California Public Utilities Commission
Energy Division

California Solar Initiative
Proposed Research, Development and Demonstration Plan

April 2, 2007

Overview

This paper proposes an implementation strategy to award up to $50 million for research, development, and demonstration (RD&D)[1] grants as part of the California Solar Initiative (CSI). The proposed strategy includes the following:

- Suggested priority targets
- Guidelines for funding allocations and project solicitation
- An implementation strategy
- An administrative structure; and
- Program and project evaluation

To help put the RD&D proposal in context, we include an Appendix which identifies potential overlap areas with California RD&D programs and grants.

1. Introduction to California Solar Initiative's RD&D Program

On January 12, 2006, the California Public Utilities Commission (Commission or CPUC) established an RD&D budget for distributed solar under the CSI to help achieve the CSI's 3,000 MW goal for solar installations by 2016.[2] The Commission's intent for RD&D is to "explore solar technologies and other distributed generation technologies that employ or could employ solar for power generation and storage or to offset natural gas usage, as well as market development strategies."

Senate Bill 1 (SB1), signed into law on August 21, 2006, directed the CPUC to allocate not more than $50 million to research, development, and demonstration that explores as part of the California Solar Initiative:

1. solar technologies, or
2. other distributed generation technologies that employ or could employ solar energy for generation or storage of electricity or to offset natural gas usage.

The overall goal of the RD&D funds is to help build a sustainable and self-supporting industry for customer-sited solar in California. A clearer way to describe this goal in operational terms might be to say the CSI program needs to achieve two key outcomes:

- Move the market from the current retail solar price of $9/watt or about 30 cents/kWh to levels that are comparable to the retail price of electricity.

[1] Staff proposes to include deployment, which we view as an element of the category "demonstration" that helps to support market adoption of solar.

[2] Up to 5% within the then-$2.5 billion total CPUC CSI budget.

- Install increasing volumes of solar DG that build from the current range of 40+MW per year to 350 MW or more per year with the expected associated benefits from scale economies.

Staff recommends the funds be used to fill critical needs or gaps in the market to facilitate greatly expanded market penetration of cost-effective solar applications. The RD&D program effort is intended to produce results to ensure achieving the goal of 3,000 MW of solar distributed generation and without further ratepayer subsidization beyond 2016.

While the SB1 definition of eligible technologies is broad, staff recommends the Commission focus the first project solicitation on PV-oriented RD&D proposals in order to achieve the CSI goals. Subsequent requests for proposals (RFPs) may consider other RD&D activities on non-PV technologies.

The Legislature, via SB1, also imposed several requirements on any such Commission program:

1. The program must be developed in collaboration with the California Energy Commission to prevent duplication,
2. The Commission must adopt the program via a rulemaking or other appropriate public proceeding,
3. The program must require that each specific award will be approved by the full Commission at a public meeting, and
4. The Commission must include in its annual assessment of the California Solar Initiative to the Legislature a description of the program, with a summary of each award made, including the intended purpose and results of the award.

Staff developed this proposed R&D strategy to align with the U.S. Department of Energy (DOE), National Renewable Energy Laboratory (NREL), and California Energy Commission Public Interest Energy Research (PIER) priorities, and to address priority unmet needs. In late 2006, the CEC commissioned a study for PIER funding considerations. The study identified a number of milestones or target activity areas that could be pursued to achieve solar success in California. Many of the milestones tightly correspond to CSI RD&D goals. In February 2007, Energy Division staff circulated a draft RD&D proposal and held a workshop to discuss the proposal and to solicit informal comments.

In addition to the RD&D fund, the CPUC CSI program reserves 10% of program funds for administration of the program, Marketing and Outreach (M&O), and Evaluation, Measurement, and Verification (EM&V). These two areas may appear to overlap with this proposed RD&D focus (see Appendix A for examples of possible overlap). The Commission plans to address these issues later in the year.

2. Proposed Commission CSI RD&D Strategy

The following proposed strategy includes RD&D program principles, budget allocation guidelines, and guidelines and criteria for project selection. The principles, guidelines and criteria will guide project selection. These are all tied closely to the CSI policy goals outlined in Section 1. In this RD&D strategy, staff aims to establish robust, public guidelines in order to direct appropriate funding levels to the types of work needed in the field. At the same time, staff wishes to avoid overly-prescriptive rules that might limit solid, innovative grants, or fail to anticipate changes in the industry's RD&D needs in future years. The following recommended percentages are general guidelines for the RD&D Program Manager to consider in selecting projects. We do not expect these guidelines to be rigorously applied across allocations by RD&D stages, target activity areas, or risk.

2.1 RD&D Strategy Principles

The CPUC RD&D strategy should adhere to five key principles:

1. Improve the economics of solar technologies by reducing technology costs and/or increasing system performance.

Up-front cost remains the single largest barrier to widespread adoption of solar DG technologies. Addressing the cost barrier will require continued commitment to a research and development program to identify technology breakthroughs and demonstration projects to test and confirm the performance and cost improvements necessary to overcome this barrier. It will also require support for demonstration projects needed to ensure that potentially cost-reducing products successfully reach the market.

2. Focus on issues that directly benefit California, and that may not be funded by others.

Funding should also be directed towards issues that have a clear relevance to California's energy end-uses, transmission and distribution issues, and other local needs. This will ensure that California ratepayers who are funding the CSI program will realize benefits from the RD&D program.

3. Fill knowledge gaps to enable successful, wide-scale deployment of solar DG technologies.

A third key principle is to maximize the impact of RD&D funds by filling in important gaps in RD&D funding that industry or government agencies are not addressing. For example, industry and DOE are already making investments in many production technologies in order to lower the costs of a solar cell, while private investors are largely supporting work to aid the deployment of near-commercial technologies. The State could therefore focus on other funding categories in order to maximize leverage. All projects should demonstrate an ability to help accomplish the overall goal of 3,000 MW of solar installations in California by 2016, followed by a self-sustaining solar market in the years beyond.

4. Overcome significant barriers to technology adoption.

A fourth principle is to help distributed solar overcome barriers to adoption, particularly across the innovation "valley of death." By targeting RD&D activities at those barriers or opportunities that promise high impact but are currently under-funded, distributed solar applications could become more widespread.

5. Take advantage of California's wealth of data from past, current, and future installations to fulfill the above.

The final principle is to take advantage of the wealth of solar data and experience in California. California has already installed over 15,000 solar projects and will install thousands more through the CSI. The CSI RD&D program should analyze various facets of current installations and the market (California's "natural experiment"), and then apply important lessons in further shaping and expanding California's solar market. A number of project ideas serve as examples here, such as the effect of temperature on BIPV performance, impacts on grid congestion, and so on.

