Behind-the-Meter PV Fleet Forecasting

UTILITY VARIABLE-GENERATION INTEGRATION GROUP
FALL TECHNICAL WORKSHOP, Oct. 25, 2012

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Overview

- Simulate PV output for entire fleet of behind-the-meter PV systems in California
- Validate accuracy for selected systems (Preliminary Results)
- Special thanks to Jim Blatchford, California ISO for his support

Simulate PV Output Using SolarAnywhere®

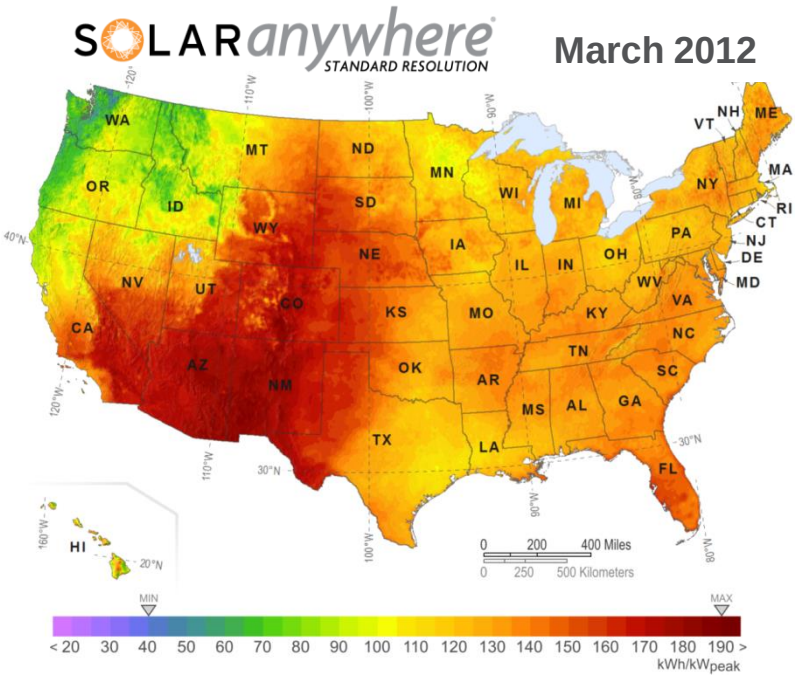
Web-accessible solar irradiance data & analytical tools

Irradiance data

- Satellite-derived time-series data
- Historical values from 1998 through latest hour
- Forecasts up to 7-days in advance

Analytical tools

- PV system modeling (FleetView)
- Benchmark to site data (DataGage)
- PV fleet variability



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Three SolarAnywhere Resolutions

