

EXPERTISE TO
ENABLE GRID
TRANSFORMATION

GridLAB

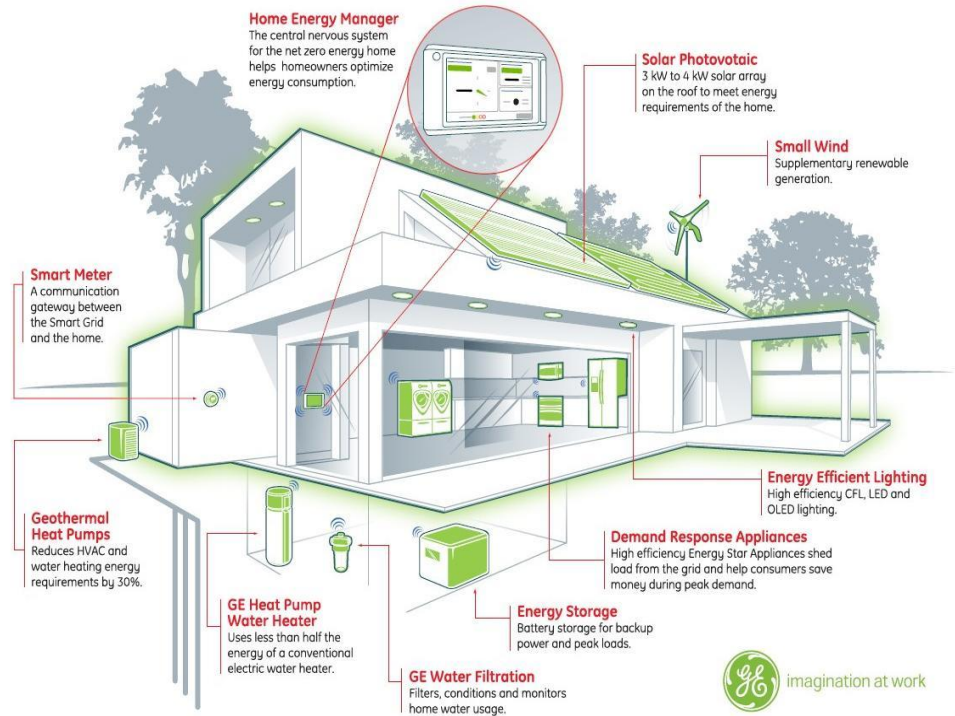


PROBLEM
STATEMENT

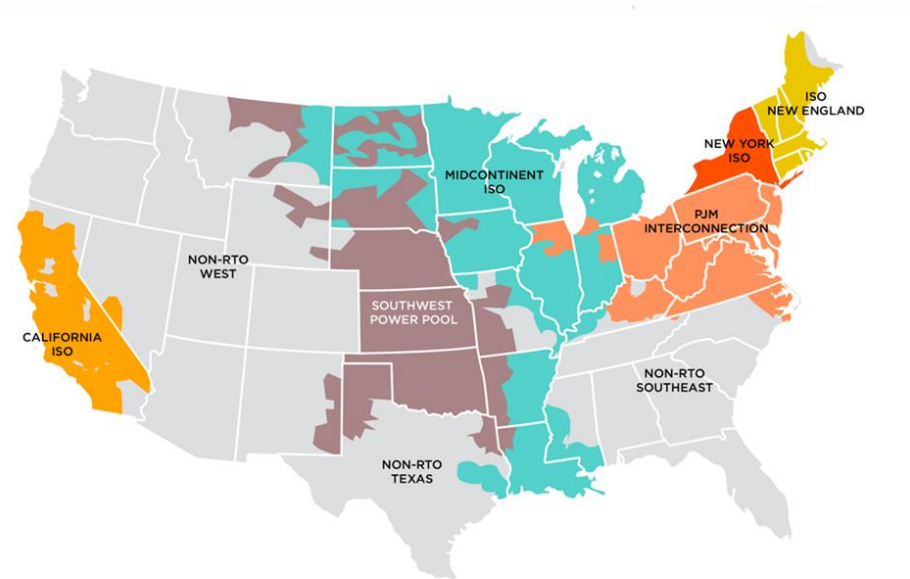
*DER control
philosophy*

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

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



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*

RELIABILITY ASSUMPTIONS

*Do we need
communications
and control?*

