



# SUMMARY REPORT



10-YEAR TRANSMISSION SYSTEM ASSESSMENT

2017



## Transmission investments

Projections from past and current Transmission System Assessments

	2013	2014	2015	2016	2017
<b>Specific Network Projects</b>	\$1.2B	\$1.4B	\$1.4B	\$1.3B	<b>\$0.7B / \$1.0B*</b>
<b>Regional Multi-Value Projects</b>	\$0.5B	\$0.5B	\$0.5B	\$0.5B	<b>\$0.4B</b>
<b>Asset Maintenance</b>	\$1.1B	\$1.2B	\$1.4B	\$1.4B	<b>\$1.4B</b>
<b>Other Capital Categories</b>	\$0.2B / \$0.8B	\$0.2B / \$0.8B	\$0.4B / \$1.2B	\$0.4B / \$1.2B	<b>\$0.3B / \$0.8B</b>
<b>Total 10-Year Capital Cost</b>	\$3.0B / \$3.6B	\$3.3B / \$3.9B	\$3.7B / \$4.5B	\$3.6B / \$4.4B	<b>\$2.8B / \$3.6B</b>

\*The Specific Network Projects range in 2017 reflects the fact that NARA projects in the 10-Year Assessment project list and in the MTEP database may be replaced by generation being considered in the MISO generation queue.

## Best-value planning for a reliable future

Delivery of electricity is an essential service, one that provides for the well-being of our modern society. This is evident whenever severe weather occurs — the first order of business for public health and safety is to restore the electric grid. At ATC, we rely on a robust planning effort to assure resilient, reliable service for the customers and communities we serve.

For more than 15 years, American Transmission Co. has been helping to keep the lights on in its service territory with a robust planning effort to build out the system to meet regional needs. Our long-range planning efforts assure the reliability that our customers depend on, and each year our 10-Year Transmission System Assessment has outlined the specific projects required to achieve that goal.

We continue to provide best-value planning in a number of ways:

- listening to our customers to accurately understand and plan for their future needs,
- anticipating and planning for changes in generation, including generator retirements,
- understanding and enabling new technologies and
- anticipating long-term changes in the industry.

Our current planning studies show a reduced need for new projects due to slowing load growth and other factors. As a result, there is a reduction in our capital plan.

The 2017 10-Year Transmission System Assessment calls for a lower capital expenditure than in recent years, from \$2.8 billion to \$3.6 billion in system improvements. This document contains a summary of ATC's planning initiatives, an overview of asset renewal and network-driven projects in each of our planning zones.

For more detailed information, please visit [www.atc10yearplan.com](http://www.atc10yearplan.com).

Ron Snead  
Vice President, System Planning

John McNamara  
Vice President, Asset Management

## Regional and economic planning update

ATC is an active participant in a variety of efforts to address regional and interregional planning initiatives designed to maintain a reliable grid and capture economic benefits in a dynamic energy marketplace. Policy initiatives to curb greenhouse gas emissions and expand the use of renewable energy continue to evolve, and we work closely with our customers to plan for an electric transmission system that will serve their needs well into the future.

### MIDCONTINENT INDEPENDENT SYSTEM OPERATOR TRANSMISSION EXPANSION PLANNING

MISO planning studies address long- and short-term issues as well as targeted needs. Long-term studies primarily look at value-based options that provide economic benefits in the 10- to 20-year horizon. Short-term planning is primarily driven by transmission owners' reliability and North American Electric Reliability Corporation compliance needs in a five- to 10-year period.

ATC staff participates in the MISO short-term reliability and economic studies in a variety of ways: ensuring accurate project information is included in the MISO database, building and reviewing models, correlating needs identified by MISO analyses with specific ATC projects and participating in various studies and stakeholder forums.

### MARKET CONSTRAINTS

Two of the five narrowly constrained areas identified in the MISO region are associated with ATC, and we continue to track these as well as other constraints. Such tracking assists in planning projects that alleviate congestion within the MISO market.

### OTHER MISO PLANNING ACTIVITIES

Our planning staff participates in various technical and policy discussions and provides future direction for MTEP activities. We also are involved in joint planning studies with neighboring regional transmission organizations, including PJM and SPP.

MISO and PJM coordinate, conduct and analyze several market efficiency project studies. This analysis is reviewed by an interregional planning stakeholder advisory committee, which typically examines economic projects that could benefit both RTOs and qualify for cross-border cost-sharing.



# Major projects update



Construction continues on the North Appleton-Morgan portion of the Bay Lake Project; a new substation, Benson Lake, was placed into service in July.



## BADGER COULEE

Construction is underway on the Badger Coulee transmission line, one of MISO's 17 Multi-Value Projects. The project was approved by the Public Service Commission of Wisconsin in spring 2015. A portion of the project from the Cardinal Substation to the North Madison Substation will be placed in service in fall 2017. The entire project is expected to be in service in late 2018. The 180-mile, 345-kV line between the La Crosse and Dane County areas will deliver reliability, economic and public policy benefits. Developed jointly with Xcel Energy, the line will:

- offset the need for about \$190 million in lower-voltage upgrades in western Wisconsin,
- increase access to the wholesale energy market and provide between \$118 million and \$700 million in net economic benefits over the life of the line, and
- establish another pathway for renewable energy into Wisconsin with a connection to key load centers.

## BAY LAKE

The Bay Lake Project is a package of projects that address the delicate, shifting balance between generation, load and transmission in the northern portion of our service area.

The Holmes-Old Mead Road portion of the Bay Lake project, a \$120 million, 58-mile, 138-kV line from the Holmes Substation in Menominee County to the Old Mead Road Substation in Escanaba, Mich., was placed into service on time and under budget in 2016.

