TIOGA ENERGY

A Tioga Energy Report – June 2008

Hedging Against Utility Rate Fluctuations with a Solar PPA

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Executive Summary

This paper reports on a study comparing probable future electric utility rates with the cost of electricity from a solar power purchase agreement (PPA). There are many factors likely to affect future utility electricity rates, including natural gas pricing and supply constraints, carbon regulation, and higher power plant development costs. These issues are too complex and interdependent to analytically model their impact on future electric utility rates with any accuracy. Instead, in order to predict probabilities of future electric utility rate scenarios, we apply a statistical method widely used by financial and insurance industries to assess future risk based on historical data. Our data set comprises over 30 years of historical electricity rate data for California, the world's 13th largest electricity consumer. When we compare utility rates predicted by the model with the long-term costs of a solar PPA we uncover compelling results: the rates associated with a solar PPA are most often lower than predicted future utility electricity rates. The study shows that solar PPAs offer strong financial protection against the uncertainties of electric utility rate increases.

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Introduction

In today's marketplace, energy has become a strategic issue. Organizations of all types, including corporations, government agencies and non-profits, are evaluating where they get their power, how much they use and what they're spending for it. Many now view distributed renewable energy, such as solar power, as a viable alternative to utility power due to its financial, environmental and corporate image benefits. One of the increasingly popular solutions for implementing solar is a power purchase agreement (PPA). With a solar PPA, customers pay only for the electricity generated by a solar system; the system's design, installation, capital equipment and maintenance are financed and managed by the solar power provider. A solar PPA is typically a 15- to 25-year service contract that includes a fixed annual rate increase called an escalator.

In addition to their 'green' appeal, solar PPAs offer solid financial benefits. To illustrate these financial benefits, we compared future utility rate scenarios, modeled using historical California electricity rate data, with the long-term costs of a solar PPA. In this paper, we first look at California electricity rates and the factors likely to affect them in the future. Then we explain our statistical modeling method and review the compelling results of potential savings to be realized by "going solar."

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California's Future: Electricity Rate Increases

California consumes more electricity than all but twelve of the largest countries in the world and is leading the charge to adopt solar energy in the United States. Looking at the range of factors likely to affect utility electricity rates in the near future, the state's innovative energy strategy is not surprising—it's an economic imperative. Simply because of its size—and continued growth—California consumes a lot of power. Trends and regulations that may raise the future price of that power include:

Increased reliance on expensive and dwindling natural gas supplies. California legislation has halted construction of coal- and nuclear-powered electrical plants, leaving natural gas-fired plants as the primary option for new power plant construction. According to the California Energy Commission, natural gas currently powers 41.5% of the state's electricity needs, up substantially from 36.5% in 2002 ("2007 Integrated Energy Policy Report," California Energy Commission). California's coastal location puts the state at the end of the West's natural gas pipelines. Domestic natural gas is not only expensive, its availability to California is declining as the energy needs of the Southwest and other intermediate transportation points increase.

Liquefied natural gas (LNG) a long way out. Imports of LNG are expected to supplement conventional natural gas sources and help stabilize prices in the long term. However, almost every LNG facility proposed for the West Coast has drawn significant environmental opposition. To date, there are no operating or fully permitted LNG facilities on the U.S. West Coast. Sempra has one facility almost complete in Baja, California. Were LNG from international sources to become available in significant quantities, the expense could increase power rates. Pacific Rim LNG prices typically exceed the cost of U.S. pipeline gas. In addition, California is farther from LNG Pacific Rim exporting facilities than other major consumers such as Japan and Korea, a distance that will impact both supply and cost.

Investor Owned Utilities (IOU) not as price sensitive as consumers. IOUs' primary focus is to provide a safe and highly reliable supply of electricity to businesses and consumers. When the cost of producing electricity rises, IOUs pass those costs on to customers in the form of increased rates.

