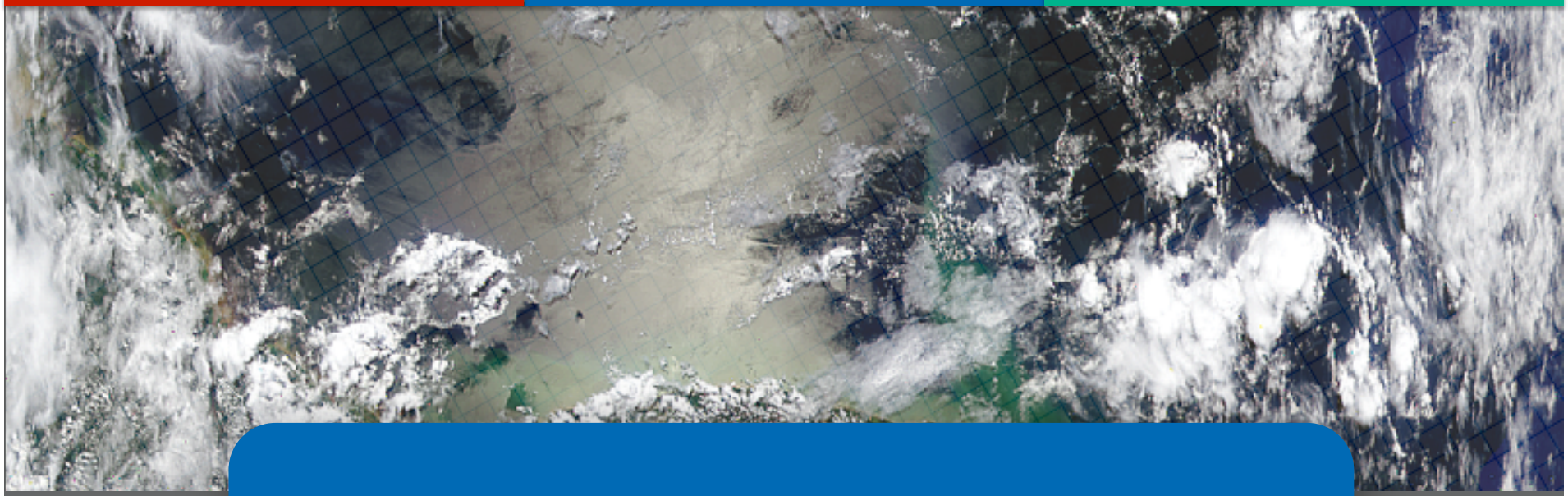

The Role of Solar Forecasting in the Energy Transformation

Jeff Ressler
President, Software Services

Clean Power Research®

August 19, 2015

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Work Shown is a Result of Multiple Projects

- California Solar Initiative RD&D
- DOE SUNRISE (for California ISO)
- CEC EPIC (CPR Teamed with Itron)
- Mexico
  - UNAM - IER
  - CONACYT
  - With Mexico-based partner Solartronic

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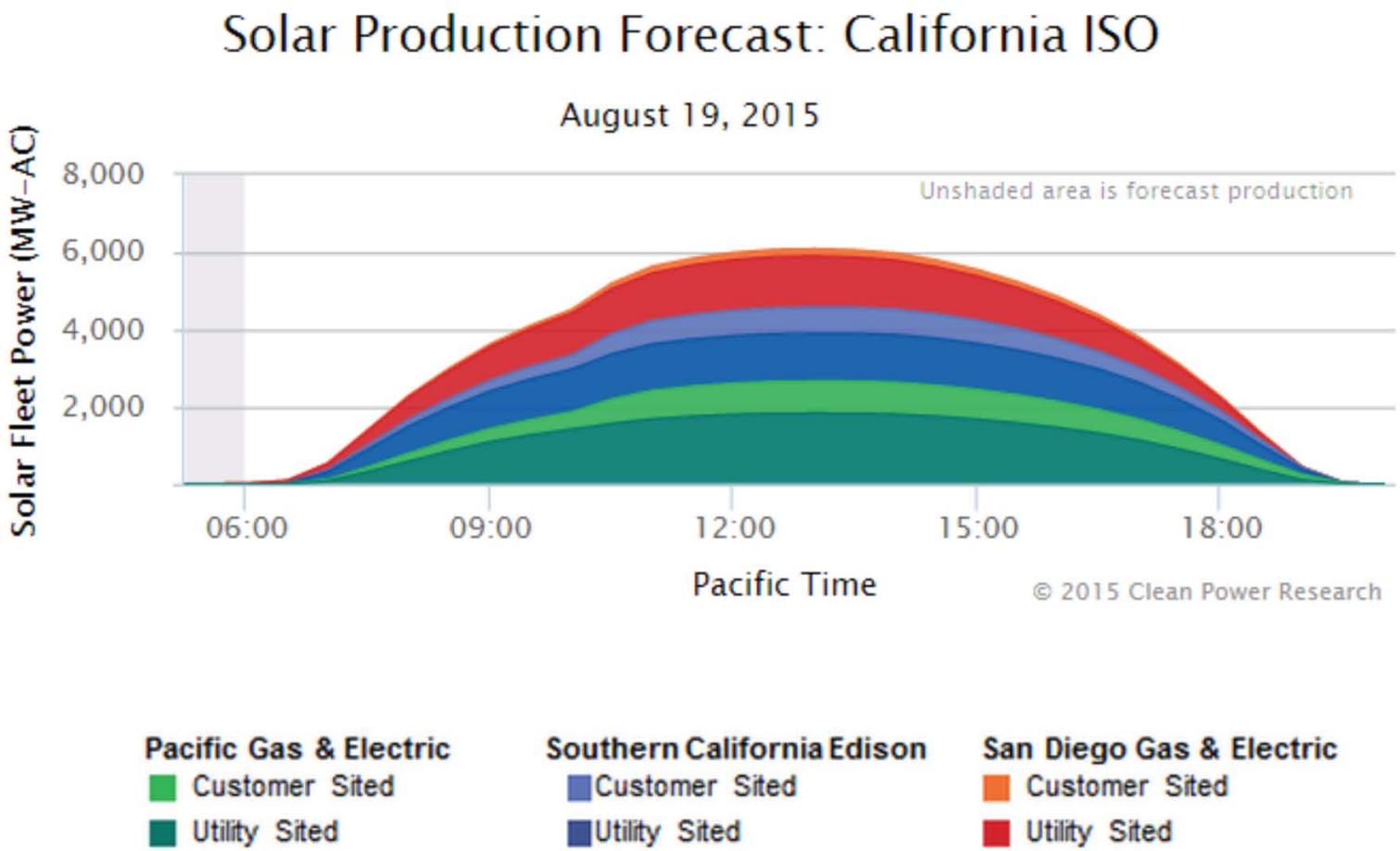
PV Fleet Power Forecasting