As part of the North Appleton-Morgan project, a new substation, Benson Lake in Marinette County, was placed into service in July 2017. It includes a large voltage-control device. Construction of the 345-kV and 138-kV lines from our North Appleton Substation in Outagamie County to the Morgan Substation in Oconto County, Wis., is underway; both substations will be expanded. Additional work will be required at 11 other substations. The project was approved by the Public Service Commission of Wisconsin in May 2015. Construction of the \$328 million project began in 2016. It has an in-service date of late 2018.

## CARDINAL-HICKORY CREEK

ATC, ITC Midwest LLC and Dairyland Power Cooperative have plans for a 125-mile, 345-kV transmission line connecting Dubuque County, Iowa, to Dane County, Wis.

The Cardinal-Hickory Creek Project is another of MISO's Multi-Value Projects. Studies indicate that Cardinal-Hickory Creek will deliver benefits to local communities and the Midwest region by:

- improving electric system reliability locally and regionally,
- delivering economic benefits for utilities and electric consumers, and
- expanding infrastructure to support public policy for greater use of renewables.

If approved by Wisconsin and Iowa regulators, the project is estimated to be in service in 2023.

## NORTHERN AREA RELIABILITY ASSESSMENT

ATC initiated an effort in 2014 to engage stakeholders and identify potential reinforcements due to generation uncertainties in the northern portion of the ATC system. The 10-year project list includes the following preliminary projects:

- Plains-National 138-kV line,
- Plains-Arnold 138-kV line uprate,
- increased Plains 345 / 138-kV transformer capacity, and
- Morgan-Thunder-Crivitz 138-kV project.

ATC had collaborated with MISO to include these projects in MTEP15. ATC is assisting with the evaluation of generation proposals in this area of Michigan. The need for some of the transmission projects may be eliminated if generation is appropriately located in this area. When generator interconnection agreements are signed, ATC will cancel the appropriate projects and proceed with any projects that result from the MISO interconnection studies.



### WISCONSIN-ILLINOIS RELIABILITY PROJECT

ATC has proposed a reinforcement project to address reliability concerns associated with the high-voltage transmission system in Southeastern Wisconsin. The reliability concerns are impacted by system load and generation profiles. To enable more efficient power flow, the project reconfigures two existing 345-kV lines in Wisconsin and Illinois, linking them with approximately three to five miles of new double-circuit, 345-kV transmission and a new substation.

This proposed reliability project has been approved in the MISO regional-planning process and by the Illinois Commerce Commission. The project also requires approval from the Public Service Commission of Wisconsin and is targeted for completion in 2021.

### SPRING VALLEY-NORTH LAKE GENEVA

Construction is underway on the \$71 million Spring Valley-North Lake Geneva Project, which was approved by the Public Service Commission of Wisconsin in spring 2016. This project is needed to meet an increase in electric demand in Walworth and Kenosha counties in Wisconsin.

The project involves:

- construction of a new 138-kV transmission line of approximately 23 miles, stretching from the North Lake Geneva Substation in southern Walworth County to the Spring Valley Substation in western Kenosha County,
- construction of a new 138-kV and 69-kV substation on an ATC-owned parcel along Highway 50 in the Town of Wheatland,
- construction of a new 69-kV transmission line to connect the new substation to the existing Twin Lakes Substation in Twin Lakes, and
- other power line modifications.

The project is expected to be placed into service in 2019.

### FINGER ROAD-CANAL

The rebuild of a 69-kV line in northeastern Wisconsin, along with associated substation work, was approved by the Wisconsin Public Service Commission in spring 2017 at a cost of \$60.7 million. About 55 miles of 1950s-vintage wood poles running between Finger Road Substation and Canal Substation will be rebuilt. The line serves seven distribution substations in northern Kewaunee County and Door County.

The project includes:

- the replacement of 834 wood pole structures,
- the replacement of line conductor and addition of a fiber optic shield wire, and
- the replacement of some associated substation equipment.

Construction is scheduled to complete in January 2021.



## Our progress

ATC's top priority has always been electric reliability. Now we have a grid that enables our customers to participate in and reap the benefits of the wholesale energy market.

As we continue to use our system-wide planning process to effectively and economically improve reliability, more emphasis is being placed on the need to efficiently maintain and upgrade our older assets. Our asset management program is focused on the life-cycle management of transmission assets. The objective is to ensure assets perform the required function in a sustainable manner while managing life-cycle cost. Coordination of design, commissioning, operation, maintenance and replacement strategy is crucial to developing the replacement strategy of the asset life cycle. Asset renewal is driven by public and worker safety, regulatory compliance, reliability and operational performance.

Due in large part to our asset management efforts, in 2016 we achieved top decile performance for components operating at 69-kV and between 100- and 161-kV, along with top quartile for the 345- to 500-kV voltage classes.

Our single-focus, transmission-only business model has produced significant results for our customers over the years.

Coordination of design, commissioning, operation and maintenance is crucial to developing the replacement strategy of the asset life cycle.

Over the past ten years, we have:

- upgraded more than 875 miles of transmission line,
- improved 98 electric substations,
- built 24 new transmission lines (436 miles)
- connected 2,700 MW of new generation at 16 sites,
  - Including 680 MW of renewable generation at eight sites
- increased import and export capability, and
- improved transmission reliability.



# What drives the need for transmission system improvements?



Early in our operational existence, we focused on “seams” issues – finding the logical places in our service area to link transmission assets to create a smooth-flowing electrical highway to serve our customers. Those major, network-driven projects accounted for significant investment in the build-out of our 345-kV system. As we were making our network more interconnected and reliable, we also focused on the life-cycle maintenance of our existing assets, focusing on an asset management strategy to complement and create synergies with our network additions.

