

Interconnecting Generators to the Exelon Systems

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In this Presentation we will discuss ...

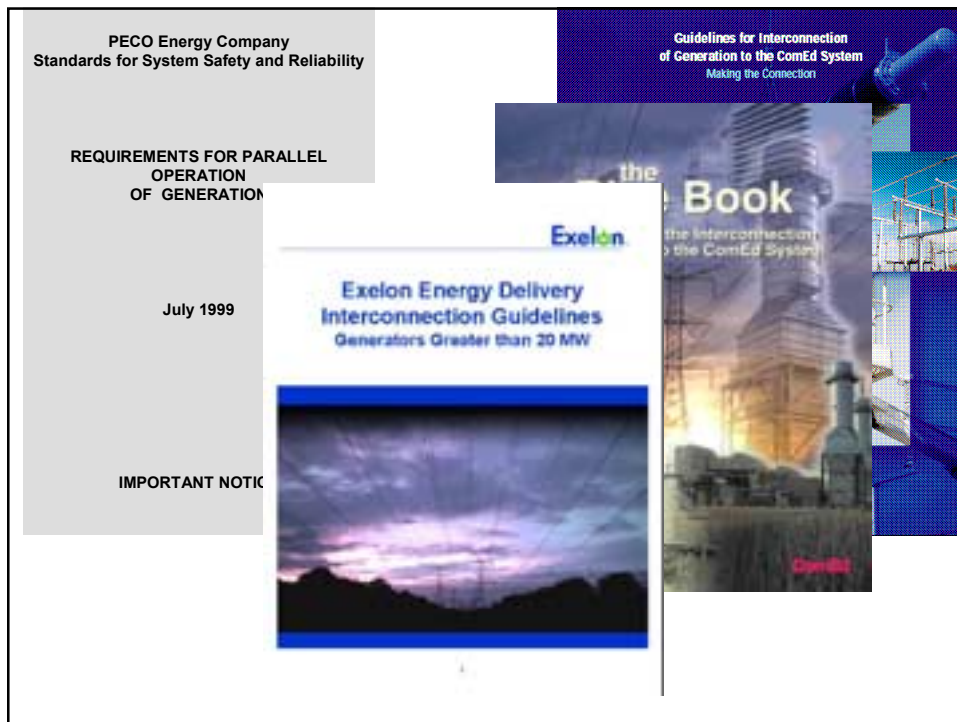
- **Interconnection to the Exelon (ComEd and PECO) Systems**
- **The development of the Interconnection Guidelines**
- **Any questions you may have**

ComEd History and Facts

- 1907 - Chicago Edison and Commonwealth Electric form Commonwealth Edison
- 2000 – Exelon became Parent Company for PECO and ComEd
- Today - ComEd
 - Maintains 82,000 Miles of T&D Power Lines
 - Serves 3.7 Million Customers
 - Interconnected 8853 MW of IPPs to the System since 1999 via a Progression of Processes

PECO History and Facts

- 1902 The Philadelphia Electric Company of Pennsylvania Incorporated
- 2000 – Exelon became Parent Company for PECO and ComEd
- Today – PECO
 - Maintains 29,000 Miles of T&D Power Lines
 - Serves 1.5 Million Customers
 - Interconnected 3552 MW of IPPs to the System since 2002 via the PJM Process



The PJM Interconnection Process

- Feasibility Study
- Impact Study
- Facilities Study
- Interconnection Service Agreement
- Construction Service Agreement

The PJM Interconnection Process “The Studies”

- Feasibility Study
 - Preliminary determination of the type and scope of the attachment facilities. Looking for overloads on lines, transformers and breakers.
- Impact Study
 - Comprehensive regional analysis of the effect of adding generation
 - Evaluates the Impact on deliverability to the PJM market
 - Identifies system constraints (Attachment Facilities, Local and Network Upgrades)
- Facilities Study
 - An Engineering Study, Schedule and Cost Estimate

