Understanding Financial Analysis Methods for Photovoltaic (PV) Systems
Fall 2011

These links are provided as information only and are not in any way to be considered a comprehensive listing or as an endorsement by PG&E. All links were current at time of list creation. An electronic version of this list is available at www.pge.com/energyclasses/

Related Online Resources:

General Information on PV – California

California Energy Commission Reports
http://www.energy.ca.gov/reports/2001-09-04_500-01-020.PDF
http://www.energy.ca.gov/reports/2003-03-11_500-03-014F.PDF

Go Solar California
This is California’s gateway to solar information for both residential and non-residential buildings. Information about the California Solar Initiative, solar technology, financial incentives, vendors, eligible equipment, vendors, solar contractors, installers, and other available solar programs can be found here. Links to several solar calculators are also provided.
http://www.gosolarcalifornia.ca.gov

Impact of Retail Rate Structures on the Economics of Commercial Photovoltaic Systems in California
This Lawrence Berkeley National Laboratory report presents a detailed analysis the impact of electricity rate design on the value of commercial PV systems. Data from 24 commercial PV installations was used for the study.

Northern California Solar Energy Association (NCSEA)
NCSEA is a chapter of the American Solar Energy Society. The Web site features news, event information, training opportunities, FAQs, as well as, financing information, guides to tools, equipment manufacturers, solar resources and information for ordering the latest edition of the Solar Energy Resource Guide (SERG).
http://www.norcalsolar.org

Incentives for PV

California Solar Initiative (CSI)
Learn about the California Solar Initiative Program here. The site includes information about incentive programs, the CSI Newsletter, regulatory proceeding documents, recent news, the CSI Handbook, links to calculators, and other useful Program Tools.
http://www.cpuc.ca.gov/PUC/energy/Solar/
Clean Power Estimator™. California Energy Commission
Enter your zip code and renewable energy source to begin using this evaluation tool. The tool provides an estimate of the costs and benefits of investing in a photovoltaic (PV) solar or small wind electric generation system.
http://www.consumerenergycenter.org/renewables/estimator/index.html

California Solar Initiative (CSI) Statewide Trigger Point Tracker
This site provides a table of current incentive rates for photovoltaic systems for residential and non-residential customers.
http://csi-trigger.com/

DSIRE. Database of State Incentives for Renewables & Efficiency
DSIRE provides information about financial incentives for renewable energy and energy efficiency projects throughout the United States. Information is provided on state, local, utility, and federal tax incentive programs and is organized by state. Color coded maps and summary tables provide an overview of incentives and policies that promoted renewable energy. Click on the state of California to view information about its available incentives.
http://www.dsireusa.org

ENERGY STAR: Federal Tax Credits for Energy Efficiency
Details of current tax credits and deductions for energy efficiency products and systems are provided here. Tax credits are available for qualified solar water heating and photovoltaic systems.
http://www.energystar.gov/index.cfm?c=products.pr_tax_credits

New Solar Homes Partnership
Learn about California's New Solar Homes Partnership at this Go Solar California Web site. The 3rd edition of the New Solar Homes Partnership Guidebook is available for download. The site also includes FAQs, application instructions, documents and forms, the latest version of the PV Calculator, eligible PV equipment, and information about tax credits.
http://www.gosolarcalifornia.org/about/nshp.php

Calculators and Software Tools

California Solar Initiative Incentive Calculators. Expected Performance Based Buydown Calculator
This CSI Incentive calculator provides an estimate of appropriate incentive level and expected PV system performance based on site and equipment specifications entered by the user.
http://www.csi-epbb.com/

HOMER Optimization Model
HOMER software is a free computer model for the evaluation of design options for both off-grid and grid-connected power systems. HOMER evaluates the economic and technical feasibility of a large number of design options. An overview, sample files, a users' guide, and the HOMER software can be downloaded here. Registration is necessary to download the software.
http://www.homerenergy.com/

Photovoltaic System Economics. Texas State Energy Conservation Office
This simple online PV system calculator gives users a rough estimate of the costs of a PV system.
http://www.infinitepower.org/calc_pv.htm

PVWATTS
PVWATTS was developed by the National Renewable Energy Laboratory. It calculates electrical energy produced by a grid-connected photovoltaic (PV) system. PVWATTS has two versions that permit users to select location and system specifications for the performance calculation.
http://www.nrel.gov/rrdc/pvwatts/
General Information on PV

**Energy Payback of Roof Mounted Photovoltaic Cells. Colin Bankier and Steve Gale**

This 2006 *Energy Bulletin* article presents the results of a review of assumptions and considerations in PV Life Cycle Analysis modeling. The authors use the entire life of PV cells, from manufacturing to installation and operation, for determining energy payback for a typical residential rooftop system.

http://www.energybulletin.net/node/17219

**Find Solar**

Find Solar has a searchable directory of solar professionals. Enter your zip code to find professionals in your area. Also available are solar calculators for generating a rough estimate of the amount of solar available in your area, interactive solar maps, and many other useful solar resources.

http://www.findsolar.com

**Florida Solar Energy Center (FSEC). Solar Electricity**

The FSEC’s Solar Electricity section includes an illustrated primer that discusses the history of PV, how PV cells and systems work, plus a glossary of solar electricity terminology.


