



Behind the Meter Solar:

Understanding the impact of distributed solar generation

New Perspectives on Renewable Energy

World Renewable Energy Technology Congress

August 23, 2017

- Why do we need forecasting?
- Behind the meter
- Potential Uses

About Locus Energy



Company: Founded in 2007; operating in utility, commercial, industrial & residential PV markets.

Acquired by Genscape in 2015.

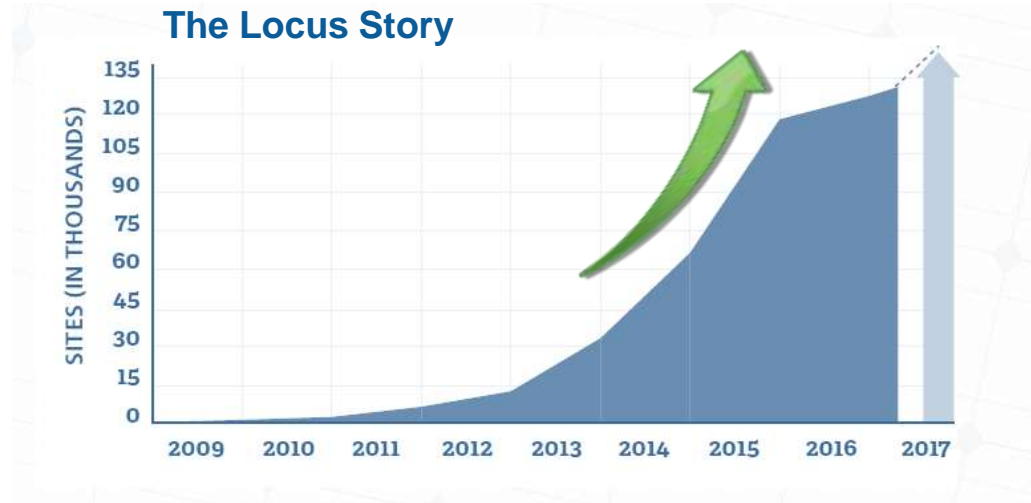
Capabilities:

- PV monitoring & Analytics
- Engineering & Development
- Managed services.

Presence:

- USA | APAC | Middle East

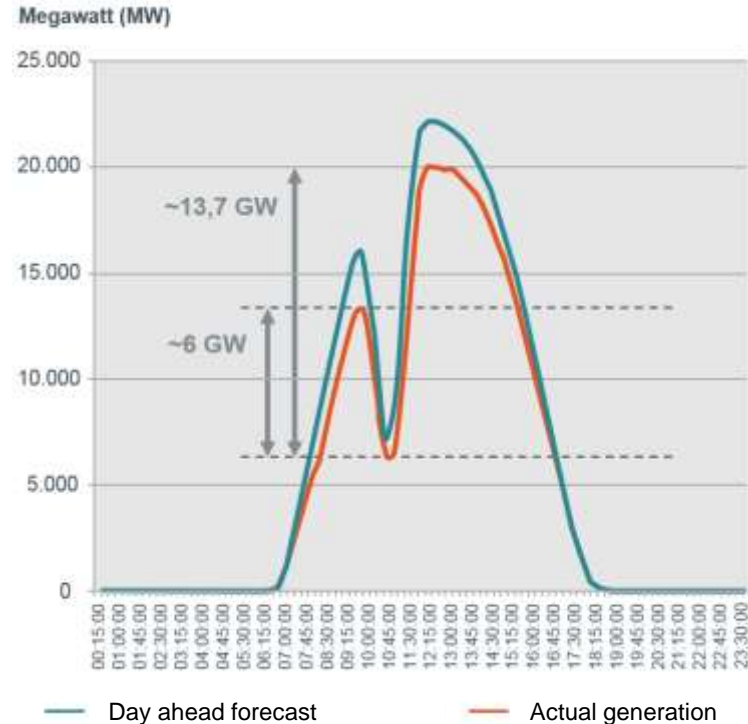
Offices: Hoboken, NJ | San Francisco, CA | Louisville, KY | Delhi, India