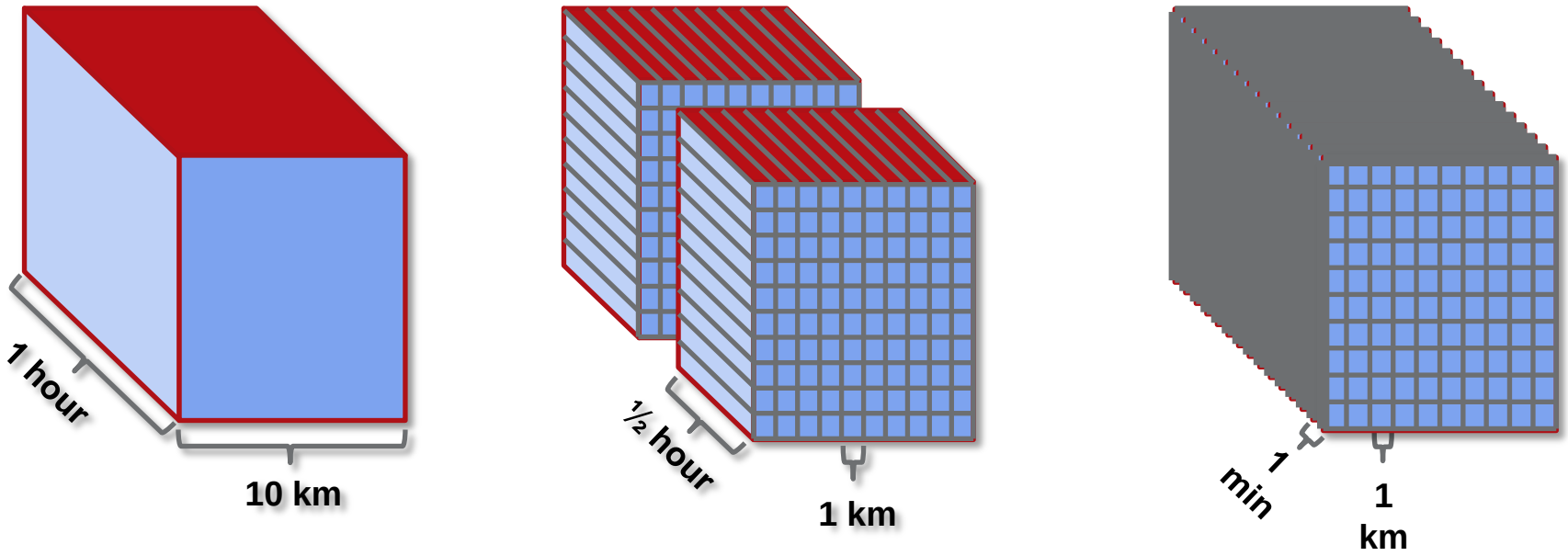
Standard Resolution
10 km, 1 hour

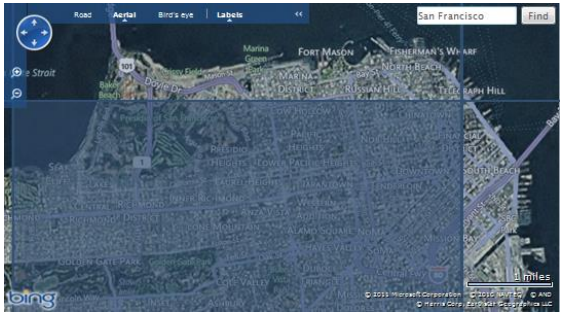
→

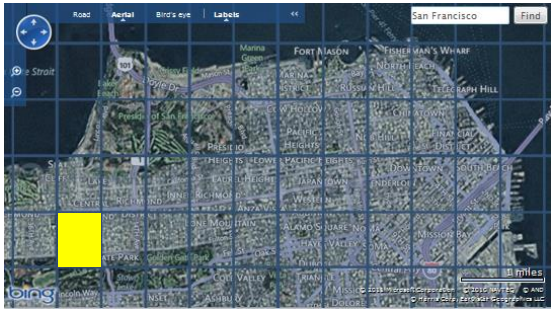
Enhanced Resolution
1 km, ½ hour

→

High Resolution
1 km, 1 minute

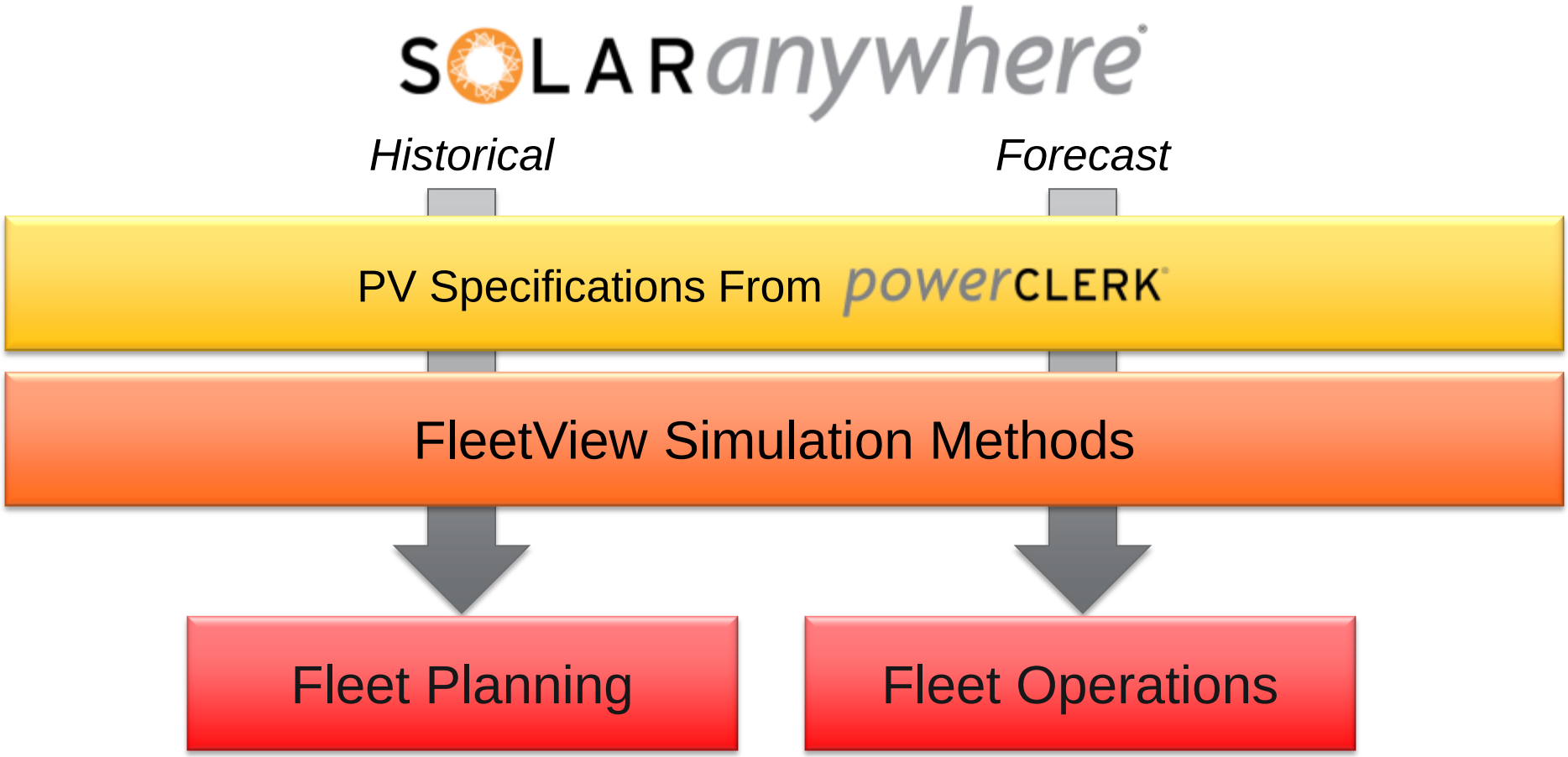






