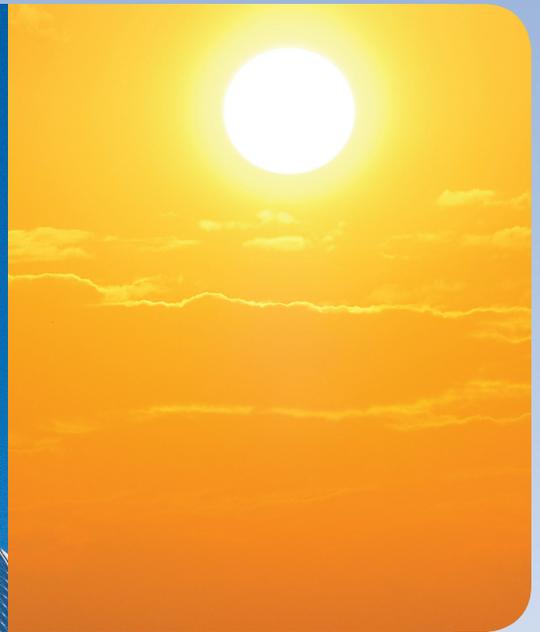




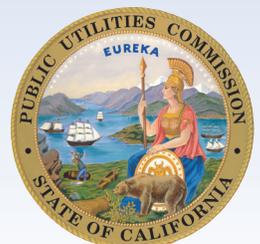
# California's Solar PV Paradox:

*Declining California Solar Initiative Prices and  
Rising Investor Owned Utility Bid Prices*

**Division of Ratepayer Advocates**



**October 2010**





# **California's Solar PV Paradox:**

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*A Report from the Division of Ratepayer Advocates*

**October 2010**

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## **About DRA**

The Division of Ratepayer Advocates (DRA) is an independent organization within the California Public Utilities Commission that represents consumers' interests on utility matters. DRA's statutory mission is to obtain the lowest possible rates for utility services consistent with safe and reliable service levels.

## Executive Summary

Beginning in 2008 wholesale prices for solar photovoltaic (PV) modules dropped worldwide as a period of increased production coincided with a sharp reduction in demand, resulting in a surplus supply of PV modules. Industry analysts predicted that the corresponding drop in wholesale module prices would, in turn, yield reduced prices for retail solar PV systems and declining rates for new solar generation projects.

In this report, the California Public Utilities Commission's (CPUC) Division of Ratepayer Advocates (DRA) examines the impact of falling solar PV production costs and wholesale prices on California ratepayers and participants of the California Solar Initiative Program. The report examines whether California consumers have enjoyed the price declines for solar PV technology that would be expected given the changes in the international solar PV market. DRA's analysis reveals that:

- Prices for retail solar PV in California have declined from a peak experienced at the end of 2008. The price of a retail solar system in the California Solar Initiative (CSI) program dropped by 19-22% in July 2010 compared to the 4<sup>th</sup> Quarter of 2008.
- Prices for utility-scale solar projects, however, appear to have increased. The average bid price of a shortlisted solar PV project in the annual Renewables Portfolio Standard (RPS) project solicitation increased significantly between 2007 and 2009.

These results pose an important question for Californians: why have retail solar prices declined with declining wholesale prices, while utility-side solar prices have not? Explanations for these trends include: 1) Difficult credit markets causing independent developers of utility-scale solar projects to price risk into their project bids, 2) Looming deadlines for compliance with California's Renewable Portfolio Statute ("RPS") interfering with the expression of competitive price signals in the wholesale solar PV market, and 3) the CPUC's reluctance to reject high-priced contracts providing a disincentive for developers to price their bids competitively.

To ensure that California's ratepayers benefit from the declining price for solar PV modules, DRA recommends that the CPUC take steps to:

- Reject high-priced contracts to send a signal to markets and incentivize developers to price their bids as competitively as possible and keep prices low while negotiating final contracts with utilities.
- Utilize flexible compliance mechanisms to provide utilities with greater flexibility in meeting procurement targets until prices for large-scale solar PV projects decline.
- Allow excess energy from CSI system to count toward the utilities' RPS goals, which may lower utilities' RPS procurement burden.

## Introduction

In 2008 the global solar photovoltaic market experienced a dramatic and unanticipated shift, characterized by sharply declining costs for materials and manufacturing of solar PV panels. As a result, many analysts and industry experts predicted that declining costs for these goods would yield declining solar PV prices for customers and eventual grid parity for this technology.

Prices for solar PV in California, however, have not uniformly declined as predicted. Data on solar PV prices from recent reports from the Lawrence Berkeley National Laboratory, Pacific Gas and Electric Company (PG&E), Itron Inc. & KEMA Inc., and SunCentric show that retail customers in the California Solar Initiative program have enjoyed a significant drop in system prices. But prices for utility-side solar have increased, even in the face of declining material costs, according to DRA's own analysis of utility-scale solar PV bids selected for negotiation as a result of the most recent Renewables Portfolio Standard project solicitation conducted by California's Investor Owned Utilities (IOUs).

So why have utility-scale solar PV projects in California not experienced the same price declines that retail solar PV systems have?<sup>1</sup> In this report, DRA attempts to answer this question by addressing the declining costs associated with solar module productions and materials used in both commercial and residential installments and the macroeconomic forces that led to these sharp declines in cost in 2009. Using current industry information, DRA analyzes the impact this has had on solar photovoltaic prices for California's ratepayers and retail purchasers.<sup>2</sup> The report concludes by examining possible reasons for stagnating or increasing prices for utility-side solar PV installations and policy recommendations the California Public Utilities Commission could adopt to help ratepayers realize lower prices for solar PV generation.

