



California ISO
Shaping a Renewed Future

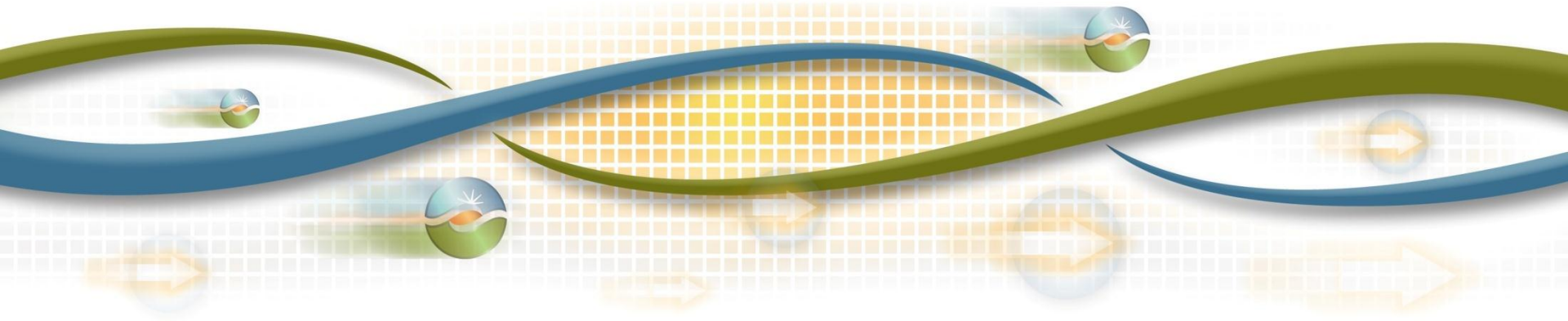
UWIG Solar Integration Workshop

October 11, 2011

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Lead Renewable Integration Specialist

Smart Grid Technologies and Strategy

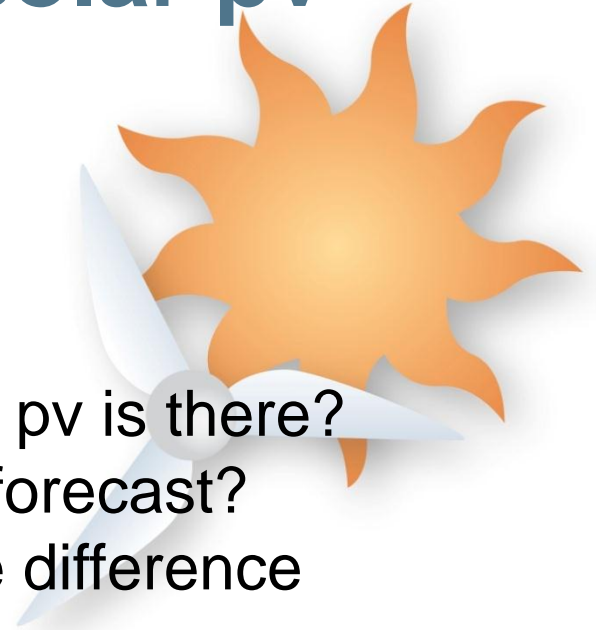


California ISO by the numbers



- Non-profit, for public benefit company
- 80% of California load served by the ISO
- 50,270 MW record peak demand (July 24, 2006)
- 30,000 market transactions per day
- 25,526 circuit-miles of transmission lines
- 286 million megawatt-hours of electricity delivered annually
- Governing Board appointed by the governor and confirmed by the state Senate

Prototype for load forecasting for non-ISO metered solar pv



The Big Questions:

- How much non-ISO metered solar pv is there?
- How is solar pv affecting the load forecast?
- How can we accurately predict the difference between load and solar pv?
- How do we maintain grid reliability?

How much non-ISO metered solar pv is there?



NEWSLETTER

SEARCH

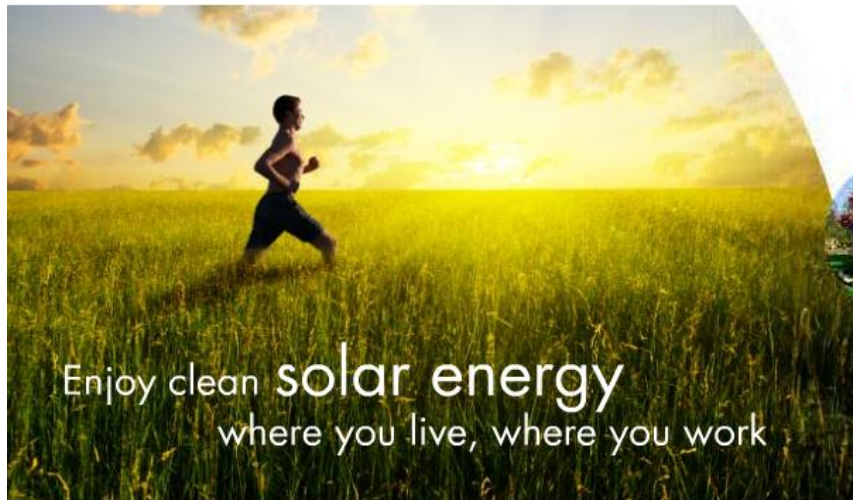
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COMMUNITY SOLAR CALENDAR