2.2 Allocation by RD&D Stage

Staff offers the following definitions to guide discussion of recommended CPUC focus on RD&D stages:

- Research: Basic and fundamental research that yield discoveries with potential application to the improvement of energy technologies, and that are directed at the invention or improvement of specific energy technologies.

- Development: Activities that convert the fruits of fundamental and applied research into working prototypes of new or improved technologies.

- Demonstration: An activity that bring promising technologies closer to market in order to increase chances of adoption, such as by testing in conditions that approximate real-world applications in order to gain economic and performance data that improve technologies and enhance potential for commercialization; and demonstrating real-world feasibility of new technologies to manufacturers.

- Deployment (Market Support): Activities that aid the new technology to compete or gain acceptance in the market and thus achieve wide-scale adoption, or to reach a "tipping point" into widespread commercialization.

We observe that most state-level RD&D agencies tend to focus on demonstration and deployment activities, and we recommend that the CPUC focus most of its efforts in these areas, as well. Industry and the federal government should handle the bulk of the basic research and

development, and that states should only enter that arena if there is a particular RD&D area that is not being adequately addressed by industry or federal entities.

CPUC staff recommends the following breakdown of funding across four RD&D stages. The funding percentages that follow are not a hard-and-fast constraint, but rather a general principle to guide the RD&D Program Manager.

Suggested Allocation by RD&D Stage	
Research	20%
Development	10-15%
Demonstration	50-60%
Deployment	10-15%

2.2.1 Research

As discussed above, because research funding is generally handled by the federal government, research should be a secondary aim of the CPUC's CSI program, and viewed as a way to kick-start or supplement national and industry efforts when the potential gains for California are extraordinarily large. Research activities are typically more expensive than demonstration or deployment activities, and therefore a research funding allocation of 20% may appear to be larger than the extensive gains possible from other areas with slightly lower funding levels.

However, there is a need to commit some portion of CSI RD&D funds to research to ensure adequate attention to fundamentally new solar materials and technologies.[3] Staff recommends committing 20% of the CSI RD&D program funds ($10 million) to a single, large consortium that will focus on developing break-through solutions to low-cost solar electricity generation technology for homes, businesses, institutions and other distributed locations. Staff recommends these funds be dedicated to the Helios Project, a large multi-disciplinary and multi-investigator project led by Lawrence Berkeley National Laboratory and University of California at Berkeley. (See Appendix B for a more detailed description of this project). Staff proposes that the research funding category alone be allocated on this one, non-competitive basis as a high-risk, long-term focused effort to develop "breakthrough" solar technologies.

Over the long term, the Helios project will focus on research to develop:

- High efficiency, low-cost, high-volume photovoltaic materials and electricity generation for scalable manufacture,
- Solar storage solutions that transfer excess power generated during peak solar hours into chemical fuels that can be stored and used at a later time to produce electricity. This might involve hydrogen, oxygen, methanol, ethanol, or other energy fuels integrated into storage and conversion mechanisms.

[3] This view was recently underscored by SunPower Chief Technology Officer Dick Swanson at a March 21, 2007 U.C. Berkeley conference, where he commented that what is missing in solar RD&D is university research for products needed in 5-20 year time frame.

This particular CPUC grant will fund a fraction of the construction of the facility that will house the Helios project ($10 million of a $100-140 million facility).

Staff believes this project is consistent with the overall goals of the CSI program to achieve 3,000 MW of distributed solar power by 2016, and to achieve cost and scale economies that will permit elimination of ratepayer solar subsidies. Although the products of this research program will likely come toward the end of the CSI program, there is a value for the CPUC in helping to set up a long-term institution in California for alternative energy RD&D. Staff believes CSI RD&D funding for Helios will:

- Ensure faster launch of critically-needed longer-term, higher-risk basic research that is needed to achieve low-cost solar photovoltaic electricity production.

- Leverage by more than a 10:1 ratio the CSI contribution along with other State of California "cost-sharing" funds that together can command additional federal, corporate, and individual donor sources to establish the research facility.

- Leverage an expected annual budget of $20-30 million from other funding sources for solar research and development, expected from sources such as the California Energy Commission, California Environmental Protection Agency, US Department of Energy, foundations and corporations.

- Support a multi-disciplinary approach to research and development to achieve complete solutions across materials science, electricity generation efficiencies, grid integration, and competitive market pricing dictates.

- Bring together a wide group of California scientists and experts to collaborate on finding solutions for widespread use of distributed solar electric applications in California.

According to Helios developers at a March 21, 2007 workshop on solar research at the University of California at Berkeley, the Helios project aims to build approaches that will cut solar production costs to one-fifth or one-tenth of today's costs. The remaining 80% of solar RD&D funds would be allocated according to this paper's recommended competitive solicitation strategy.

2.2.2 Development

Development should also receive roughly 10-15% of funds. Participants at the February 2007 Energy Division workshop noted that there appears to be adequate federal and venture money flowing into solar, and therefore state funds are largely unnecessary for business enterprise investments. Moreover, the costs of typical activities in this area are apt to be beyond the CPUC's resources. However, some development activities may have more interest to the local California market. Therefore, the CSI fund should only contribute where it is demonstrated that there is a gap to fill that clearly benefits California.

2.2.3 Demonstration

Demonstration is the highest priority for the CPUC RD&D strategy; staff recommends that the CPUC should focus at least 50-60% of dollars in these activities. The CSI RD&D fund is following the lead of other clean energy state funds and proposes to focus on bridging the funding cycle "valley of death," where risk is high and return is low for potential private sector investors. Demonstration projects may not be attractive investments to the finance community given that they lack prospects for intellectual property and outsize earnings in the immediate future. As a result, investors may not have a strong incentive to invest in these types of projects.

The Commission can fund promising solar technologies and bring them closer to market, which will lower the risk of adopting new technologies and bring more competition and lower prices to consumers. This strategy will prioritize demonstration of projects that have already been accepted for DOE and PIER research and development grants and which receive strong evaluation results in those programs. All results from demonstration projects would require public dissemination of data collected and analyses performed, in order to maximize the benefit to stakeholders and the public.