Note: Utility Sited systems include intertie systems in NV and AZ

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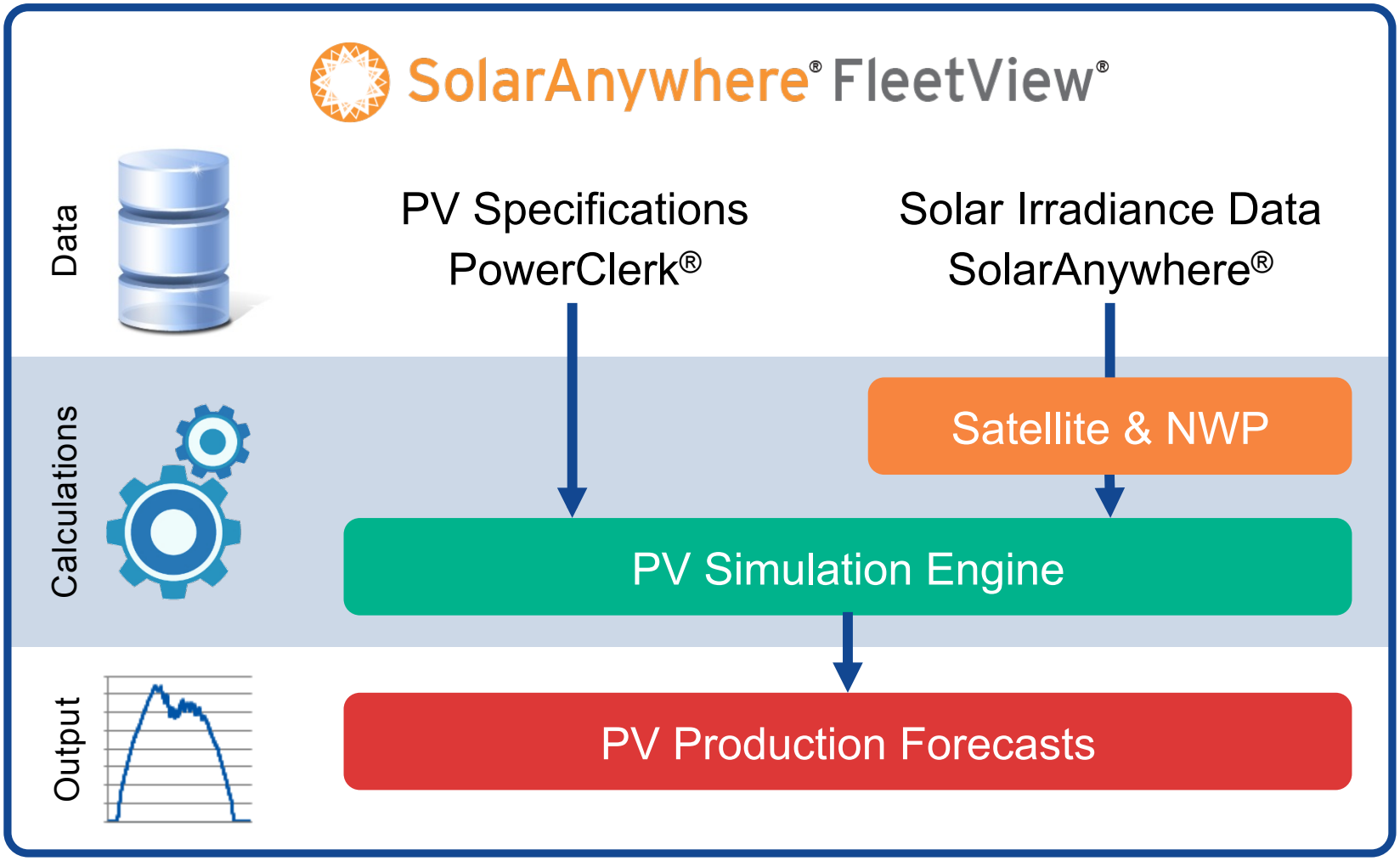
FleetView® PV Simulation Methodology



