EXPERTISE TO ENABLE GRID TRANSFORMATION

GridLAB

GridLAB

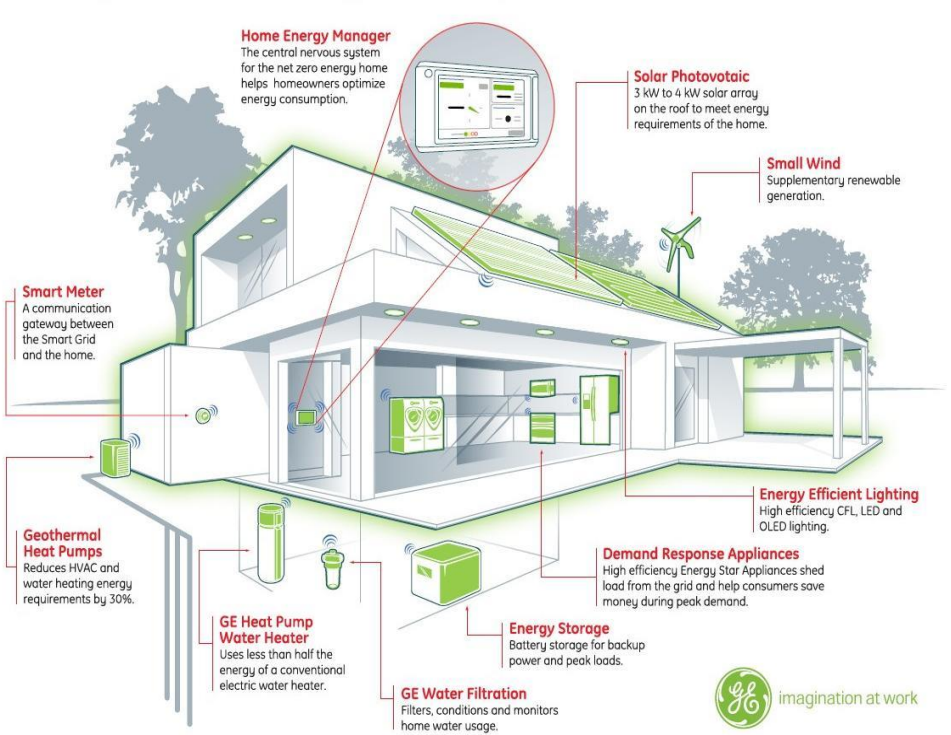
PROBLEM STATEMENT

DER control philosophy

What is the communications and control architecture for DER that maintains reliability and unlocks grid services for DER?

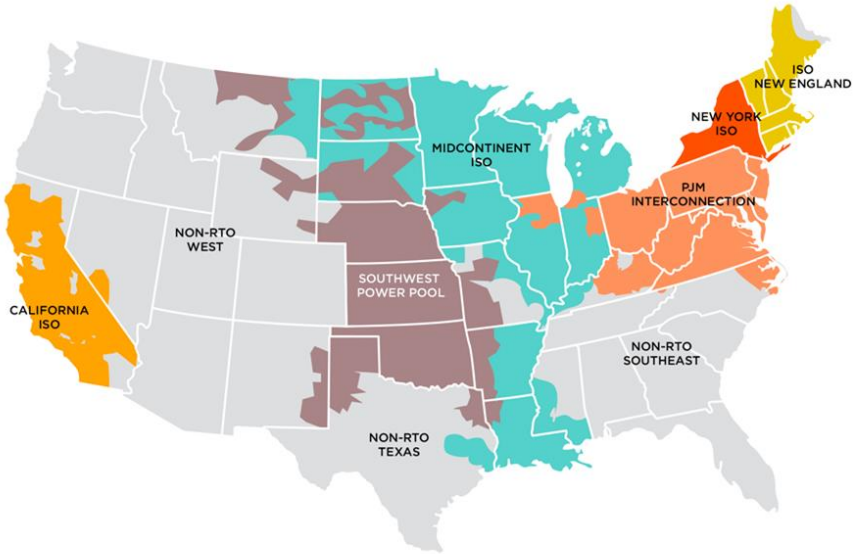
GridLAB

Distributed Energy Resources: *Not just rooftop solar anymore*. The emergence of batteries, EV charging, and advanced demand response means DER has more abilities to provide grid services. **Smart Inverters** enable communications and control



GridLAB

Where are we now?



- ✓ *California and Hawaii – high penetrations of DER, early adopters of smart inverters.*
- ✓ *IEEE-1547 2018 is coming, with communications* ***capabilities***
- ✓ *Some wholesale DER products (e.g. CAISO), not much traction*
- ✓ *Some early Virtual Power Plants (VPP's) – e.g. SunRun in ISO-NE, NWS*

GridLAB

RELIABILITY ASSUMPTIONS

Do we need communications and control?