2.2.4 Deployment (Market Support)

Staff recommends that the CPUC reserve a very modest level of funding for deployment activities that will help build market-volume or scale. First, the CSI program itself is essentially a deployment program that gives consumers financial incentives to purchase solar systems. Second, many deployment activities are already funded by the private sector, the DOE Solar America Initiative, and the CEC, making a CSI RD&D investment in this area somewhat duplicative. DOE and industry representatives strongly suggested at the Energy Division workshop that staff diminish focus in this area – particularly with respect to business model deployment activities – noting that the performance-based nature of CSI incentives and the changing solar marketplace will address these needs more effectively than CSI RD&D would be able to. Third, deployment activities are relatively less expensive than research or development, thus priority activities may be carried out with less funding. Finally, because deployment activities would be directed toward near-commercial products, funding such projects would also be unlikely to satisfy the fifth strategy principle ("overcome significant barriers to technology adoption").

Therefore, staff suggests a rough target of 10-15% of total RD&D funds for deployment activities, subject to reconsideration during the project solicitation process. Further, staff also recommends that CSI funding in the deployment area be directly related to CPUC or CEC's potential regulatory role with respect to solar – e.g. testing technologies or measures where regulatory processes and standards can be streamlined to allow new products to come to market more quickly and at lower cost.

2.3 Target Activity Areas

Based upon staff analysis of federal, state, and industry solar RD&D priorities, staff recommends a narrow set of focal issues. They are:

- Production Technologies
- Grid Integration
- Business, Development, and Deployment

The work is grouped according to milestones being considered by CEC staff for the PIER program; we retain the CEC's milestone numbers in parentheses for consistency and recognition purposes (in parentheses).[4] Each target area lists a set of milestones for CPUC grants that could serve CSI RD&D goals and may apply particularly well to a CPUC role or CPUC CSI focus. Asterisks denote target areas with no known overlap with PIER, CEC Renewable Energy program, or CEC Building and Appliances Program funding plans. As with the funding allocations across each RD&D stage, these are general guidelines and not strict fund requirements.

Suggested Allocation by Target Activities

Production Technologies	10-20%
Grid integration, storage, metering	50-60%
Business Development and Deployment	10-15%

Production Technologies **(10-20% of funds):** Supporting the commercialization of new PV technologies

Staff proposes CPUC CSI grantmaking to focus on proposals that advance the field in the following areas:

- ✶ Economic viability of distributed concentrating PV systems demonstrated (P5)
- ✶ Building integral PV products become cost competitive with rooftop PV and key technical integration issues are addressed (e.g. spacing/cooling) (P7)

The success of the CSI program depends on increasing performance and efficiency of solar technologies in the market. Distributed solar is currently constrained by the size of a roof or available land to site the system. More efficient solar cells, inverters, and wiring solutions will decrease the overall size of the system thus allowing greater potential for more generation. Additionally, developing innovative PV materials or methods of integrating PV into buildings are also highly promising methods of reducing the cost of PV systems and/or expanding the market for them, by, among other things, reducing material and production costs and allowing more of a building's surface to be used.

Grid Integration **(50-60% of funds):** improving the integration of PV with the distribution and transmission system

[4] CPUC staff reconfigured a few of the CEC categories of "End Use" and ""Market" Milestones into a new category.

Staff proposes CPUC CSI grantmaking in this area to focus on proposals that advance the field in the following areas:

- ✶ Key barriers to the development of PV minigrids or central PV are identified (P2)
- Economic viability of new PV system storage technologies are demonstrated (G8)
- High value locations for DG PV on Transmission & Distribution (T&D) are identified and the impacts/benefits of large concentrations of DG PV in one location on T&D are assessed (G5)

Of the three activities discussed in this section, grid integration projects are the most likely to focus on California-specific issues and fall into the "valley of death" in funding cycles, because production technologies often receive federal dollars and venture capital, while business development projects also receive venture funding. For these reasons, staff recommends devoting the majority of resources to this area.

Examples of projects which target grid integration include:

- PV production forecasting models that could enable grid managers to anticipate weather-related spikes or reductions in PV output. This capability could mitigate the need to dispatch fossil fuel generators and help to reduce operating costs.
- An RD&D project that quantifies the transmission and distribution system impacts of raising the net metering cap.
- Projects that assist highly efficient inverters to meet applicable federal and local codes or regulations.

The US DOE is developing similar ideas for a strong suite of grants on Grid Integration topics, such as working with utility grid operators on grid impact simulations, and it plans to develop proposed funding priorities by Fall 2007. The Commission should monitor these developments to determine where the projects may have a California element.

Business Development and Deployment **(10-15% of funds):** supporting the market and end-users

Staff proposes CPUC CSI grantmaking here should focus on proposals that advance the field in the following areas:

- Potential roles for utilities in solar PV, including attractive business models, are identified and vetted with utility companies. (E5)
- Lower cost, utility grade PV system control, metering, and monitoring capacity developed consistent with 1% cost parameter established by CPUC for CSI (E7)
- ✶ Field tests done to quantify operational risks and benefits of PV (work heavily with utilities) (E10)
- Improved PV economics demonstrated using advanced metering, price responsive tariffs (e.g. TOU, Feed-in Tariff) and storage (E11)

2.4 Allocations by Risk and Timeframes

Our proposed CSI RD&D program aims to achieve measurable results within the next ten years, but recognizes the need to remain open to new ideas and projects with higher risk and longer return time. The Commission should consider allocating up to 20% of the funds for higher risk projects. Google, for example, uses the "70-20-10 Rule," where staff devotes 70% of work time to core business (i.e. "safe" projects that will have a relatively short time to payoff), 20% to other related business (i.e. projects that are a few years further away from payoff), and the remaining 10% on areas of their own choosing (presumably higher risk concepts that may be rather far away from payoff but could make a dramatic impact). This type of diversified investment approach is also utilized by the Massachusetts Technology Collaborative, which administers a variety of programs investing in projects at a wide range of commercialization stages—from early stage development, demonstration, deployment, and even a small venture capital fund.

The Commission could implement this approach through a diversified range of investments in a wide range of commercialization stages – from early stage development, demonstration, deployment, or even a small venture capital fund. For example, for every three projects that anticipate commercial potential in the next 1-3 years, The CSI RD&D program could fund one project that has a longer commercialization horizon, such as 4-7 years. In addition, the RD&D program could put out an open solicitation to capture new ideas that the CPUC and Program Manager have not yet thought of.

Suggested Allocation by Risk or Timeline to Results

Highest risk, results 8+ years horizon	20%
4-7 year results horizon	20%
1-3 year results horizon	60%

Staff does not recommend granting all of the funds in the first solicitations. See Section 2.5.4 for more information.

