MTEP 17 Retirement Sensitivity Analysis Scope

Scope

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Contents

1 Retirement Sensitivity Analysis Objective

The Retirement Sensitivity Analysis will allow MISO and stakeholders to identify indicative transmission system needs based on forecasted generator retirements (age based retirements) within MISO and will allow use of that information in long term planning. This analysis may also inspire development of Non-Transmission alternatives. This analysis will be closely coordinated with Market Congestion Planning Study ("MCPS") and Regional Transmission Overlay Study. Additionally, this analysis can support MISO's reliability assessment of assumed state implementation plans for Clean Power Plan ("CPP"), if needed,

This analysis is non-binding and it is performed for informational purpose only; it is out of the scope of MISO's reliability assessment for compliance with the NERC TPL standards.

2 Study Assumptions

2.1 General Assumptions

To be consistent with the age based MTEP17 "Existing Fleet" Future generation retirement assumptions, all coal units 65 years or older and all gas & oil units 55 years or older will be modelled offline in all selected study models.

The time horizon of this analysis is 10 year out using MTEP17 series models and hence the age of each generating unit will calculated from its commissioning date to year 2027. The summary of MTEP17 age driven retirement assumptions per local resource zone is listed in Table 1. All generators assumed to be retired by 2027 (MISO and Non-MISO) are listed in the attached Appendix 1-Table 1.

Table 1 Summary of MTEP17 Age Driven Retirement Assumptions by Year 2027 (MISO Only)

Local Resource Zone	Maximum Capacity (MW)		
	Coal	Gas/Oil	Total
1	629	1,437	**2,066**
2	546	602	**1,148**
3	202	635	**837**
4	293	19	**312**
5	1,628	335	**1,963**
6	558	293	**851**
7	2,348	806	**3,154**
8	0	788	**788**
9	196	4,185	**4,381**
10	0	1,621	**1,621**
Total	**6,400**	**10,721**	**17,121**

2.2 Study Models

2.2.1 Steady State Models

Steady state studies will be performed using the following power flow models:

- MTEP17 Series: 2027 Summer Peak TA (wind[1] at 16%)
- MTEP17 Series: 2027 Summer Shoulder TA (wind[1] at 40%)
- MTEP17 Series: 2027 Summer Shoulder TA (wind[1] at 90%)

2.3 Model Assumptions

2.3.1 Generation

MISO will consider the following generation assumptions:

- Regional Merit order Dispatch ("RMD") will be used.
- All approved unit retirements as per the Attachment Y process will be modelled offline (as of March 6, 2017[2])
- All MISO units listed in Appendix-1, Table-1 of this scope will be modelled offline. This list includes all units to be retired based on the age assumption this list also includes all known publically announced retirements. The short fall in generation in any LBA will be replaced with available MISO Market Resources.
- All extended forced outage units will be modelled offline
- All Non-MISO units in First-Tier areas that appear in Appendix-1, Table-1 of this scope will be modelled offline and the short fall in generation will be replaced by scaling up the dispatchable thermal generation (i.e., nuclear, wind, hydro, pumped storage, etc. will be excluded) within their control areas or near-by areas within the same Power Base Area. For TVA area, the available generation resources are no longer sufficient to meet TVA's demand with the assumed age-based retirements applied. For this reason TVA's age-based retirements will no longer be considered in this study.

[1] This wind level is for wind generation in MISO's footprint only. All assumptions are same as in the typical MTEP17 models.

[2] Units with approved Attachment Y retirements, whose assumed age-based retirements are beyond year 2027, are not listed in Appendix-1, Table-1 to respect the Attachment Y process confidentiality.

- Firm generation additions with Generation Interconnection Agreement (“GIA”) signed through MISO Generation Interconnection queue (as of February 28, 2017). Any IA signed after this date may be considered as mitigation, if applicable.