Today, our effective management of transmission components complements our planning strategy for electric reliability and economic benefits.

In a collaborative process, our asset management and planning teams work with other functional groups and stakeholders to achieve the best solutions to transmission system needs. Asset management staff monitor the system through maintenance and inspection programs to identify issues related to equipment performance or condition. Equipment needing attention is discussed internally and with customers to determine if replacement in kind is required or other reliability needs exist within the geographic area. Needs are evaluated using various options to determine the best means of maintaining reliability. These discussions with customers and at 10-Year Assessment stakeholder meetings offer the opportunity for stakeholders to request information that could lead to non-transmission options.

## COMMON NEEDS THAT DRIVE SYSTEM IMPROVEMENTS INCLUDE:

- New or retiring generation – changes the generation impact on transmission
- Economics – greater access to the wholesale energy marketplace provides economic opportunities to utility customers
- Enhanced NERC reliability standards – require a greater degree of redundancy and analysis to assure reliable operation
- Public policy – renewable energy mandates and pending air quality regulations will affect how the transmission system will be built and used
- Asset renewal – maintaining the system in good operating condition extends its life and improves safety and performance
- Interconnections – changes in how our customers distribute electricity to consumers require new or modified transmission facilities
- Load changes – while overall load growth is low, loads are appearing and disappearing; changing power flows on the system
- New technologies – synchronized phasor measurements, demand-side management and distributed energy resources affect how the grid is planned and operated to maintain reliability
- Communications – improvements in communication technology, such as fiber optics, are incorporated to support an ever-increasing need to see and control what is happening on the transmission system in real time

## Plans and proposals for the transmission system

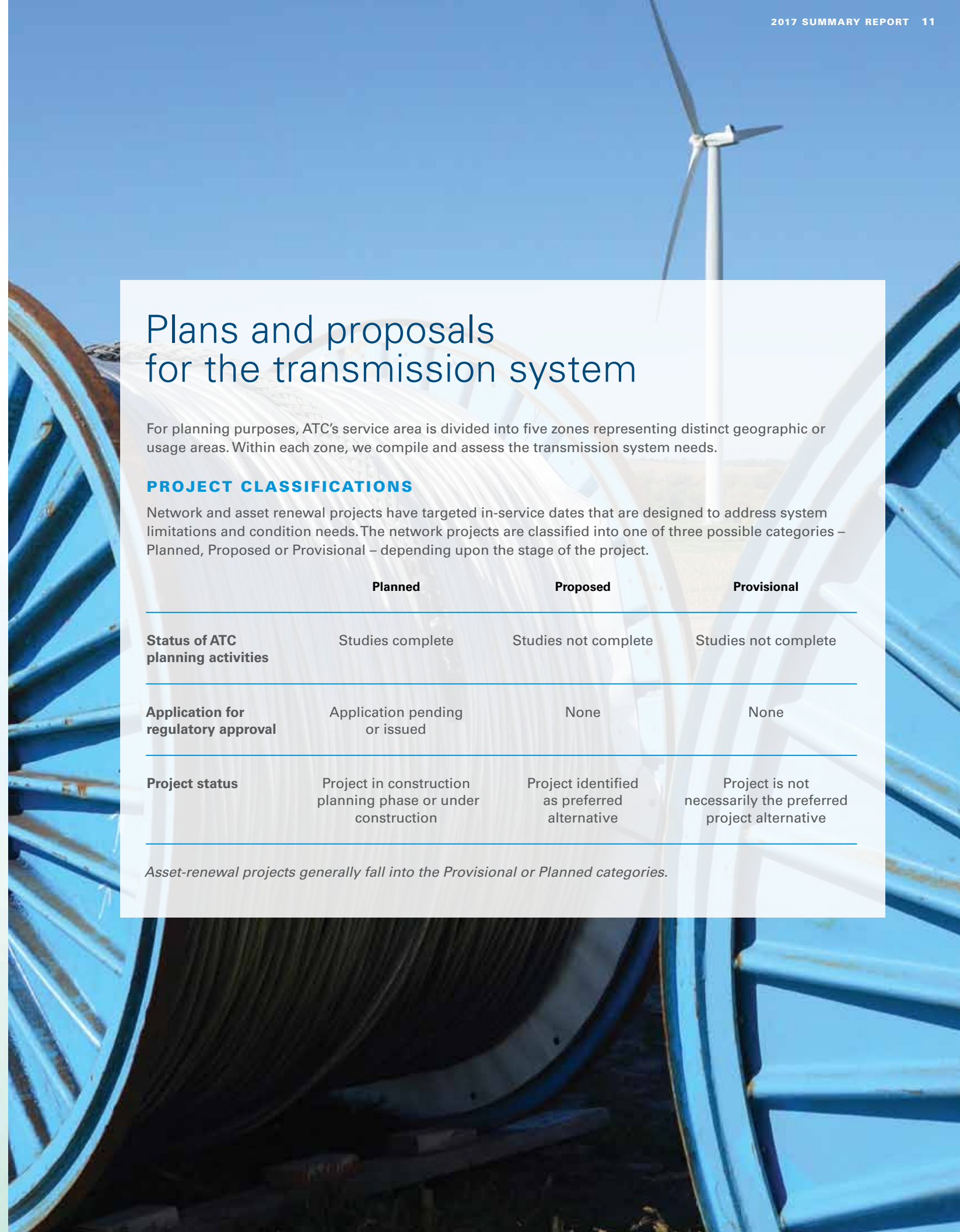
For planning purposes, ATC’s service area is divided into five zones representing distinct geographic or usage areas. Within each zone, we compile and assess the transmission system needs.

