

Staff Subcommittee on Electricity and Electric Reliability



Staff Subcommittee on Electricity & Electric Reliability and Staff Subcommittee on Energy Resources & the Environment

Distributed Solar: Which Code When?

Distributed Solar: Which Code When?

Moderator: Patricia Poli, Michigan

Speakers:

Michael Coddington, NREL

Sue Vogel, IEEE

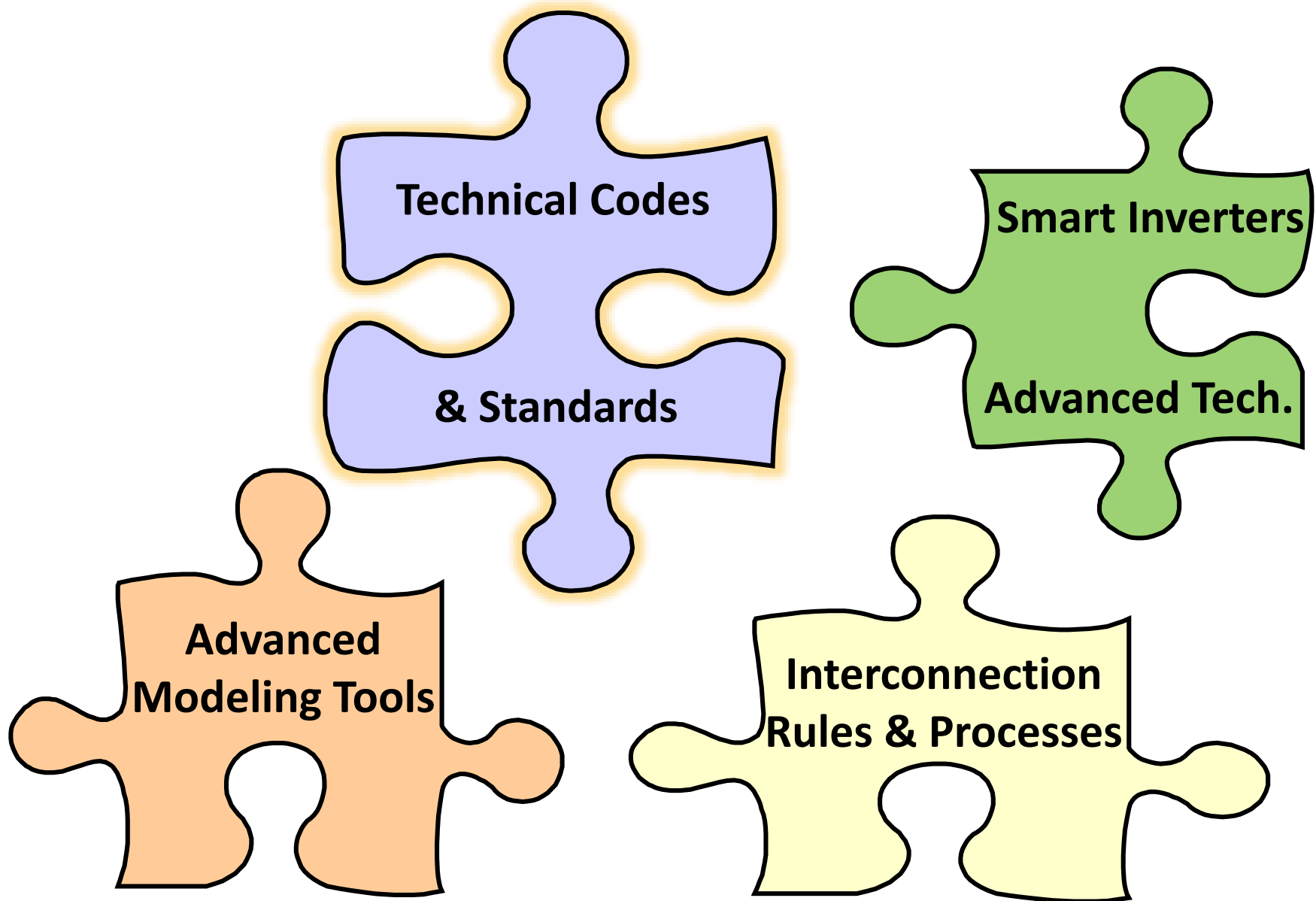
Nelson Bingel, NESC



Improving DER Interconnection with Updated Standards and Codes, Smart Inverters, and Distribution System Design

Michael Coddington, Principal Engineer
National Renewable Energy Laboratory

DER Interconnection Puzzle Pieces



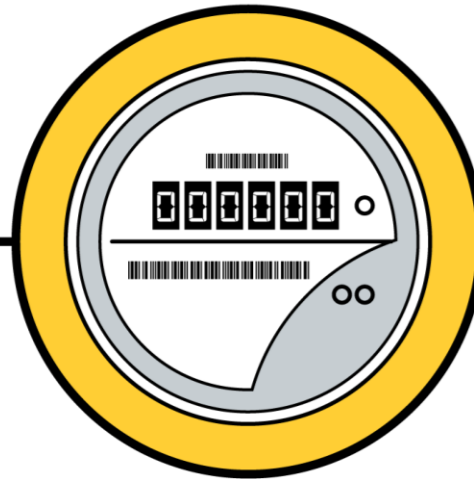
Where Do KEY Standards & Codes Apply on the Grid?

Electric Utility
T&D Systems



- ANSI C84.1 Voltage Ranges A&B
- National Electrical Safety Code

PCC (Point of
Common Coupling)



- IEEE 1547 Interconnection Standard
- IEEE 1547.x Family of Standards

Industrial, Commercial,
Residential Buildings



- National Electrical Code (NEC)
- UL 1741 / UL1741 SA

U.S. Solar-Centric Codes & Standards

Critical C&S

- IEEE 1547.x
- NEC
- NESC
- UL 1741
- ANSI C84.1

Important C&S

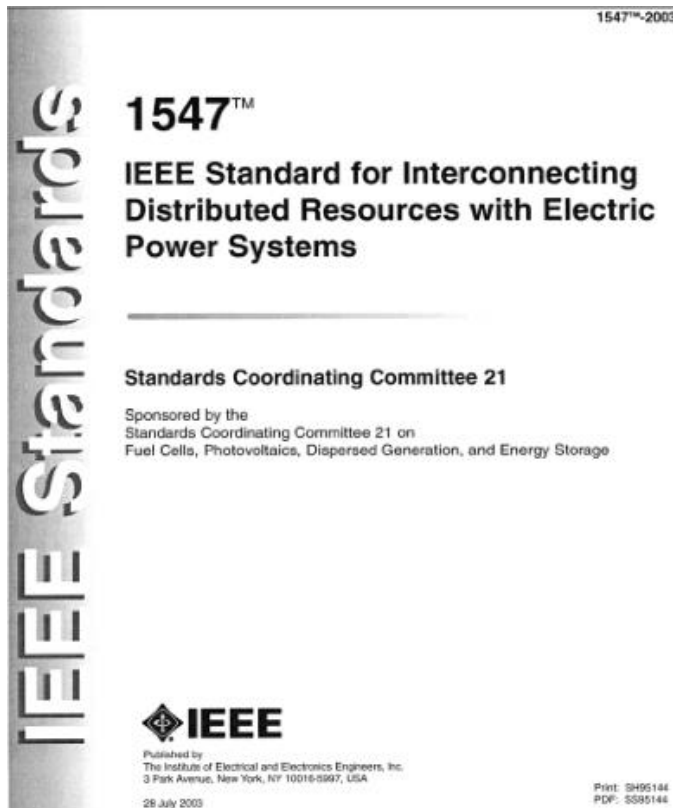
- IEEE 1547.4
- IEEE 1547.6
- IEEE P1547.7
- IEEE P1547.8

Other Relevant C&S

- IEEE 1547.1, IEEE 1547.2, IEEE 1547.3
- IEEE 2030.x
- IEEE 519 (Power Quality)
- IEEE 1453 (Flicker)
- UL 1703
- IEC 61850

IEEE 1547™ - Full Revision

Standard for Interconnecting Distributed Energy Resources with Electric Power Systems



- Goal is an updated standard for higher levels of DER tied to utility distribution systems
- Significant focus on frequency ride through and voltage ride through – MUST STAY CONNECTED
- Major goal is to support voltage and frequency
- Utilize Smart Inverter functions while remaining technology neutral
- Harmonize with the California Smart Inverter Working Group and California Rule 21

IEEE 1547 Full Revision – Topics

- Voltage ride-through & frequency ride-through capabilities
- Some technology-specific requirements
- Variable settings for grid support, including Volt/VAR, Volt/Watt, frequency/Watt, etc.
- Revised Power Quality settings and requirements
- Intentional Island and Unintentional Island provisions
- Secondary Network Interconnection Guidelines
- Energy Storage system integration
- Grid Support functions and Interoperability

National Electrical Code - NEC

NFPA 70

(Revised every 3 years)

- Applies to Residential, Commercial and Industrial facilities
- Often used in utility power plants, utility service centers
- This Code is used by inspectors and other Authorities Having Jurisdiction (AHJs)
- Articles
 - 690 (*PV systems*)
 - 691 (*Utility Scale PV*)
 - 705 (*Interconnected Electric Power Production Sources*)

