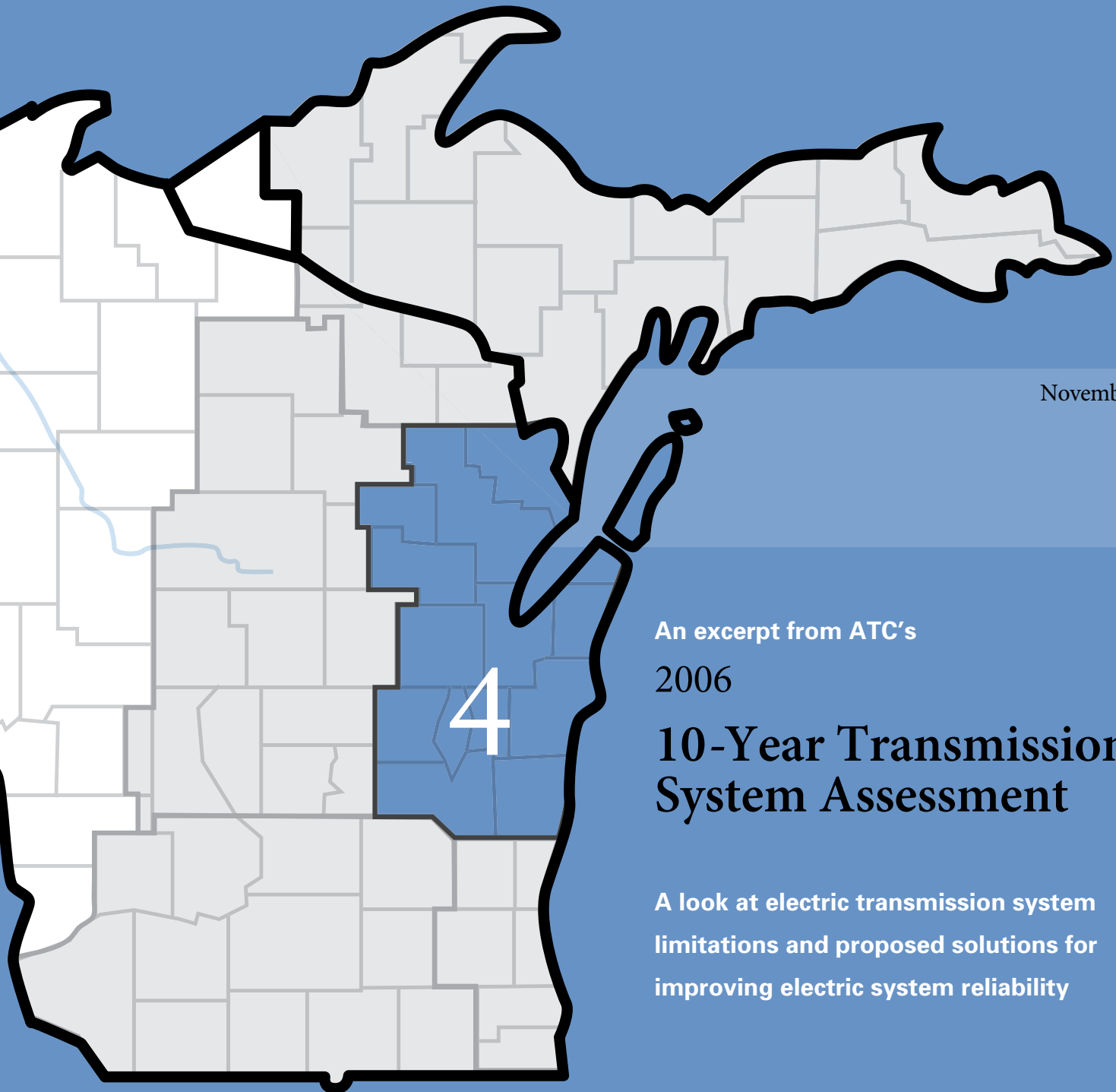




# Zone 4 – Northeast Wisconsin



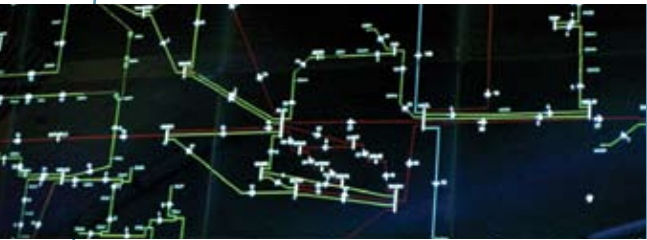
November 2006

An excerpt from ATC's  
2006

## 10-Year Transmission System Assessment

A look at electric transmission system  
limitations and proposed solutions for  
improving electric system reliability