Without mandates to develop alternative energy sources, such as the Renewable Portfolio Standards (RPS), IOUs can continue to rely on natural gas with its volatile pricing and increase rates to offset their costs. California IOUs, which are adopting renewable energy technologies in response to RPS requirements, are among the most progressive in the nation. Still, the cost of electricity in California is driven largely by the price of fuel – specifically natural gas.

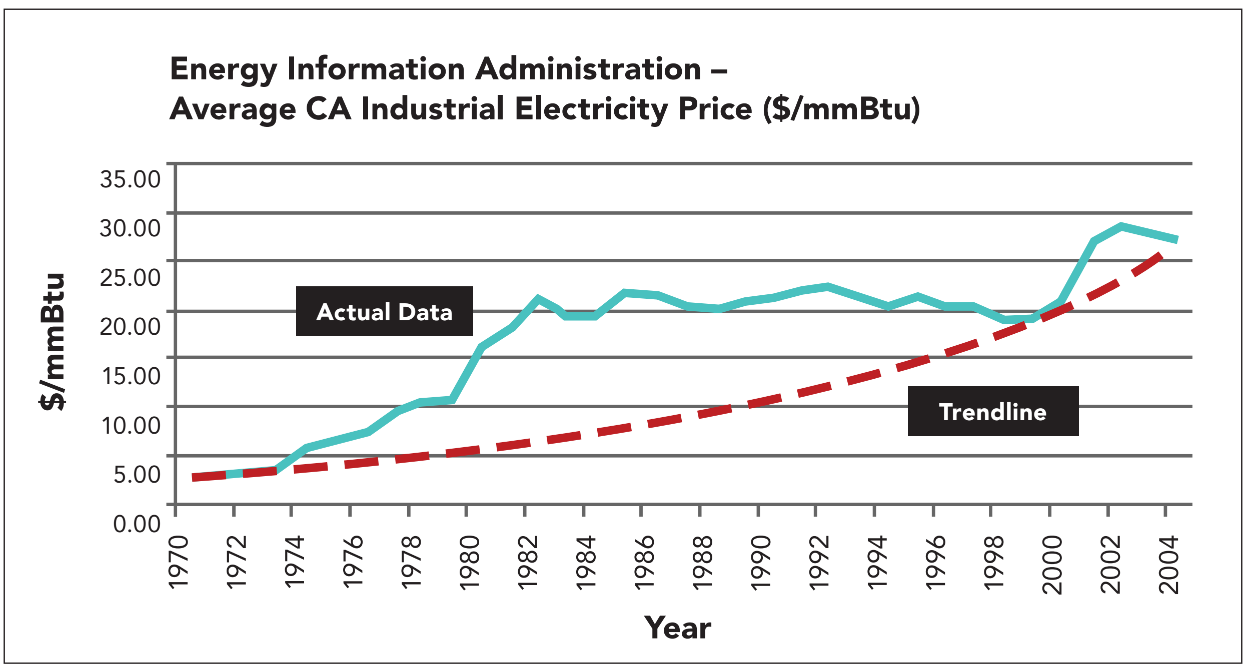
Carbon legislation will increase electricity costs. California legislation calls for the reduction of carbon emissions to 1990 levels by 2020 and requires the California Air Resources Board to regulate and track carbon emissions statewide. The costs of meeting these carbon reduction requirements, along with expected Federal carbon emission regulations, will make coal and natural gas plants more expensive to run. Despite recent legislation that bans long-term contracts for electricity from coal-powered plants, approximately 10% of California's electricity still comes from coal-powered plants in other states. Natural gas, though the cleanest burning fossil fuel, still emits on average 56% as much carbon as coal ("EIA—Natural Gas Issues and Trends 1998," Energy Information Administration). What is the net result of these factors? Power providers will be paying carbon costs in some form, a cost that will ultimately increase power rates.

Higher power plant development costs and longer timelines. In California, power plant development faces significant financial and development hurdles. Materials to build plants, such as steel and concrete, and resources to operate them, such as water, are becoming less available and more expensive. Widespread opposition to development of fossil fuel plants, LNG facilities, and transmission lines means that these projects will certainly cost more and take longer, if they are built at all. Under such development constraints, the ability of energy providers to respond to increased power demands is slowed, again resulting in higher rates.

