Smart Inverter Functionality

SDGE

A Sempra Energy utility®

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Chief Engineer

CPUC Workshop
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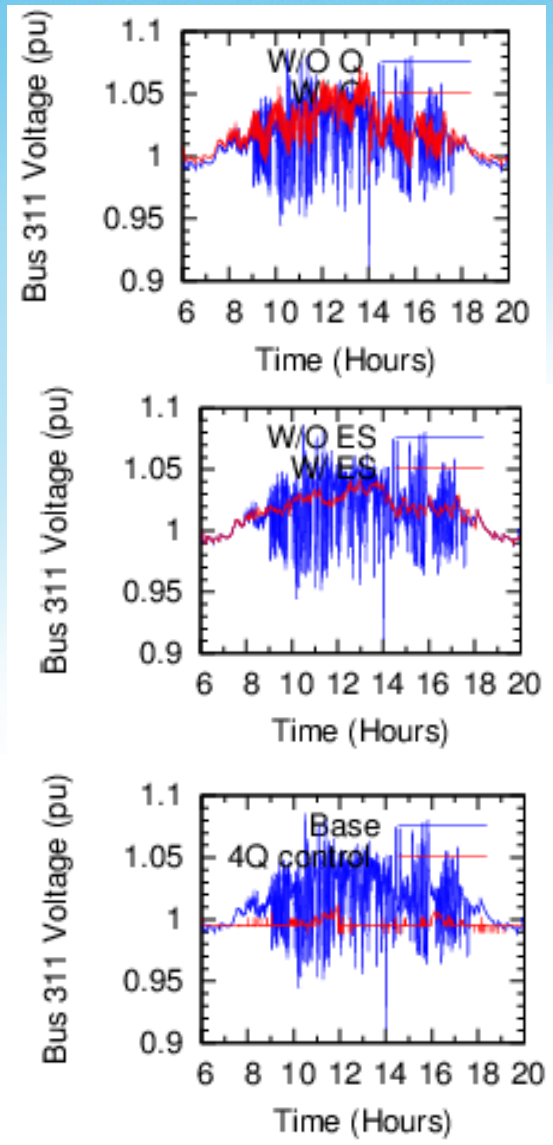
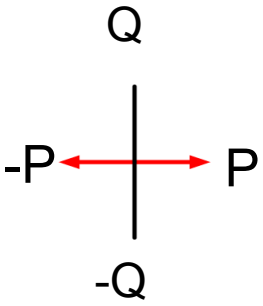
PV Intermittency Mitigation Based Upon Modeling with Smart Inverters

