Valuing a Portfolio of PV Investments

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October 13th, 2010
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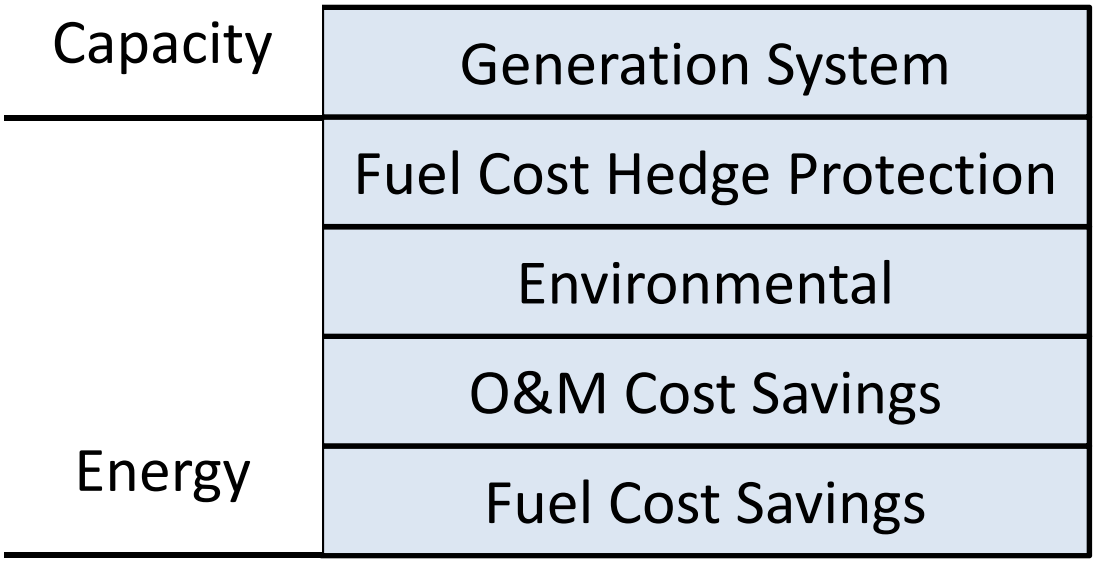
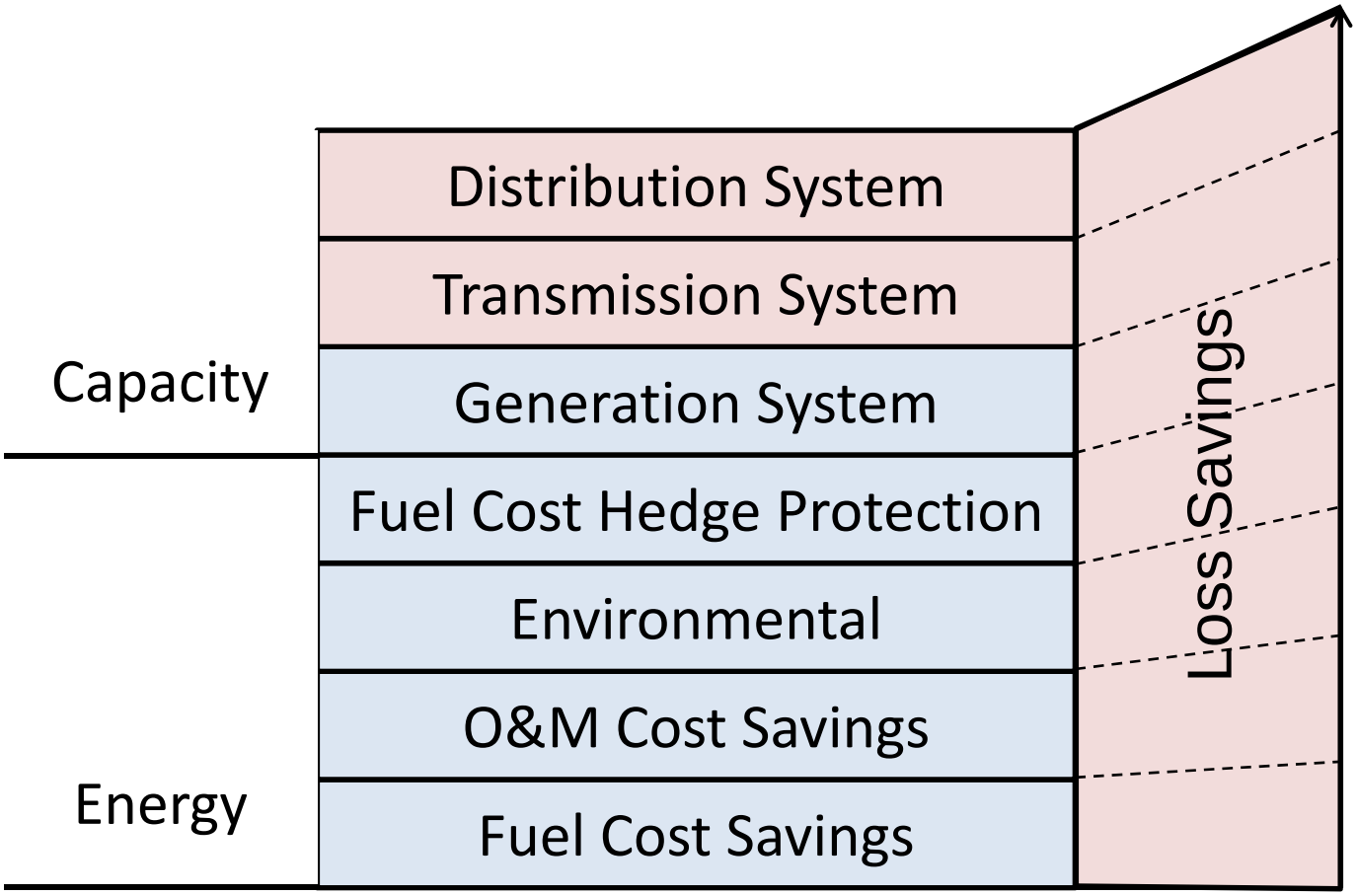
CLEAN POWER® RESEARCH