Capacity vs. Energy Resource

- Capacity Resource - The net capacity from owned or contracted for generating facilities which are accredited pursuant to the procedures set forth in the Reliability Assurance Agreement. (1.3D)
- Energy Resource – A generating facility that is not a Capacity Resource. (1.11A)

The PJM Interconnection Process “The Service Agreements”

- Interconnection Service Agreement
 - An agreement among the Transmission Provider, Interconnection Customer and Interconnected Transmission Owner regarding Interconnection under Part IV of the Tariff
- Construction Service Agreement
 - An agreement among the Transmission Provider, Interconnection Customer and Interconnected Transmission Owner regarding Construction



Table of Contents

- Introduction
- Regulatory Requirements for Interconnection
- General System Requirements
- Testing and Acceptance Requirements
- Operation Requirements
- Ongoing Responsibilities



Regulatory and General System Requirements

- **Retail Service Requirements ComEd/PECO**
 - Local self supply
 - Remote self supply
 - Third party supply
 - Illinois by Retail Electric Supplier (RES) or ComEd
 - Pennsylvania by Electric Generation Supplier (EGS) or PECO



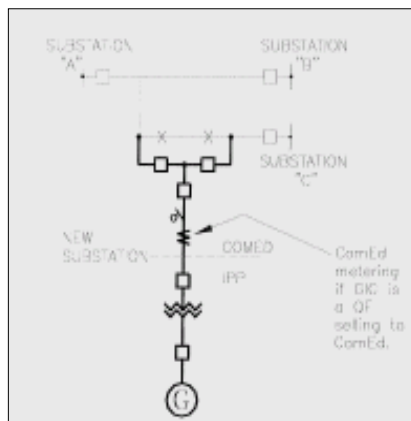
Regulatory and General System Requirements

- **Responsibilities of Generator Interconnection Customer (GIC)**
 - Design, Install, Operate and Maintain GIC Interconnection
 - Install, Operate and Maintain GIC Protective Devices
 - Meet Exelon and PJM Standards
- **Connection Rule of Thumb**
 - < 20 MVA possibly Distribution
 - > 20 MVA possibly 138 kV to 500 kV

ComEd Transmission System

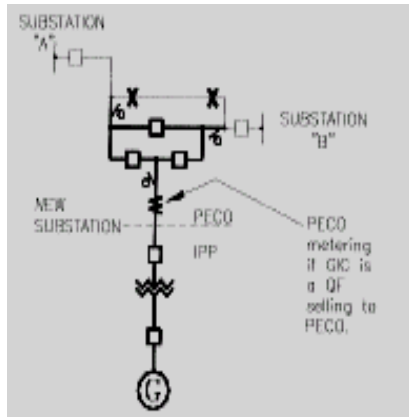
- 138 kV and 345 kV
- Divided into Red and Blue Systems
 - Improves Reliability for ComEd and the Generator Interconnection Customers
 - Reduces Fault Duty Requirements

138 kV Interconnection in ComEd



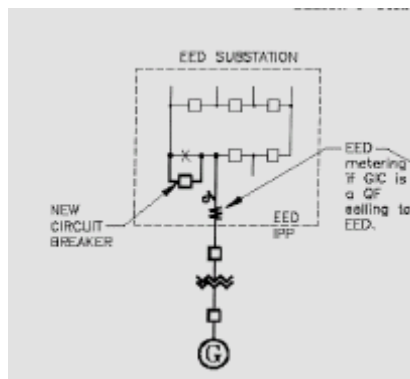
- More load tapped off between major sites
- Use a three breaker "T" interconnection between major sites
- Breaker failure relaying depends on local relays
- GIC owned circuit breaker required per National Electric Code