2.5 General Guidelines for Competitive Project Solicitation

2.5.1 Eligible Technologies

Eligible technologies are described by SB1 as "solar technologies and other distributed generation technologies that employ or could employ solar energy for generation or storage of electricity or to offset natural gas usage." Thus all solar technologies and balance of system components that are used for distributed generation are generally eligible for RD&D grants. Examples of balance of system components are advanced meters, inverters, and storage methods. The CSI program is mainly focused on photovoltaics. Therefore, staff recommends that in order to further the state goal of installing 3,000 MW of new, solar-produced electricity by 2016, proposals designed to advance PV technology be given priority over proposals involving non-PV solar technologies alone, at least in the first round of grants.

2.5.2 Eligible Recipients

The CPUC staff strongly prefers to fund in-state businesses, or at least projects with an in-state sponsor. Since California ratepayers are the source of the funds, they should also receive the benefits. Due to the administrative practicalities required to make overseas grants, the program will not fund foreign-based proposals.

2.5.3 Project Location

For the same reasons provided in 2.5.2 above, projects that have a California-based component are strongly preferred to ensure results are consistent with the overall CSI goals, funding principles, guidelines, and award criteria. This recommendation is further justified since the strategy focuses predominantly on demonstration projects. However, staff recognizes that projects located elsewhere in the US may still have components that are demonstrably linked to CA needs and may therefore be considered.

2.5.4 Timing of Solicitations and Awards

Staff recommends two or three solicitation and funding cycles over the term of this program. The first cycle should invite projects that might have any of three time frames (1-3 years, 4-7 years, 8 years or longer), but would provide funding for projects focused on PV. This initial cycle may consist of three RFPs (one for Production Technologies, one for Grid Integration, and one for Business Deployment). Each RFP would describe a goal, or cap, for the number of projects and the grant amount to be funded.

Then, perhaps in one- or two-year cycles, additional RFPs would be sent out for only those projects that expect to offer results in shorter time frames, such as 1-3 years. For example, if 60% of the funds are to be used for projects offering results in 1-3 years, there might be three cycles of award solicitations at this risk level, each offering 20% of the RD&D funds. Again, each RFP will group proposals by activity area. These later rounds of solicitations might also be open to non-PV solar technologies, depending on the relevance and potential of PV-focused proposals received, and would also likely specify funding priorities by target activity area and/or RD&D phase. Section 3.5.1 discusses the RFP review and distribution process.

2.5.5 Size of Awards

The CSI needs to balance making meaningful grants that will have an impact versus funding a larger portfolio of projects. This typically is done by capping the size of awards for any individual project. For example, the Connecticut Clean Energy Fund awards grants up to $750,000 for early stage technologies. The New Jersey Renewable Energy Business Venture Assistance program makes grants ranging from $50,000 to $500,000. However, the larger size of the CSI grant program allows for larger-scale projects.

CPUC staff recommends that the funding awarded to any individual project be no larger than $3 million (excluding the single non-competitive research award described in section 2.2.1). However, as discussed in other sections of this proposal, it should be noted that this figure is a guideline only, subject to the discretion of the RD&D Program Manager and the Commission.

The actual level of funding awarded may be higher or lower for individual projects depending, for example, on the type of target area (production technology, grid integration, or business development and deployment), the background of the team, or the level of promise shown by the proposal. (It is expected, for instance, that given the high costs associated with demonstration projects, awards in this area will probably lie toward the upper end of the award spectrum compared to awards in the development or deployment categories, even with cost-sharing requirements.)

In addition, at the recommendation of the RD&D Program Manager and the Commission, the Commission should reserve the right to fund only a portion of a given project proposal. The Program Manager may also recommend that the team apply for funding for other portions of the proposal at a later funding round, or indicate that certain portions of the proposal do not meet CPUC standards for CSI funding. In either case, the funding awarded would be restricted to use on the section of the project for which the Commission granted funding approval.

Finally, CPUC staff recommends establishing a 20% ceiling on the amount of grant funding that can be allocated to overhead costs on individual project proposals. This requirement is designed to ensure that RD&D funds are used in an efficient, cost-effective manner by project teams.

2.5.6 Project Selection Criteria

The CPUC staff recommends applying a set of criteria across all activity categories to evaluate and select projects. Staff proposes the following criteria be used to evaluate applications submitted under the competitive solicitation process:

Project Characteristics

- High priority milestone targeted
- Benefits accrue to California ratepayers
- Level of funding sought from CSI RD&D program
- Potential to expand PV market opportunities or reduce barriers
- Ability to leverage award with funding from other sources
- Institutional and regulatory feasibility
- Utility participation
- Probability of commercial success
- Cost-sharing requirements
- Visibility and educational benefit

Proponent(s) Characteristics

- Capabilities, qualifications, and experience of team members

Project Characteristics

High priority milestone targeted

The proposed project should address a milestone defined above as a CSI RD&D target activity area. The CPUC staff chose these milestones because they rank high on the priority list vetted with the solar industry in the PIER PV priority setting process.

Benefits accrue to California ratepayers

Because the CSI is a program supported by – and designed to benefit – California ratepayers, this is a very important criterion. All else equal, projects that are located in, and/or are sponsored by California-based entities will be given priority. Similarly, projects that target PV barriers that particularly affect California will be given priority over those that address barriers that are less prevalent in California. Examples of benefits accruing to California that could be considered include grid reliability, lower rates, T&D system improvements, and environmental benefits.

Level of funding sought from CSI RD&D program

Cost is also a critical consideration. The RD&D Program Manager will consider a number of questions, such as "Is the cost reasonable and within the funding range? Does the cost require a large amount of the RD&D budget? How significant are the benefits that could potentially accrue from the project relative to the funding request?"

Potential to expand distributed solar market opportunities or reduce barriers

In order to reach the CSI outcome goal of 3,000 MW of new, solar-generation, the solar industry will need to find a broader customer market.

Ability to leverage award with funding from other sources

Projects that can leverage funding from sources other than the CPUC have a significantly greater chance of achieving success than those with just a single source of support. Particular priority will be given to projects that promote collaboration and coordination between CPUC and other solar RD&D organizations (e.g. CEC, DOE, NYSERDA).

Another approach to consider is whether grant funding can be leveraged through partnerships. There may be distinct advantages to scale, with larger organizations spending comparatively less on RD&D yet attaining larger benefits.[5] By partnering with other state agencies (e.g. CEC, the New York State Energy Research and Development Authority, or the Massachusetts Technology Collaborative), DOE, or industry, the Commission may be able to obtain the benefits that scale provides and leverage the relatively modest amount of RD&D funding allocated in the CSI through the resources of these partners. Such partnerships may also help to shorten the relatively long (approximately 20 year) gestation period that new PV technologies typically require to reach the market. Where possible, staff recommends that proposals seek co-funding from multiple states. In those cases, the Program Manager will contact other state RD&D leads to evaluate the virtues of the proposal and probability of cofunding.

