NARUC Winter Policy Summit

Public Purpose Microgrids

Sunday February 10th
1:30-2:30 PM

NARUC Winter Policy Summit

Public Purpose Microgrids

Moderator:

- Ryan Laruwe, Michigan Staff

Panelists:

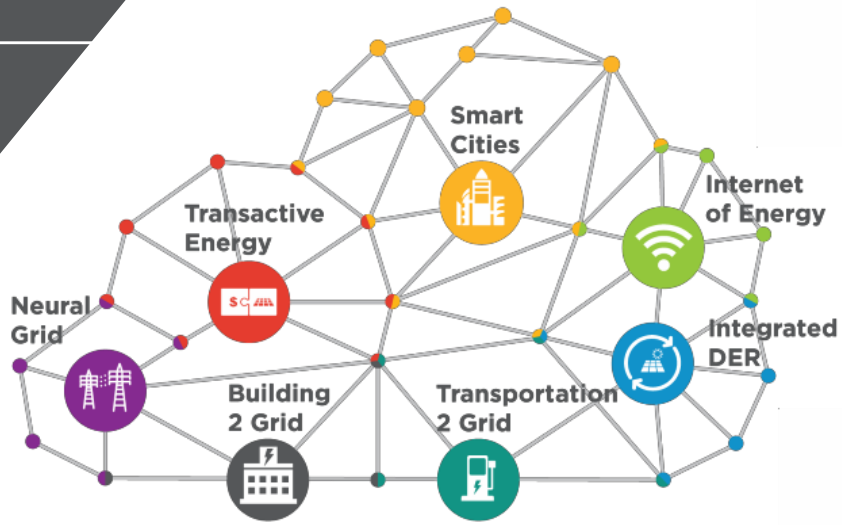
- Lon Huber, Director, Energy, Navigant
- Shay Bahramirad, Vice President, Engineering and Smart Grid, ComEd
- Jason Allnutt, Conformity Assessment Program Specialist, IEEE
- Chairman Griffin, Hawaii Public Utilities Commission

MICROGRIDS AND REGULATION: OPPORTUNITIES AND CHALLENGES

NARUC

FEBRUARY 10TH, 2019

LON HUBER
DIRECTOR - HEAD OF NORTH AMERICAN
RETAIL REGULATORY OFFERING



NAVIGANT

ENERGY INFRASTRUCTURE MARKET

Energy Infrastructure

Grid-Connected Energy Infrastructure

Grid Distribution Energy Infrastructure

Grid-Connected DER System

Also Islandable DER System (aka “microgrid”)

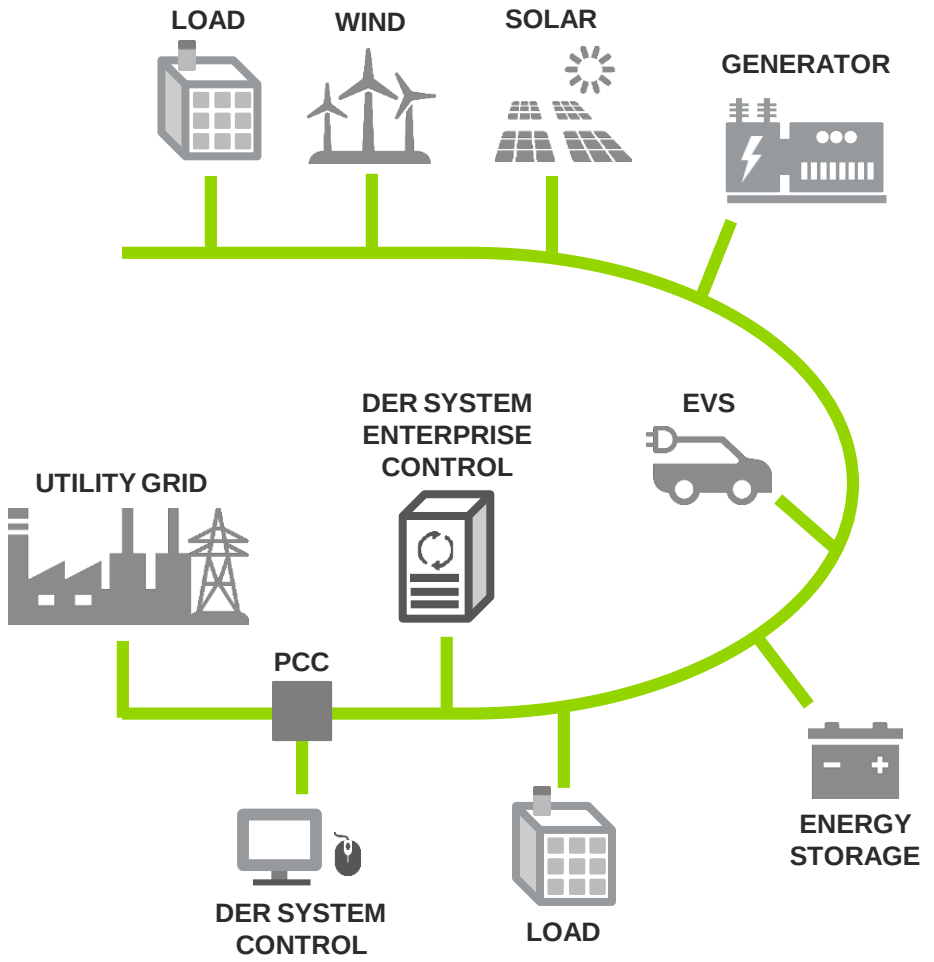
“Microgrids” are a small niche digital / physical infrastructure business within a much larger energy infrastructure market.

NAVIGANT

DER SYSTEMS VS MICROGRIDS

Grid-Connected DER System

A distribution network component connected to a traditional utility power grid that includes multiple DER assets collected and controlled as a single entity.



