbury Park	41837	1059.2	39.50	SCE	1138
91361	Westlake Village	20864	862.5	24.19	SCE	1365
92389	Tecopa	82	0.4	212.39	SCE	3
92618	Irvine	9330	332.9	28.03	SCE	2723
93001	Ventura	34261	394.9	86.76	SCE	1045
93012	Camarillo	32978	683.5	48.25	SCE	883
93021	Moorpark	37965	612.8	61.95	SCE	712
93023	Ojai	22922	74.0	309.77	SCE	630
93033	Oxnard	80125	2327.9	34.42	SCE	590
93060	Santa Paula	33708	294.4	114.51	SCE	490
93065	Simi Valley	70305	1662.1	42.30	SCE	1895
93066	Somis	3258	56.2	57.99	SCE	98
93204	Avenal	17041	55.8	305.18	PG&E	50
93205	Bodfish	2205	148.4	14.86	SCE	5
93207	California Hot Springs	1000	5.7	176.93	SCE	8
93219	Earlimart	11997	58.8	204.11	SCE	33
93230	Hanford	63731	233.7	272.76	SCE	1053
93245	Lemoore	36151	230.9	156.57	PG&E	332
93256	Pixley	4574	61.5	74.39	SCE	38
93262	Sequoia National Park	39	0.4	110.33	PG&E	4
93266	Stratford	1983	13.8	144.04	PG&E	7
93291	Visalia	48177	560.6	85.94	SCE	1267
93402	Los Osos	14843	461.0	32.20	PG&E	287
93405	San Luis Obispo	32988	279.7	117.92	PG&E	389
93420	Arroyo Grande	27946	108.3	257.93	PG&E	817
93430	Cayucos	3281	42.3	77.51	PG&E	95
93432	Creston	1270	13.7	92.43	PG&E	26
93442	Morro Bay	11129	258.9	42.98	PG&E	420
93446	Paso Robles	44069	129.5	340.42	PG&E	1291

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
93449	Pismo Beach	8922	1077.5	8.28	PG&E	384
93461	Shandon	1446	2.9	493.59	PG&E	9
93465	Templeton	9104	97.4	93.45	PG&E	285
93512	Benton	194	0.7	291.34	SCE	5
93513	Big Pine	1856	4.7	397.62	SCE	24
93514	Bishop	14955	9.3	1605.21	SCE	468
93517	Bridgeport	376	2.0	190.08	SCE	36
93529	June Lake	623	2.5	251.33	SCE	36
93531	Keene	283	44.9	6.30	SCE	16
93546	Mammoth Lakes	7625	46.6	163.73	SCE	492
93601	Ahwahnee	2088	73.3	28.50	PG&E	39
93623	Fish Camp	267	5.8	46.27	PG&E	7
93637	Madera	35723	155.5	229.80	PG&E	670
93643	North Fork	3160	16.5	192.02	PG&E	49
93667	Tollhouse	2817	47.7	59.04	PG&E	31
94020	La Honda	1157	22.1	52.46	PG&E	25
94021	Loma Mar	435	20.0	21.78	PG&E	8
94035	Mountain View	310	106.2	2.92	PG&E	59
94060	Pescadero	1731	30.3	57.16	PG&E	57
94062	Redwood City	26568	334.8	79.36	PG&E	666
94074	San Gregorio	103	8.0	12.87	PG&E	11
94089	Sunnyvale	18086	1477.6	12.24	PG&E	602
94551	Livermore	38245	514.8	74.29	PG&E	748
94552	Castro Valley	14279	338.8	42.14	PG&E	173
94555	Fremont	33242	2908.3	11.43	PG&E	342
94922	Bodega	179	23.3	7.69	PG&E	15
94923	Bodega Bay	1770	95.2	18.60	PG&E	60
94924	Bolinas	1527	168.5	9.06	PG&E	48
94929	Dillon Beach	341	72.1	4.73	PG&E	10
94930	Fairfax	8479	295.1	28.73	PG&E	246
94933	Forest Knolls	940	895.2	1.05	PG&E	25
94938	Lagunitas	393	304.7	1.29	PG&E	24
94941	Mill Valley	29698	1113.1	26.68	PG&E	1117
94945	Novato	16922	625.1	27.07	PG&E	742

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
94946	Nicasio	1023	16.4	62.52	PG&E	34
94947	Novato	24809	1225.7	20.24	PG&E	491
94951	Penngrove	4007	267.7	14.97	PG&E	99
94954	Petaluma	37766	531.9	71.00	PG&E	941
94956	Point Reyes Station	1374	37.9	36.28	PG&E	89
94963	San Geronimo	776	130.9	5.93	PG&E	20
94965	Sausalito	10639	934.1	11.39	PG&E	769
94970	Stinson Beach	763	136.3	5.60	PG&E	38
94971	Tomales	287	25.7	11.17	PG&E	8
94972	Valley Ford	126	225.0	0.56	PG&E	10
95002	Alviso	2090	470.7	4.44	PG&E	37
95014	Cupertino	55933	1687.3	33.15	PG&E	1591
95017	Davenport	449	23.4	19.17	PG&E	13
95023	Hollister	51696	86.8	595.40	PG&E	856
95033	Los Gatos	9278	95.0	97.71	PG&E	151
95043	Paicines	776	0.9	875.18	PG&E	16
95045	San Juan Bautista	4012	56.2	71.40	PG&E	90
95065	Santa Cruz	8243	776.2	10.62	PG&E	284
95230	Farmington	1027	6.4	160.03	PG&E	13
95322	Gustine	9476	36.3	261.06	PG&E	108
95323	Hickman	1095	24.0	45.63	PG&E	10
95338	Mariposa	11023	31.7	347.52	PG&E	244
95360	Newman	11662	35.7	326.48	PG&E	120
95363	Patterson	26978	107.2	251.55	PG&E	229
95364	Pinecrest	2	0.0	170.72	PG&E	13
95369	Snelling	1359	7.1	192.02	PG&E	11
95370	Sonora	26774	252.2	106.15	PG&E	956
95391	Tracy	2593	171.6	15.11	PG&E	27
95410	Albion	1098	26.2	41.89	PG&E	28
95415	Boonville	1435	43.4	33.05	PG&E	45
95417	Branscomb	252	2.3	111.61	PG&E	3
95420	Caspar	344	88.4	3.89	PG&E	15
95421	Cazadero	2063	6.8	303.87	PG&E	48
95422	Clearlake	15274	771.8	19.79	PG&E	217