CALCULATE YOUR SAVINGS

GETTING STARTED

ANNOUNCEMENTS

- [September CSI Newsletter](#)
 - [Staff Workshop on Proposed Revisions to the NSHP Guidebook](#)
 - [NEW: Check your PV system value with SAVE](#)
- [See SAVE FAQs](#)

California Leads the Nation

- 98829** solar projects
- 982** megawatts installed
- \$ 8.33** avg cost/watt <10kW
- \$ 7.28** avg cost/watt >10kW

last updated: 9.29.11
[California Solar Statistics](#)

Upcoming Events

October 04, 2011

[Inspecting Photovoltaic \(PV\) Systems for Code Compliance - An Online Course](#)

October 05, 2011

[CSI Application Process](#)

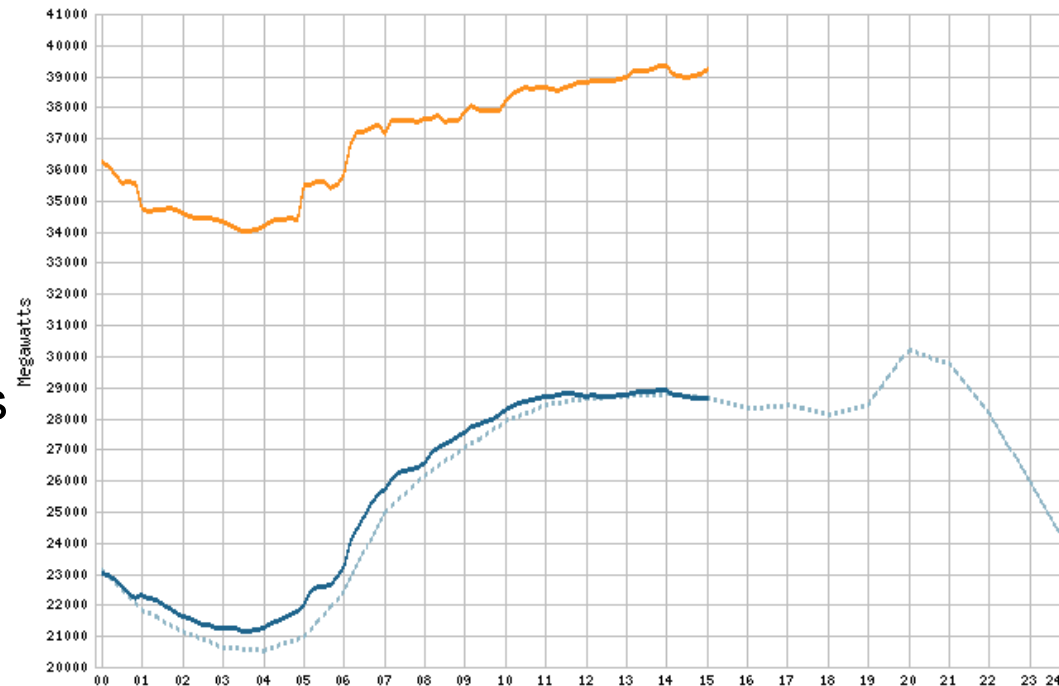
[Made Easy](#)

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How is non-ISO metered solar pv affecting our load?

- Unknown reduced load / non conforming load.
- Load statistics are skewed by gradual non-ISO metered increase.
- Non-ISO metered effects are included as average reductions by models.
- More accurately procure reserves?

