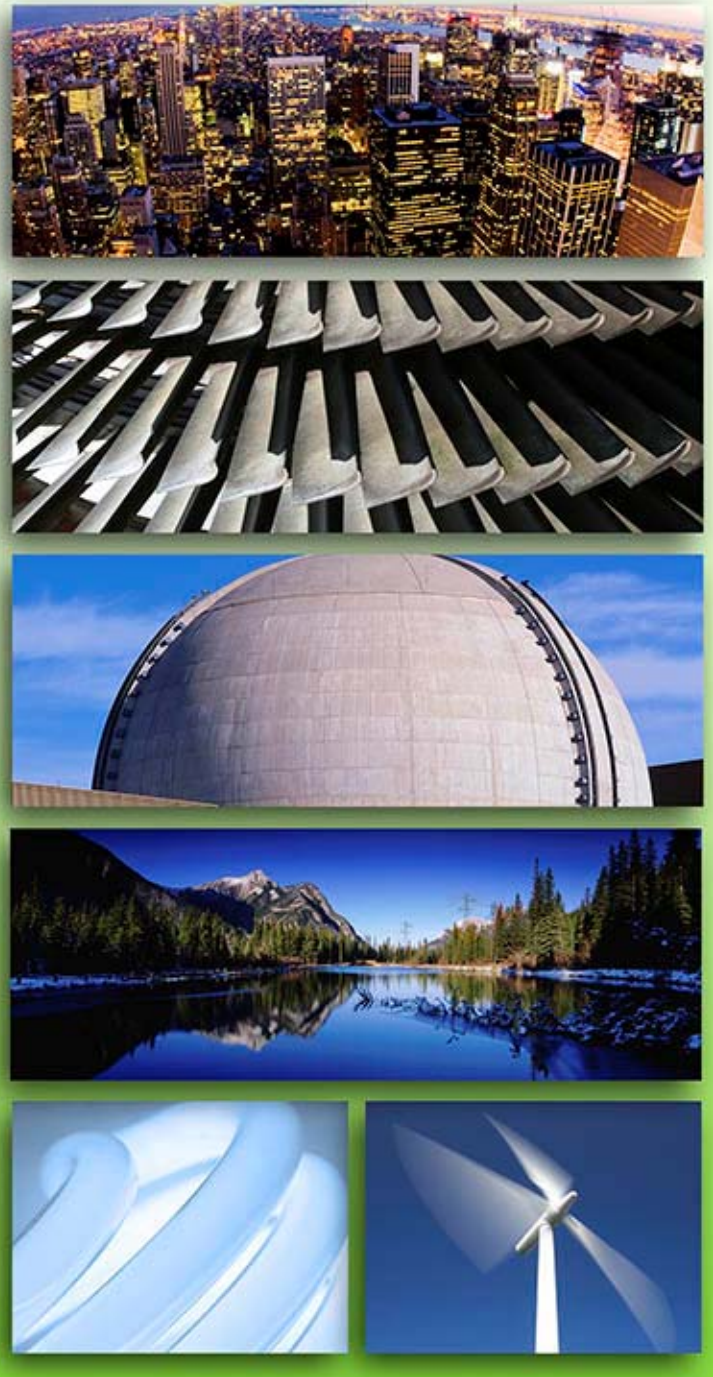

ELECTRIC POWER RESEARCH INSTITUTE

EPRI Perspective on Distribution Infrastructure Challenges for DG

California Energy Commission

Distributed Generation Workshop

June 22nd, 2011

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EPRI Perspective Basis

- Working with a diverse utility membership
  - Some with aggressive RPS, some with none at all. Some expecting or experiencing high penetration now, others without any signs.

- Facilitation of the “Smart Inverter Communication Initiative”
  - Engaging over 500 individuals, working to identify uniform smart-inverter functionalities that can then be mapped into open standard protocols