FleetView methodology also supports historical simulation needs

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STANDARD RESOLUTION | ENHANCED RESOLUTION

You are logged in as public | Change Login

Zoom in to select location(s)

Select Time Period

2014

Start Date

1/1/2014

End Date

12/31/2014

Solar Model

v2.4

☐ Include Wind/Temperature*

* Paid Option

No tiles selected

Get Data

Estudio sobre el uso de la energía solar en aplicaciones residenciales, industrials y comerciales en diferentes estados del país

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RESOLUCIÓN MEJORADA

Bienvenido test.conacyt@gmail.com | Finalizar la sesión

Amplíe para seleccionar ubicaciones

Seleccione el período	Fecha de inicio	Fecha de finalización	Modelo Solar
1998	1/1/1998	12/31/1998	v2.4

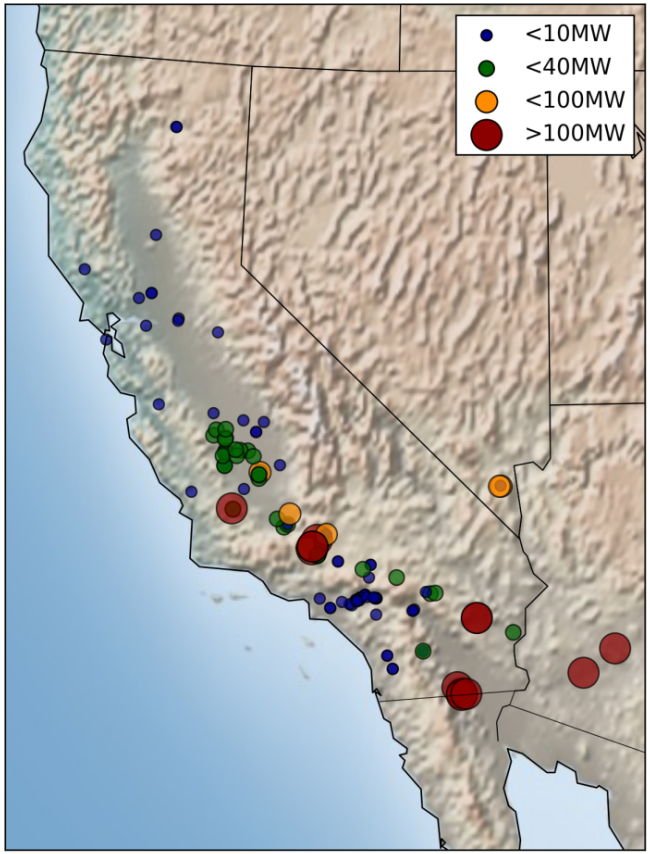
Incluir viento y temperatura

* Opción de pago

No tiles selected

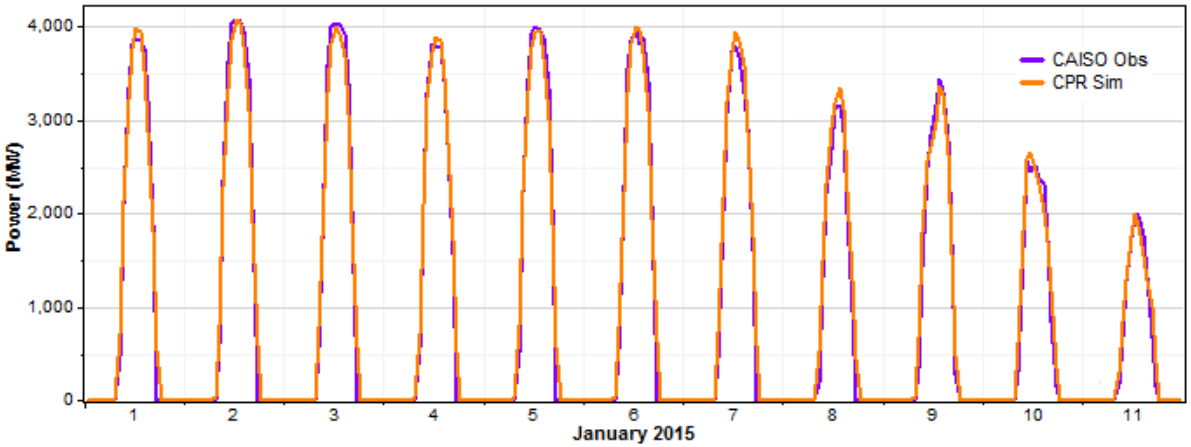
Obtener datos

California Metered PV System Simulations



- Accurate utility-scale PV simulations require detailed site specifications (PV modules, inverters, orientation, row spacing, etc.).
- Same methodology as pre-construction PV energy simulations (PVsyst, SAM, etc.)

