

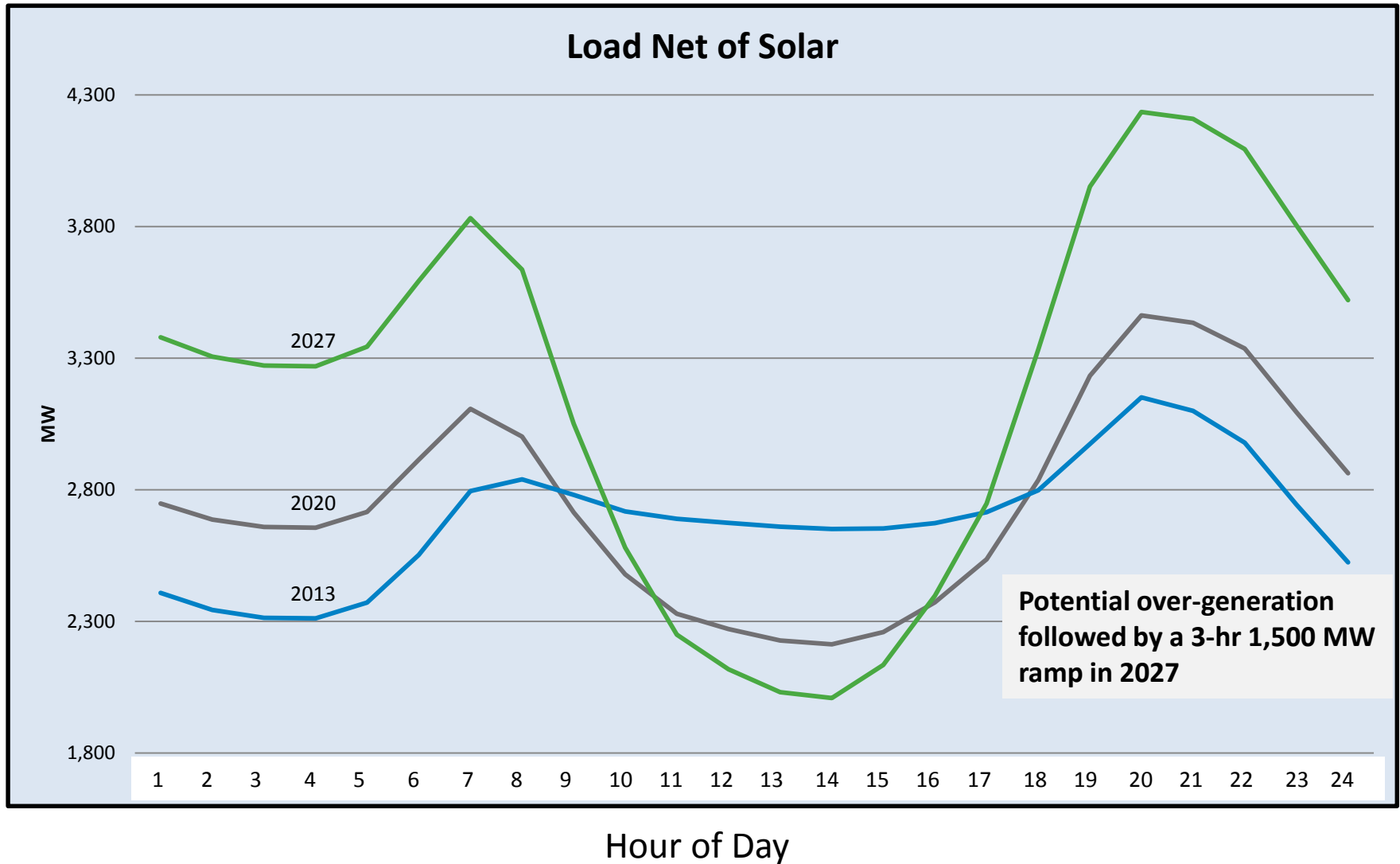
Grid Flexibility Strategies

Justin Thompson

October 20, 2014



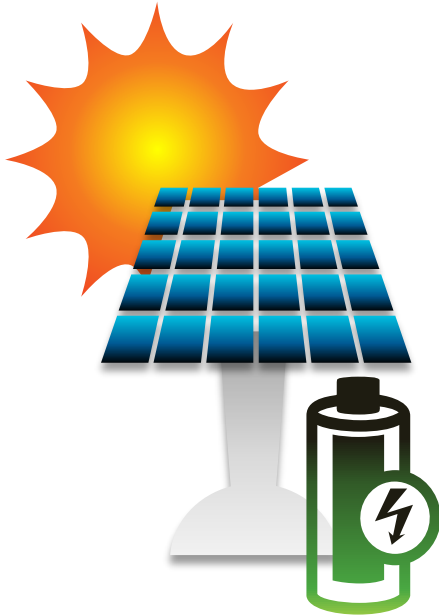
APS Typical March Day



Technology Solutions

Resource mix

- More flexible generation
- Energy storage
- Dispatchable intermittent resources



