EKPC Local Planning Assumptions for 2021 Planning Cycle

December 2020

EAST KENTUCKY POWER COOPERATIVE

A Touchstone Energy® Cooperative

EKPC Project Identification Process

- EKPC develops three different categories of projects:
  - **Baseline projects** are projects that address planning criteria violations which originate from internal analysis and/or PJM RTEP analysis.
  - **Network upgrade projects** are developed in conjunction with PJM to provide facilities for connection of new generation facilities and/or upgrades in output of existing generation facilities.
  - **Supplemental projects** are not covered by baseline analysis and address the following drivers:
    - Equipment Material Condition, Performance and Risk
    - Operational Flexibility and Efficiency
    - Customer Service
    - Infrastructure Resilience
    - Other

EKPC Baseline Planning Criteria

- EKPC plans its system to meet:
  - NERC TPL Reliability Standards
  - SERC regional criteria
  - PJM planning criteria
  - EKPC transmission planning criteria
- EKPC planning criteria for both BES and non-BES facilities is similar to Table 1 of the existing NERC TPL Standards in most respects
  - Primary difference -- EKPC considers the loss of a line, transformer, or generator in conjunction with the loss of a generator to be a single-contingency (P1) event subject to the performance requirements for P1 events.
  - EKPC planning criteria are posted at http://www.pjm.com/planning/planning-criteria/to-planning-criteria.aspx

EKPC Baseline Planning Methodology & Assumptions

- EKPC will share its baseline assessment results with PJM, and will work with PJM to analyze and validate results.

- EKPC generally uses a 10-year baseline planning horizon, but will expand the planning horizon to 15 or 20 years, as appropriate and necessary for specific areas of its system.

- EKPC will either interpolate or extrapolate power flow results from these models to determine specific timing of needs

EKPC Baseline Planning Methodology & Assumptions (cont.)

- EKPC jointly develops internal base cases with LGE/KU for EKPC baseline project planning studies
  - EKPC and LGE/KU have 54 free-flowing interconnections
  - EKPC has 58 distribution delivery points connected to the LGE/KU system (800+ MW at peak)
  - LGE/KU has 17 distribution delivery points connected to the EKPC system (100+ MW at peak)
  - System topology is based on the 2019 MMWG modeling efforts extended to include both the EKPC and LGE/KU respective area topology updates since the creation of the MMWG models.
    - All EKPC known future baseline and supplemental projects are modeled as in-service in the appropriate year.
- EKPC considers external contingencies from neighboring systems (AEP, DEOK, LGE/KU, and TVA) in addition to all internal EKPC contingencies in its baseline project planning

EKPC Baseline Planning Methodology & Assumptions

- For the 2021 planning cycle, EKPC utilizes the following power flow models for assessment of EKPC's Form 715 criteria violations:
  - 2022, 2025, 2030 summer peak (50% load probability)
  - 2022/23, 2025/26, 2030/31 winter peak (50% load probability)
  - 2022, 2025, 2030 summer extreme (10% load probability)
  - 2022/23, 2025/26, 2030/31 winter extreme (10% load probability)

- All power-flow models, analysis files, and results can be provided to interested stakeholders via PJM's CEII process.

EKPC Baseline Planning Methodology & Assumptions (cont.)

- EKPC uses the following load forecast assumptions/methodology:
  - EKPC uses substation load forecasts developed internally
    - Developed using a top-down approach
      - Start with overall EKPC system forecast developed by EKPC Load Forecasting department approved by EKPC's Board of Directors. For the 2021 planning cycle, the load forecast was approved in 2018.
      - The overall EKPC system forecast is segmented by the EKPC Load Forecasting department among the 16 EKPC distribution cooperatives based on a variety of factors, including historical load, anticipated growth in service area residential, commercial, and industrial builds, etc.
      - EKPC Transmission Planning then allocates each distribution cooperative forecast among the delivery points for that distribution cooperative using similar factors.
        - Individual substation forecasts are modified as necessary based on known or likely added or decreased customer demand.

EKPC Baseline Planning Methodology & Assumptions (cont.)