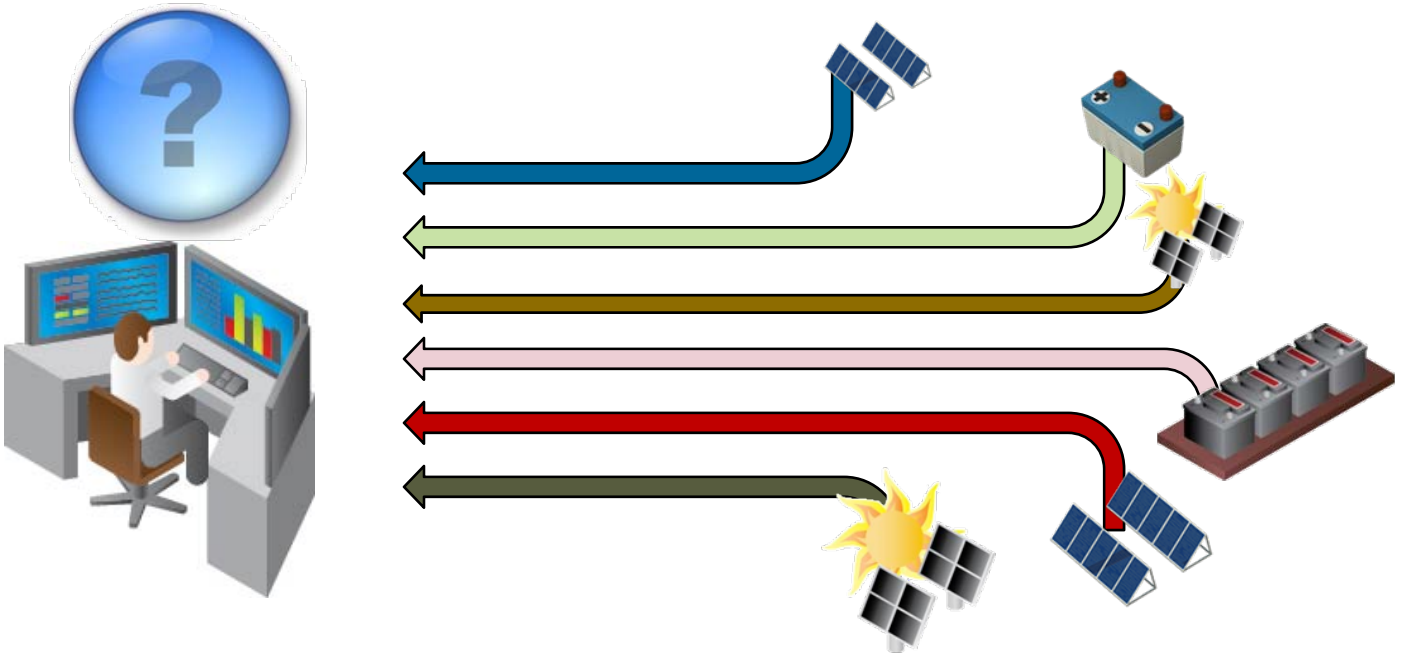
Communication Connectedness is Key

- Without communication connectedness (i.e. manageability),utilities don't want DER to try to do anything "smart" or grid supportive, due to concerns that the behavior will not work as intended, even potentially working against the utility. Existing IEEE1547 rules reflect this do-nothing approach.