We are particularly interested in opportunities to promote public-private venture fund partnerships, which could leverage industry and government knowledge and funding to achieve

[5] Jaruzelski, B., Dehoff, K., Bordia, R., "Smart Spenders: The Global Innovation 1000," Booz Allen Hamilton, http://www.boozallen.com/media/file/Global_Innovation_1000_2006.pdf

greater results with newer and riskier technologies. The Commission should encourage the RD&D Program Manager to explore new and innovative public-private models and to report back to the Commission as to how these arrangements could be implemented.

Institutional and regulatory feasibility

Some projects may identify a need to modify codes, standards, state law, or regulatory rules. For example, solar installations cannot operate during grid outages due to safety hazards for utility workers. If a new project could provide a technical fix to this problem, the rules may have to change to accommodate this technology, delaying the expected benefit from the project.

Utility participation

Project proposals that can demonstrate the early participation of utility staff are apt to show smoother implementation and better results. The RD&D Program Manager will rate proposals which demonstrate utility participation more favorably.

Probability of commercial success

While the RD&D program should consider some projects with higher risk, the majority should have a medium to high probability of commercial success. Projects developing technologies with a proven commercial track record, or that present a realistic business plan for achieving commercial success, will therefore be evaluated preferentially.

Cost-Sharing Requirements

Cost-sharing is an important program component, in part because it encourages project discipline. A general cost-sharing principle to follow is that the closer a project is to commercialization, the higher its cost-share requirement. This requirement encourages companies to engage more with the private sector and consider market needs as their product becomes more technically advanced. Thus cost-share requirements for development projects should be low, around 10%, while projects reaching the demonstration and deployment phases should be required to provide a 50-75% cost-share – a target that is fairly consistent with DOE and other funding agency requirements.

Some specific guidelines regarding these cost-share recommendations are worthy of mention. First, staff recommends that funding received from any non-CPUC source qualify for the cost-share requirement. Thus, the cost-share requirement may be met through monies received from DOE or another state funding agency, not simply from the private sector. However, funding received for non- PV R&D activities will not count. If the project transcends a PV focus, it will not be rejected. However, the CPUC CSI RD&D funds will only go to a PV element of the proposal and that part of the proposal must still meet cost-sharing requirements. Proposals will be required to demonstrate evidence of cost-share funding at the time the proposal is submitted.

As with the allocation breakdowns, these cost-share requirements are guidelines only, and may be larger or smaller depending on the project and the team sponsoring the project. Since deployment activities are geared towards a diffuse group of market participants, cost sharing may not be straightforward.

Suggested Cost-Sharing Requirements

Development	10%
Demonstration	50%
Deployment	75%, depending upon nature of project

Visibility and educational benefit

Although not critical, visibility and public education potential would enhance the competitiveness of proposed projects. Since the CSI aims to educate California consumers about the benefits of solar in addition to promoting a self-sustaining industry, demonstration or other types of projects that involve the public would provide a supplementary benefit.

Proponent(s) Characteristics

Capabilities, qualifications, and experience of team members

The team should be professional and possess both technical skills and solar business experience. While not a requirement, experience of team members in shepherding products through the RD&D funding continuum to commercialization will be regarded favorably.

3. RD&D Strategy Administration

This section describes the required functions, necessary qualifications, and administrative processes required for a successful RD&D Program Manager.

3.1 Functions

The essential functions of the RD&D Program Manager include:

- Support the CPUC Energy Division throughout the RD&D program, including reports, public comment periods, meetings and workshops, and evaluation activities.
- Develop specific funding opportunities consistent with goals and objectives set forth by the Commission to implement CSI RD&D grants.
- Solicit, through a formal RFP process, a strategic variety of RD&D proposals with the potential to add lasting value to the California solar economy.
- Evaluate requests within a standard timeframe and assemble a list of project proposals to receive funding.
- Recommend the list of project proposals to the Commission, including: (1) projects; (2) proposers; (3) a short description per project; and (4) full proposal.
- Work with the utilities to coordinate funding for approved projects.
- Oversee project implementation by establishing target check-ins and evaluation files for Commission oversight.
- Examine project budgets and expenditures, prepare quarterly statements and facilitate semi-annual review at joint CPUC/CEC workshops.

3.2 Personnel Qualifications and Experience

The substantive requirements for an effective Program Manager can be further broken down into two basic categories: (1) institutional and (2) personnel.

The RD&D Program Manager must have solid institutional strength on technical issues and contracting and accounting experience. Technical issues will run a broad gamut from generation technologies, to photovoltaic materials, to transmission grid integration issues, to business models and capital financing options, and more. Understanding these issues and remaining up-to-date on emerging solar issues will require experienced technical experts. This knowledge and experience will be critical to sound evaluations of funding proposals and development of overall funding objectives. Moreover, an effective Program Manager requires in-house contracting and accounting specialists that are experienced with state grant and legal requirements.

Second, the Program Manager must demonstrate robust qualifications of named personnel in the target activities areas of this proposed strategy. No substitution of personnel will be allowed without advance approval from Energy Division.

3.3 Recommended Institutional Structure

3.3.1 Management Recommendation

Staff recommends that the Commission outsource the day-to-day management of this program to a competent outside firm or non-profit entity, with appropriate oversight by the Commission or Commission-designated staff. This recommendation is premised on concerns for time-effectiveness, management experience with RD&D grants, public scrutiny, and overhead cost considerations. The staffing required for this program will vary substantially over the life of the program. Maintaining a competent technical staff can be more efficiently accomplished outside the CPUC due to enhanced hiring and contracting flexibility. The Program Manager can then report back to the Commission for final approvals, as envisioned in the statute.

In SB1, the Legislature intended to hold the Commission accountable for the expenditure of $50 million of ratepayer funds. The Legislature directed the Commission to use its extant legal and regulatory process, i.e., Commission decisions, to establish the program as well to approve each award of funds. The Legislature did not require that the Commission and its staff perform all program functions, therefore, a third-party administrator can add necessary expertise outside the normal scope of Commission and staff duties. While essential technical management and an appropriate level of analytical support and oversight should reside with Commission staff, the Commission does not maintain the number of personnel to perform all of the necessary functions. Specialized external management resources must supplement internal staff so that the CPUC can suitably meet its legal and statutory obligations.