UL 1741

UL 1741 SA

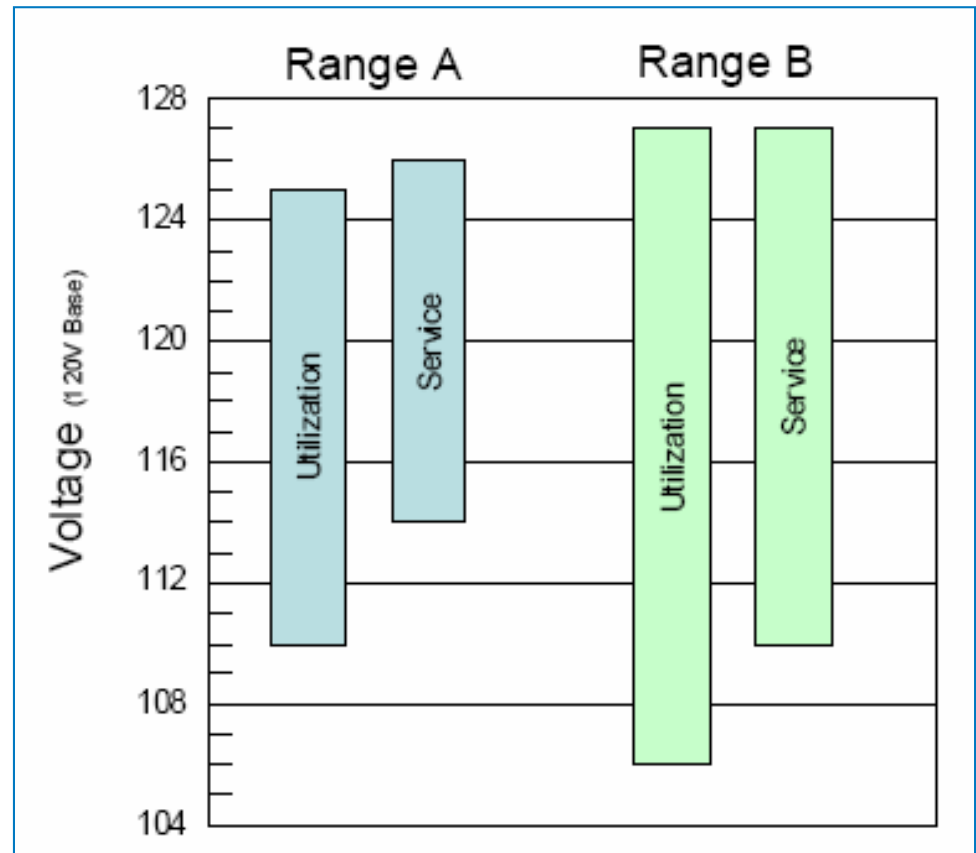
Inverters, Converters, Controllers and Interconnection System
Equipment for Use with Distributed Energy Resources

- Applies to the Inverter and interconnection equipment
- Inverters should be listed to this standard
- Harmonized with IEEE 1547
- Underwriters Laboratories – Standard for Safety
- UL 1741 SA standard for “Smart Inverters”, approved September 2016

ANSI C84.1 – Standard for Voltage Regulation

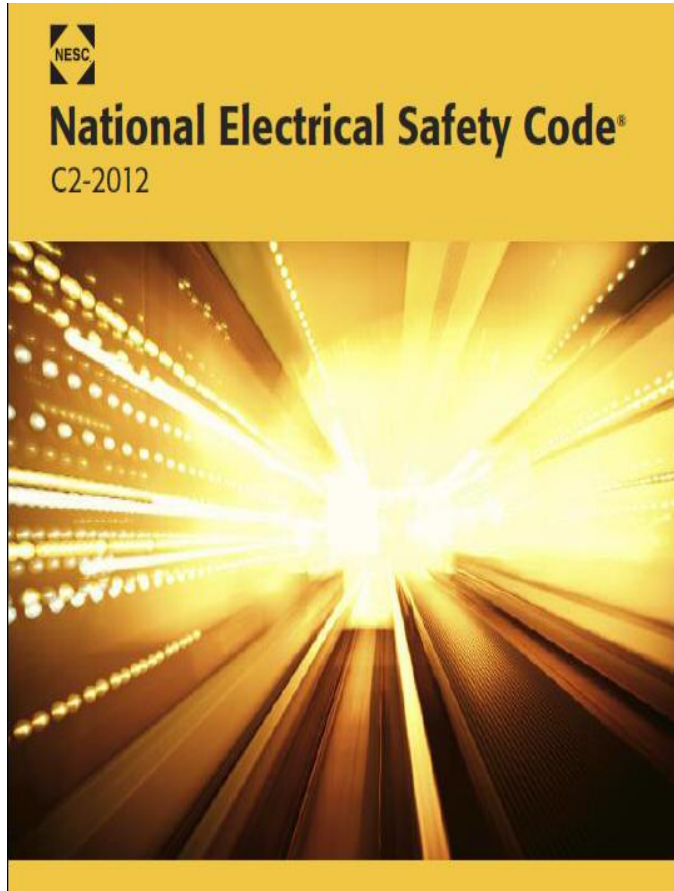
ANSI C84.1 - American National Standard for Electrical Power Systems and Equipment-Voltage Ratings (60 Hz)

- Often cited as the primary concern to utilities
- Utilities are required to keep voltage at the customers load within a narrow operating range per ANSI C84.1
- Range A most commonly cited and can be remembered as the +/- 5% rule



Range B: Emergency conditions; corrective action shall be undertaken within a reasonable time to improve voltages to meet a Range A requirements.

NESC – Standard for Utility Practices



NESC Requirements for De-energized Work

- Section 444 of the NESC details “De-energizing equipment of lines to protect employees”
- Isolate - operate switches, disconnects and lockout / tagout
- Test for voltage
- Install protective grounds on each side of the work location

California Smart Inverter Working Group – Phase 1

Proposed Phase 1: Autonomous Inverter Functionalities Recommended as Technical Operating Standards within Electric Tariff Rule 21. The SIWG recommends the following **autonomous** inverter functionality modifications to the technical operating standards set out in Rule 21:

1. Support anti-islanding to trip off under extended anomalous conditions.
2. Provide ride-through of low/high voltage excursions beyond normal limits.
3. Provide ride-through of low/high frequency excursions beyond normal limits.
4. Provide volt/VAr control through dynamic reactive power injection through autonomous responses to local voltage measurements.
5. Define default and emergency ramp rates as well as high and low limits.
6. Provide reactive power by a fixed power factor.
7. Reconnect by “soft-start” methods.



Panel:

Distributed Solar: Which Code When?

Topic:

NEC/NESC Recent History

Sue Vogel

IEEE

NESC Senior Manager

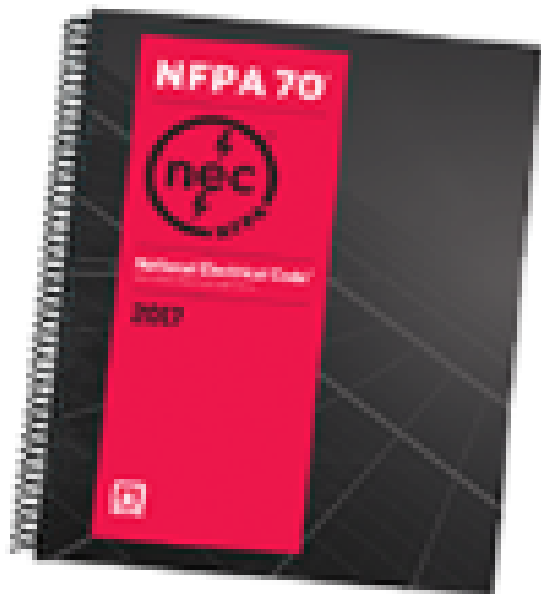
**NARUC Summer
Policy Summit**

16 July 2017
San Diego, CA

Two Different Codes

■ National Electrical Code (NEC)

- Owned by National Fire Protection Association (NFPA)

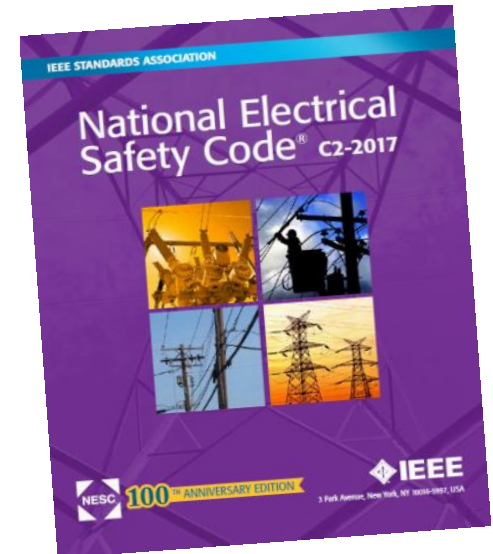


■ National Electrical Safety Code (NESC)

- IEEE is Secretariat

Both Codes in existence over 100 years

Two different organizations, membership bodies, and constituencies, though some overlapping



