Future Communications to Support DSO / DER Markets

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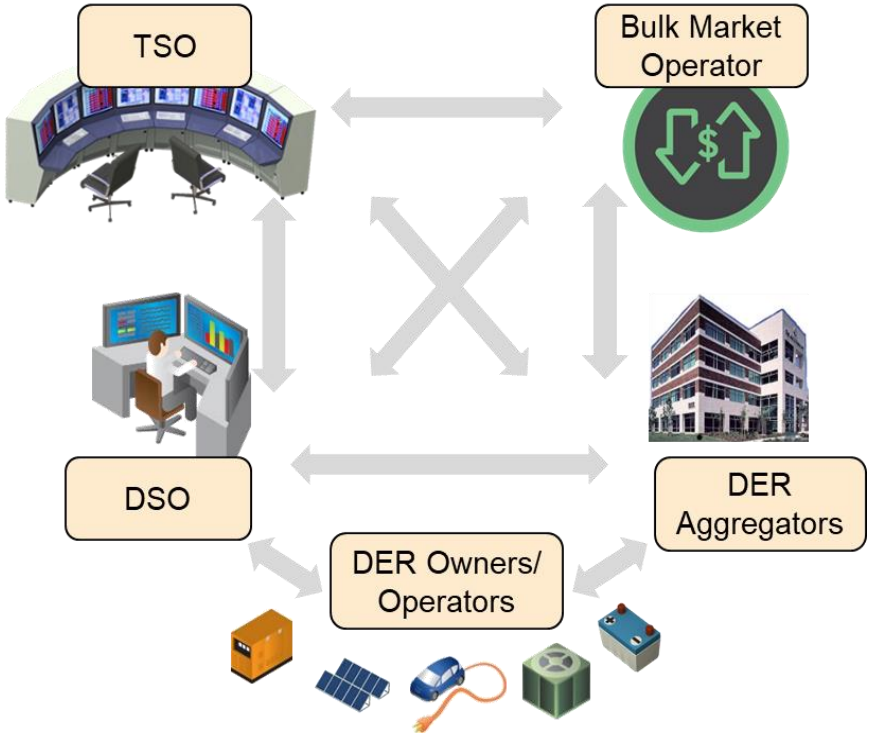
Coordination for DSOs

FUNCTION	Prepar-atory	Pre-Action	Interim	Dis-patch	Service	Post-Action	TYPICAL ROLES
DER Group Reference Control Method Notification	X						AGG→DSO
LSE to DER Association	X						DSO→AGG, AGG→ISO, DSO→ISO
DER Group Status Monitoring				X	X	X	AGG→DSO, AGG→ISO
DER Group Telemetry	X	X	X	X	X	X	AGG→ISO
DER Group Constraint Optimization	X	X	X	X	X		
Energy Market Participation		X	X	X			AGG→ISO,
DER Group Service Award Notification		X					ISO→AGG
Advance Notification		X	X				
DER Device Dual Service Notification		X		X		X	ISO→DSO
Real Power (Energy) Dispatch				X	X		
Reactive Power Dispatch				X	X		
Device-Level Service Plan (DLSP) Notification			X				AGG→DSO
Device-Level Constraint Notification			X		X		DSO→AGG
DSO Device-Level Limiting and Notification					X		DSO→DER DSO→AGG
DER Group De-rate Notification			X		X		AGG→ISO
DER Group Service Point(s) Discovery/ Notification	X		X		X		DSO→ISO, DSO→AGG
Offer Curve Distribution Constraint Correction		X		X			DSO→ISO
Real-Time Market Participation				X			AGG→ISO, ISO→AGG
Service Point Total		X					