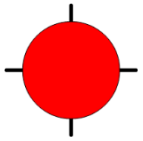


With and without dynamic VAr device

With and without energy storage

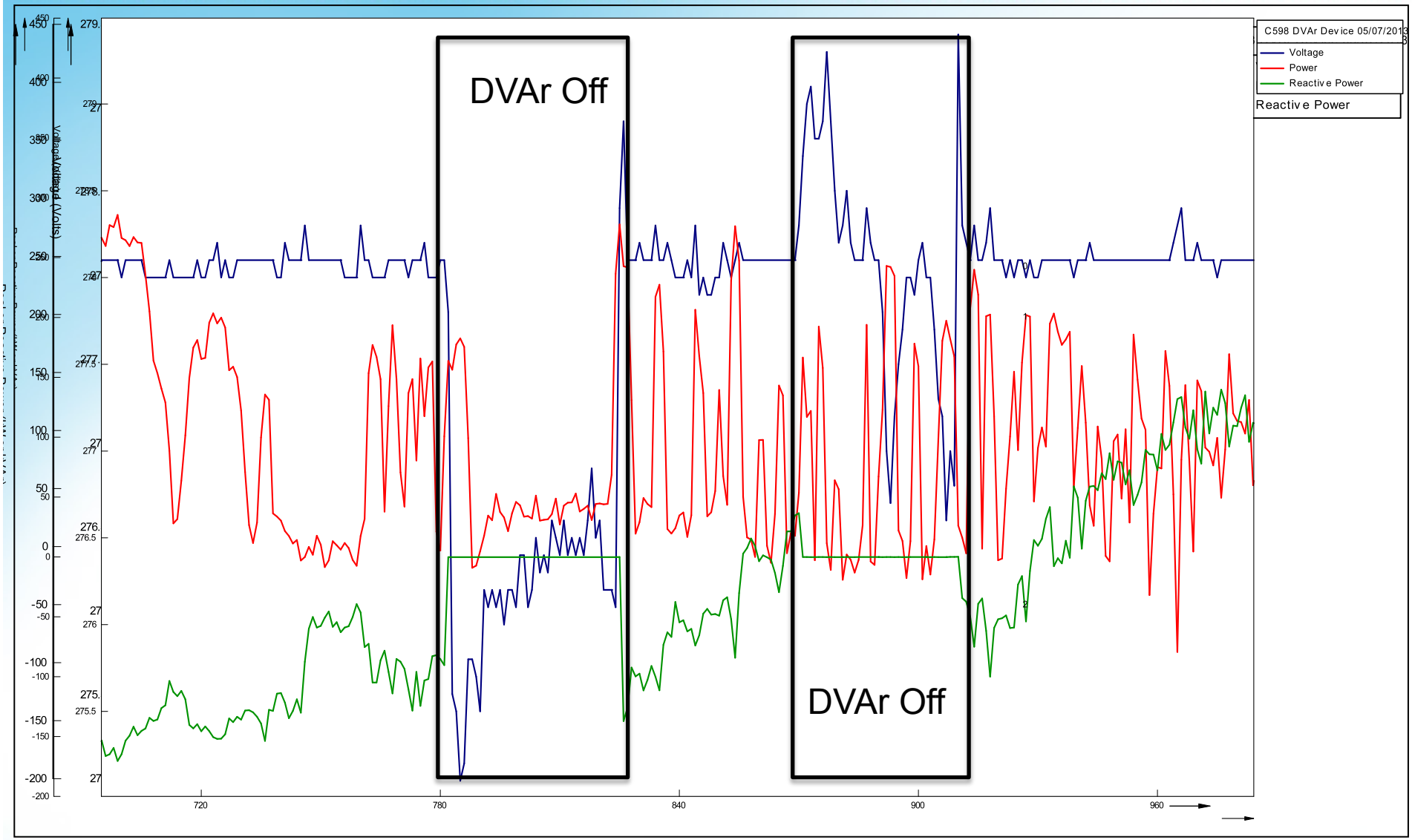


