SRRTEP Meeting – 2022 Assumptions for Exelon Utilities

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December 17, 2021 - West

December 20, 2021 – Mid-Atlantic

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Agenda

- Base Case Power Flow Model
- Baseline Analysis
- FERC 715 Analysis
- Supplemental Project Drivers
- Asset Management Guidelines and Practices
- Retirement of Existing Facilities

Base Case Power Flow Model

- Use PJM developed RTEP power flow models for all assessments if available
  - Updated with latest information including updated project status and distribution load profiles, etc.
- Use most recent ERAG MMWG series power flow models if PJM RTEP cases not available
- Loads will be modeled consistently with the 2022 PJM Load Forecast Report

Baseline Analysis

- All Exelon Utilities study their respective transmission systems to identify the need for baseline reliability upgrades:
  - NERC planning criteria
  - PJM criteria (Manual 14B)
  - Exelon Utilities' FERC Form 715 planning criteria
- Exelon Utilities work with PJM to analyze and validate results
- Potential violations are included in a PJM Open Window per schedule 6 of the PJM Operating Agreement
- Proposed solutions are presented at TEAC or Sub-Regional RTEP and, once confirmed, become baseline projects
- All applicable cases, analysis files and available results can be made accessible through PJM's CEII process.

FERC Form 715 Planning Criteria

- There have been no Exelon Utility Planning Criteria changes from the March 2021 FERC Form 715 annual submittal
- The specific details of the Planning Criteria established for the Exelon Utilities can be found through the following link.

  Exelon Utilities Planning Criteria

- Exelon Utilities' Transmission Planning Criteria compliments PJM planning criteria detailed in attachments D and G of Manual 14B
- Exelon Utilities specific planning criteria include: contingency analysis on lower voltage transmission facilities, additional 90/10 load analysis studies, additional voltage recovery and stability studies, and the system impacts due to the variability of wind generation.

Supplemental Project Drivers

#	Driver	Definition
1	Equipment Material Condition, Performance and Risk	Degraded equipment performance, material condition, obsolescence, equipment failure, employee and public safety and environmental impact.
2	Operational Flexibility and Efficiency	Optimizing system configuration, equipment duty cycles and restoration capability, minimize outages.
3	Infrastructure Resilience	Improve system ability to anticipate, absorb, adapt to, and/or rapidly recover from a potentially disruptive event, including severe weather, geo-magnetic disturbances, physical and cyber security challenges, critical infrastructure reduction.
4	Customer Service	Service to new and existing customers. Interconnect new customer load. Address customer transmission & distribution load growth, outage exposure, and equipment loading.
5	Other	Meet objectives not included in other definitions including: industry recommendations, potential generation retirements, technological pilot projects, and governmental / utility commission regulations, & State policy goals.

Supplemental Project Drivers

Equipment Material Condition, Performance and Risk

- **Equipment Material Condition, Performance and Risk:**
  Degraded equipment performance, material condition, obsolescence, equipment failure, employee and public safety and environmental impact
- Refer to EU Asset Management Guidelines & Practices

  Identify and make the needed investments to ensure the safe and reliable operation of the transmission system. These decisions can be based on equipment performance, obsolescence and expected service life concerns, condition of equipment, reliability impact, increased maintenance costs, and engineering recommendations.

- **Project drivers can include:**
  - Employee and public safety
  - Transmission infrastructure replacements (EOL/condition/obsolescence) that are consistent with efficient asset management decisions
  - Programmatic review and/or replacement of breakers, relays, wood poles, etc.
  - Environmental drivers
  - Supply Strategy guidance resulting in standard conductor sizes and other standard equipment
  - Building new facilities giving consideration for future higher voltage conversion
  - Eliminating 69kV in areas with dense load pockets, stranded load, or where there have been capacity and reliability performance issues
  - Facility Relocation

Supplemental Project Drivers

Operational Flexibility and Efficiency

- Operational Flexibility and Efficiency:
  Optimizing system configuration, equipment duty cycles and restoration capability, minimize outages

  Planning teams coordinate with Operations to identify needed improvements on the transmission system that will provide for improved operating flexibility. These projects can reduce the impact and limit exposure to our customers for planned or forced events and can facilitate improved restoration times. These projects can opportunistically bring the system up to current standards and design principals.

- Project drivers can include:
  - Internal and/or regulatory recommended design guidelines or standards
  - Enhancing system functionality, flexibility, visibility, or operability
  - Removal of existing SPS/RAS/LPS
  - Networking existing radial facilities
  - Diversifying multiple radial circuits on the same structures from the same sources
  - Limiting the number of taps on a transmission line
  - Increasing system capacity
  - Remedy recurring operational problems
  - Provide Operations more options to deal with non-standard operating conditions

Supplemental Project Drivers

Infrastructure Resilience

- Infrastructure Resilience:
  Improve system ability to anticipate, absorb, adapt to, and/or rapidly recover from a potentially disruptive event, including severe weather, geo-magnetic disturbances, physical and cyber security challenges, critical infrastructure reduction.