[www.atc10yearplan.com](http://www.atc10yearplan.com)



## Looking at tomorrow's electric needs today

Advances in technology powered by electricity are improving our quality of life. At the same time, it's created a dependence on and expectation for an uninterrupted supply of electricity. We rarely notice how plugged in we are...unless the lights go out.

At ATC, we are helping to keep the lights on, businesses running and communities strong. However, the age of the electric transmission system and changes in the regional wholesale electricity market are impacting the reliability of the electric system upon which people and businesses have become so dependent.

To address the issues, ATC continually conducts engineering studies on the electric transmission system looking for potential problems that may affect the future performance of the system. As part of our technical studies, we take a comprehensive look at various factors affecting electricity utilization in the region, such as business development, employment trends, population and projected growth in electricity usage.

Our findings are summarized in an annual 10-Year Transmission System Assessment, which identifies and begins to prioritize future projects needed to improve the adequacy and reliability of the electric transmission system. We look 10 years into the future because it can take up to eight years to plan, study route options, get approvals and build new transmission lines.

### **Studies indicate need for \$3.1 billion investment over 10 years**

In our assessment of the electric transmission system needs through 2016, we estimate \$3.1 billion in system improvements including 360 miles of new transmission lines and upgrades to more than 840 miles of existing lines across our service area. Summarized in this booklet are highlights of the electric transmission system issues in Northeast Wisconsin.

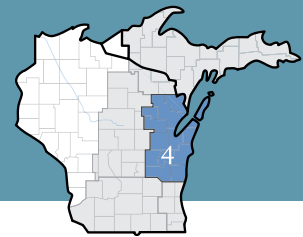
For complete information from our 2006 10-Year Assessment, go to: [www.atc10yearplan.com](http://www.atc10yearplan.com)

### **Transmission is the vital link in bringing power to communities**

Transmission lines move electricity at high voltages over long distances – from power plants to communities where local utilities deliver power to homes and businesses via local electric distribution lines. A reliable transmission network provides access to many sources of power, whether they are local or regional. Having multiple paths to get power from producers to consumers lessens the chance that they will experience service interruptions. Multiple major transmission lines also give power generators and local utilities the flexibility to access regions where they can sell and buy electricity to control overall costs for everyone.



[www.atc10yearplan.com](http://www.atc10yearplan.com)



# Zone 4 – Northeast Wisconsin

## Electric System Overview

### Population, employment increasing

- Population in Zone 4 is projected to grow 0.7 percent annually through 2011. From 2001 to 2006, Brown County realized the largest increase in population, while Calumet County had the highest growth rate.
- Employment in Zone 4 is projected to grow 1.2 percent annually through 2011. From 2001 to 2006, Brown County realized the largest increase in employment, while Calumet County had the highest growth rate.

### Electricity usage growing

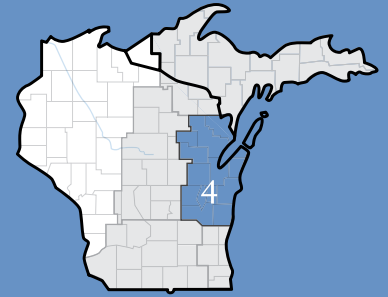
- Peak electric demands typically occur during the summer months, though the northern portion of Zone 4 typically experiences nearly equal winter peaks. Paper mills and foundries in the Green Bay and Appleton metropolitan areas are some of the largest electricity users in the zone.
- Electric load is projected to grow at approximately 2.4 percent annually through 2015. Comparing load with generation (at maximum output) within the zone indicates that Zone 4 has more generation than load during peak load periods. Actual operating experience indicates that during lighter load periods, Zone 4 is a net exporter of power.