With and without storage and 4 quadrant control



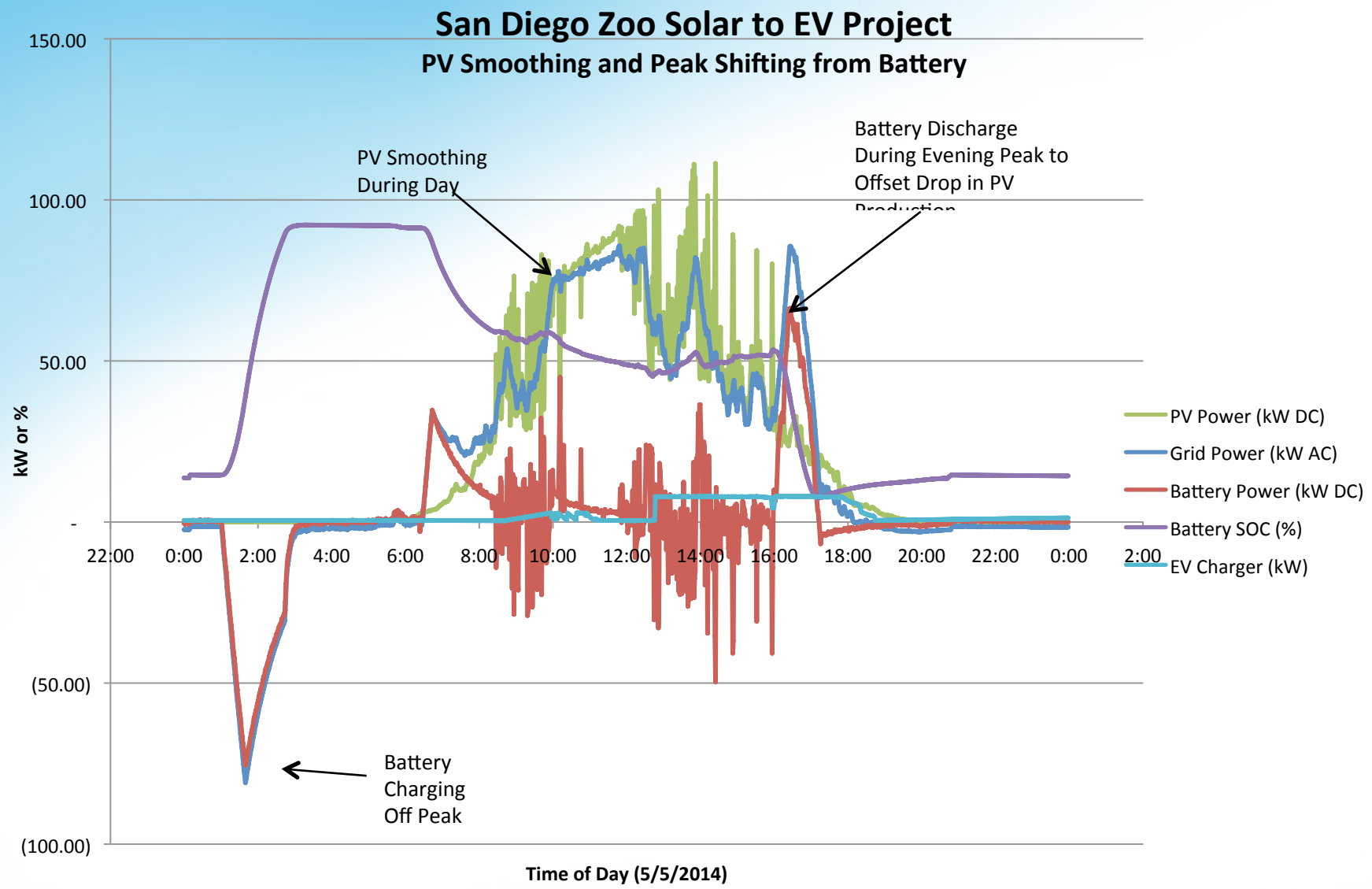
Red = With Blue = Without