Central station PV value to utility



Distributed PV value to utility

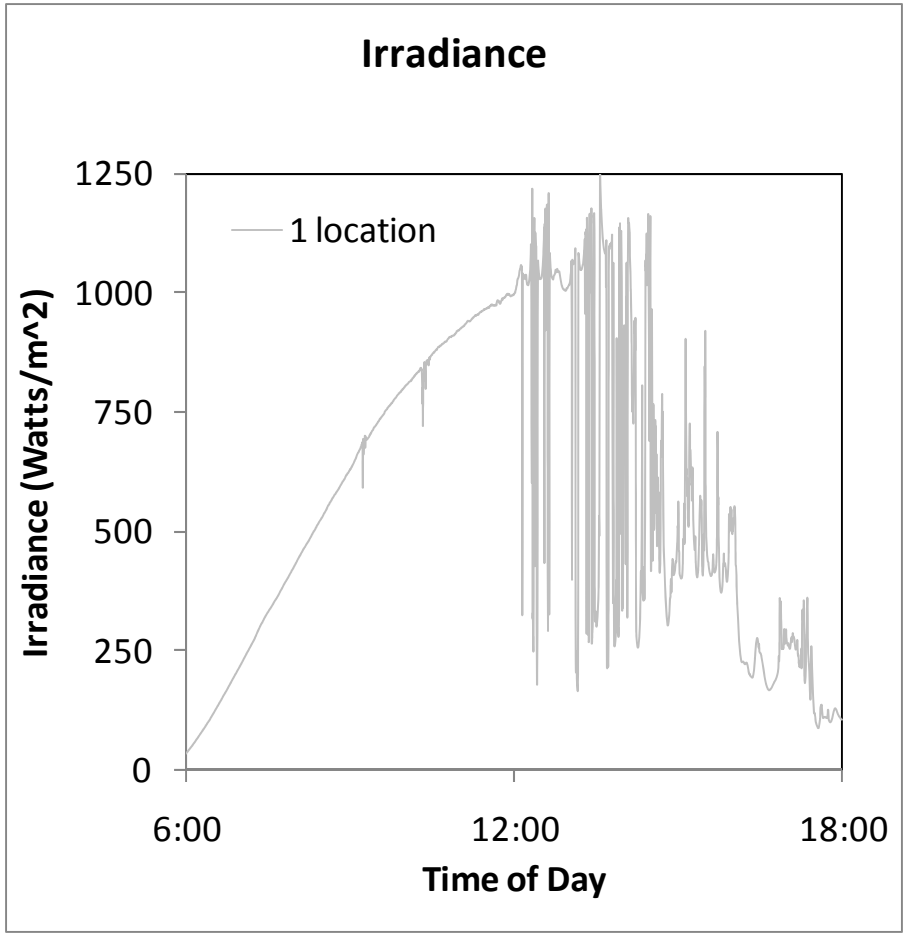


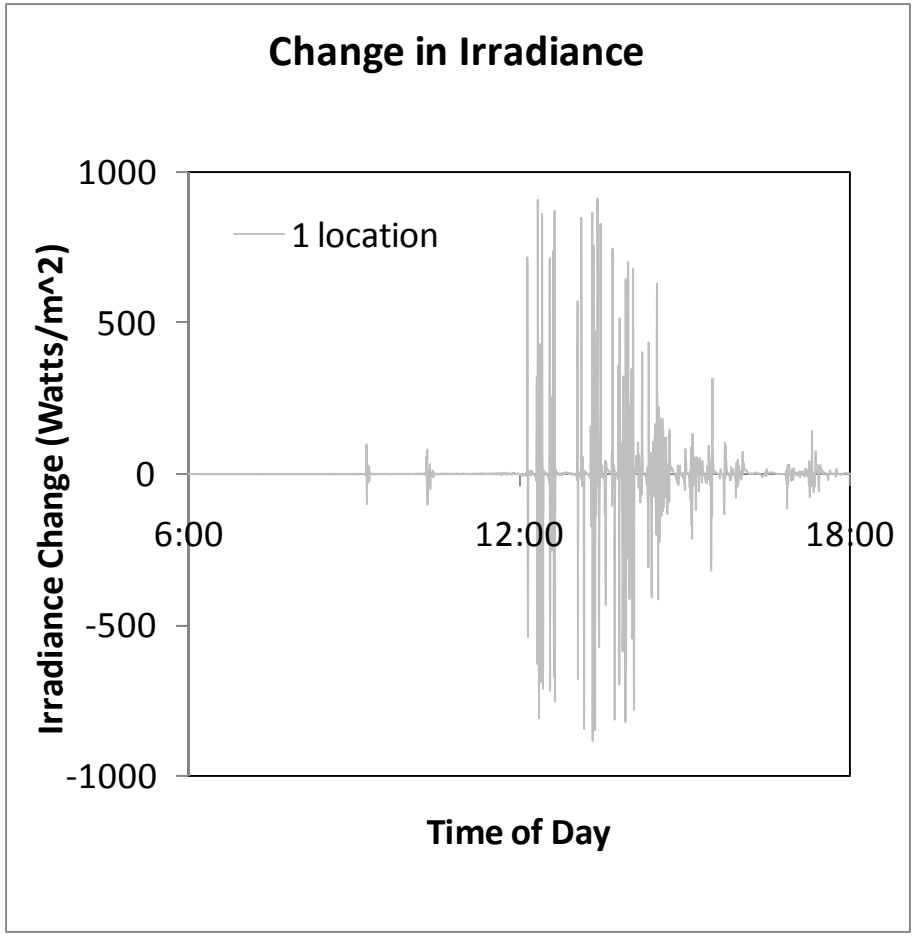
Output variability