- EKPC baseline planning models use two sets of forecast probabilities
  - 50/50 probability for summer and winter (equal probability of actual load being above or below the forecast)
  - 90/10 probability for summer and winter (10% probability of actual load reaching the forecast)

- Modeled power factor at each substation is based on the substation's previous year actual power factor at summer peak (for summer models) and winter peak (for winter models).

EKPC Baseline Planning Methodology & Assumptions (cont.)

- EKPC uses the following generation assumptions:
  - EKPC generators are dispatched as needed to meet EKPC load based on economic merit order.
  - The Laurel Dam and Greenup hydroelectric facilities are connected to the EKPC transmission system, and are therefore modeled as generation within the EKPC zone.
    - For baseline planning studies, EKPC assumes the Laurel Dam generation is offline.
      - Rationale for this assumption is the uncertain nature of availability to operate due to the primary goal of the U.S. Army Corps of Engineers being the control of lake level and flood control.
      - There is no guarantee that the facility will be generating during peak-load conditions, and a reasonable likelihood that generation will not be available.
    - For baseline planning studies, EKPC assumes the Greenup Hydro generation is at half output and non-scalable.
      - Rationale for this assumption is this unit is run of river and the uncertain nature of the water level that controls the units output.

EKPC Baseline Planning Methodology & Assumptions (cont.)

- EKPC uses the generation dispatch scenarios below during annual planning analysis. These generation dispatch scenarios, when coupled with a contingency, are assumed to create the worst case power flow condition for the EKPC system.

Generation Outage	Replacement Generation Imported From
Big Sandy	South
Brown 3	North
Brown 3	South
Cooper 1&2	North
Cooper 1&2	South
Ghent 1	South
JK Smith 9 & 10	North
JK Smith 9 & 10	South
Mill Creek 4	South
Spurlock 2	South
Trimble 2	South

Supplemental Projects

- Supplemental Projects – EKPC supplemental projects are identified based on the following drivers:
  - Equipment Material Condition, Performance and Risk
  - Operational Flexibility and Efficiency
  - Customer Service
  - Infrastructure Resilience
  - Other

Supplemental Projects – Equipment Material Condition, Performance and Risk

- **Equipment Material Condition, Performance and Risk projects** are identified to address degraded equipment performance, material condition, obsolescence, equipment failure, safety and environmental impact.
- Project drivers include:
  - Safety
  - Transmission infrastructure replacements based on condition, obsolescence, or equipment that has reached its end of life
  - Environmental drivers
  - Other
- Inputs considered include:
  - Outage history, maintenance history, condition assessment reports, number of customers/amount of load/type of load at risk, current EKPC standards for design or equipment type, etc.

Supplemental Projects – Operational Flexibility and Efficiency

- **Operational Flexibility and Efficiency projects** are identified to optimize system configuration, equipment duty cycles, restoration capabilities and to minimize outages.
  - Project drivers include:
    - Enhancing system functionality, flexibility, or operability
    - Recurring real time equipment overloads and/or undervoltages
    - PCLLRW frequency
    - Number of outages and annual outage duration
    - Load exposure
    - Adding additional capacity/margin in the system for adequate performance during extreme load events and/or multiple simultaneous facility outages
  - Inputs considered include:
    - Number of customers/amount of load/type of load at risk, number of PCLLRWs, restrictions in ability to take maintenance outages, operational loading/voltage concerns, etc.

Supplemental Projects – Customer Service

- **Customer service projects** are identified to address customer outage exposure, equipment loading, load growth or to interconnect new customer load.
  - Project drivers include:
    - Member System Needs
      - Identified based on Member System requirements for service to end-use customers
    - SAIDI, CAIDI, number of outages and annual outage durations
    - New customer connections/modifications to existing customer connections
    - Economic development infrastructure needs
  - Inputs considered include:
    - Member system/customer input, ability to serve from existing system, outage history, etc.

Supplemental Projects – Infrastructure Resilience

- **Infrastructure Resilience projects** improve the system's ability to anticipate, absorb, adapt to, and/or rapidly recover from a potentially disruptive event, including severe weather, geo-magnetic disturbances or physical and cyber security challenges.
- Project drivers include:
  - Network existing radial facilities
  - Building new 69kV for future higher voltage conversion and eliminate 69kV in dense load pockets
  - Adding redundant facilities
  - Infrastructure hardening (additional physical/cyber security, replacement of equipment, etc.)
  - Limiting the number of taps/distribution substations between circuit breakers
- Inputs considered include:
  - Load exposure, long-term plan compatibility, outage history, type/amount of load at risk, environmental considerations, etc.