138 kV Interconnection in PECO



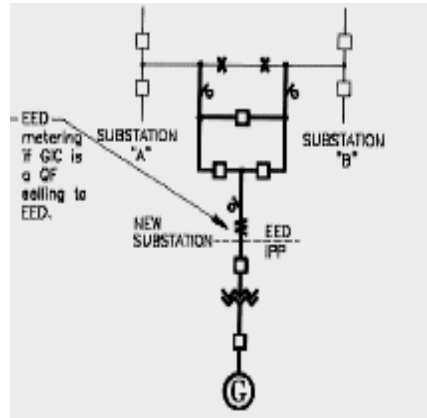
- There are circuit breakers at every adjacent load site
- Use a three breaker “ring” bus
- Circuit breaker failure relaying depends on the communication link
- GIC owned circuit breaker required per National Electric Code

Typical 230 to 500 kV Design into Existing Substation



- ComEd and PECO
- Real Estate Requirements
- Relay
- Metering
- GIC owned circuit breaker required per National Electric Code

Typical 230 to 500 kV Design ComEd and PECO “Greenfield” Site



- ComEd and PECO
- Generator Lead vs Transmission Line
- Relay
- Metering
- GIC owned circuit breaker required per national electric code



Listing of Standards and Requirements

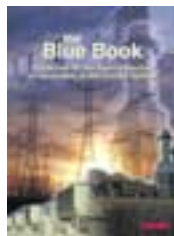
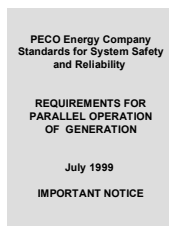
- Continuous Telemetry
 - For each Generator, Points of Interconnection with EED and Points of Service from EED
 - Revenue Grade
 - Instantaneous MW and MVAR
 - Cumulative MWhr and MVARhr
 - Breaker Positions
- Inspection and Testing
 - GIC Responsible to provide qualified personnel to perform tests on GIC Equipment
 - PJM, in collaboration with EED, will provide a list of tests
 - EED will witness the testing



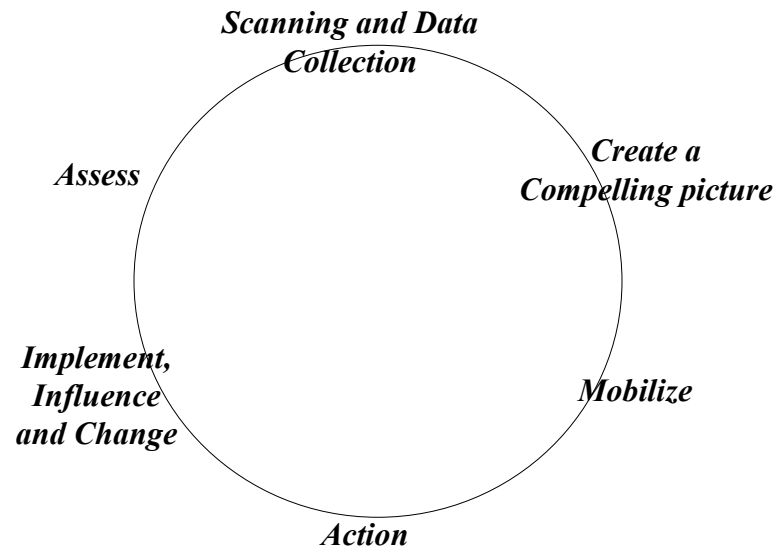
Listing of Standards and Requirements

- Operations
 - PJM Ensures the Stability and Reliability of its System
 - Monitor Breaker Position, Watts, VARS, Volts, Unit Status via Telemetry Reporting to EED's Energy Management System
 - GIC, EED and PJM coordinate Planned Outages

*...and now
for something
completely different...
Aligning the PECO and ComEd
Interconnection Standards*



Consensus Building



Scanning The Period

“It was the best of times, it was the worst of times...it was the season of Light, it was the season of Darkness...we had everything before us, we had nothing before us...the period was so far like the present period, that some of the noisiest authorities insisted on its being received, for good or evil, in the superlative of the comparison only.”