- One factor excluded from a typical value analysis is power output variability

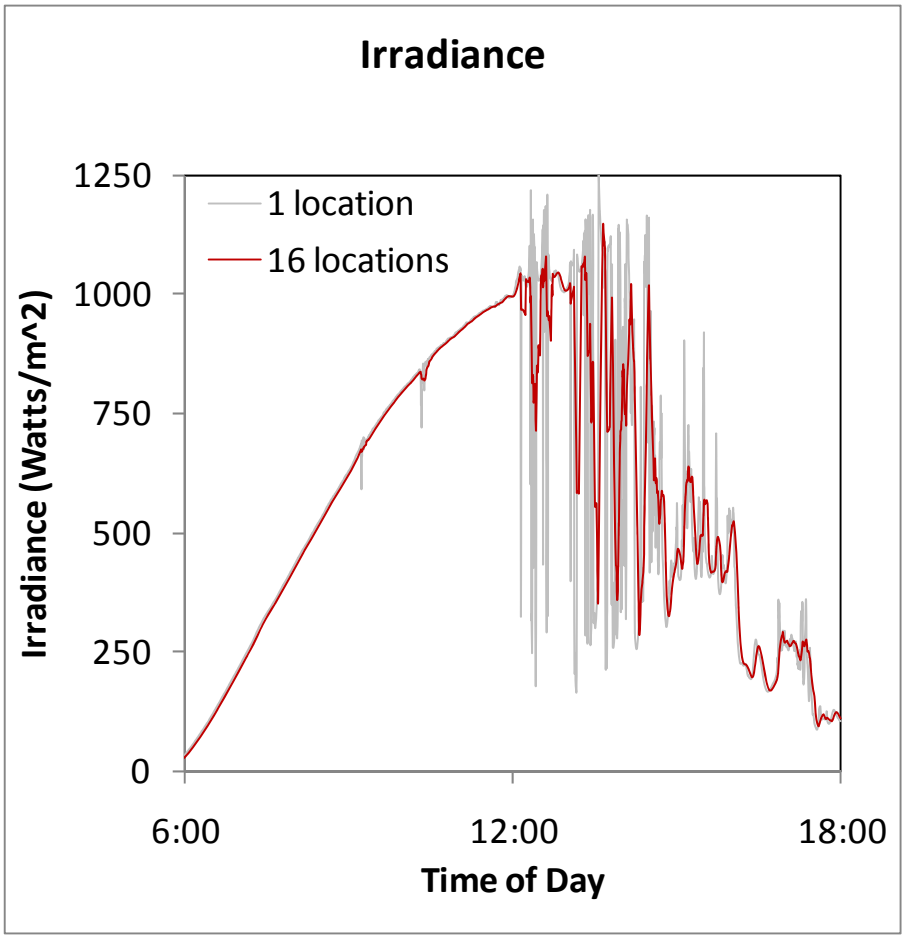
- Output variability, and thus integration