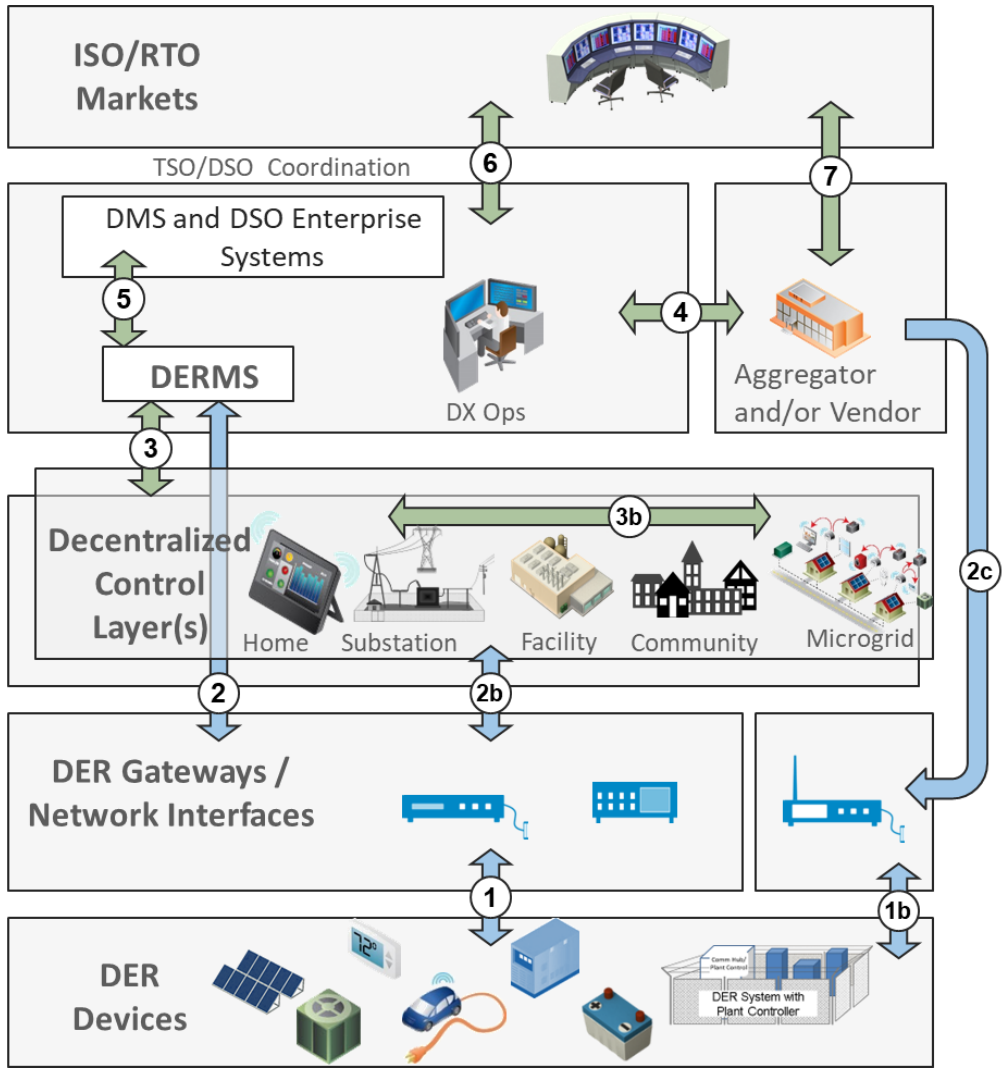
https://www.epri.com/research/products/000000003002021985

37 Functions & counting,
216 Pages



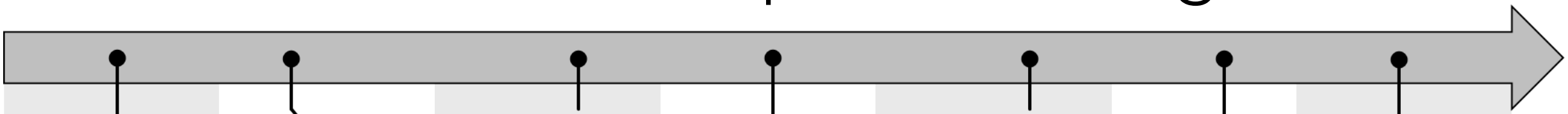
Group-Level vs Device-Level Messages

- Device-level interactions are type-specific but group-level interactions are grid-oriented, type agnostic.
- Aggregators want to innovate and compete in how group results are produced
- DER aggregations with mixed/diverse DER types
- Decentralized controllers representing combinations of DER
- Device-level standards appeared first, more mature



Protocol Standards Gaps & Coverage

Device Level
Group Level



DER Awareness
Direct or indirect, ability to know what, where and how of DER availability, including customer preferences

Program and Locational Awareness
Consumer and aggregator ability to know opportunities, requirements, how to best form VPPs

Eligibility, Authorization & Enrollment
Process for becoming a participant, standard contracts, simplicity, automation.

