

Infrastructure Codes and Standards—the National Electrical Code®—Electric Vehicles and DC Power

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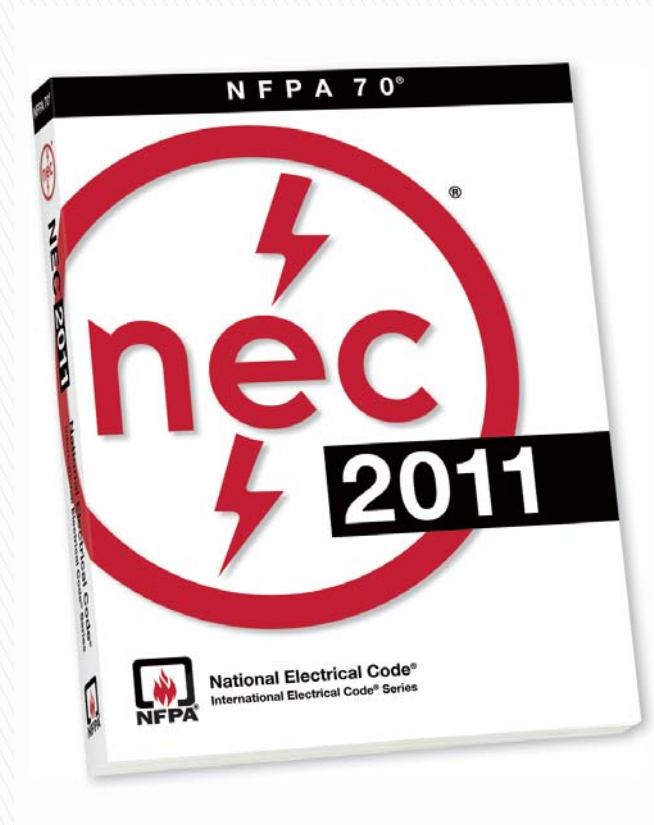
What is the National Electrical Code?

- ▶ Also known as the NEC ® or ANSI/NFPA 70
- ▶ There are two electrical codes that govern electrical installation
 - The National Electrical Safety Code® –governs electrical and communications utility installations
 - The National Electrical Code® –governs electrical installations in the built environment



History

- ▶ First edition issued in 1897
- ▶ There have been 52 editions
- ▶ Since 1953, the NEC has been issued every three years
- ▶ Adopted into law



National Electrical Code® Articles on Alternative Energy

- Alternative Energy Sources
 - Article 480–Batteries
 - Article 625–Electric Vehicle Charging Systems
 - Article 690–PV Systems
 - Article 692–Fuel Cells
 - Article 694–Small Wind Systems
 - Article 625–Electric Vehicles
 - Article 705–Interconnected Electrical Power Production Sources

Article 625–Electric Vehicles

- ▶ Section 625.26 recognizes interactive electric vehicle charging infrastructure.
 - Listed for the purpose
 - Used in optional standby systems (Article 702)
 - When used as a production source Article 705 also applies

Microgrids

- ▶ Who owns it?
 - Utility–National Electrical Safety Code®
 - 29 States do not allow other entities to sell power
 - Non Utility–National Electrical Code®
- ▶ Whose side of the line of demarcation is the equipment on?
 - National Electrical Code®
 - National Electrical Safety Code®

Article 705

- ▶ The pivotal article for alternative energy requirements
- ▶ Necessary for combining sources
 - Protects the premises
 - Protects the grid
 - Protects workers

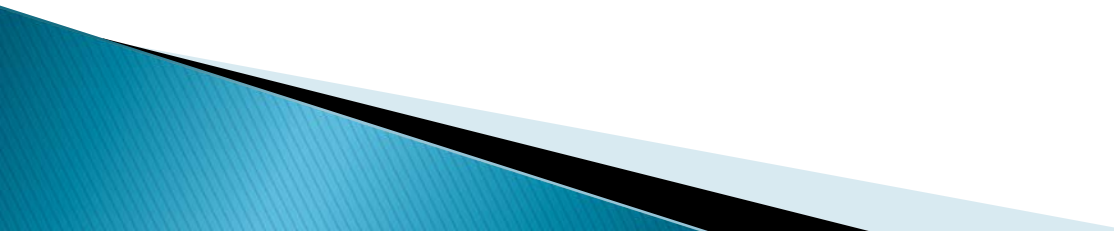
NEC Requirements

- ▶ Most general requirements apply to all electrical systems, regardless of power source

The Three Legged Stool

- ▶ Electrical installation requirements--*NEC*[®]
- ▶ Product standards -UL, NEMA, etc
 - Product testing to standards
- ▶ Electrical inspection (ensures compliance with the installation rules of the *NEC*, along with any product installation requirements)

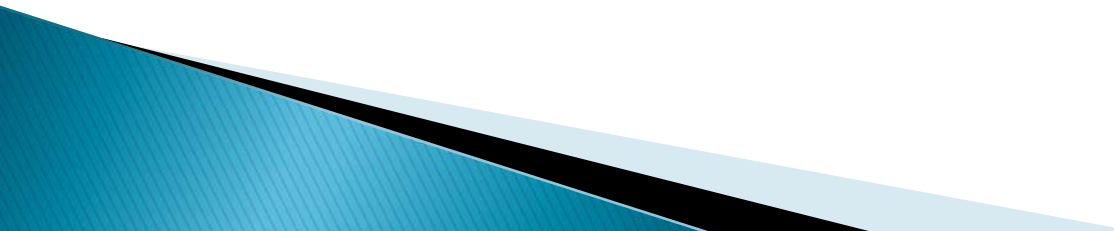
DC Requirements

- ▶ Have been in every edition since the 1897 edition.
 - ▶ There are specific AC and DC requirements
 - ▶ Where not specified, requirements apply to AC and DC
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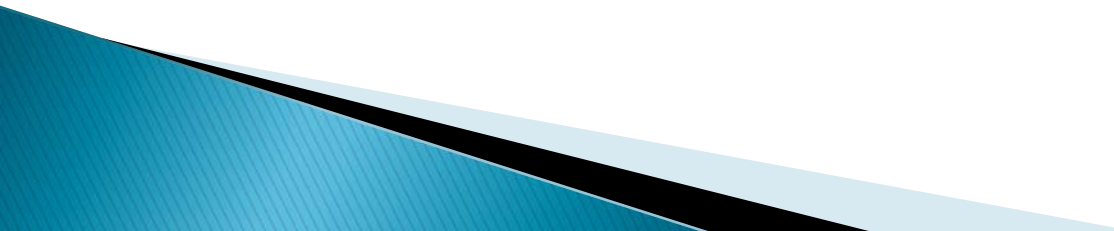
Thoughts to Ponder

- ▶ Are the Common Requirements a Good Idea?
 - Based on current applications, yes!
 - Based on current technology, the requirements of the NEC have worked well.
 - Higher power DC may present new challenges
 - Overcurrent protection
 - GFCI protection
 - AFCI protection
 - Switching
 - Circuit protection
 - Arc flash evaluation
 - Circuit separation

NEC TCC Task Group on DC

- ▶ Chaired by John Kovacic, UL
 - ▶ Members from various parts of the *NEC* community and from parts of the electronics industry
 - ▶ May be soliciting additional members with DC expertise
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Conclusions

- ▶ Major changes to our Electrical infrastructure are on the way.
 - ▶ The NEC has been very responsive to change
 - ▶ The NEC has requirements for interactive electrical systems
 - ▶ Safety must not be compromised in our quest to become energy independent and green!
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Thank you!