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Research Timeline

A chronological listing of more than two decades of published research covering topics in solar prediction, economic evaluation and incentive program optimization.

2013

- **Net Metering: Quantifying Benefits and Sharing Costs**
(<http://cleanpower.com/resources/net-metering-quantifying-benefits-and-sharing-costs/>) (Feb. 2013)
- **Integrating PV into Utility Planning and Operation Tools**
(<http://www.cleanpower.com/resources/integrating-pv-into-utility-planning-and-operation-tools/>) (Feb. 2013) – presentation

2012

- **Solar Monitoring, Forecasting and Variability Assessment at SMUD**
(http://www.cleanpower.com/resources/smud_solar_assessment/) (April 2012)
- **Reporting of Irradiance Model Relative Errors**
(<http://www.cleanpower.com/resources/reporting-of-irradiance-model-relative-errors/>) (March 2012)
- **Predicting Short-term Variability of High Penetration PV**
(<http://cleanpower.com/resources/high-penetration-pv-variability-prediction/>) (March 2012)
- **Off-shore Wind and Grid-connected PV: High Penetration Peak Shaving for New York City** (<http://cleanpower.com/wp-content/uploads/Offshore-Wind-and-Grid-Connected-PV-High-Penetration-Peak-Shaving-for-New-York-City.pdf>) (March 2012)
- **Evaluating Irradiance Accuracy Using California ISO Data: Lessons Learned**
(<http://cleanpower.com/resources/evaluating-irradiance-accuracy-using-california-iso-data-lessons-learned/>) (Feb. 2012)

2011

- **Determining Storage Reserves for Regulating Solar Variability**
(<http://cleanpower.com/resources/determining-storage-reserves-for-regulating-solar-variability/>) (Nov. 2011)
- **Modeling PV Fleet Output Variability** (<http://cleanpower.com/resources/modeling-pv-fleet-output-variability/>) (May 2011)
- **PV Power Output Variability: Calculation of Correlation Coefficients Using Satellite Insolation Data** (<http://cleanpower.com/resources/pv-power-output-variability-calculation-of-correlation-coefficients-using-satellite-insolation-data/>) (March 2011)
- **Short-term Irradiance Variability: Station Pair Correlation as a Function of Distance**
(<http://cleanpower.com/resources/short-term-irradiance-variability-station-pair-correlation-as-a-function-of-distance/>) (March 2011)

FEATURED RESEARCH

Behind-the-Meter PV Fleet Forecasting

DOWNLOAD ([HTTP://WWW.CLEANPOWER.COM/WEB-TO-LEAD/?00NF0000008VHKQ=BEHINDMETERPVFLEETFORECAST.PDF](http://www.cleanpower.com/web-to-lead/?00NF0000008VHKQ=BEHINDMETERPVFLEETFORECAST.PDF))

FEATURED RESEARCH

Solar Power Generation in the US: Too Expensive or a Bargain?

DOWNLOAD ([HTTP://WWW.CLEANPOWER.COM/WEB-TO-LEAD/?00NF0000008VHKQ=SOLAR-POWER-GENERATION-IN-U.S.-TOO-EXPENSIVE-OR-A-BARGAIN.PDF](http://www.cleanpower.com/web-to-lead/?00NF0000008VHKQ=SOLAR-POWER-GENERATION-IN-U.S.-TOO-EXPENSIVE-OR-A-BARGAIN.PDF))

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A Micro-Grid with PV, Fuel Cells and Energy Efficiency

DOWNLOAD ([HTTP://WWW.CLEANPOWER.COM/WEB-TO-LEAD/?00NF0000008VHKQ=MICROGRIDSPVFUELCELLSEE.PDF](http://www.cleanpower.com/web-to-lead/?00NF0000008VHKQ=MICROGRIDSPVFUELCELLSEE.PDF))

