
Modeling and Analysis Session: Market, Value, and Policy Analysis

2008 Solar Annual Review Meeting
Austin, Texas
April 23, 2008



Robert Margolis
National Renewable Energy Laboratory
robert_margolis@nrel.gov

Solar America Initiative Alignment and Budget



- Primary objectives:
 - To provide a broad range of analytical support to the Solar Program.
 - To anticipate and respond to the rapidly evolving analytical needs of the Solar Program.
- Three broad types of analysis are being carried out under this project including:
 - **Market analysis:** Developing a PV market penetration model – the SolarDS model – and other tools, in order to gain insight into the factors influencing market penetration of PV technology in U.S. markets.
 - **Value analysis:** Providing inputs to, support for, and review of the annual GPRA benefits analysis. Also developing methods and tools for improving the quantification of the benefits and cost of solar technologies.
 - **Policy analysis:** Defining and carrying out analysis that meets the needs of the Solar Energy Technologies Program in a timely fashion, for example evaluating the potential role of solar in the energy economy in the long-term.

| Organization | FY07 Budget | FY08 Budget | Total Budget |
|--------------|-------------|-------------|--------------|
| NREL | \$ 510k* | \$ 1,350k | TBD |
| LBNL | \$ 100k | \$ 100k | TBD |

* An additional \$280k in carryover from FY06 was used to support this project in FY07.

Market analysis example: High PV penetration analysis with PVFlex



- Used PVFlex to evaluate the limits of PV in the electricity generation system in the U.S. (ERCOT example).
- Examined the potential role of:
 - Increased flexibility
 - Energy Storage
 - Controls/Load shifting
- A combination of increased flexibility, storage and controls could enable PV to contribute ~50% of the systems energy with a modest cost penalty.

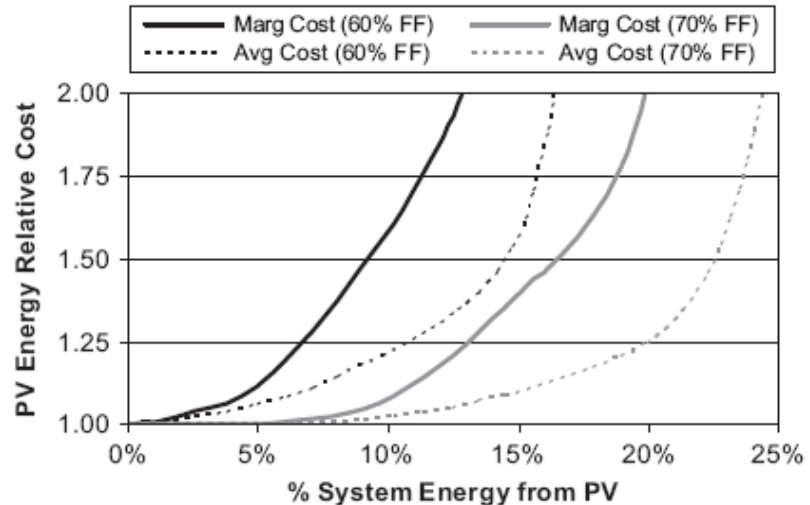


Fig. 1. Relative cost of PV electricity as a function of PV penetration for a flexibility factor (FF) of 60% and 70% (simulations are for ERCOT using 2000 load and insolation data).

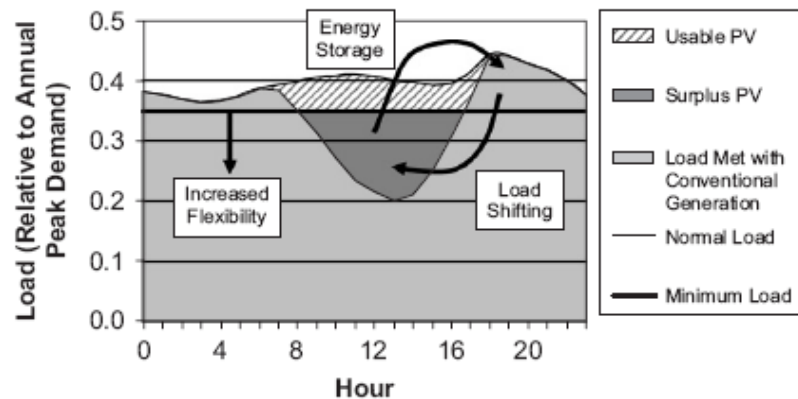



Fig. 2. Options for using surplus solar PV generation.