Purpose of Both Codes is Similar



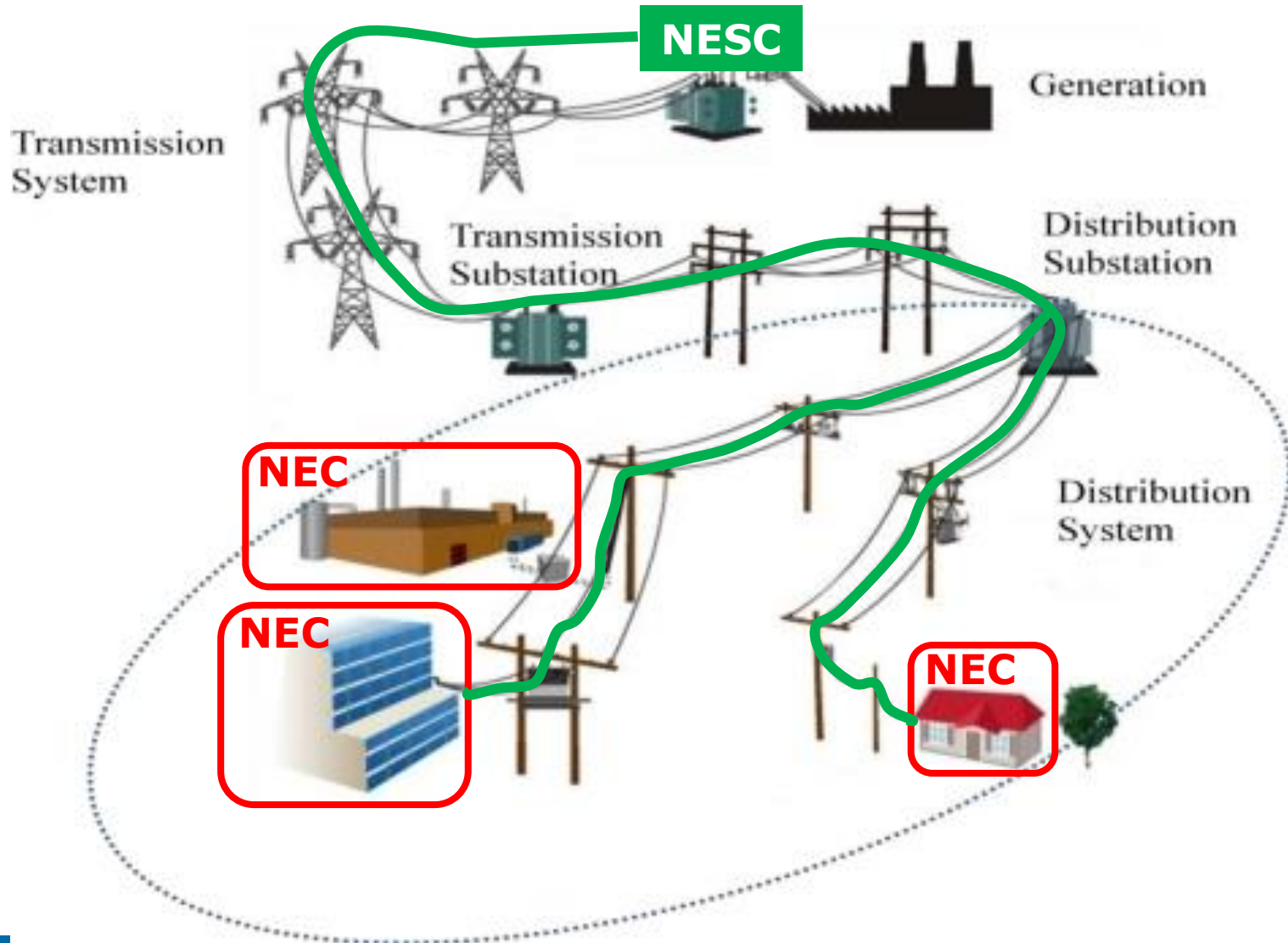
■ NESC Rule 010. Purpose

– The purpose of the NESC is the ***practical safeguarding of persons and utility facilities*** during the installation, operation, and maintenance of electric supply and communication facilities, under specified conditions.

■ NEC Article 90.1 Purpose

– The purpose of this Code is the ***practical safeguarding of persons and property*** from hazards arising from the use of electricity.

Decades of Stable Electricity Model



2008-2012 NEC/NESC Activity



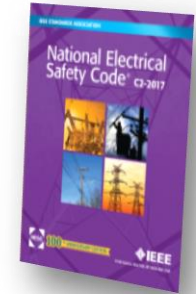
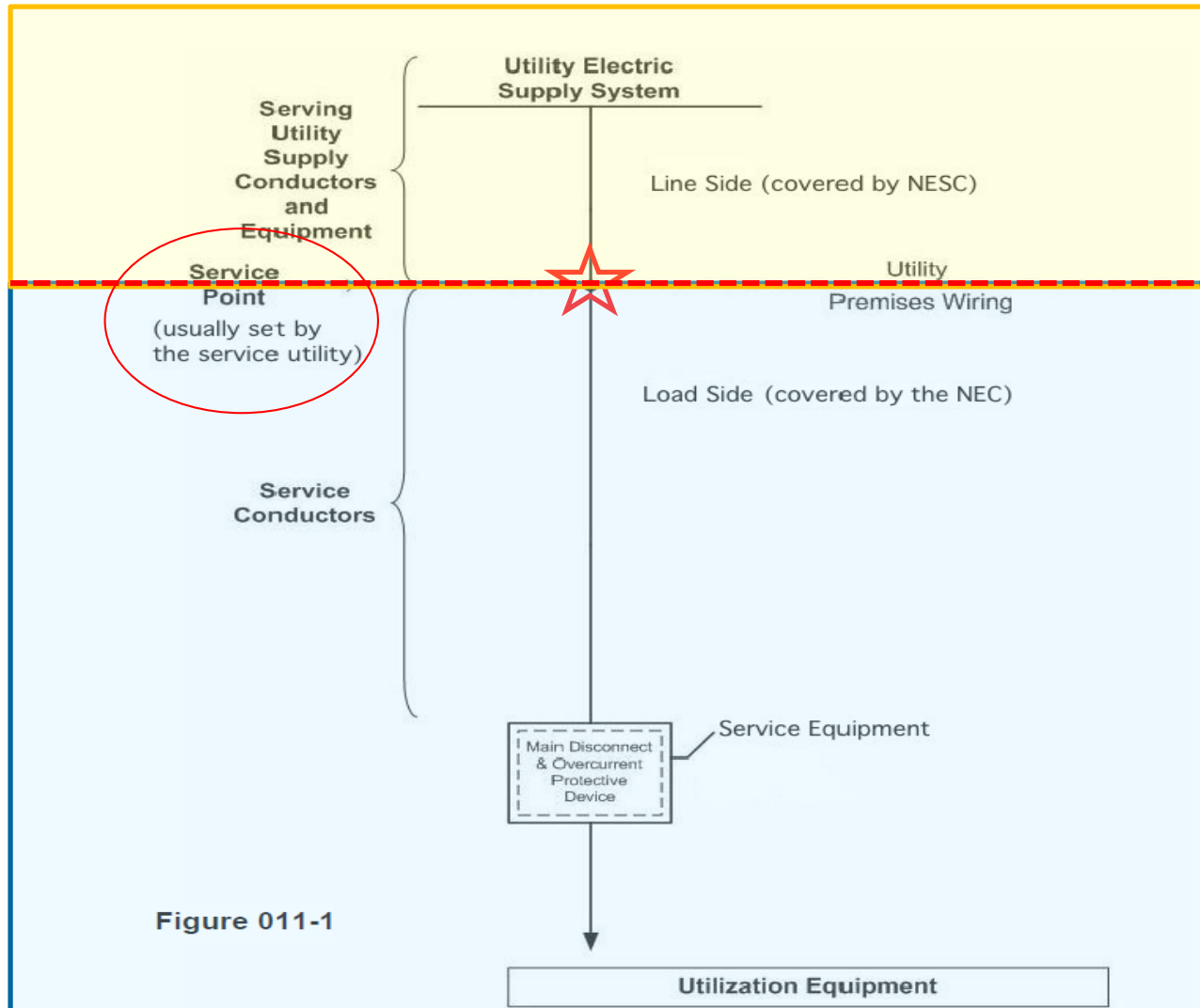
- Encountered “scope creep” issues
 - Preparing for:
 - NEC 2010 edition
 - NESC 2012 edition
- Held several joint meetings
 - Some difficulties to get on same page
 - Proposals submitted to both codes

2012 NESC



- Added clarity to NESC Scope
- Added Figure 011-1 within Scope
- Modified definition of Private Utility

NESC Scope: Figure 011-1



NESC Definition

Private Utility. A private utility is an entity that (a) performs or provides one or more utility services to its own facilities, such as a large industrial complex, large campus, military complex, railroad system, trolley system, or extensive gas or oil field through its own electric supply, communication, street and area lighting, or signal system **and/or (b) generates or transmits power that is delivered to another utility.**

NOTE: Although many private utilities only operate a distribution level system, others operate generation and transmission systems.