Aggregated CAISO Fleet PV production



120+ Metered Utility-Scale PV Systems in the CAISO region

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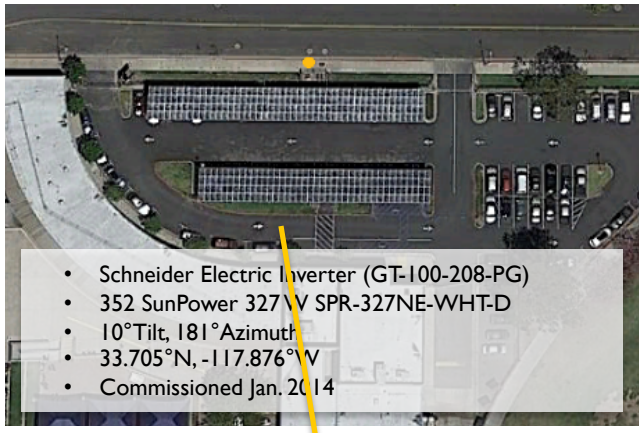
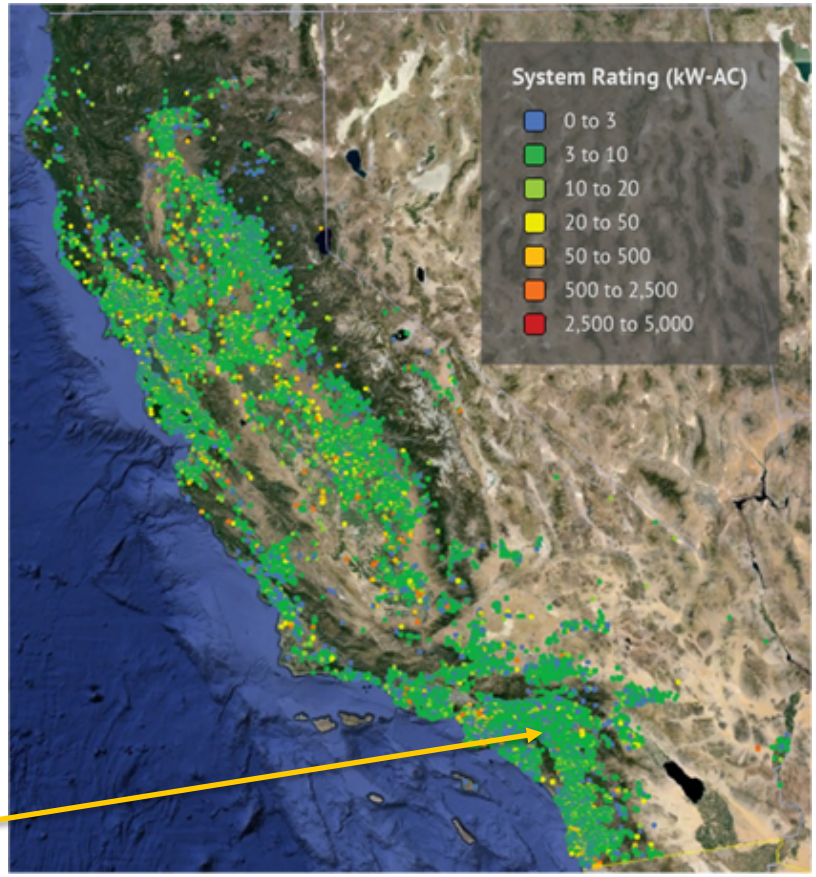
CA Behind-the-Meter (BTM) PV Fleet Simulation

- PowerClerk® links administration to fleet simulation
- Use same methodology as employed with utility-scale PV simulations