Installed Dynamic VAr Device

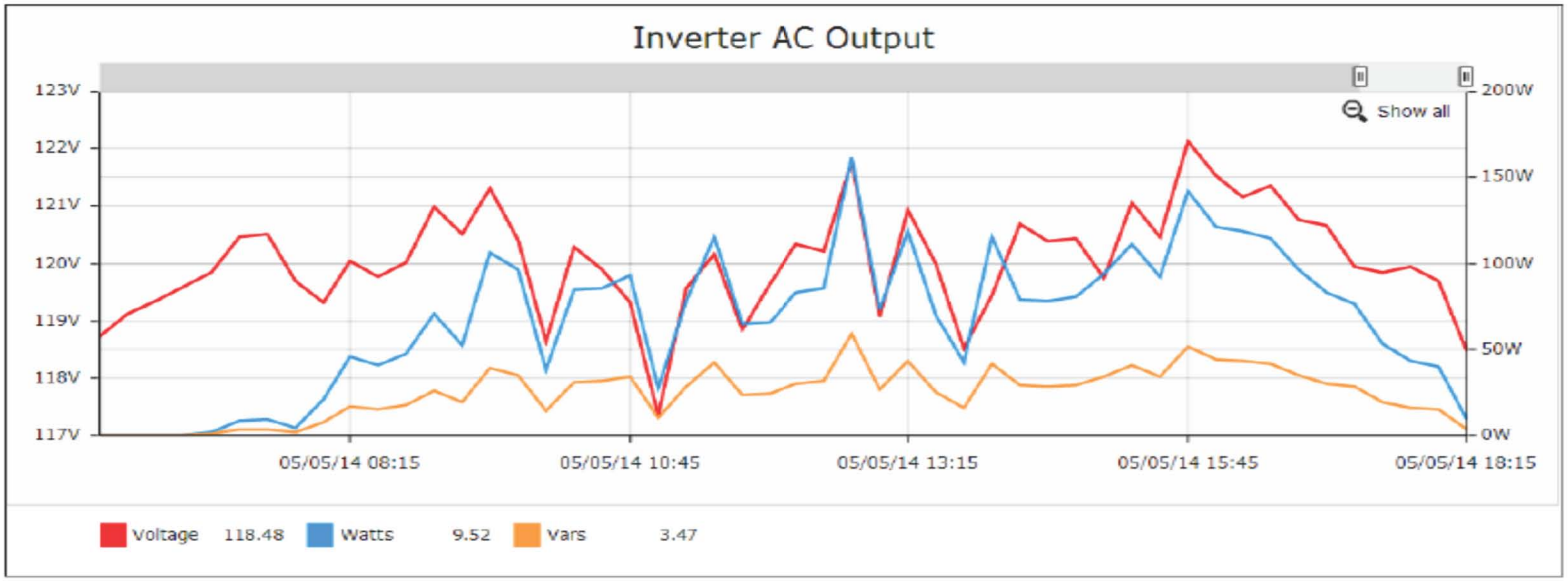


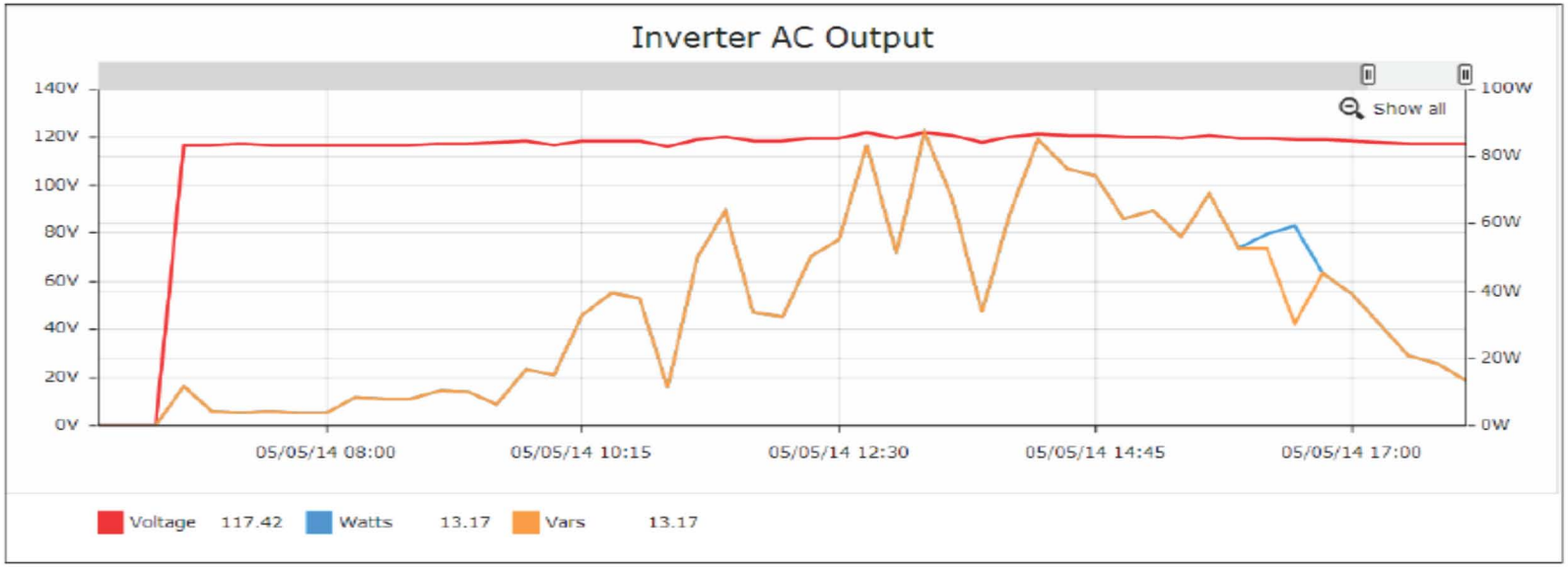
The Possible: Peak Smoothing through Storage