Forecasting the potential effect on electric utility rates of any one of these factors would be difficult. Predicting their cumulative impact is impossible. Looking at historical data, however, we can see how economic and regulatory factors have resulted in rate changes in the past. For example, "deregulation" of electricity markets in California led to the 2000-2001 California energy crises and dramatic increases in California electricity rates. In the late 1970s and early 1980s, inflation combined with safety concerns about nuclear power plants led to a period of dramatic rate increases. Though future factors affecting change are not likely to mirror past events, past data do offer a good indicator of how rates react to various market forces. To understand what might happen to future electricity rates, we can use a well-established statistical modeling method that evaluates the probability of future rate increases based on California's rate changes over the past 30 plus years.

California Utility Electricity Rates: A History

Our sources for California historical rates are the Energy Information Administration database and an analysis by the California Public Utilities Commission. From 1970 to 2004 (the data available from both studies) California energy rates have generally been rising, at times with great volatility. During this period, industrial electricity rates grew at a compound annual growth rate (CAGR) of 6.8% (Energy Information Administration). Increases for investor owned utilities were even higher, with a CAGR of 7.2% for large businesses (analysis by California Public Utilities Commission, see Appendix 1). These rate increases were frequently drastic: in three cases rates increased by more than 40% in a single year.

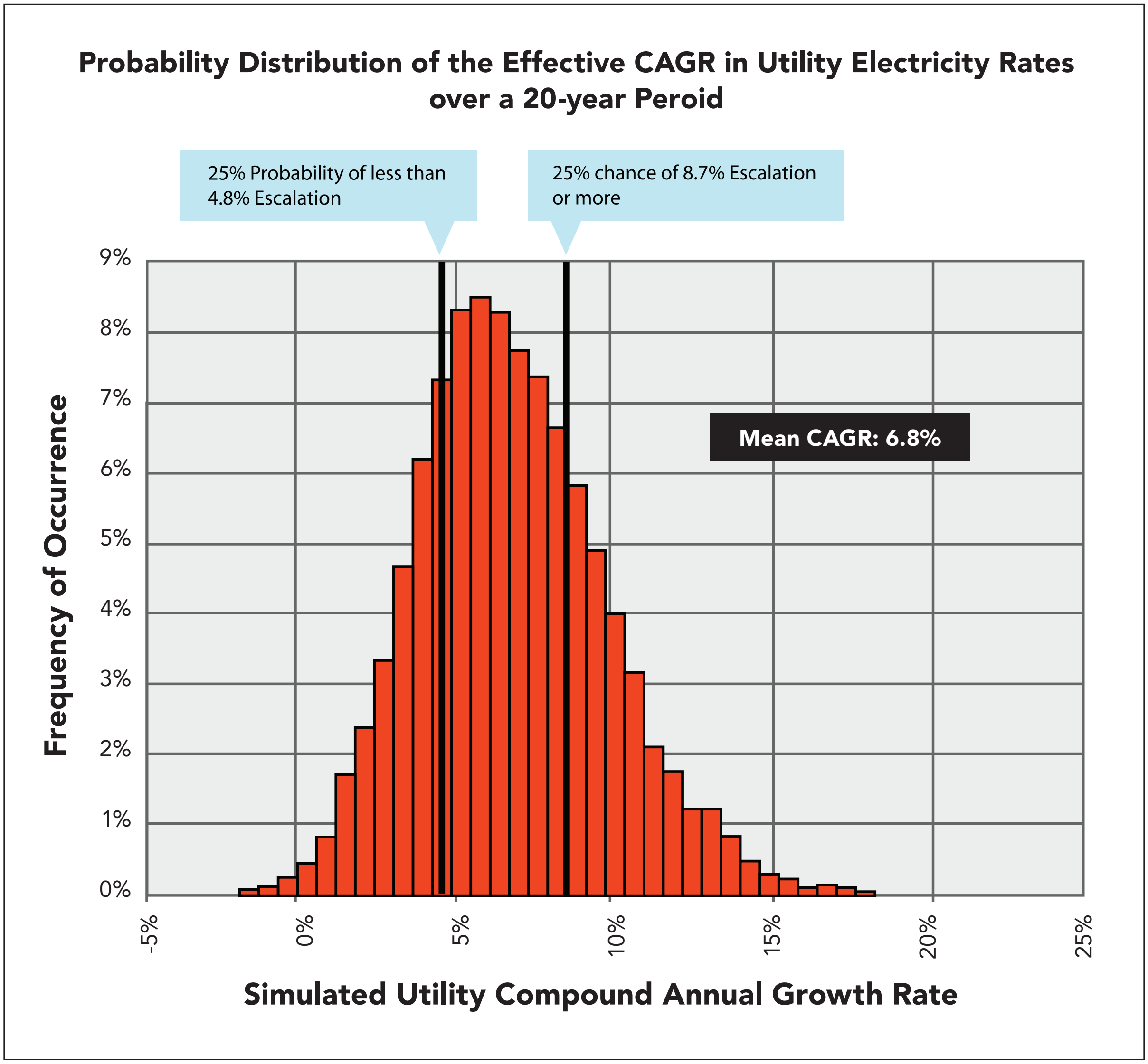