Regional and system-wide BTM simulation capabilities

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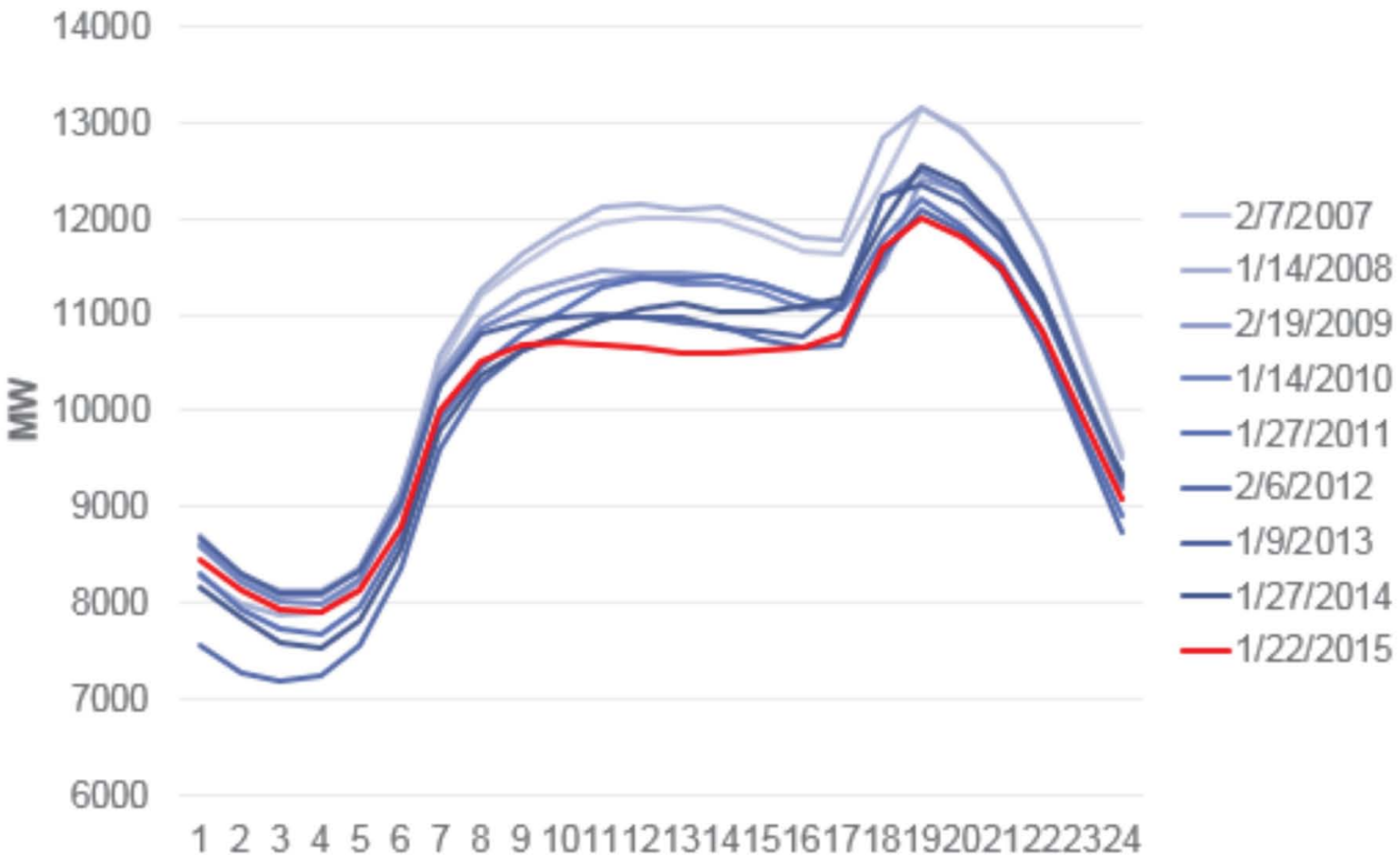
Behind-The-Meter PV Changes Load Shapes



Source: California Independent System Operator (CAISO)

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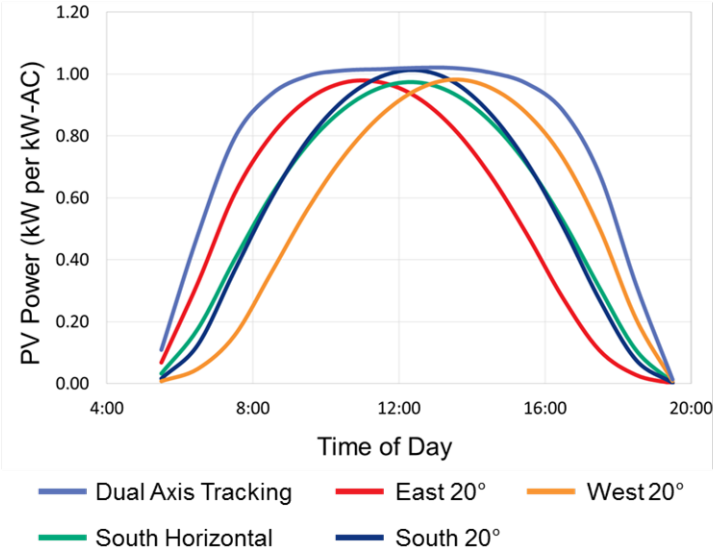
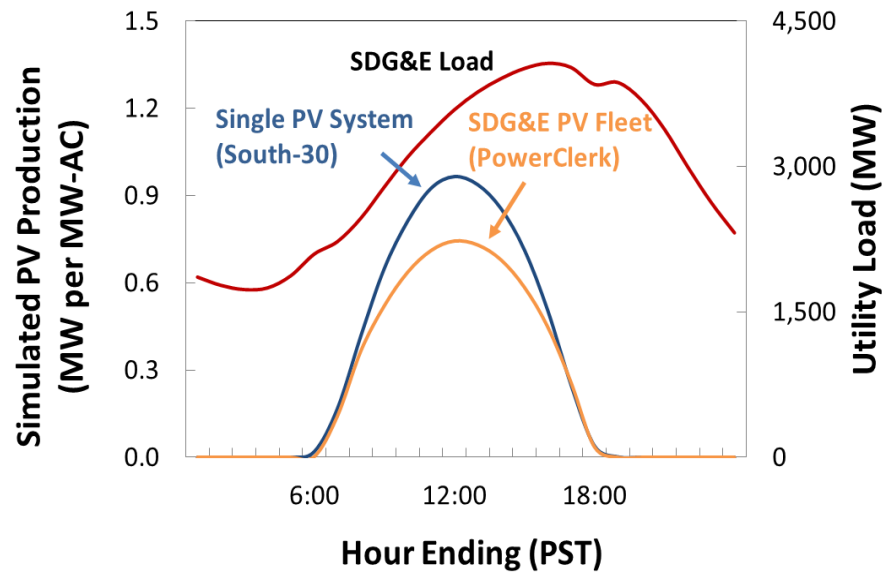
Advantages of Explicit PV Fleet Simulations