FEATURED RESEARCH

Photovoltaic Incentive Design Handbook

DOWNLOAD ([HTTP://WWW.CLEANPOWER.COM/WEB-TO-LEAD/?00NF0000008VHKQ=PVINCENTIVEDESIGNHANDBOOK.PDF](http://www.cleanpower.com/web-to-lead/?00NF0000008VHKQ=PVINCENTIVEDESIGNHANDBOOK.PDF))

EVENTS

- **Designing Austin Energy's Solar Tariff Using a Distributed PV Value Calculator** (<http://cleanpower.com/resources/designing-austin-energys-solar-tariff-using-a-distributed-pv-calculator/>) (March 2011)

2010

- **Parameterization of Site-specific Short-term Irradiance Variability** (<http://cleanpower.com/resources/parameterization-of-site-specific-short-term-irradiance-variability/>) (Nov. 2010)
- **PV Power Output Variability: Correlation Coefficients** (<http://cleanpower.com/resources/pv-power-output-variability-correlation-coefficients/>) (Nov. 2010)
- **Valuing a Portfolio of PV Investments** (<http://cleanpower.com/resources/valuing-a-portfolio-of-pv-investments/>) (Oct. 2010)
- **Validation of Short and Medium Term Operational Solar Radiation Forecasts in the U.S.** (<http://cleanpower.com/resources/validation-of-short-medium-term-operational-solar-radiation-forecasts-in-the-u-s/>) (Aug. 2010)
- **Validation of PV Performance Models Using Satellite-based Irradiance Measurements: A Case Study** (<http://cleanpower.com/resources/validation-of-pv-performance-models-using-satellite-based-irradiance-measurements-a-case-study/>) (May 2010)
- **Weather Adjusted Performance Guarantees** (<http://cleanpower.com/resources/weather-adjusted-performance-guarantees/>) (May 2010)
- **Market Transformation Benefits of a PV Incentive Program** (<http://cleanpower.com/resources/market-transformation-benefits-of-a-pv-incentive-program/>) (May 2010)
- **Quantifying the Cost of High Photovoltaic Penetration** (<http://cleanpower.com/resources/quantifying-the-cost-of-high-photovoltaic-penetration/>) (May 2010)
- **The CA Net Energy Metering Report: Approach, Results & Implications** (<http://cleanpower.com/resources/the-ca-net-energy-metering-report-approach-results-implications/>) (April 2010)

2009

- **Evaluating PV Fleet Output Variability** (<http://cleanpower.com/resources/evaluating-pv-fleet-output-variability/>) (Dec. 2009)
- **Quantifying PV Power Output Variability** (<http://cleanpower.com/resources/quantifying-pv-power-output-variability/>) (May 2009)

2008

- **Solar Sustained Vehicles: A Consumer's Solution to Protection in an Age of Oil Dependence, Economic Uncertainty, & Global Warming** (<http://cleanpower.com/resources/solar-sustained-vehicles-a-consumers-solution-to-protection-in-an-age-of-oil-dependence-economic-uncertainty-global-warming/>) (Nov. 2008)
- **Shining on the Big Apple: Satisfying New York City's Peak Electrical Needs with PV** (<http://cleanpower.com/resources/shining-on-the-big-apple-satisfying-new-york-citys-peak-electrical-needs-with-pv/>) (Nov. 2008)

2006

- **How to Incorporate Perspective When Performing a Solar Value Analysis** (Oct. 2006)
- **Incentive Level Analysis: Workshop on the Design of the New Solar Homes Partnership** (<http://cleanpower.com/resources/incentive-level-analysis-workshop-on-the-design-of-the-new-solar-homes-partnership/>) (June 2006)
- **Expected Performance Based Buydown (EPBB) Incentive Structure: Rationale &**



(<http://www.ases.org/solar2013/>)

ASES Solar 2013

(<http://www.cleanpower.com/events/ases-solar-2013/>)

Apr 16th to Apr 20th

Location: Baltimore, MD

RESEARCH INDEX

Solar Prediction Research

(<http://www.cleanpower.com/research/solar-prediction-research/>)