Example: San Francisco, CA

Simulate Fleet Output Using SolarAnywhere FleetView™



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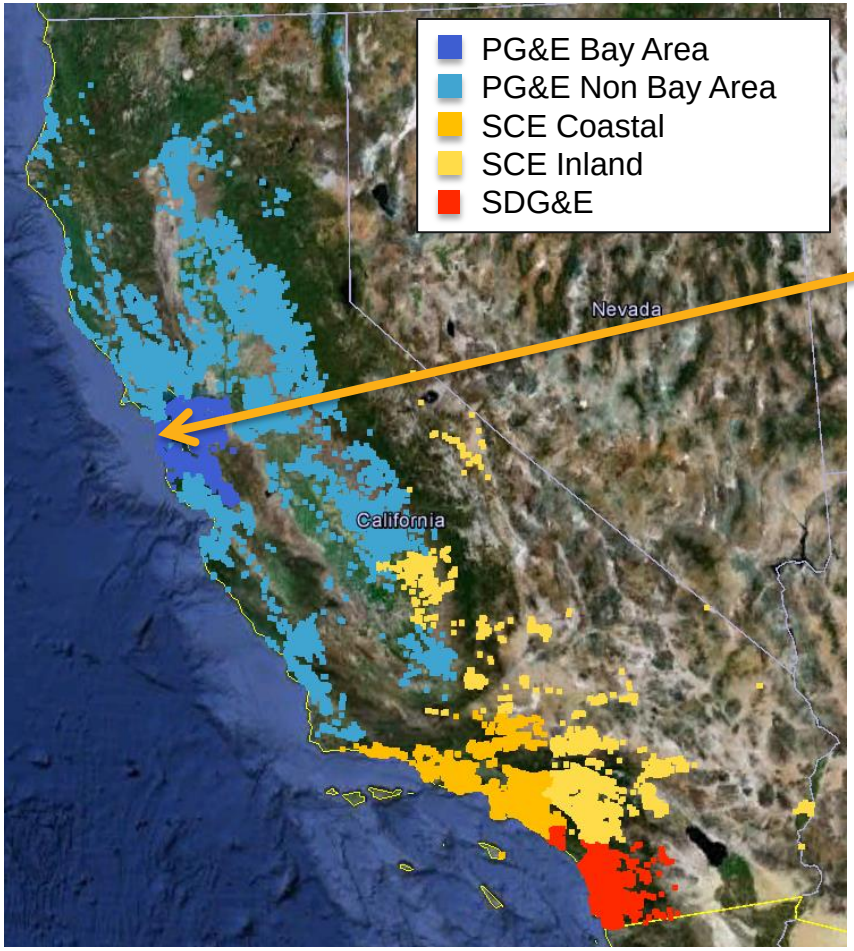
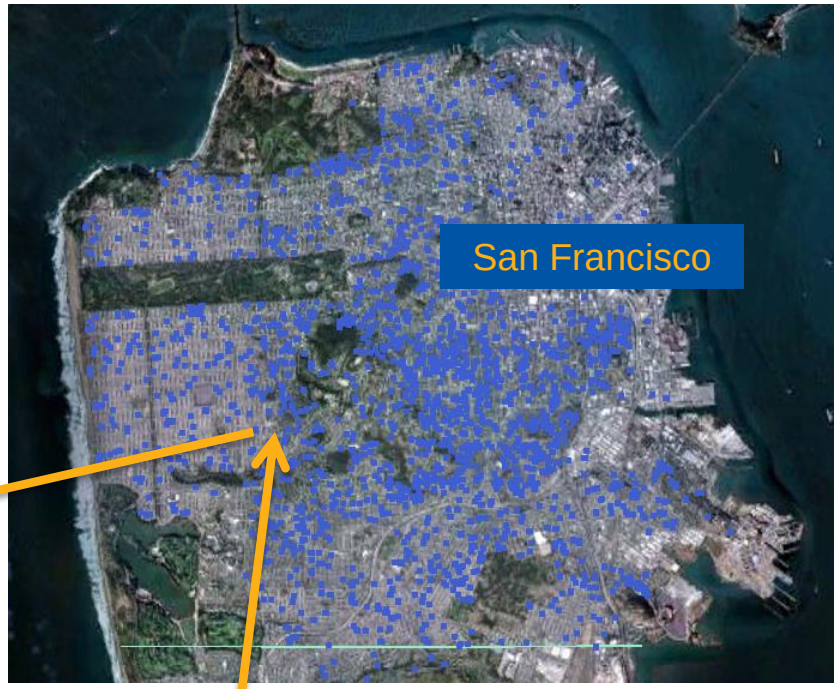
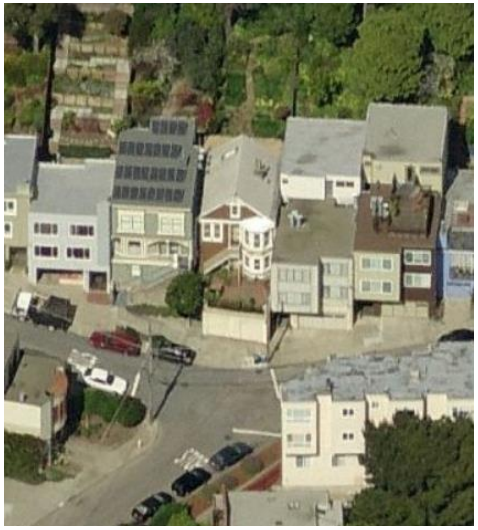
CAISO PV Fleets