## I. Background on California Solar Initiative and California Renewables Portfolio Standard Programs

Efforts to install solar PV in California accelerated in response to two state-initiated programs: the California Solar Initiative (CSI) and Renewables Portfolio Standard (RPS).

The goal of the CSI program, which was signed into law with Senate Bill (SB) 1 in 2006 as part of Governor Schwarzenegger's Million Solar Roofs vision, is to install and bring 1,750 megawatts (MW) of solar capacity online by the end of 2016.<sup>3</sup> As of August 2010, over 45,000 CSI projects amounting to 801 MW of generation have either been installed or are in the process of being approved or completed.

California's RPS program, which was established to increase the amount of energy derived from renewable resources, requires California's electric Load Serving Entities (LSEs) to procure at least 20% of their retail sales from renewable resources by 2010. LSEs are afforded a three-year flexible time frame to meet this initial RPS goal and thus are permitted to earmark projects

coming online through 2013 to count for their 2010 goals. In November 2008, Governor Schwarzenegger signed Executive Order S-14-08, which increases RPS requirements to 33% of renewable retail energy sales by 2020.<sup>4</sup>

Despite increasing reliance on solar PV as a result of the two programs, solar PV remains among the most expensive of renewable resources. However, recent declining costs for solar PV materials, modules, and installations have encouraged new analysis into the stability of declining prices for this technology.

## II. Causes of Declining Costs for Solar PV Modules

In 2009, the cost of solar PV modules, materials and installations declined sharply compared to previous years. This is supported by many international and national events and trends and provides tangible market indicators that solar PV prices should be on the decline.

### **Shift in Market Share and Changing Political Landscape**

In recent times Spain and Germany have been at the forefront of developing and advancing the use of renewable energy technologies through government-backed programs and subsidies. These were the first countries to provide broad support for solar PV as a reliable and efficient source of renewable energy.<sup>5</sup> Feed-in Tariff programs offered in both nations helped to bolster the market for expensive solar panels by providing subsidies to program participants. However this trend is beginning to shift eastward as new players in the global renewable energy market emerge, spurred by global concerns of climate change and the attractiveness of non-fossil fuel based resources.

China has emerged as the world's de facto supplier of polysilicon, the primary material used in solar PV production, and is now the world leader in solar PV panel production and manufacturing. Over the past few years Chinese manufacturers have rapidly increased production of solar PV materials and achieved economies of scale faster than their Western counterparts due in part to the Chinese government's comprehensive support of the industrial sector through the allocation of free land for factories, subsidized electricity, and tax incentives. Chinese solar PV product manufacturers have become leaders in the renewable energy market for their low cost, high-quality products, which has helped to sustain the production of cheap solar panels in global demand.<sup>6</sup> Western solar PV manufacturers have in turn lowered the price of their products in order to remain competitive in this dynamic market.

The 2009 American Recovery and Reinvestment Act (ARRA) is also driving down costs associated with solar PV installations in the United States and may be leading to a shift in the solar PV market away from Europe. ARRA allocates about \$5.5 billion in government spending to renewable energy projects, procurement and energy efficiency.<sup>7</sup> Analysts anticipate that the consumer market for solar PV will continue to shift away from Europe due to waning government support for renewable energy development there and increasing support in countries such as China, India, and the United States.

## **Reduced Demand: the Global Economic Downturn and Declining Government Support**

Global news sources reported that from 2008 to 2009 the demand for solar PV decreased by 50% and many solar companies, both foreign and US-based, reported quarter-losses and overall drops in revenue in 2009.<sup>8</sup> The global economic downturn and worldwide freeze on credit also triggered a shift in government support away from subsidized programs for renewable energy and consequently resulted in a surplus in supply. For example, in response to the economic downturn, the government of Spain decreased the subsidies given to solar energy development. The German government also recently announced plans to reduce solar PV incentives by 16% by the summer of 2010.<sup>9</sup> These and other developments have left many solar PV manufacturers and companies watching the market demand for their products diminish virtually overnight.

## **Excess Supply: Increase in Polysilicon Supply and Solar PV Materials**

While demand diminished, the cost of materials used to make solar PV panels also declined in 2009. Part of the decline in the cost of materials for solar PV panels is attributable to increased production of polysilicon, a primary material used in the manufacturing of solar panels.<sup>10</sup> Until recently, polysilicon had been primarily manufactured and used in the semiconductor industry. However, the increasing demand for renewable energy shifted the market for polysilicon away from semiconductors and toward solar PV panel production. According to the Information Network, it is now estimated that almost two-thirds of polysilicon manufactured is for solar PV applications and that polysilicon is used in more than 90% of all PV cells due to its higher than average efficiency.<sup>11</sup>

Since polysilicon factories take at least three years to establish from initial conception to production, around the mid-2000s polysilicon manufacturers began investing in new plants and ramping up production under the expectation that strong demand driven by German and Spanish subsidies would continue. The result was a boom in polysilicon factories that coincided with the economic downturn to create an atmosphere of excess supply during a period of decreasing demand.

The year 2008 marked the first year of overproduction in the solar panel industry. In this year, the number of polysilicon factories and manufacturers worldwide increased dramatically, most notably in China where manufacturers revolutionized ways to develop solar panels cheaper than their competitors in the US and Europe. Heavy government subsidies for the industrial and manufacturing sectors also enabled Chinese solar PV manufacturers to price their products aggressively, or as some analysts put it, “unsustainably low”, to appeal to and capture a larger portion of the global solar PV market.