Economic Valuation Research

(<http://www.cleanpower.com/research/economic-valuation-research/>)

Program Optimization Research

(<http://www.cleanpower.com/research/program-optimization-research/>)

Research Timeline

(<http://www.cleanpower.com/research/research-timeline/>)

Implications (<http://cleanpower.com/resources/expected-performance-based-buydown-epbb-incentive-structure-rationale-implications/>) (May 2006)

- Incentive Structure Alternatives (<http://cleanpower.com/resources/incentive-structure-alternatives/>) (April 2006)
- Overview of PBI Design Issues: Performance Based Solar Incentives Workshop (<http://cleanpower.com/resources/overview-of-pbi-design-issues-performance-based-solar-incentives-workshop/>) (March 2006)
- The Value of Distributed Photovoltaics to Austin Energy & the City of Austin (<http://cleanpower.com/resources/the-value-of-distributed-photovoltaics-to-austin-energy-the-city-of-austin/>) (March 2006)

2005

- Moving Towards a More Comprehensive Framework to Evaluate Distributed Photovoltaics (<http://cleanpower.com/resources/moving-towards-a-more-comprehensive-framework-to-evaluate-distributed-photovoltaics/>) (June 2005)
- Maximizing the Value of Customer-Sited PV Systems Using Storage & Controls (<http://cleanpower.com/resources/maximizing-the-value-of-customer-sited-pv-systems-using-storage-controls/>) (Jan. 2005)

2004

- Increasing the Value of Customer-Owned PV Systems Using Batteries (<http://cleanpower.com/resources/increasing-the-value-of-customer-owned-pv-systems-using-batteries/>) (Nov. 2004)
- Economic Benefits of Performance-Based Incentives (<http://cleanpower.com/resources/economic-benefits-of-performance-based-incentives/>) (July 2004)
- Quick Review of Basic Economics (<http://cleanpower.com/resources/quick-review-of-basic-economics/>) (July 2004)
- Field Validation of the Clean Power Estimator's Obstruction Analysis Algorithm (<http://cleanpower.com/resources/field-validation-of-the-clean-power-estimators-obstruction-analysis-algorithm/>) (Feb. 2004)
- Are Photovoltaic Systems Worth More to Residential Consumers on Net Metered Time-of-Use Rates? (<http://cleanpower.com/resources/are-photovoltaic-systems-worth-more-to-residential-consumers-on-net-metered-time-of-use-rates/>) (Jan. 2004) – paper + presentation

2003

- Potential Economic Benefits of Distributed Photovoltaics to the Nevada Power Company (Nov. 2003)
- Distributed Photovoltaics in New Jersey (<http://cleanpower.com/resources/distributed-photovoltaics-in-new-jersey/>) (Oct. 2003)
- A Simple Method for Consumers to Address Uncertainty When Purchasing Photovoltaics (<http://cleanpower.com/resources/a-simple-method-for-consumers-to-address-uncertainty-when-purchasing-photovoltaics/>) (Sep. 2003)
- Determination of Photovoltaic Effective Capacity for Nevada Power (<http://cleanpower.com/resources/determination-of-photovoltaic-effective-capacity-for-nevada-power/>) (Sep. 2003)
- Maximizing PV peak shaving with solar load control: validation of a web-based economic evaluation tool (<http://cleanpower.com/resources/maximizing-pv-peak-shaving-with-solar-load-control-validation-of-a-web-based-economic-evaluation-tool/>) (Aug. 2003)
- Validation of a Simplified PV Simulation Engine (<http://cleanpower.com/resources/validation-of-a-simplified-pv-simulation-engine/>) (June 2003)

- **Estimator Documentation** (<http://cleanpower.com/resources/estimator-documentation/>) (May 2003)