Year-to-year since 1970, electric utility rates rarely fell; the greatest annual decrease of roughly 11% occurred during the recovery period after the California Energy Crisis, the most recent example of electricity market volatility. While events of the past are unlikely to be repeated, future disruptive events will undoubtedly create similar, if not greater, volatility. With this in mind, we can use our historical data with a standard statistical modeling method to predict the probability of future electric rate changes. We can then compare these probable rate changes with long-term pricing of a solar PPA.

Modeling the Future: Solar PPAs Long-Term Financial Benefits

The chosen simulation method is a stochastic statistical analysis method used to evaluate potential outcomes in complex systems for cases where developing deterministic equation-based modeling algorithms is impossible or unwieldy. The method is widely used in the insurance and financial services industries to assess risk by modeling the future probability of certain outcomes. It is also used extensively in the physical sciences to study complex systems with a large number of interrelated variables.

Using this method, our model first selects an annual utility electricity rate change at random from the population of all annual rate changes from the 35 years of California data and then applies it to year 1 of a 20-year period. The model then picks annual rate changes at random for each subsequent year, creating one potential 20-year future utility electricity rate scenario. The model repeats this process tens of thousands of times and eventually converges on a probability distribution of potential future electricity rates for each year in the 20-year period. Finally, for the entire 20-year period, the model tells us through a range of potential CAGRs how likely it is that a specific CAGR will occur. The following chart shows the probability distribution of the effective CAGR in utility electricity rates over the next 20 years, as predicted using this method.



