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- NESC Purpose and Scope
- NESC Membership and Committee Structure
- NARUC representation
- Today’s Issues for Tomorrow’s NESC
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    ~Has a simple definition but is a complex problem
  - New Generation Technologies (Disruptive)
    ~Solar, Wind, etc.
  - Distributed Generation
    ~NESC/NEC Collaboration
  - 5G Wireless Networks
    ~Small Cell Antennas
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NESC

Oregon PUC: A Success Story
National Overhead Line Safety Standard

NESC

ANSI C2
National Electrical Safety Code

- Secretariat: IEEE (Institute of Electrical and Electronics Engineers)
- Oversight and Infrastructure
- Publisher and Copyright Owner
  - Revised: 5 year cycle
  - Established in 1915
010. Purpose

A. 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.

NOTE: NESC rules are globally recognized and intended to provide a practical standard of safe practices that can be adopted by public utilities, private utilities, state or local utility commissions or public service commissions, or other boards or bodies having control over safe practices employed in the design, installation, operation, and maintenance of electric supply, communication, street and area lighting, signal, or railroad utility facilities.

B. NESC rules contain the basic provisions, under specified conditions, that are considered necessary for the safeguarding of:

1. The public,
2. Utility workers (employees and contractors), and
3. Utility facilities.

C. This Code is not intended as a design specification or as an instruction manual.
A. The National Electrical Safety Code (NESC) sets the ground rules for practical **safeguarding** of persons during the:

- Installation
- Operation
- Maintenance of electric supply and communication lines, and associated equipment.

B. NESC for:

1. 
2. 
3. Utility facilities.

C. This Code is not intended as a design specification or as an instruction manual.
010. Purpose

A. The purpose of the NESC is the practical safeguarding of persons and utility facilities during the course of work on overhead lines and other utility equipment, transmission and distribution circuits, and related activities.

B. NESC rules contain the basic provisions, under specified conditions, that are considered necessary for the safeguarding of:

1. The Public
2. Utility workers (employees and contractors), and
3. Utility facilities

C. This code is not intended as a design specification or as an instruction manual.
NESC Committee Structure

Main Committee
- Chairman
- Vice Chair
- Secretariat-IEEE
- 24 Organizational Members

Executive Subcommittee
- Chairman
- Secretary
- 6 - 10 Members

Technical Subcommittees
- Chairman
- Secretary
- SC 1 – Coordination; Sections 1,2,3
- SC 2 – Grounding
- SC 3 – Substations
- SC 4 – Overhead Lines – Clearances
- SC 5 – Overhead Lines – Strength & Loading
- SC 7 – Underground Lines
- SC 8 – Work Rules
Members of the Committee:

Organizations

Associations

Government Agencies

which are national in scope, all having a direct and material interest in the activities of the Committee

- American Public Power Association
- American Public Transit Association
- Alliance of Telecommunication Industry Solutions
- Association of American Railroads
- Association of Edison Illuminating Companies
- Bonneville Power Administration
- Edison Electric Institute
- IEEE
- Independent Electrical Contractors
- International Brotherhood of Electrical Workers
- International Municipal Signal Assn
- National Association of Regulatory Commissioners
- National Cable Television Association
- National Electrical Contractors Assn
- National Electrical Manufacturers Association
- National Society of Professional Engineers
- National Rural Electrical Cooperative Assn
- Society of Cable Telecommunications Engineers
- Tennessee Valley Authority
- USDA/Rural Utilities Services
- Solar Energy Industries Association
- Western Area Power Administration
2017 NESC

- The NESC is revised every 5 years
  - Becomes effective 6 months following publication—1 Feb 2017

New products
- NESC Premiere Handbook
  - Integrates discussion for each section/rule with a representation of Code text interspersed
- NESC Mobile App
- Massive Online Open Courses (MOOCs) and E-Learning

Next Edition is 2022
- Change proposals are due 18 July 2018
- 2022 NESC revision process kicked off in October 2016 at NESC Workshop
A Word on MOOCs

- The first MOOC is “An Overview of the NESC”
  - This course is being re-run a second time, beginning February 22, 2017
  - [https://www.edx.org/course/introduction-national-electrical-safety-ieeex-nesc01-x-0](https://www.edx.org/course/introduction-national-electrical-safety-ieeex-nesc01-x-0)
  - There is no charge for this course