The growth of the polysilicon industry in China consequently led to a decline in the wholesale prices for polysilicon. Compared to early 2008 when the cost of polysilicon peaked at around \$500 per kilogram (kg), by early 2010 this number had fallen to \$55 per kilogram.<sup>12</sup> Although

analysts expect polysilicon prices to remain low throughout 2010 they also project a 64.7% increase in demand for solar PV in 2010 due in large part to an anticipated flood of Federal stimulus funds.<sup>13</sup>

The boom in solar panel manufacturing also contributed significantly to the oversupply of solar PV materials and products. In 2009, shipments of solar PV modules from China and Taiwan accounted for 46% of total global shipments.<sup>14</sup> iSuppli, a market research company, reported that in 2009 close to eight gigawatts (GW) of solar modules were produced but only four GW were installed.<sup>15</sup> Another report claimed that at the beginning of 2010 there was still an excess of 2.2 GW of uninstalled inventory available, most of it being held in China, where manufacturers reported having excess inventory.<sup>16</sup> iSuppli forecasted that by the end of 2009 the global supply of solar panels would exceed demand by 65.9% with the excess in products expected to continue throughout 2011.<sup>17</sup> Given the numerous competing pressures in the solar market, analysts expect the cost of solar modules to be in a flux until 2012, when the price of polysilicon is expected to normalize.<sup>18</sup> As of late September 2009, the Chinese government was already vowing to curb the over-manufacturing of products in the steel, aluminum, cement and silicon industry in an effort to stabilize prices and revitalize these industries.<sup>19</sup>

### **Technological Developments: the Future of Thin Film**

The year 2009 was not only characterized by declining costs for solar PV modules and products but also by a rise in the market share of thin film technology from 10% in 2007 to 15% in 2009. At prices as low as \$3.00 per watt to manufacture—25% less expensive than polysilicon—industry experts noted thin film technology's impact on the cost of polysilicon-based solar panels.<sup>20</sup> Although thin film technology is less efficient than polysilicon-based solar PV, its lower price, in an atmosphere of heightened competition for solar PV, has forced many manufacturers of polysilicon panels to reduce their prices. Analysts predicted that if current trends continued, thin film's market share could double to 30% by 2013.<sup>21</sup>

However, recent developments in the solar PV market reveal that thin film's growth may not be won as easily as analysts predicted. Many of the features of thin film that once made it so appealing are now making the product less attractive to potential investors. Thin films' main advantage—its low price—is being diluted as the cost for polysilicon and solar panels and materials continues to slide. As one article states, "the assumed price advantage (because of assumed lower manufacturing costs) continues to evaporate."<sup>22</sup> This, compounded with overall lower efficiency of the technology, has significantly reduced the edge thin film may have held over polysilicon panels. The same article claims that in the foreseeable future thin film will continue to face competition from "slower demand, lower prices, and high inventories of higher-efficiency technologies."<sup>23</sup>

### **Summary of Solar PV Cost Trends**

The combination of political shifts, product oversupply, global economic instability, and technological development has caused solar PV materials and production costs to decline significantly, creating a buyers' market for these products. Some analysts predict that the

declining costs associated with PV production is a sign that solar PV could be on the cusp of achieving grid parity—the point at which solar PV electricity is equal to or cheaper than conventional energy sources—as early as 2010 in the sunnier parts of the United States and Europe, and elsewhere by 2014.<sup>24</sup>

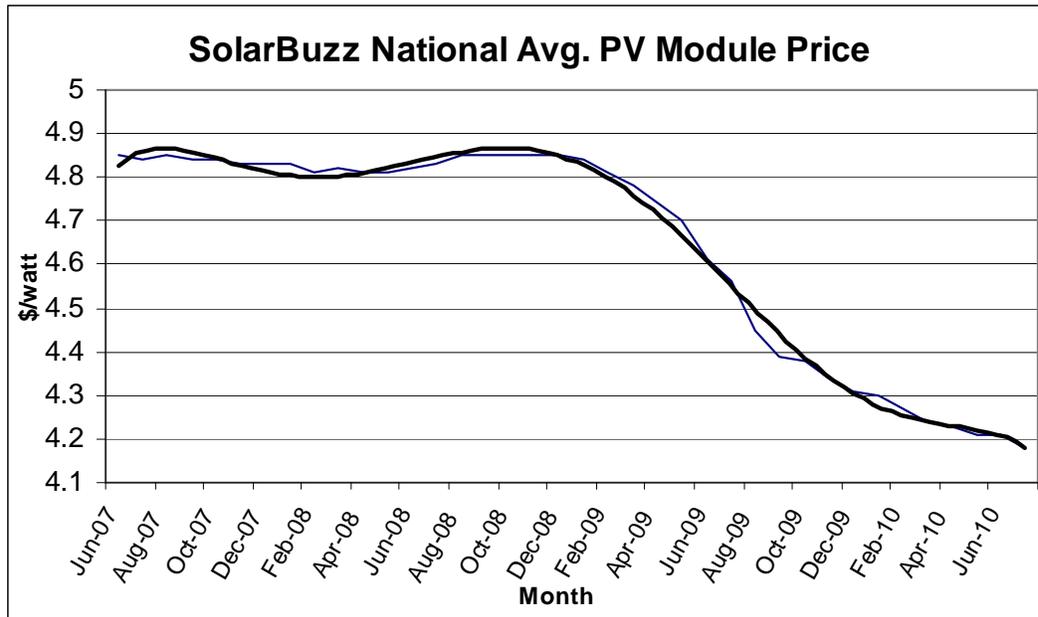
### **III. Solar PV Prices in 2009: Impact on CSI Participants and California Ratepayers**

For residents of California, the important question stemming from the recent changes in the global solar PV market is how the declining costs for solar production translate into dollars saved for ratepayers and participants of the CSI program. Data from a variety of sources<sup>25</sup> shows that retail prices for solar PV in California have declined in unison with the declines in costs along the PV supply chain.