Value analysis example: Enhanced Web-based distributed PV value clearinghouse



- Improved clearinghouse interface,
- Expanded content in clearinghouse.


NREL National Renewable Energy Laboratory
Innovation for Our Energy Future

NREL HOME

ABOUT NREL
SCIENCE & TECHNOLOGY
TECHNOLOGY TRANSFER
APPLYING TECHNOLOGIES
LEARNING ABOUT RENEWABLES

Energy Analysis

PV Value Clearinghouse

More Search Options

Site Map

PV Clearinghouse Home

Database

Logout

Access Data

Submit New Report

Help/Tutorial

Key Term Definitions

Contacts

Database - Access Data

Evaluation Matrix
(Basic Search)

Documents
(Advanced Search)

Summary
Details

Resource Evaluation Matrix (261 documents)

| Benefit Cost Category | Participant | All Ratepayers | Utility | Industry | Local Government | State Government | Federal Government |
|--------------------------------------|-------------|----------------|---------|----------|------------------|------------------|--------------------|
| Investment | 12 / 27 | 1 | 2 / 7 | 12 / 4 | | 2 | 1 / 1 |
| Utility Bill | 29 / 1 | 10 / 14 | 2 | | | | |
| Incentives | 25 | 1 | 1 / 5 | 2 | 1 | 1 / 16 | 5 |
| Tax Effects | 5 / 1 | | 2 | | | 1 / 2 | 2 / 3 |
| Utility Cost Savings | 7 | 2 | 64 / 3 | | 1 | | 1 |
| Environmental | 4 | 30 / 2 | 9 | | | 2 | 4 / 1 |
| Jobs | 1 | 1 | 1 | 13 | 2 | 8 | 7 |
| Reliability | 11 | 5 | 30 | | 1 | 1 | |
| Risk Factors | 14 | 5 | 29 / 1 | | 1 | 1 | 5 |

benefit + cost -

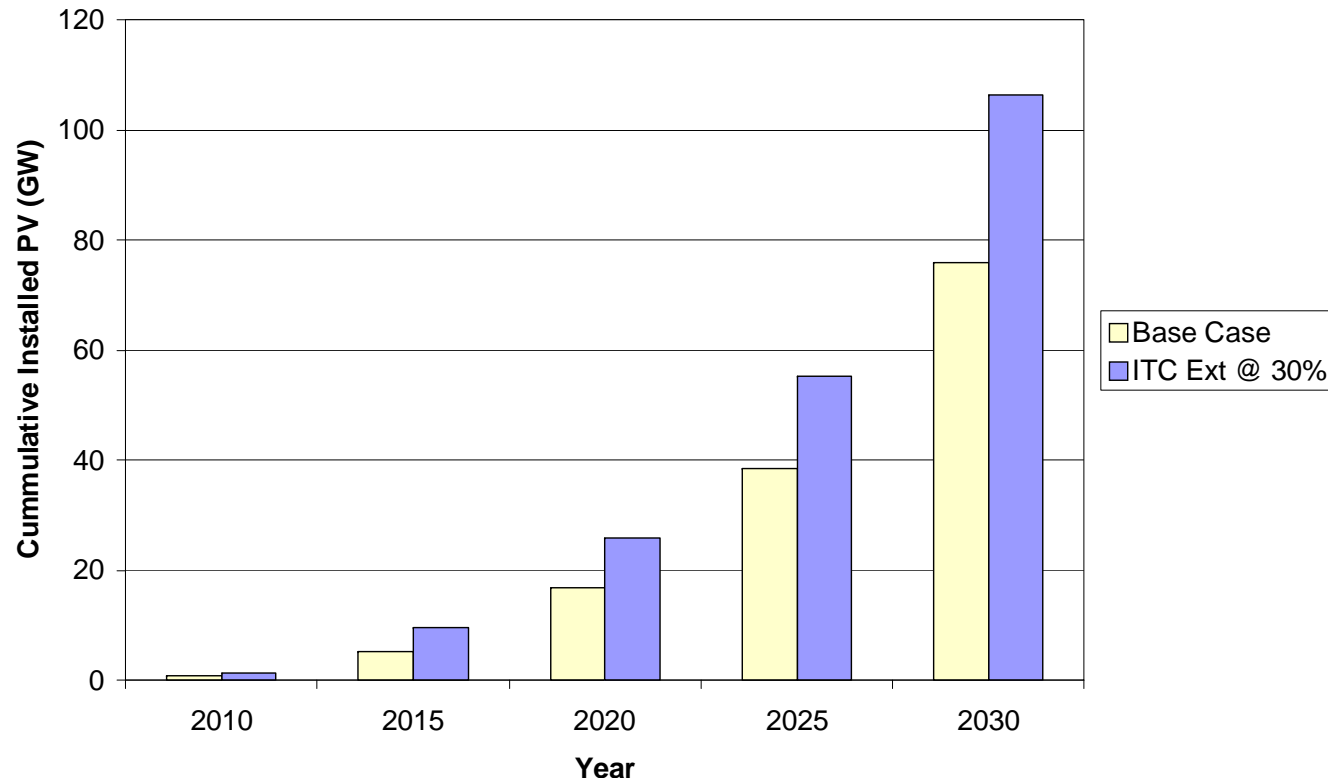
Access at: <http://www.nrel.gov/analysis/pvclearinghouse/>