- Subsequent courses on the code will be launched in the near future
  - Nominal course fee
  - Next
    - Changes to the 2017 NESC
    - Grounding Methods (Section 9)
    - Work Rules (Part 4)
  - In the works:
    - Electric Supply Stations (Part 1)
    - Overhead Lines-Clearances & Strength and Loading (Part 2)
    - Underground (Part 3)
NARUC Membership Status

Since November 2014, NARUC representation on the NESC has grown

- **NESC Main Committee**
  - Jorge Camacho, District of Columbia PSC (Principal Rep)
  - Mark Rettmann, Oregon PUC (Alternate Rep)

- **Subcommittee 2, Grounding**
  - David Hansen, Wisconsin

- **Subcommittee 4, Overhead Lines-Clearances**
  - Darren Gill, Pennsylvania
  - Akanksha Pachpinde, Wisconsin
  - Mark Rettmann, Oregon

- **Subcommittee 7, Underground Lines**
  - Jorge Camacho, District of Columbia
  - Akanksha Pachpinde, Wisconsin

- **Subcommittee 8, Work Rules**
  - Mohammed Monawer, Wisconsin

- **Seeking NARUC representation on:**
  - NESC Subcommittee 3, Electric Supply Stations
  - NESC Subcommittee 5, Overhead Lines-Strength & Loading
Significance to NARUC

• Each new edition of the NESC drives a higher level of safety
  • Citing up-to-date Code increases safety for workers and the public

• Regulatory input via participation and the public comment process can influence the final Code

• Participate in consensus process to approve the NESC

• The NESC will be ever-changing in an integrated grid landscape

• Increase understanding of the Code and its development
  • How and why rules are revised

• Stay on top of changes that impact industry, regulation

• Resiliency will be considered going forward
Resiliency
National Electrical Safety Code

- Provides construction criteria
  - for Overhead & Underground lines
    - Wind
    - Ice
    - Grade of Construction
    - Strength Factors
    - Load Factors
    - Clearances
    - Grounding

- The NESC is not a complete “How To” design guide
System Performance

- **Safety**
  - Systems built to NESC criteria are considered to have adequate safety

- **Reliability** (electrical)
  - Indices measure the number, frequency, duration, etc. of outages (*without major storms*)

- **Resiliency**
  - How well a system withstands a major storm to minimize service interruptions
  - How quickly service is restored
Resiliency depends on many factors

- Smart grid communication
- Sectionalizing
- Redundancy
- Preparedness
- Mutual assistance agreements
System Performance

- Resiliency depends on many factors
  - Smart grid communication
  - Sectionalizing
  - Redundancy
  - Preparedness
  - Mutual assistance agreements
  - ...........
  - **Structural resiliency**
  - ...........
Initial Structural Resiliency depends on:

Grade of Construction

- Grade B (3.85 SF)
- Grade C (2.06 SF)
Structural Resiliency
(System Performance in Major Storms)

Subsequent Structural Resiliency depends on:

**Maintenance**

Wood Poles may Decay just below Ground
(Out of Sight)

Wood Poles are Likely to Fail at the Ground From Wind Loads

Reduced Strength from Decay Reduces the Pole Capacity
Structural Resiliency
(System Performance in Major Storms)

The **Effectiveness** of Pole Maintenance Programs **Varies Greatly**

**From**
Finding a Small Portion of the Poles Below Code Strength

**To**
Finding 98% of all Decayed Poles and Extending Pole Service Life
# Effects of Structural Resiliency

## Neighboring Utilities Impacted by the Same Hurricane

<table>
<thead>
<tr>
<th></th>
<th>Utility &quot;A&quot;</th>
<th>Utility &quot;B&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pole Inspection Reject Accuracy</td>
<td>98%</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>Actual</td>
<td>Factored</td>
</tr>
<tr>
<td></td>
<td>Numbers</td>
<td>Numbers</td>
</tr>
<tr>
<td>Wood poles replaced</td>
<td>152</td>
<td>2,790*</td>
</tr>
<tr>
<td>Number of Peak Outages</td>
<td>95,000</td>
<td>487,984*</td>
</tr>
<tr>
<td>Cost of Restoration</td>
<td>$20 M</td>
<td>$310 M*</td>
</tr>
<tr>
<td>Time of Restoration</td>
<td>100% in 5 days</td>
<td>100% in 13 days</td>
</tr>
</tbody>
</table>

* Factored for having 60% more poles
Structural Resiliency
(System Performance in Major Storms)

Wood Pole Plants
With **Effective Groundline Maintenance** are
More Resilient
in Major Storm Events

- Fewer Weakened Poles
- Fewer Pole Failures
- Fewer Outages
- Faster Restoration
- Far Less Restoration Costs
National Association of Regulatory Utility Commissioners (NARUC)

- “Under state law, NARUC’s members have an obligation to ensure the establishment and maintenance of utility services as may be required by law and to ensure that such services are provided at rates and conditions that are fair, reasonable and nondiscriminatory for all customers.”