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
95423	Clearlake Oaks	4418	18.1	244.55	PG&E	48
95425	Cloverdale	10523	81.6	129.02	PG&E	215
95427	Comptche	476	3.8	126.91	PG&E	15
95428	Covelo	2566	2.7	948.13	PG&E	31
95429	Dos Rios	79	2.0	39.83	PG&E	3
95432	Elk	187	16.1	11.64	PG&E	18
95437	Fort Bragg	14965	108.4	138.07	PG&E	527
95439	Fulton	788	338.2	2.33	PG&E	27
95442	Glen Ellen	4555	179.9	25.32	PG&E	107
95443	Glenhaven	192	2.4	81.14	PG&E	4
95445	Gualala	2095	16.1	130.34	PG&E	140
95446	Guerneville	5586	203.8	27.41	PG&E	100
95448	Healdsburg	18470	97.9	188.71	PG&E	766
95449	Hopland	1936	8.9	217.24	PG&E	39
95450	Jenner	255	14.3	17.88	PG&E	15
95451	Kelseyville	13309	118.9	111.90	PG&E	168
95452	Kenwood	1561	110.7	14.10	PG&E	59
95453	Lakeport	12546	89.2	140.72	PG&E	417
95454	Laytonville	2372	15.1	157.21	PG&E	50
95456	Littleriver	1213	82.7	14.66	PG&E	28
95457	Lower Lake	4109	39.6	103.86	PG&E	87
95458	Lucerne	3027	578.8	5.23	PG&E	25
95460	Mendocino	2096	50.5	41.50	PG&E	167
95461	Middletown	3955	29.9	132.15	PG&E	127
95462	Monte Rio	1536	297.7	5.16	PG&E	31
95464	Nice	2672	586.0	4.56	PG&E	30
95468	Point Arena	1460	13.3	110.10	PG&E	50
95469	Potter Valley	1834	9.5	193.50	PG&E	34
95470	Redwood Valley	6497	48.9	132.90	PG&E	110
95476	Sonoma	36083	334.5	107.88	PG&E	1147
95485	Upper Lake	2964	31.1	95.27	PG&E	43
95488	Westport	342	3.0	114.66	PG&E	10
95490	Willits	14181	37.4	379.10	PG&E	320
95493	Witter Springs	103	40.1	2.57	PG&E	2

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
95497	The Sea Ranch	1159	100.9	11.49	PG&E	30
95511	Alderpoint	313	5.1	61.48	PG&E	3
95514	Blocksburg	165	1.7	99.64	PG&E	2
95519	McKinleyville	17201	285.8	60.19	PG&E	277
95521	Arcata	22015	377.4	58.34	PG&E	638
95526	Bridgeville	772	2.6	292.84	PG&E	13
95527	Burnt Ranch	362	2.8	129.36	PG&E	4
95536	Ferndale	3101	12.8	242.08	PG&E	84
95540	Fortuna	13398	289.4	46.29	PG&E	358
95542	Garberville	2455	7.9	311.66	PG&E	108
95546	Hoopa	3362	9.0	371.95	PG&E	20
95547	Hydesville	1274	216.7	5.88	PG&E	17
95549	Kneeland	427	2.3	185.60	PG&E	14
95551	Loleta	1354	48.9	27.71	PG&E	21
95552	Mad River	18	4.4	4.13	PG&E	4
95555	Orick	457	5.2	88.51	PG&E	14
95556	Orleans	529	7.2	73.73	PG&E	10
95558	Petrolia	287	2.6	108.80	PG&E	10
95560	Redway	534	83.6	6.39	PG&E	67
95562	Rio Dell	3321	210.9	15.75	PG&E	36
95563	Salyer	925	7.3	126.70	PG&E	9
95564	Samoa	397	130.2	3.05	PG&E	11
95573	Willow Creek	1686	27.1	62.29	PG&E	50
95585	Leggett	435	4.6	93.78	PG&E	10
95587	Piercy	350	1.9	188.66	PG&E	6
95589	Whitethorn	799	7.6	105.79	PG&E	23
95595	Zenia	491	2.3	215.49	PG&E	
95615	Courtland	852	40.2	21.19	PG&E	10
95655	Mather	3179	402.9	7.89	PG&E	72
95668	Pleasant Grove	1553	25.5	60.80	PG&E	23
95742	Rancho Cordova	2914	68.8	42.38	PG&E	857
95912	Arbuckle	5245	22.9	228.68	PG&E	50
95918	Browns Valley	1933	31.4	61.49	PG&E	30
95920	Butte City	324	4.5	72.12	PG&E	3