- *130,000+ Sites*
- *5GW*
- *80+ Billion Data Points Collected*

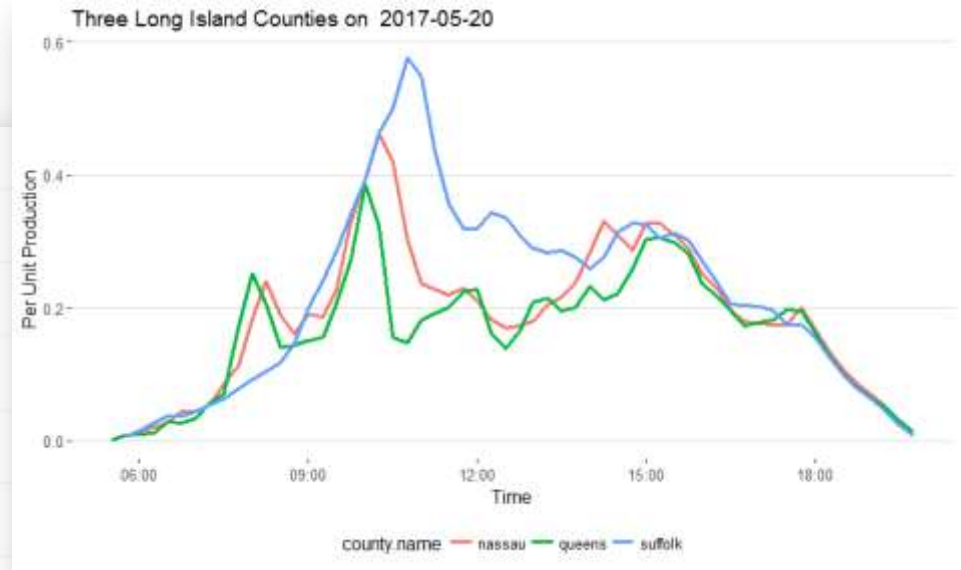
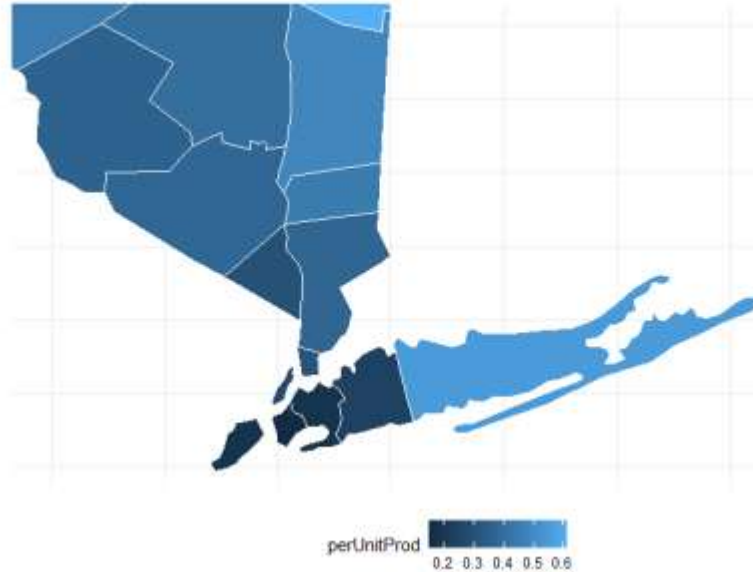
Crystal ball gazing – Forecasting the Renewable Future

- Share of RE in power-mix increasing
- Unlike conventional fossil fuel power, which can be generated as per load with greater predictability, RE production largely depends on the weather conditions.