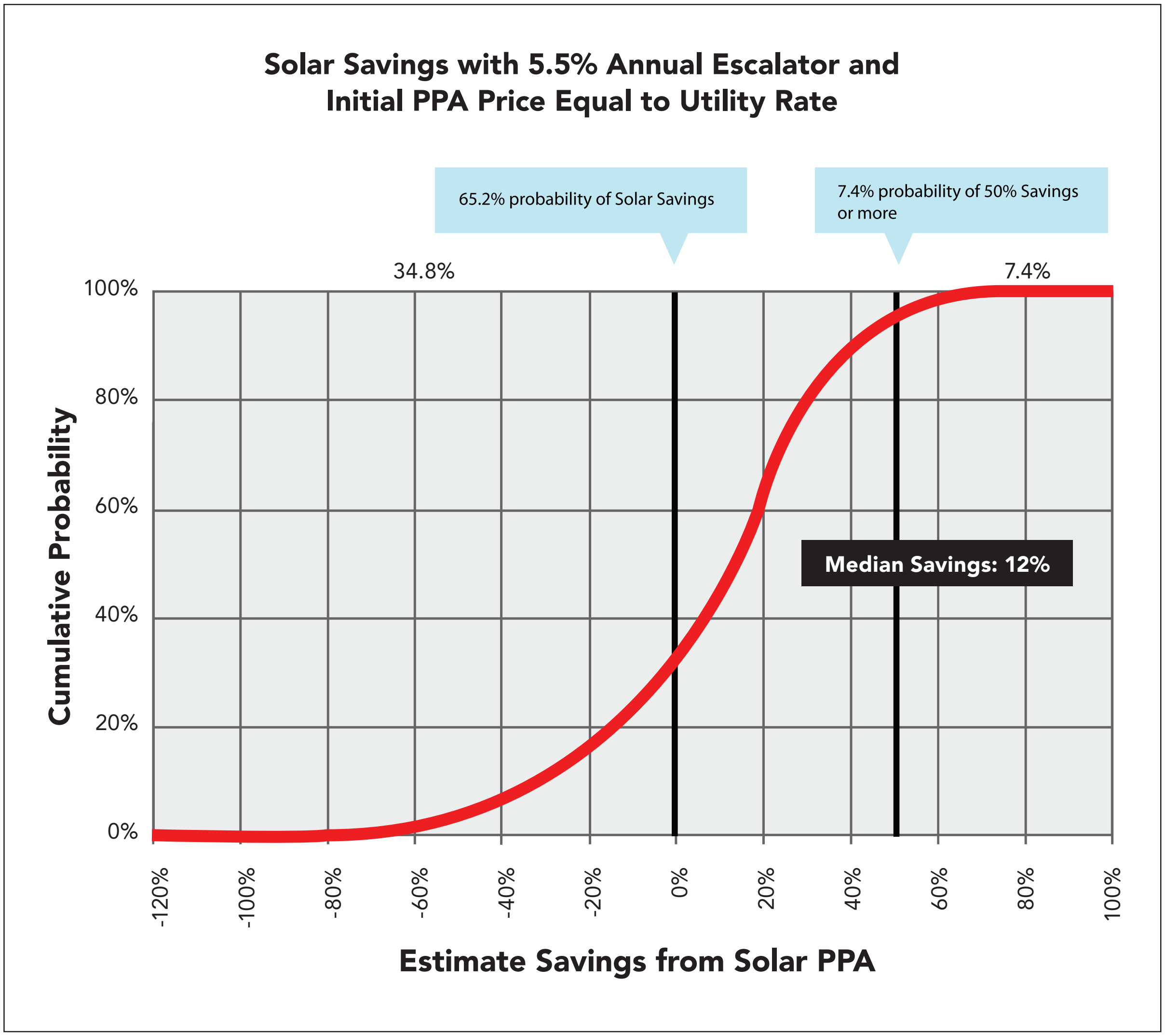
Comparing a solar PPA's electricity costs against future electric utility rate scenarios shows the magnitude of savings realized if those utility rate increases were to occur. The probability that a certain rate increase scenario will occur, determined through the simulation method, is equal to the probability that the corresponding level of savings will be achieved. So if there is a 65% chance that the utility rate will rise at a given rate, there is also a 65% chance of realizing the corresponding savings. We constructed the table on the following page using this method to evaluate the probability and the magnitude of savings associated with the solar PPA for a variety of PPA scenarios. For example, a solar PPA with a 5.5% annual escalator and an initial rate equal to the utility rate has a 65% probability of saving the customer money. The median savings for all customers in this scenario is 12%.