Source: Navigant Research

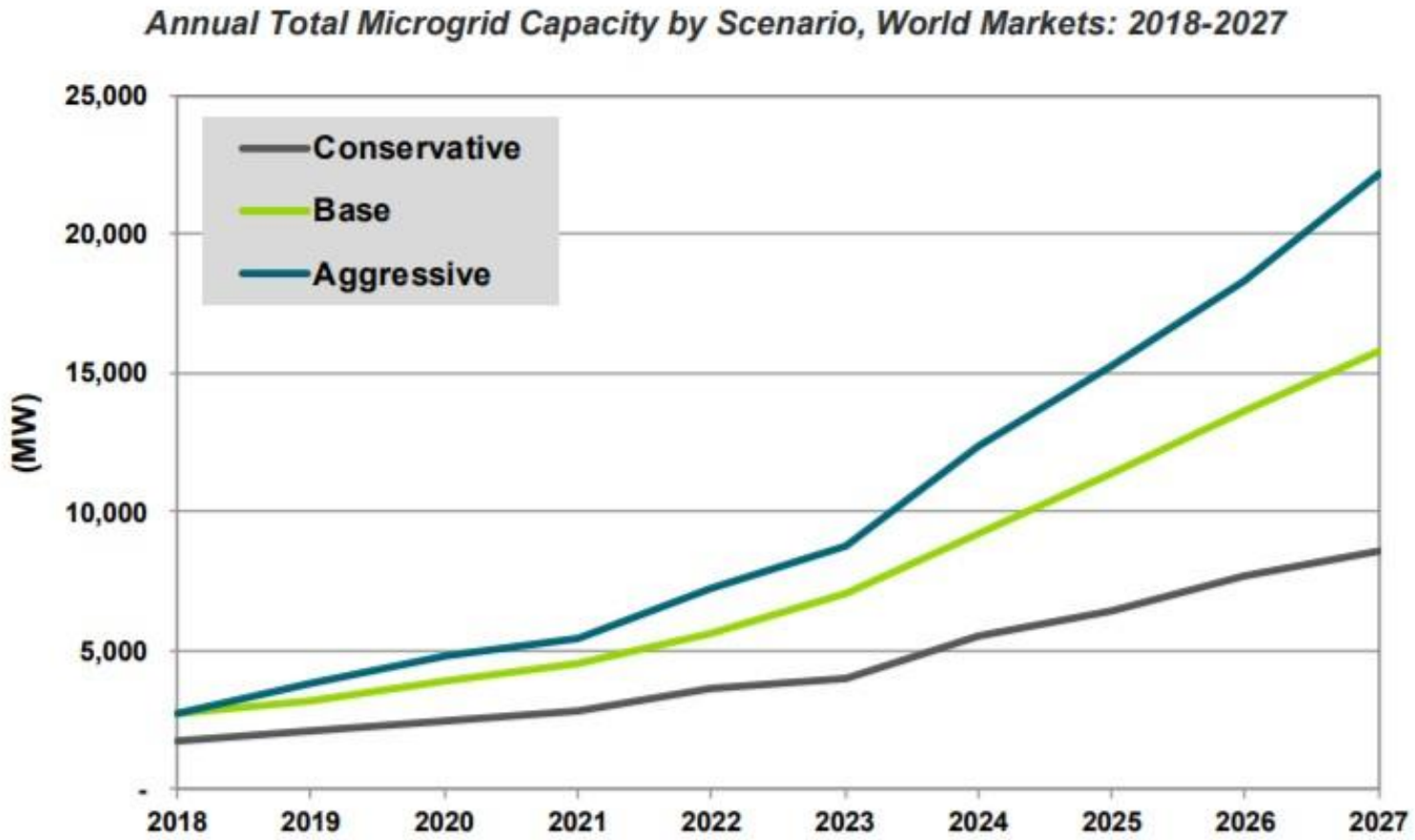
Islandable DER System (aka “microgrid”)

A DER System that also islands from a traditional utility power grid by isolating at the point of common coupling and then controlling the balance of multiple loads with dispatchable load and local generation and/or storage.

NAVIGANT

MICROGRID FLAVORS

1. Campus/institutional microgrids:
2. C&I microgrids:
3. Military microgrids
4. Utility distribution microgrids
5. Remote microgrids



(Source: Navigant Research)

NAVIGANT

THE MORE STRAIGHT FORWARD USE CASE: SINGLE CAMPUS CUSTOMER

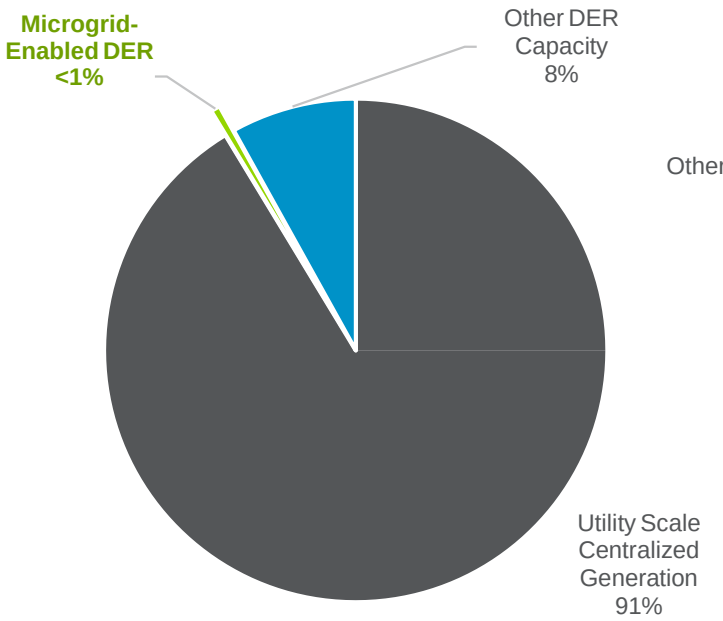
Marine Corps Air Station Yuma

- A shared grid reliability resource
  - Meets peak requirements
  - Autonomous Frequency Response
  - Full load to grid in less than 20 seconds
  - Reduces or eliminates customer down time in microgrid configuration
- 33 MW at two locations
  - Low-medium capital costs
  - Cost sharing improves economics with customer sited microgrids

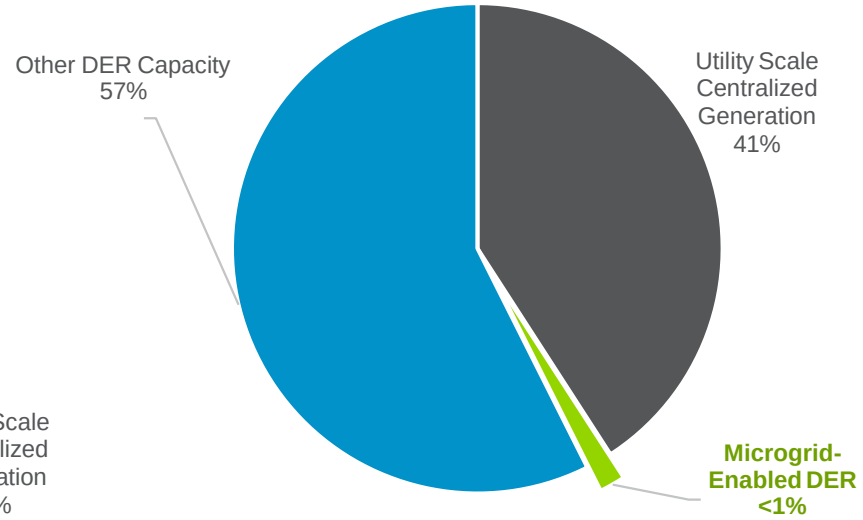
UTILITY DISTRIBUTION MICROGRIDS

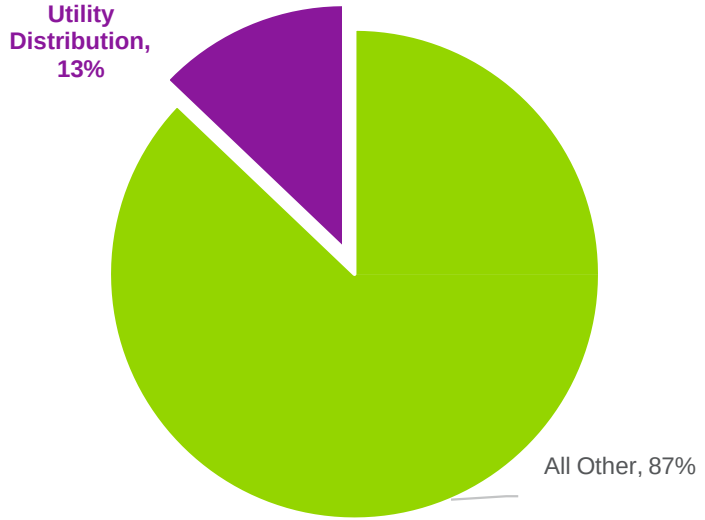
Microgrids represent small share of US power capacity and Utility Distribution Microgrids will continue to represent a small share of US Microgrid capacity.