### PROJECT CLASSIFICATIONS

Network and asset renewal projects have targeted in-service dates that are designed to address system limitations and condition needs. The network projects are classified into one of three possible categories – Planned, Proposed or Provisional – depending upon the stage of the project.

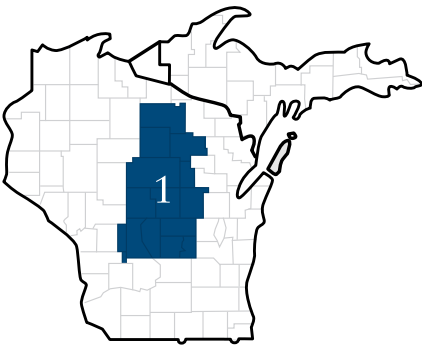
	Planned	Proposed	Provisional
<b>Status of ATC planning activities</b>	Studies complete	Studies not complete	Studies not complete
<b>Application for regulatory approval</b>	Application pending or issued	None	None
<b>Project status</b>	Project in construction planning phase or under construction	Project identified as preferred alternative	Project is not necessarily the preferred project alternative

*Asset-renewal projects generally fall into the Provisional or Planned categories.*



# NORTH CENTRAL WISCONSIN

## Zone 1



### Transmission system characteristics in Zone 1

ATC delivers power in Zone 1 with various transmission facilities including:

- East-west 345-kV line from Arpin through Stevens Point extending to the Appleton area,
- 345-kV line extending from Stevens Point north to Wausau toward eastern Shawano County (Highway 22),
- 345-kV line extending from Wausau to northeastern Minnesota,
- 115-kV network in the northern portion of the zone, and
- 138-kV and 69-kV network in the southern portion of the zone.

### Transmission system limitations in Zone 1

Zone 1 has a few key system performance issues. Low voltages that are a result of potential multiple contingency events will continue to be monitored, high voltages in the northern portion of the zone, and other studies have identified thermal limitations in the northern portion of the zone. The most severe limitations occur during both peak and off-peak periods.

### ELECTRIC SYSTEM OVERVIEW

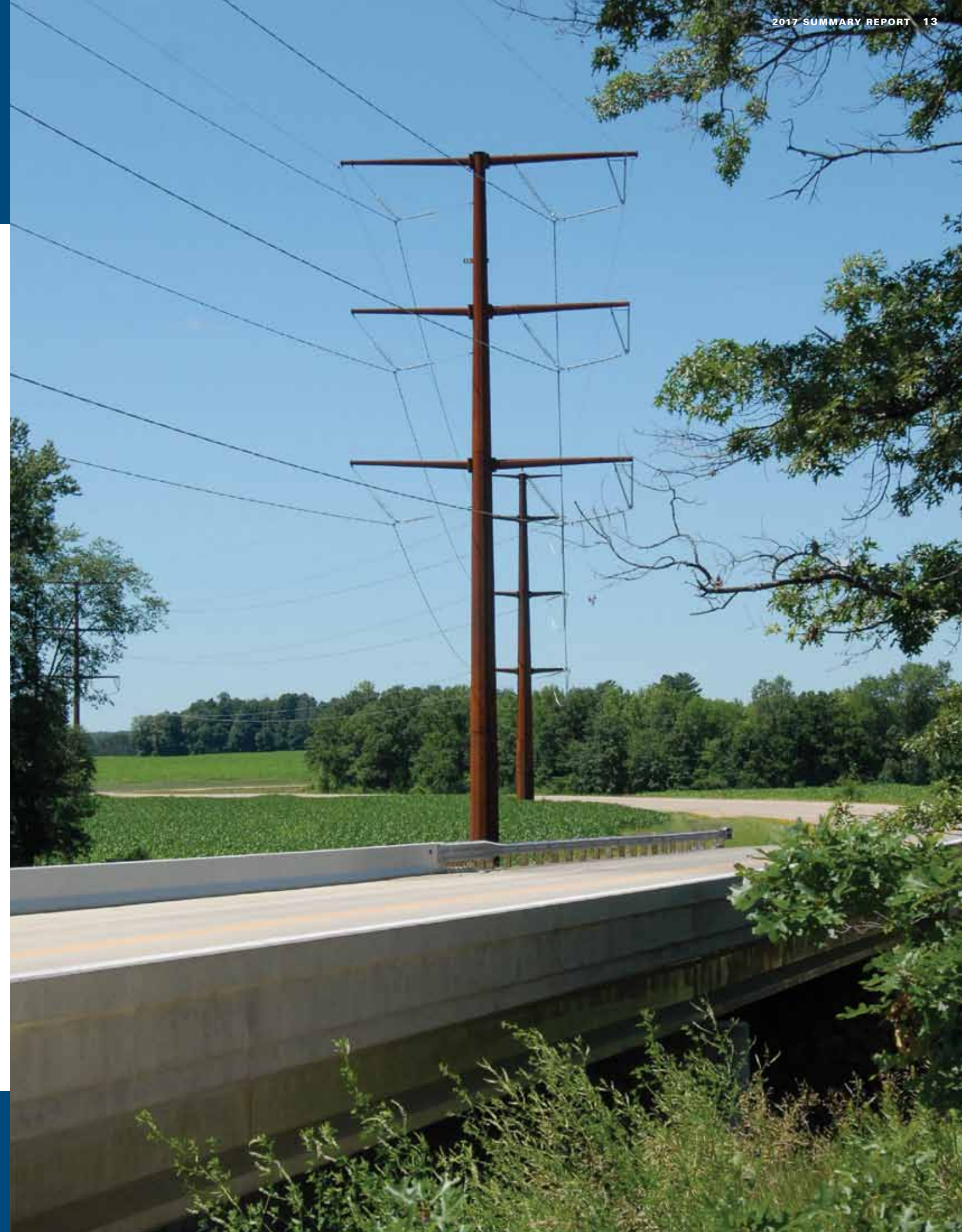
#### Small increases expected in population, employment

Population in Zone 1 is projected to grow at 0.47 percent annually between now and 2026. Employment is projected to grow at 0.85 percent annually between now and 2026. Marathon County is projected to realize the largest increase in population and employment, while Adams County is projected to have the highest growth rate in population and employment.