- ...ensure the establishment and maintenance of utility services

- ...provided at rates and conditions that are fair
2004 – Hurricane Wilma
- 10,000+ wood poles failed

2016 – Hurricane Matthew & FPL
0 poles failed due to wind
500 poles failed due to trees
- Excavated & Inspected all poles
- Applied preservative treatment to all poles
- Restored poles with strength below code
- Upgraded wood poles to harden lines
- Replaced some wood poles with concrete or steel poles
<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Should the NESC address resiliency?</td>
</tr>
<tr>
<td>Describe and explain structural resiliency?</td>
</tr>
<tr>
<td>Be more definitive about T&amp;D inspection and maintenance? ... wood and steel structures?</td>
</tr>
<tr>
<td>Absolve itself from resiliency?</td>
</tr>
<tr>
<td>Should NARUC add structural resiliency to resiliency considerations?</td>
</tr>
<tr>
<td>Do commissions want to better understand the details of wood pole asset management?</td>
</tr>
</tbody>
</table>
Distributed Generation
New Generation Technologies

DISRUPTIVE TECHNOLOGY

A technology that significantly alters the way that industries operate and forces the participants to alter their approach or risk becoming irrelevant.
The Pace of Change is Accelerating

Solar Capacity Rising

Solar photovoltaic capacity in the U.S. has increased dramatically in the past decade.

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity in Megawatts</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>104.7</td>
</tr>
<tr>
<td>2015</td>
<td>7,286</td>
</tr>
</tbody>
</table>

Photovoltaic capacity, in megawatts

Source: Solar Energy Industries Assoc.

Kris Kinkade, USA Today
New Generation Technologies

What really constitutes a utility?  

Where’s the service point?

Which Code applies?
Decades of Stable Electricity Model
HOW THE NESC® DIFFERS FROM THE NATIONAL ELECTRICAL CODE® (NEC®)
NEC/NESC Collaboration

- NEC/NESC White Paper
  - http://standards.ieee.org/about/nesc/nec_nesc_case_study.pdf

- NEC/NESC Collaboration Working Group Formed

- Developed NEC/NESC Roadmap

- Prioritized: Gaps – Overlaps - Discrepancies

- Coordinated NEC/NESC Change Proposals
Wireless and 5G Developments
Wireless and Wireless Plus Land Lines
Mobile TV Phones – Video Streaming
Wireless Network

3G Cell Towers
Wireless Network

Close-up of Clearwire Array

WiMax Antennas

Clearwire's WiMax

Possibly Verizon & AT&T (UNCONFIRMED)

Microwave Backhaul (Line-of-sight; two total here)
3G Towers with Microwave Transmission
4G LTE - Faster
4G LTE - Faster

Small Cell
4G LTE

What’s Next?

Smaller Cell
5G Wireless vs 4G Wireless

5G

5x Faster Response Time
25ms ping latency to 5ms

10x Higher Bandwidth
100Mbps to 1Gbps

10x the Number of Users
5G Wireless – Driverless Cars
5G Wireless – Connected Cities
5G Wireless – Connected Cities

- Remote Healthcare
- Drone Delivery
- Internet of Things
- Virtual Reality
- Empowering Consumers
46% of millennials want a mobile plan with: *Unlimited video streaming*

And they use multiple on-demand services
5G had a fantastic evolution during 2016 with achievements in standardization, industry use cases, live field trials and big efforts in R&D plus industry-wide collaborations. With Ericsson’s strategy going forward, 2017 is set to be an inspiring year.
RCR Wireless News

Link:  http://www.rcrwireless.com/20170201/carriers/att-to-buy-fibertower-for-millimeter-wave-tag4

Select the 5G tab for news articles:

By Dan Meyer on JANUARY 24, 2017

Verizon testing 5G in 10 locations, could expand beyond fiber footprint

5G trial progress a highlight of Verizon Q4 results as the telecom giant suffered under competitive strain from T-Mobile, AT&T...

