



## **Zone 5 – 2019 study results**

Refer to [Table ZS-3](#), [Table ZS-3a](#) and [Figure ZS-19](#)

### *Summary of key findings*

- Heavy load growth in Waukesha, Washington, Dodge and Jefferson counties will require voltage and load support. A new 345-kV line from Rockdale to Mill Road (formerly Lannon Junction) is one option being considered to solve these problems.
- Voltage and thermal issues remain in Zone 5 under contingency conditions.
- Thermal, voltage, and load serving issues in Kenosha and Walworth might be resolved with a 138-kV line between Spring Valley and North Lake Geneva

Three 138-kV buses in Waukesha and Washington County experience marginal bus voltages under NERC Category A or TPL-001-0 conditions (intact system) in 2019. The buses are Bark River (95.8 percent), Germantown (95.5 percent), and Maple (95.7 percent). Modeling the Bluemound and Mukwonago capacitors in service as well as running additional generation at Germantown will improve the voltage profile in Washington County.

Following are the results of the 2019 contingency analysis (NERC Category B or TPL-002-0 conditions) performed on Zone 5.

Low probability bus outages at Pleasant Prairie continue to be a problem. Relief can be provided by reducing the output of Pleasant Prairie generator #2 to about 350 megawatts.

An outage of the Bain–Kenosha 138-kV line will result in the Albers–Kenosha 138-kV line loading to 97.8 percent of its summer emergency rating.

Loading issues on the Arcadian–Waukesha 138-kV lines and Arcadian transformers under contingency conditions get worse when compared to 2014. Increasing line clearances and replacing the two smaller transformers are potential solutions. Running generation at Concord and Germantown provides relief.

An outage of the Oak Creek–Pennsylvania 138-kV line will cause the Branch–Kansas 138-kV line (100.5 percent) to exceed its summer emergency ratings. Increasing line conductor clearances on the Branch–Kansas 138-kV line will provide relief.

A low probability bus outage at Burlington 138-kV bus will result in marginal 138-kV bus voltages at Tichigan (91.4 percent).

An outage of the Bark River – Sussex 138-kV line causes the Bark River 138-kV bus voltage to drop to 91.8 percent.

An outage of the Maple – Saukville 138-kV line causes the Germantown (88.7 percent) and Maple (88.2 percent) 138-kV bus voltages to be constrained under NERC Category B requirements. Running generation at Germantown will provide relief.



Past studies have shown low bus voltages in eastern Jefferson, western Waukesha, and southern Washington counties, all areas where load growth has been and is expected to remain high. To provide relief, a new 345-kV line connecting the Madison area with the Milwaukee area is being considered. The components of the project could include:

- Construct a new 345/138-kV Mill Road Substation (formerly known as Lannon Junction) at the intersection of the Cypress-Arcadian 345-kV line, the Arcadian-Granville 345-kV line, Germantown-Bark River 138-kV line and Sussex-Tamarack 138-kV line. This project will improve the 138-kV voltage profile in the area and facilitate expansion of the 345-kV network to the west of this substation. A 500 MVA, 345/138-kV transformer will be installed.
- Construct a Rockdale-Concord 345-kV line adjacent to the existing Rockdale-Jefferson-Concord 138-kV line on existing double-width right-of-way and install a 500 MVA, 345/138-kV transformer at Concord.
- Convert the Bark River-Mill Road 138-kV line (currently built to 345-kV standards) to 345-kV operation and install a 500 MVA, 345/138-kV transformer at Bark River.
- Construct a new 345-kV line from Concord to Bark River.

In addition to improving the voltage profiles in Jefferson, Waukesha and Washington counties, reducing loadings on parallel 138-kV circuits and reducing system losses, the above reinforcements will improve ATC's existing east-west transfer capability in this region. Such a project is not being proposed in this Assessment, but may be justified in future Assessments for analysis beyond the current 10-year horizon. Potential economic benefits will need to be reviewed as the future develops.

Provisional projects to install 2-32 MVAR of capacitance at the Mukwonago Substation and upgrading the Oak Creek-Pennsylvania 138-kV line are being considered in the 2015-2019 timeframe in order to address remaining voltage and thermal issues.

*Projects whose "Need date" precedes the "In-service date"*

- None

*Projects whose "In-service date" precedes the "Need date"*

- None

### *Zone 5 - 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 5. However, bus voltages worsen in the Germantown area. Additionally, the Arcadian transformer overload worsens. Future projects and/or increasing area generation mitigates the situation(s). These results



# 10-Year Assessment

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

2009

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occur because of area generation dispatch and the associated change in the flow of power associated with the 20% Wind scenario. Please refer to Table ZS-3a for the limitations and performance criteria exceeded for these futures.

In the Slow Growth Future, line overloads and bus voltages generally improve throughout Zone 5. This result is consistent with the reduced loading and associated generation redispatch throughout the zone.