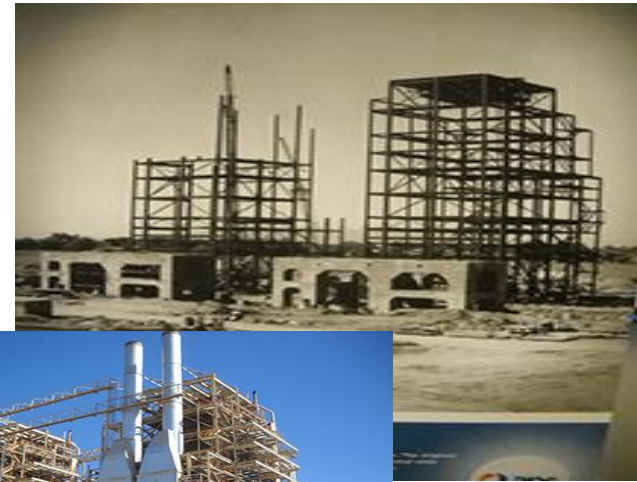
Solana Solar W/Thermal Storage



Flexible Generation

Ocotillo Modernization Project

- Retire aging, large steam units constructed in 1960
- Replacing with 5 LMS100s



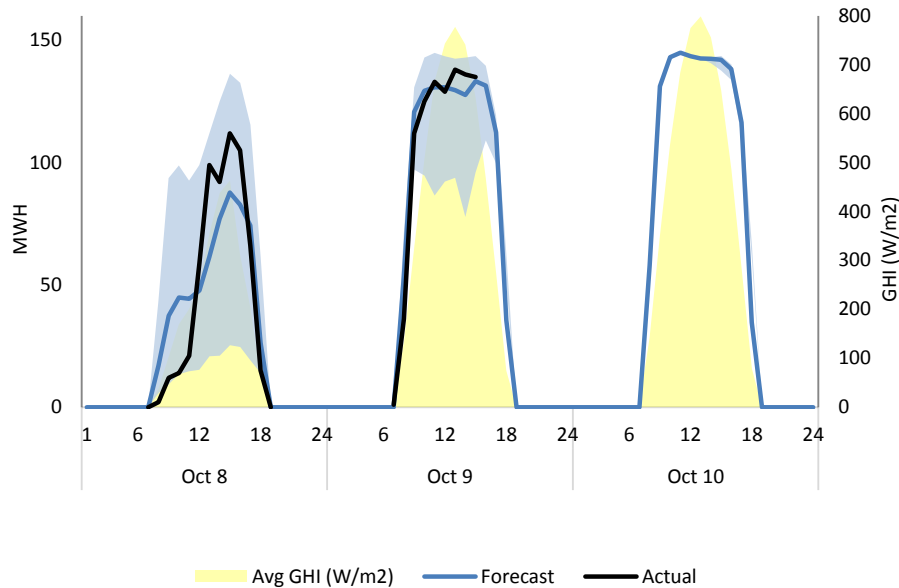
- Maintain reliability
- Responsive unit operations
- Environmental attributes
- In-service planned for summer 2018

Market Driven Solutions

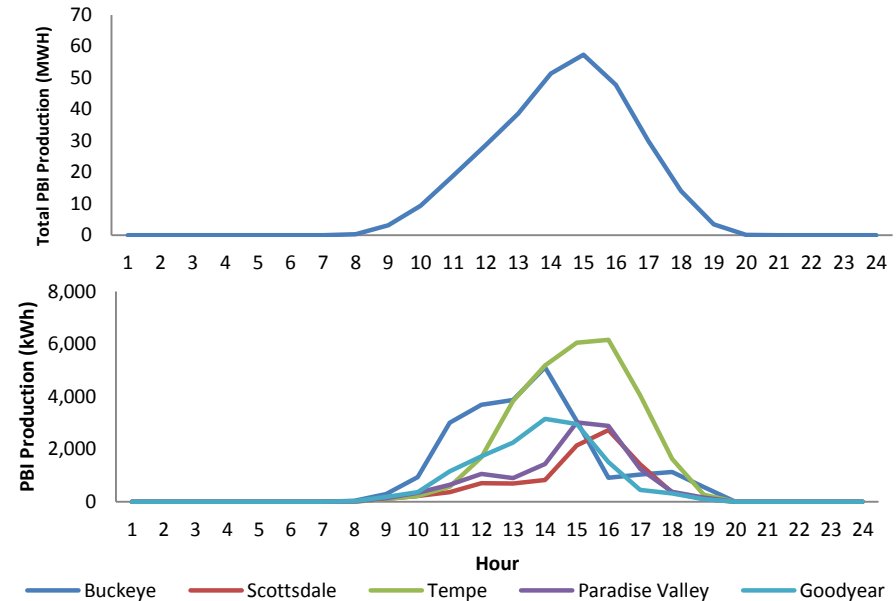
- Energy Imbalance Market
 - Conducting due diligence on whether to join
- 15 minute and sub-hourly market transactions
 - Requires more automation on internal systems
 - too labor intensive
 - Upgrading computer systems to able to manage record keeping and automate tie-setter changes

Improved Forecasting Accuracy

University of Arizona Forecasting – AZ Sun Sample



Example of DG Solar on Cloudy Day



University of Arizona – Renewable Energy Forecasting

- ◆ Day-ahead forecasting of utility-scale solar PV and wind plants
- ◆ Forecasted weather by GPS coordinates, for use in solar DG forecasting
- ◆ *Starting Oct 2014*

Solar Forecasting & Visualization

- ◆ Incorporation of data in PI
- ◆ Demonstration of leveraging meter data to improve solar DG forecasting
- ◆ Organizing solar DG data for enterprise use: meter, feeder, transformer, location characteristics, APS balancing area

Regional Cooperation - Southwest Variable Energy Resource Integration (SVERI) Group

- Members include: APS, PNM, SRP, IID, TEP, WAPA, AEPCO, EPE
- Purpose is to be forward thinking on how increased renewable generation can be economically managed across the combined footprint of the group

SVERI Group

Current Initiatives:

- Created Website that posts cumulative generation and renewable data – 10 second granularity
 - Increases system operator visibility - shows renewable generation across the entire SVERI footprint
 - <http://sveri.uaren.org>
- Allows analysts to further study how renewables can and will impact the collective footprint
- Future enhancements for regional cooperation will be explored after analysis conducted