Significant variance in PV energy production by orientation



Wide distribution of PV systems can alter fleet PV energy output



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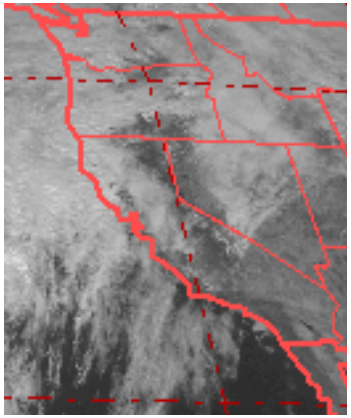
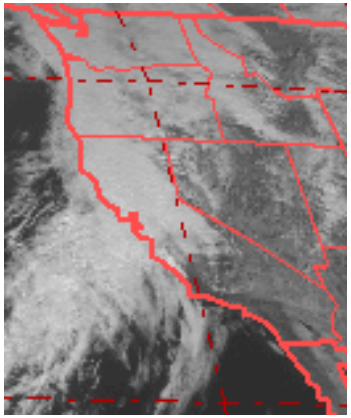
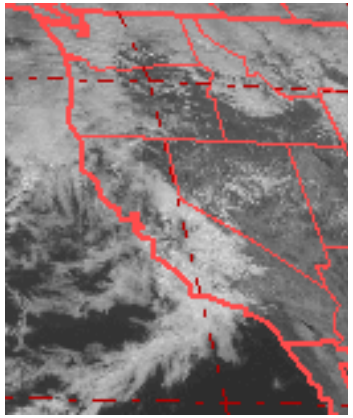
Preliminary ALFS Results (Forecasting)