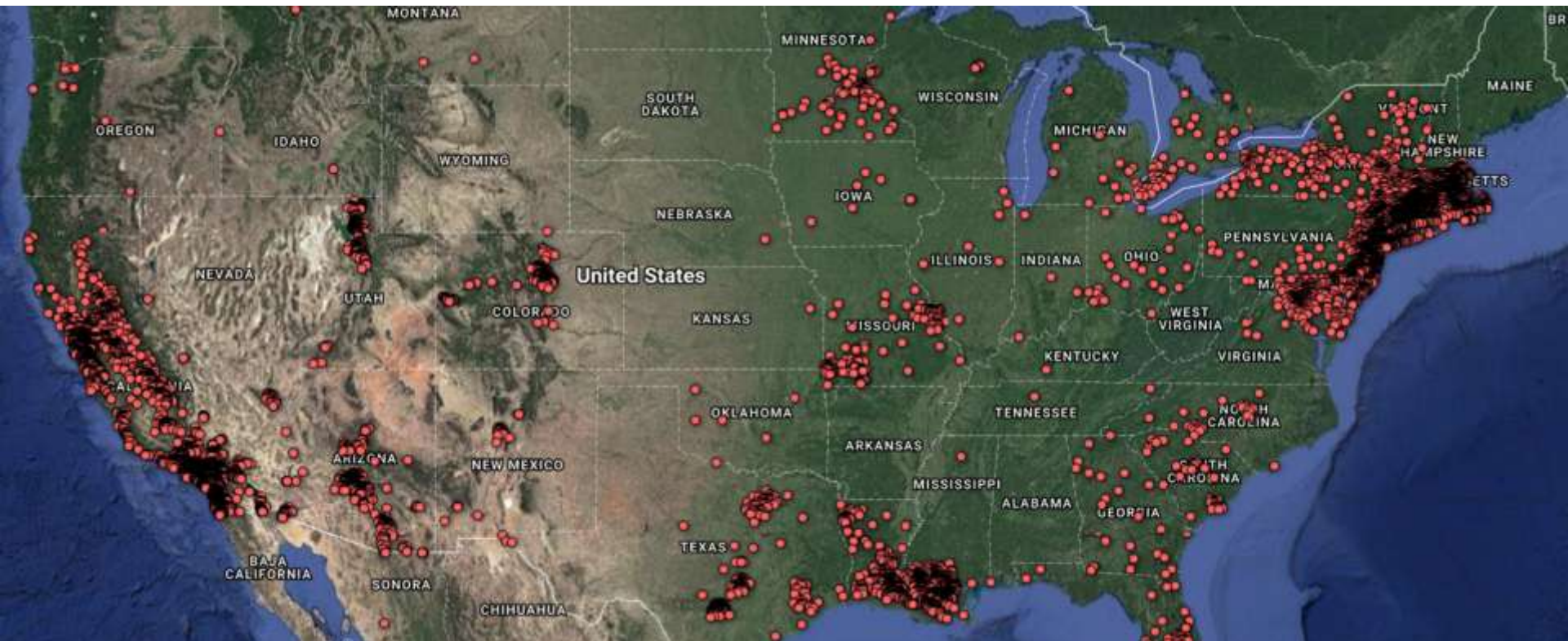


Short-Term Regional Variability From Weather Movements Can Have A Significant Impact On Solar Production

County Level Per Unit Production at 11:30am

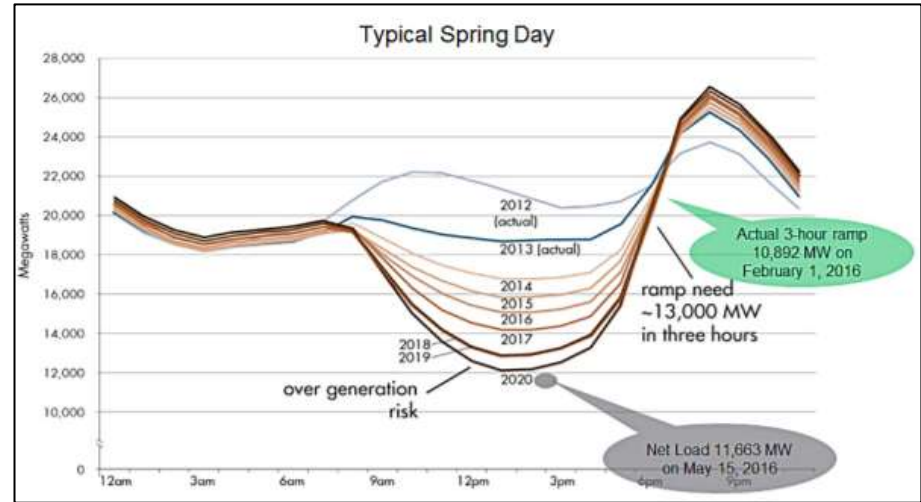


Locus Monitors A Broad Base Of Over 130,000 Sites That Send Solar Production Data Around The Clock