By Dan Meyer on JANUARY 24, 2017

Trump nominates Pai to lead FCC, course set for Open Internet challenge 5G support

FCC views on Open Internet regulations expected to hit significant review under Pai, though 5G support could flourish. The Federal...
5G Wireless News

By Jeff Kagan on JANUARY 23, 2017

Kagan  The 5G wireless brand war has begun

Marketing of the next generation of wireless services has begun. That means get ready for a noisy and confusing battle...

By Dan Meyer on JANUARY 26, 2017

5G standards battle continues, T-Mobile 4×4 MIMO shows speed boost

3GPP work on 5G standards continues to make progress as milestones come into view, while T-Mobile 4×4 MIMO deployment posted...

By Juan Pedro Tomás on JANUARY 26, 2017

Orange, Ericsson trial 5G technology in France

5G trial reached peak rates of more than 10 Gbps. French telecommunications provider Orange and Ericsson said they hit peak...
International 5G

By Juan Pedro Tomás on FEBRUARY 1, 2017

ITU adopts KT pilot 5G technology as the draft for international standards

5G technology is currently being reviewed by ITU member countries. Korean telecommunications operator KT said its pilot 5G technology has...

By Juan Pedro Tomás on JANUARY 23, 2017

Telenor thinks 5G trials will take off in 2017

In addition to 5G, big moves in AI and IoT are forecast. Norwegian telecommunications group Telenor believes artificial intelligence, the...

By Juan Pedro Tomás on JANUARY 31, 2017

Orange and Nokia to collaborate on 5G services

The two companies will develop services for industries and consumers to take advantage of 5G technologies Finnish vendor Nokia and...
New Draft Chapter 15 on Wireless Facilities

- RF safety programs
- RF exposure level markings/labels for poles
- Placement issues and recommendations based on NESC Section 23 – Clearances
- Compliance with NESC Work Rules in Part 4
5G – The Next Wireless Network

– Faster Response and Data Speeds
– **Shorter signal range**
  \(<300\text{m}\)
– Additional tall towers are not viable
– Communities want the technology without additional infrastructure
– Power is needed
– Fiber is needed
5G – The Next Wireless Network

- 150,000,000 locations
- Power is available
- Fiber is likely available

Existing utility poles
Telecom Needs

- Space on a pole
  - Direct Attachment
  - On an arm
  - On a strand

- Power
  - Transformer
  - Breaker
  - Meter
  - Grounding

- Fiber
  - Connected to aggregation points
Electric Pole Owners Need

- Policies
  - Permitting

- Analysis
  - Equipment Spec’s
  - Clearances
  - Grounding
  - Loading
  - Power connection
  - Metering
  - RF
  - ...............
NESC Emerging Technologies WG

5G - Clearances  Grounding  Loading  Work Rules

Telecom  Power

Manufacturers  Stakeholders

May 3, 2017
Atlanta, GA
Is there a platform within NARUC that can:

A. Provide a forum to bring electric and telecom together?

B. Participate on the NESC Working Group

C. Help facilitate standards development?

D. Investigate communication & cooperation within states between Power and Telecom
State Adoption
State Adoptions/Use of the NESC

- In 2016, NRRI collected data from State commissions to identify state code adoptions

- IEEE evaluated the data and urls; analyzed 50 state statutes, rules, administrative circulars

- Compiled a spreadsheet containing urls and direct links to statutes, administrative circulars, rules for each state

- Compiled maps based on two principles:
  - What is the latest edition of the NESC that states have adopted?
  - Is the NESC adopted automatically or does it go through a rulemaking process (or other)?
## State Adoption/Use of 2012 National Electrical Safety Code (NESC)

|--------------------------------------|------------------------------|------------------------------------|-------------------------------------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
NOTE: The information from this survey was compiled and distributed for informational purposes only. This information is not intended to provide an interpretation of the data received. The IEEE is not responsible for verifying the accuracy of information provided by the Commissions.
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Survey Information: What Next?