US Power Total Capacity (2018)



US Power Total Capacity Additions (2018)

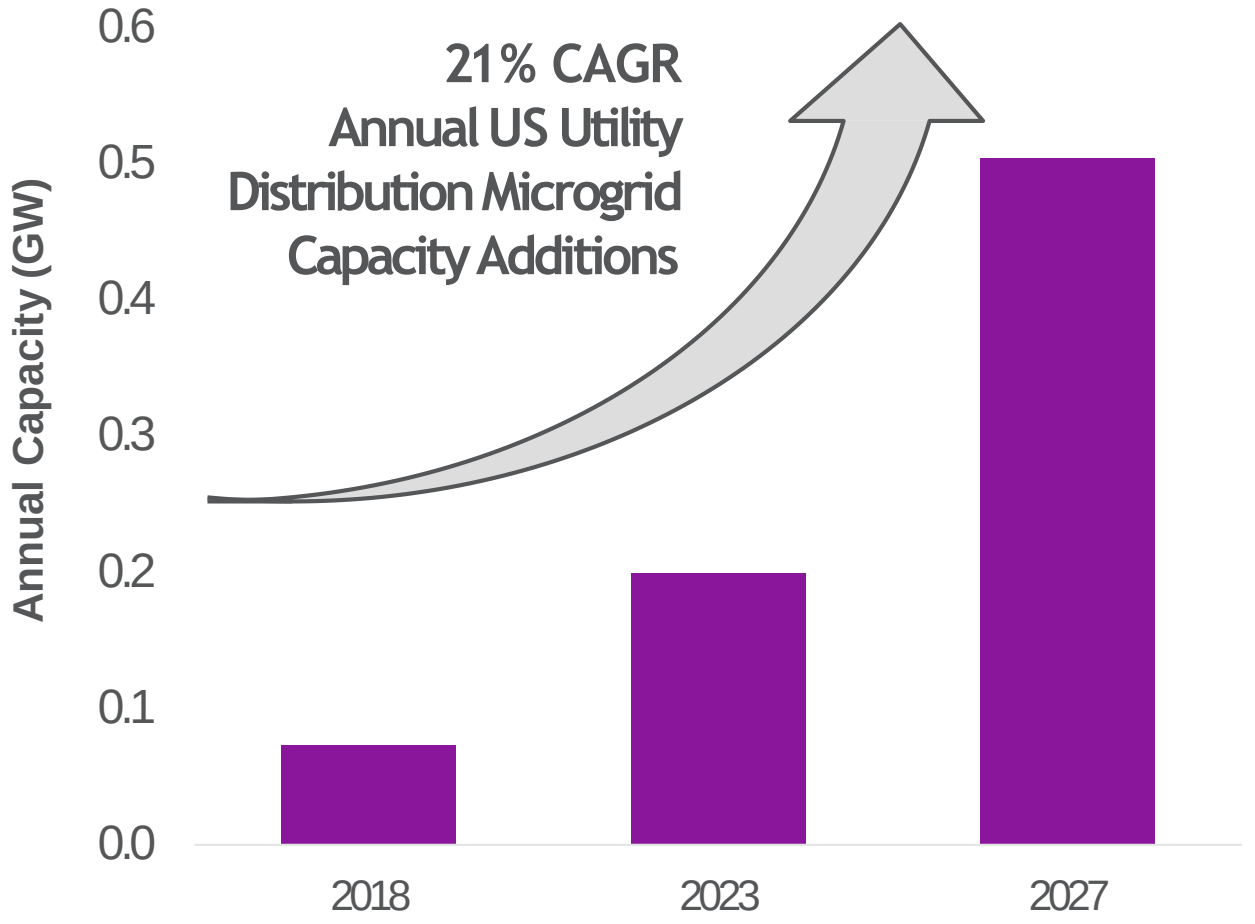




Source: Navigant (as of 2Q 2018)

UTILITY DISTRIBUTION MICROGRIDS

Navigant Research forecasts US Grid-Connected DER-Enabled Capacity within Utility Distribution Microgrids to grow 21% annually through 2027.



Source: Navigant (as of 2Q 2018)

MICROGRIDS OF INTEREST

So just what kind of DER System are we talking about?

- The kind that can operate independent from the grid (i.e. a microgrid)
- The kind that serves energy to two or more different metered customers
- The kind that serves energy across rights of way to reach all of those connected customers
- The kind that is (at least in part) owned or operated by a private entity (i.e. not fully by the utility)

MICROGRID REGULATION CHALLENGES

Community (Multi-Customer) Microgrids disrupt the regulatory compact.

Common Regulatory Assumption

- Utility service is (substantially) the same for all rate payers (customers).
- All utility service benefits are directly paid by individual customers (including both direct benefit and subsidization of benefits to others).
- Supply infrastructure investments are held at the system level and are (mostly) ‘generic’ and not specific to a given customer.

Privately Owned Microgrid Reality

- Differentiated service for a very small collection of directly-connected customers (who can afford it).
- Non-customer community members receive (but do not pay for) tangible benefits from differentiated microgrid service externalities.
- System assets are invested to optimize for and are inextricably tied to a specific site and a specific customer load and quality need.

THE CHALLENGE

Multi party microgrid with indirect benefits

Tiered Recovery Model

nationalgrid
HERE WITH YOU. HERE FOR YOU.

	Service Territory by Tier					
	Police Department	Wastewater Treatment	Water Treatment	Fire Department	Rescue Squad	Hospital
Tier 1	✓	✓	✓	✓	✓	✓
Tier 2	✓	✓	✓	✓	✓	✓
Tier 3				✓	✓	✓
Tier 4					✓	✓
Tier 5						✓

NAVIGANT

MICROGRID REGULATION OPPORTUNITIES

How can we pursue these large, complex projects successfully, given the regulatory challenges?

1. **Regulator**: Recognize that not all loads have the same societal value, and customer-differentiated utility service can support the broader public interest mission (and therefore merit both utility recovery consideration and private owner permissions).
2. **Utility:** Give and take can yield new opportunities for growth and service and deepen customer relationships for the long term.
3. **Interconnector:** Recognize that physical inertia, regulation services, and last-resort supply (among others) are not free to provide.
4. **Customer:** Expecting microgrid-enabled benefits for free is (usually) a non-starter – if you really want resiliency, renewables integration, economic development, etc., then work to find ways to financially support projects that offer these benefits to you.