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
95922	Camptonville	672	4.5	147.74	PG&E	10
95923	Canyon Dam	29	1.0	27.83	PG&E	7
95925	Challenge	375	9.5	39.37	PG&E	6
95932	Colusa	8334	44.9	185.60	PG&E	182
95934	Crescent Mills	236	11.9	19.89	PG&E	8
95935	Dobbins	1229	42.5	28.93	PG&E	11
95943	Glenn	1008	16.3	61.74	PG&E	17
95945	Grass Valley	25817	300.5	85.91	PG&E	1167
95946	Penn Valley	9707	156.7	61.96	PG&E	175
95949	Grass Valley	20563	173.8	118.32	PG&E	382
95953	Live Oak	10464	116.1	90.10	PG&E	99
95955	Maxwell	1567	25.8	60.77	PG&E	20
95960	North San Juan	617	16.8	36.66	PG&E	16
95962	Oregon House	534	52.7	10.13	PG&E	25
95970	Princeton	494	17.0	29.04	PG&E	6
95981	Strawberry Valley	170	0.7	242.93	PG&E	3
95982	Sutter	3692	51.5	71.75	PG&E	44
95983	Taylorsville	356	3.3	107.31	PG&E	18
95987	Williams	5490	15.8	347.34	PG&E	91
95988	Willows	9223	22.5	409.11	PG&E	205
95993	Yuba City	34656	415.4	83.43	PG&E	631
96021	Corning	16194	42.1	384.81	PG&E	219
96022	Cottonwood	14971	48.5	308.96	PG&E	184
96024	Douglas City	890	6.2	142.72	PG&E	11
96035	Gerber	4404	87.2	50.49	PG&E	22
96048	Junction City	756	6.0	126.45	PG&E	12
96052	Lewiston	2644	7.3	360.57	PG&E	30
96055	Los Molinos	4112	127.7	32.21	PG&E	43
96056	McArthur	2773	1.3	2151.60	PG&E	35
96059	Manton	514	19.0	27.08	PG&E	6
96091	Trinity Center	599	1.3	448.40	PG&E	27
96125	Sierra City	351	8.4	41.92	PG&E	11

Table A.4-4. GIS Analysis Results: Scenario 2 Wind Speed 15.7+ mph

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
91307	West Hills	24522	1737.9	14.11	SCG	641
91320	Newbury Park	41837	1059.2	39.50	SCE	1138
92389	Tecopa	82	0.4	212.39	SCE	3
92618	Irvine	9330	332.9	28.03	SCE	2723
93012	Camarillo	32978	683.5	48.25	SCE	883
93015	Fillmore	19253	138.3	139.23	SCE	223
93021	Moorpark	37965	612.8	61.95	SCE	712
93023	Ojai	22922	74.0	309.77	SCE	630
93033	Oxnard	80125	2327.9	34.42	SCE	590
93060	Santa Paula	33708	294.4	114.51	SCE	490
93065	Simi Valley	70305	1662.1	42.30	SCE	1895
93066	Somis	3258	56.2	57.99	SCE	98
93204	Avenal	17041	55.8	305.18	PG&E	50
93210	Coalinga	20404	28.3	719.77	PG&E	169
93225	Frazier Park	7714	15.0	512.94	SCE	85
93243	Lebec	824	2.7	310.94	PG&E	60
93252	Maricopa	3388	8.5	399.12	PG&E	15
93260	Posey	275	4.4	62.02	SCE	
93285	Wofford Heights	3909	18.3	214.08	SCE	31
93401	San Luis Obispo	28108	447.8	62.77	PG&E	2059
93405	San Luis Obispo	32988	279.7	117.92	PG&E	389
93420	Arroyo Grande	27946	108.3	257.93	PG&E	817
93430	Cayucos	3281	42.3	77.51	PG&E	95
93432	Creston	1270	13.7	92.43	PG&E	26
93442	Morro Bay	11129	258.9	42.98	PG&E	420
93453	Santa Margarita	2801	2.6	1095.54	PG&E	45
93512	Benton	194	0.7	291.34	SCE	5
93513	Big Pine	1856	4.7	397.62	SCE	24
93514	Bishop	14955	9.3	1605.21	SCE	468
93517	Bridgeport	376	2.0	190.08	SCE	36
93529	June Lake	623	2.5	251.33	SCE	36
93546	Mammoth Lakes	7625	46.6	163.73	SCE	492

