**2016 10-Year Assessment**
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# Generator Retirement and Additions Study

## Executive Summary

The objective of this 2015 Assessment screening was to identify any major impacts to the ATC system when potential generation retirements or additions are considered in aggregate. The base model for the screening was the 2025 all project summer peak model from the 2015 10-Year Assessment. Two models were created from the base model, one including only retirements and one with retirements and additions, within the ATC system. The total amount of generation output retired in the retirement model was about 1,100 MW. The total amount of generation output added in the retirement and additions model was about 1,500 MW, for an increase in generation output of approximately 400 MW.

Limitations were excluded from study results if they were observed in the base model, or appeared to be due to a specific generator retirement or addition. The generator retirement and additions screening showed that potential retirements or additions of generation in the ATC system could cause additional limitations; however, potential reinforcements for these limitations are not expected to greatly impact the ATC capital forecast at this time. ATC will continue to monitor the status of existing and new generation to assess the impacts of any changes.

## Objective

The objective of this screening effort was to identify potential major impacts to the ATC system when potential generation retirements or additions are considered in aggregate. The study does not identify complete reinforcement packages needed to remove or add potential generation. Specific impacts and reinforcements for specific generation changes will be identified through MISO studies. The objective of this screening study was to determine if there is a need for any major planning study initiatives to anticipate long lead-time reinforcements.

A request to retire or add generation to the ATC system would proceed through the MISO Attachment Y or Attachment X process, respectively. The MISO analysis would include a full set of contingencies under peak and off-peak conditions in accordance with the MISO processes. Therefore, the MISO analysis may identify additional impacts to the transmission system than identified in this screening.

## Study Assumptions

This screening examined the steady state impacts from retirement and addition of generation. Other potential impacts including fault duty, dynamic stability and voltage stability were not evaluated. The screening study analyzed summer peak conditions and focused on NERC contingencies where load shed is not allowed. This screening study did not attempt to create or remove any operating guides or Special Protection Systems.

**Retirements.** The generators that were considered retired in the study were developed with the following steps:

1. The fuel type and age of all the generators within the ATC system was obtained from the 2013 EIA-860 report (this was the latest version at the start of this study).
2. An initial list of the ATC connected coal and diesel generators greater than fifty years old by the year 2030 in the 2013 EIA-860 report, was developed.
3. Generators with plans to install emission controls were removed from the list (determined through research in various online news outlets)
4. ATC connected generators with current or previous Attachment Y submissions were added to the list.

The total amount of generation output retired in the retirement model was about 1,100 MW

**Additions.** The generators added in the study was based on generators proposed for connection to the ATC system that were in the MISO DPP as of March 1, 2015. The total amount of generation output added in the retirement and additions model was about 1,500 MW.

**Base Model**

As noted, this is a screening study, so ATC utilized the 2025 all project model created for the 2015 10-Year Assessment. Since not all of the future projects in this model are appropriate for this screening study they were adjusted. The outside world for this model comes from the 2014 MMWG 2025 summer peak model.

**Study Specific Model**

The base model was adjusted by including and excluding certain future projects that more appropriately reflect future plans for the transmission system. Two models were created from the base model. One model includes only generator retirements, while the other includes generator retirements and additions.

In the first model, with only generator retirements, the retired generation output is replaced from generators outside ATC. The replacement generation was obtained by scaling down load in the external areas with increased exports to ATC. The additional power ATC imported to replace the retired generation was about 1,100 MW.

The second model, with generator retirements and additions, only used generator additions to replace generator retirements. The additional output totaled roughly 1,500 MW for a net increase in output of approximately 400 MW. ATC assumed the generators added would be fully dispatched. Transactions between Local Balancing Authorities (LBAs) were used to balance resources and load within the ATC system. Even with resource balancing, this meant that several existing generators were turned off.

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## Study Area

The study area consisted of the entire ATC footprint. The monitored area was set up in the same manner as the 2015 10-Year Assessment analysis.

## Limitations Identification Criteria

ATC used the steady state portion of its version 16.1 Planning Criteria to identify potential limitations.
Transient stability analyses were not performed due to the screening nature of this study.

## Contingencies

ATC studied BES and non-BES NERC Category contingencies that do not allow load shed as described in ATC's Planning Criteria version 16.1. These contingencies include category P1.1, P1.2, P1.3, P1.4, and P2.1 in the ATC system and select contingencies in neighboring systems. In addition, within the ATC system P3 and the EHV contingencies in categories P2.2, P2.3, P5.5 were studied.

## Study Methodology

The contingency screening analysis was performed using PSSE through the ACCC function. The ACCC settings consisted of a 3.0 MW mismatch tolerance, with transformer taps, phase shifters, DC taps, and switched shunts enabled. Area interchange was disabled during the screening process. This means that the MW output for generator contingencies was replaced by generation outside the ATC system.

Any contingencies that resulted in a non-convergent power flow on the summer peak model were solved through a variety of methods to provide valid results. Various solution options were employed to ensure that common non-convergence issues were addressed. These options included additional solution iterations, locking of switched shunts, and locking of LTCs.

## Results

The results from this study were compared to the results of the 2025 all project summer peak case of the 2015 TYA to see if there were any major impacts to the ATC system. Certain limitations identified in either of the retirement or additions models were excluded from study results if they met the following criteria:

1. The limitation was observed in the base model.
2. The limitations appeared to be due to a specific generator addition (these limitations would be addressed in the MISO DPP process).
3. The limitations appeared to be due to a specific generator retirement (these limitations would be addressed in the MISO Attachment Y process).

The results from the summer peak analysis show that there are three remaining limitations within the ATC system, most likely due to the aggregated generator retirements and additions. These three limitations are lines E-57 (Forest Junction – Glenview 138 kV), G-111 (North Fond du Lac – Aviation 138 kV), and X-50 (Aviation – Progress Ave - Ellinwood 138 kV). The study did not appear to show any major impacts for either model.

## Potential Reinforcements

Potential reinforcements were developed for the three remaining limitations identified in the results section.

***Retirements*.** In the retirements model lines G-111 (North Fond du Lac – Aviation 138 kV), X-50 (Aviation – Progress Ave - Ellinwood 138 kV), and E-57 (Forest Junction – Glenview 138 kV) can overload. The potential reinforcement for the limitations on line G-111 was to rebuild the line. The potential reinforcement for the limitations on line X-50 was to partially rebuild the line. The potential reinforcement for the limitations on line E-57 was to uprate line E-57.

***Retirements plus Additions*.** In this scenario only the limitations on line E-57 (Forest Junction – Glenview 138 kV) remained. The potential reinforcement developed for this limitation was still to uprate line E-57.

At this time, based on these potential reinforcements, ATC does not expect the combinations of retirements and additions would have major impacts to the ATC system. Other impacts for specific generator additions or retirements have been or will be identified through the MISO G-T and Attachment Y processes.

## Conclusions

The generator retirement and additions screening showed that potential retirements or additions of generation in the ATC system could cause limitations. These limitations are not expected to have a major impact on the ATC capital forecast. A detailed analysis will be conducted for each specific retirement or addition request made to MISO in accordance with MISO's Attachment Y and Attachment X processes, respectively, which may identify generator specific limitations not assessed in this study. ATC will continue to monitor the status of existing and new generation to help assess any changes to impacts.