Participation
Advance notification, opt in/out, dispatch, service, duration, frequency of occurrence, comfort limits, recovery

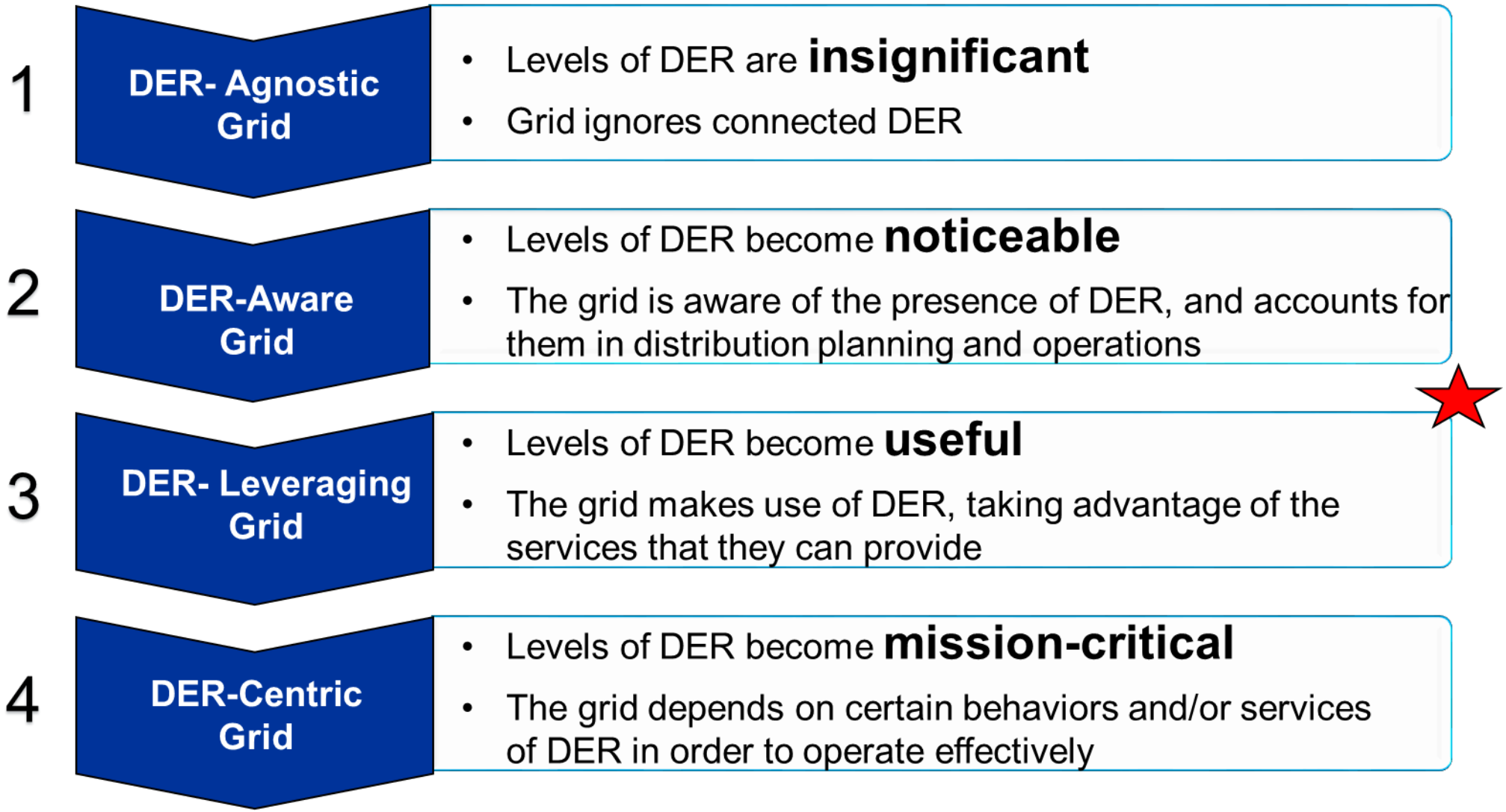
Optimization
Interactions to make DER/VPP services better, add value, avoid constraints