PPA Escalation Rate (Probability of Savings / Median Solar Savings)

Initial PPA Rate	3.0%	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%
80% of Utility Rate	99% / 46%	96% / 40%	94% / 37%	91% / 34%	87% / 29%	83% / 26%	78% / 22%
90% of Utility Rate	96% / 39%	90% / 33%	87% / 29%	82% / 25%	77% / 21%	71% / 17%	65% / 12%
95% of Utility Rate	93% / 36%	86% / 29%	82% / 25%	76% / 21%	71% / 16%	66% / 12%	58% / 7%
Utility Rate	90% / 32%	82% / 26%	77% / 21%	71% / 17%	65% / 12%	59% / 8%	52% / 2%
105% of Utility Rate	87% / 29%	77% / 22%	71% / 17%	66% / 13%	59% / 7%	54% / 3%	47% / -3%
110% of Utility Rate	83% / 25%	72% / 18%	66% / 13%	60% / 9%	54% / 3%	48% / -1%	41% / -8%
120% of Utility Rate	74% / 19%	63% / 11%	56% / 5%	50% / 0%	44% / -6%	38% / -11%	33% / -18%

The results in the table above show many scenarios in which a California solar PPA customer is more likely than not to save over future electric utility rates. The data also suggest a fundamentally different way to view the financial and economic benefits of a solar PPA. Typically, customers determine whether or not to enter a solar PPA using an economic savings model and an assumed electric utility CAGR. If the model shows savings, proceed, otherwise don't. In this analysis, the specific utility CAGR used is critical to the outcome – assuming a CAGR lower than what actually occurs implies lower savings; while assuming a higher than actual CAGR over-estimates savings. It fails to factor in the risk-reward profile of the probability that the selected CAGR (and resultant savings) will occur. In addition, a straight economic savings model based on a single CAGR, or small set of CAGRs for different time periods, ignores the likelihood of savings across the much broader spectrum of simulated CAGRs in our model.

The "fixed CAGR" analysis also fails to show the probability of upside potential. The following graph shows a cumulative probability distribution of savings for the solar PPA example discussed above, which had a 50% probability of saving 12% or more. For this same set of PPA terms, there is a 20% probability of saving nearly 30% and a 7.4% probability that a solar PPA's electricity will cost only half as much as utility electricity over the PPA's 20-year term.


Solar Savings with 5.5% Annual Escalator and
Initial PPA Price Equal to Utility Rate
65.2% probability of Solar Savings
7.4% probability of 50% Savings or more
34.8%
7.4%
Median Savings: 12%
Cumulative Probability
100%
80%
60%
40%
20%
0%
-120%
-100%
-80%
-60%
-40%
-20%
0%
20%
40%
60%
80%
100%
Estimate Savings from Solar PPA

Conclusion

Application of the statistical simulation method, which yields a probability distribution of future electric utility rates based on historical CAGRs, offers a robust view of the potential benefits of a solar PPA and the potential risks of future electric utility rate increases. Using this method, we are able to illustrate the risk-reward profile of a solar PPA and show that the probability of savings with a solar PPA offers a hedge against rising electric utility rates. In a rapidly evolving global economy and a warming global climate, a solar energy PPA is a sound environmental and financial choice.

About the Author

Kristian Hanelt, VP Project Finance for Tioga Energy, has spent his career financing energy projects. Prior to Tioga Energy, Hanelt worked for ArcLight Capital Partners, Gunnison Energy Corporation, Goldman Sachs and PA Consulting Group. Hanelt received a Masters in Business Administration from Stanford Graduate School of Business and a Bachelor of Science degree in Business Administration from Boston University.

Resources

"California State Energy Consumption, Price, and Expenditure Estimates (SEDS)." Energy Information Administration, www.eia.doe.gov/emeu/states/state.html?q_state_a=ca&q_state=CALIFORNIA.