#### Electricity usage

Peak electric demand typically occurs during the summer months, with some winter peaks appearing in the northern portion of the zone. Primary electricity users in Zone 1 include a number of large paper mills and food processing plants.

Electric load is forecasted to grow approximately 0.4 percent annually through 2027.

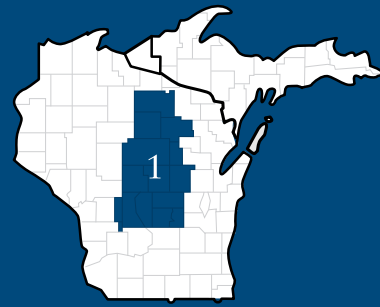


### COUNTIES INCLUDED IN ZONE 1 – NORTH CENTRAL WISCONSIN

Adams | Forest (southwestern portion) | Fond du Lac (northwestern portion) | Green Lake | Juneau | Langlade | Lincoln  
 Marathon | Marquette | Monroe (eastern portion) | Oneida | Portage | Shawano (western portion) | Vernon (eastern portion)  
 Vilas (southern portion) | Waupaca | Waushara | Winnebago (western portion) | Wood

# NORTH CENTRAL WISCONSIN

## Zone 1



### TRANSMISSION PROJECTS IN ZONE 1

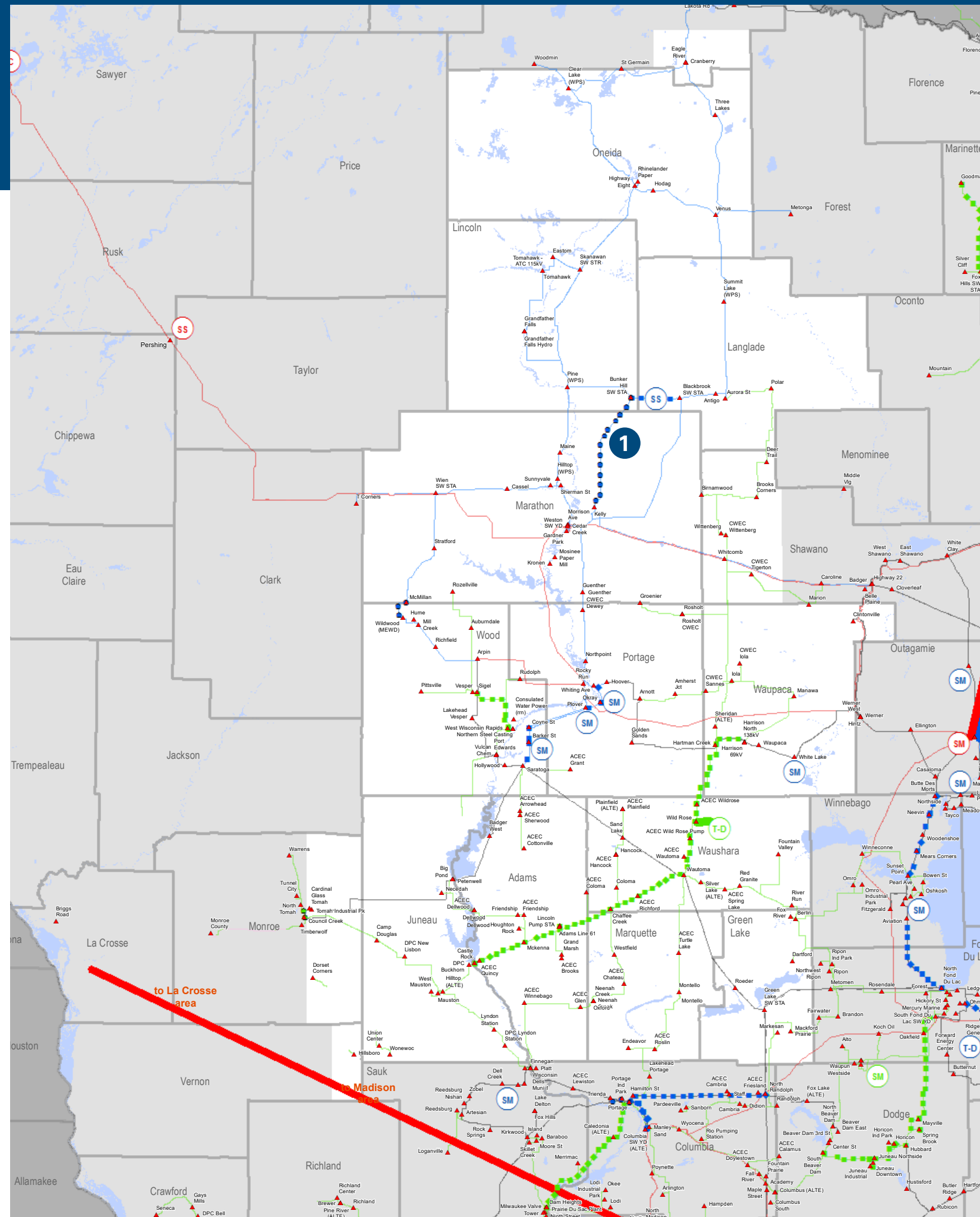
The most notable planned, proposed and provisional network projects and asset-renewal projects in Zone 1, along with their projected year of completion and the factors driving the need for the projects, are listed below.