#### **Solarbuzz Data Shows National Solar PV Module Prices are Declining**

Data taken from Solarbuzz, an international solar energy research and consulting firm, supports market indicators that wholesale PV module prices in the United States are falling. Solarbuzz issues monthly surveys to retail solar companies nationwide to assess the number of price movements of solar PV modules for that month. This includes the number of price declines, increases, and prices unchanged. Solarbuzz then determines the average monthly national retail price of a solar PV module system sold on the wholesale market. Although Solarbuzz data does not represent the final installed price of a solar PV system, this data provides an indication of the direction national solar PV system retail prices should be moving as the PV module component of the system accounts for a majority (roughly 57%) of the overall installed price.<sup>26</sup>

Solarbuzz data shows that nationwide solar PV module prices began to decline in January 2009 and have continued on a steady, downward trend through to the publication of this report in August 2010 (Figure 1). In 2009 there were a total of 1,069 price declines and only 231 price increases among the retail solar PV companies surveyed.<sup>27</sup> The number of price declines peaked in August 2009 with 176 price declines occurring in that month.<sup>28</sup> As of July 2010, Solarbuzz reported there were 518 solar modules priced below \$4.00 per watt (or 36.4% of all retailers), up from 327 modules priced below \$4.00 per watt in November 2009. According to Solarbuzz data, wholesale PV module prices also dropped 16.0% from their peak in October 2008 of \$4.86 per watt, to their present price of \$4.18 per watt, the lowest price ever attained in the United States.<sup>29</sup> The 16.0 % decline in module prices coupled with an increase in the number of modules priced below \$4.00 per watt both support the notion that retail prices for solar PV modules are accurately capturing the market transformations occurring in the solar PV industry.<sup>30</sup>

Figure 1. Solar PV Module Retail Prices 2007 – 2010<sup>31</sup>

Trendline maximum: \$4.86/watt in October 2008

Trendline minimum: \$4.18/watt in July 2010

Decline from peak price: 13.9%

**Note:** Black line is the trendline; Blue line is the actual data

*Source: Solarbuzz.com*

## Multiple Sources Reveal that Solar PV Prices in California Have Declined Since Late 2008

A number of recent reports on solar PV price trends all reveal that prices of solar PV systems in the CSI program have been declining since the end of 2008. These reports include: the Lawrence Berkeley National Laboratory's *Tracking the Sun II*, Pacific Gas and Electric Company's (PG&E) *January 2010 CSI Program Forum Presentation*, SunCentric's *CPUC's CSI in Pictures*, and the June 2010 *CSI Impact Evaluation* prepared by KEMA, Inc. and Itron, Inc. The report from Itron, Inc. & KEMA, Inc. differs slightly from the other three by measuring the price at the time of a system's *installation* rather than its *approval*, but nevertheless reveals that the average price of a residential CSI project has been in decline since late 2008.

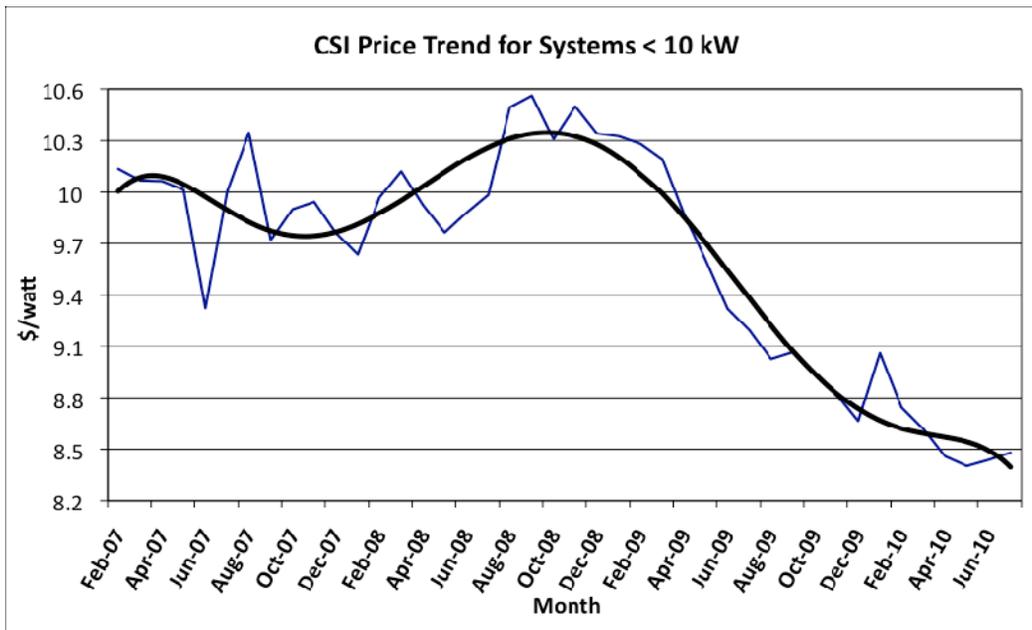
The first of these studies, Lawrence Berkeley National Laboratory's *Tracking the Sun II* report released in October 2009, indicates that prices for approved CSI systems fell 9.5% over the first 8 ½ months of 2009.<sup>32</sup> PG&E's *January 2010 CSI Program Forum Presentation* also shows that prices for approved systems less than 10 kilowatts (<10kW) decreased 9.2% while prices for systems greater than 10 kW (>10kW) decreased 14.0% between the 3<sup>rd</sup> quarter of 2008 and the 3<sup>rd</sup> quarter of 2009.<sup>33</sup> An unexpected spike in prices in the 4<sup>th</sup> quarter of 2009 followed these declines but is unlikely to be representative of the quarter as a whole due to the fact that it was based on a small number of expedited projects both *approved* and *installed* in the space of one quarter.<sup>34</sup>

