



## Zone 3 - 2019 study results

Refer to [Table ZS-3](#), [Table ZS-3a](#) and [Figure ZS-11](#)

### Summary of key findings

- Additional reactive support is needed throughout the Zone 3.
- Under single contingency, all three Columbia 345/138-kV transformers are approaching to their maximum summer emergency ratings.
- Load growth in Lake Geneva area causes several single-contingency thermal overloads and low voltages.
- Potential single-contingency thermal overloads on the Dane-Lodi 69-kV line and the Kirkwood-Artesian 138-kV line will require system reinforcements.
- The existing Hillman 138/69-kV transformer potentially overloads under single contingency in the Dairyland Power system.
- With no generation running at Concord Substation, severe low voltages are observed under both system intact and single-contingency conditions. Economic benefit analysis may be performed to evaluate whether new transmission projects can be justified.
- Several projects in the Madison area were on hold due to a potential large T-D project development although the project need years were delayed based on the 2009 analysis.
- Potential single-contingency thermal overloads on the Gran Grae-Boscobel 69-kV line will require system reinforcements.
- The in-service date for a second 138/69-kV transformer at the Spring Green Substation is delayed due to other project and load changes.

In response to low voltages throughout Zone 3, a total of 362 MVAR of capacitor banks distributed at the Eden, Mazomanie, Concord, Sun Prairie, Dam Heights, North Monroe and Boscobel substations in the 2015-2019 timeframe were deemed to be the preliminary solutions.

The provisional project of constructing a Hubbard-East Beaver Dam 138-kV line will address not only several 69-kV thermal overloads, but also the low voltages in the Beaver Dam area for an outage of the North Randolph-North Beaver Dam 138-kV line.

There were a number of facility overloads and several facilities near their emergency ratings in Zone 3 based on the 2019 analysis. Three line uprate projects (one 138-kV uprates and two 69-kV uprates) and one 138/69-kV transformer upgrade (Hillman Substation) have been proposed to address these thermal problems.

The Columbia and Sauk County areas are experiencing high load growth, especially in Wisconsin Dells. A total of 98 MVAR of capacitor banks were installed at the Kilbourn and Artesian substations in 2009. However, potential Kirkwood to Artesian line overloads and serious post-contingency low voltages around the Reedsburg loop call for additional transmission reinforcements. The Lake Delton-Birchwood 138-kV project in 2017 will not only interconnect a new T-D substation, but also address impending low voltages and overloads identified on the transmission system.

Back In the 2008 Assessment, the West Middleton 138/69-kV transformers and West Middleton-Blackhawk 69-kV line were observed to be potentially overloaded under single-contingency



conditions in the 2017 timeframe. To address these thermal overloads, a West Middleton to Blount 138-kV line project was being considered. In conjunction with the Rockdale-West Middleton 345-kV line project (2013), the West Middleton-Blount 138-kV line could eliminate the thermal overload issues in the long term and provide additional transfer capability to into downtown Madison. The status of this project was provisional for several reasons.

- The West Middleton 345/138 kV transformer ratings need to be validated.
- The 2017 in-service date driver needs to be confirmed, to determine whether the summer normal overloads can be mitigated by other means.
- Project alternatives have not been thoroughly developed and evaluated.

Since the 2008 Assessment, the West Middleton 345/138 kV transformer ratings have been validated with higher ratings. In addition, with the new load forecast used for the 2009 Assessment, the needs for the West Middleton-Blount 138-kV project were out of 10-year planning horizon. However, due to a potential large T-D project development in Madison area, the in-service date for this project will be kept as 2017 in the project table along with the following three projects until the T-D project development is finalized.

- Femrite capacitor bank project (2014),
- Sun Prairie capacitor bank project (2016), and
- Royster-Sycamore line uprate project (2016).

Constructing a 5.13-mile 138-kV line from North Lake Geneva to South Lake Geneva and installing a 138/69-kV transformer at South Lake Geneva substation will address several potential system violations in Lake Geneva area. Potential violations include the single-contingency thermal overloads on the Cobblestone-Zenda and North Lake Geneva-South Lake Geneva lines, and low voltage issues at Cobblestone and Lake Geneva. The status of this project is also provisional because Planning has not thoroughly compared it with other project alternatives in a long term study.

Significant load growth near the Lamar area causes numerous system constraints. Near term solutions are developed. They include:

1. Uprating Stoughton Substation terminal equipment to achieve a 169 MVA summer emergency rating on Y46 in 2009 (recently completed).
2. Uprating the McCue-Lamar section of the Y-61 to a minimum summer emergency rating of 115 MVA in 2010.
3. Installing 2-12.45 MVAR 69-kV capacitor banks at Lamar Substation in 2010.

However, these near-term solutions will not be sufficient after approximately six years. Subsequently, a longer term plan will be developed and implemented before 2017 to address emerging McCue-Lamar and Bass Creek-Footville thermal overloads and voltage issues at Lamar Substation under single-contingency conditions. A second 69-kV line from McCue-Lamar is currently being considered as a placeholder to resolve the issues in this area.

Based on the 2009 Assessment and due to the following three reasons, the need for the second Spring Green transformer has been delayed from 2013 to 2016.

1. The Nelson Dewey third generator project and supporting projects have been canceled.
2. The load forecast in the area was reduced; speculative load at Arena was removed.



# 10-Year Assessment

An annual report summarizing proposed additions and expansions to the transmission system to ensure electric system reliability.

2009

October 2009 10-Year Assessment  
[www.atc10yearplan.com](http://www.atc10yearplan.com)

3. Spring Green 2-16.33 MVAR capacitor banks also reduces var flow through the existing Spring Green 138/69-kV transformer.

A project to construct a Spring Valley-North Lake Geneva 138-kV line is being considered in 2018. Please refer to [Zone 5 – 2019 study results](#) for details.

*Projects whose “Need date” precedes the “In-service date”*

- None

*Projects whose “In-service date” precedes the “Need date”*

- None

### *Zone 3 - 2019 futures study results*

Two potential 2019 futures were studied as part of this Assessment:

- 20% Wind Future
- Slow Growth Future

Please refer to the [Methodology & Assumptions](#) for details about how the futures models were developed.

In the 20% Wind Future, line overloads and bus voltages generally improve in Zone 3. However, line overloads and bus voltages worsen significantly in the Lamar/Fulton/Harmony, Richland Center, Boscobel, Sheepskin and Monroe areas. Future projects, adjusting area phase shifters and/or increasing area generation mitigates the situation(s). These results occur because of area generation dispatch and the associated change in the flow of power associated with the 20% Wind scenario.

In the Slow Growth Future, voltages generally improve throughout Zone 3. In addition, line overloads generally improve, but worsen under certain contingencies. This result is consistent with the reduced loading and associated generation redispatch throughout the zone. Please refer to [Table ZS-3a](#) for the limitations and performance criteria exceeded for these futures.