Operational Verification
Telemetry, verification of successful service operation

M&V, Settlement
How VPP services are verified, baseline methods, payment

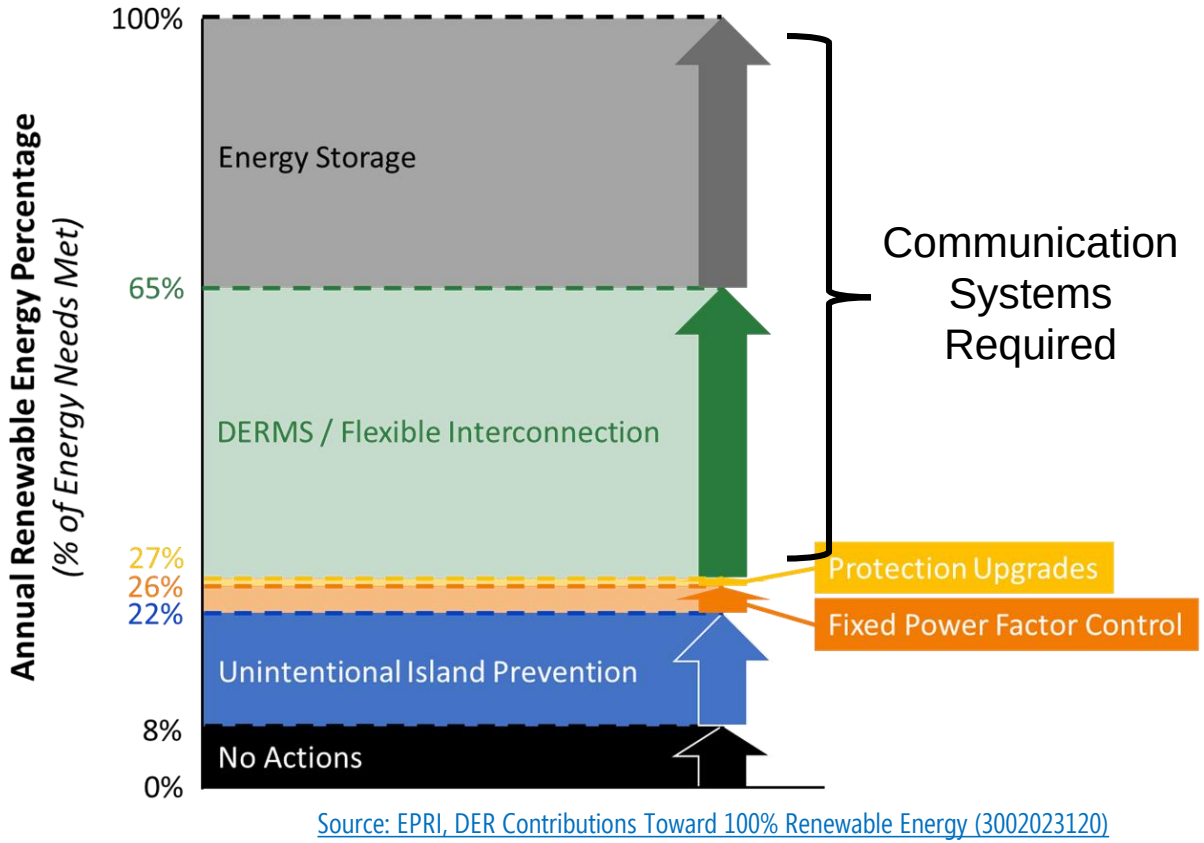
2030.5
2030.5
2030.5 - 2024
2030.5 – Next
SunSpec
DNP3
DNP3
DNP3
CIM (e.g. IEC 61968-5, IEC 62325)
ICCP
Websites & APIs
ANSI
Lack of Standard Service Definitions

Stages in DER Integration



Communication Necessity

- Regional targets based on renewable % of total energy use
- % expected on distribution systems varies
- EVs with V2G capability drive up distribution hosting
- Average of 5000 feeders studied, DER comms required above AREP=27%