cost, is based on the structure of the PV portfolio (e.g., distributed vs. centralized)

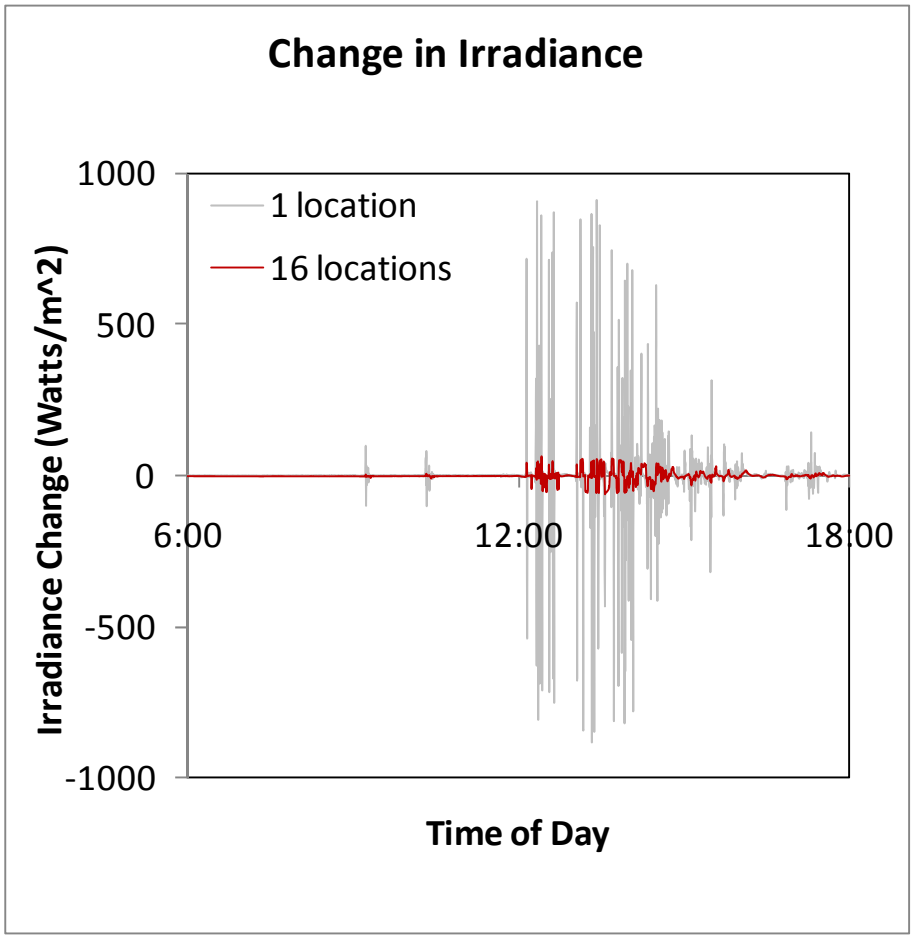
What is meant by variability?