NEC/NESC Problem Statement: NARUC, February 2016

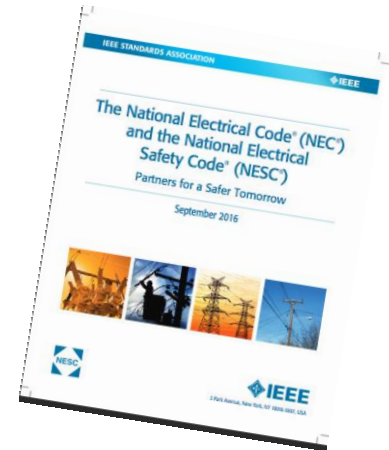


- Only NESC includes definition of private utilities
- Both claim private utilities are in their scopes
- Permitting Authorities are increasingly treating ***emerging generation technologies*** as covered by ***NEC*** (wind, solar, large storage and microgrids)
- Authorities Having Jurisdiction (AHJ) may not be equipped to enforce code requirements due to the complexity of the systems, leading to conservative interpretations of the Code
- NESC does not have specific safety requirements for emerging technologies

NEC & NESC Recently



- Continued good collaboration and dialogue
- Codes must be complementary
 - Respectful of scopes
- Joint effort developed:
 - NEC-NESC White Paper, *Partners for a Safer Tomorrow*



http://standards.ieee.org/about/nesc/nec_nesc_case_study.pdf

NEC & NESC - Recently



- Joint effort continuing:
 - NEC-NESC Roadmap
 - Identifies intersects, gaps, and overlaps between two Codes
 - Comparison of terms and definitions in both Codes completed
 - Joint NEC-NESC Terms & Definitions Working Group formed
- Attending each other's Code meetings
- Opportunities for referring/cross referencing to each other's Codes where appropriate
 - Next NEC is 2020
 - Next NESC is 2022

Needs for Improved Clarity



- Overall scope alignment between both Codes
- What constitutes a Private Utility
- Code ownership surrounding Independent Power Producers (IPP) / Non-Utility Generators (NUG)
- Code ownership surrounding medium and higher voltage facilities (when on the load side of the Service Point)
- The specific competency requirements needed by AHJs for medium and higher voltage facilities (when on the load side of the Service Point)

Needs for Improved Clarity



- Work rules for *Large-Scale PV/Wind/Storage*
- Code demarcation with:
 - ***Independent Power Producers***
 - Whether regulated by State PUCs/FERC or not
 - Whether owned by utilities or privately owned
- Work rules and 'code ownership' for *Microgrids*
 - Supply and premises sides

Needs for Improved Clarity



- Work rules associated with:
 - ***Emergency power generation systems***
 - Their interconnection to the commercial grid
 - Identification of emergency generation locations

Needs for Improved Clarity



- Work rules associated with:
 - ***Residential-Scale Distributed Energy Resources (PV/Wind/Storage...)***
 - Their interconnection to the commercial grid
 - Identification of DER locations

Needs for Improved Clarity



- Jurisdictional 'ownership' of:
 - *Energy Management Systems*
 - Control of premises loads
- NESC handling of design/construction requirements for:
 - Large-Scale Distributed Energy Resources (PV/Wind/Storage...)

Style Differences Between Codes



- NEC language is very prescriptive
- NESC is often not prescriptive or performance-based
 - Oftentimes in the 'middle'
- Some NESC requirements can be difficult to enforce due to 'non-mandatory' wording:
 - 'should', 'suitable' and 'adequate'
 - This can cause issues for AHJs in achieving consistent compliance

2016 NESC Workshop: The Future

2017 Changes

New (Disruptive) Technologies

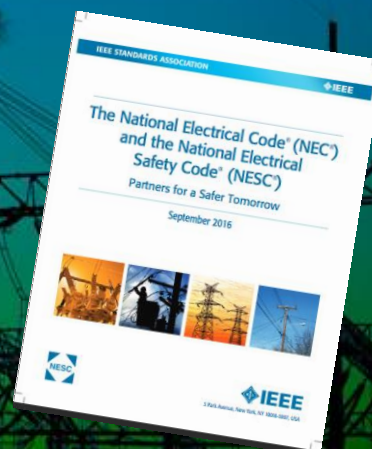
MicroGrids

Interconnection of DER

NEC/NESC



Michael J. Johnston
Chairman NEC Correlating Committee



Emerging Tech Site Visit



NESC Main Committee Meeting

@Duke Energy Charlotte, NC, Sept 12-13

NESC members will tour
Duke's Mount Holly R&D Facility

*Emerging technologies, smart grid, microgrid test bed,
battery storage, solar, etc.*

- NEC chair/staff will also attend
- Impactful for both codes
- NCUC staff invited to address NESC Main Committee and attend site visit
- NESC members

Savannah, GA Meeting



- Next NESC National Workshop event:

April 10-11, 2018

Savannah, GA

- Preview of change proposals for the 2022 edition
- Technical topics continued
- NEC-NESC collaboration progress
- Increasing NESC community engagement



Thank you!

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**IEEE
STANDARDS
ASSOCIATION**





Panel:

Distributed Solar: Which Code When?

Topic:

NEC/NESC Current Activity

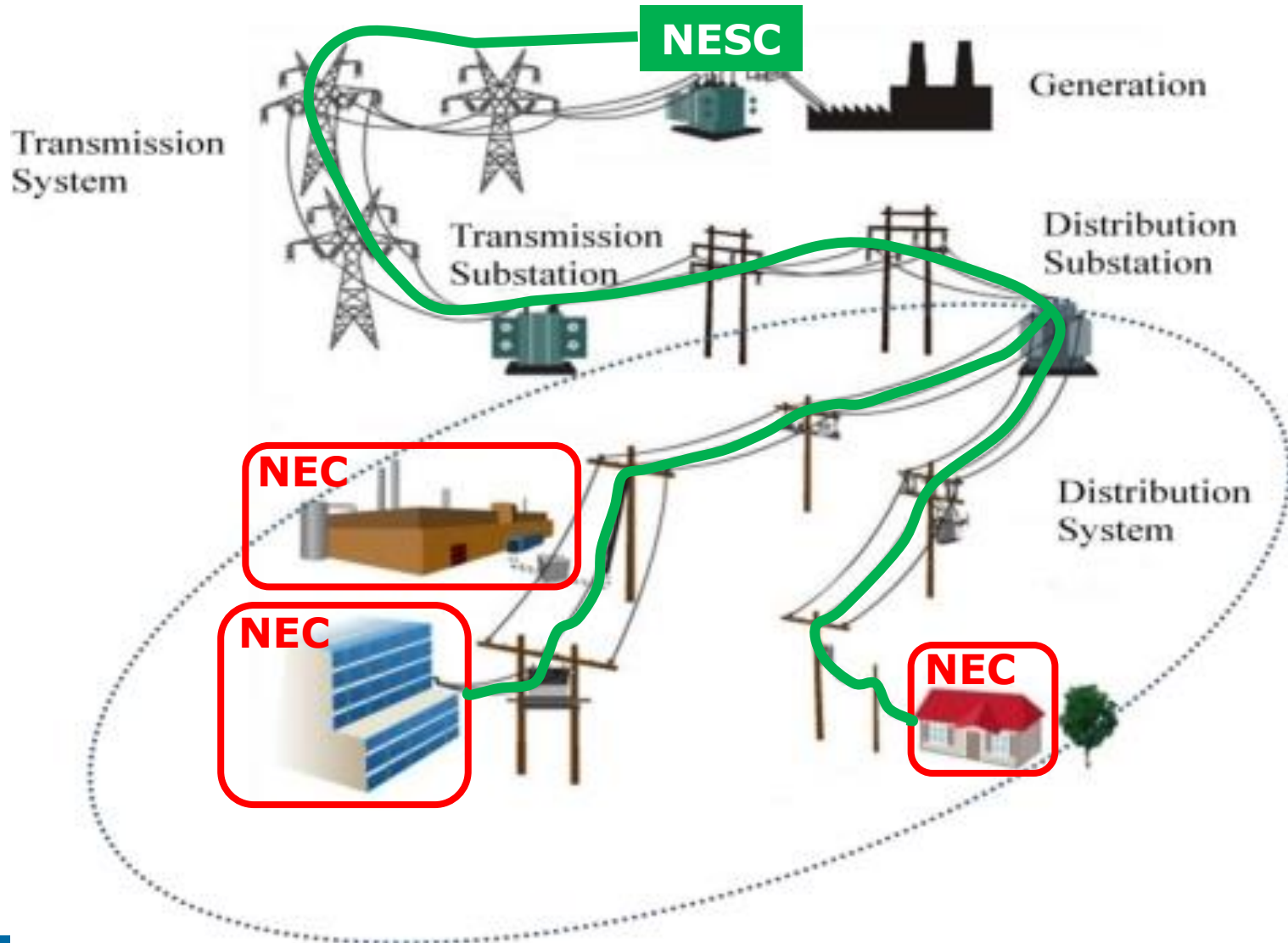
Nelson G. Bingel, III

Chairman - NESC

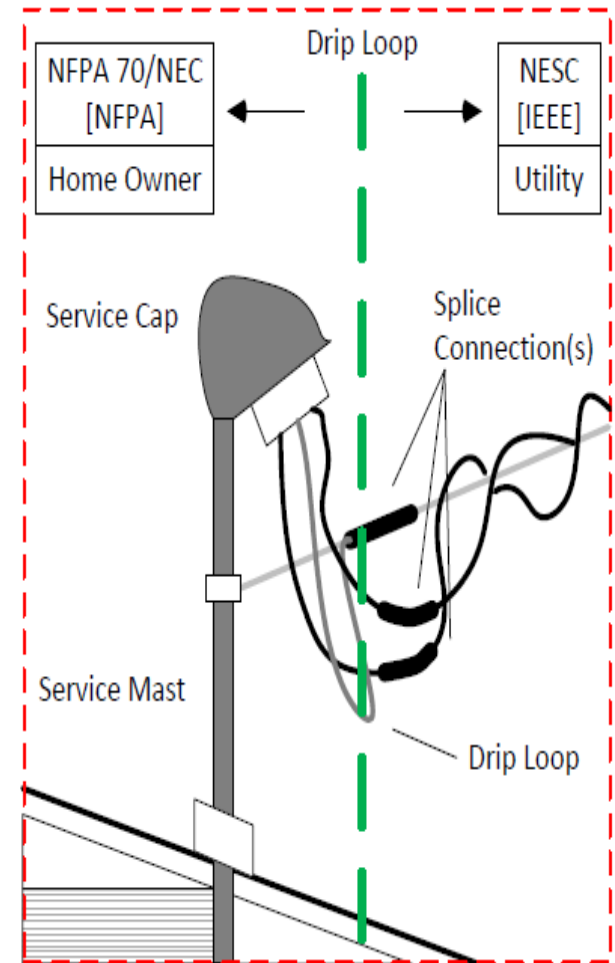
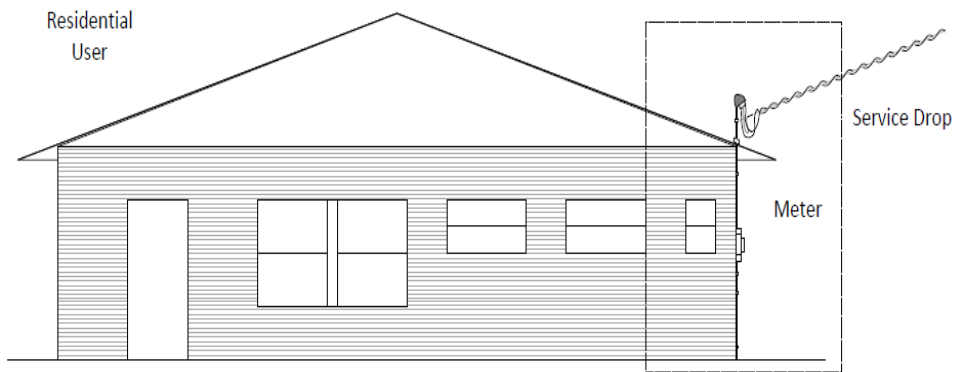
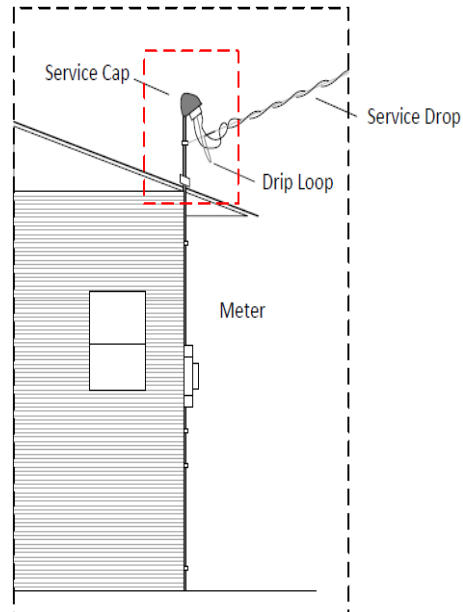
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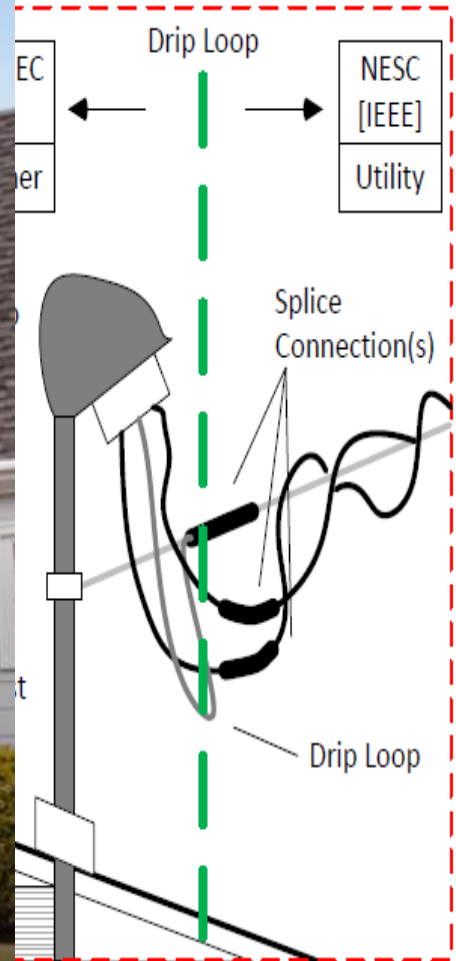
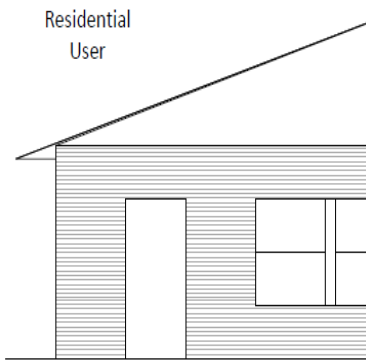
Decades of Stable Electricity Model



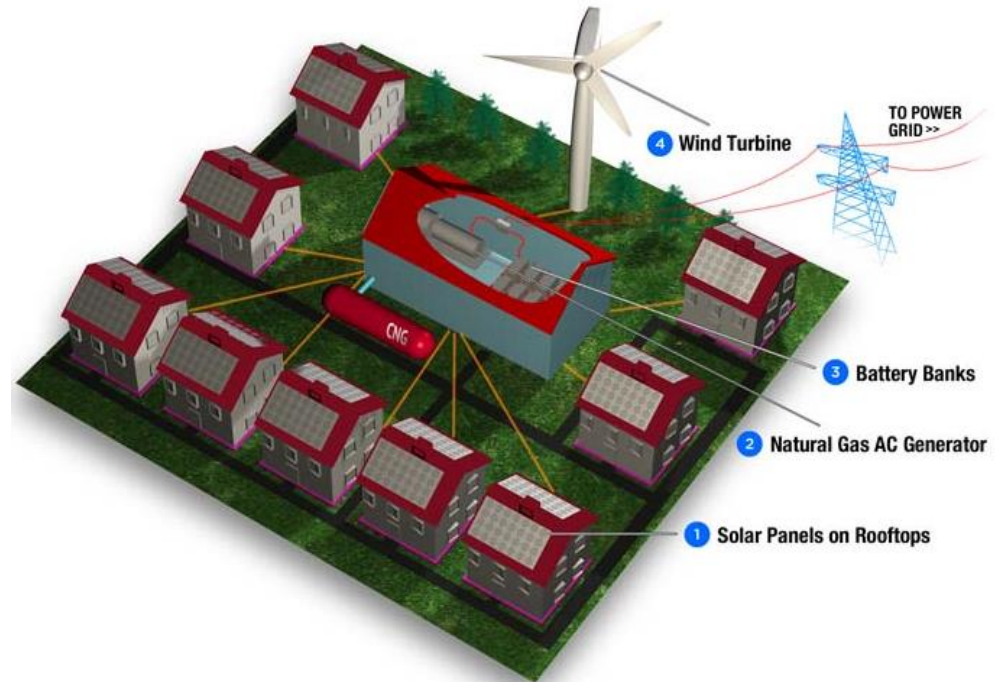
Point of Service



Generation on the Premises



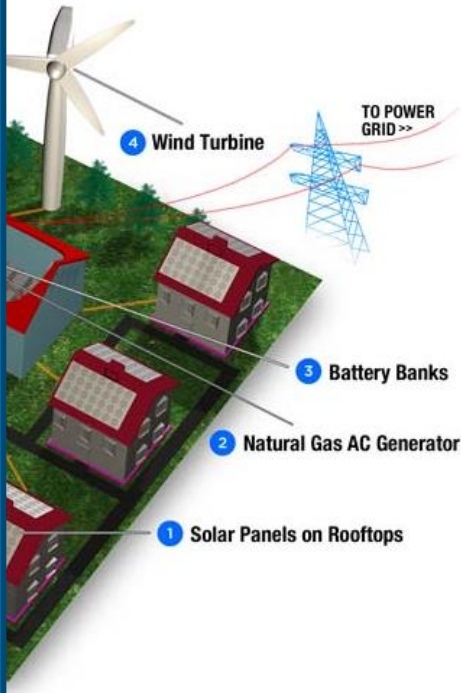
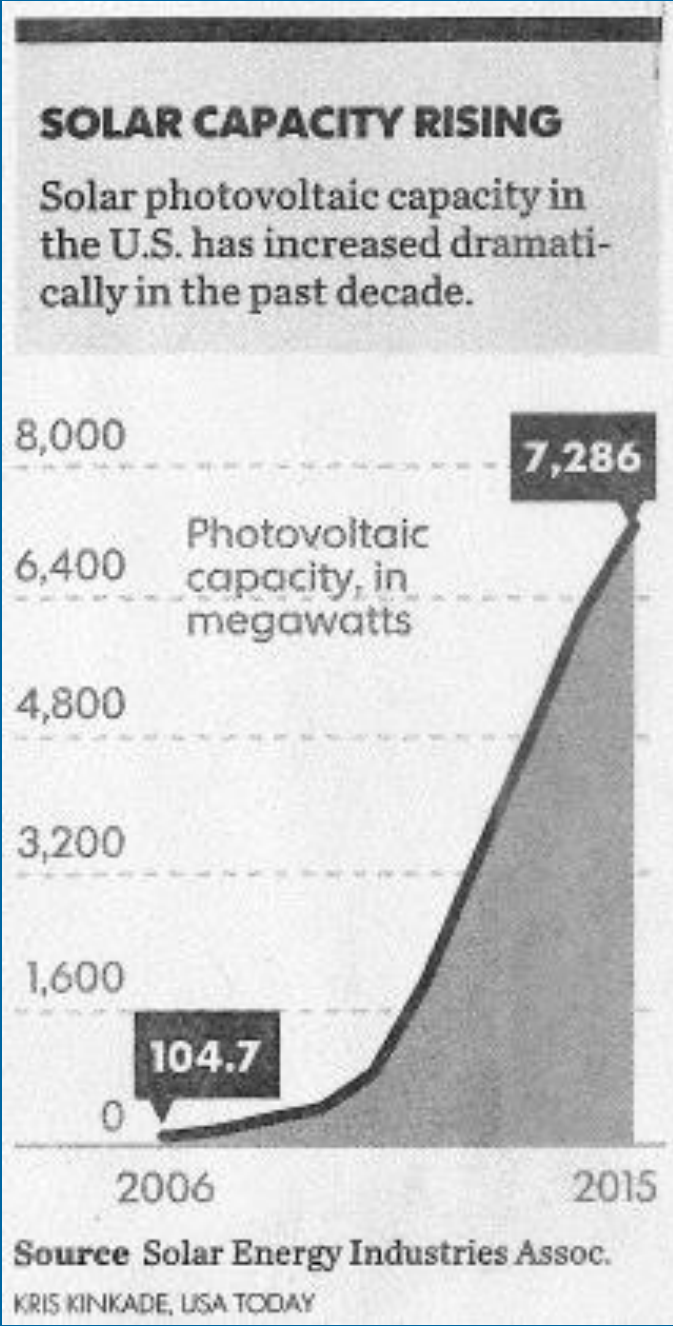
The Pace of Change is Accelerating