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
93635	Los Banos	41510	74.3	558.48	PG&E	467
93664	Shaver Lake	1056	1.2	907.73	SCE	51
94019	Half Moon Bay	18984	256.7	73.96	PG&E	438
94038	Moss Beach	5640	815.0	6.92	PG&E	48
94550	Livermore	45604	120.0	379.95	PG&E	1467
94551	Livermore	38245	514.8	74.29	PG&E	748
94923	Bodega Bay	1770	95.2	18.60	PG&E	60
94929	Dillon Beach	341	72.1	4.73	PG&E	10
94930	Fairfax	8479	295.1	28.73	PG&E	246
94937	Inverness	1397	23.4	59.72	PG&E	46
94940	Marshall	122	10.4	11.68	PG&E	16
94941	Mill Valley	29698	1113.1	26.68	PG&E	1117
94945	Novato	16922	625.1	27.07	PG&E	742
94946	Nicasio	1023	16.4	62.52	PG&E	34
94952	Petaluma	32702	151.8	215.43	PG&E	1263
94965	Sausalito	10639	934.1	11.39	PG&E	769
94971	Tomales	287	25.7	11.17	PG&E	8
95023	Hollister	51696	86.8	595.40	PG&E	856
95043	Paicines	776	0.9	875.18	PG&E	16
95321	Groveland	4042	9.9	409.10	PG&E	100
95322	Gustine	9476	36.3	261.06	PG&E	108
95335	Long Barn	709	1.6	437.17	PG&E	17
95360	Newman	11662	35.7	326.48	PG&E	120
95363	Patterson	26978	107.2	251.55	PG&E	229
95364	Pinecrest	2	0.0	170.72	PG&E	13
95389	Yosemite National Park	1569	4.3	367.45	PG&E	58
95391	Tracy	2593	171.6	15.11	PG&E	27
95410	Albion	1098	26.2	41.89	PG&E	28
95417	Branscomb	252	2.3	111.61	PG&E	3
95421	Cazadero	2063	6.8	303.87	PG&E	48
95423	Clearlake Oaks	4418	18.1	244.55	PG&E	48
95425	Cloverdale	10523	81.6	129.02	PG&E	215
95428	Covelo	2566	2.7	948.13	PG&E	31

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
95441	Geyserville	2904	26.6	109.07	PG&E	66
95443	Glenhaven	192	2.4	81.14	PG&E	4
95445	Gualala	2095	16.1	130.34	PG&E	140
95448	Healdsburg	18470	97.9	188.71	PG&E	766
95449	Hopland	1936	8.9	217.24	PG&E	39
95450	Jenner	255	14.3	17.88	PG&E	15
95451	Kelseyville	13309	118.9	111.90	PG&E	168
95454	Laytonville	2372	15.1	157.21	PG&E	50
95457	Lower Lake	4109	39.6	103.86	PG&E	87
95461	Middletown	3955	29.9	132.15	PG&E	127
95465	Occidental	2538	50.3	50.46	PG&E	54
95468	Point Arena	1460	13.3	110.10	PG&E	50
95488	Westport	342	3.0	114.66	PG&E	10
95514	Blocksburg	165	1.7	99.64	PG&E	2
95525	Blue Lake	500	2.7	186.51	PG&E	36
95526	Bridgeville	772	2.6	292.84	PG&E	13
95527	Burnt Ranch	362	2.8	129.36	PG&E	4
95536	Ferndale	3101	12.8	242.08	PG&E	84
95540	Fortuna	13398	289.4	46.29	PG&E	358
95542	Garberville	2455	7.9	311.66	PG&E	108
95546	Hoopa	3362	9.0	371.95	PG&E	20
95549	Kneeland	427	2.3	185.60	PG&E	14
95554	Myers Flat	3078	12.8	239.81	PG&E	7
95558	Petrolia	287	2.6	108.80	PG&E	10
95563	Salyer	925	7.3	126.70	PG&E	9
95565	Scotia	1135	19.7	57.50	PG&E	14
95585	Leggett	435	4.6	93.78	PG&E	10
95587	Piercy	350	1.9	188.66	PG&E	6
95589	Whitethorn	799	7.6	105.79	PG&E	23
95595	Zenia	491	2.3	215.49	PG&E	
95666	Pioneer	6285	25.7	244.21	PG&E	82
95728	Soda Springs	106	0.5	212.71	PG&E	39
95934	Crescent Mills	236	11.9	19.89	PG&E	8
95936	Downieville	186	14.2	13.14	PG&E	14

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region	Number of Establishments
95947	Greenville	2523	11.5	218.79	PG&E	51
95953	Live Oak	10464	116.1	90.10	PG&E	99
95979	Stonyford	887	2.8	318.94	PG&E	7
95981	Strawberry Valley	170	0.7	242.93	PG&E	3
95982	Sutter	3692	51.5	71.75	PG&E	44
95983	Taylorsville	356	3.3	107.31	PG&E	18
95987	Williams	5490	15.8	347.34	PG&E	91
96010	Big Bar	198	1.1	175.13	PG&E	6
96024	Douglas City	890	6.2	142.72	PG&E	11
96046	Hyampom	270	1.7	156.62	PG&E	4
96048	Junction City	756	6.0	126.45	PG&E	12
96052	Lewiston	2644	7.3	360.57	PG&E	30
96056	McArthur	2773	1.3	2151.60	PG&E	35
96080	Red Bluff	30330	27.3	1111.19	PG&E	734
96091	Trinity Center	599	1.3	448.40	PG&E	27
96125	Sierra City	351	8.4	41.92	PG&E	11

Table A.4-5. GIS Analysis Results: Scenario 3 Federal Land Wind Speed 12.5-15.7 mph