### Transmission projects completed or under way address electric needs

- **Gardner Park-Central Wisconsin project** – The PSC approved our application to build a 50-mile, 345-kV line between two new substations in Wausau and Shawano County.
- **Morgan-Werner West project** – The PSC approved our application to build a new 50-mile, 345-kV line between new substations in Oconto Falls and New London. The line will relieve electric system congestion in and around Green Bay, provide additional transfer capability and improve electric system reliability.

Our 2006 10-Year Transmission System Assessment outlines more than 40 projects to ensure electric system reliability in Northeast Wisconsin. These projects are in various stages of development. The following pages describe the system limitations in Northeast Wisconsin and our planned, proposed and provisional projects to address those limitations.

# Zone 4 – Northeast Wisconsin



## Transmission system characteristics in Zone 4

ATC delivers power in Zone 4 with various transmission facilities including:

- four 345-kV lines extending from Kewaunee and Point Beach nuclear plants,
- two 345-kV lines extending from Edgewater Power Plant,
- a west-east 345-kV line extending from Stevens Point to the Appleton area,
- three 345-kV lines connecting the Fond du Lac area to Columbia, Edgewater and North Appleton, and
- one 345-kV line connecting Morgan to Plains.

There are a number of transmission system performance issues in Zone 4, most notably insufficient transformer capability, limited transfer capability to and from Michigan's Upper Peninsula, aging facilities in poor condition and heavily loaded facilities in the Fox Valley and Green Bay areas. Primary drivers of these issues include steady load growth in certain areas, new power plants and increased desire to transfer power through the system.

## Transmission system limitations in Zone 4

In the analysis of Zone 4 for 2007, we identified low voltages, transmission facility overloads and transmission service limitations. In addition, transmission service limitations during off-peak periods provide very small operating margins. During these off-peak periods the Ludington Pumped Storage Facility is in its pump mode which contributes to heavy loading on facilities from south of Green Bay to Michigan.

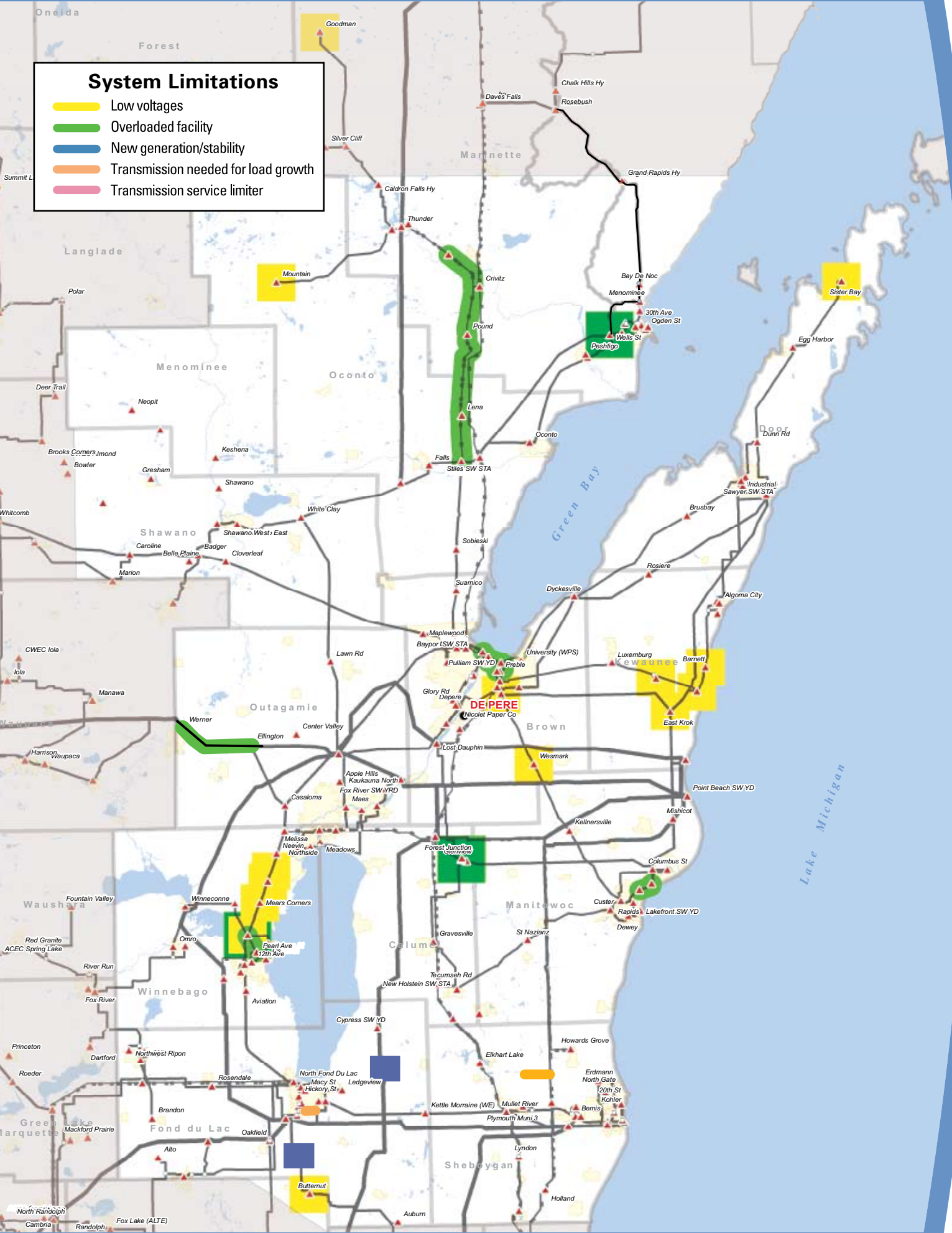
Areas of this zone identified as vulnerable to low voltages include Upper Peshtigo, Door County, north of Oshkosh and south of Fond du Lac. Areas with facility overloads include the West Marinette, Oshkosh and Green Bay areas. The most notable transmission service limitation affecting Zone 4 is the Plains-Stiles 138-kV line. This line limitation is being addressed for the near term with projects planned to be completed in 2006.