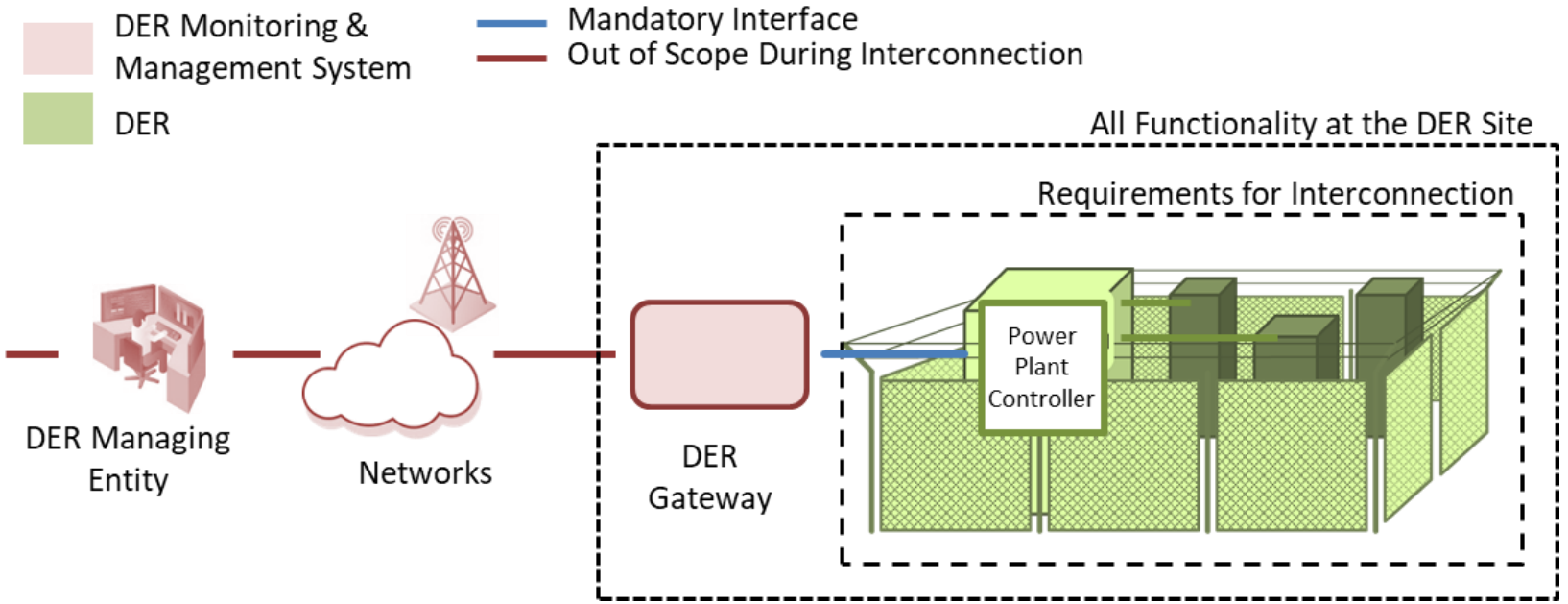


Source: EPRI, DER Contributions Toward 100% Renewable Energy (3002023120)

If DER are mission-critical, fewer communication architectures are feasible

Use of DER Gateways

- Edge-most element of DER management systems
- Present focus of IEEE 1547.10
- Uniform requirements for all managing entities
- Network connection/interface ≠ DER local interface

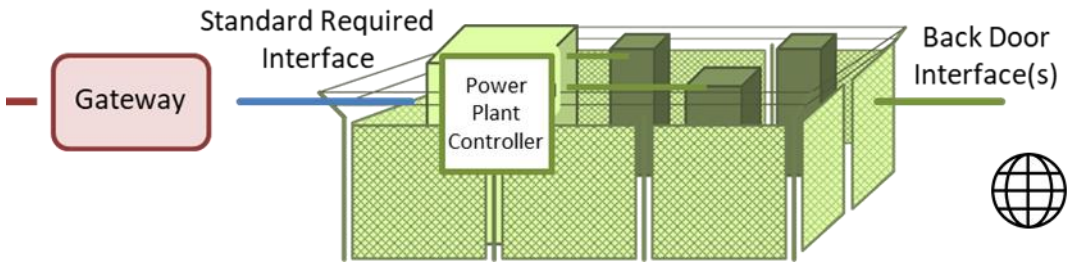


Trend Toward Local, Air-Gapped Networks

One of the more significant elements of a cyber threat, contributing to the uniqueness of cyber risk, is the cross-cutting and horizontal nature of networked technology that provides the means for an intelligent cyber attacker to impact multiple assets at once, and from a distance.