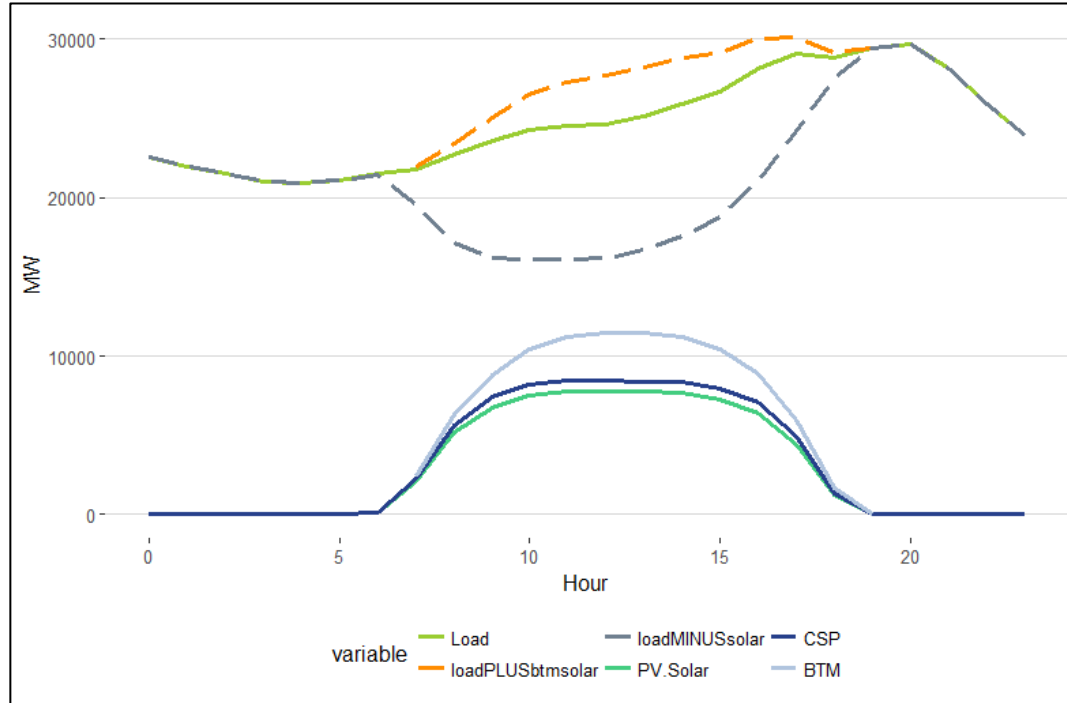
Behind-the-Meter Solar Production Is Affecting Forecast Error, And Estimation Methods Are Insufficient

1. Solar installations are rapidly increasing
2. The impact on net system load and power prices/congestion is increasing (example: [duck curve](#))
3. Limited visibility into the production from behind-the-meter solar generation, and its subsequent impact on net system demand
4. Current methods of estimating production from distributed solar generation fail to incorporate many factors that may impact performance such as soiling, snow cover, shading and system degradation
5. Current ISO and utility demand forecasting methodologies don't independently model behind-the-meter solar generation, leading to higher error (MAPEs) during "solar hours"



