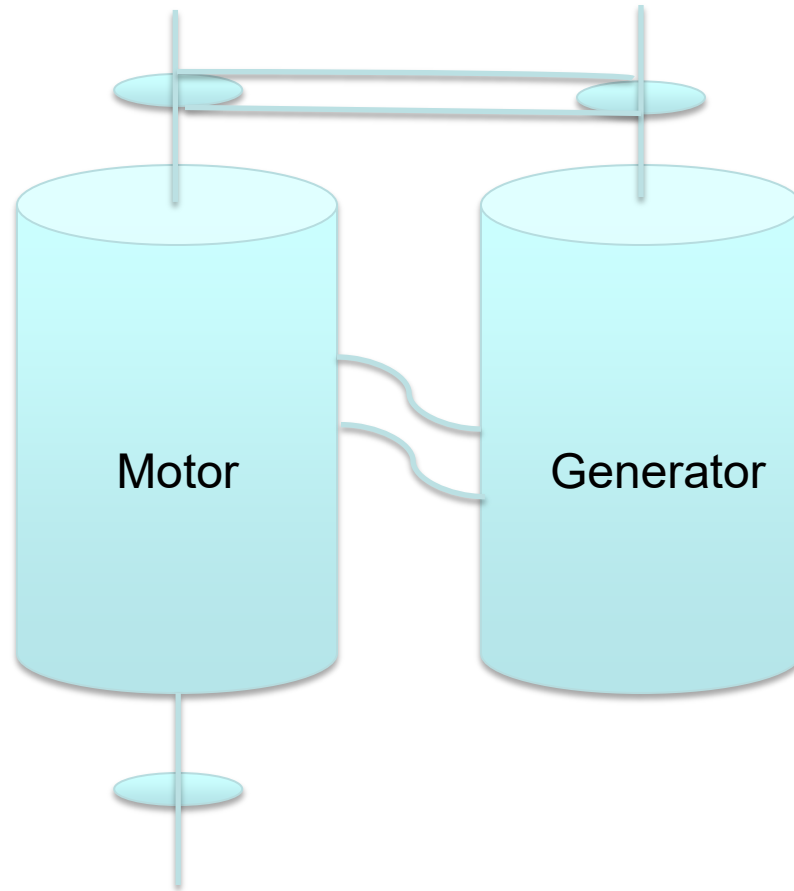


# All the World Needs is Unlimited EE's in Power

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*4-4-2016*

*CAPER*





Steps to Ensure Effective  
Substation Grounding

## Teach them

- to question everything
- to keep asking why until they get to the root cause
- not to settle for “that’s the way we’ve always done it”
- to experiment
- to solve big problems

# Santee Cooper

- Generation – 5200 MW
- coal, natural gas, nuclear, hydro, solar, landfill gas
- Transmission – 5,000 miles
- Customers – mostly Wholesale and Industrial
- 20 Cooperatives and 28 Industries
- 1700 employees, 300 in Transmission
- 83 engineers, mostly electrical













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DANGER











## We have EE's who:

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- Maintain transformers, breakers, relays
- Calculate relay settings
- Install new relays
- Plan, design, build new transmission lines and substations
- Monitor real time operations
- Run studies that support operations
- Support the network in the ECC
- Design and maintain our communications system
- Support our line crews
- Conduct long range system studies
- Administer the OAT tariff
- Administer the OASIS
- Train the system operators

# What we look for when we interview



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- Competence
  - Character
  - Chemistry
  - Communications
  - Computer
  - Cost
  - Connection
  - Compliance



# Competence

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- We will test you to find out how much you know. This is what I would like for you to know. Most have none of this.
  - Basic power equations for 3 phase systems
  - Single line diagrams
  - Per unit calculations
  - Delta-wye conversions
  - Calculating line parameters including mutuals
  - Voltage drop
  - Equipment ratings
  - Load flow
  - Economic dispatch
  - Symmetrical components
  - Fault studies
  - Specifying CT tap settings
  - Calculate protective device settings
  - Fault location
  - Stability studies

# Character



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21 character qualities we would like to have in an engineer. Things like Initiative, Diligence, Attentiveness, Alertness, Punctuality, Discretion, Thoroughness, Responsibility, Truthfulness, Persuasiveness, Flexibility, etc.

## Top Three

- **Initiative** – Recognizing and doing what needs to be done before I am asked to do it
- **Diligence** – Focusing all my energy to complete the tasks assigned to me
- **Flexibility** – not being attached to plans or ideas that could be changed by my authorities

# Chemistry



- 
- The ability to get along well with others
  - Work on a team
  - Respect – treat people the way you want to be treated
  - Persuasiveness – the ability to guide vital truths around another person’s mental roadblocks

# Communication Skills

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- Listening skills (attentive and active)
- Writing skills (including spelling, punctuation and grammar)
- Speaking skills (including public speaking)
- Power Point

# Computer



- 
- Word, Excel, Powerpoint, Visio, Access, Project (basic and advanced)
  - Networking
  - Database on a large scale
  - Coding
  - Control theory
  - Cyber security

# Cost Control

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No one has unlimited funding

You need to know how to:

- Map and re-engineer business processes
- Define requirements for a RFP
- Economically compare alternatives
- Evaluate bids
- Cost justify a solution
- Build a business case

# Connections (Theory with application)



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Co-op or summer job with a

- Power company
- Industry
- Manufacturer

Does your school have an “Office of Professional Practice” to make sure that students are doing some sort of internship?

Tours – power plant, substations, energy control center

Senior design project or research

- vet with an industry person
- ensure all team members contribute

## Real life experience or at least exposure

# Compliance



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## Mandatory NERC Standards Subject to Enforcement

BAL Resource and Demand Balancing	10
CIP Critical Infrastructure Protection	9
COM Communications	3
EOP Emergency Preparedness and Operations	8
FAC Facilities Design, Connections, and Maintenance	9
INT Interchange Scheduling and Coordination	5
IRO Interconnection Reliability Operations and Coordination	15
MOD Modeling, Data, and Analysis	17
NUC Nuclear	1
PER Personnel Performance, Training, and Qualifications	4
PRC Protection and Control	21
TOP Transmission Operations	9
TPL Transmission Planning	1
VAR Voltage and Reactive	4



# Compliance

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Need engineers who have:

- Technical competence
- Cross-functional experience
- Thoroughness – knowing what factors will diminish the quality of my work if neglected – Meticulous – can't sleep until it is documented

# Professional Registration

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Make sure all students are getting a thorough understanding of professional licensing

Strongly encourage getting the FE **before** they graduate

Start preparing to pass the PE as soon as possible

Questions ???