  Regional Resource Forecast (“RRF”) additions from the “Existing Fleet” will be modelled in-service as needed to meet the 2027 Summer Peak demand plus the capacity of the largest two units in MISO to solve the worst possible NERC category P3.1 contingency. In order to avoid masking any reliability issues that may be caused by the generation retirements. To not mask any reliability issues attributed to the age-based retirements, additional generation will not be added beyond this point. Exception can be made if a base case voltage collapse/decline situation occurs.

  The additional RRF resources will be selected in consistence with the MTEP17 Futures siting methodology. Appendix-1, Table-2 lists the generation additions with the highest siting priorities. Additional generation may be added if voltage collapse/decline issues arise that prevent solving the base cases.

2.3.2 Transmission Topology

All previously approved Appendix A and Target Appendix A projects in MTEP17 cycle will be modelled as in service.

3 Planning Criteria

Similar to relevant sub-sections of Appendix E1 (Reliability Planning Methodology – Section E1.2 Baseline Reliability Assessment Methodology – pursuant to TPL-001-4 requirements R3, R4, R5, and R6), MISO will apply the Transmission Planner criteria for acceptable steady state thermal loading, system steady state voltage limits, and post-contingency voltage deviations

Similar to section E1.10 of Appendix E1 (Reliability Planning Methodology – Nuclear Plant Assessments), following Nuclear Plant Interface Coordination (NUC-001-2) standard and the Nuclear Plant Operating Agreements (NPOAs).

4 Contingencies Examined

Similar to relevant sub-sections E1.2, E1.3, E1.5.1, and E.1.5.2 of Appendix E1 (Reliability Planning Methodology – pursuant to TPL-001-4 requirements R3 and R4), MISO will evaluate the following events:

a. All category P1, P2, P4, P5 and P7 events to be used in MTEP17

b. All category P3 and P6 events in the vicinity of the generation retirement/addition sites. Following TPL-001-4, category P3 and P6 contingencies are created by pairing P1 events. In order to limit the possible number of pairing combinations and to keep only combinations with significant impact (i.e. in the vicinity of the retirement site), only selected P1 events will be used for this purpose.

   For each retirement site, the following criteria will determine which P1 events selected to create the required P3 and P6 pairs for that site, duplicated P3 and/or P6 combinations will be discarded:

   i. All non-generator single events (i.e., category P1.2 to P1.5) of contingencies with the following criteria will be selected:

      - at least one facility operated above 200 kV and within 10 buses[3] away from the retired generator bus,
      - at least one facility operated between 100 - 200 kV and within 8 buses[3] away from the retired generator bus,

      or

      - at least one facility operated below 100 kV and within 6 buses[3] away from the retired generator bus.

   ii. Generator single events (i.e., category P1.1) with aggregated Pmax above 100 MW will be selected.

[3] Any two buses connected via a branch with negative or zero impedance will be counted as one bus.

5 Monitored Facilities

- All MISO Bulk Electric System (“BES”) facilities will be monitored for steady-state thermal and voltage violations

6 Methodology

6.1 Steady-State Performance Analysis

AC Contingency Analysis will be performed on the 2027 summer peak and 2027 summer shoulder steady state models as specified in section E3.2.2.1. PTI – PSS/e version 33.0, TARA version 870, and POM version 2016 will be used to perform AC contingency analysis. The power flow cases are solved with the following settings:

- Automatic control of LTCs: Stepping enabled
- Switched shunt adjustments: Enable all
- Area interchange control:
    - For Base Case: tie-lines and loads enabled
    - For Contingencies: disabled
- Adjust phase shift: Enabled
- Adjust DC taps: Enabled

7 Study Schedule

The retirement sensitivity analysis schedule is outlined below in Table 3. In case MISO is not able to meet any or all of the milestones listed, adjustments will be made.

Table 2 Study Schedule

Task	Completion Date
MTEP17 Final Models and Contingency Creation	Apr 2017
Perform Contingency Analysis	Apr 2017
Sensitivity Analysis for potential retirements	May 2017
Present results of Sensitivity Analysis during second SPM	May – Jun 2017
Solicitation of potential solutions for indicative Transmission Need	Jun – July 2017
Review study findings and report	Aug – Sep 2017