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
90265	Malibu	20094	212.4	94.60	SCE
91011	La Canada Flintridge	21201	341.3	62.12	SCE
91042	Tujunga	27441	896.2	30.62	SCG
91321	Newhall	34243	858.9	39.87	SCG
91342	Sylmar	88942	702.2	126.66	SCG
91384	Castaic	21491	110.4	194.73	SCG
91390	Santa Clarita	20973	130.6	160.64	SCG
91759	Mt Baldy	576	6.8	85.05	SCE
91901	Alpine	17502	174.8	100.13	SDG&E
91916	Descanso	2382	18.0	132.57	SDG&E
91917	Dulzura	706	17.1	41.25	SDG&E
92036	Julian	3773	8.9	421.92	SDG&E
92055	Camp Pendleton	21258	124.5	170.75	SDG&E
92241	Desert Hot Springs	7041	62.0	113.61	SCE
92242	Earp	1910	22.5	84.73	SCE
92256	Morongo Valley	4301	34.1	126.05	SCE
92274	Thermal	30580	35.1	870.04	SCE
92277	Twentynine Palms	29015	28.2	1029.73	SCE
92278	Twentynine Palms	5809	6.4	908.18	SCE
92280	Vidal	50	0.1	582.24	SCE

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
92282	White Water	1184	15.8	75.11	SCE
92283	Winterhaven	4743	2.2	2116.00	SCE
92285	Landers	2540	5.6	450.98	SCE
92305	Angelus Oaks	204	1.9	109.29	SCE
92309	Baker	1374	0.5	2736.48	SCE
92310	Fort Irwin	9972	8.5	1172.57	SCE
92317	Blue Jay	1230	1397.7	0.88	SCE
92322	Cedarpines Park	998	166.3	6.00	SCE
92328	Death Valley	359	0.1	2800.80	SCE
92338	Ludlow	79	0.1	638.16	SCE
92339	Forest Falls	1459	15.7	93.17	SCE
92342	Helendale	5981	46.8	127.88	
92359	Mentone	8330	158.2	52.65	SCE
92363	Needles	6446	5.0	1287.13	SCE
92364	Nipton	251	0.1	1696.72	SCE
92368	Oro Grande	1123	16.4	68.50	SCE
92384	Shoshone	195	0.1	1694.76	SCE
92389	Tecopa	82	0.4	212.39	SCE
92397	Wrightwood	5383	157.6	34.16	SCE
92407	San Bernardino	64098	358.4	178.85	SCE
92530	Lake Elsinore	46368	396.3	116.99	SCE
92549	Idyllwild	4716	49.5	95.30	SCE
92561	Mountain Center	1700	3.9	431.66	

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
92570	Perris	43901	426.5	102.93	SCE
92618	Irvine	9330	332.9	28.03	SDG&E
92672	San Clemente	35470	1099.5	32.26	SCE
92880	Corona	50867	1952.7	26.05	SCE
93023	Ojai	22922	74.0	309.77	SCE
93105	Santa Barbara	26959	93.1	289.45	SCE
93205	Bodfish	2205	148.4	14.86	SCE
93225	Frazier Park	7714	15.0	512.94	SCE
93238	Kernville	1059	18.1	58.39	PG&E
93243	Lebec	824	2.7	310.94	PG&E
93252	Maricopa	3388	8.5	399.12	SCE
93255	Onyx	394	1.8	214.43	PG&E
93262	Sequoia National Park	39	0.4	110.33	SCE
93265	Springville	5283	9.3	565.90	SCE
93271	Three Rivers	2662	6.9	383.21	SCE
93283	Weldon	2447	7.0	349.57	SCE
93285	Wofford Heights	3909	18.3	214.08	PG&E
93426	Bradley	1507	4.7	322.28	PG&E
93429	Casmalia	1	0.0	48.08	PG&E
93437	Lompoc	6159	59.8	102.95	SCE
93512	Benton	194	0.7	291.34	SCE
93513	Big Pine	1856	4.7	397.62	SCE
93514	Bishop	14955	9.3	1605.21	SCE

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
93517	Bridgeport	376	2.0	190.08	SCE
93523	Edwards	8191	34.4	238.34	SCE
93524	Edwards	29	0.1	348.20	SCE
93527	Inyokern	2339	13.9	168.25	SCE
93528	Johannesburg	204	7.0	29.33	SCE
93529	June Lake	623	2.5	251.33	SCE
93532	Lake Hughes	3033	22.7	133.44	SCE
93546	Mammoth Lakes	7625	46.6	163.73	SCE
93550	Palmdale	72083	707.3	101.91	SCE
93554	Randsburg	55	2.7	20.71	SCE
93555	Ridgecrest	32039	8.9	3603.88	SCE
93560	Rosamond	18683	41.5	450.07	SCE
93563	Valyermo	821	2.2	365.46	PG&E
93633	Kings Canyon National Park	199	0.3	685.44	SCE
93664	Shaver Lake	1056	1.2	907.73	PG&E
93920	Big sur	1385	5.0	276.41	PG&E
93927	Greenfield	16311	71.4	228.56	PG&E
93932	Lockwood	1011	3.1	322.42	PG&E
94129	San Francisco	2415	1023.3	2.36	PG&E
94521	Concord	42795	2179.0	19.64	PG&E
94937	Inverness	1397	23.4	59.72	PG&E
94946	Nicasio	1023	16.4	62.52	PG&E
94965		10639	934.1	11.39	PG&E