Portfolio configuration can reduce variability





Power output variability is driven by a few factors

For a ***single*** PV system, changes in short-term output are driven by:

1. Clearness of the sky
2. Sun position

For a ***portfolio*** of PV systems, changes in output are driven by the same forces as those of a single system but also include fleet configuration

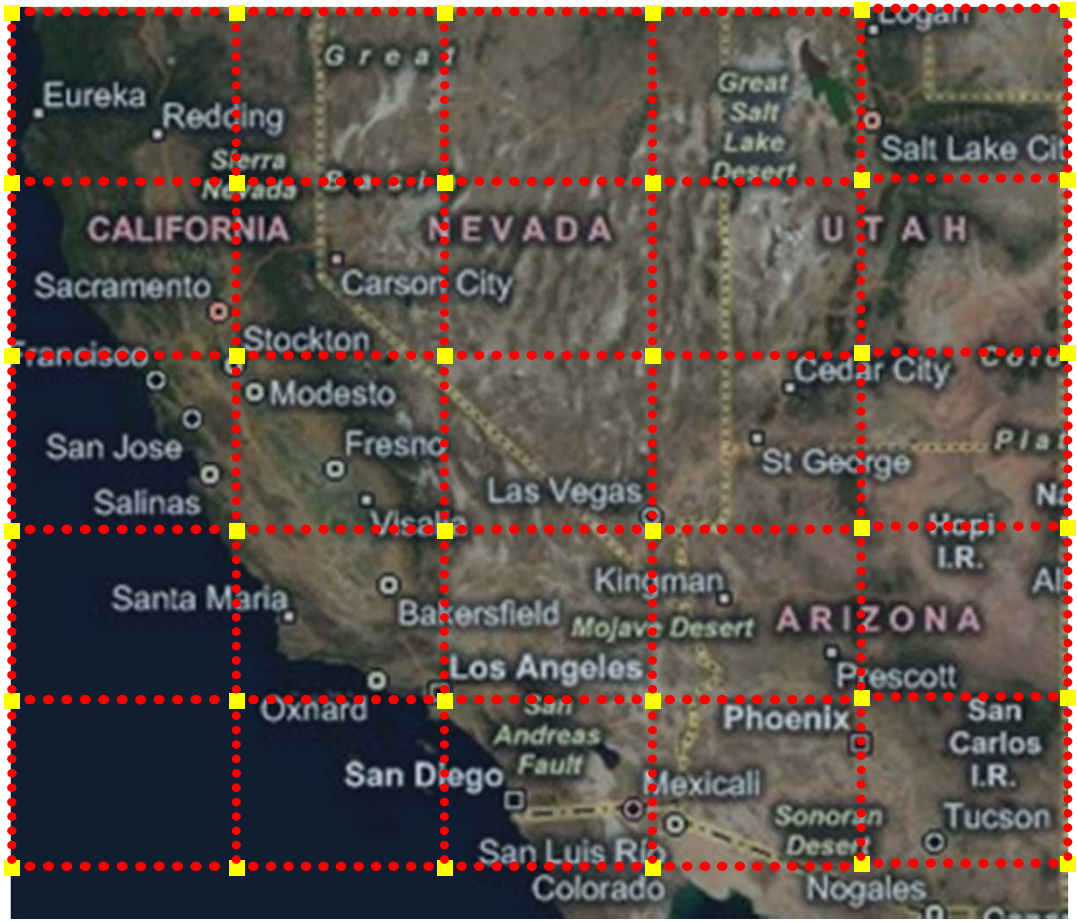