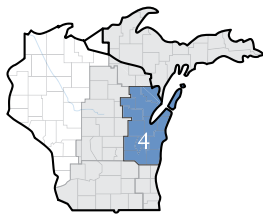
## Zone 4 includes the Wisconsin counties of:

- Brown
- Calumet
- Dodge (northeast corner)
- Door
- Fond du Lac (eastern portion)
- Kewaunee
- Manitowoc
- Marinette (southern portion)
- Menominee, Mich. (southern portion)
- Menominee, Wis.
- Oconto
- Outagamie
- Shawano (eastern portion)
- Sheboygan
- Winnebago (eastern portion)

### System Limitations

- Low voltages
- Overloaded facility
- New generation/stability
- Transmission needed for load growth
- Transmission service limiter





# Zone 4 – Northeast Wisconsin

We have completed six network projects in Zone 4 since the 2005 Assessment Update, most notably the Martin Road transmission-to-distribution interconnection and the series reactor at Highway V.

Our current plans in Zone 4 include 40 projects between 2006 and 2016. These projects are in various stages of development. The most notable planned, proposed and provisional projects in Zone 4, along with their projected year of completion and the factors driving the need for the projects, are listed below.

	Project description	In-service year	Need driver
	<b>Planned projects</b>		
1	Loop Butternut-South Fond du Lac 138-kV into Forward Energy Center	2006	Interconnection of new Forward Energy Center Power Plant
2	Loop Forest Junction-Arcadian 345-kV into Cypress Substation	2006	Interconnection of new wind farm generation
3	Werner West (New London) 345/138-kV Substation	2006	Addresses chronic transmission service limitation and facility overloads, improves system voltages in the area
4	Stiles-Amberg double circuit 138-kV line rebuild	2006	Addresses chronic transmission service limitation, improves voltage stability limit in the UP, addresses aging facilities in poor condition
5	Werner West-Morgan 345-kV line and Clintonville-Werner West 138-kV line	2009	Addresses chronic transmission service limitations in Green Bay, improves Wisconsin-UP transfer capability, lowers system losses
	<b>Proposed projects</b>		
6	Crivitz-High Falls 69-kV double-circuit line rebuild	2008	Addresses low voltages and facility overloads
7	Canal (Sturgeon Bay)-Dunn Road 138-kV line	2012	Addresses low voltages and facility overloads
8	Dunn Road-Egg Harbor 69-kV line	2016	Addresses low voltages and provides network service
	<b>Provisional projects</b>		
9	Shoto-Custer 138-kV line	2012	Addresses facility overloads
10	Bayport-Suamico-Sobieski-Pioneer 69-kV line rebuild & conversion to 138 kV	2016	Addresses facility overloads, addresses aging facilities in poor condition and provides network service
11	Northside-City Limits (Appleton) 138-kV line	2016	Addresses facility overloads