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
94970	Sausalito	763	136.3	5.60	PG&E
95223	Stinson Beach	6979	33.9	206.17	PG&E
95255	Arnold	2358	21.8	107.97	PG&E
95321	West Point	4042	9.9	409.10	PG&E
95335	Groveland	709	1.6	437.17	PG&E
95346	Long Barn	1144	3.2	353.71	PG&E
95364	MI Wuk Village	2	0.0	170.72	PG&E
95389	Pinecrest	1569	4.3	367.45	PG&E
95423	Yosemite National Park	4418	18.1	244.55	PG&E
95428	Clearlake Oaks	2566	2.7	948.13	PG&E
95443	Covelo	192	2.4	81.14	PG&E
95470	Glenhaven	6497	48.9	132.90	PG&E
95527	Redwood Valley	362	2.8	129.36	PG&E
95556	Burnt Ranch	529	7.2	73.73	PG&E
95563	Orleans	925	7.3	126.70	PG&E
95573	Salyer	1686	27.1	62.29	PG&E
95595	Willow Creek	491	2.3	215.49	PG&E
95631	Zenia	6730	13.8	488.61	PG&E
95634	Foresthill	2778	21.7	128.07	PG&E
95636	Georgetown	740	16.0	46.14	PG&E
95666	Grizzly Flats	6285	25.7	244.21	PG&E
95679	Pioneer	18	0.7	25.41	PG&E
95684	Rumsey	3575	19.9	179.39	PG&E

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
95715	Somerset	46	0.8	58.78	PG&E
95720	Emigrant Gap	202	1.4	142.04	PG&E
95721	Kyburz	67	4.0	16.59	PG&E
95726	Echo Lake	9387	52.4	179.02	PG&E
95728	Pollock Pines	106	0.5	212.71	PG&E
95910	Soda Springs	87	8.9	9.78	PG&E
95915	Alleghany	28	0.2	133.25	PG&E
95916	Belden	1382	8.5	163.24	PG&E
95922	Berry Creek	672	4.5	147.74	PG&E
95923	Camptonville	29	1.0	27.83	PG&E
95925	Canyon Dam	375	9.5	39.37	PG&E
95936	Challenge	186	14.2	13.14	PG&E
95939	Downieville	378	1.7	220.00	PG&E
95942	Elk Creek	1491	19.3	77.23	PG&E
95944	Forest Ranch	132	3.1	41.94	PG&E
95947	Goodyears Bar	2523	11.5	218.79	PG&E
95956	Greenville	84	3.4	24.98	PG&E
95959	Meadow Valley	19823	65.6	302.33	PG&E
95981	Nevada City	170	0.7	242.93	PG&E
95983	Strawberry Valley	356	3.3	107.31	PG&E
95984	Taylorsville	113	1.0	111.16	PG&E
96010	Twain	198	1.1	175.13	PG&E
96013	Big Bar	4806	14.3	336.02	PG&E

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
96016	Burney	514	9.3	55.26	PG&E
96020	Cassel	2840	9.1	312.86	PG&E
96024	Chester	890	6.2	142.72	PG&E
96033	Douglas City	384	1.8	215.91	PG&E
96040	French Gulch	365	2.3	159.41	PG&E
96047	Hat Creek	876	4.1	215.58	PG&E
96048	Igo	756	6.0	126.45	PG&E
96056	Junction City	2773	1.3	2151.60	PG&E
96063	McArthur	200	1.7	120.93	PG&E
96075	Mineral	496	3.6	138.13	PG&E
96091	Paynes Creek	599	1.3	448.40	PG&E
96125	Trinity Center	351	8.4	41.92	PG&E
96142	Sierra City	1740	186.9	9.31	PG&E
96143	Tahoma	5881	324.6	18.12	PG&E
96145	Kings Beach	7146	85.7	83.37	
	Tahoe City				

Table A.4-6. GIS Analysis Results: Scenario 3 Federal Land Wind Speed 15.7+ mph

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
90265	Malibu	20094	212.4	94.60	SCE
91011	La Canada Flintridge	21201	341.3	62.12	SCE
91042	Tujunga	27441	896.2	30.62	SCG
91321	Newhall	34243	858.9	39.87	SCG
91342	Sylmar	88942	702.2	126.66	SCG
91384	Castaic	21491	110.4	194.73	SCG
91390	Santa Clarita	20973	130.6	160.64	SCG
91759	Mt Baldy	576	6.8	85.05	SCE
91901	Alpine	17502	174.8	100.13	SDG&E
91916	Descanso	2382	18.0	132.57	SDG&E
92036	Julian	3773	8.9	421.92	SDG&E
92241	Desert Hot Springs	7041	62.0	113.61	SCE
92242	Earp	1910	22.5	84.73	SCE
92256	Morongo Valley	4301	34.1	126.05	SCE
92277	Twentynine Palms	29015	28.2	1029.73	SCE
92278	Twentynine Palms	5809	6.4	908.18	SCE
92280	Vidal	50	0.1	582.24	SCE
92282	White Water	1184	15.8	75.11	SCE
92283	Winterhaven	4743	2.2	2116.00	
92285	Landers	2540	5.6	450.98	SCE
92305	Angelus Oaks	204	1.9	109.29	SCE
92309	Baker	1374	0.5	2736.48	SCE