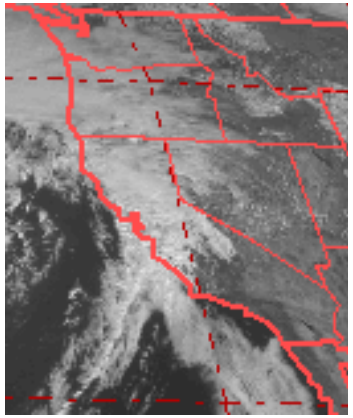
2/5 12 LST



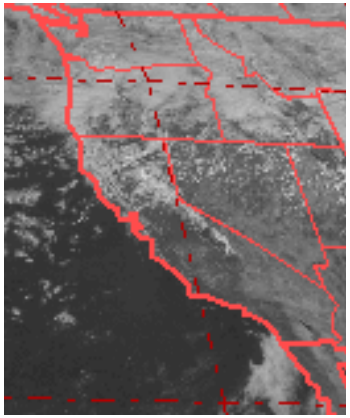
2/6 12 LST



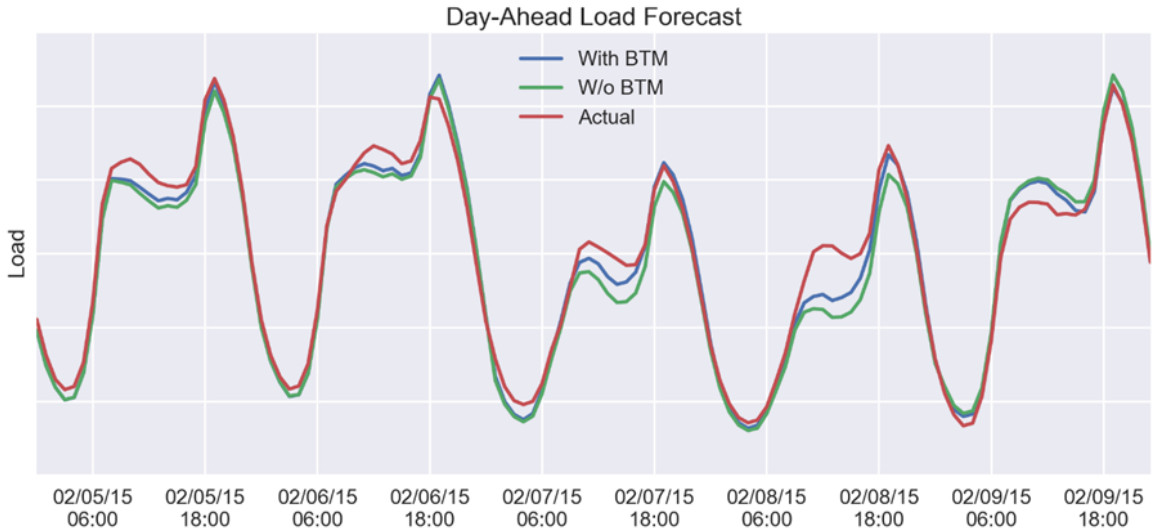
2/7 12 LST



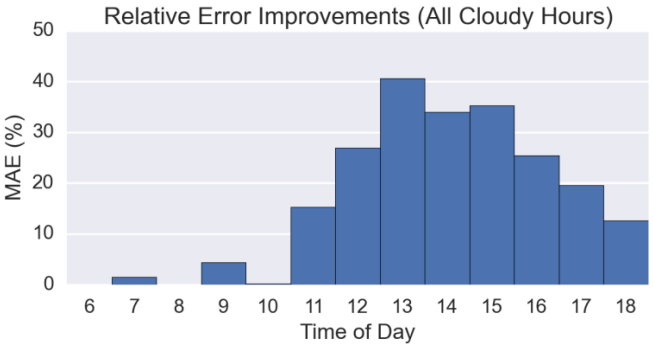
2/8 12 LST



2/9 12 LST



Hourly Error Stats



Significant day-ahead load forecast improvement observed on cloudy days with inclusion of BTM solar forecasts!

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Preliminary ALFS Results (Historical Training)

Hour of Day Ahead Forecast	9 am		12 pm		3 pm	
CPR BTM Dataset?	No	Yes	No	Yes	No	Yes
Load Forecast Error (MW)	122.3	121.7	136.7	130.1	149.3	142.7
Load Forecast Error (%)	1.11%	1.10%	1.18%	1.12%	1.27%	1.21%
BTM Coefficient	-	-0.21	-	**-0.92**	-	**-0.94**
T-test (significant if < -1.64)	-	-1.8	-	-10.1	-	-8.9

- A BTM coefficient of -1 is the ideal result (i.e., for every predicted MW of BTM generation, one MW of load is shed)
- BTM production datasets offer a statistically significant improvement for mid-day and late-afternoon load forecasting
  - results lie quite close to the theoretical value of -1
- BTM production datasets offer a smaller impact for morning load forecasting
  - Believed to result from higher morning load variability

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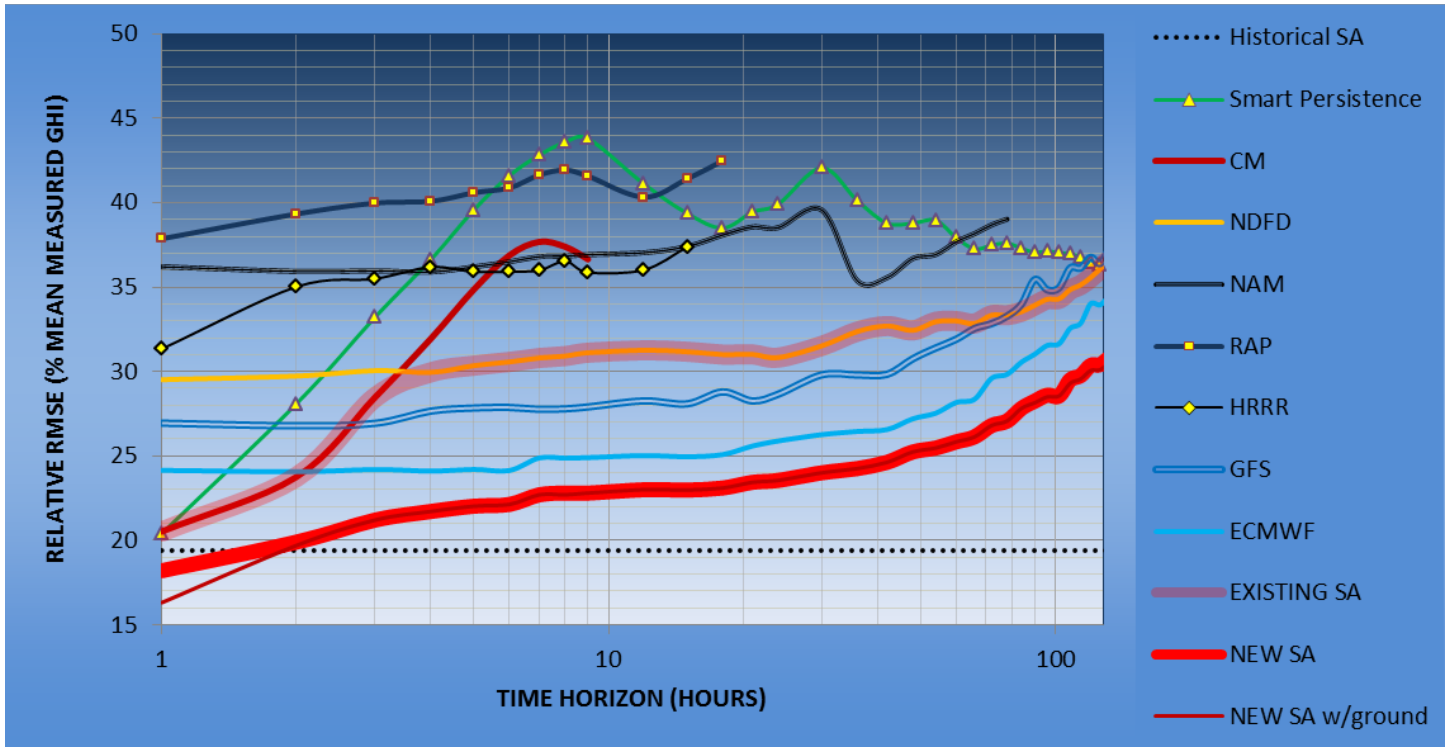
Implementing Next Generation Forecasting