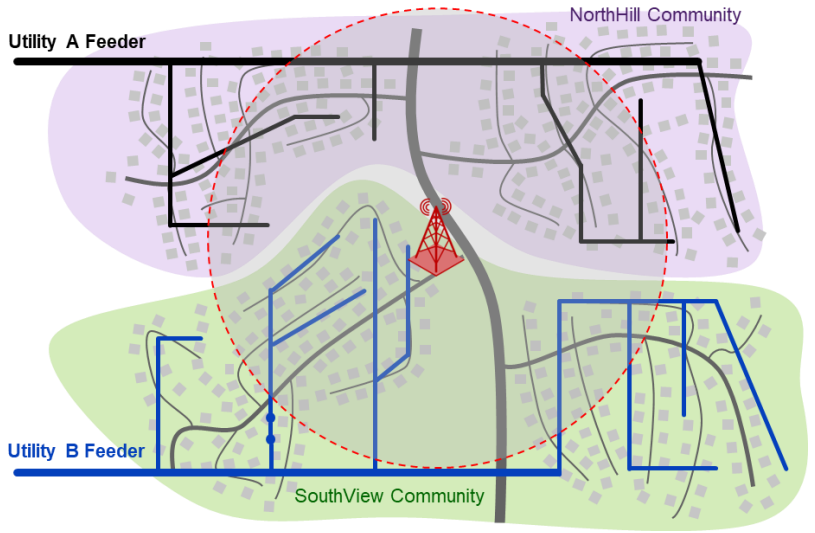
-Michael Assante
NERC Chief Security Officer, April 7th 2009

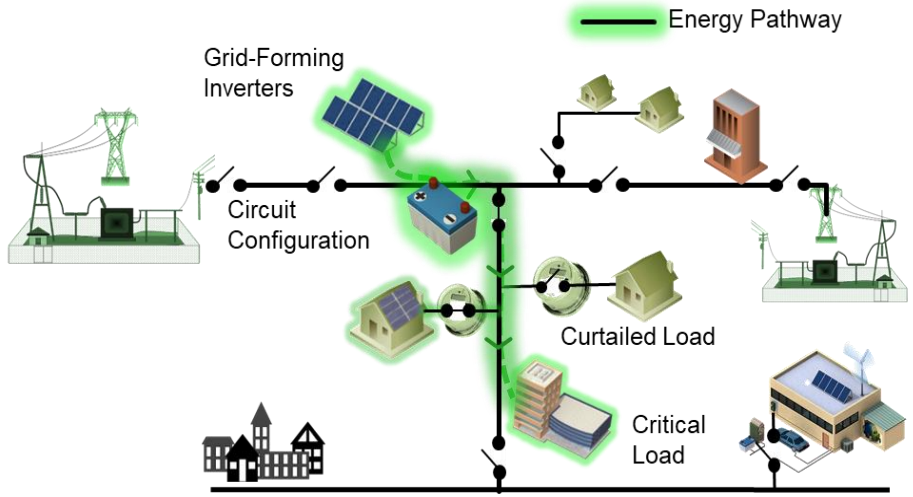
- All systems & devices are hackable
- DER are assumed to be compromised
- Aggregator systems falling outside NERC/CIP
- Policies regarding DER “back doors”
- Controlling the attack-surface: air-gapped comm networks