NAVIGANT

INVESTMENT DRIVERS

There are eight core DER System value propositions requiring utilities to carefully consider the role of microgrids within their distributed energy infrastructure investment strategy.

DER System Value Propositions for Utilities

1. Regulator Permission or Mandate	Community Microgrids, Renewables Integration, Climate Change Reduction / Mitigation, Emergency Response
2. Revenue Protection	Large Load Retention, Customer Service Market Share Retention, Customer Relationship Retention, Thermal Energy Fuel Switching Revenue Retention
3. Revenue Growth	Premium Power Solutions, Asset O&M Services, Commercial Asset Investment, Customer Relationship Monetization, Energy Surety Insurance
4. Non-Wire Asset Alternative	Reliability, Congestion, Capacity, Useful Life Extension / Replacement Deferral
5. Local Grid Services	Demand Response, Voltage Management, VAR Support, Frequency Support, Hosting Capacity, Storm Restoration Enablement
6. Grid Architecture	Platform Model, Distribution System Operator (DSO) Model, Cellularization for Defense-in-Depth Resiliency
7. Community and Society	Resiliency, Carbon Reduction, Economic Development, Transport Electrification, Smart City / Citizen Services, Social Equity of Access
8. Demonstration and Learning	Technology pilot and demonstration, business model exploration, talent capability, skill, and experience acquisition, transactive energy, VPPs