**Figure 2. CSI Program Price Information: Systems < 10 kW**

A March 2010 report, *CPUC's CSI in Pictures*, from the solar industry consulting firm SunCentric shows an approximate 19.5% decline in prices for approved residential solar systems within the CSI program (mostly systems less than 10 kW) from their peak in the 3<sup>rd</sup> quarter of 2008 to the 1<sup>st</sup> quarter of 2010.<sup>35</sup> Lastly, the CPUC's *June 2010 CPUC CSI Impact Evaluation*, prepared by Itron, Inc. and KEMA, Inc., demonstrates that prices for installed systems less than 10 kW decreased 7.3% and systems over 10 kW decreased 18.5%, from the 3<sup>rd</sup> quarter of 2008 to the 4<sup>th</sup> quarter of 2009.<sup>36</sup>

DRA's own analysis of CSI prices is consistent with these reports and supports the emerging consensus that retail solar PV prices in the CSI program have fallen in the past 18 months. Using publicly available data from the California Solar Statistics website,<sup>37</sup> DRA conducted a month-by-month analysis of price trends for systems < 10 kW and systems 10 – 100 kW based on the date the reservation for the system was confirmed.

As shown in Figures 2 and 3 below, DRA's analysis reveals that July 2010 prices for CSI systems < 10 kW decreased 18.8% from their peak of \$10.35 per watt in October 2008, and that July 2010 prices for medium-sized CSI systems—those between 10 – 100 kW—decreased 22.3% from their peak of \$9.67 per watt in November 2008.



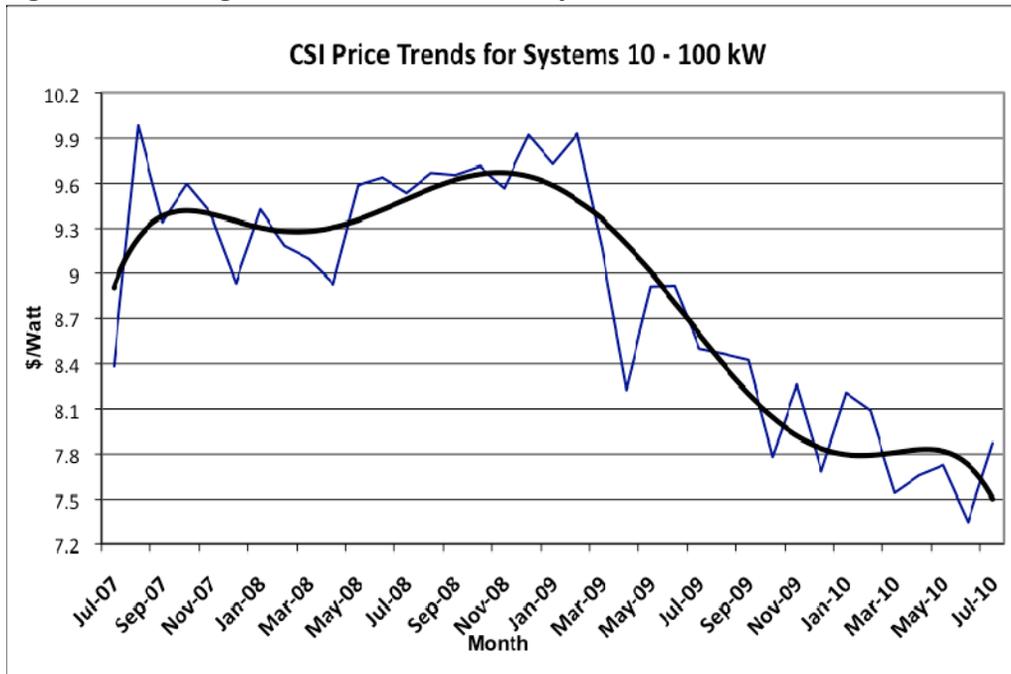
Trendline maximum: \$10.35/watt in October 2008.

Trendline minimum: \$8.40/watt in July 2010.

Decline from peak price: 18.8%

**Note:** Black line is the trendline; Blue line is the actual data **Source:** California Solar Statistics Database

**Figure 3. CSI Program Price Information: Systems 10 – 100 kW**



Trendline maximum: \$9.67/watt in November 2008

Trendline minimum: \$7.51/watt in July 2010

Decline from peak price: 22.3%

**Note:** Black line is the trendline; Blue line is the actual data *Source: California Solar Statistics Database*

### **Early Indicators Suggest that the CSI Program is Succeeding in Lowering Solar PV Prices in California**

One of the central goals of the California Solar Initiative program is to lower the cost of retail solar energy in California by boosting the solar market in the state. The program is structured so that incentive amounts gradually diminish as the number of solar rooftops in California grows. For example, since the program's inception in January 2007, the incentive amount for customers in PG&E's and San Diego Gas and Electric Company's (SDG&E) service areas has declined from \$2.80 per watt to \$0.65 per watt, while the incentive for customers in Southern California Edison Company's (SCE) service area has declined from \$2.80 to \$1.90 per watt.<sup>38</sup> Diminishing incentives are intended to help foster economies of scale in California's solar industry by lowering system costs, increasing consumer demand, and fostering competitiveness in the marketplace.