The Impact of BTM Solar on Load Is Becoming Very Significant In Some Areas

California Load on September day in 2016

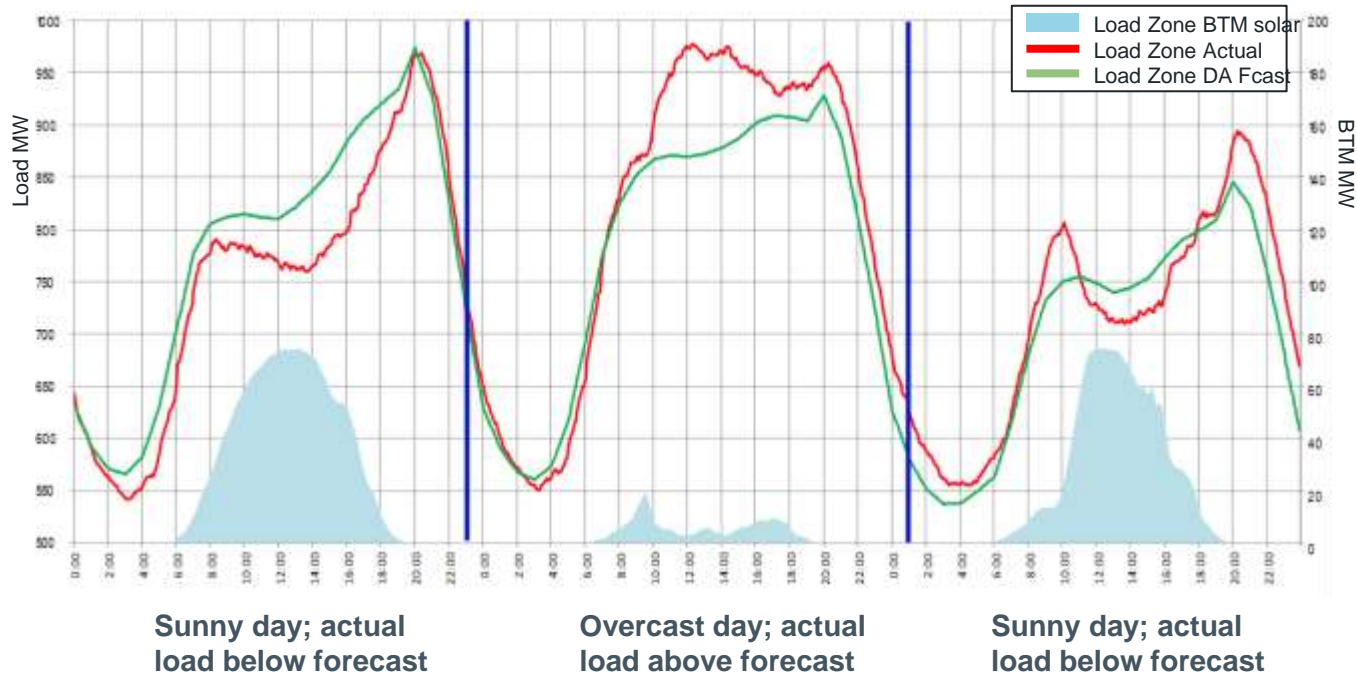


- Behind-the-Meter solar production drives down mid-day demand
- The magnitude of behind-the-meter solar is similar to that of utility scale solar in California

Without Solar Data, Forecasts Tend To Underestimate Load On Cloudy Days, And Overestimate On Sunny Days

Actual & Forecast Load With Behind-The-Meter Solar Over 3 Consecutive Days

Actual load and solar data, scaled to 1000 MW load, 200 MW solar



Most deviation between forecast and actual can be explained by solar.

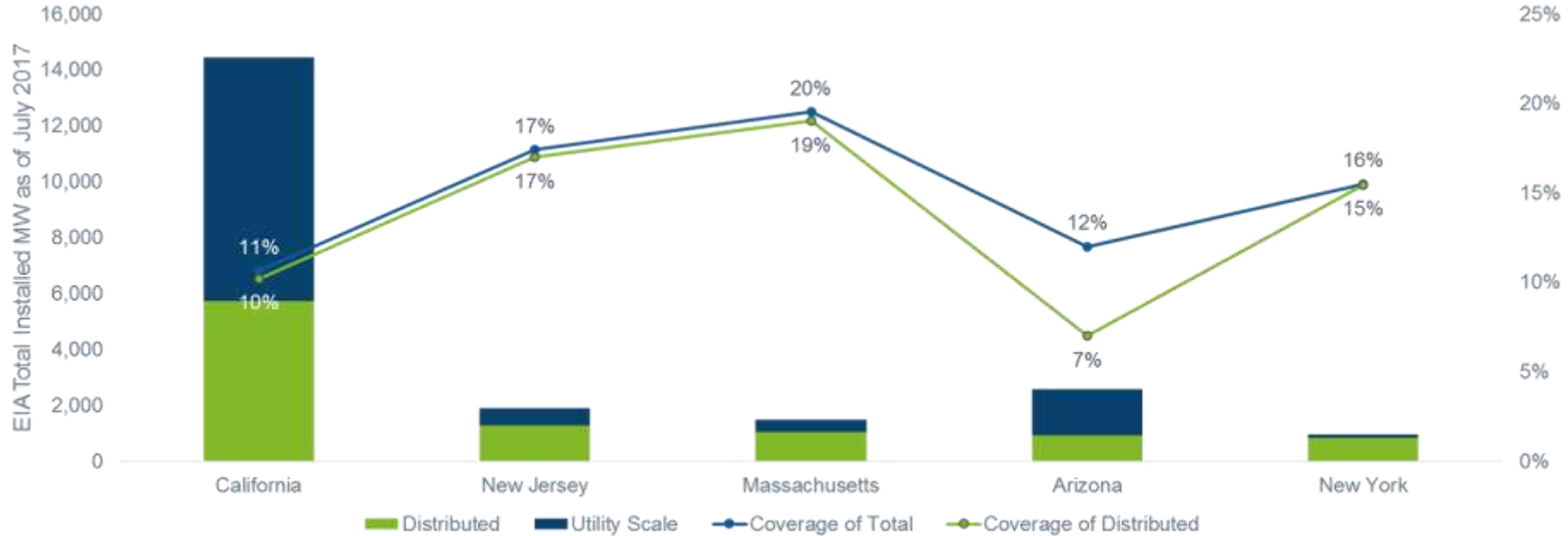
This case example with real data shows how without solar data, a forecast will likely split the difference between sunny and overcast days