MICROGRID

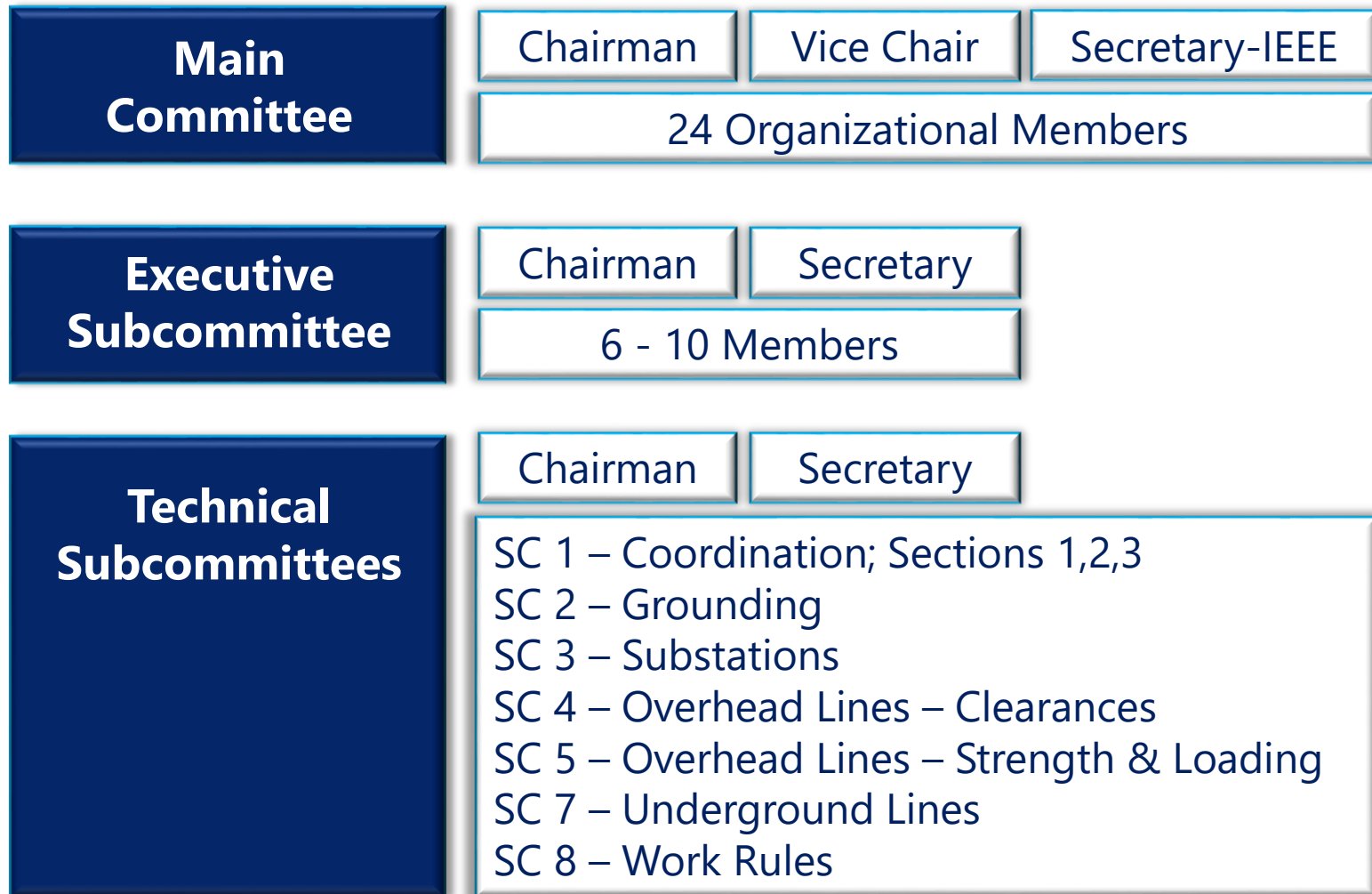
The Pace of

erating



GRID

NESC Committee Structure



NESC Committee Structure



**Main
Committee**

Chairman

Vice Chair

Secretariat-IEEE

24 Organizational Members

**Emerging
Technology WG**

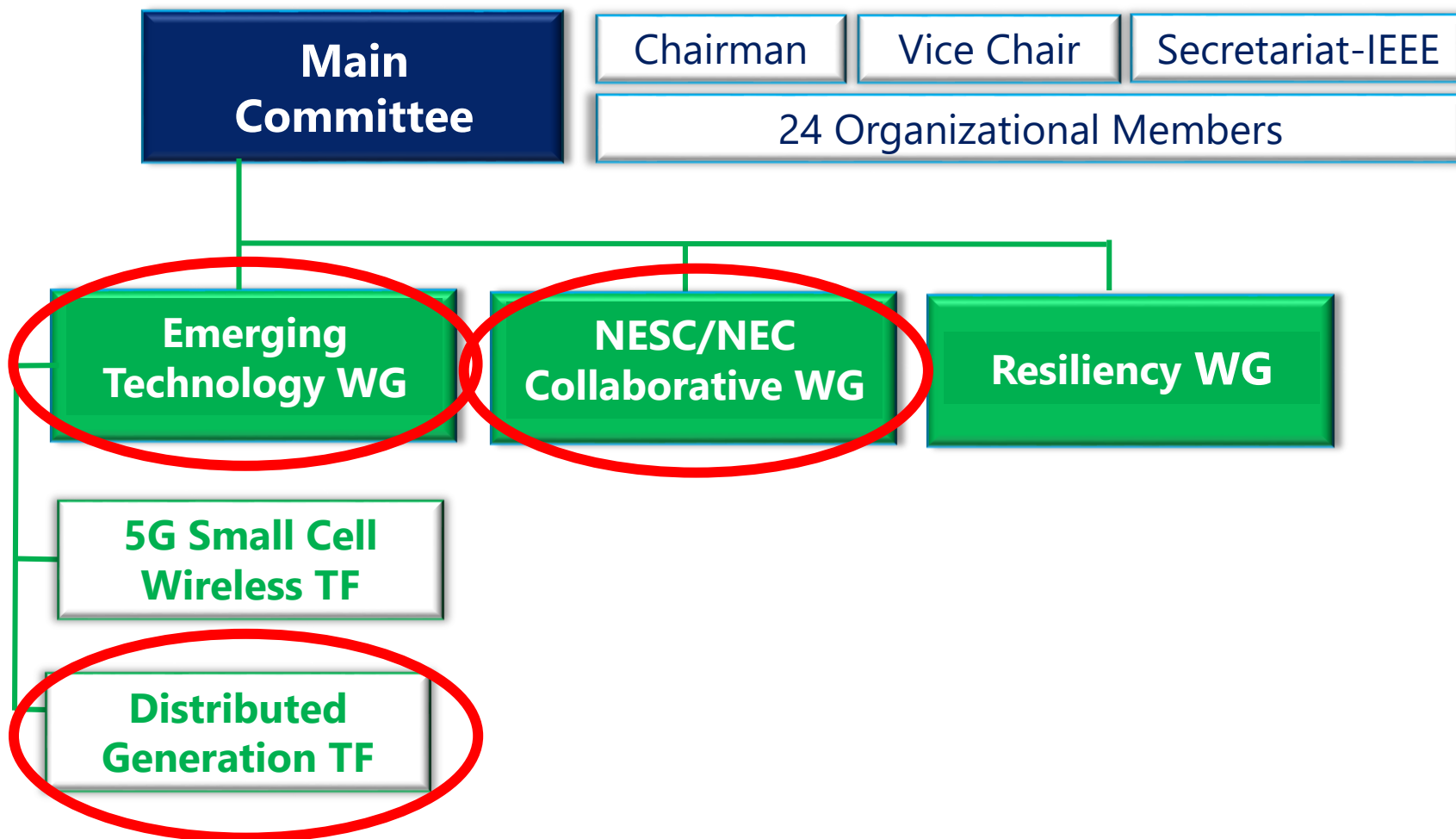
**NESC/NEC
Collaborative WG**

Resiliency WG

**5G Small Cell
Wireless TF**

**Distributed
Generation TF**

NESC Committee Structure



NEC/NESC Collaboration



- Identify & Prioritize:
 - Gaps – Overlaps – Intersects - Discrepancies
- Developed an NEC-NESC Roadmap
 - Also addresses batteries and other energy storage systems
- Coordinate NEC/NESC Change Proposals
- Need technical expertise that spans both codes

NEC-NESC Roadmap

Key Stakeholder Perspectives

January 12, 2017

IEEE Confidential Controlled Distribution Information Inside -
Classified by Sue Vogel for use by IEEE SA Staff, NESC
Executive Committee, and NFPA Staff and NEC
leadership until two years after the report recommendations
have acted upon.