NAVIGANT

CONTACTS

LON HUBER
Director
(928) 380-5540
lhuber@navigant.com

KENNETH HORNE
Director
(781) 270-8368
Ken.Horne@navigant.com

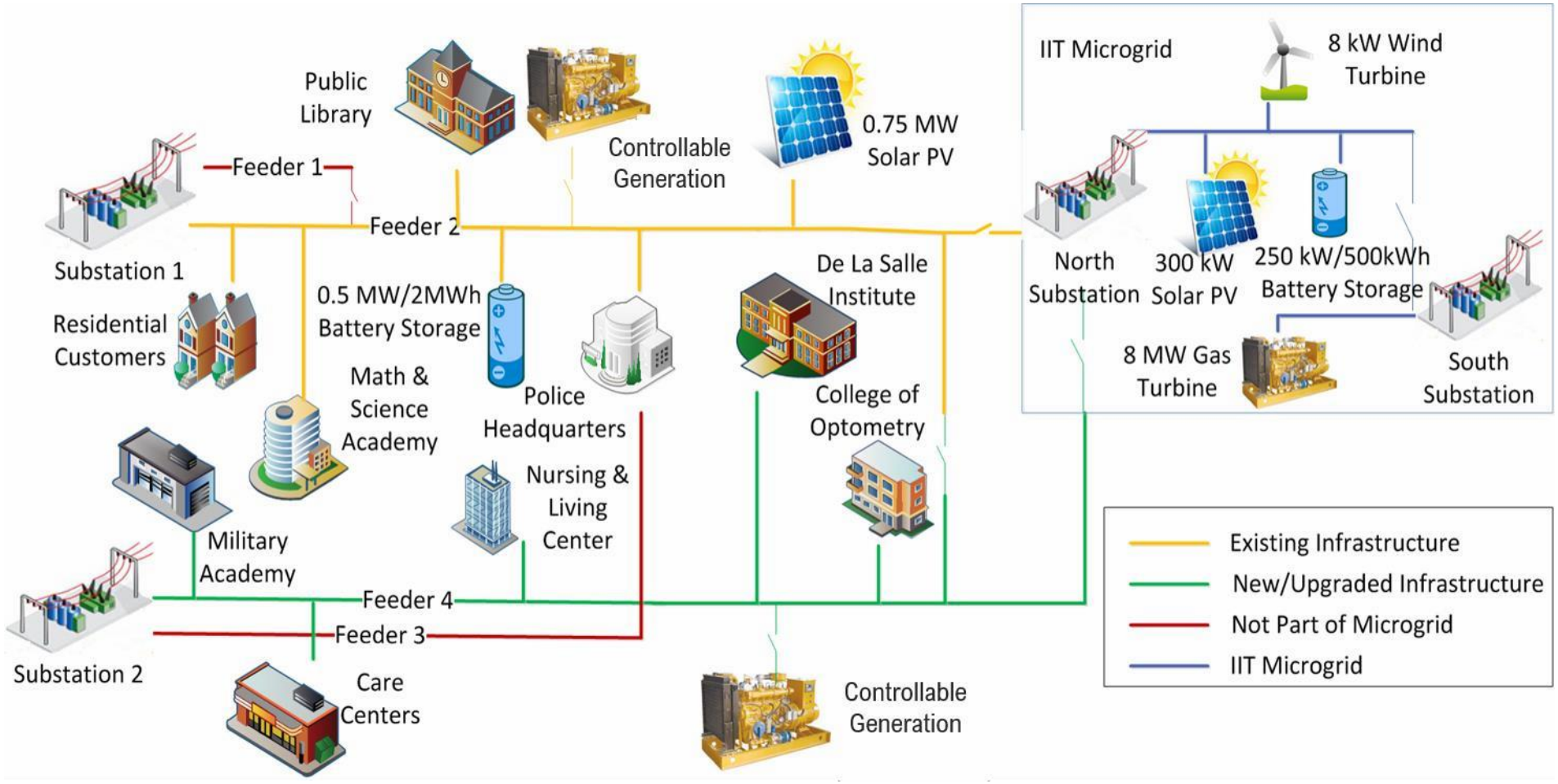
NAVIGANT

ComEd
An Exelon Company

Bronzeville Community Microgrid and ComEd Smart Inverter Initiative

Shay Bahramirad, Ph.D.
Vice President Engineering and Smart Grid

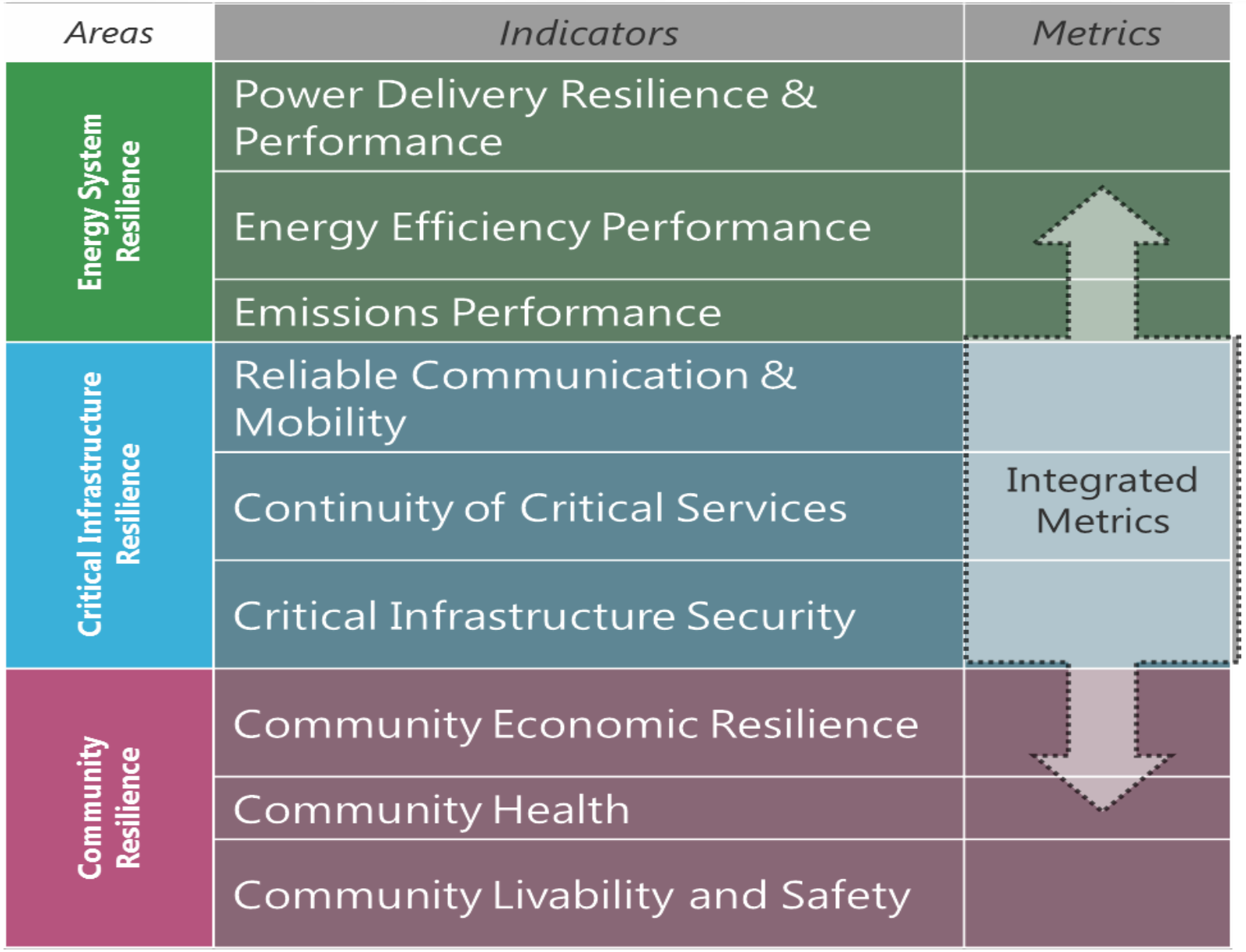
The Bronzeville Community Microgrid



Reviewed & approved by the Illinois Commerce Commission in Docket No. 17-0331 (2/28/18)

ComEd
An Exelon Company

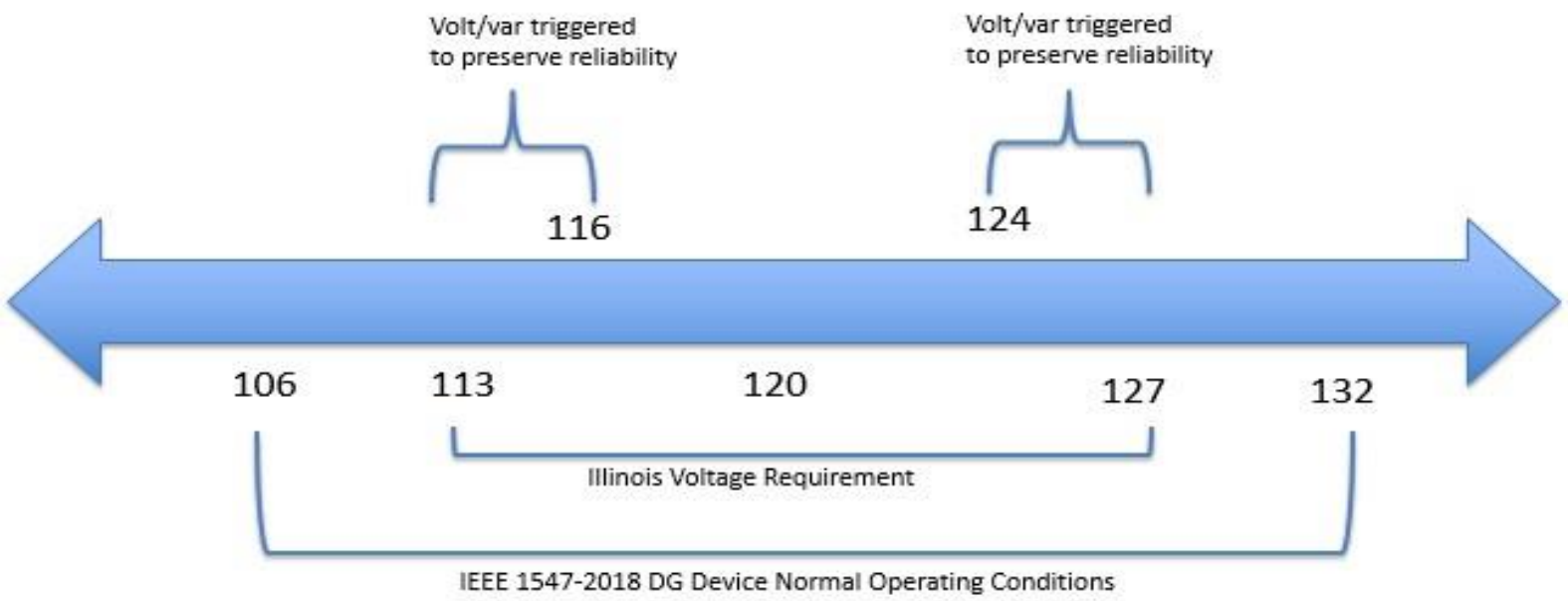
Metrics – from Grid Resiliency to Community Resiliency



ComEd
An Exelon Company

Smart Inverter Provisions in Future Energy Job Act in IL

- ✓ Implemented through a utility tariff as provided by law
- ✓ ComEd offers a $250/kW rebate
- ✓ Authorizes the utility to operate and control the smart inverter for the purpose of preserving reliability during distribution system reliability events
- ✓ Tariff can also specify other uses of the smart inverter (*e.g.*, voltage and VAR support, regulation, and other grid services) and associated compensation