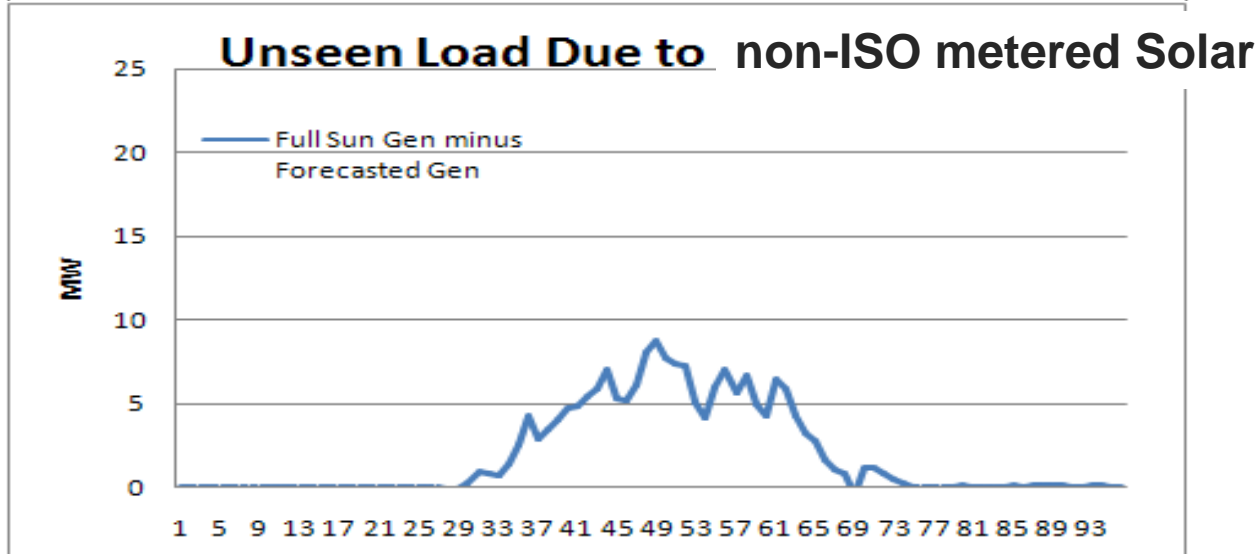
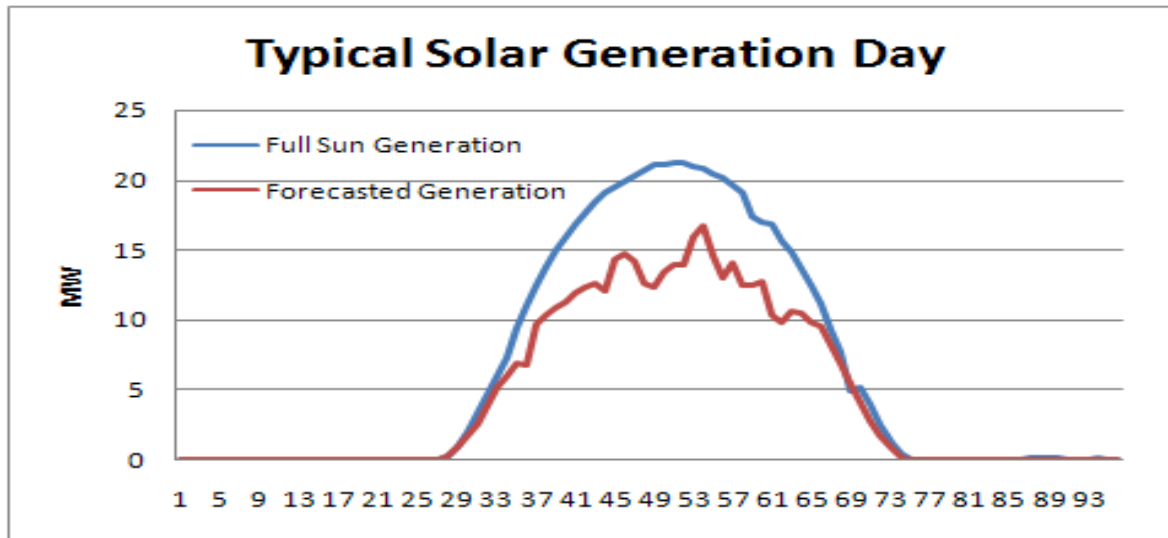
Today's Outlook



Predicting non-ISO metered pv by load zone

	<u>CSI Rating (MWac)</u>	<u>County Distribution Factor</u>	<u>Shading & Soiling Factor</u>	<u>non-ISO metered Solar MWac</u>	<u>Typical Max Proxy Gen Output (MW)</u>	<u>Scale Factor non- ISO metered/Proxy</u>
<u>PGE Bay Area</u>						
Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara	169.7	1	0.9	152.73	X	Y
<u>SCE Coastal</u>						
Orange & Ventura	72.1	1	0.9	64.89		
LA (not incl North of Tehachapi mtns or City of LA)	128	0.25	0.9	28.8		
Santa Barbara (portion served by SCE)	9.1	0.6	0.9	4.914		
				98.604	X	Y
<u>SCE Inland</u>						
San Bernardino, Mono, Inyo, Tulare	76.5	1	0.9	68.85		
Kern	47.9	0.5	0.9	21.555		
LA (north of Tehachapi mtns)	128	0.25	0.9	28.8		
Riverside	63.7	1	0.9	57.33		
				176.535	X	Y
<u>SDGE</u>						
San Diego	94.5	1	0.9	85.05	X	Y
<u>PGE Non Bay Area</u>						
All counties in California not included above except Sacramento, DelNorte, Siskiyou, Modoc	243.7	1	0.9	219.33		
Kern	47.9	0.5	0.9	21.555		
				240.885	X	Y
Behind-the-Meter Solar Total MWac						
				753.804		

Separating load from solar



How do we maintain grid reliability?

