

Building a Sustainable Energy Future

Distributed Energy Management

The Problem

- ▶ *Distributed Energy Resources are rapidly proliferating the distribution grid*

Voltage excursions are the primary limiting factor of increased DER penetration.

*Distributed Energy Resources is growing **3 times faster** than centralized generation*

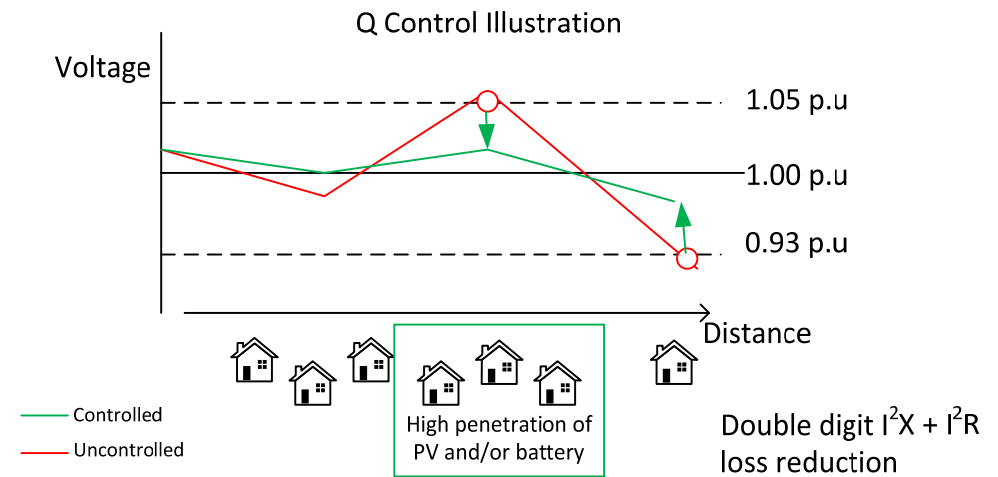
*Among 400 utility stakeholders, **90% of survey** respondents believe that the growth of DER will force a major shift in utility business models.*

Reduction of voltage excursions via Q control

- The first order limit of Hosting Capacity is due to voltage excursions

- Traditional methods to manage voltage are expensive and coarse

- Intermittent injection from DERs is the predominate cause; and, if managed, the solution!!



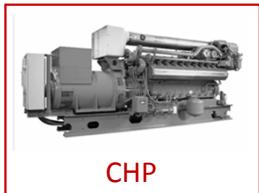
- Q management has the *side effect* of reducing technical losses

- Inverter costs are generally covered in other business cases

Co-optimization of Diverse Assets

Complexity

Simplicity



Dynamic Operational Constraints & Control Operations



Non-Constant "Control" and "Storage" Characteristics

- Storage
- Real Power
- Real Energy
- Reactive Power
- Ramp In/Out Rates
- Tariff
- ...and more

Optimizing & Coordinating Diverse Assets



Network Response

Confidential & Proprietary

Multi-Layer Control / Optimization

Grid Level Optimization for Grid/Service level objectives (i.e. Grid Regulation, Capacity)

Grid Level Optimization

Collection of Networks Optimizing for the Network Scale objectives (i.e. Substation or Region)

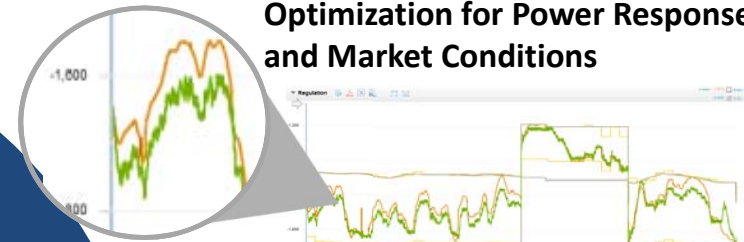
Regional Level Optimization

Collection of Local Resources into a Network Level Optimization (i.e. Campus, Feeder etc.)

Network Level Optimization

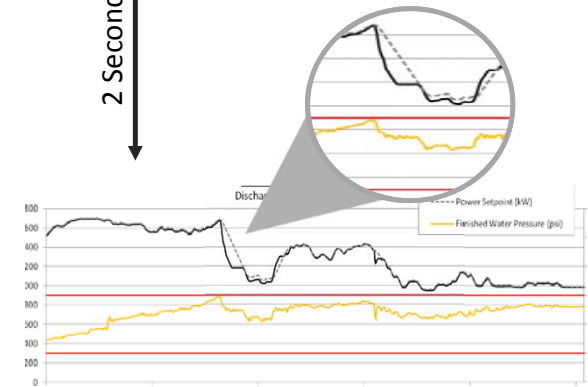
Local Constraint Based Optimization of the Objective based on Local Conditions and Operations (i.e. DER, Load, System)

Local Resource Optimization



Optimization for Power Response and Market Conditions

2 Second Action



Optimization for Power Response and Local Resource Conditions



Thank you for managing
your P's and Q's

Eric Young
VP, Solutions
Enbala Power Networks
eyoung@enbala.com