The fact that retail solar prices in California have declined by more than their component materials is a strong indication that the CSI program is helping to lower the cost of retail solar PV systems in California. DRA's analysis indicates that retail solar PV prices have decreased by 19 – 22% since their peak in late 2008, while Solarbuzz reports that the price of modules has decreased by only 16% since late 2008 and the price of inverters has decreased by less than 1% since March 2009 (the earliest data reported).<sup>39</sup> Though it is difficult to say for certain, the additional 5 – 8% price decline beyond what is attributable to global macroeconomic forces could reasonably be attributed to the success of the CSI program in lowering prices in California.

Other evidence that the CSI program is helping to foster economies of scale in the California solar PV industry is the fact that as of July 2010, mid-size systems (10 – 100kW) are 10.6% less expensive and are declining in price at a faster rate than small systems (< 10kW). Since the beginning of 2008, prices of mid-size systems declined 19.4% while small prices of systems declined 14.0% (see Figures 2 & 3 above).

### **Solar PV Bid Prices Increased from 2007 to 2009**

Although retail prices for solar PV in the CSI program have declined from 2008 onward, the average bid price for large-scale solar PV projects in the investor owned utilities' (IOUs) annual RPS solicitation has actually increased over the same period. DRA's analysis of bid price data supplied by the three IOUs—SCE, PG&E, and SDG&E—indicates an upward trend in the weighted average bid price of solar PV projects on a per megawatt-hour (MW/h) from 2007 to 2009.<sup>40</sup> The increase in the average bid price occurred despite an increase in the number of shortlisted solar PV bids in the annual RFO from 2007 to 2009.

The upward trend in shortlisted solar PV bid prices may be a signal that the wholesale power market in California is not capturing the global shifts in the solar industry that have driven down material costs and lowered prices for retail solar in the CSI program.

## **IV. Possible Explanations for Increased Large-Scale Solar PV Bid Prices**

Why are bid and contract prices for utility-scale solar PV increasing even while prices for retail solar PV in the California Solar Initiative program are falling? What accounts for the fact that prices for utility-scale solar PV have failed to decline in the face of lower material costs? DRA's analysis reveals at least three possible explanations for this apparent paradox.

### **State Policy Dictating Demand**

Rising solar PV bid and contract prices may also be caused by policies guiding renewable energy procurement and California's renewable energy goals as mandated by state law. California's ambitious renewable energy programs set forth strict targets for procurement; this may be putting an upward pressure on solar PV prices within the state as the IOUs are attempting to reach the 20% RPS program mandate by 2010 (which may be extended to 2013 through existing flexible compliance provisions) to avoid shareholder-funded penalties. This source of artificial demand has created a seller's market, and provides a likely incentive for solar PV developers to attempt to increase profits. The looming RPS deadline could be creating disincentives for solar developers to lower prices or bid competitively so long as there are mandatory buyers. This is not a new phenomenon. Ratepayers in both Spain and Germany experienced higher prices for electricity that resulted from the government sponsored Feed-in Tariff programs and ambitious renewable energy goals.

### **Reduced Financing from Global Credit Crunch**

The increase in the average price of a solar PV bid in the IOU's most recent RPS solicitations reflect ongoing repercussions of the global economic downturn and ensuing credit crunch on the renewable energy sector. Although the costs for solar PV modules and materials have decreased significantly, utility representatives argue that decreasing panel costs and components have been offset by a reduction in the amount of financing available to developers.

Solar PV developers claim that the current credit crisis has severely hindered their ability to secure project financing, especially for projects that appear risky. This in turn is reflected in the stable or rising bid prices put forth to the IOUs. Proposals for thin film projects have reportedly been hit particularly hard by the credit crunch. As one report claims, "the credit crisis is driving bankers' hesitancy to finance thin-film projects. Capital today is both scarce and expensive, forcing bankers to pass on projects they might have financed only nine months ago. Today, only low risk, "gold plated" projects are receiving financing."<sup>41</sup>

### **Lack of Judicial Review in Approving High Priced Solar PV Contracts**

Another possible contributing factor to the continued rise in utility-scale solar PV bid and contract prices may be the failure of the Commission to date to reject any RPS contract solely on the grounds of excessive pricing. Since the advent of Renewable Portfolio Standard legislation in California, the Commission has rejected only two projects, neither of which was of solar PV technology. The Commission rejected the Klickitat Wind Farm project in Oregon based on its non-compliant contract structure and the Finivera Wave project due to a combination of its use of unproven technology and excessive price.<sup>42</sup> During this time, the Commission has approved numerous projects priced above the prescribed price benchmark known as the market price referent (MPR) even as the above market funds allotted to the utilities for renewable procurement have been exhausted.

For reasons of confidentiality, the general public (renewable energy developers included) is not privy to details about the exact prices of shortlisted RFO bids or executed contracts. However, the fact that only two projects have been rejected by the Commission—and neither based solely on price—even as cost overruns in the RPS program run rampant, sends a signal to developers that the Commission is unlikely to reject a project on the grounds of excessive pricing. If developers know that the CPUC is very likely to approve almost any renewable contract that comes across its desk, it stands to reason that these developers have little incentive to price their bids competitively.