**Home Power Magazine. Solar Electricity Basics.**

*Home Power Magazine* publishes articles and papers on renewable technologies for homes. The Solar Electricity Basics section provides a good brief overview of the components and functions of a grid-tied photovoltaic system. “Home Power” also has several articles on the economic payback of solar and other renewable systems.

http://www.homepower.com/basics/solar/

**IEA Photovoltaic Power Systems Programme**

Participants in this International Energy Agency collaborative program conduct joint projects in the application of photovoltaics. The Web site contains PV news, statistics, program information, publications, and project results. Presentations from recent workshops and *PV Trends 2010* are included on the site.

http://www.iea-pvps.org/

**PV FAQs: What is the Energy Payback for PV?**

A brief fact sheet on energy payback, produced by the staff of the National Renewable Energy Laboratory.

http://www.nrel.gov/docs/fy05osti/37322.pdf

**Solar Energy Technologies Program. U.S. Department of Energy (DOE)**

Learn about the research and program activities of the DOE’s Solar Energy Technologies Program here. Information about research programs, market transformation, funding opportunities, and resources for additional information on a variety of solar topics are provided.

http://www1.eere.energy.gov/solar/index.html

**Solarbuzz**

Solarbuzz provides international solar industry news and statistics. A vendor directory, calendar of upcoming events, summary of the annual PV industry market report, an article on economic payback, and a list of some of the codes and standards that apply to photovoltaics are available on this site.

http://www.solarbuzz.com

**Guidelines and Tools for PV Design and Installation**

**Solar Radiation Data Manual for Flat-Plate and Concentrating Collectors**

This Renewable Resource Data Center publication contains solar radiation values for over 200 stations in the U.S. and its territories. Additional climatic conditions, such as average daily minimum temperature are also included.

http://rredc.nrel.gov/solar/pubs/redbook/
Tool Lending Library at the Pacific Energy Center
The Tool Lending Library (TLL) site contains images and descriptions for its data collecting devices from over 100 vendors. Application Notes describe measurement techniques and provide step-by-step instructions for using specific tools. The TLL has a search feature to help you select the right tools for your project. A tool request form and contact information is also provided.
http://www.pge.com/pec/tll/

Energy Efficiency Resources

American Council for an Energy Efficient Economy (ACEEE)
The ACEEE’s Consumer Guide to Home Energy Savings offers tips on reducing energy usage throughout a home.
http://www.aceee.org/consumerguide/

ENERGY STAR
The ENERGY STAR program labels hundreds of products for their energy saving performance. The site includes a directory of ENERGY STAR products, information on home improvements for better energy performance, and information about tax credits for energy efficiency.
http://www.energystar.gov/index.cfm?c=home.index

Energy Savers is a good resource for information and guidance on making a home more energy efficient. Topics include appliances and electronics; lighting; space heating and cooling; windows and doors; insulation; water heating; and designing and remodeling. A link to information on Federal Tax Credits for energy efficient home improvements is also provided.
http://www.energysavers.gov/your_home/

PG&E Resources:

Business Tools
PG&E Business Tools include Energy Usage, Billing History and Rate Comparison Tools.
http://www.pge.com/mybusiness/myaccount/analysis/

Demand Response Incentives
Information on the various Demand Response incentives offered by PG&E can be found here.
http://www.pge.com/mybusiness/energysavingsrebates/demandresponse/

Energy Analyzer and Audits
Here are quick on-line tools for identifying and analyzing business energy use. Tools include an Online Energy Analyzer.
http://www.pge.com/mybusiness/energysavingsrebates/ analyzer/

Energy Management Solutions by Industry
Here you will find information about cash rebates and incentives for replacing existing equipment with new energy efficient technologies or purchasing new equipment. Design assistance for a new facility and system process is also available.
http://www.pge.com/mybusiness/energysavingsrebates/incentivesbyindustry/

Small and Medium Businesses Energy Management Solutions
Information about rebates, incentives, and resources available for your retrofit or new construction project can be found here.
http://www.pge.com/mybusiness/energysavingsrebates/smallmediumbusiness/
PG&E PowerPathway™
PowerPathway offers a Portfolio of programs aimed at building capacity within the state of California to produce the skilled workers needed by PG&E and the energy and utility industry. The PowerPathway Portfolio includes four separate but interconnected efforts: Career preparation, Industry workforce challenges, Education, and Green communities.
http://www.pge.com/about/careers/powerpathway/

Partners and Trade Professionals
PG&E program partners, local contractors and trade professionals offer special assistance in implementing energy efficiency measures for your business.
http://www.pge.com/mybusiness/energysavingsrebates/partnersandtradeprs/

Self-Generation Incentive Program at Pacific Gas and Electric
Financial incentive information, description of eligible technologies, forms, resources, and program contact information can all be accessed here.
http://www.pge.com/mybusiness/energysavingsrebates/selfgenerationincentive/

Solar Energy
PG&E provides information on how a photovoltaic system works; steps to take before installing solar in your home or business; solar schools; and requirements and applications for the California Solar Initiative Program.
http://www.pge.com/solar/

Tariff Book
This site contains all current gas and electric rate schedules.
http://www.pge.com/tariffs/

Third Party Incentive Programs and Fact Sheets
PG&E has partnered with energy efficiency specialists in order to extend the reach and effectiveness of energy efficiency, demand response, renewable energy, and self-generation programs. A fact sheet describing all of the specialists and their energy efficiency programs can be downloaded here. Use the search function to find information about all of the programs that are available for your market segment.
http://www.pge.com/thirdparty/

Understanding Your Bill
Sample business class bills with explanations for each bill item.

Print Resources Available in the PEC’s Resource Center:


**Journals:**

- Home Power Magazine
- Northern California Sun. Newsletter of the NCSEA
- Photon International: The Photovoltaic Magazine
- REFOCUS: The International Renewable Energy Magazine
- Solar Today Magazine

**Other Print Resources:**