Charles Dickens – A Tale of Two Cities



Pictures courtesy of www.aviewoncities.com

Chicago History

- 1673 Discovery
- 1779 Jean Baptiste Point du Sable
- 1818 Illinois Admitted to the Union
- 1837 Incorporated as a City
- 1871 Chicago Fire
- 1885 First Skyscraper
- 1892 First Elevated Mass Transit
- 1893 World's Columbian Exposition
- 1900 Chicago River Reversed
- 1902 Commonwealth Edison Incorporated
- 1914 Wrigley Field Built
- 1917 Chicago White Sox win the World Series
- 1933 Century of Progress Exposition
- 1943 Deep Dish Pizza
- 1945 Orchard Field Bought by Chicago
- 1956 Congress Expressway Opened
- 1963 O'Hare Field Dedicated
- 1971 Union Stockyards Closed
- 2005 Chicago White Sox Sweep the World series



Philadelphia History

- 1682 First Brick House Erected for William Penn
- 1698 First Public School Opened in the Colonies
- 1731 First Public Library founded by Ben Franklin
- 1734 Immigrants arrived from Silesia and Germany
- 1775 Continental Congress in Session
- 1776 Declaration of Independence
- 1777 – 1778 British Occupy Philadelphia
- 1789 First Election of a US President
- 1800 Philadelphia Largest City in the United States
- 1809 First Experimental Railroad Track Laid Down
- 1835 First Gas Pipes Laid Sown
- 1845 Consolidation Act Created Current Boundaries of Philadelphia
- 1899 National Export Exposition
- 1902 Philadelphia Electric Company Incorporated
- 1930 Philadelphia Steak Sandwich – 5 cents
- 1950 Philadelphia Cheese Steak

The Work Group

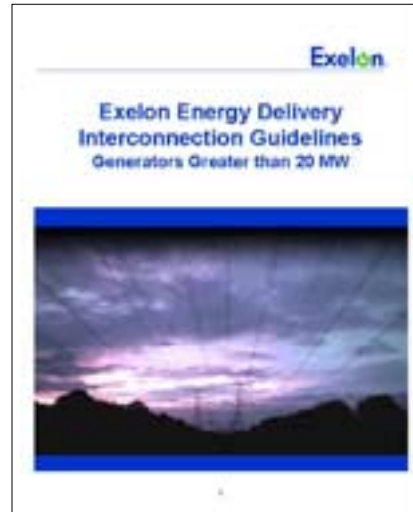
- Mix the group with Natural Leaders and Anointed Subject Matter Experts
- Set the Boundaries with the Group
 - Encourage Contrary Opinions
 - Identify a Decision Process
 - Respect all Opinions
 - Identify what “Best” means
 - Be wary of quick agreements
 - Agree, in some cases, to disagree
 - Look out for “violent agreements”

Scan the Environment

- Identify Resources Needed
- Identify and Ask the Stakeholders
 - Find out what Works, doesn’t Work, Missing, Unnecessary and any Improvement Ideas
- Identify the Current State
 - Existing Material Available, Measures and Metrics
- Identify a Change Management Plan
 - Champions
 - Roadblocks
 - Communications

Create a Compelling Picture

- Agree to a Common Picture of Success
- Responsible for Reliability
- Agree with PJM Tariff
- A Change of Thinking
- Need to Let Go



Mobilize

- Focus on the Similarities
- Identify the Areas of Difference
- Create a Dictionary of Terms
- Identify Best Practices
- Involve as Many as Possible in the data collection

Action

- Subject Matter Experts Write Chapters
 - Areas of Agreement
 - Areas of Disagreement
- Check In Meetings
 - Identify Overlaps
 - Identify Missing Elements
 - Involve Customers
- Repeat as Needed

Implement, Influence and Change

- Involve Key Customers and Champions
- Plan the change process up front
 - Honor the Old and Welcome the New
 - Explain the Changes and Reasons for Change
 - Listen to Comments from Customers
 - Become a Cheerleader
- Measure the Impact

Assess

- What worked well.
- What could have been done better?
- What should have been done but was not?
- Is it really done, done?

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ANY QUESTIONS???