Earlier, staff explored four RD&D Program administration options and discussed them with participants in a solar R&D workshop at the CPUC on February 26, 2007. Compelled by simplicity, uniformity and transparency, many participants favored a single, third-party administrator, such as a consulting firm or a non-profit organization, to manage RD&D projects with CPUC staff oversight. Staff rejected assigning the role to the utilities because R&D expertise is usually outside of usual utility business and due to potential perceptions of an inherent conflict of interest. Because negotiating financial arrangements between the CEC and CPUC are time consuming and may impede program implementation, PIER management of the program is not recommended. The CPUC could enter into an inter-agency agreement with the University of California, but this could be counter-productive because conflict of interest principles may preclude UC researchers from submitting proposals.

3.3.2 Process of Selection

The CPUC will direct one of the IOUs to issue a five-year RFP for the Program Manager according to the above criteria, qualifications, and experience, within three months of Commission approval of a final RD&D strategy. CPUC Energy Division staff would participate in drafting the RFP. Prior to the IOU releasing a final RFP, Energy Division would issue a draft RFP for parties to the proceeding to provide comments. Energy Division staff would direct the IOU to make any necessary revisions to the RFP. CPUC Energy Division staff would also participate in reviewing and evaluating incoming proposals. Energy Division will select the Program Manager with input from the IOU. The CPUC will also direct the IOU to contract with

the Program Manager within three months of the selection. The Commission would direct the utilities to establish accounts with the selected RD&D Program Manager to transfer ratepayer funding for the program to the Program Manager for its contract. The IOUs should work together to determine the most-efficient means of paying both the Program Manager and the grants. Utilities would be compensated for their expenses for accounting and payment functions by an advice letter process.

The scope of the management contract should be broad, specifying work to be performed by the Program Manager and deliverables. Similar contracts for RD&D management at other state agencies are exhaustive. The list of significant topics to negotiate with the Program Manager may include: Attachment with Standard Terms and Conditions for State Contracts, i.e., wages, discrimination, tax laws, etc.; financial arrangements for PA subaccounts; necessary billing calculations and schedule for progress payments; Subcontracting; Conflict of Interest; Rights in technical data, Patents, Intellectual Property Rights and Royalty payments; Annual reports; Insurance, Warranties, Indemnification; Business reorganization; Termination Provisions. The contract will contain a right to terminate the contract for any reason, including but not limited to, performance concerns.

CPUC staff will be expected to provide significant input into and oversight of both the contract between the IOU and the Program Manager and contracts between the IOU and grantees. The CPUC staff will refer to existing RD&D contracts with other state agencies in making final determinations regarding the RD&D Program Manager contract.

3.4 Program Manager Budget

Publicly-funded programs deserve special care on overhead, administrative, and general expenses (O,A&G). In accord with stakeholders and ratepayer advocacy, the CPUC staff recommends limiting O,A&G expenses to ensure that a maximal level of funding is available to achieve RD&D goals and objectives throughout the program's lifespan.

Assuming the active period of the RD&D program is at least 6-7 years, it seems reasonable that approximately 15- 20% of the total RD&D budget be reserved for administration (pro-rated for the duration of the Program Manager's contract). Some participants at the CPUC RD&D workshop and informal comments also expressed concerns for overhead and administration costs, urging staff to cap it at 15-20%.

3.5 Project Solicitation and Selection Process

3.5.1 RFP

The Program Manager will work closely with the CPUC Energy Division staff to prepare a Solicitation Requesting Submission of Applications for RD&D Awards (or RFP) for projects. The substantive content for this solicitation will be the final, approved CPUC RD&D plan, in particular, the Target activity areas, RD&D phase, other funding requirements, and project selection criteria, and evaluation metrics. The RFP will also provide details on the treatment of issues including cost-sharing, intellectual property rights and royalty payments, and conflicts of interest. The Energy Division will issue draft RFPs for public comment. After any necessary revisions, the Program Manager will issue the RFP.

The outline of the RFP content could resemble:

I. Description of Funding Opportunity
- Milestone(s) to be addressed
- Amount to be awarded
- Expected number of proposals funded in the RFP
- Functional requirements
- Specified intellectual property rights and royalty obligations (if applicable)

II. Proponent Requirements
- Reiteration of funding principles, guidelines, and eligibility criteria
- Staff qualifications

III. Submission Deadline
- Proposal deadline
- Other state contracting requirements
- Timing of bidders' workshop

IV. Proposal Requirements
- Project strategy and justifications for requested funding
- Conformity to project selection characteristics
- List of proposed personnel and qualifications
- Time schedule and deliverables
- Budget, broken out by phases or elements
- Cost-sharing and other criteria requirements
- Organization budget
- List of named personnel
- Participation of a utility

V. Evaluation of Individual Grants
- Ongoing evaluation process
- Evaluation metrics

As described earlier, the Program Manager may group RFPs according to target activity area (Production Technologies, Grid Integration, or Business Development and Deployment). Or, the Program Manager may choose to bundle similar areas into a meta project RFP in order to coordinate research and development efforts along a single theme.

The size of the RFPs will vary. For example, $4.5 million would be available for Production Technologies RFPs over the period, assuming the earlier breakouts for a sole-source research grant, 20% administration costs, and a 15% focus on the area. Another $15 million would be available for Grid Integration RFPs over the period. Another $4.5 million would be released in multiple RFPs for Business Development and Deployment. Staff recommends that to maximize opportunities for good grants, the Program Manager should split these budgets across 2-3 funding cycles, as described in Section 2.5.4.

Sample Budget Over Ten Years

Administration, evaluation	$10 mn
Research:	$10 mn
Production Technologies:	$5 mn
Grid Integration:	$20 mn
Business Development, Deployment:	$5 mn
TOTAL	$50 mn

During consideration of the proposals, the Program Manager will perform due diligence to ascertain whether similar work is already funded elsewhere.

3.5.2 Grant Selection Process

When an RFP is ready, the Energy Division will issue a Notice of Funding Opportunity via the CPUC website, CSI service list, and email distribution lists. The Program Manager will conduct a bidders' workshop or conference call to discuss the intent of the RFP with interested bidders. After proposals are received, the Program Manager will summarize proposals, recommend grant candidates into a recommended program portfolio, and submit the summary and all proposals to the Energy Division. Staff will work with the Program Manager to consider the portfolio and make changes before making a final recommendation to the Commission for public comment and Commission consideration. All award decisions will be made by a public vote of the full Commission, following the regular procedures of public notice and opportunity for comment on proposed Commission decisions. The Program Manager would provide projects approved by the Commission to the IOUs for individual grant funding. CPUC staff is expected to provide significant input into and oversight of both the contract between the IOU and the Program Manager and contracts between the IOU and grantees.