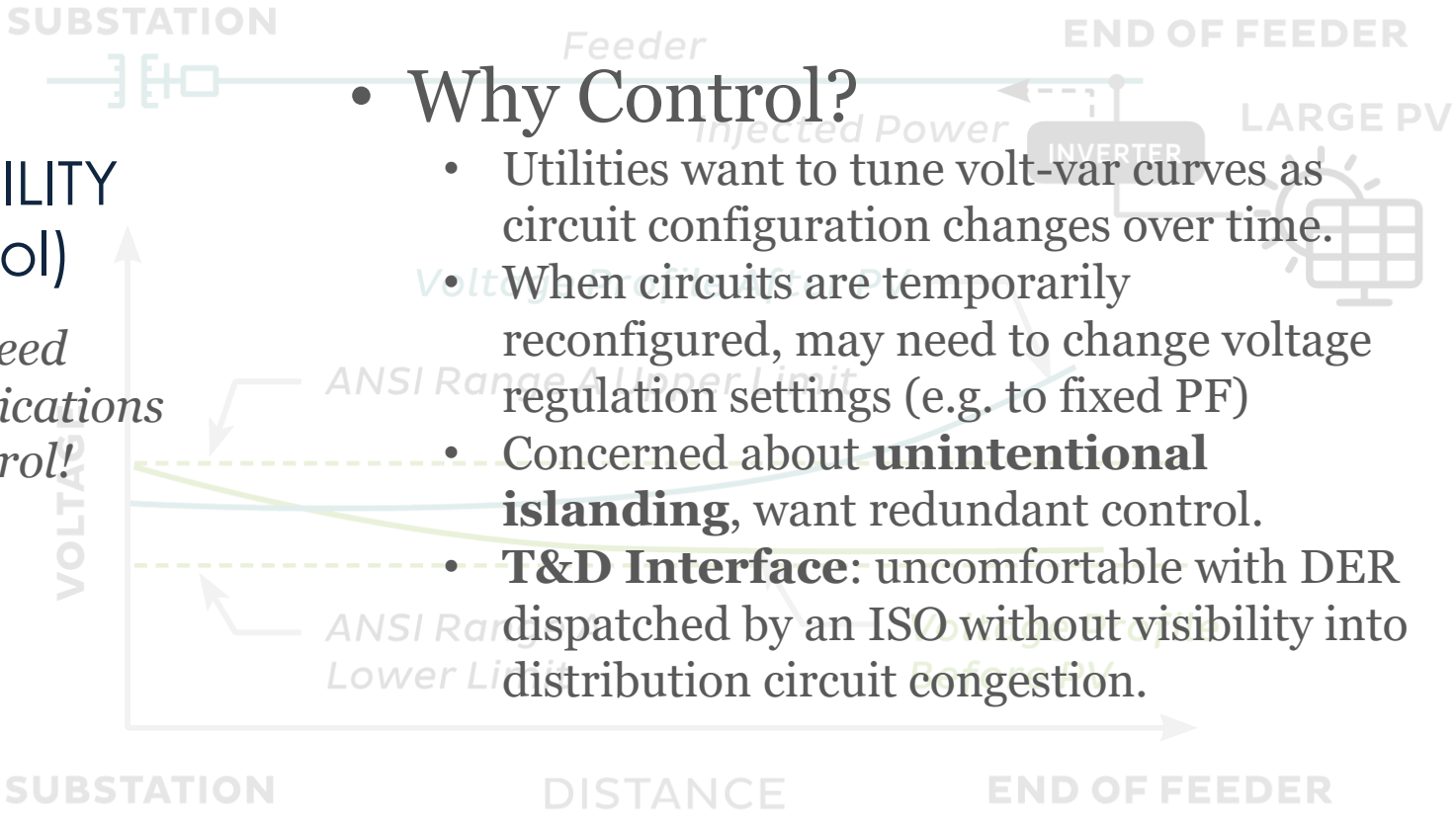
- Control required
  - Many utilities assume communications and control of DER will be needed to maintain reliability.
  - Focus has been on effects of distribution reconfiguration, anti-islanding concerns
- Autonomous Approach
  - California, Hawaii continue to progress with autonomous controls (e.g. volt-var, volt-watt in some cases.
  - Illinois, Minnesota following

GridLAB

RELIABILITY (Control)

We do need communications and control!