San Diego Zoo - May 5, 2014

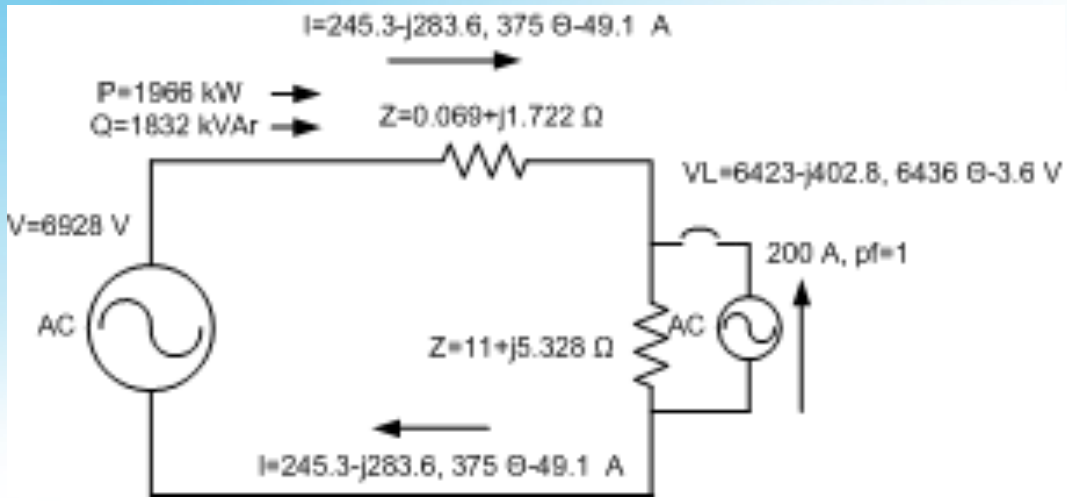


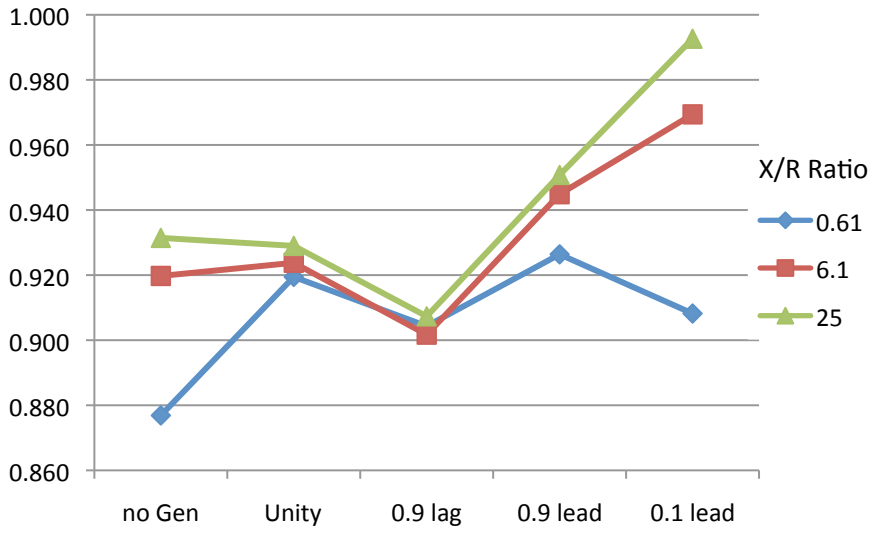
PV with Smart Inverter





Circuit X/R Voltage Impact





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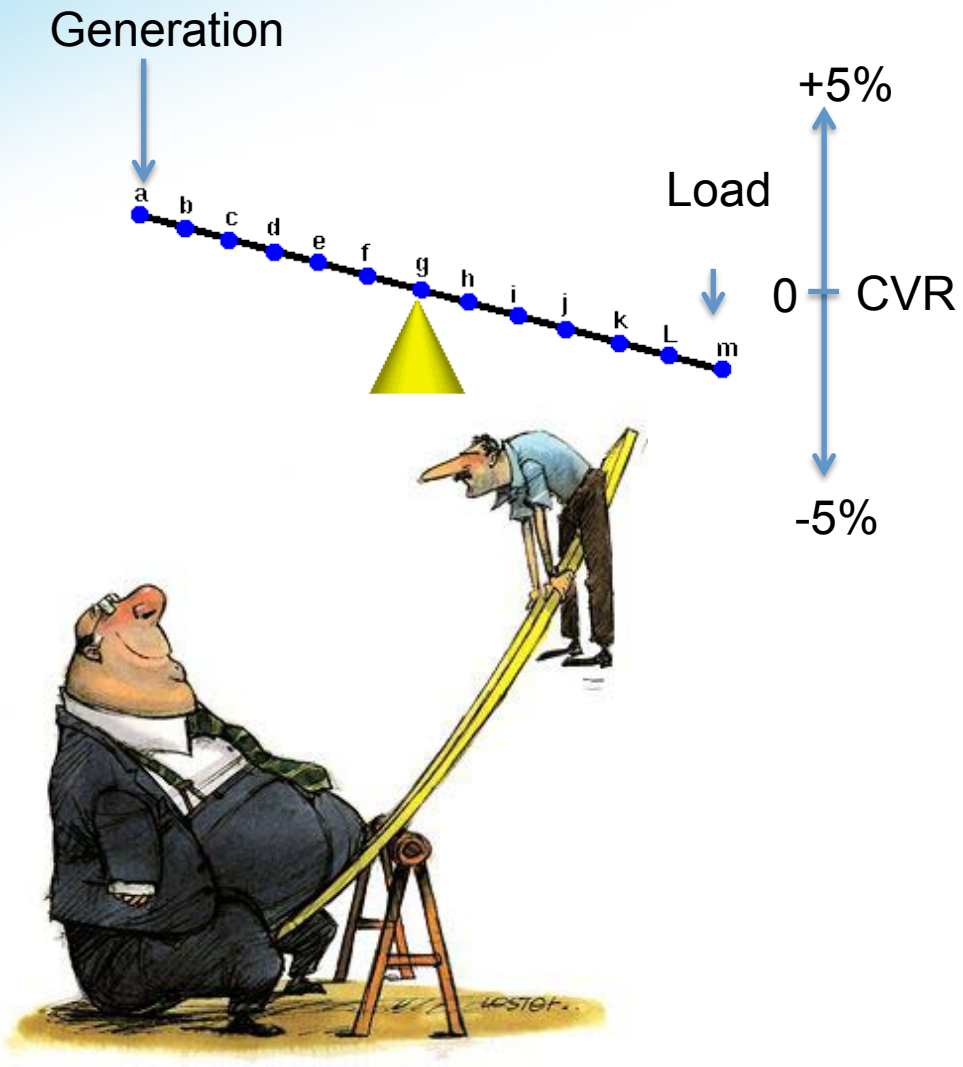
Factors Determining Impact

- **Location on the Circuit**
  - Near Substation vs End of Circuit
- **Circuit Rating**
  - 4 kV vs 12 kV
- **Type of Circuit**
  - Urban vs Rural
- **Circuit minimum loading**
  - High vs Low
- **Circuit X/R ratio at location**
  - High vs Low
- **Aggregate DG capacity**
  - Transmission issues
- **Voltage Regulation Equipment**