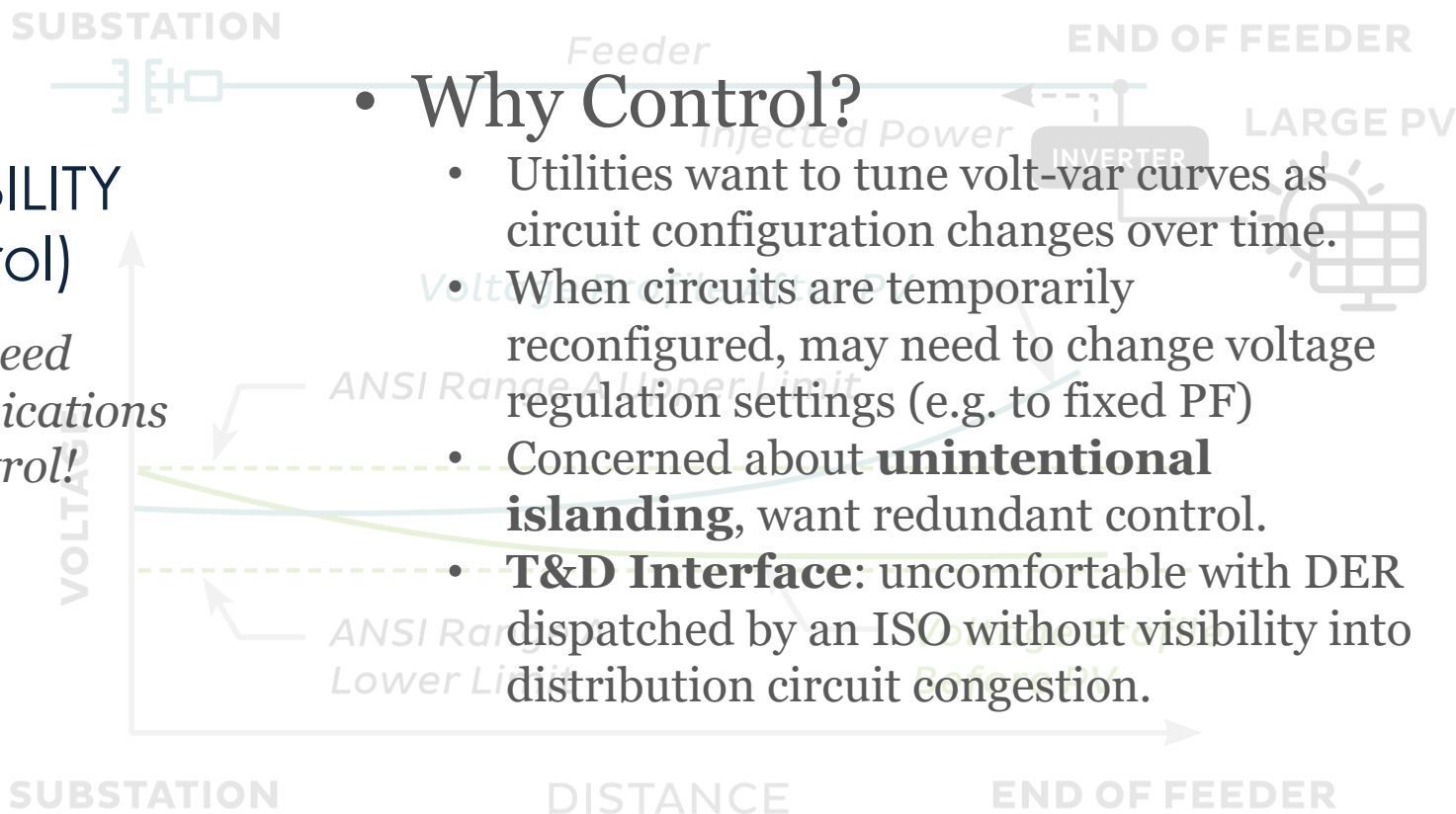
- **Control required**
 - Many utilities assume communications and control of DER will be needed to maintain reliability.
 - Focus has been on effects of distribution reconfiguration, anti-islanding concerns
- **Autonomous Approach**
 - California, Hawaii continue to progress with autonomous controls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

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.