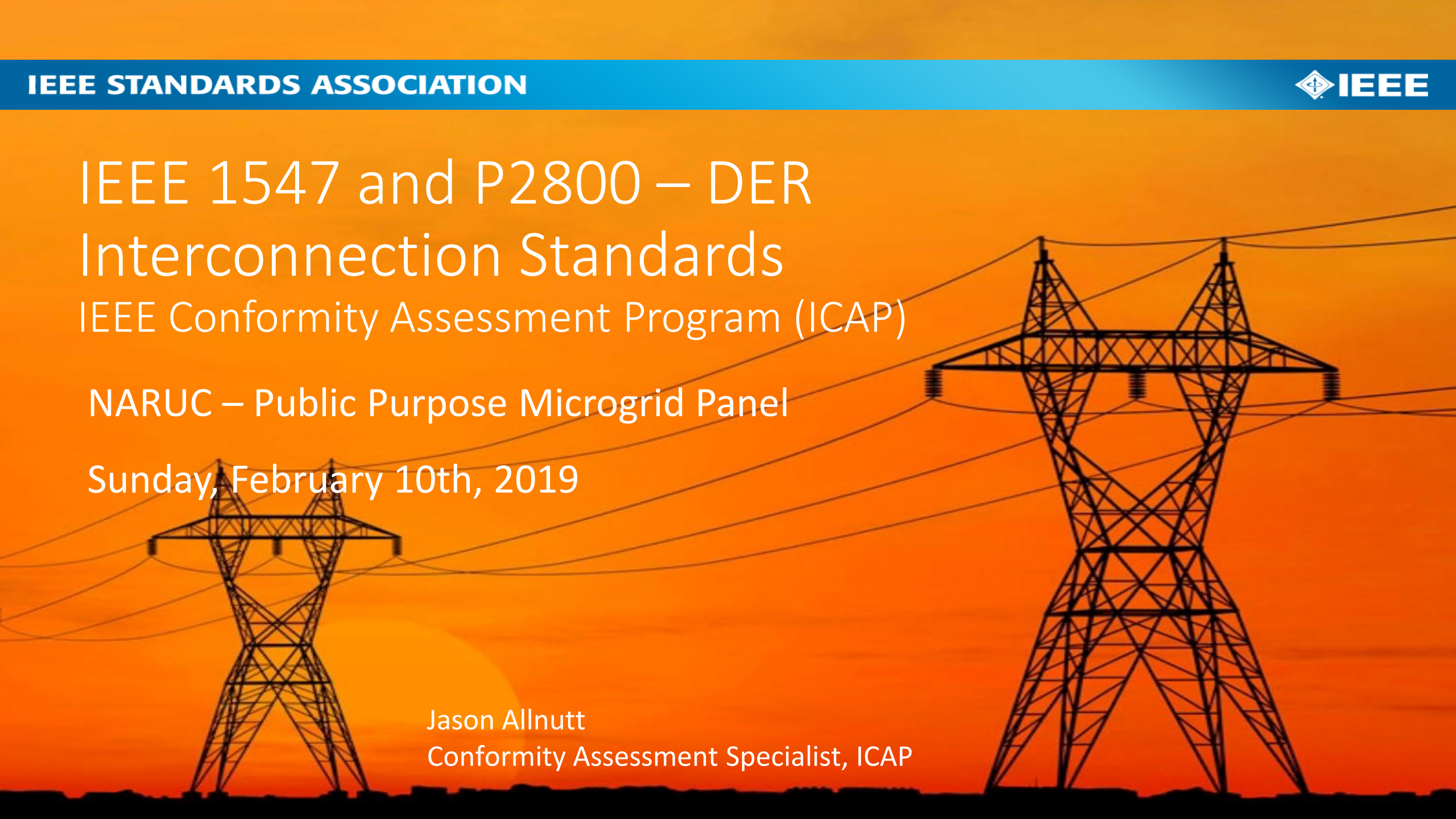
ComEd
An Exelon Company

IEEE 1547 and P2800 – DER Interconnection Standards

IEEE Conformity Assessment Program (ICAP)

NARUC – Public Purpose Microgrid Panel

Sunday, February 10th, 2019



Jason Allnutt
Conformity Assessment Specialist, ICAP

The Institute of Electrical and Electronic Engineers

The world's largest professional association advancing technology for the benefit of humanity.

Members – Over 374,000

Countries – Over 160

Conferences – 1200+ per year

Publications – 30% of the world's electro-tech literature

Standards – 1,300 Active Standard and 500 Active Projects

IEEE Standards Association (IEEE-SA)

- Leading member driven consensus based Standards Development Organization (SDO) in technology
- Governed by our Board of Governors (BOG) who are elected by IEEE-SA Members
- Standards Development process is open to members AND non-members of IEEE-SA
- Actively engages in the global standards communities i.e., IEC, ISO and ITU among others

MAC Address Registration Authority

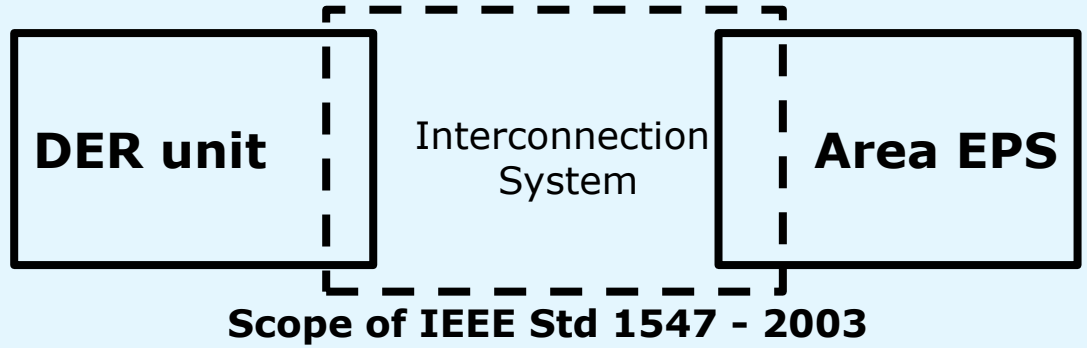
80:7B:85:FE:10:95

IEEE Related Standards and Activities

1. **IEEE Std 1547™ - 2018**: IEEE Standards for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces – Techstreet Link
   a) IEEE 1547 Conformity Assessment Program – Techstreet Link
2. **IEEE Std P1547.1:** Standard Conformance Test Procedures for Equipment Interconnecting Distributed Energy Resources with Electric Power Systems and Associated Interfaces
3. **IEEE Std P1547.2**: Application Guide for IEEE Std 1547(TM), IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems
4. **IEEE Std P1547.9**: Guide to Using IEEE Standard 1547 for Interconnection of Energy Storage Distributed Energy Resources with Electric Power Systems
5. **IEEE Std P2800**: Standard for Interconnection and Interoperability of Inverter-Based Resources Interconnecting with Associated Transmission Electric Power Systems
6. **IEEE Std 2030.7™ - 2017**: Standard for the Specification of Microgrid Controllers – Techstreet Link
7. **IEEE Std P2030.9**: Recommended Practice for the Planning and Design of the Microgrid
8. **IEEE Std P2030.10**: Standard for DC Microgrids for Rural and Remote Electricity Access Applications