- 4.49 kW-AC
- SunPower Inverter (SPR-5000X, 240V)
- 27 Modules (SunPower 210 W, SPR-210-WHT)
- 37.76281º N, 122.44313º W
- Commissioned April 2008

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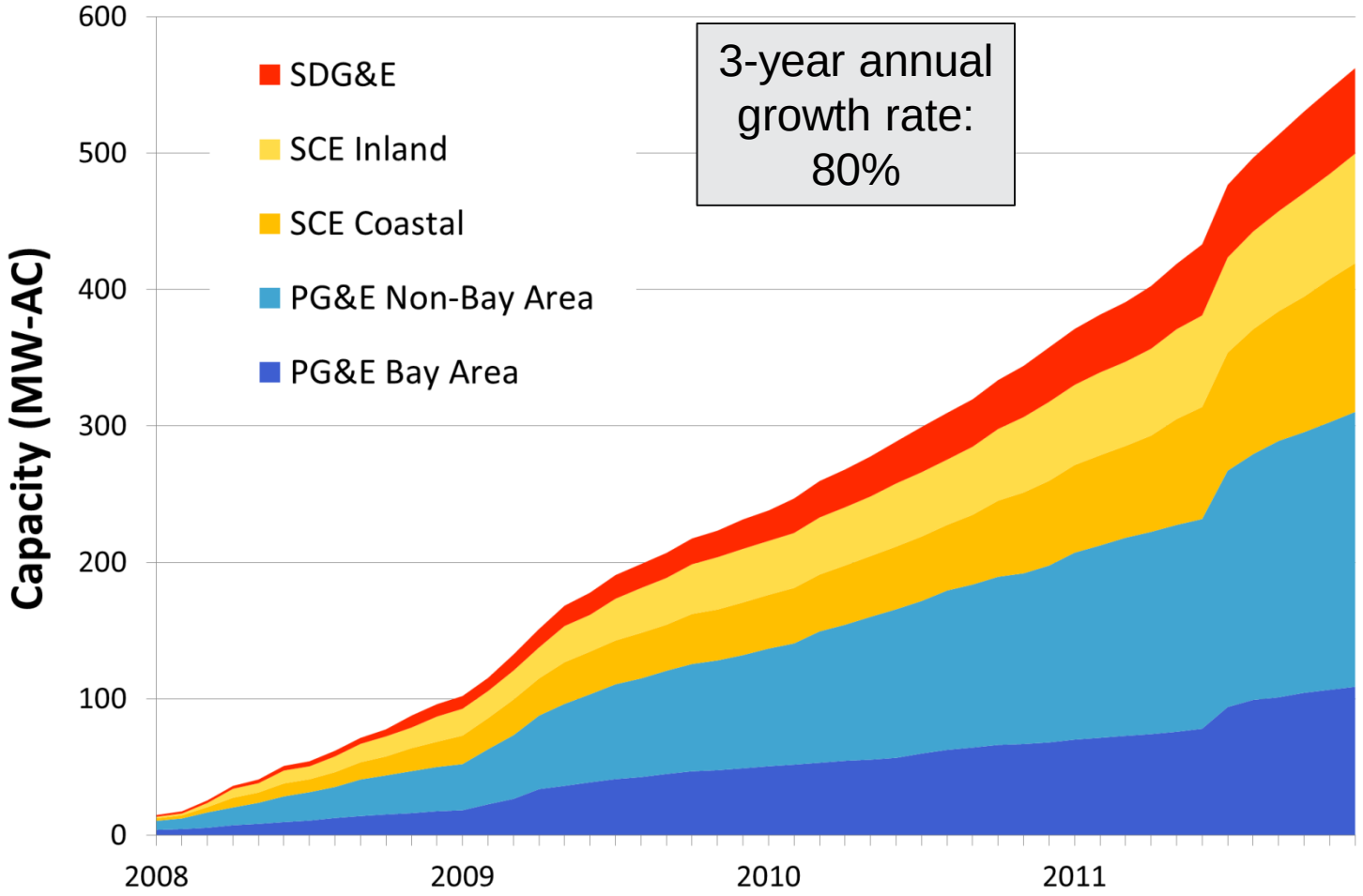
California Fleet Size Divided by CAISO Load Zones by Month (Capacity)