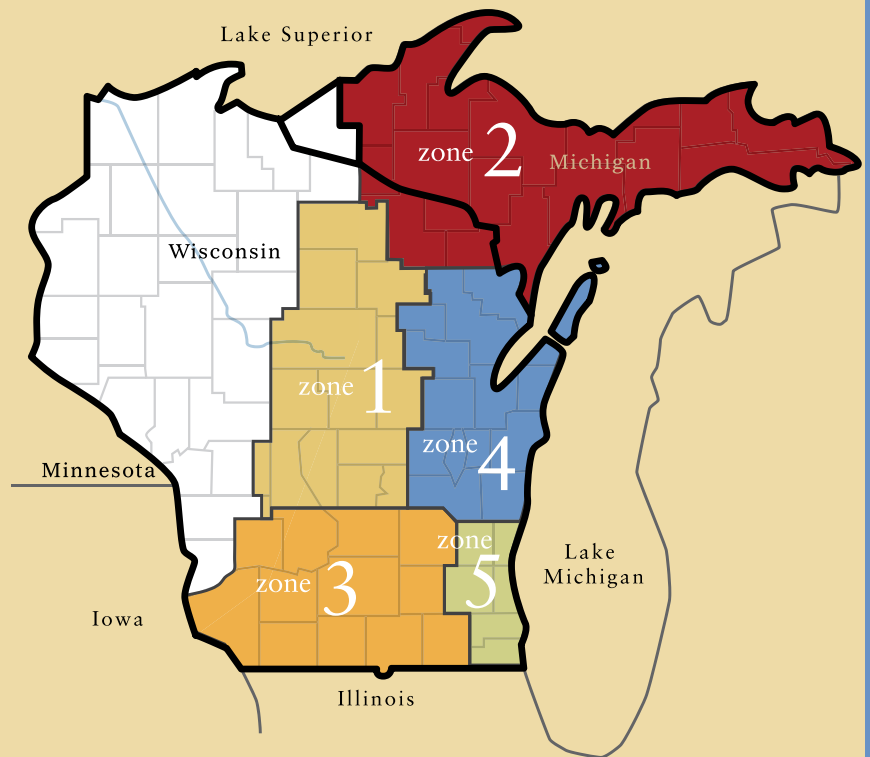
### System Solutions

- |       |                          |     |   |
|-------|--------------------------|-----|---|
| (SS)  | New substation           | ●●● | 345-kV transmission line                |
| (SM)  | Substation modifications | ▬▬▬ | 115-, 138- or 161-kV transmission line  |
| (PS)  | Phase shifter            | ▬▬▬ | Rebuilt 115- or 138kV transmission line |
| (T)   | Transformer              | ▬▬▬ | Transmission line voltage conversion    |
| (C)   | Capacitor bank           | ▬▬▬ | 69-kV transmission line                 |
| (R)   | Reactor                  | ▬▬▬ | Rebuilt 69-kV transmission line         |
| (T-D) | T-D interconnection      |     |   |



## ATC at a glance

- Formed in 2001 as the first multi-state, **transmission-only utility**.
- Owner and operator of approximately **8,900 miles of transmission line and 480 substations**.
- Meeting electric needs of approximately **five million people**.
- Transmission facilities in **66 counties** in Wisconsin, Michigan and Illinois.
- **\$1.5 billion** in total assets.
- **Seven offices** in the communities of Cottage Grove, De Pere, Madison, Waukesha and Wausau, Wis.; Kingsford, Mich.; and Washington DC.



## As a public utility, we have duties and responsibilities to:

- Operate the transmission system reliably,
- Assess the ability of the system to adequately meet current and future needs,
- Plan system upgrades to meet those needs in the most efficient, effective and economic ways,
- Construct upgrades in time to meet those needs,
- Maintain the transmission equipment and surroundings to minimize opportunity for failures.



Helping to **keep the lights on,**  
businesses running and communities strong.

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