Policy analysis example: Solar investment tax credit (ITC) analysis (using NEMS).



- Examined various approaches for structuring the Solar ITC.
- Estimated market impacts, benefits (jobs, energy displaced, etc.) and cost to Treasury.

Impact of 8-year ITC extension



- Benefits continue after ITC ends
- Additional 30 GW of PV in 2030

Future Directions



- Publish an Annual Report on Solar Market, Cost, and Performance Trends.
- Provide analytical and technical support to the PV Industry Roadmap process.
- Continue to maintain and enhance the PV Value Clearinghouse.
- Support the annual GPRA benefits and Program Decision Support analysis efforts.
- Continue to produce a series of topical reports that anticipate and respond to emerging critical needs of the Solar Program.

FY07 Publications



- Denholm, Paul, and Robert M. Margolis. 2007. "Evaluating the Limits of Solar Photovoltaics (PV) in Electric Power Systems Utilizing Energy Storage and Other Enabling Technologies," *Energy Policy*. Vol. 35, pp. 4424-4433.
- Denholm, Paul, and Robert M. Margolis. 2007. "Evaluating the Limits of Solar Photovoltaics (PV) in Traditional Electric Power Systems," *Energy Policy*. Vol. 35, pp. 2852–2861.
- Denholm, Paul, Robert M. Margolis, Ken Zweibel. 2007. "Tackling Climate Change in the U.S.: Potential Carbon Emissions Reductions from Solar Photovoltaics by 2030." Chapter in: *Tackling Climate Change in the U.S.: Potential Carbon Emissions Reductions from Energy Efficiency and Renewable Energy by 2030*. Bolder, CO: American Solar Energy Society.
- Grover, Steve. 2007. "Energy, Economic, and Environmental Benefits of the Solar America Initiative." National Renewable Energy Laboratory, Golden CO. Report NREL/SR-640-41998. August.
- Hoff, Thomas E. Richard Perez, and Robert M. Margolis. 2007. "Maximizing the Value of Customer-Sited PV Systems Using Storage and Controls," *Solar Energy*. Vol. 81, pp. 940-945.
- Levene, Johanna Ivy, Margret K. Mann, Robert M. Margolis, and Anelia Milbrandt. 2007. "Analysis of Hydrogen Production from Renewable Electricity Sources." *Solar Energy*. Vol. 81, pp. 773-780.
- Wisler, Ryan, Andrew Mills, Galen Barbose, and William Golove. 2007. "The Impact of Retail Rate Structures on the Economics of Commercial Photovoltaic Systems in California." Lawrence Berkeley National Laboratory, Berkeley, CA. Report LBNL-63019. July.
- Wisler, Ryan, Mark Bolinger, Peter Clappers, and Robert Margolis. 2006. "Analyzing Historical Cost Trends in California's Market for Customer-Sited Photovoltaics." *Progress in Photovoltaics: Research and Applications*. Vol. 15, pp. 69–85.
- Wisler, Ryan, Mark Bolinger, Peter Clappers, and Robert Margolis. 2006. "PV Cost Trends: Letting the Sun Shine on Solar Costs in California." *REFocus*. September/October. pp. 26-31.