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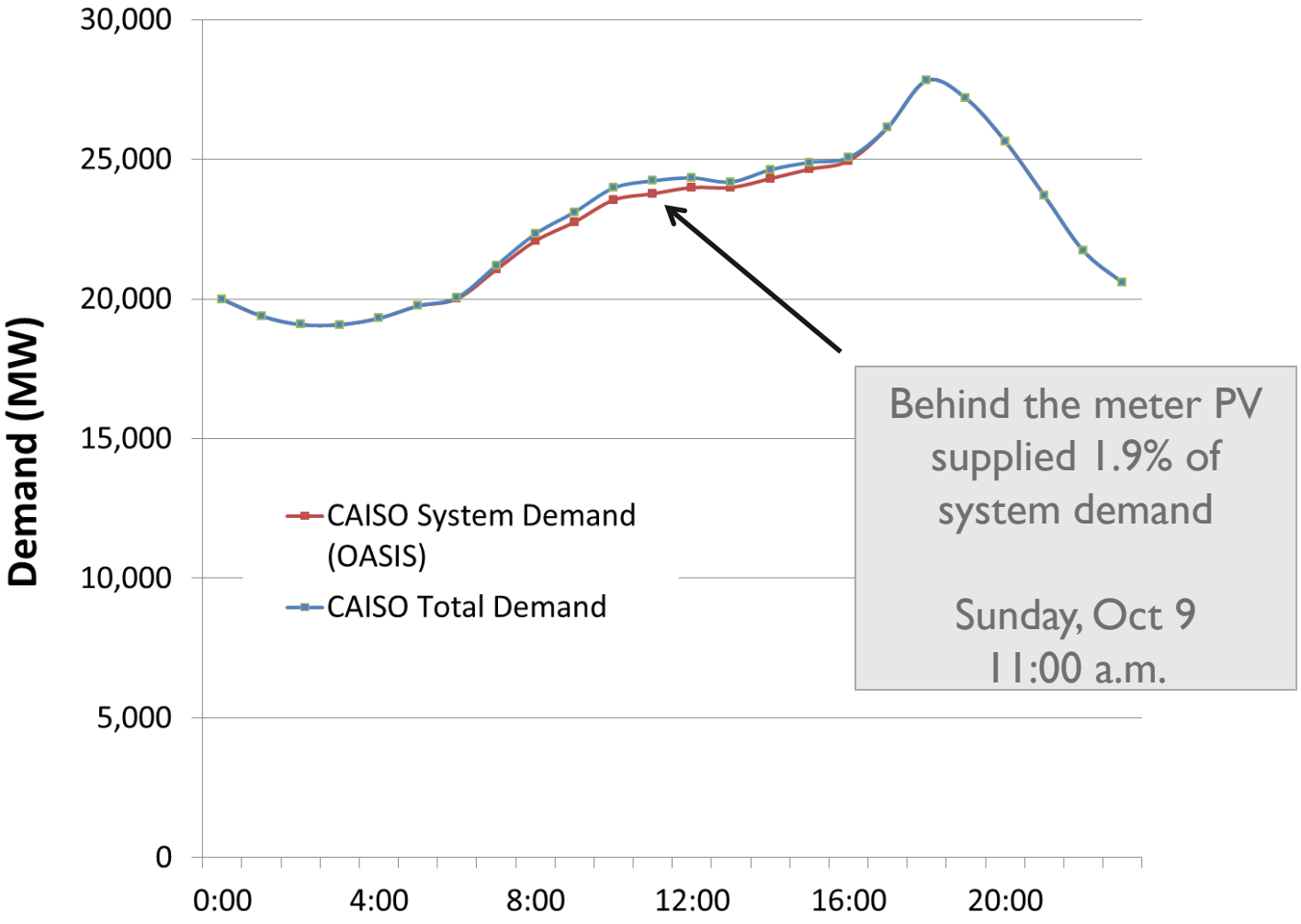
PV Fleet Contribution