Supplemental Projects – Other

- These projects would address concerns not discussed in the other definitions.
- Project drivers include:
  - Industry recommendations
  - Technological pilot projects
  - Potential generation retirements
  - Other drivers not covered by other categories of Supplemental Projects

EKPC Project Approval Process

- EKPC has a Capital Management Committee (CMC) responsible for overseeing the transmission capital project development process.
  - Process starts with a problem/need to be addressed.
    - SME team is established to develop solution alternatives to address the identified problem/need.
    - Each alternative is scored to determine the best holistic solution to recommend for CMC approval.
    - All alternatives considered and the recommended solution are presented to the CMC.
    - CMC decides whether to approve the recommended solution, an alternative solution, or to not address the problem with a project for a supplemental need.
  - All projects approved by the CMC move on for approval by the COO, CEO and the EKPC Board of Directors.

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EKPC Assumptions and Methodology – EOL Needs

SRRTEP Committee Meeting

December 18, 2020

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Attachment M3 Project Assumptions – EOL Needs

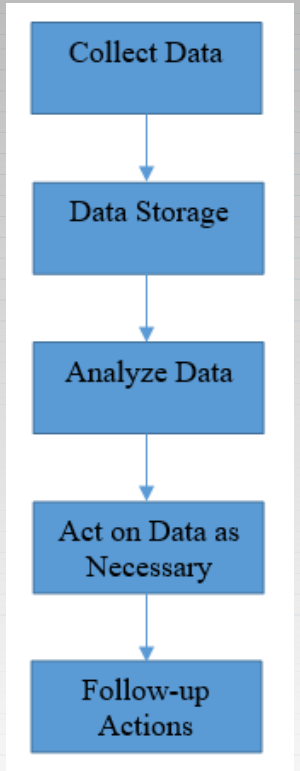
- Attachment M3 EOL planning criteria - section (d) (1) (ii)
  - Presented annually
    - Sub-regional RTEP assumptions meeting - section (c) (2)
    - Separately delineated
- Candidate EOL needs list
  - Identified by EOL planning process
  - Five-year projection
  - Submitted annually to PJM
  - Non-public, confidential, non-binding

Attachment M3 Project Assumptions – EOL Needs

- EOL Needs – (b) (5)
  - TO deems asset to be near the end of is useful life
  - Population
    - Transmission lines 100kV and above
      - EKPC has 962 miles of line in this category
    - Transformers
      - Not connected to distribution
      - 100kV and above on high-side
      - EKPC has 44 large power transformers in this category

Attachment M3 EOL Methodology

- EKPC EOL Methodology
  - Prescribed data is collected for each asset
  - A preliminary health score is calculated from the revised data-set
  - Asset population is ranked by the score
  - A team of subject matter experts evaluates the population
  - EKPC acts on the findings
    - Maintenance action
    - Draft the five-year EOL candidate list
  - Follow up actions
    - PJM Attachment M3 process
    - EKPC internal project process



Example – Asset EOL Candidate List

- Data analysis
  - Subject matter experts
    - Health Score is generated from condition and performance data
    - Determine preliminary health score threshold indicating end of life (EOL)
    - Review ranking list to focus asset review and confirm 5 year EOL candidate list

Factor	Weight Percentage
Condition	75
Performance	25

Example – Asset EOL Candidate List

- Performance Data (both assets)
  - Outages in the last five years
  - Loading limits exceeded
- Condition Data Examples
  - Transformers (from detailed assessments and inspection data)
    - Age factored into score
    - DGA history (evidence of internal arcing or thermal fault)
    - Test results (power factor, partial discharge, infrared)
    - Cooling system issues (fans, pumps, gauges)
  - Transmission Lines (regular patrols and detailed assessments as warranted)
    - >40 years old
    - Structure Issues (rust, loose components, rot, woodpecker holes, cross arm issues)
    - Conductor (splice issues, steel core corrosion and pitting, vandalism, broken strands)
    - Insulators flashed or broken
    - Guy, ground and static wire condition

Questions and Discussion