## **V. Solutions: Where Do We Go From Here?**

### **Select More Cost Competitive Contracts**

First and foremost, ratepayers would be better served if the CPUC would consider rejecting more expensively priced contracts and favor those that are more cost-competitive. Even though project developers are not privy to precise pricing information, the fact that only two projects have been rejected throughout the RPS program's history has conveyed the message that projects are likely to be granted approval regardless of price. While rejecting every solar PV contract that comes in over the MPR is not feasible, the Commission would be well served to begin rejecting more contracts on the grounds of excessive pricing. Such actions would forewarn project developers that high priced projects will not be guaranteed approval and could conceivably help rein in bid prices in subsequent solicitations. Figure 4 shows the forecasted renewable generation in California through 2020, including projects that are currently either pending CPUC approval or under negotiation. The graph makes evident that, even after accounting for the scheduled retirement of some generating capacity that is currently online, the IOUs should have enough contracts to meet a 33% RPS goal by 2014.

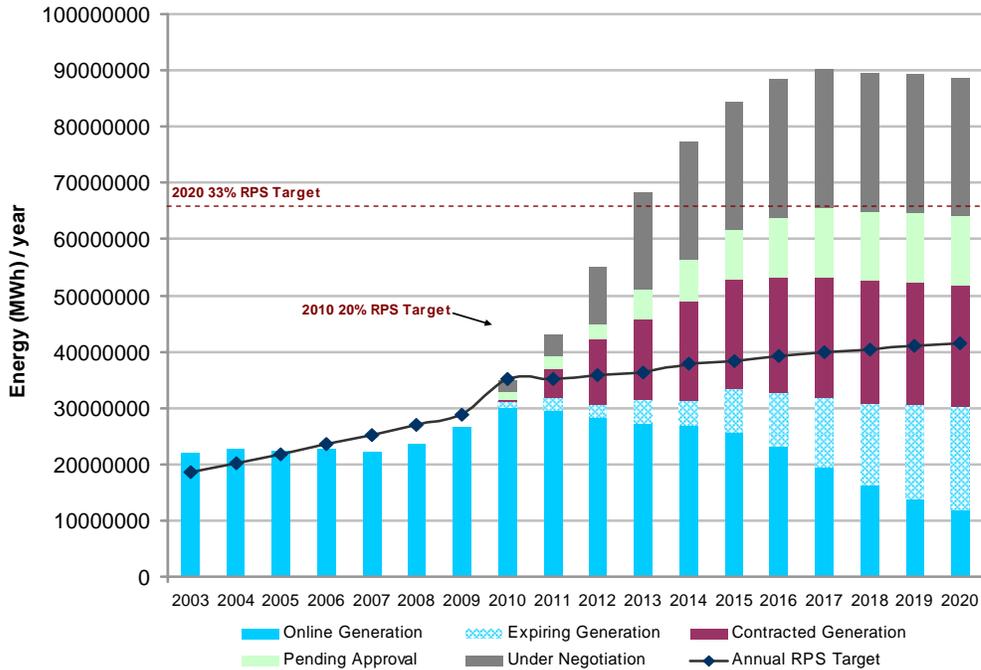
Of course, not all of the RPS contracts currently pending approval or under negotiation will actually be built; the Commission considers a higher volume of projects than what is needed due to the higher failure rates for RPS projects. However, the fact that the IOUs are *in the ballpark* of meeting a 33% RPS target six years ahead of schedule suggests that the CPUC can afford to be more selective in approving solar PV contracts, especially those that are uncompetitive in price.

### **Utilize Flexible Compliance**

The recently observed increase in solar PV bid prices in the IOU's annual RFO solicitations provides a strong case in support of flexible compliance mechanisms and the continual inclusion of such cost mitigation off-ramps in future RPS legislation. At present, the IOUs are permitted to utilize flexible compliance mechanisms that give them the ability to temporarily defer their current year's RPS compliance by earmarking signed renewable energy contracts with future deliveries to apply towards their current deficit. By allowing the IOU a limited amount of flexibility to meet its annual RPS procurement target, flexible compliance helps to reduce costs associated with procurement and helps the IOU to avoid penalties that would otherwise result from being out of compliance. Such cost mitigation measures like flexible compliance are particularly important for ratepayers and should be utilized to help alleviate the high prices associated with renewable energy procurement.

**Figure 4. Projected RPS Generation through 2020**

## IOUs Actual and Forecasted RPS Generation



### Permit Excess Generation from CSI Projects to Count Towards State RPS Goals

At present, the CPUC does not allow distributed generation (DG) from solar PV installations in the CSI program to count towards the state's 20% RPS goal. Theoretically, excess energy produced by CSI resources should be allowed to count towards the utility's RPS requirement. However, per Decision 07-01-018, the CPUC does not authorize the sale of customer-owned solar PV RECs for RPS requirements for the reason that the CSI program already provides sufficient financial incentives to stimulate the desired growth in the California solar industry.<sup>43</sup> As such, the RECs associated with CSI program solar PV systems remain unused and none of the excess power generated by these systems is eligible to count towards the state's renewable energy goals.