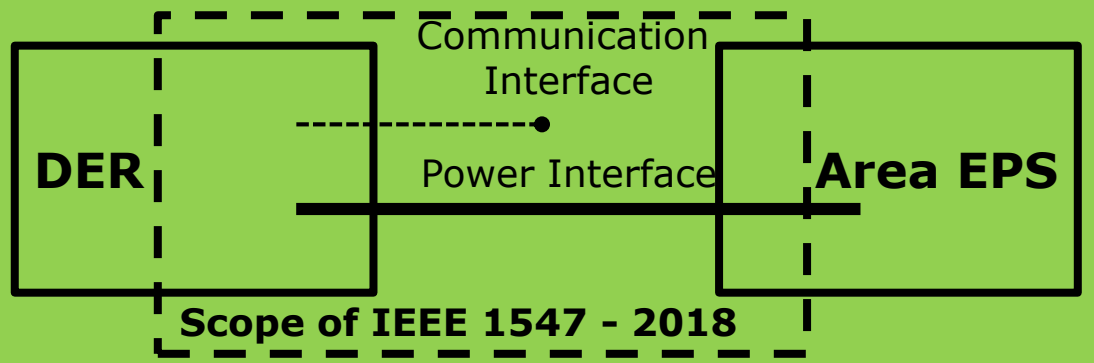
IEEE Std 1547-2018

- Defines and standardizes "**smart DERs**" across the industry.
- Attempts to specify **safe, reliable,** and **cost-effective** new interconnection and interoperability **requirements** for DERs.
- Provides a widely-accepted **technical basis for regulatory proceedings** that can be **flexibly** adjusted to regional differences.



IEEE Std 1547-2003

- Focused on distribution system aspects.
- Specifications for the "interconnection system" sufficiently achieve the standard's objective.
- Meant as DER interconnection standard but mainly used for equipment listing.
- Limited to electrical requirements.



IEEE Std 1547-2018

- Focused on distribution and includes bulk system aspects.
- Requirements influence the whole DER.
- Can be used for equipment listing as well as plant-level verification.
- Includes both electrical as well as interoperability/communications requirements.

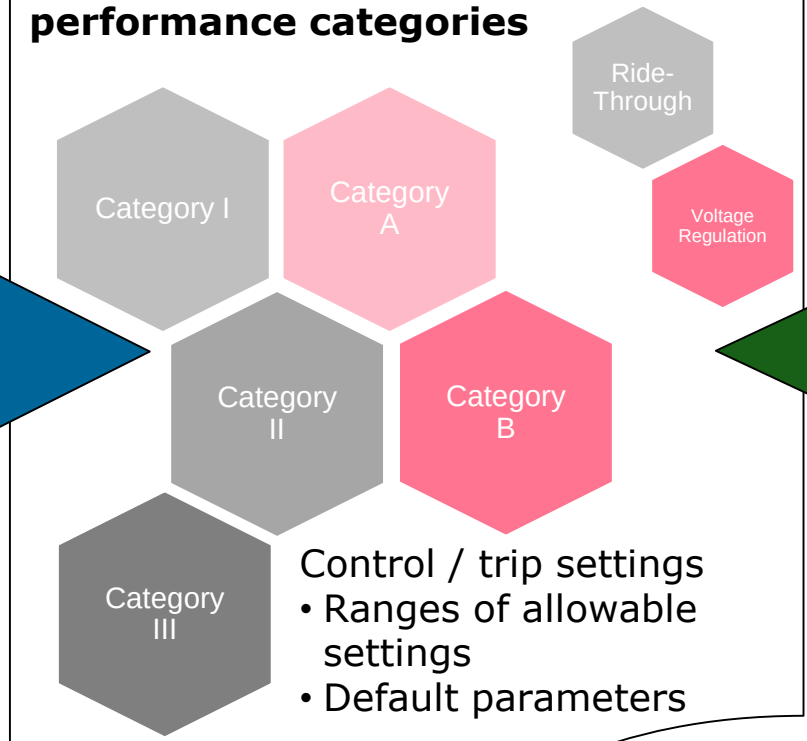
IEEE Std 1547-2018 Performance Categories

DER Vendors

Market Analysis

- Costs
- Market segment
- Etc.

Normal and abnormal operating performance categories



Control / trip settings
- Ranges of allowable settings
- Default parameters

Authorities Governing Interconnection Requirements (AGIRs)[1]

Impact Assessment

- Technical conditions: type & capacity & future penetration of DERs, type of grid configuration, etc.
- Non-technical issues: DER use case, impacts on environment, emissions, and sustainability, etc.

Stakeholder Engagement

- Area EPS Operators/ Distribution utilities
- Regional reliability coordinator
- DER Operators/ developers
- DER vendors
- Consumers

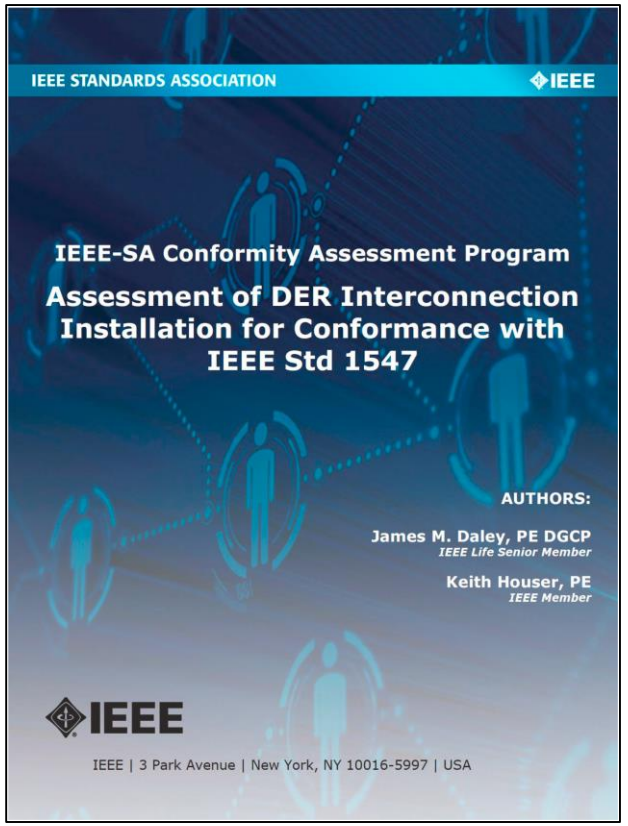
[1] State Regulator, Area EPS or bulk system operator, etc.