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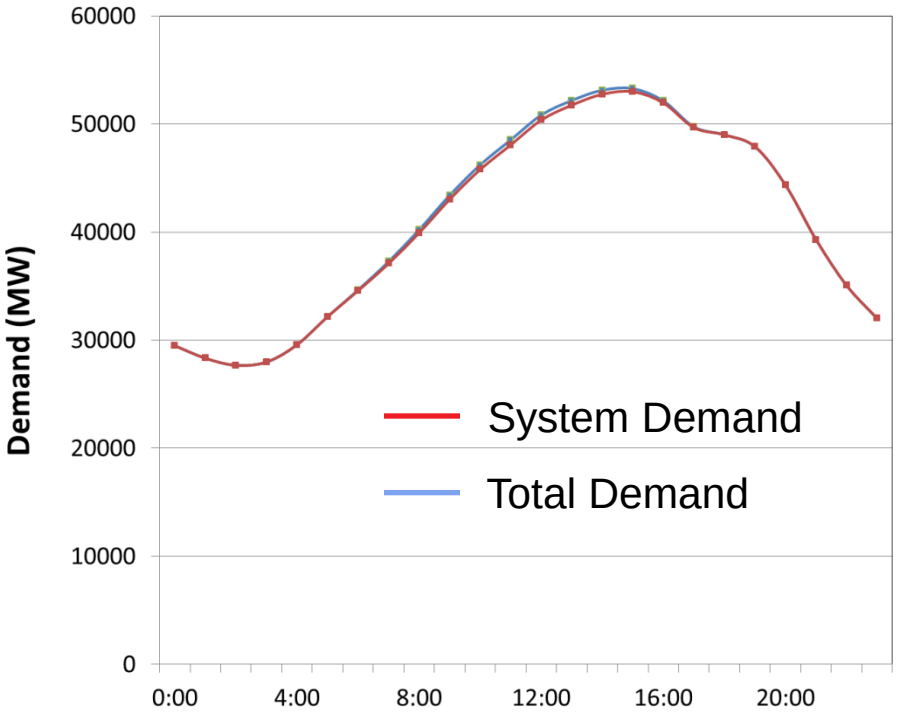
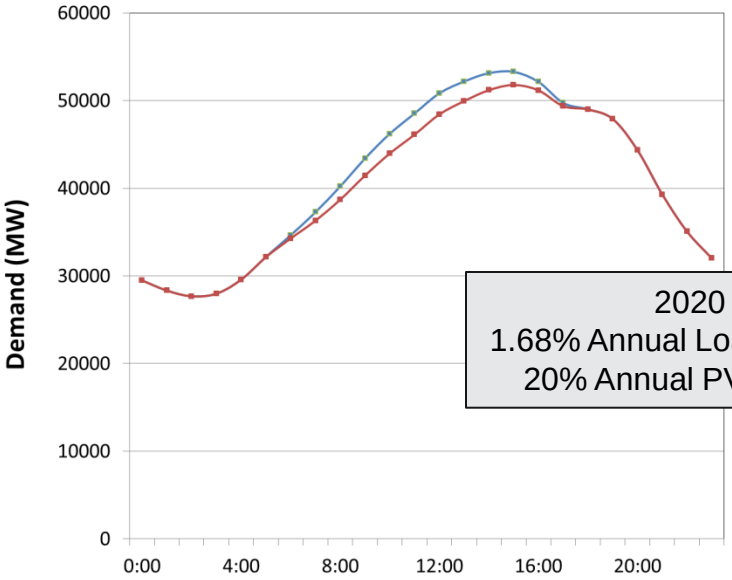
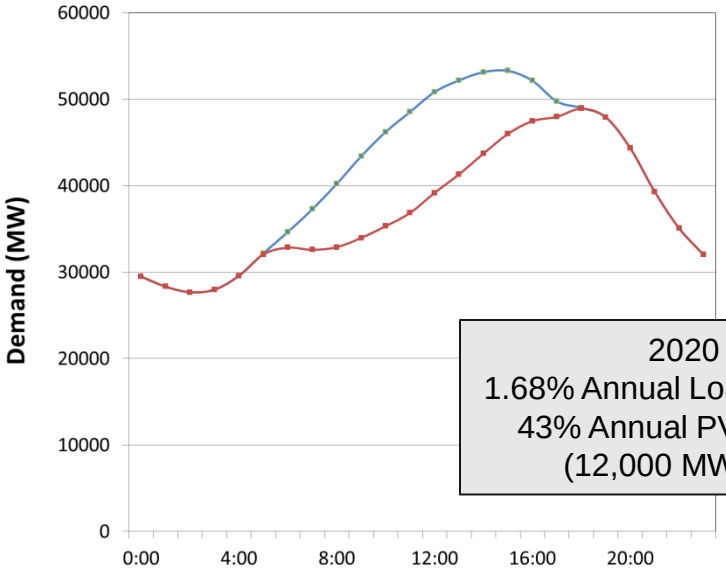
CAISO Peak Demand



2011 Actual
(Sept. 7)



2020
1.68% Annual Load Growth*
20% Annual PV Growth



2020
1.68% Annual Load Growth*
43% Annual PV Growth
(12,000 MW DG)

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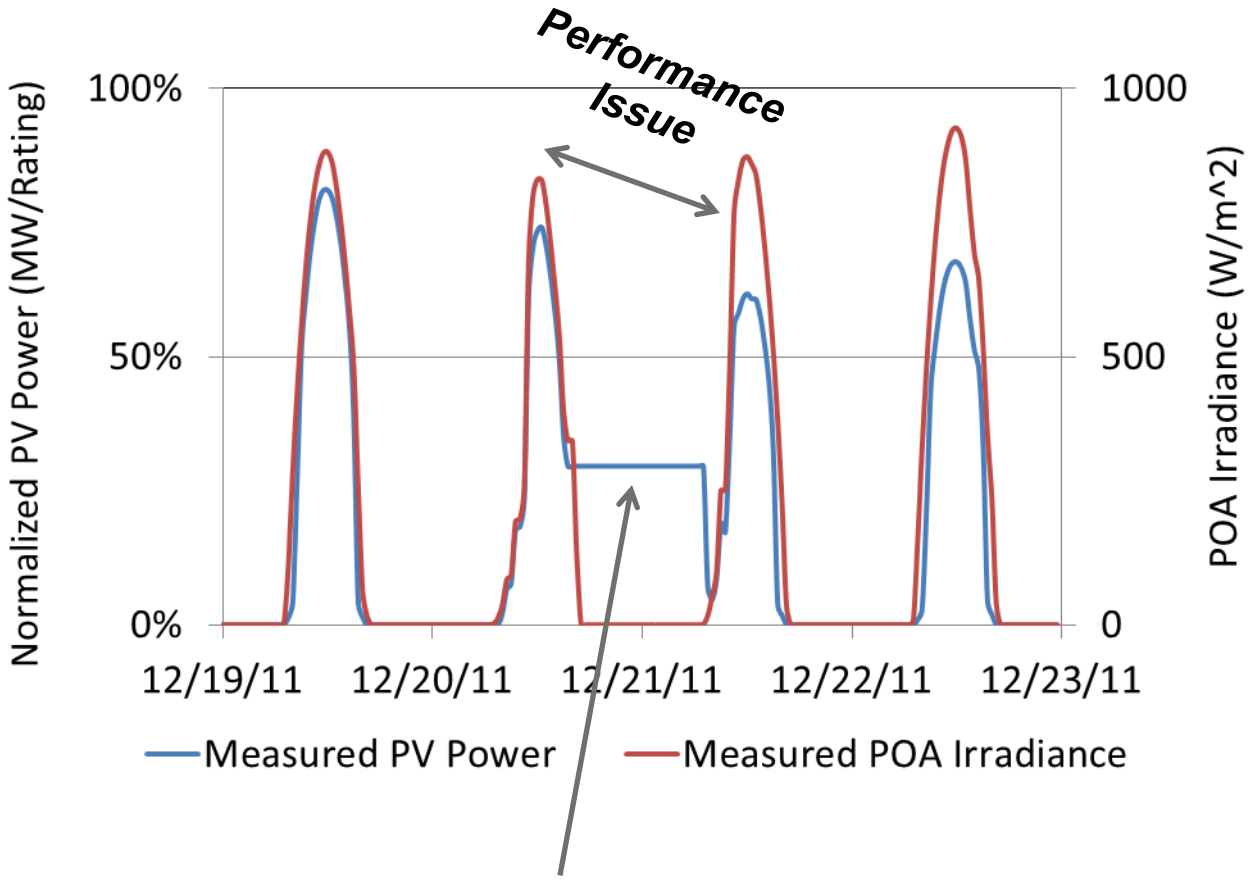
* CEC non-coincident demand forecast, 2010-2020, preliminary mid-demand case.