Exhibit: *Gaps/Overlaps/Discrepancies*



Source: *Ericsson*

Describe Gap or Overlap?	Which Code has the Gap or Overlap?	Gap/Overlap pertains to which Chapter/Part + Section	Which Code-Making Panel/Subcommittee should address the Gap/Overlap?	What priority would you assign to addressing the Gap/Overlap? (Critical / Important / Moderate / Low)
<u>Demarcation Clarity</u>	<u>Overlap</u>	<p>NESC – Rules 011 – Figure 011-1</p> <p>NEC – Rule 90</p>	<p><u>NESC SC1 and other SCs</u> get involved for collateral changes (see general comment above)</p> <p>NEC - Panel 1 and correlation committee (CC)</p>	<p>Moderate –</p> <p>To define better the terms as they are used in both codes – NESC and NEC</p> <p>1) Exclusive control 2) Utility 3) Load side versus line side - demarcation point between utility company (supply side) and customer (load) for both power and communications. The best precise point may be different for different utilities and different customer services.</p>

Exhibit: *Gaps/Overlaps/Discrepancies*



Source: *Ericsson*

Describe Gap or Overlap?	Which Code has the Gap or Overlap?	Gap/Overlap pertains to which Chapter/Part + Section	Which Code-Making Panel/Subcommittee should address the Gap/Overlap?	What priority would you assign to addressing the Gap/Overlap? (Critical / Important / Moderate / Low)
<p><u>Distributed generation (DG) sites</u> that are interfaced with the power grid</p> <p>(Solar Farms..... wind farms..... large energy storage systems including batteries - includes other emerging technologies)</p>	<p><u>Gap</u> – NESC has an implicit gap in that the DG type sites are not explicitly identified as being covered in scope</p>	<p><u>Rule 011A</u> (scope) and definition of utility and <u>Part 1</u> – substations – expand to include DG facilities</p>	<p><u>Main Committee, SC1</u> - scope/definition <u>SC3</u> – substation sections revised to explicitly include DG sites and any specific rules for these sites.</p>	<p><u>Critical to Important</u> - to help position NESC for the future as power networks with more DG sites and connections to the grid evolve. It is assumed that most of the NESC rules will be applicable and adequate but there may be places that fine tuning is required for the specific power sources /wiring /interfaces associated with the DG facilities The individual sites at houses are appropriately be covered under NEC by the referenced articles</p>
		<p><u>Part 4</u> for work rule in DG sites</p>	<p><u>SC8</u> – rules for working in DG sites and around other similar facilities</p>	
	<p><u>Overlap</u> – NEC has an overlap with new Article 691 - solar farms, & other related articles 692 on Fuel cells, 694 on wind farms –</p>	<p><u>NEC Article 691</u> (Article 90 on scope is also involved since NEC does not have a clear definition of a “utility”)</p>	<p>Other IEEE, UL, and NFPA standards get involved as well.</p>	

Compiled NEC/NESC Priorities



1. Distributed Generation (as outlined in slides 10 &19).						
1. Distributed Generation						
1. Distributed Generation (slide 10 and 19)						
1. Distributed Generation						
1. Distributed Generation						
2. Work Rules for Distributed Generation						
2. Work Rules for DG Facilities						
2. Smart Grid Devices						
2. Smart Grid Devices						
2. NESC/NEC Demarcation Clarity						
3. Work Rules around energy storage systems						
3. Work Rules for Smart Grid Devices (Pole Congestion)						
3. Batteries and Other Energy Storage Systems						
3. NESC/NEC Demarcation Clarity						
3. Smart grid devices (supply vs. communication)						

183 Definition Comparisons

NEC®, NFPA 70E, and NESC



Comparison of Definitions: NFPA 70-2017: National Electrical Code® (NEC®), NFPA 70E-2015, and ANSI C2-2017, National Electrical Safety Code® (NESC®)

Term	2017 NESC definition	NESC Subcommittee, if applicable	Rule Location	2017 NEC definition	NEC Code Making Panel, if applicable	Article Location	Comments
administrative authority	The governmental authority exercising jurisdiction over application of this Code.	1, 2, 4, 5	013, 016, 092, 217, 250	See NEC's definition, Authority Having Jurisdiction			Defined in NESC only; See NEC's definition, Authority Having Jurisdiction
Authority Having Jurisdiction	See NESC's definition, administrative authority			An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, installation, or a procedure. Informational Note: ...	CMP-1		Defined in NEC only; See NESC's definition, Authority Having Jurisdiction
ampacity	The current-carrying capacity, expressed in amperes, of an electric conductor under stated thermal conditions.	2, 3	092, 095, 096, 160	The maximum current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating.	CMP-6		
anchorage	A secure point of attachment to which the fall protection system is connected.	8	411, 420	Not defined			
area lighting	An electrical installation that provides lumens on public or private property. NOTE: Area lighting installations under the exclusive control of a utility are covered by the NESC. All other area lighting installations are covered by the NEC.	1, 4, 5, 7, 8	010, 011, 232, 263, 352, 420	Not defined			NESC definition refers to NEC.
authorized person	A person who has been authorized by the controlling utility or its designated representative to perform specified duties in, on, or in the vicinity of utility facilities, as applicable.	3, 4, 7, 8	110, 213, 216, 217, 234, 312, 323, 383, 410, 411, 421	Not defined			
automatic	Self-acting, operating by its own mechanism when actuated by some impersonal influence—as, for example, a change in current strength; not manual; without personal intervention. Remote control that requires personal intervention is not automatic, but manual	2, 3, 4, 7, 8	Rules 093, 111, 142, 216, and 381. Sections 13, 15, 17, 42, and 44	Performing a function without the necessity of human intervention	CMP-1		
backfill (noun).	Materials such as sand, crushed stone, or soil, that are placed to fill an excavation.	2, 7	094, 321, 322, 352	Not defined			
ballast section (railroads).	The section of material, generally trap rock, that provides support under railroad tracks.	7	320, 351	Not defined			
bonding	The electrical interconnecting of conductive parts, designed to maintain a common electrical potential	2, 4, 7, 8	092, 093, 099, 235, 341, 342, 354, 374, 384, 434, 446	Connected to establish electrical continuity and conductivity	CMP-5		Defined in the NEC as "bonded (bonding)"

183 Definition Comparisons

NEC®, NFPA 70E, and NESC



Term	NESC Definition	NESC Subcommittee	Rule Location
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NEC Definition	NEC Code Making Panel	Article Location	Comment
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Definition Comparisons

NFPA 70-2017 (NEC)
NFPA 70E-2015
ANSI C2-2017 (NESC)

NESC Term: Administrative Authority

The governmental authority exercising jurisdiction over application of this Code.

NEC Term: Authority Having Jurisdiction

An organization, office, or individual responsible for **enforcing** the requirements of a code or standard, or for **approving** equipment, materials, installation, or a procedure.

Definition Comparisons

NFPA 70-2017 (NEC)
NFPA 70E-2015
ANSI C2-2017 (NESC)

NESC Scope:

The NESC defines its scope as covering utility facilities excluding facilities on the customer side of the service point.

NESC Rule 011.

NEC Scope:

The NEC defines its scope as covering facilities for the use of electricity ***excluding*** facilities under exclusive control of an electric utility.

NEC Article 90.2(A) and Article 90.2(B)(5).

Definition Comparison

NFPA 70-2017 (NEC)
NFPA 70E-2015
ANSI C2-2017 (NESC)

NESC Term: *Grounded/Effectively Grounded*

Connected to or in contact with earth or connected to some extended conductive body that serves instead of the earth

NEC Term: *Grounded/Grounding*

Connected (connecting) to ground or to a conductive body that extends the ground connection

Definition Comparison

NFPA 70-2017 (NEC)
NFPA 70E-2015
ANSI C2-2017 (NESC)

NESC Term: *Grounded/Effectively Grounded*

Connected to or in contact with earth **or connected to some extended conductive body that serves instead of the earth**

NEC Term: *Grounded/Grounding*

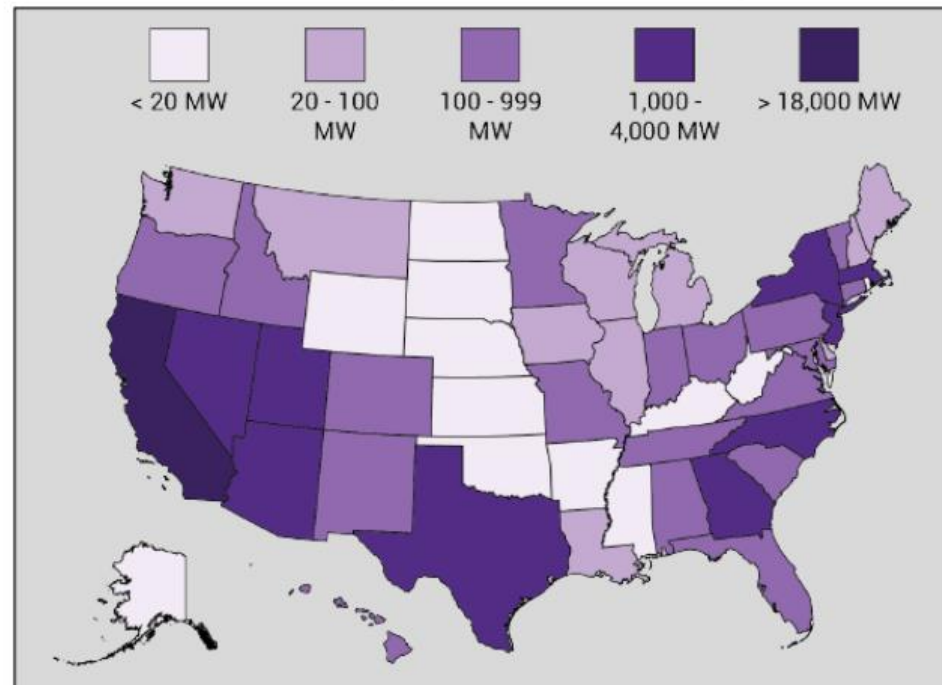
Connected (connecting) to ground or to a conductive body that extends the ground connection