Ensemble Solar Energy Forecasts

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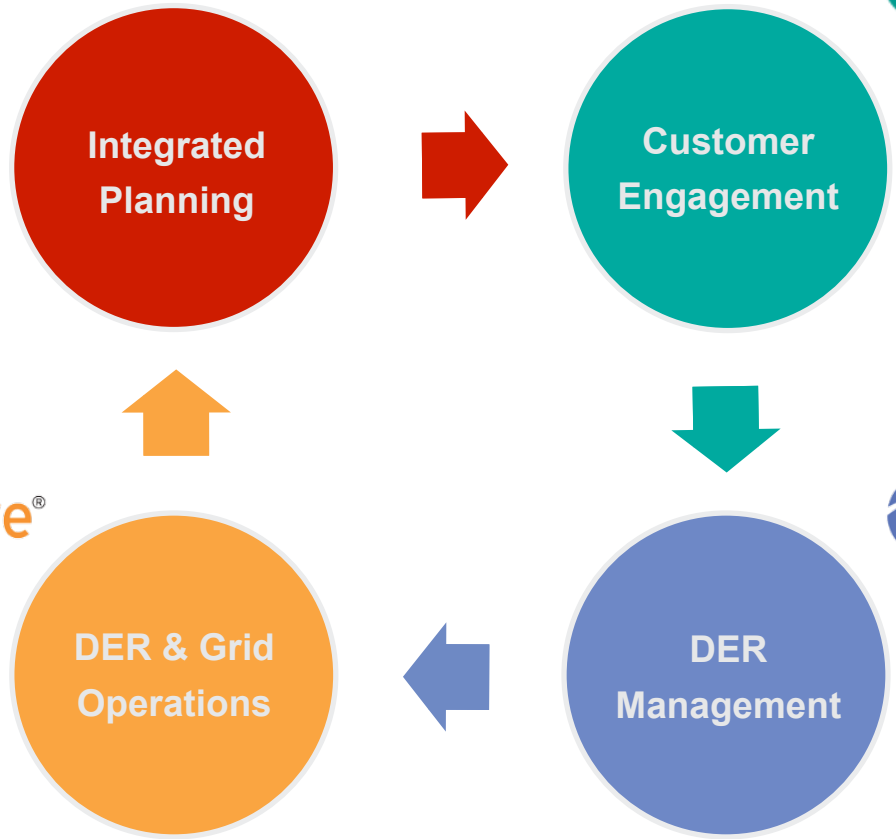
A Key Step in the Distributed Energy Resource (DER) Lifecycle

DER Planning Tools

Plan for and guide household DER adoption



WattPlan™

30 million quotes and counting

PowerClerk®

>70% of US PV incentives processed

SolarAnywhere®

PV forecast provider for CAISO, SMUD, and others

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Solar Forecasts in the Energy Transformation

- Forecasting (including behind-the-meter) will be critical with higher penetration PV
- Preliminary results demonstrate that detailed PV fleet simulations can improve load forecast accuracy (especially under challenging cloudy day conditions)
- Other considerations exist beyond forecast accuracy:
  - Maintaining the system (e.g., where will the PV system spec data come from? Is it scalable as number of PV systems grows?)
  - Integrating forecasts into existing tools
- Science advancing
  - Infrared to enhance pre-dawn and early morning accuracy
  - Ensemble forecasts

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Thank you

Please feel free to contact me for any details or clarification related to presentation

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