CSI RD&D project

- Enhance spatial and temporal resolution of SolarAnywhere®
- Integrate output variability into PV simulation tools
- Integrate PV into distribution modeling tools
- Create tool to calculate economic value of a PV fleet

Use SolarAnywhere to assess variability

Select 1st station every 200 km in the southwest

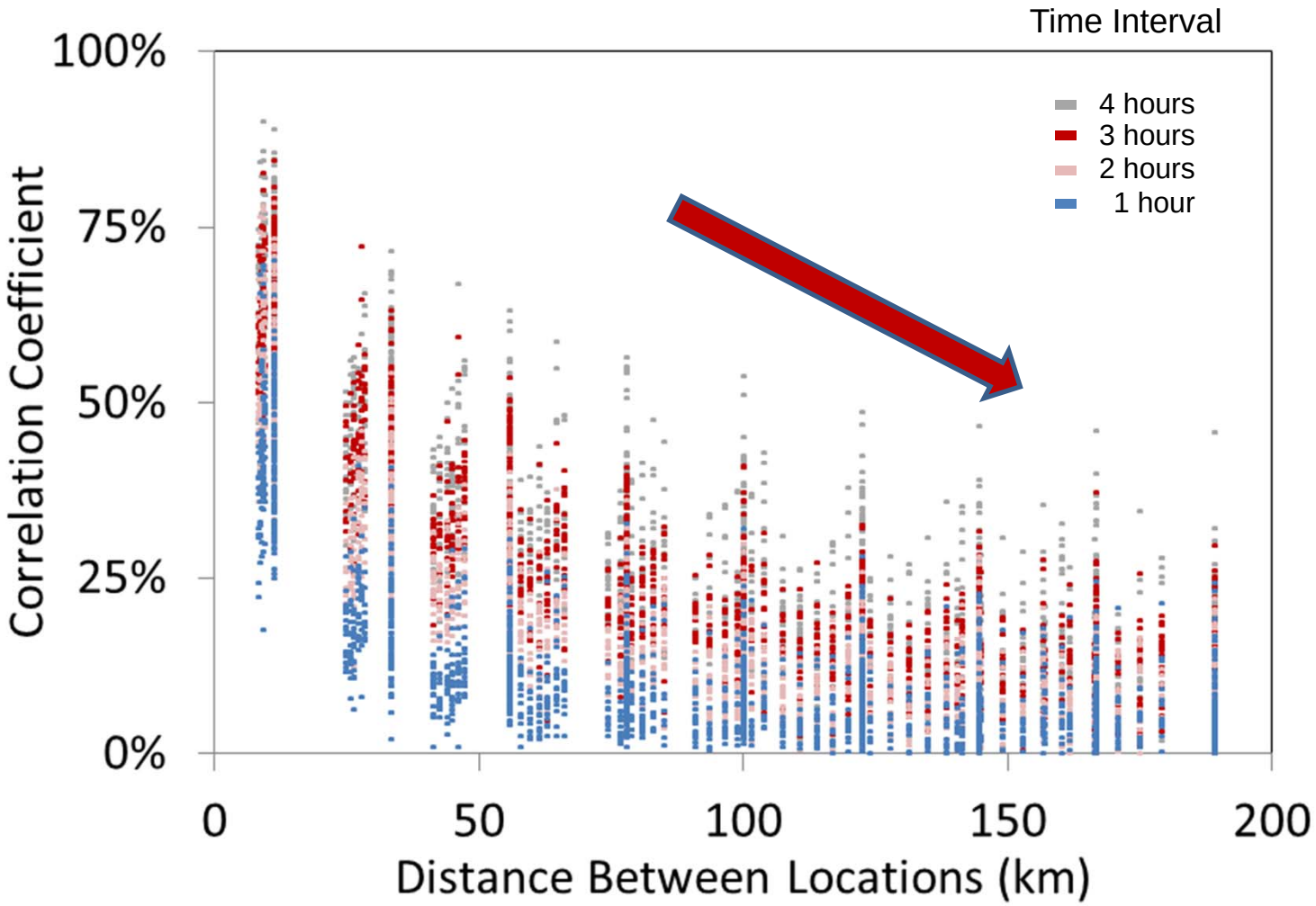
Add a station pair 10, 30, … 190 km from 1st station