Building prototype of load forecasts accounting for non-ISO metered solar pv:

- For five load zones
 - Compute load forecast accounting for non-ISO metered solar pv
 - Full sun forecast minus weather-based forecast
- To improve accuracy
 - Add non-ISO metered solar load forecast to Automatic Load Forecast System (ALFS) load forecast
 - We expect additional load above ALFS load forecast due to weather effects
- This process will improve total ISO ALFS load forecast

PIER funded research –EnerNex

(Contract 500-10-060)

- Facilitate grid integration of variable generation resources
- Goals and Objectives
 - Improve solar forecasting techniques using combined data from satellite and ground sensors
 - Validate forecasts against known PV generation output obtained from minute by minute SCADA data
 - Model renewable energy’s variability impacts on generation resource planning, utility operations and grid reliability
 - Perform a grid analysis study to incorporate solar PV penetration at rates up to 45% in California’s Inland Empire area
 - Transfer forecasting and impact models to UWIG working groups to impact models into NERC and WECC models and Industry
- Major deliverables
 - Report describing intra-hour forecast accuracy for satellite forecast, sky imager forecast, and the combination of the two
 - Report describing improvements in intra-hour forecast accuracy for a satellite-only versus a satellite + sky imager ramp rate forecast
 - Report containing the calculated solar output (ramp rate) based on the data available
 - Power system and PV generation models
- Team
 - EnerNex, SCE, Advantech, UCSD & CAISO

PIER funded research – Clean Power Research

(Contract 500-10-059)

- Demonstration & validating pv output modeling approach
- Goals and Objectives
 - CPR has developed methodology that uses satellite derived solar resource data to forecast pv fleet output given the design attribute and locations of the pv systems
 - To demonstrate and validate the methodology in collaboration with the CAISO in order to measure model accuracy and ensure compatible data delivery.
 - Result will be a validated methodology that forecast PV fleet output and delivers information to support CAISO in it planning and operations.
- Major deliverables
 - Fleet Performance Report
 - Fleet Model Validation
 - Technology transfer
- Team
 - Clean Power Research, Dr. Richard Perez, Sol Verde engineering, CAISO

PIER funded research – AWS Truepower (Contract 500-10-057)

- Application of a solar forecasting system to a utility sized pv plants on a spectrum of timescales.
- Goals and Objectives
 - Incorporate satellite & other observations into advanced meteorological modeling
 - Incorporate models over various time periods
 - Develop metrics to estimate reductions in forecast errors
- Major deliverables
 - Solar Forecasting systems
 - Optimization of forecasting products
 - Technology Transfer
- Team
 - AWS Truepower, Clean Power Research, UCSD, Servitek, CAISO

PIER funded research – UCSD

(Contract 500-10-043)

- How solar forecasting RD&D can help advance DG, RPS, and AB32?
- Goals and Objectives
 - What is of RD&D in advancing DG, RPS, and AB32?
 - Which technologies or components should RD&D focus on?
 - What issues impede deployment of DG technologies in utility distribution systems?
 - What other future research direction may be recommended to help advance DG
 - Role of RD&D in solar forecasting.
- Major deliverables
 - Maintain equipment and data transfer through CAISO to UC San Diego.
 - Conduct forecasting of pv plant power output for 6 months
 - Description of experimental data and algorithms used to deliver power output forecasts.
 - Analysis of the performance of the forecast against actual output data.
 - Recommendations for future applications of sky imagery for solar forecasting.
- Team
 - UCSD, EnerNex, AWS Truepower Garrad Hassan, Clean Power Research, Byron Washom, CAISO.

Sky Imager Project – Copper Mountain UCSD

- 2 Total Sky Imagers operational on site
- CAISO is receiving real time images

Video to be installed when I get
to meeting

Thank You

Special thanks for prototype non-ISO metered forecast to:

Gary Klein

Power Systems Forecaster Specialist

Rebecca Laferriere

Associate Power Systems Forecaster Specialist

Dennis Gaushell

Power Systems Technology Operations

Jim Blatchford

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