Validate Simulated vs. Measured PV Production

- Evaluate one year of data (9/1/11 to 8/31/12) for 18 systems
- Filter data to eliminate data collection errors while retaining PV plant performance issues
- Normalize to plant capacity to isolate effect of PV system capacity
- Evaluate three cases
  - No site tuning
  - Static site tuning
  - Dynamic site tuning

Eliminate Data Collection Errors While Retaining PV Plant Performance Issues



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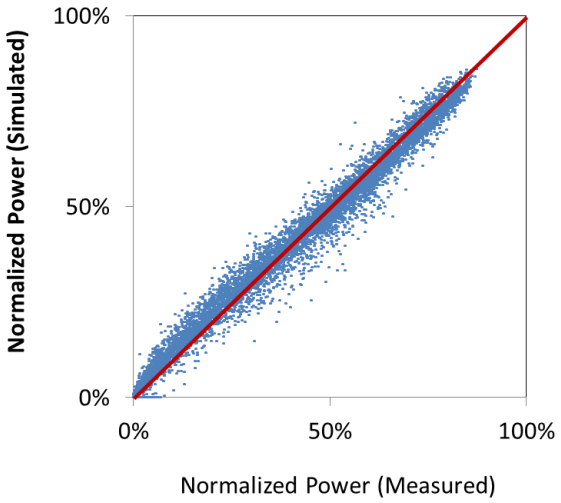
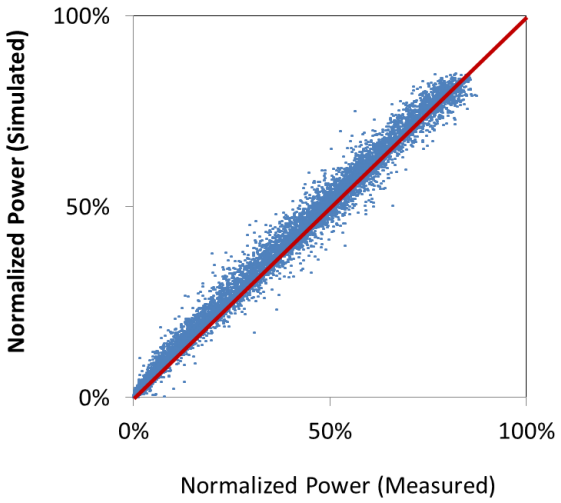
Fleet Results

Fleet Results (Capacity Normalized)