- Why Control?
  - Utilities want to tune volt-var curves as circuit configuration changes over time.
  - When circuits are temporarily reconfigured, may need to change voltage regulation settings (e.g. to fixed PF)
  - Concerned about **unintentional islanding**, want redundant control.
  - **T&D Interface**: uncomfortable with DER dispatched by an ISO without visibility into distribution circuit congestion.

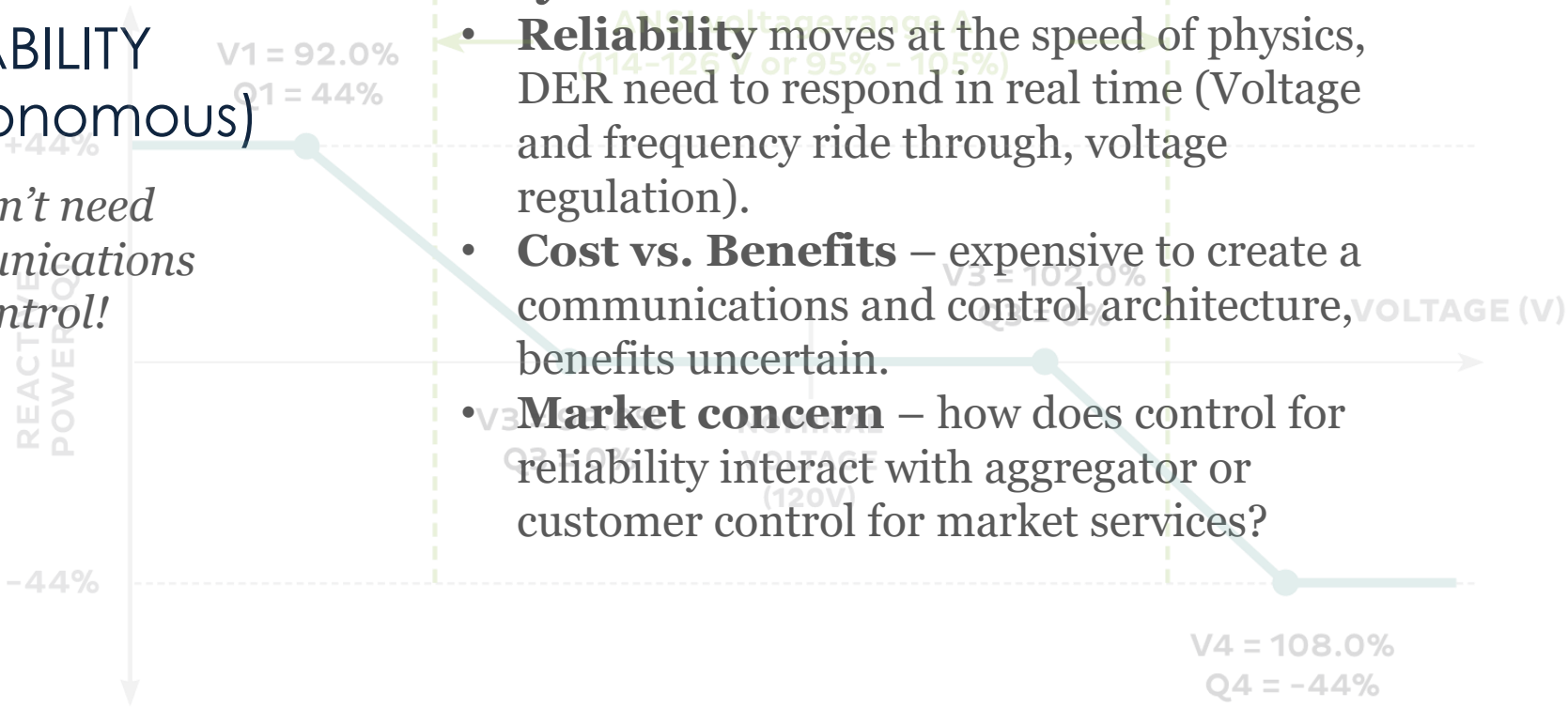


GridLAB

RELIABILITY (Autonomous)

We don't need communications and control!

- Why Autonomous?
  - **Reliability** moves at the speed of physics, DER need to respond in real time (Voltage and frequency ride through, voltage regulation).
  - **Cost vs. Benefits** – expensive to create a communications and control architecture, benefits uncertain.
  - **Market concern** – how does control for reliability interact with aggregator or customer control for market services?



GridLAB

Draft Principles

POTENTIAL PATH FORWARD

- **Autonomous** approach appears to work even with high penetrations of DER (CA, HI experience).
  - Volt-var, volt-watt as backstop
  - No need for redundant control for unintentional islanding
- Communications for **larger systems** only
- Incorporate **distribution congestion** in pricing?
- Market participation through **aggregators**