  Improving the resilience of the system is an important consideration in the design of the transmission system and these projects are designed to reduce the impact to our customers for disruptive natural or man-made events. These projects can also improve the operability of the system and will reduce customer exposure.

- Project drivers can include:
  - Resiliency enhancements
  - Regulatory recommendations and/or requirements
  - Network existing radial facilities
  - Diversify multiple radial circuits on the same structures from the same sources
  - Limit the number of taps on a transmission line
  - Building new facilities giving consideration for future higher voltage conversion
  - Eliminating 69kV in areas with dense load pockets, stranded load, or where there have been capacity and reliability performance issues

Supplemental Project Drivers
Customer Service

- **Customer Service:**
  Service to new and existing customers. Interconnect new customer load. Address Transmission & Distribution load growth, customer outage exposure, equipment loading.

  Projects that accommodate new, increasing, or future load so that the system can reliably address customer needs. Also includes improvements to facilities that serve our customers.

- **Project drivers can include:**
  - Transmission System configuration changes due to new or expansion of existing distribution substations
  - New transmission customer interconnections or modification to an existing customer
  - Building to support future economic growth
  - Wholesale customers on transmission voltages

- **Link to Exelon Utilities Transmission Facility Interconnection Requirements:**

  Transmission Facility Interconnection Requirements

Supplemental Project Drivers

Other

- **Other:**

  Meet objectives not included in other definitions.

- **Project drivers can include:**
  - Industry recommendations
  - Potential generation retirements
  - Technological pilot projects
  - Governmental / Utility Commission Regulations
  - State policy goals such as such as clean energy and transportation electrification etc.
  - Others

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Exelon Utilities Asset Management Guidelines & Practices

Asset Management Supports Reliability

- Asset management activities considers the point at which infrastructure will or is at risk of failing based on various contributing factors.
- The replacement of an asset that is near or at the end of its useful life provides for the following benefits
  - ✓ Maintains and improves the safety and reliability of the bulk electric system
  - ✓ Reduces outage duration and frequency which improves service to customers
  - ✓ Improves operations by increasing system flexibility
- The Asset Management Replacement Process provides for a holistic approach of identifying EOL needs and solutions, taking into account other system drivers.