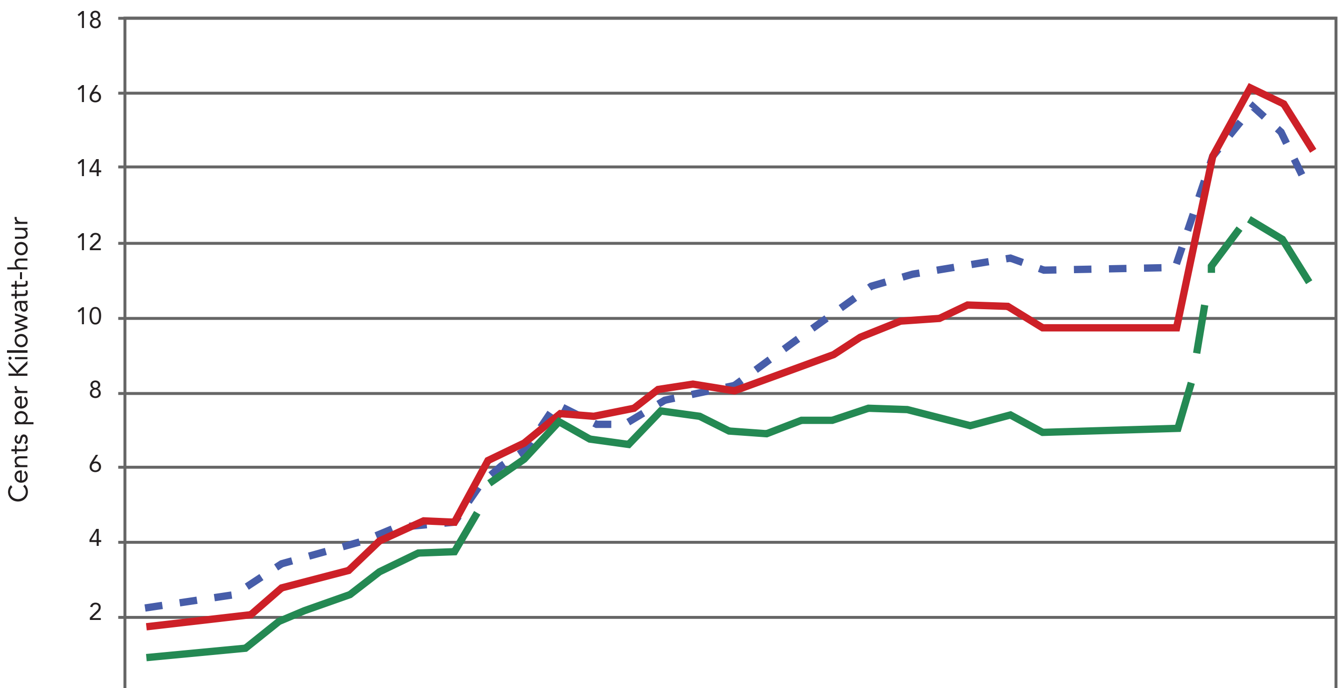
"2007 Integrated Energy Policy Report." November 2007, p. 122. California Energy Commission, www.energy.ca.gov/2007publications/CEC-100-2007-008/CEC-100-2007-008-CTF. PDF.

"Natural Gas and the Environment." NaturalGas.org, www.naturalgas.org/environment/naturalgas.asp.

For more information on solar PPAs, contact Tioga Energy at 877-333-9787 or visit us at www.tiogaenergy.com.

APPENDIX

Trends in California Electricity Rates 1970 - 2004



	1970	1975	1980	1985	1990	1995	2000	2004
Residential	2.228	3.844	5.862	7.779	9.984	11.61	11.32	12.81
Small Business	1.713	2.979	6.138	8.056	8.98	10.26	9.775	14.41
Large Business	0.989	2.286	5.473	7.506	7.285	7.367	6.933	10.63

Source: Prepared by the CPUC Energy Division to show general trends in rates. This data has not been adopted by the CPUC, and does not reflect actual rates charged to any specific customers. Dataset from Energy Information Administration (EIA), DOE/EIA-0376(95), State Energy Price and Expenditure Report, 1995, Tables 36-38. Data for 1996 -2000 reflects AB 1890 frozen rates. Rates from 2001-2004 reflect changes implemented by the following rate-setting Commission Decisions: D.01-01-018, D.01-05-064, D.03-07-029. D.04-02-062, and D.04-07-022; rates from 2001-2004 reflect SCE and PG&E only.