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
92310	Fort Irwin	9972	8.5	1172.57	SCE
92322	Cedarpines Park	998	166.3	6.00	SCE
92328	Death Valley	359	0.1	2800.80	SCE
92338	Ludlow	79	0.1	638.16	SCE
92339	Forest Falls	1459	15.7	93.17	SCE
92359	Mentone	8330	158.2	52.65	SCE
92363	Needles	6446	5.0	1287.13	
92364	Nipton	251	0.1	1696.72	SCE
92368	Oro Grande	1123	16.4	68.50	SCE
92384	Shoshone	195	0.1	1694.76	SCE
92389	Tecopa	82	0.4	212.39	SCE
92397	Wrightwood	5383	157.6	34.16	SCE
92407	San Bernardino	64098	358.4	178.85	SCE
92549	Idyllwild	4716	49.5	95.30	SCE
92561	Mountain Center	1700	3.9	431.66	SCE
92618	Irvine	9330	332.9	28.03	SCE
92880	Corona	50867	1952.7	26.05	SCE
93023	Ojai	22922	74.0	309.77	SCE
93105	Santa Barbara	26959	93.1	289.45	SCE
93225	Frazier Park	7714	15.0	512.94	SCE
93238	Kernville	1059	18.1	58.39	SCE
93243	Lebec	824	2.7	310.94	PG&E
93252	Maricopa	3388	8.5	399.12	PG&E

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
93255	Onyx	394	1.8	214.43	SCE
93265	Springville	5283	9.3	565.90	SCE
93271	Three Rivers	2662	6.9	383.21	SCE
93283	Weldon	2447	7.0	349.57	SCE
93285	Wofford Heights	3909	18.3	214.08	SCE
93426	Bradley	1507	4.7	322.28	PG&E
93429	Casmalia	1	0.0	48.08	PG&E
93437	Lompoc	6159	59.8	102.95	PG&E
93512	Benton	194	0.7	291.34	SCE
93513	Big Pine	1856	4.7	397.62	SCE
93514	Bishop	14955	9.3	1605.21	SCE
93517	Bridgeport	376	2.0	190.08	SCE
93527	Inyokern	2339	13.9	168.25	SCE
93528	Johannesburg	204	7.0	29.33	SCE
93529	June Lake	623	2.5	251.33	SCE
93532	Lake Hughes	3033	22.7	133.44	SCE
93546	Mammoth Lakes	7625	46.6	163.73	SCE
93550	Palmdale	72083	707.3	101.91	SCE
93554	Randsburg	55	2.7	20.71	SCE
93555	Ridgecrest	32039	8.9	3603.88	SCE
93560	Rosamond	18683	41.5	450.07	SCE
93563	Valyermo	821	2.2	365.46	SCE
93633	Kings Canyon National	199	0.3	685.44	PG&E

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
93664	Park	1056	1.2	907.73	SCE
93920	Shaver Lake	1385	5.0	276.41	PG&E
93927	Big sur	16311	71.4	228.56	PG&E
93932	Greenfield	1011	3.1	322.42	PG&E
94521	Lockwood	42795	2179.0	19.64	PG&E
94937	Concord	1397	23.4	59.72	PG&E
94946	Inverness	1023	16.4	62.52	PG&E
94965	Nicasio	10639	934.1	11.39	PG&E
95223	Sausalito	6979	33.9	206.17	PG&E
95255	Arnold	2358	21.8	107.97	PG&E
95321	West Point	4042	9.9	409.10	PG&E
95335	Groveland	709	1.6	437.17	PG&E
95364	Long Barn	2	0.0	170.72	PG&E
95389	Pinecrest	1569	4.3	367.45	PG&E
95423	Yosemite National Park	4418	18.1	244.55	PG&E
95428	Clearlake Oaks	2566	2.7	948.13	PG&E
95443	Covelo	192	2.4	81.14	PG&E
95527	Glenhaven	362	2.8	129.36	PG&E
95563	Burnt Ranch	925	7.3	126.70	PG&E
95595	Salyer	491	2.3	215.49	PG&E
95631	Zenia	6730	13.8	488.61	PG&E
95666	Foresthill	6285	25.7	244.21	PG&E
95679	Pioneer	18	0.7	25.41	PG&E

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
95715	Rumsey	46	0.8	58.78	PG&E
95720	Emigrant Gap	202	1.4	142.04	PG&E
95721	Kyburz	67	4.0	16.59	PG&E
95728	Echo Lake	106	0.5	212.71	PG&E
95915	Soda Springs	28	0.2	133.25	PG&E
95916	Belden	1382	8.5	163.24	PG&E
95936	Berry Creek	186	14.2	13.14	PG&E
95939	Downieville	378	1.7	220.00	PG&E
95942	Elk Creek	1491	19.3	77.23	PG&E
95947	Forest Ranch	2523	11.5	218.79	PG&E
95981	Greenville	170	0.7	242.93	PG&E
95983	Strawberry Valley	356	3.3	107.31	PG&E
95984	Taylorsville	113	1.0	111.16	PG&E
96010	Twain	198	1.1	175.13	PG&E
96013	Big Bar	4806	14.3	336.02	PG&E
96020	Burney	2840	9.1	312.86	PG&E
96024	Chester	890	6.2	142.72	PG&E
96033	Douglas City	384	1.8	215.91	PG&E
96047	French Gulch	876	4.1	215.58	PG&E
96048	Igo	756	6.0	126.45	PG&E
96056	Junction City	2773	1.3	2151.60	PG&E
96063	McArthur	200	1.7	120.93	PG&E
96075	Mineral	496	3.6	138.13	PG&E

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
96091	Paynes Creek	599	1.3	448.40	PG&E
96125	Trinity Center	351	8.4	41.92	PG&E
96142	Sierra City	1740	186.9	9.31	PG&E
96145	Tahoma	7146	85.7	83.37	PG&E
	Tahoe City				

Table A.4-7. GIS Analysis Results: Scenario 3 Native American Land Wind Speed 12.5-15.7 mph