2002

- **Tax Revenue Protection Through Outage Risk Mitigation: The Value of Distributed PV to The Federal Government** (<http://cleanpower.com/resources/tax-revenue-protection-through-outage-risk-mitigation-the-value-of-distributed-pv-to-the-federal-government/>) (Oct. 2002)
- **Electricity Rate Structures Can Be Used to Promote Customer-Sited PV: A Lesson From California** (<http://cleanpower.com/resources/electricity-rate-structures-can-be-used-to-promote-customer-sited-pv-a-lesson-from-california/>) (June 2002)
- **A Tool To Market Customer-Sited Small Wind Systems** (<http://cleanpower.com/resources/a-tool-to-market-customer-sited-small-wind-systems/>) (June 2002)

2001

- **Using Product Portfolios to Increase the Value of Customer-Sited PV** (<http://cleanpower.com/resources/using-product-portfolios-to-increase-the-value-of-customer-sited-pv/>) (Oct. 2001) – paper + presentation
- **Using the Internet to Promote PV & Other Clean Technologies** (<http://cleanpower.com/resources/using-the-internet-to-promote-pv-other-clean-technologies/>) (June 2001)

2000

- **Reduce, Reuse, Renew: One Possible Approach to Cut Carbon Emissions** (<http://cleanpower.com/resources/reduce-reuse-renew-one-possible-approach-to-cut-carbon-emissions/>) (July 2000)
- **The Potential Market for Photovoltaics & Other Distributed Resources in Rural Electric Cooperatives** (<http://cleanpower.com/resources/the-potential-market-for-photovoltaics-other-distributed-resources-in-rural-electric-cooperatives/>) (July 2000)
- **Building Integrated Photovoltaics At the New York City Transit's Corona Maintenance Shop & Car Wash Facility** (<http://cleanpower.com/resources/building-integrated-photovoltaics-at-the-new-york-city-transits-corona-maintenance-shop-car-wash-facility/>) (July 2000)
- **The Market for Photovoltaics in New Homes Using Micro-Grids** (<http://cleanpower.com/resources/the-market-for-photovoltaics-in-new-homes-using-micro-grids/>) (June 2000)
- **The Market for Photovoltaics in New Homes Using Micro-Grids (Report)** (<http://cleanpower.com/resources/the-market-for-photovoltaics-in-new-homes-using-micro-grids-report/>) (Jan. 2000)

1999

- **Clean Distributed Resources in the U.S. Residential Market** (<http://cleanpower.com/resources/clean-distributed-resources-in-the-u-s-residential-market/>) (Nov. 1999)

1998

- **Distributed Resources: A Potentially Economically Attractive Option to Satisfy Increased Demand on Okanogan County Electric Cooperative's Mazama Feeder Line** (<http://cleanpower.com/resources/distributed-resources-a-potentially-economically-attractive-option-to-satisfy-increased-demand-on-okanogan-county-electric-cooperatives-mazama-feeder-line/>) (Oct. 1998)
- **Distributed Resources in Okanogan County Electric Co-op: Preliminary Feasibility Study Results** (Oct. 1998)
- **A Preliminary Analysis of Block Island Power Company's Use of Clean Distributed Resources to Provide Power to Its Customers** (<http://cleanpower.com/resources/a-preliminary-analysis-of-block-island-power-companys-use-of-clean-distributed->

[resources-to-provide-power-to-its-customers/](#)) (Aug. 1998)

- **Keep the Door Open for Micro-Grids** (<http://cleanpower.com/resources/keep-the-door-open-for-micro-grids/>) (July 1998)
- **A Micro-Grid with PV, Fuel Cells, & Energy Efficiency** (<http://cleanpower.com/resources/a-micro-grid-with-pv-fuel-cells-energy-efficiency/>) (June 1998) – paper + presentation
- **Modular Green Generation: An Untapped Green Market** (<http://cleanpower.com/resources/modular-green-generation-an-untapped-green-market/>) (June 1998)
- **Green Futures: Managing Financial Risks & Protecting the Environment** (<http://cleanpower.com/resources/green-futures-managing-financial-risks-protecting-the-environment/>) (June 1998)
- **Using Distributed Resources to Manage Risks Caused by Demand Uncertainty** (<http://cleanpower.com/resources/using-distributed-resources-to-manage-risks-caused-by-demand-uncertainty/>) (Jan. 1998)