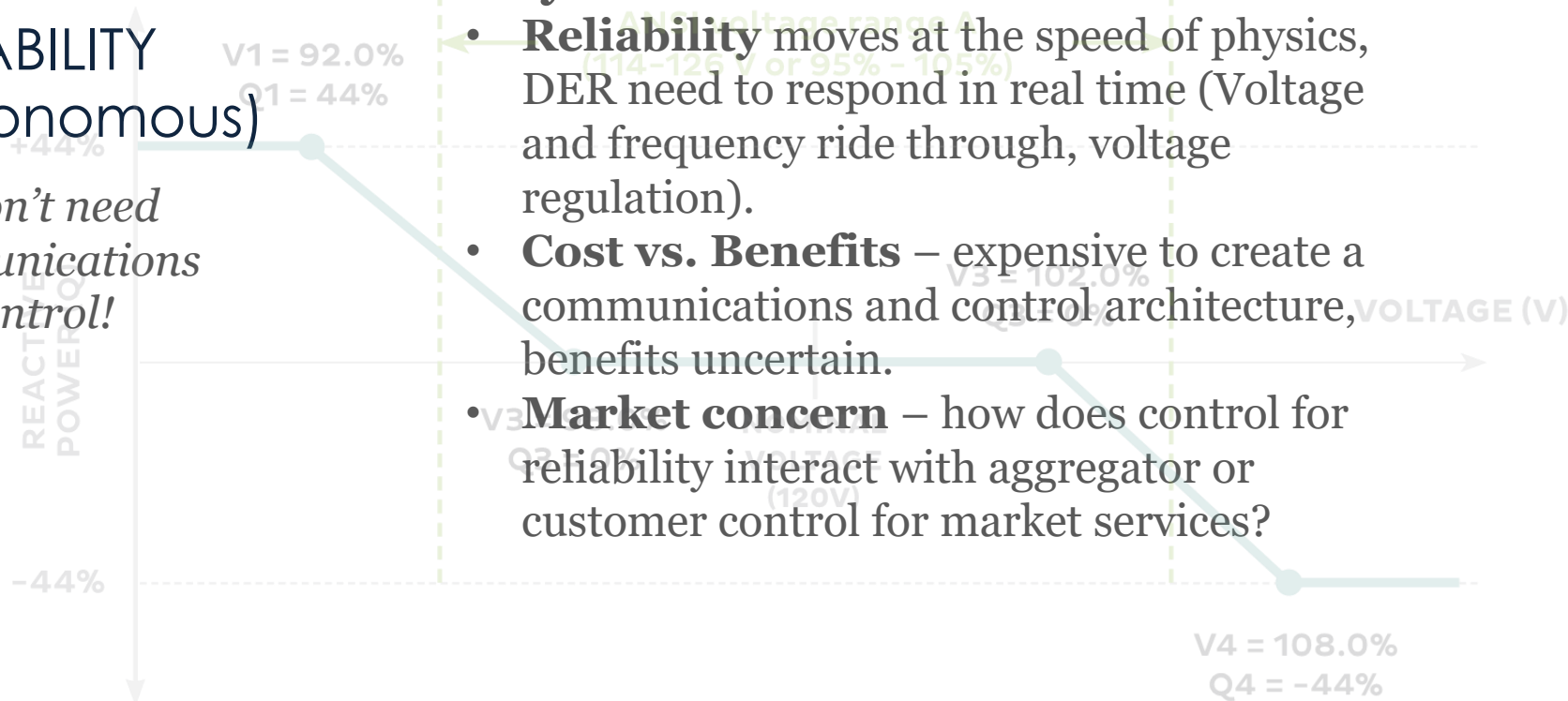


DEFAULT CATEGORY B VOLT-VAR SETTINGS IN IEEE 1547

• Why Autonomous?

RELIABILITY (Autonomous)

*We don't need
communications
and control!*



- **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?

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**