PROJECT DESCRIPTION	IN-SERVICE YEAR	NEED DRIVER
<b>Planned Project</b>		
<b>1</b> M13-Reinforcement-Bunker Hill-Blackbrook	2019	Overloads and condition
<i>Additional projects may be found in the full 10-Year Assessment at <a href="http://atc10yearplan.com">atc10yearplan.com</a>.</i>		

#### SYSTEM SOLUTIONS KEY

<b>SS</b> <b>New substation</b> Supports transmission system expansion	<b>TRANSMISSION LINE KEY</b> 345-kV transmission line 115-, 138- or 161-kV transmission line 69-kV transmission line Rebuilt 115- or 138-kV transmission line 115- or 138-kV transmission line rating upgrade 69-kV transmission line rating upgrade	<b>EXISTING TRANSMISSION LINES KEY</b> 69 kV 115 kV 138 kV 161 kV 230 kV 345 kV
<b>SM</b> <b>Substation modifications</b> Upgrades equipment ratings to avert facility overloads		
<b>T</b> <b>Transformer</b> Supports local growth and improves voltage levels		
<b>C</b> <b>Capacitor bank or reactor</b> Relieves low voltages or high voltages		
<b>T-D</b> <b>T-D interconnection</b> Supports local growth		

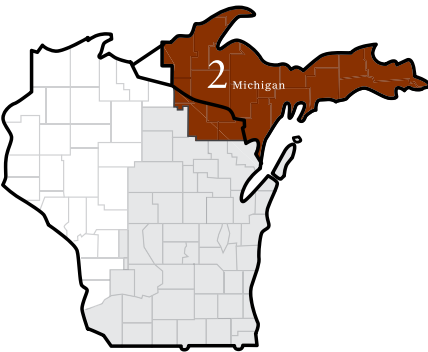
Lines of proposed projects on the map are for illustrative purposes only and do not reflect actual routes. For information on project status and routes, see [atc-projects.com](http://atc-projects.com).





# MICHIGAN'S UPPER PENINSULA AND NORTHERN WISCONSIN

## Zone 2



### Transmission system characteristics in Zone 2

ATC delivers power in Zone 2 with various transmission facilities including:

- Morgan-Plains, Plains-Arnold, and Arnold-Dead River 345-kV lines,
- Plains-Stiles 138-kV double-circuit line,
- Lakota Road-Plains 138-kV line,
- Holmes-Old Mead Rd 138-kV line and
- 138-kV facilities tying the Upper Peninsula of Michigan to lower Michigan.

### Transmission system limitations in Zone 2

There are a number of transmission system performance issues in Zone 2 including limited ability to import or export power, generator instability, overloaded lines and equipment, low and high system voltages, and chronic limitations to transmission service. Primary drivers of these issues include a mismatch of load to generation in the Upper Peninsula and aging facilities in poor or obsolete condition. In addition, other ongoing studies, including northern area studies performed by ATC and MISO, have identified several voltage and thermal limitations. The most severe limitations occur during both peak and off peak periods.

### ELECTRIC SYSTEM OVERVIEW

#### Small increases expected in population, employment

Population in Zone 2 is projected to grow about 0.2 percent annually between now and 2026, and employment is expected to grow about 0.8 percent each year in the same time period. Marquette County (Michigan) is projected to realize the largest increase in population and employment. Florence County (Wisconsin) is projected to have the highest growth rate in population while Forest County (Wisconsin) is projected to have the highest growth rate in employment.

#### Electricity usage

Zone 2 typically experiences peak electric demand during the winter months. Ore mining and paper mills are the largest electricity users in the zone.

In the recent past, there have been some load reductions in Zone 2. From these reduced levels, electric load is forecasted to increase by 0.5 percent annually through 2027. Also, locally generated electricity is declining in the area with smaller, coal-fired generators most at risk. This includes generation owned by industry, municipalities and utilities.



### COUNTIES INCLUDED IN ZONE 2 – MICHIGAN'S UPPER PENINSULA AND NORTHERN WISCONSIN

Alger, Mich. | Baraga, Mich. | Chippewa, Mich. | Delta, Mich. | Dickinson, Mich. | Florence, Wis.  
 Forest, Wis. (northern portion) | Gogebic, Mich. (eastern portion) | Houghton, Mich. | Iron, Mich. | Keweenaw, Mich.  
 Luce, Mich. | Mackinac, Mich. | Marinette, Wis. (northern portion) | Marquette, Mich. | Menominee, Mich. (northern portion)  
 Ontonagon, Mich. (eastern portion) | Schoolcraft, Mich. | Vilas, Wis. (northern portion)

# MICHIGAN'S UPPER PENINSULA AND NORTHERN WISCONSIN

## Zone 2



### TRANSMISSION PROJECTS IN ZONE 2

The most notable planned, proposed and provisional network projects and asset renewal projects in Zone 2, along with their projected year of completion and the factors driving the need for the projects, are listed on page 19.