Existing Solar Power

TOP 10 STATES

1. CA: 18,963 MW
2. NC: 3,288 MW
3. AZ: 3,151 MW
4. NV: 2,269 MW
5. NJ: 2,114 MW
6. MA: 1,592 MW
7. UT: 1,527 MW
8. GA: 1,478 MW
9. TX: 1,228 MW
10. NY: 1,012 MW

Cumulative Solar Capacity by State, through Q1 2017

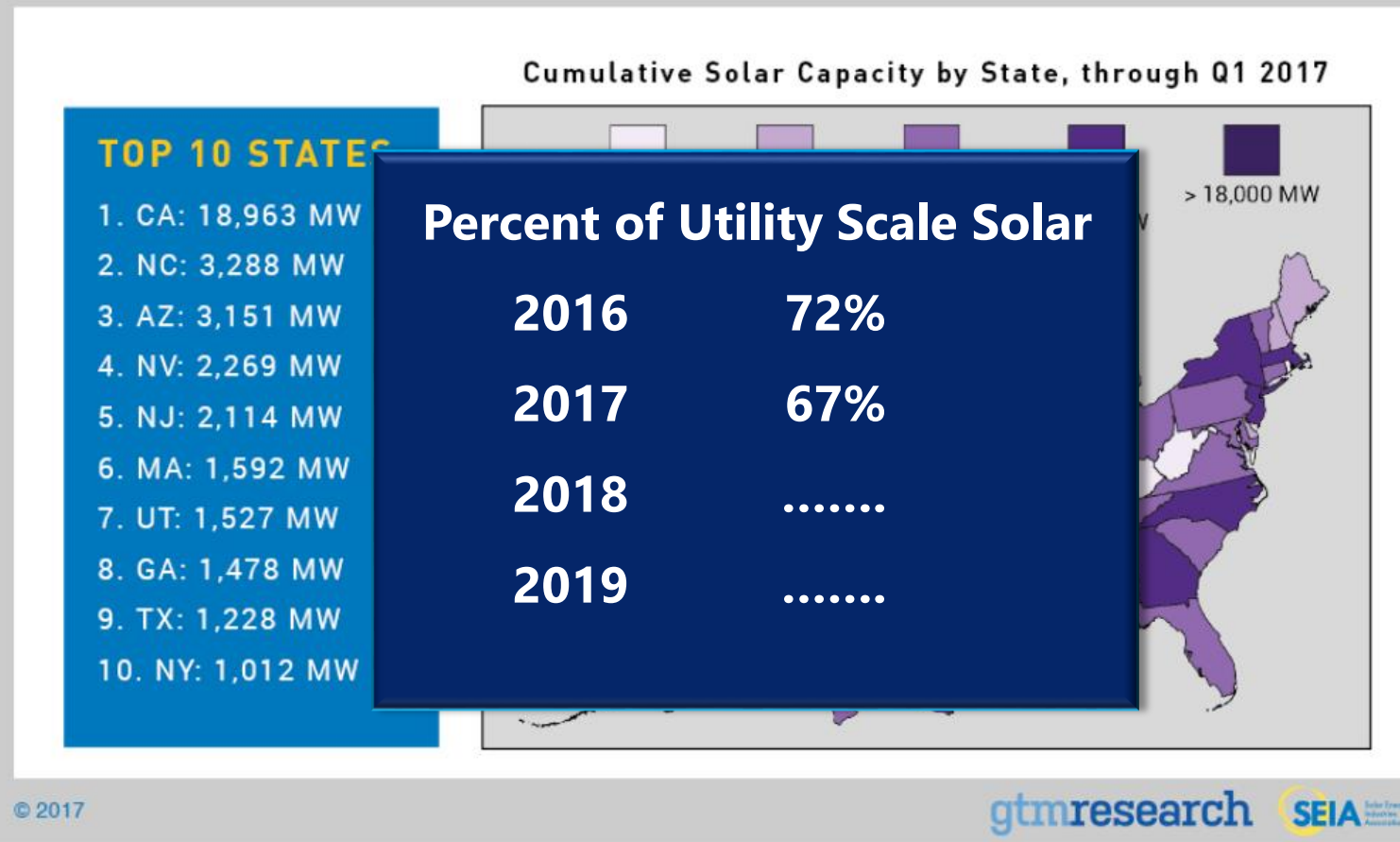


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gtmresearch SEIA Solar Energy Industries Association

<http://www.seia.org/research-resources/solar-industry-data>

Existing Solar Power



<http://www.seia.org/research-resources/solar-industry-data>

Lack of Large Scale PV Code



- NEC Article 690 was written when rooftop PV dominated the market.
 - Strict adherence to 690 in utility projects can create unsafe conditions and creates economic hardship for owners/operators.
- NESC has no Solar or Wind power requirements.
 - Leaves a vacuum that AHJs fill with NEC.
- The NEC leads the AHJ to the conclusion that all PV and Wind systems are within the scope of the NEC.
 - Only PV systems within NEC jurisdiction fall under the scope defined in NFPA 70 90.2

“New” NEC Article *for* **Large Scale PV**



- A new article was needed
- 3 year project
- Primary objective:
 - to allow for engineering supervision in place of restrictive code requirements

2017 NEC Article 691

Large Scale PV



- Systems must provide electricity to the transmission/distribution system
- Systems must be >5,000 kW
- Accessible only to authorized personnel
- Maintained and operated by qualified personnel
- Access to PV electric supply stations is restricted by fencing or other adequate means
- Documentation of the electrical portion of the electric supply station shall be stamped and provided upon request of the AHJ.

NEC Position

- Point of Service determines which code
- **NEC**
 - When Facilities are Private Development
- **NESC**
 - When Facilities are under Exclusive Control of Regulated Utility

NEC Position

- Point of Service determines which code
- **NEC**
 - When Facilities are Private Development
- **NESC**
 - When Facilities are under Exclusive Control of Regulated Utility

**Ongoing review and
discussion with stakeholders**

NESC Emerging Technologies WG



■ Purpose:

Ensure NESC is relevant and addresses safety for emerging energy generation and storage technologies

- (Wind, Solar, Battery Storage)

NESC Emerging Technologies WG



■ Objectives:

- Complete a gap assessment of current NESC for:
 - Emerging generation and storage systems
 - Designers, installers, owners and operators.
- Create Change Proposals to address gaps
- Make recommendations to the NESC Main Committee.

Solar Representation



- Chair: Lee Kraemer – First Solar
NESC Main Committee
- Alex Hofmann - American Public
Power Association
- Alkesh Shah – First Solar
- Bren McKinney – City Utilities
- Brian Bartos CPS Energy
- Greg Ball – Tesla
- Jan Gunnar Rislø – Power
Constructors
- Jil Stahl – Mortenson Engineering
- Joe Barnard – IEEE
- John Gajda- Duke Energy
- Larry Cisneros – North East
Oklahoma Elec Coop
- Mark Konz – Southern Co
- Nick Pasquerilla – Schneider
Electric
- Patrick Rafferty – Leeward Energy
- Reza Hessabi – Bay Area Rapid
Transport (BART)
- Richard Geisler – OGE
- Robert Harris – NRECA Coop
- Robert Wills – National Wind
Energy Assoc
- Steve Wozniak – First Solar
- Thomas Gwinn Jr. NRECA Coop
- William Rodriguez - Prizer

NESC Sections to Address Solar Power



- Scope –
 - Need to recognize generation behind the meter belongs to NEC
 - Need agreement from NFPA that generation on line side of meter is NESC.
- Definitions – IPP, PV Array, Wind Turbine, Storage etc...
- Section 11 - Protective arrangements in electric supply stations
- Section 12 - Installation and maintenance of equipment
- Section 14 - Storage batteries
- Section 15 - Transformers and regulators
- Section 16 – Conductors
- Section 17 - Circuit breakers, reclosers, switches, and fuses
- Section 18 - Switchgear and metal-enclosed bus
- Part 4. Work Rules for the Operation of Electric Supply and Communications Lines and Equipment

Storage/Battery Efforts

- Section 14 of the NESC addresses storage batteries
 - Has not been significantly updated since 1981
 - Subcommittee 3 – Electric Supply Stations
 - Working Group formed with battery expertise
- NESC Rule 420G - Working Rule for liquid-cell batteries
 - Joint effort
 - Subcommittee 3 - Electric Supply Stations
 - Subcommittee 8 – Work Rules
 - To address unresolved issues from 2017 change proposal
 - Trevor Bowmer (Ericsson/ATIS) – WG Chairman
- All pertinent rules need review and revision to help ensure that new battery technologies are sufficiently covered.

Ongoing Efforts

- Align on Private Facilities and other issues
- Submit change proposals for:
 - 2020 NEC
 - 2022 NESC
- Develop NESC requirements for:
 - Solar
 - Wind
 - Storage
 - Microgrids
- Look to State regulators for perspectives on NEC/NESC issues

Thank you!

For more information, contact:

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**IEEE
STANDARDS
ASSOCIATION**



Staff Subcommittee on Electricity and Electric Reliability