1997

- **Distributed Generation & Micro-Grids** (<http://cleanpower.com/resources/distributed-generation-micro-grids/>) (Sep. 1997) – paper + presentation
- **Credit Ratings & Photovoltaic Investments** (<http://cleanpower.com/resources/credit-ratings-photovoltaic-investments/>) (Sep. 1997)
- **Investments Under Uncertainty: State Prices in Incomplete Markets** (<http://cleanpower.com/resources/investments-under-uncertainty-state-prices-in-incomplete-markets/>) (Aug. 1997)
- **Integrating Renewable Energy Technologies in the Electric Supply Industry: A Risk Management Approach** (<http://cleanpower.com/resources/integrating-renewable-energy-technologies-in-the-electric-supply-industry-a-risk-management-approach/>) (June 1997)
- **Managing Risk Using Renewable Energy Technologies** (<http://cleanpower.com/resources/managing-risk-using-renewable-energy-technologies/>) (Jan. 1997)

1996

- **Identifying Distributed Generation & Demand Side Management Investment Opportunities** (<http://cleanpower.com/resources/identifying-distributed-generation-demand-side-management-investment-opportunities/>) (Sep. 1996)
- **Distributed Generation: An Alternative to Electric Utility Investments in System Capacity** (<http://cleanpower.com/resources/distributed-generation-an-alternative-to-electric-utility-investments-in-system-capacity/>) (Sep. 1996)
- **Photovoltaic Economics & Markets: The Sacramento Municipal Utility District as a Case Study** (<http://cleanpower.com/resources/photovoltaic-economics-markets-the-sacramento-municipal-utility-district-as-a-case-study/>) (Sep. 1996)
- **Strategic Planning in Electric Utilities: Using Wind Technologies as Risk Management Tools** (<http://cleanpower.com/resources/strategic-planning-in-electric-utilities-using-wind-technologies-as-risk-management-tools/>) (June 1996)
- **Strategic Planning in Electric Utilities: Using Renewable Energy Technologies as Risk Management Tools** (<http://cleanpower.com/resources/strategic-planning-in-electric-utilities-using-renewable-energy-technologies-as-risk-management-tools/>) (April 1996)

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- **The Value of Grid-Support Photovoltaics in Reducing Distribution System Losses** (<http://cleanpower.com/resources/the-value-of-grid-support-photovoltaics-in-reducing-distribution-system-losses/>) (Sep. 1995)
- **Performance & Value Analysis of the Kerman 500 kW Photovoltaic Power Plant**

(<http://cleanpower.com/resources/performance-value-analysis-of-the-kerman-500-kw-photovoltaic-power-plant/>) (April 1995)

1994

- **The Value of Grid-Support Photovoltaics to Substation Transformers** (<http://cleanpower.com/resources/the-value-of-grid-support-photovoltaics-to-substation-transformers/>) (Aug. 1994)
- **The Value of Grid-Support Photovoltaics in Providing Distribution System Voltage Support** (<http://cleanpower.com/resources/the-value-of-grid-support-photovoltaics-in-providing-distribution-system-voltage-support/>) (June 1994)

1993

- **PV DSM: Policy Actions to Speed Commercialization** (<http://cleanpower.com/resources/pv-dsm-policy-actions-to-speed-commercialization/>) (May 1993)

1992

- **Evaluating the Revenue Impacts of Customer-Sited Renewable Generation Using Load Research Data** (<http://cleanpower.com/resources/evaluating-the-revenue-impacts-of-customer-sited-renewable-generation-using-load-research-data/>) (Oct. 1992)

1991

- **Economic Determination of Optimal Plant Design for Photovoltaics in the Utility Distribution System**

1988

- **Calculating Photovoltaics' Value: A Utility Perspective**

1987

- **Two Years of Performance Data for the World's Largest Photovoltaic Power Plant**

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