	PROJECT DESCRIPTION	IN-SERVICE YEAR	NEED DRIVER
<b>1</b>	<b>Planned Project</b> Munising-Blanney Park 69-kV partial rebuild	2019	Condition and performance
<b>2</b>	<b>Proposed Project</b> Plains-Arnold 138-kV uprate	2019	Network integration transmission service request
<b>3</b>	<b>Provisional Projects</b> J703: Huron Substation, new G-T interconnection	2019	G-T interconnection
<b>4</b>	J704 / J711: Silver River Substation, new G-T interconnection	2019	G-T interconnection
<b>5</b>	J704 / J711: North Lake-Silver River 138-kV line NLKG31, uprate	2019	G-T interconnection
<b>6</b>	Lakota-Winona 138-kV conversion	2021	Overloads and low voltages
<b>7</b>	Plains-National 138-kV project	2023	Overloads and low voltages
<b>8</b>	Plains 345 / 138-kV project	2023	Overloads and low voltages
<b>9</b>	Winona-Atlantic 69-kV line rebuild	2024	Overloads and low voltages

*Additional projects may be found in the full 10-Year Assessment at [atc10yearplan.com](http://atc10yearplan.com).*

#### SYSTEM SOLUTIONS KEY

**SUBSTATION KEY**

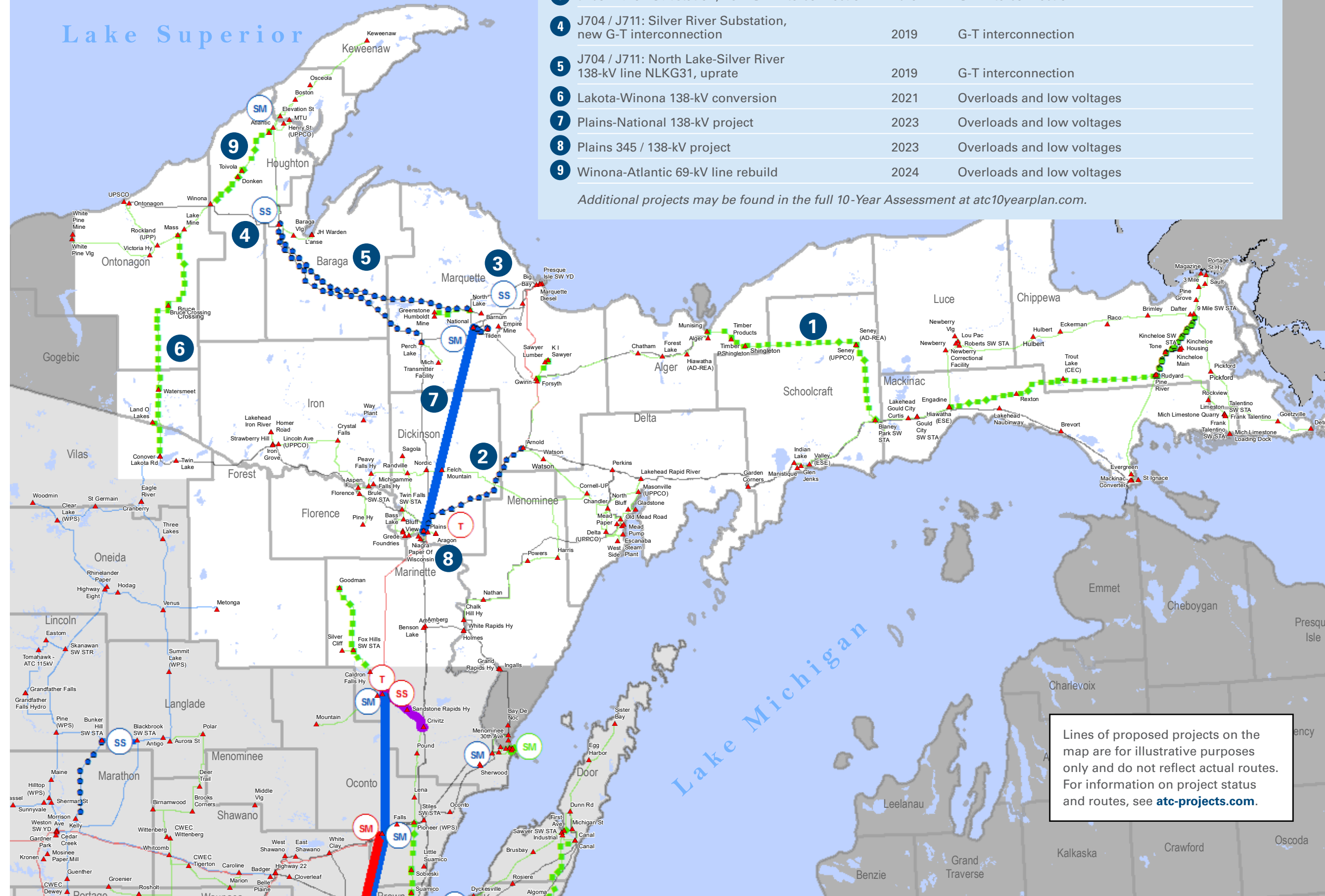
- SS** New substation  
Supports transmission system expansion
- SM** Substation modifications  
Upgrades equipment ratings to avert facility overloads
- T** Transformer  
Supports local growth and improves voltage levels
- C** Capacitor bank  
Relieves low voltages or high voltages
- T-D** T-D interconnection  
Supports local growth

**TRANSMISSION LINE KEY**

- 345-kV transmission line**
- 115-, 138- or 161-kV transmission line**
- 69-kV transmission line**
- Transmission line voltage conversion**
- Rebuilt 115- or 138-kV transmission line**
- Rebuilt 69-kV transmission line**
- 115- or 138-kV transmission line rating upgrade**
- 69-kV transmission line rating upgrade**