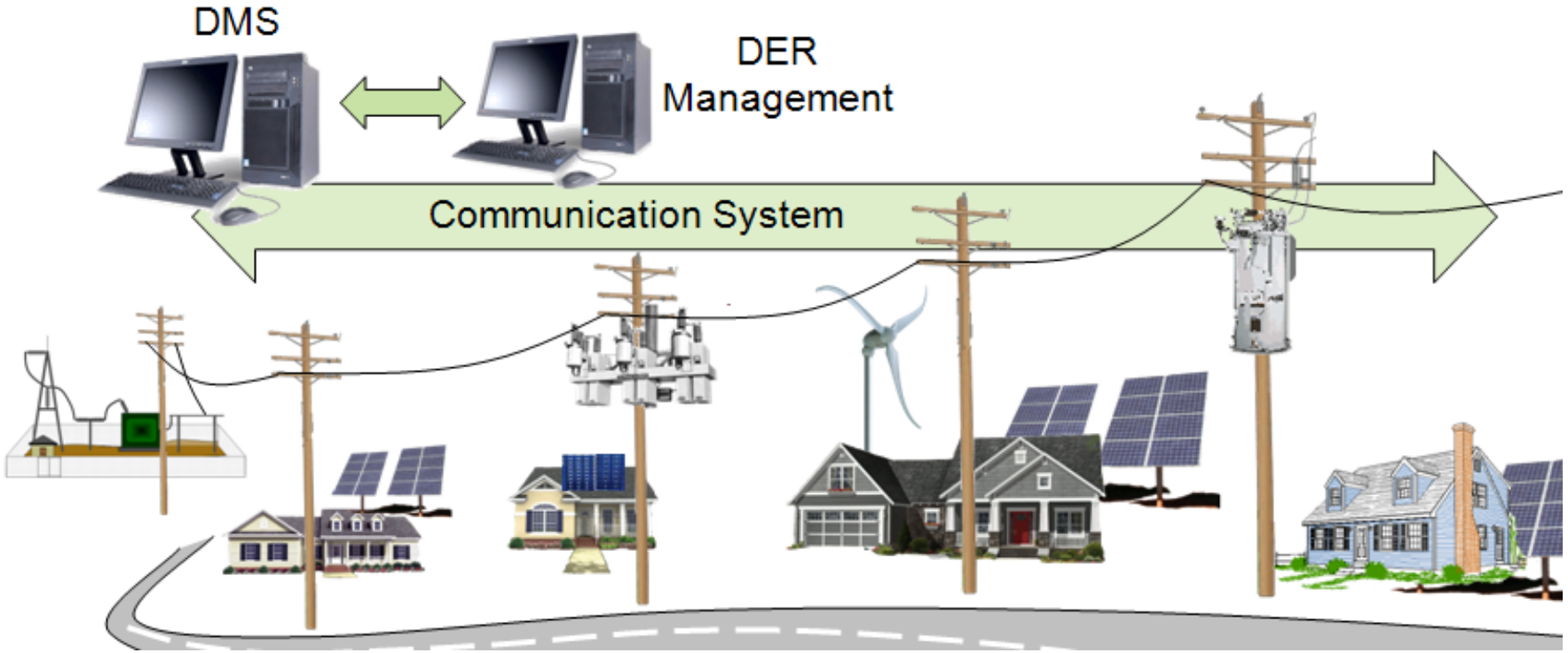
- With communication-connectedness, and authority to manage (control, or reconfigure), utilities are interested is a long list of potential grid-supportive functions from DER.

Standard Functionalities are Necessary

- All vendors have “grid supportive” capabilities
- All vendors have communication capability
- But all in different, proprietary ways



More than Enabling High Penetration



Communication-Connected Distributed Resources as Beneficial Distribution System Assets

Smart DER Not Necessarily High Bandwidth

Autonomous “smart” behaviors are favored, responding to local voltage & frequency, steady-state and transients

Centralized control via infrequent configuration of desired behaviors

Configurable “Modes” can enable fast management of many devices

Common AMI and SCADA systems may be used for this kind of management

Key Functionalities for High Penetration

Volt-Var Management*

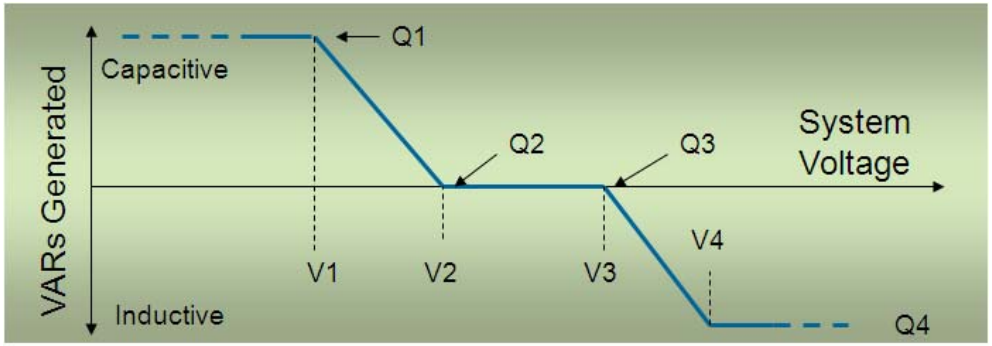
Watt-Volt Management*

Simple Curtailment*

Watt-Frequency Management

Dynamic Grid Stabilization (inertia)

Voltage Sag Ride-through



* Potential customer sensitivities – policy attention needs

Continued Work is (of course) Needed

- Manufacturers and Owners must understand why their products should be grid supportive:
  - Incent manufacturers to build intelligent functions and standard communication capability into their products.
- Standards work must continue:
  - More standard functions need to be defined, existing ones tested
  - Transient behaviors need to be determined and documented
- Significant gap in DMS integration and coordination
- New techniques such as active anti-islanding may be needed to prevent high penetrations of smart inverters from unintentionally islanding
- Standard test harnesses and certification agencies are needed