3.6 Stakeholder Process

For ongoing project management, staff recommends two paths: a) periodic meetings between the Energy Division staff and the RD&D Program Manager; and b) semi-annual public meetings of joint CPUC and CEC staff. Many of the issues the RD&D Program Manager might face are strategic and unique to California policy, therefore joint CPUC/CEC staff meetings are a critical coordination system. The agencies established a partnership in the early stages of CSI program development and are committed to the ongoing relationship to ensure the program's success.

Staff recommends that the Program Manager sends notice of the public meeting to key DOE, NREL, and other state RD&D managers, advocacy groups, non-profits, utilities, technical associations, governmental agencies, industrial representatives, and parties to the CSI proceeding.

3.7 Confidentiality of Information and Intellectual Property Rights

The CPUC RD&D strategy will mirror the treatment granted to project Confidentiality of Information and Intellectual Property (IP) rights under the CEC PIER program. Staff recommends including, at a minimum, provisions covering the following areas:

1. The designation and treatment of confidential information.

2. The designation and treatment of IP rights, including, but not limited to: information described in the project agreement for delivery under the CSI R& D program; data produced under the project agreement; proprietary data; patent rights; copyrights; and intellectual property indemnification.

4. Evaluation

4.1 Evaluation Process

The CPUC will ensure evaluation of the RD&D program through ongoing oversight of individual grants and a formal, triennial evaluation of the entire Program. The triennial evaluator will be paid from the RD&D administration budget.

4.1.1 Ongoing Oversight:

The Program Manager will work with CPUC staff to regularly monitor grant progress on all awarded projects, according to the scope of work, milestones, and deliverable schedules outlined in contractual documents for each award.

First, the Program Manager will monitor the progress of individual projects through discussion with proposal managers. The Program Manager will also support CPUC staff in reporting on the progress of the RD&D awards to the Legislature and other decision makers on an as-requested basis. As mandated by SB1, "If the commission allocates additional moneys to research, development, and demonstration that explores solar technologies and other distributed generation technologies … the commission shall include in the assessment submitted to the Legislature, a description of the program, a summary of each award made or project funded pursuant to the program, including the intended purposes to be achieved by the particular award or project, and the results of each award or project." The Program Manager will support CPUC staff at the outset of the contract to establish these and other data collection and reporting expectations and deadlines.

The Program Manager will support RD&D coordination activities between CPUC and CEC programs, which include conducting the semi-annual workshop proposed in Section 3.6, above.

It is important to understand that some technologies or demonstrations may "fail" (see earlier discussion of risk), although there still can be valuable lessons learned. The Program Manager should help the Commission develop exit strategies for both for unsuccessful grants (e.g., early termination plans) and successful grants. Staff recommends that the Program Manager recommend suggestions for next steps, disseminating lessons learned, and the extent of approval of the grant's achievements.

4.1.2 Triennial Evaluation

The Commission will also measure the progress of the entire RD&D program through a second means, a triennial independent evaluation. Every three years, Energy Division will select an independent evaluator to review both the Program Manager and the RD&D grants against evaluation criteria. Working closely with the Energy Division, one IOU will issue an RFP for the evaluator. The IOU would collect evaluator proposals and together with Energy Division staff will review and evaluate proposals. Energy Division will select the evaluator with input from the IOU. The evaluator will rely on the following in its review: interviews with project coordinators and stakeholders, individual project progress reports provided by the Program Manager, prior program evaluation results, issues identified by Commission staff for further investigation and new information about technologies or the marketplace. If suggested in the

evaluation, the Commission may consider directing the RD&D Program Manager to refocus RD&D milestones and alter administrative processes.

4.2 Evaluation Criteria

With regard to individual project evaluation, staff recommends evaluating progress against the range of principles, guidelines, and criteria for grant-making decisions discussed above. In particular, the CPUC staff, Program Manager, and evaluator should consider solicitation criteria and, at a minimum, the following criteria in assessing individual grant achievements:

- Size of grant obtained from CSI RD&D funds
- Benefits for California ratepayers
- Economic value to the California grid
- Whether and how the project expands PV market opportunities or reduces barriers
- Leverage from other funding sources
- Institutional and regulatory acceptance of project findings or outcomes

The CPUC staff, Program Manager, and evaluator will rely upon CPUC evaluation protocols which are already established for the utility energy efficiency programs in the 2006-2008 funding cycle. Specifically, we will draw upon evaluation protocols for:

- The "Emerging Technologies" and "Information Programs" protocols in evaluating individual projects; and
- The "Market Effects" protocol for evaluating the overall solar RD&D program.

In the triennial evaluation, the independent evaluator will consider whether the RD&D portfolio as a whole is demonstrating progress on at least the following four overall dimensions:

- Increase performance and efficiency of solar panels, inverters, and system designs
- Decrease costs on a $/kWh basis
- Contribute to a significantly greater scale of annual installation activity
- Apply results within the ten-year program, and no later than 2017

Prior to the first grant RFP, the Program Manager will work with Commission staff to develop a comprehensive program evaluation plan and post it to the service list for parties' comments. The plan will contain a format for individual project contractors to submit data such that the data is consistent and measurable across different projects. The Commission staff and the Program Manager will also meet with the CEC, PIER, NREL and other non-profit agencies to inform the project evaluation plan.

Appendix A: CPUC Draft Target Milestones

CEC PIER Prioritization Study - Which activities is the PUC CSI already funding or planning to fund?
Potential CPUC and CEC Funding Mechanisms

X = Funding expected, O = could be defined activity/issue
CPUC $: RD&D = Research, Development, and Demonstration; EM&V = Evaluation, Measurement, and Verification; M&O = Marketing and Outreach
CEC Funding: Other PIER = non-RE and non-building PIER programs; RE = CEC Renewable Energy program; Bldgs = CEC Bd & App program
NOTE: "Overall Rank" represents preliminary rank as of November 2006 from CEC study. May not be same as final CEC report.
This table was used by CPUC staff as a convenient format for succinctly recording ideas for potential CPUC funding areas.

