**2013 10-Year Assessment**
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## Generator Retirement Study

### *Objective*
This is a sensitivity screening study that is part of the 2013 10-Year Assessment. The goal of the study will be to identify reliability impacts and potential projects needed in the ATC system due to the potential retirement of several generators in and near the ATC footprint. This study will only examine the steady state and ignore angular stability. This study will not create and/or remove any operating guides, nor develop and/or remove any Special Protection Systems.

### *Study Need/Drivers*
The need for this study is driven by potential generator retirements due to new and changing EPA regulations. Although the future of generation is extremely uncertain, as evidenced by the Kewaunee power plant shutdown, it is important to start this screening process to identify potential impact.

### *Study Assumptions*
The list of generators that were determined to be considered retired in this study was obtained by first finding the fuel type of all the generators within ATC. This was accomplished with the 2011 EIA-860 document (this was the latest version). All coal generators were assumed to be at risk for retirement. With research via various publically available resources, it was found that certain generators are planned to have pollution control installed. The list of generators that were considered retired in the study are included in the Generator Retirement Study Update presentation.

### *Base Model*
The originating model is the 2023 project deficient model created for the 2013 10-Year Assessment. The initial simulations will be run on the summer peak and shoulder model. The outside world model which is used in the 2013 10-Year Assessment models comes from the 2012 MMWG 2023 summer peak model.

### *Study Specific Model*
There are two models that were created from the base model. Each model used different assumptions to replace the power from the retired generators. In the first sensitivity model, the generation is made up by dispatching the rest of the generation within ATC until the swing generators were within their limits. No wind or hydro generation was increased beyond what they were dispatched at in the base model. Since the remaining ATC area generation did not make up for the loss of generation, a total of 169 MW was imported from Xcel and ComEd. This import was divided evenly and the load was scaled down in each area to prevent any biases from occurring.

The second sensitivity model assumed that ATC imported all of the required power. The load in each of the areas where generation was recovered was scaled back in an attempt to reduce any biases that may appear. The total power imported was 1382 MW.

The shoulder model used the same scaling percentages as the shoulder model in the 2013 TYA Reinforcement Guidelines Study. This model will turn on co-gen plants to make up power from within ATC and import the rest. The loading on MWEX will be maintained to that in the base shoulder case.

Each of these models assumed the Dubuque 8th street power plant retired and the power was made up by turning on additional power in the ALTW area. The power lost from the Waukegan plant retirement was made up through a transaction of 792 MW from AEP to ComEd since the model has no other available ComEd generation to make up the difference.

***Study Area***

The study area consisted of the entire ATC footprint. The monitored area was setup in the same manner as the traditional analysis for the 10-Year Assessment.

***Study Criteria***

The NERC TPL-001-0 reliability standard states that the transmission system is required to be evaluated under normal system conditions. The Category A simulations for the models identified analyzes the ATC transmission system under intact system conditions, i.e. no forced or planned maintenance outages. Per ATC Planning Criteria version 14, for intact system conditions in the study area all voltages must be between 0.95 p.u. and 1.05 p.u. of their nominal bus voltage and all branch loadings must be below their normal rating. Therefore, voltages and loadings will be monitored to identify:

- Any bus voltages exceeding 104% or below 96% of its nominal voltage under system intact conditions
- Any thermal loadings exceeding 95% of its summer normal rating under system intact conditions

The NERC TPL-002 reliability standard states that the transmission system is required to be evaluated following an outage on any single system element. Power flow simulations on the models identified below were performed to analyze the ATC transmission system under various single contingency conditions, i.e. NERC Category B.1, B.2, and B.3 defined outages. Per ATC Planning Criteria version 14, for single contingency conditions all voltages must be between 0.90 p.u. and 1.10 p.u. of the nominal bus voltage and all branch loadings must be below their emergency rating. Therefore, voltages and loadings will be monitored to identify:

- Any bus voltages exceeding 108% or below 92% of its nominal voltage under single contingency conditions
- Any thermal loadings exceeding 95% of its summer emergency rating under single contingency conditions

Transient stability analyses will not be performed as part of this study due to the screening nature of this study.

***Contingencies***
All NERC Category B contingencies were studied including Category P1.4 switched shunts. Maintenance plus category B outages were studied on the shoulder model. The prior maintenance outages were the same outages that were used in the 2013 TYA Reinforcement Guidelines Study.

***Study Methodology***
The contingency screening analysis was performed using PSSE through the ACCC function. When the ACCC function is used, the settings consisted of a 3.0 MW mismatch tolerance with transformer taps, phase shifters, DC taps, and switched shunts enabled. Area interchange will be disabled during the screening process.
Any contingencies that result in a non-convergent power flow on the summer peak model were solved using manual techniques to provide valid results. Various solution options were employed to ensure that common non-convergence issues are addressed. These options will include additional solution iterations, locking of switched shunts, and locking of LTCs.

***Results***
The results from this study were compared to the results of the 2023 Project Deficient summer peak and shoulder case of the 2013 TYA. They can be seen in the Generator Retirement Study Update presentation. The results from the summer peak and shoulder peak analyses show that there are new issues in Zone 2 and Zone 4. The limitations in Zone 2 can be mitigated by future potential projects in the area.

***Conceptual Reinforcements***
After the needs were identified, a conceptual solution was developed to help determine the potential impact to the capital forecast. A conceptual project was created for the most severe limitations based on voltage and thermal overloads in Zone 4. The solution utilized the existing provisional Shoto – Custer 138-kV project and added a Shoto – Northeast 69-kV rebuild, Glenview – Shoto 138-kV rebuild, and Forest Junction – Glenview 138-kV rebuild. The total conceptual cost estimate was $66.9M, which includes the cost for the provisional Shoto – Custer 138 kV circuit.

***Conclusions***

This study reinforces the known issue that if high-risk generation were to retire, there could be severe overloads and voltage limitations within the ATC footprint, in particular the Manitowoc area of Zone 4. The lack of available generation would cause increased difficulty scheduling maintenance outages. The conceptual solution developed in this screening study will only solve the single contingencies that were studied. A future, more in depth study will need to be performed on this area to determine a robust solution. At the conclusion of this study it was announced by WP&L that Edgewater unit 4 would be retired or repowered by 2018. This demonstrates that generation in the ATC footprint is constantly changing and screening studies such as this are necessary.