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
91905	Boulevard	1604	12.2	131.04	SDG&E
91906	Campo	3748	23.6	158.67	SDG&E
91916	Descanso	2382	18.0	132.57	SDG&E
91935	Jamul	10350	80.1	129.18	SDG&E
91962	Pine Valley	2127	18.8	112.94	SDG&E
92036	Julian	3773	8.9	421.92	SDG&E
92059	Pala	1773	22.3	79.36	SDG&E
92061	Pauma Valley	2244	63.4	35.38	SDG&E
92066	Ranchita	425	6.2	68.34	SDG&E
92070	Santa Ysabel	1343	9.2	146.63	SDG&E
92082	Valley Center	18902	138.8	136.16	SDG&E
92220	Banning	30669	217.0	141.36	SCG
92230	Cabazon	2962	153.3	19.32	SCE
92254	Mecca	11968	138.3	86.51	SCG
92262	Palm Springs	30345	742.1	40.89	SCE
92264	Palm Springs	20226	229.5	88.14	SCE
92270	Rancho Mirage	17999	697.4	25.81	SCE
92274	Thermal	30580	35.1	870.04	
92276	Thousand Palms	7599	303.4	25.05	SCE
92277	Twentynine Palms	29015	28.2	1029.73	SCE
92539	Anza	4651	30.1	154.60	SCG
92561	Mountain Center	1700	3.9	431.66	SCE

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
92592	Temecula	70797	585.2	120.98	SCE
93265	Springville	5283	9.3	565.90	SCE
93460	Santa Ynez	5846	52.0	112.52	PG&E
93512	Benton	194	0.7	291.34	SCE
93513	Big Pine	1856	4.7	397.62	SCE
93514	Bishop	14955	9.3	1605.21	SCE
93517	Bridgeport	376	2.0	190.08	SCE
95421	Cazadero	2063	6.8	303.87	PG&E
95441	Geyserville	2904	26.6	109.07	PG&E
95449	Hopland	1936	8.9	217.24	PG&E
95453	Lakeport	12546	89.2	140.72	PG&E
95454	Laytonville	2372	15.1	157.21	PG&E
95461	Middletown	3955	29.9	132.15	PG&E
95468	Point Arena	1460	13.3	110.10	PG&E
95469	Potter Valley	1834	9.5	193.50	PG&E
95470	Redwood Valley	6497	48.9	132.90	PG&E
95485	Upper Lake	2964	31.1	95.27	PG&E
95490	Willits	14181	37.4	379.10	PG&E
95540	Fortuna	13398	289.4	46.29	PG&E
95551	Loleta	1354	48.9	27.71	PG&E
95556	Orleans	529	7.2	73.73	PG&E
95570	Trinidad	2533	18.2	139.40	PG&E
95606	Brooks	292	4.0	72.81	PG&E

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
95916	Berry Creek	1382	8.5	163.24	PG&E
95932	Colusa	8334	44.9	185.60	PG&E
95947	Greenville	2523	11.5	218.79	PG&E
95966	Oroville	30857	157.8	195.58	PG&E
95987	Williams	5490	15.8	347.34	PG&E
96065	Montgomery Creek	880	1.5	585.05	PG&E

Table A.4-8. GIS Analysis Results: Scenario 3 Native American Land Wind Speed 15.7 mph

Zip Code	Zip Code Area Name	Population in 2007	Population in 2007 per Square Mile	Area of Zip Code (sq. mi.)	IOU Region
91905	Boulevard	1604	12.2	131.04	SDG&E
91906	Campo	3748	23.6	158.67	SDG&E
91916	Descanso	2382	18.0	132.57	SDG&E
91962	Pine Valley	2127	18.8	112.94	SDG&E
92036	Julian	3773	8.9	421.92	SDG&E
92066	Ranchita	425	6.2	68.34	SDG&E
92070	Santa Ysabel	1343	9.2	146.63	SDG&E
92082	Valley Center	18902	138.8	136.16	SDG&E
92220	Banning	30669	217.0	141.36	SCG
92230	Cabazon	2962	153.3	19.32	SCE
92262	Palm Springs	30345	742.1	40.89	SCE
92264	Palm Springs	20226	229.5	88.14	SCE
92277	Twentynine Palms	29015	28.2	1029.73	SCE
92539	Anza	4651	30.1	154.60	SCG
92561	Mountain Center	1700	3.9	431.66	SCE
93265	Springville	5283	9.3	565.90	SCE
93460	Santa Ynez	5846	52.0	112.52	PG&E
93512	Benton	194	0.7	291.34	SCE
93513	Big Pine	1856	4.7	397.62	SCE
93514	Bishop	14955	9.3	1605.21	SCE

93517	Bridgeport	376	2.0	190.08	SCE
95421	Cazadero	2063	6.8	303.87	PG&E
95441	Geyserville	2904	26.6	109.07	PG&E
95449	Hopland	1936	8.9	217.24	PG&E
95454	Laytonville	2372	15.1	157.21	PG&E
95461	Middletown	3955	29.9	132.15	PG&E
95468	Point Arena	1460	13.3	110.10	PG&E
95540	Fortuna	13398	289.4	46.29	PG&E
95606	Brooks	292	4.0	72.81	PG&E
95916	Berry Creek	1382	8.5	163.24	PG&E
95947	Greenville	2523	11.5	218.79	PG&E
95987	Williams	5490	15.8	347.34	PG&E
96065	Montgomery Creek	880	1.5	585.05	PG&E

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