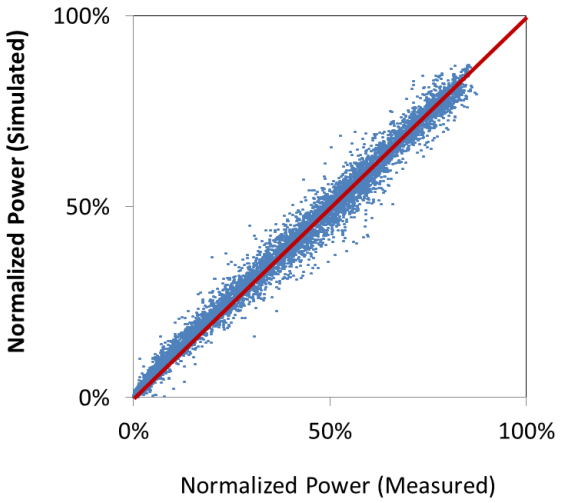
No Tuning

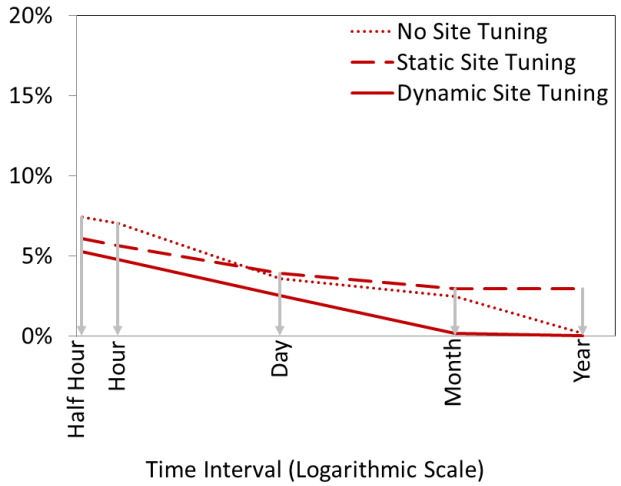


Static Tuning



Dynamic Tuning





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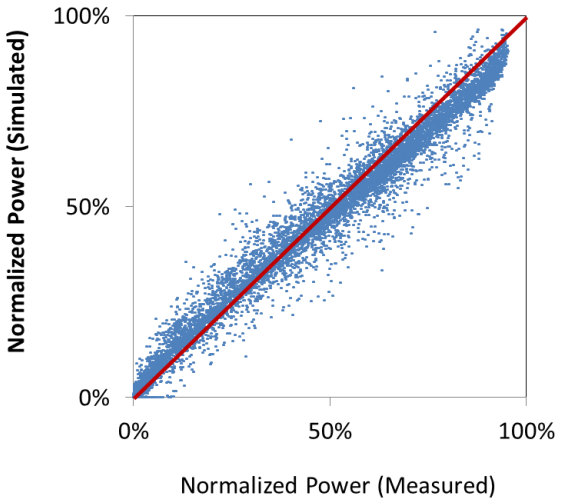
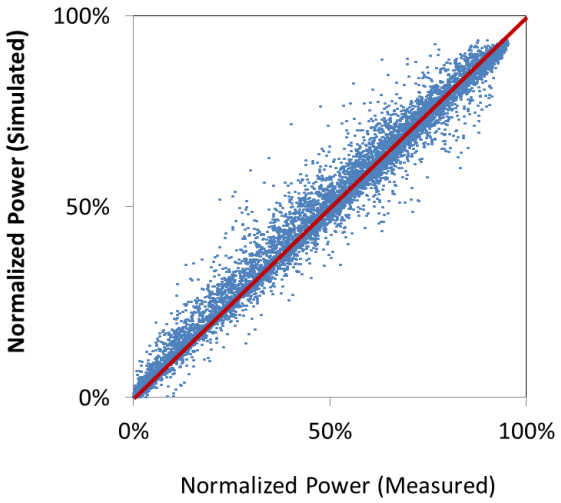
Fleet Results (Capacity Weighted)

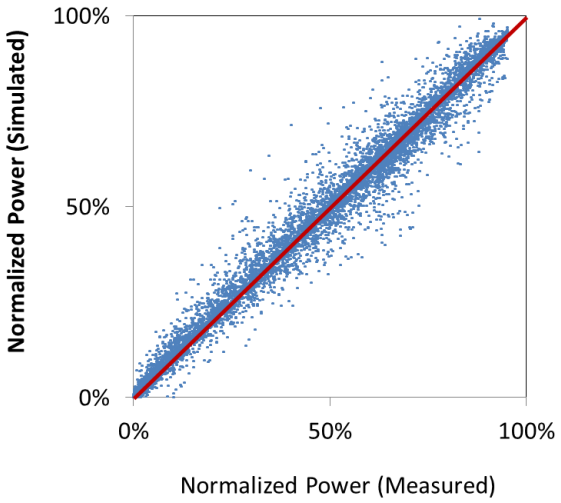
No Tuning

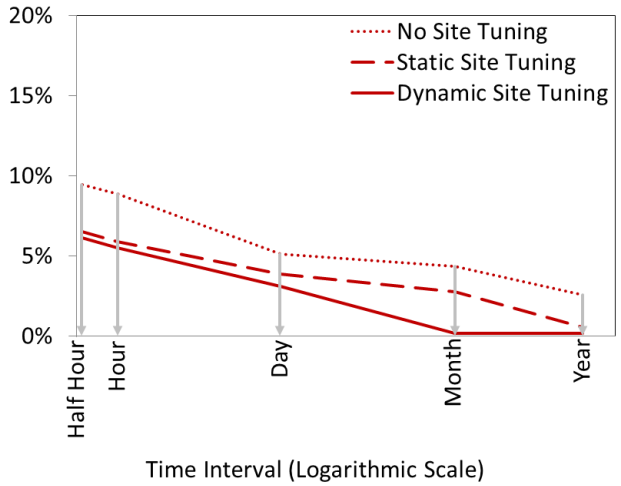


Static Tuning



Dynamic Tuning





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Conclusions

- Successfully simulating output for all CSI systems
- Static site tuning improves prediction for well performing plant
- Dynamic site tuning is needed for plants with performance issues
- Fleet simulation error is substantially lower than individual site error under all cases

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Acknowledgements

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Thank you

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Questions? Contact Tom Hoff
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