The fact that utility-scale PV bid and contract prices are failing to decline in accordance with market forces provides a strong argument in favor of allowing RECs resulting from excess CSI system generation to be counted towards the RPS goals. Though the RPS gains would be modest, it would nevertheless have a small, albeit positive effect on California ratepayers by limiting the number of (increasingly) expensive renewable energy contracts that are needed to meet the 20% and 33% goals. California should look to New Jersey for an example of a state that has successfully integrated customer-owned solar PV RECs into its RPS program, easing its procurement burden and providing a critical cost-containment measure along the way.<sup>44</sup>

## VI. Conclusion

This case study of solar PV costs and prices underscores the disconnection between the customer-side and utility-side markets for solar PV in California. While falling prices on the customer-side have accurately reflected the global shift toward cheaper solar development, the stagnating or even rising prices on the utility-side indicate that this market is not responding as it should to its economic environment.

The fact that the utility-side market in California is not capturing the macroeconomic shift toward cheaper solar energy calls forth the question of why this is occurring and what can be done to ensure that California ratepayers reap the benefit of falling costs associated with solar PV production and modules. DRA's preliminary analysis revealed three possible reasons for the failure of utility-side solar PV to fall in price. First, the lingering effects of the global credit crunch could be impairing the ability of developers to secure project financing, thus forcing them to raise project prices beyond what they otherwise need be. Second, California's aggressive renewable energy mandate could be interfering with the establishment of a robust, competitive market for utility-scale solar in California. Finally, the CPUC's disinclination to reject high priced contracts may be providing a disincentive to developers to price their projects competitively and as low as possible. More likely than not, a combination of all three aforementioned factors is playing a role in sustaining high prices for utility-side solar.

So what can be done to help nudge the price for utility-side solar PV in a downward direction? Certainly part of the solution might simply be the passage of time; as the credit crunch eases, project bids should fall as developers are able to secure financing on more favorable terms. But proactive measures should be taken to ensure that ratepayer protections are in place to guard against high utility-side solar PV prices. Utilizing current flexible compliance mechanisms and allowing customer-owned RECs from the CSI program to count toward an IOU's RPS requirements are two measures that would provide IOUs with more procurement options to reach their RPS program requirements and provide price relief until the credit market normalizes. The CPUC should also look hard at the possibility of rejecting more immoderately priced projects as a way of pushing developers to lower their project bids.

## **VII. Suggestions for Further Research**

This report has sought to shed light on the state of the solar PV industry in California by analyzing the reasons for the discrepant price trends witnessed in the consumer-side and utility-side solar PV markets. While the report hopefully has succeeded on this front, there are undoubtedly ways in which the ideas and conclusions presented here could be strengthened through further research. Any subsequent revisions to this paper should include, first and foremost, an analysis of shortlisted solar PV bid prices in the 2010 RFO. It will be worth noting how improving access to credit over the past year has affected average bid prices of shortlisted solar PV projects in the RPS solicitation. Secondly, this paper could benefit from a thorough comparison of California's and New Jersey's solar PV market, with a specific eye toward whether New Jersey experienced the same discrepancy in utility and consumer-side price

trends that California did in 2009. A third, but by no means final line of further research to improve this report would be to analyze the implications of the discrepant prices trends for utility and consumer-side solar on the debate about whether to allow for CSI system "oversizing" and expanded feed-in tariff provisions to allow for excess solar energy to be sold back to the grid.

## **Abbreviations**

ARRA - American Recovery and Reinvestment Act  
CPUC - California Public Utilities Commission  
CSI - California Solar Initiative  
DRA - Division of Ratepayer Advocates  
GW - Gigawatt  
IOU - Investor Owned Utility  
kW - Kilowatt  
LSE - Load Serving Entity  
MPR - Market Price Referent  
MW - Megawatt  
PG&E - Pacific Gas and Electric Company  
PV - Solar Photovoltaic technology  
REC - Renewable Energy Credit  
RFO - Request for Offers  
RPS - Renewables Portfolio Standard  
SB - Senate Bill  
SCE - Southern California Edison Company  
SDG&E - San Diego Gas and Electric Company

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## Endnotes

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<sup>1</sup> For the purposes of this paper, the term “retail solar” refers to customer-owned solar generation generally inhabiting residential, commercial, or government rooftops purchased with the help of incentives from the California Solar Initiative. The term “utility solar” refers to large scale solar projects (mostly 10 MW or more) whose energy is generated away from its point of use and sold to utilities for load-filling purposes.

<sup>2</sup> Please note that this paper purposefully distinguishes the terms “cost” and “price.” Cost is used generically to refer to all expenses related to solar PV production and installation including, but not limited to; module, non-module, materials, and the overall price of solar PV panels, prior to customer receipt of the product. Price is defined as the actual amount in dollars per-watt or cents per-kWh a customer or ratepayer is charged for the solar electricity.

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<sup>28</sup> Solarbuzz.com. "Solar Module Retail Price Environment", <http://www.solarbuzz.com/Moduleprices.htm>.

<sup>29</sup> Ibid.

<sup>30</sup> Ibid.

<sup>31</sup> Ibid.

<sup>32</sup> Wisner, Ryan, et al. Note that prices for approved systems are a more accurate indicator of *current* prices than installed systems, which may reflect prices locked in 4-6 months prior to completion.

<sup>33</sup> California Public Utilities Commission. "California Solar Initiative Public Forum, hosted by PG&E"., pg.

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<sup>35</sup> Harris, Glenn.

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<sup>38</sup> California Solar Initiative. "Statewide Trigger Point Tracker", <http://www.csi-trigger.com/>. Note that the incentive amounts have declined by more in the PG&E and SDG&E service areas because these utilities are further along in fulfilling their CSI generation requirements.

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