Trend Toward Grid-Aligned Telecoms

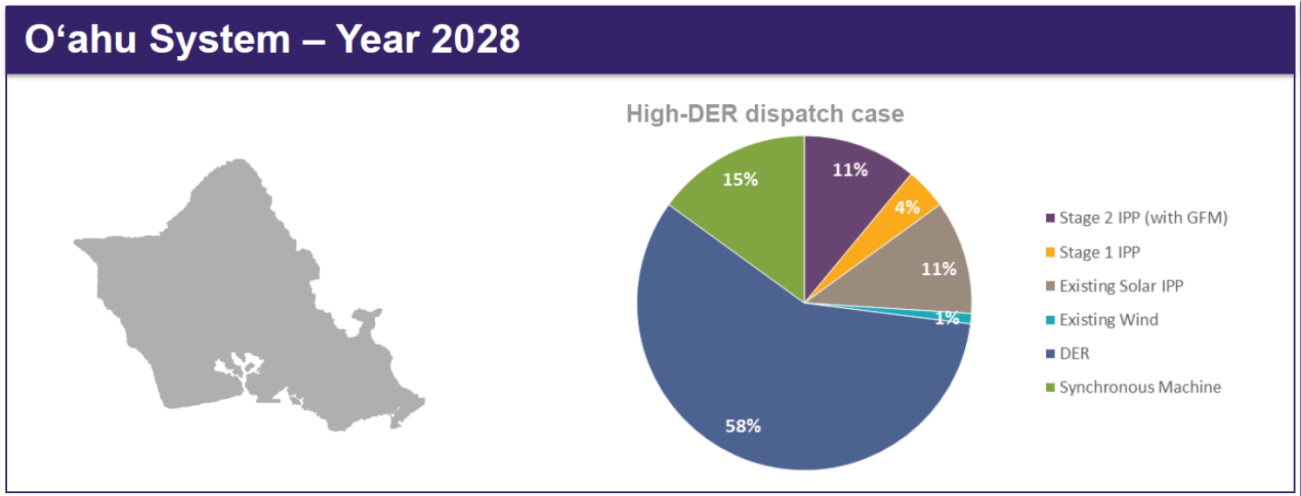
- Power local levels is increasingly practical
- Power systems are decentralizing, commercial telecom & cloud systems are centralizing
- Resiliency benefits of distributed energy require physically-aligned communication architectures
- Significant investments: grid-forming inverters, SOLACE, SECURE projects, private LTE, etc.
- Device-to-device communication without outside dependencies (e.g. 3GPP's proximity services, ProSe)

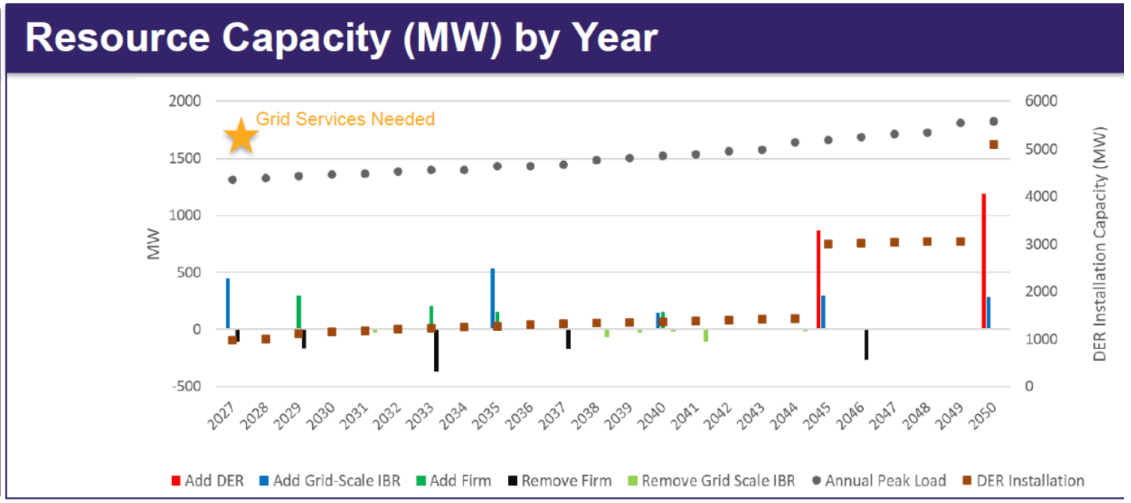




Trend Toward Higher Telecom Resiliency

- Electrification – rising dependency on electric power availability
- Comms prevalence and fewer passive power systems
- Redundancy and backup power (e.g. Southern Linc: EPRI report 300202329)
- “National Spectrum Strategy” considerations





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