Measured Solar Production Is Significantly More Accurate Than Modeled Data

- Modeled Solar Production will always have errors!
- Some of the challenges include:
 - Shading
 - Soiling
 - Dust/smog
 - Localised snowfall
 - Intermittent cloud cover
- The chart to the right, for example, shows the heavy impact of soiling in Southern California
- Actual production data will capture all of these effects



Coverage of Solar PV Capacity in Key Solar States



Notes:

- Solar PV Installed Capacity based on estimates from the EIA Electric Power Monthly. Given the fast-moving and distributed nature of PV solar, there is a wide range in estimates on total installed solar capacity by state
- The majority of sites (by count) that Locus monitors are considered distributed; however, Locus does monitor some sites that are considered utility scale. Locus Coverage of Total = Total Locus / Total State. Locus Coverage of Distributed = Total Locus / State Distributed.
- These numbers do not include Genscape monitored solar installations.

Our Behind-The-Meter API Provides Measured Solar Production Data In Near Real Time

- Behind-the-Meter Production API aggregates and compiles near-real time distributed solar production data
- We can offer frequencies of monthly down to 15 minute intervals
- Data is available at zip code, county, load zone, and the state level

$$\text{perUnitProd}_{\text{region, timestamp}} = \frac{(\text{total kW output from sites})}{(\text{total kW capacity of sites})}$$



Product Sample: Data Is Provided Via A RESTful API

ZIP Code	Time Stamp	PerUnitProd	currVI
10312	6/24/2016 18:15	0.33	450
10312	6/24/2016 18:00	0.4	480
10312	6/24/2016 17:45	0.28	490
10312	6/24/2016 17:30	0.32	490
10312	6/24/2016 17:15	0.29	530
10312	6/24/2016 17:00	0.35	550
10312	6/24/2016 16:45	0.39	620
10312	6/24/2016 16:30	0.51	740

Querying a specific state would return all zip codes in that state; enables customers to aggregate to any larger geographic region (e.g. load zone)

= (solar kW output / kW capacity) for Locus monitored sites in the zip code and may be used as a performance factor for all sites in a given zip code

Optional: Satellite derived irradiance measurement to determine how much solar resource (i.e. sunlight) was measured during a given interval

Potential Behind-The-Meter Solar Data Use Cases by Customer Type

Balancing Authority

- Gain visibility into behind-the-meter solar production based on measured actuals
- Create more accurate day ahead and real time load forecasts to enable more efficient generation dispatch
- Understand the impact of distributed solar generation on system operations and stability

Energy Trader

- Associate variances between load forecasts and actual load that can be attributed to distributed solar generation
- Identify upside/downside risks to demand forecasts based on solar production and subsequently identify trading opportunities (e.g. DA/RT spreads)
- More accurately forecast demand and power prices (esp. for quantitative traders)

System Integrator

- Develop more accurate load forecasting models and situational awareness
- Develop more accurate solar forecasting models by training models with actuals

Solar Asset Manager

- Gain early insight into SREC production by modelling total regional solar production
- Benchmark fleet performance against regional averages

Thank You

Sushain Sharma

Business Head – Locus Energy (India)

+91-7506247799 | sushain.sharma@locusenergy.com