Calculate change in clearness index correlation

- Select 12 years of solar data for a portfolio of two locations between 10 and 200 km apart
- Calculate correlation coefficient for the change in the clearness index
- Repeat this 40,000 times
  - 1,000 portfolios – pairs of locations
  - Time increments of 1,2, 3, or 4 hours
  - 10 irradiance bins

Variability decreases as plants are spread out

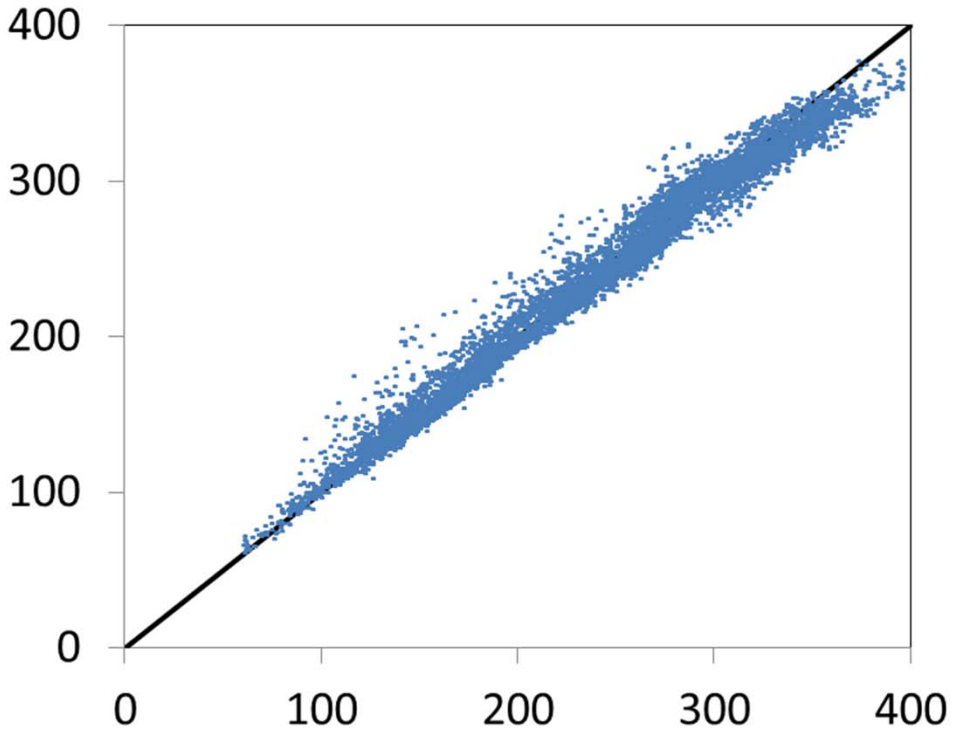


Output variability for a portfolio of PV is predictable

Standard deviation (W/m²) in output variability between two locations for 40,000 scenarios