CPUC RD&D	CPUC EM&V	CPUC M&O	Other PIER	CEC RE	CEC Bldgs	Overall Rank	Number	Year	Milestone Description	CPUC Comments
		X			X	1	E4	'08	Synergies between **building energy efficiency and PV** are identified and **business models** to encourage synergies in retrofits and new construction are identified	CPUC likely will encourage and promote development of new biz models, but may not develop them internally
O					X	2	E5	'08	Potential roles for **utilities** in solar PV, including attractive **business models,** are identified and vetted with utility companies.	
O	X				X	3	E11	'10	Improved PV economics demonstrated using advanced metering, price responsive tariffs (e.g. TOU, TR, Feed-in Tariff) and storage	CPUC will evaluate advanced metering and price responsive tariffs policies; See Rank #7 for storage.
		X			X	4	M1	'07	Updated training for CA **installers and building code officials** developed and vetted with industry/policy makers	CPUC could+L25 tackle installers, CEC to tackle building officials
					X	4	M9	'10	Options for including PV as part of CA **residential building efficiency standards** are developed and vetted with industry and policy makers	
					X	6	M8	'11	**Building standards** established that require sufficient PV-ready roof space in new construction	
O						7	G2	'08	PV systems with **storage or other technologies** demonstrate better coincidence with utility system peak load	See also Rank #3

CPUC RD&D	CPUC EM&V	CPUC M&O	Other PIER	CEC RE	CEC Bldgs	Overall Rank	Number	Year	Milestone Description	CPUC Comments
	X					8	G1	'08	**Cost/benefits of net metering** (e.g. rate impacts) understood for SB1, as well as impact of raising net metering capacity to accommodate CSI goals	
		X		X	X	9	M2	'07	Solar training and educational materials developed for **architects, building land-use planning, and roofing contractor** personnel	Land-use planning appropriate for CEC; CPUC could do training/education for roofing personnel
	X	X		X	X	10	E2	'08	**Drivers** that encourage consumer adoption of PV systems are identified and prioritized	Would require data collection and market research, appropriate for EM&V
					X	11	M5	'08	**Module certification** in CA is closely aligned with national and international standards, resulting in more robust and accurate ratings	Role for DOE and CEC
O	O				X	12	G5	'08	**High value locations** for DG PV on T&D are identified and the impacts/benefits of large concentrations of DG PV in one location on T&D are assessed	Very important; not sure yet if RD&D or EM&V more appropriate; hasn't CEC studied this before?
O						12	G8	'10	Economic viability of new PV system **storage technologies are demonstrated**	
O?					X	12	E7	'08	Lower cost, utility grade PV system **control, metering, and monitoring** capacity developed consistent with 1% cost parameter established by CPUC for CSI	
O		X		X		15	E3	'08	**New/modified business models** create sustained market growth	CPUC would support development of new business models for financing and O&M
O	O		X			16	P3	'08	PV system **design and installation procedures** enhanced to more effectively optimize system performance	For existing technologies (best practice) or new ones (next generation technologies)?
						17	G7	'09	**Utility acceptance** of protocols to allow PV system **operation during grid outages**	
		X			O	18	M7	'09	Key **barriers to** moving CA to Performance Based Incentives (**PBI** - kWh) from capital rebates (kW) are addressed	

CPUC RD&D	CPUC EM&V	CPUC M&O	Other PIER	CEC RE	CEC Bldgs	Overall Rank	Number	Year	Milestone Description	CPUC Comments
		O?			O	19	E13	'17	**Building integral PV** products (e.g. PV replacing roofing material or side/curtain walls) are commonly used **in new buildings** (residential, commercial, industrial)	Low priority short-term for CPUC M&O focused on market education of technology; Later issue @ CPUC
O?						20	P7	'11	**Building integral PV** products become **cost competitive** with rooftop PV and key **technical integration** issues are addressed (e.g. spacing/cooling)	Role for CEC or NREL
						21	G6	'09	Technical and policy analysis complete to support successful expansion of Rule 21 to cover **network interconnection**	If means "radial networks," a low priority
		X				22	E6	'08	PV system risk to homes and businesses quantified and results made available to **financial / insurance industries**	First need data (Research), then need Deployment; question of timing
O						23	E10	'10	**Field tests** done to quantify **operational risks and benefits of PV** (work heavily with utilities)	T&D, see rank 12 and 17 for concepts and modeling
						24	E8	'09	Use of **transformerless inverte**r design is widespread	Not immediate CPUC priority, unless would cuts costs significantly.
						25	G4	'08	Synergies between **PV systems and plug-in hybrids** are estimated	No opinion on this yet
O						26	M4	'08	Key relevant **RD&D results and strategies from Germany and Japan** are identified and recommendations made for application in CA	
	X			O		27	E1	'07	**Operational risks** and disputed benefits of PV systems identified (later priority issues to be studied)	T&D, see ranks 12, 17, 23. But seems Rank 27 must come before 23?
O						28	P2	'07	Key barriers to the development of PV **minigrids** or central PV are identified	See Rank 12 Item G5; CSI not involved in central PV
						29	E12	'12	PV **inverter cost reduced** 30% (due in part to volume production) and performance improved	
O?						30	P1	'07	Potential **changes to PV system design and installation** requirements caused by the emergence of **alternatives to silicon**-based PV over next 15 yrs understood	Activity might be funded by program administration, when timely. Could do a study

CPUC RD&D	CPUC EM&V	CPUC M&O	Other PIER	CEC RE	CEC Bldgs	Overall Rank	Number	Year	Milestone Description	CPUC Comments
						31	M6	'09	Differences in **policies/regulations between Western states** are identified and recommendations made to address differences that impede market growth in CA	Already part of CPUC oversight & program administration
	X					32	P4	'09	**Higher capacity factors demonstrated** (e.g. 20% vs. 18% for pitched roof, and similar improvements for flat roof mount) to meet CPUC PBI targets for CSI	Market should do it; EM&V will evaluate projects to see at what CF projects perform
						33	G3	'08	Possible net metering arrangements defined to facilitate **cooperation between homes** with solar access and neighbors who have shading and/or limited solar access	See Rank 28 for analysis. Then CPUC policy call.
						34	M3	'07	Barriers identified to the adoption of PV for use on **public sector buildings** (e.g. state/local government buildings, State water project)	See no need for any special activity on this.
X						35	E9	'09	**Business models** developed to address fact that **homeowners and renters move** frequently	Could be development of a concept for deployment activity, but not high CPUC priority, except Low Income
						36	P9	'15	**Nano and/or organic PV** economically feasible for grid-connected applications	DOE or California research area?
0	0?					37	P5	'09	Economic viability of **distributed concentrating PV** systems demonstrated	Depends on how would affect price of solar/kWh
						38	P8	'15	Highest **silicon cell efficiency** in market **25.5%** (field efficiency)	Not state-level or CPUC spending priority, though outcome welcomed
						39	P6	'10	Highest **silicon cell efficiency** in market **22%** (field efficiency)	Not state-level or CPUC spending priority, though outcome welcomed