Asset Management Replacement Process

Asset Health

Condition

History

Risk

Obsolescence

Safety

Additional Needs Identification

Customer Service

Operational Flexibility & Efficiency

Resilience

Other

Solution Determination

Multi-driver considerations

Engineering

Design Standards

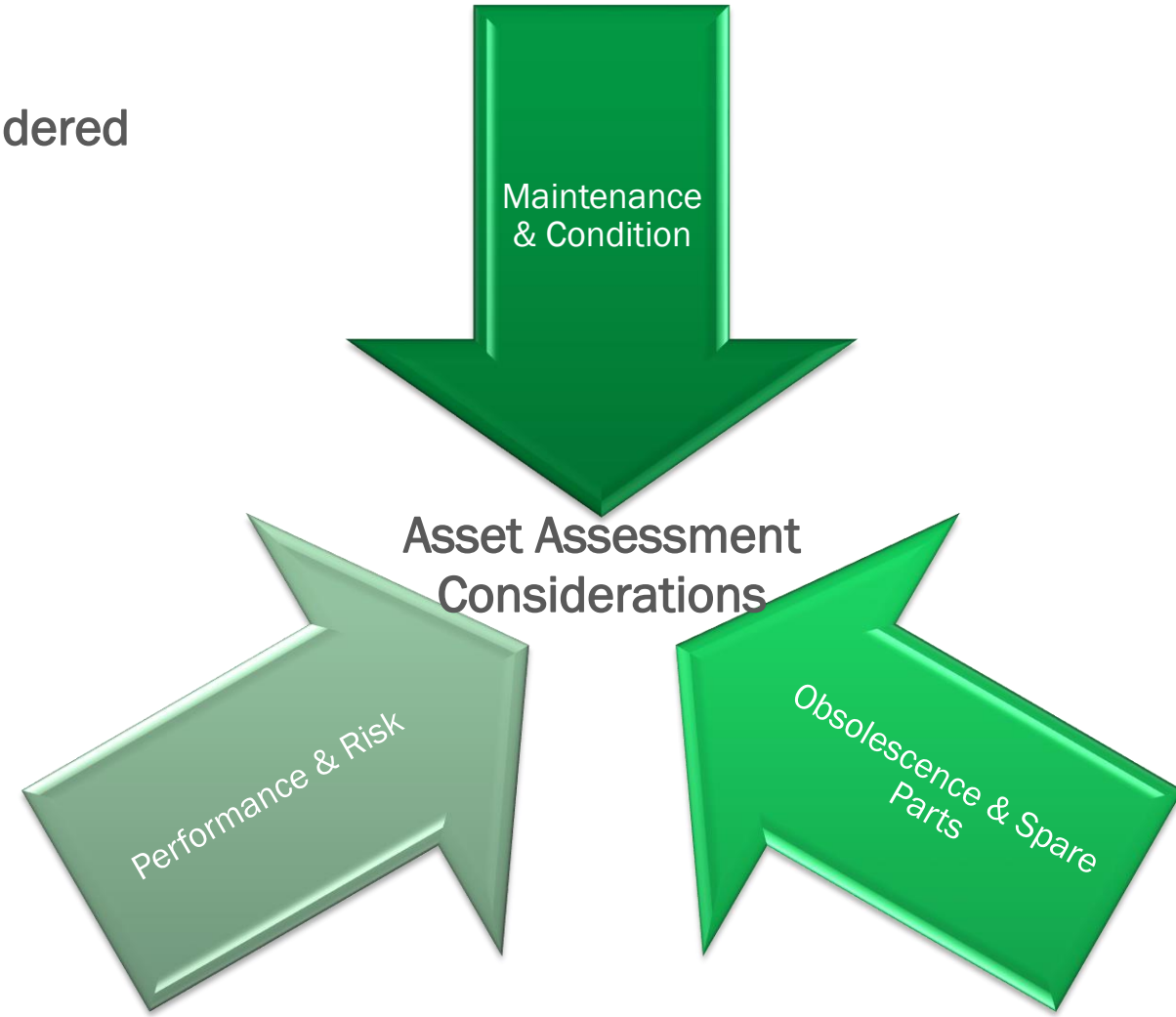
Cost Effectiveness

Project Scheduling

Asset Condition – Health/Risk Assessment

Major Types of Assets Considered

- Transmission Lines
  - Structures
  - Poles
  - Conductors
- Substations
  - Breakers
  - Transformers
  - Relays
  - Capacitors



Evaluating the health of an asset helps to determine if an asset is reaching the end of its useful life.

Asset Condition – Factors Considered

Equipment Inspection and testing - Periodic inspections of assets is based on technical standards, industry best practices, and vendor recommendations. Inspections can include but are not limited to visual patrols, thermographic checks, diagnostic testing, etc.

Historical Performance - Transmission performance metrics such as System Average Interruption Duration Index (SAIDI), Customer Average Interruption Duration Index (CADI), System Average Interruption Frequency Index (SAIFI), Momentary Average Interruption Frequency Index (MAIFI), Customers Interrupted (CI), Customer Minutes of Interruptions (CMI), Forced or Manual Outage rates and duration, where applicable, are considered.

Maintenance History – Periodic preventative and corrective maintenance can improve an asset's overall health. However, unplanned maintenance due to component failures or excessive maintenance due to defects may be indicative of an asset nearing the end of its useful life. Additionally, comparisons of maintenance cost to replacement cost may be evaluated.

Equipment Failure Data - Failure and extent of condition analysis is a critical part of determining whether problems are isolated exceptions or systematic.

Asset Condition – Factors Considered Continued

Age – The age of an asset is determined based on when the asset was manufactured and/or installed. Although age is a factor, it alone is not the single most influential criteria supporting repair or replacement decisions.

Asset Criticality – Equipment criticality is determined relative to the electrical position of the equipment on the system which considers additional aspects such as major transmission substations, critical customers & customer count, critical transmission lines & interconnections.

Third- Party Consultations – On an as needed basis, a third-party assessment will be performed on an asset or class of assets

Obsolescence - Equipment identified as obsolete due to unavailability of parts, lack of manufacturer support, etc. Equipment identified as obsolete does not automatically lead to immediate replacement once asset reaches end of service life.

Environment Conditions – Environmental conditions such as topography, weather, and land condition can be a contributing factor in an asset's operational life. For example, icing, wind, protected habitats, and animal activities may impact the operability and maintenance of an asset.

** Proprietary and/or confidential information will not be disclosed.*

Summary

Asset Replacement Criteria

- Asset management decisions are driven by asset condition, maintenance, operational improvements, obsolescence/spare part availability, cost effectiveness, outage impacts, geography, safety, and other factors
- Transmission facility replacement is an asset management decision made by utilities based on good engineering judgement, taking into account safety, reliability, risk, impact, and customer concerns
- Additional system needs are considered in developing solutions to address assets reaching the end of their useful lives
- Refer to Exelon Utilities Asset Management Guidelines and Practices document found here

Retirement of Existing Facilities

Statement

The purpose of transmission planning is to ensure that the capacity of the existing transmission system is maintained or expanded as needed to ensure the reliability, efficiency, safety, resilience and security of the transmission system for the benefit of customers. There are no national, regional or local standards or criteria driving the retirement and not replacement of existing facilities. Although in specific situations, facilities may be removed and not replaced as dictated by system and/or customer needs, or the design and construction of new or replacement transmission projects, decisions to not replace individual facilities may have the cumulative effect of negatively impacting the reliability, efficiency, safety, resilience and security of the transmission system. That cumulative negative impact could also drive the need for additional facilities to be constructed to compensate for those removed, including greenfield installations. Accordingly, existing facilities are maintained in service or retired based on Good Utility Practice.