Simulated Results

Based on a few input parameters



Measured Results

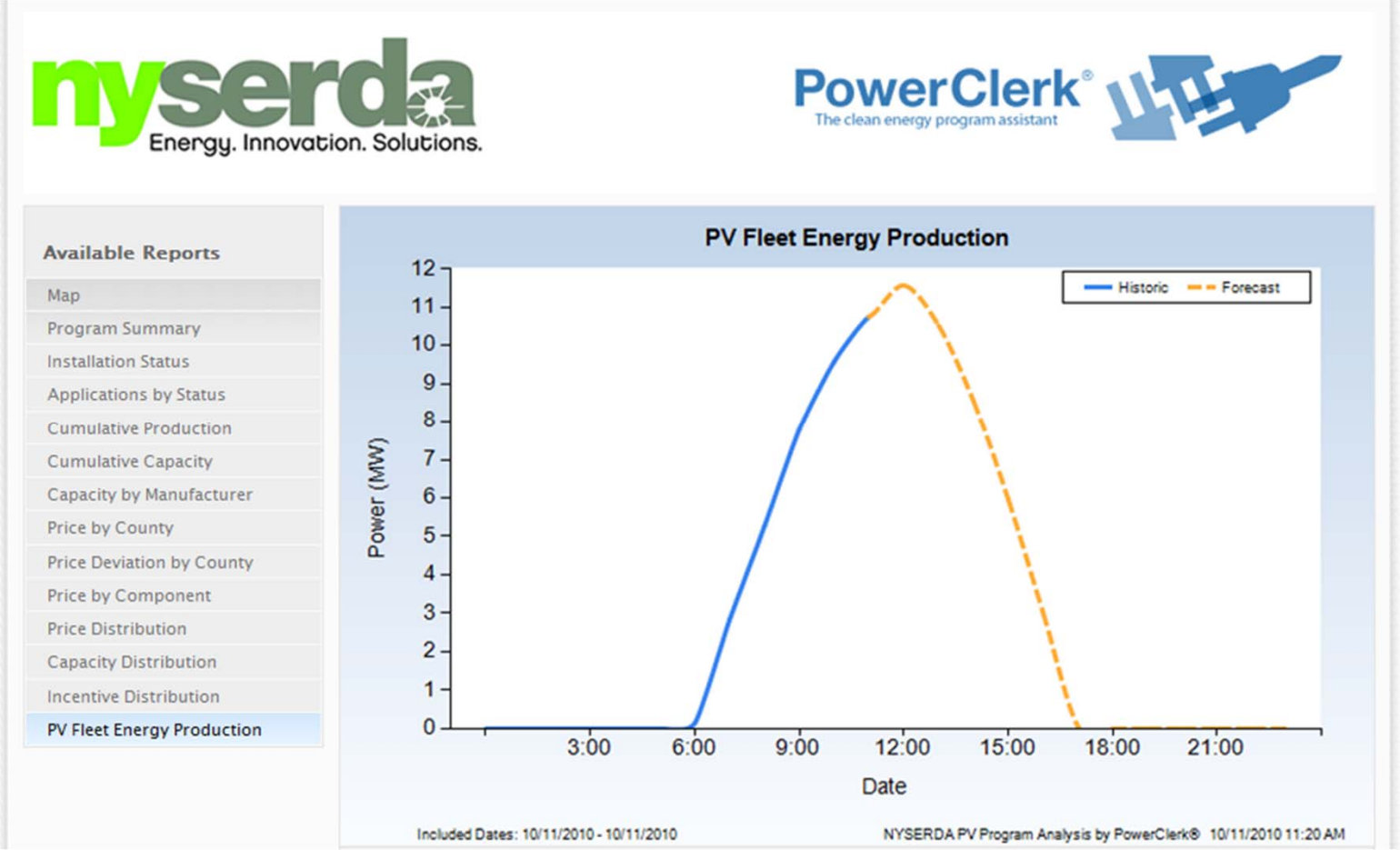
Based on 12 years of solar data

Figure presents 8,000 randomly selected results

Summary

- Output variability for a portfolio of PV is predictable for longer time increments
- Results appear to scale to shorter time increments
- Verification of results is in process
  - Virtual networks (Perez)
  - Higher resolution SolarAnywhere data
  - Short-term data collection
- Verified results will be integrated into value analysis and planning tools

Next steps: PV fleet variability forecasting?



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