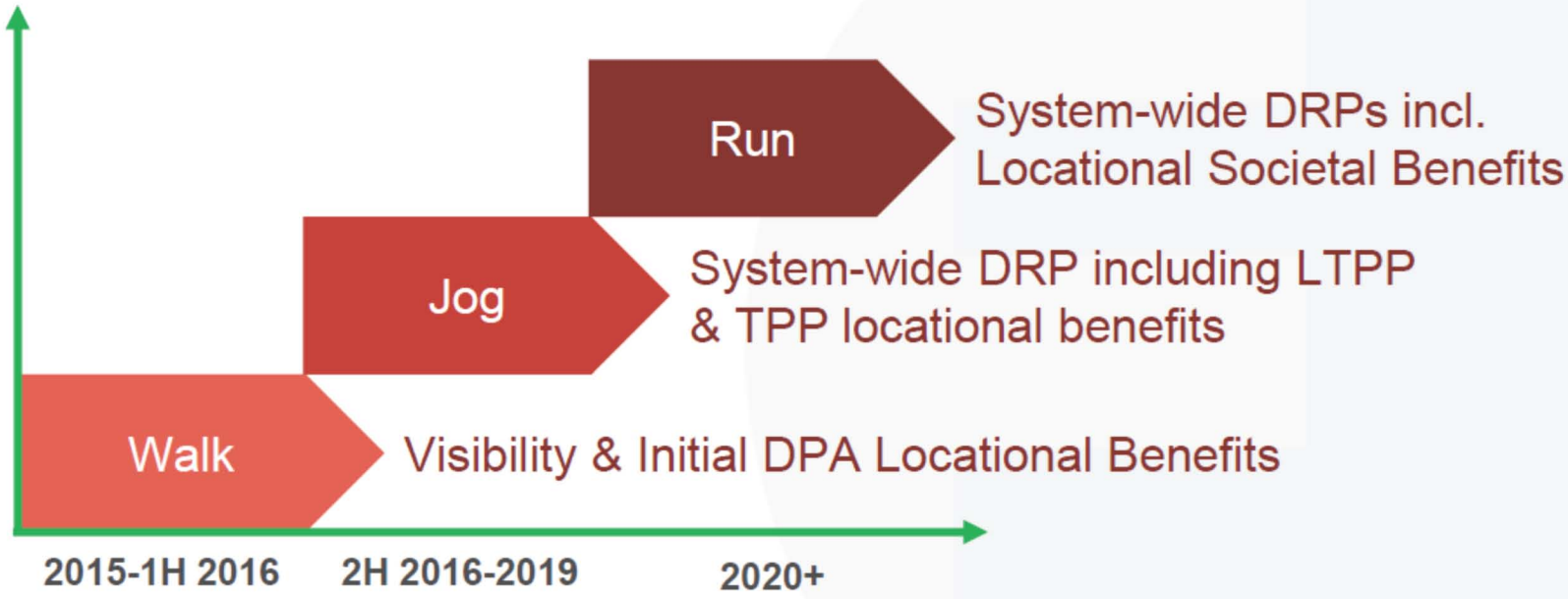


Strategy Progression

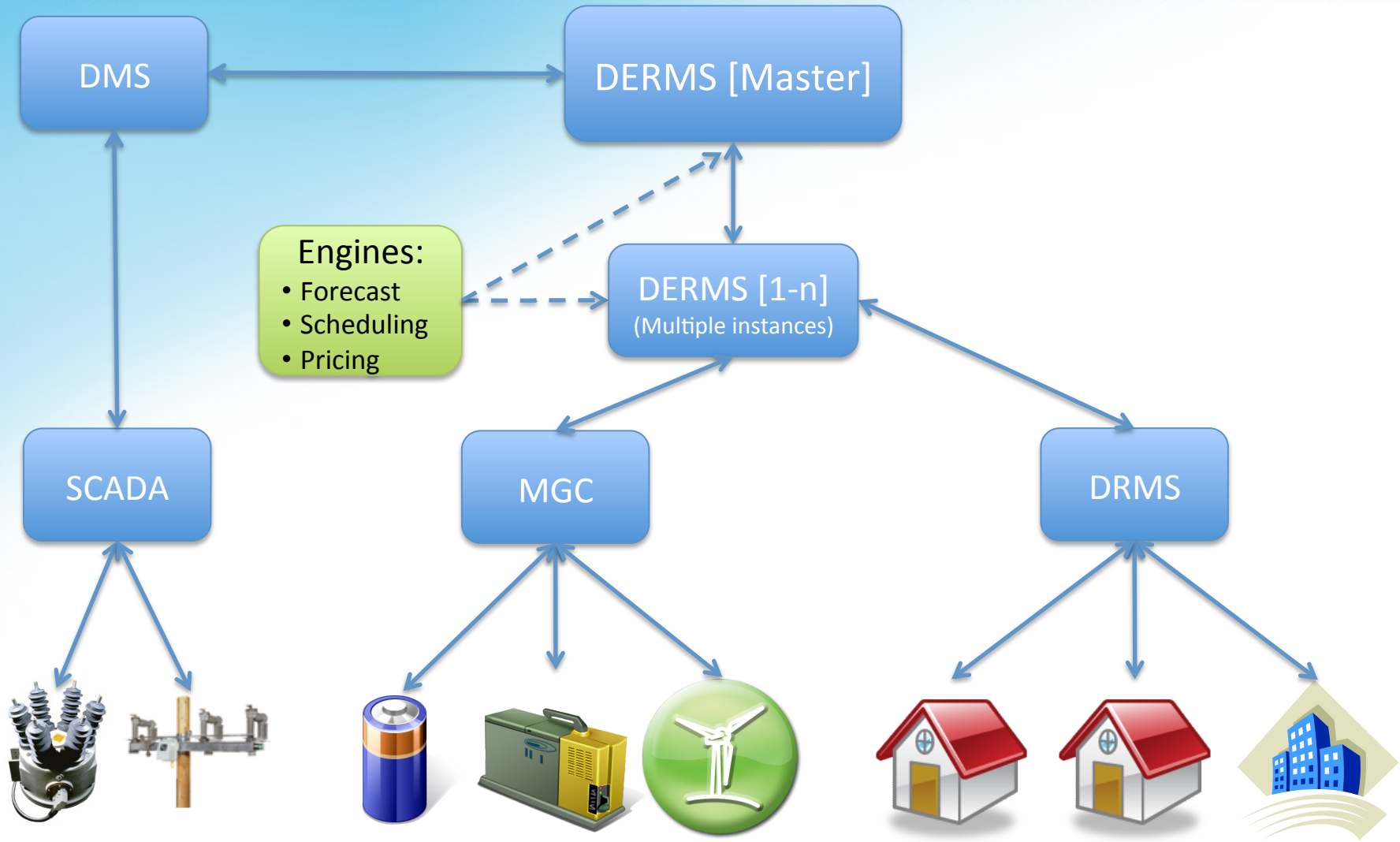
- Functionality location specific
  - Prioritize smart inverters then either dynamic VAr devices or storage
- All Phase 1 functions with dynamic VAr capability turned on for SDG&E (functionality limited by inverter design for pf)
  - Want frequency/watt functionality
- Meet requirements of all normal generators and operate anywhere in that range
- Solve problems created 1st then explore specific request capabilities
- VAr support not needed at night
- Start with large units for control
- Small units down the road with aggregators based upon Phase 2 grouping and IEEE 2030.5 protocols

Evolution of Optimal Location Benefit Analysis - DRP

- What are the immediate benefit categories that can reasonably be evaluated within the next 3 months for the first DRP (July 1, 2015)?
- What are the next logical set (incl. data and tools needed) for system-wide DRPs?



Control Hierarchy



Questions ?

Thank you.

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