IEEE 1547 Conformity Assessment Program

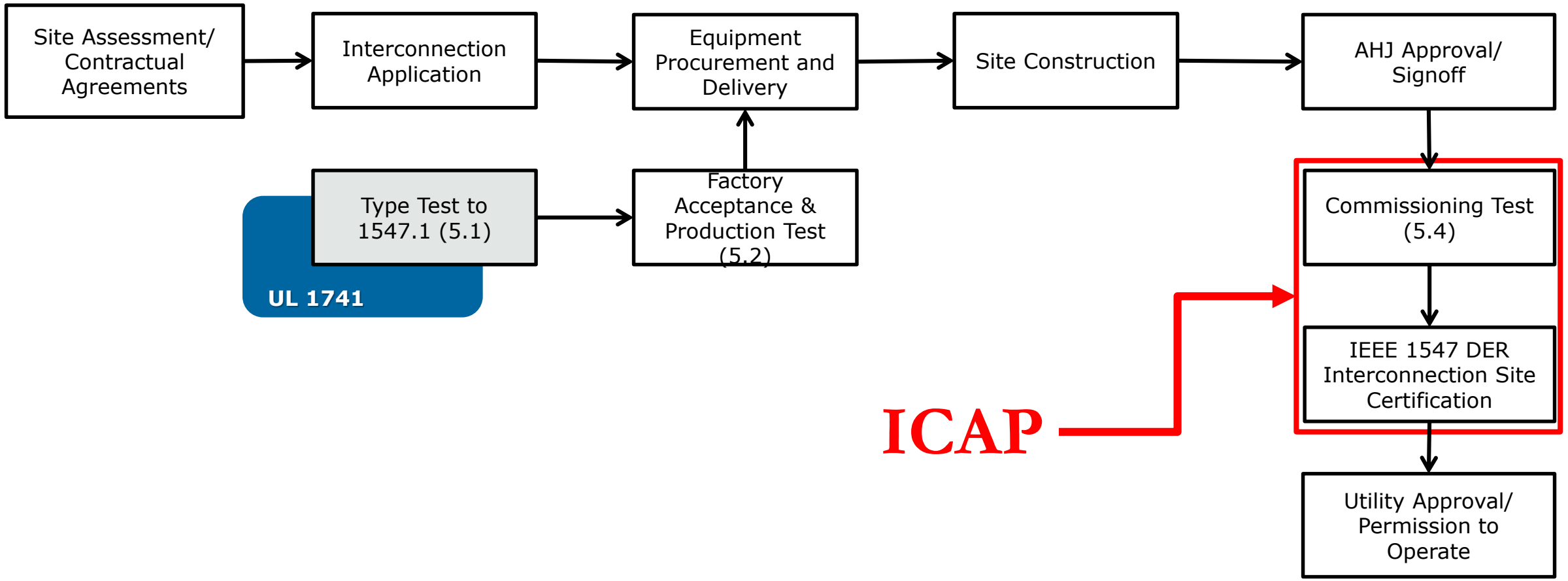
Program Objective: Develop a Site Certification [process] with respect to DER Interconnection that Emphasizes All Essential Aspects of IEEE 1547/1547.1 over the life of the Interconnection.

NC State
FREEDM Center

Duke Energy
eGrid



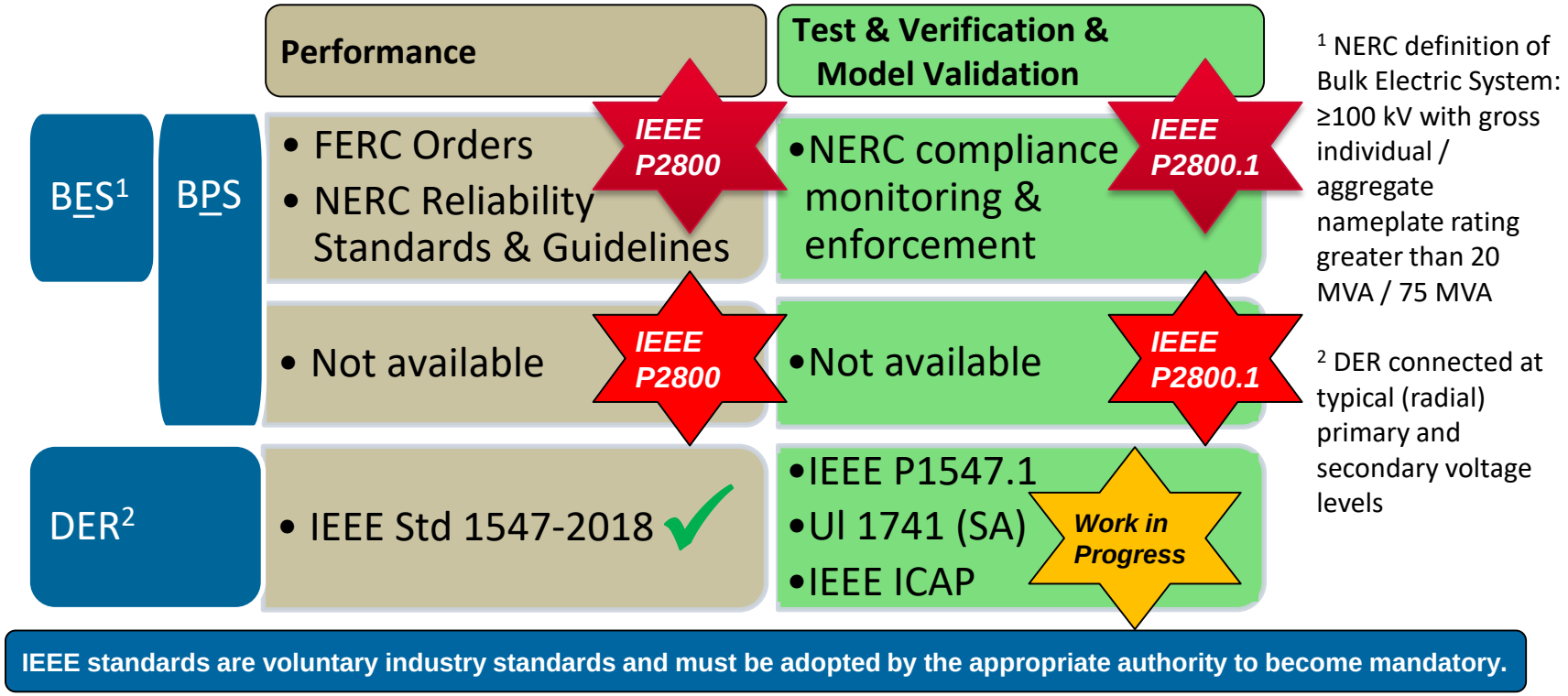
IEEE 1547 Compliance Roadmap



IEEE P2800 – The 1547 for Transmission

Title: Standard for Interconnection and Interoperability of Inverter-Based Resources Interconnecting with Associated Transmission Electric Power Systems

Existing North American Standards for Inverter-Based Generating Resources and Gaps



[1] NERC definition of Bulk Electric System: ≥100 kV with gross individual / aggregate nameplate rating greater than 20 MVA / 75 MVA

[2] DER connected at typical (radial) primary and secondary voltage levels

New landing page for SCC21

- http://sites.ieee.org/sagroups-scc21/standards/1547rev/
  - General
  - Scope
  - Purpose
  - Leadership Team
  - **Sources**
    - **✓discounted copies**
  - **SCC21-Reviewed Slide Decks Available for Interested Lecturers**
  - **Further Reading**
  - **Webinars**

- **Please submit further reading suggestions via the web form!**

Thank you

IEEE Conformity Assessment Program

http://standards.ieee.org/about/icap/index.html

IEEE Conformity Assessment Program (ICAP)
Technical Director - Ravi Subramaniam
R.Subramaniam@ieee.org
Program Manager - Jason Allnutt
J.Allnutt@ieee.org

NARUC Winter Policy Summit

Chairman Griffin
Hawaii Public Utilities Commission

State of Hawaii
Public Utilities Commission

Lon Huber

Jason Alnutt

Shay Bahramirad

Chairman Griffin

Questions