- We would like corroboration from each state commission regarding our understanding of the data
  - Information provided to the best of our knowledge
  - Seeking confirmation especially for automatic adoption
  - Some interpretation involved where
    - An edition is not specified
    - “Or current edition” language is not included
    - An older edition is specified

- Now that the 2017 edition is in effect, need to update map
  - Identification of rulemakings and date(s) of adoption

- IEEE can provide a review copy to any state commission, upon request
  - Electronic version, password protected for a defined period

- What is the best way to share this information within NARUC and state commissions?
  - IEEE will post on NESC website when finalized
Oregon PUC Success Story
Meeting with OPUC and OJUA

- October 2015: We’d heard a lot about what Oregon PUC does to enforce the NESC, so we went to find out

- IEEE-SA staff and NESC member (BPA) met with
  - OPUC staff and Commissioner Ackerman
  - Oregon Joint Use Association (OJUA) members

- OPUC: NESC Audit Program
  - In November 1999 a task force was established by the OPUC at the direction of the Oregon Legislature to address issues pertaining to utility poles.
  - The task force submitted proposed rules for determining appropriate sanctions for unauthorized attachments and criteria for certifying compliance with laws regulating pole attachments.
OPUC and OJUA

- The Oregon Joint Use Association (OJUA) was formed based on the initial work from the task force
  - Comprised of pole owners and pole users representing electric utilities (IOUs, PUDs, Co-ops), communication companies (ILEC/CLEC, and CATV) and government entities
  - Acts as an advisor to the Commission regarding adoption, amendment, or repeal of administrative rules governing pole owners and occupants

- Develop Joint Inspection Best Practices
- Conflict Resolution Procedures & Application
- Provide Annual Training on NESC
  - April 25-27, 2017, Portland, OR
  - www.ojua.org
OPUC and OJUA Success Story

- IEEE-SA worked with OPUC and OJUA to tell the success story
  - Developed a case study, *The Oregon Joint Use Association (OJUA) and the National Electrical Safety Code (NESC): A Progressive Model for Cooperation*, April 2016
    - Presented to Oregon Commissioners in April 2016
  - How can the case study be leveraged where needed to address joint use matters in other states?
OPUC and OJUA Success Story
NESC Recent and Future Events
The NESC Summit — the first meeting of its kind to help guide the future of safety in the electrical power and communications environments.
2015 NESC Summit

• Washington, DC
• 100+ attendees/stakeholders
• Keynote Speakers from
  • A/S Department of Energy
  • OSHA
• 100 Years of History
• Emerging Issues
• Jorge Camacho
  • “How is the NESC Used Today?”
• The NESC of the Future
2016 NESC Workshop: The Future

- 2017 Changes
- New (Disruptive) Technologies
- MicroGrids
- Interconnection of DER
- NEC/NESC

Resiliency
New Wind Maps
Work Rules
Future NESC Topics
Prioritization
Working Groups

Michael J. Johnston
Chairman NEC Correlating Committee
National Electrical Contractors Assoc
2018 NESC Workshop

Next NESC Workshop event: Spring 2018
  - Preview on change proposals for the 2022 edition
  - Technical topics continued
  - Increasing NESC community engagement
  - Dates/location TBD
# 2022 NESC Revision Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 July 2018</td>
<td>Final date to submit change proposals</td>
</tr>
<tr>
<td>Sept/Oct 2018</td>
<td>Subcommittees meet to consider change proposals and make initial recommendations</td>
</tr>
<tr>
<td>1 September 2019</td>
<td>Preprint is published—public comment period opens</td>
</tr>
<tr>
<td>1 May 2020</td>
<td>Final date to submit comments</td>
</tr>
<tr>
<td>Sept/Oct 2020</td>
<td>Subcommittees meet to consider comments and make final recommendations</td>
</tr>
<tr>
<td>15 January 2021</td>
<td>Proposed revision of NESC submitted to NESC Main Committee for letter ballot and concurrent ANSI public review</td>
</tr>
<tr>
<td>15 May 2021</td>
<td>Submit to ANSI for recognition as an American National Standard</td>
</tr>
<tr>
<td>1 August 2021</td>
<td>Publication of 2022 NESC</td>
</tr>
</tbody>
</table>
How Can NARUC & Commissions Help? And Vice Versa?

- Seeking regulators perspectives on issues
- Assistance with NESC Adoption/Use survey & information
- How can we help?
  - Is there another success story we can highlight?
  - Work for the public good
  - Enhance safety
Thank you

- Nelson G. Bingel, III
- NESC Chairman
- Nelson Research, LLC
- nbingel@nelsonresearch.net
- (678) 850-1461

- Sue Vogel
- Senior Manager, NESC
- IEEE Standards Association
- s.vogel@ieee.org
- (732) 562-3817

NESC Website:
http://standards.ieee.org/about/nesc/index.html

View NESC Stakeholders Discuss the NESC on Video:
http://standards.ieee.org/about/nesc/videos.html

Visit us at the NARUC Winter Meeting at the NESC Sponsor Table!