**EXISTING TRANSMISSION LINES KEY**

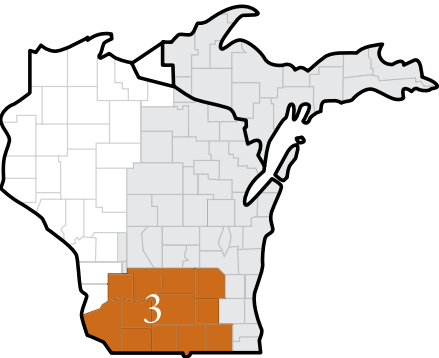
- 69 kV
- 115 kV
- 138 kV
- 161 kV
- 230 kV
- 345 kV



Lines of proposed projects on the map are for illustrative purposes only and do not reflect actual routes. For information on project status and routes, see [atc-projects.com](http://atc-projects.com).

# SOUTH CENTRAL/SOUTHWEST WISCONSIN AND NORTH CENTRAL ILLINOIS

## Zone 3



### Transmission system characteristics in Zone 3

ATC delivers power in Zone 3 with various transmission facilities including:

- Columbia-North Madison 345-kV lines,
- Columbia-Rockdale 345-kV line,
- Paddock-Rockdale 345-kV line,
- Paddock-Wempletown 345-kV line,
- Rockdale-Wempletown 345-kV line,
- Rockdale-Cardinal 345-kV line, and
- 138-kV facilities from Nelson Dewey, around the Madison area, and in the northwest and southeast portions of Zone 3.

### Transmission system limitations in Zone 3

In our analysis of Zone 3, we identified a number of transmission facility overloads. These overloads are due to new generation in the Janesville and Darlington areas. In addition, other emerging issues resulting in facility overloads include steady growth in certain areas and different generation dispatches. The most severe limitations occur during both peak and off-peak periods.

### ELECTRIC SYSTEM OVERVIEW

#### Increases expected in population, employment

Population in Zone 3 is projected to grow about 0.8 percent annually between now and 2026, and employment is projected to grow about 1.3 percent each year for the same time period. Dane County is projected to realize the largest increase in population and employment. Dane County is also projected to have the highest growth rate in population while Dodge County is projected to have the highest growth rate in employment.

#### Electricity usage

Electric load is forecasted to grow approximately 0.9 percent annually through 2027 in Zone 3.



### COUNTIES INCLUDED IN ZONE 3 – SOUTH CENTRAL/SOUTHWEST WISCONSIN AND NORTH CENTRAL ILLINOIS

Columbia | Crawford (southern portion) | Dane | Dodge | Grant | Green | Iowa | Lafayette  
Jefferson | Richland | Rock | Sauk | Walworth | Winnebago, Ill. (northern portion)

# SOUTH CENTRAL/SOUTHWEST WISCONSIN AND NORTH CENTRAL ILLINOIS

## Zone 3

### TRANSMISSION PROJECTS IN ZONE 3

The most notable planned, proposed and provisional network projects and asset renewal projects in Zone 3, along with their projected year of completion and the factors driving the need for the projects, are listed on page 23.



PROJECT DESCRIPTION	IN-SERVICE YEAR	NEED DRIVER
<b>Planned Projects</b>		
1 Dam Heights-Portage 69-kV line rebuild	2017	Condition and performance
2 Badger Coulee: Briggs Rd-North Madison-Cardinal 345-kV line construction	2018	Reliability, economics and public policy
3 Spring Valley-North Lake Geneva 138-kV line construction	2019	Overloads and low voltages, provide network service
4 Boscobel-Lone Rock 69-kV line rebuild	2019	Condition and performance
5 Portage-Staff-North Randolph 138-kV line rebuild	2020	Condition and performance
6 Sheepskin-Stoughton 69-kV line rebuild	2020	Condition and performance
<b>Proposed Projects</b>		
7 J395: Darlington-North Monroe 138-kV line X-49, uprate	2019	G-T interconnection
8 J390: Kittyhawk Substation, new G-T interconnection	2019	G-T interconnection
9 Northern Lights Substation, new T-D interconnection	2020	T-D interconnection
10 Cardinal-Hickory Creek 345-kV line construction	2023	Reliability, economics and public policy
<b>Provisional Project</b>		
11 Cardinal-Blount 138-kV line construction	2029	Overloads and low voltages

Additional projects may be found in the full 10-Year Assessment at [atc10yearplan.com](http://atc10yearplan.com).

#### SYSTEM SOLUTIONS KEY

**SUBSTATION KEY**

- SS** New substation  
Supports transmission system expansion
- SM** Substation modifications  
Upgrades equipment ratings to avert facility overloads
- T** Transformer  
Supports local growth and improves voltage levels
- C** Capacitor bank  
Relieves low voltages or high voltages
- T-D** T-D interconnection  
Supports local growth

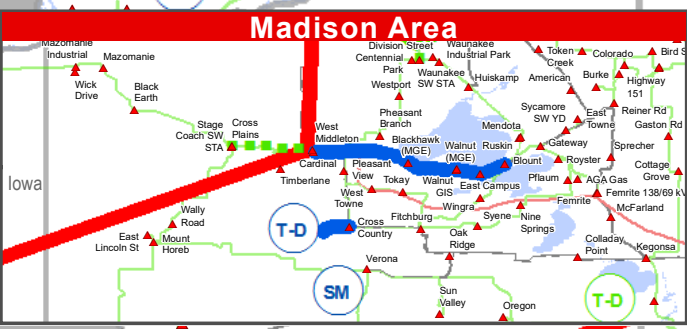
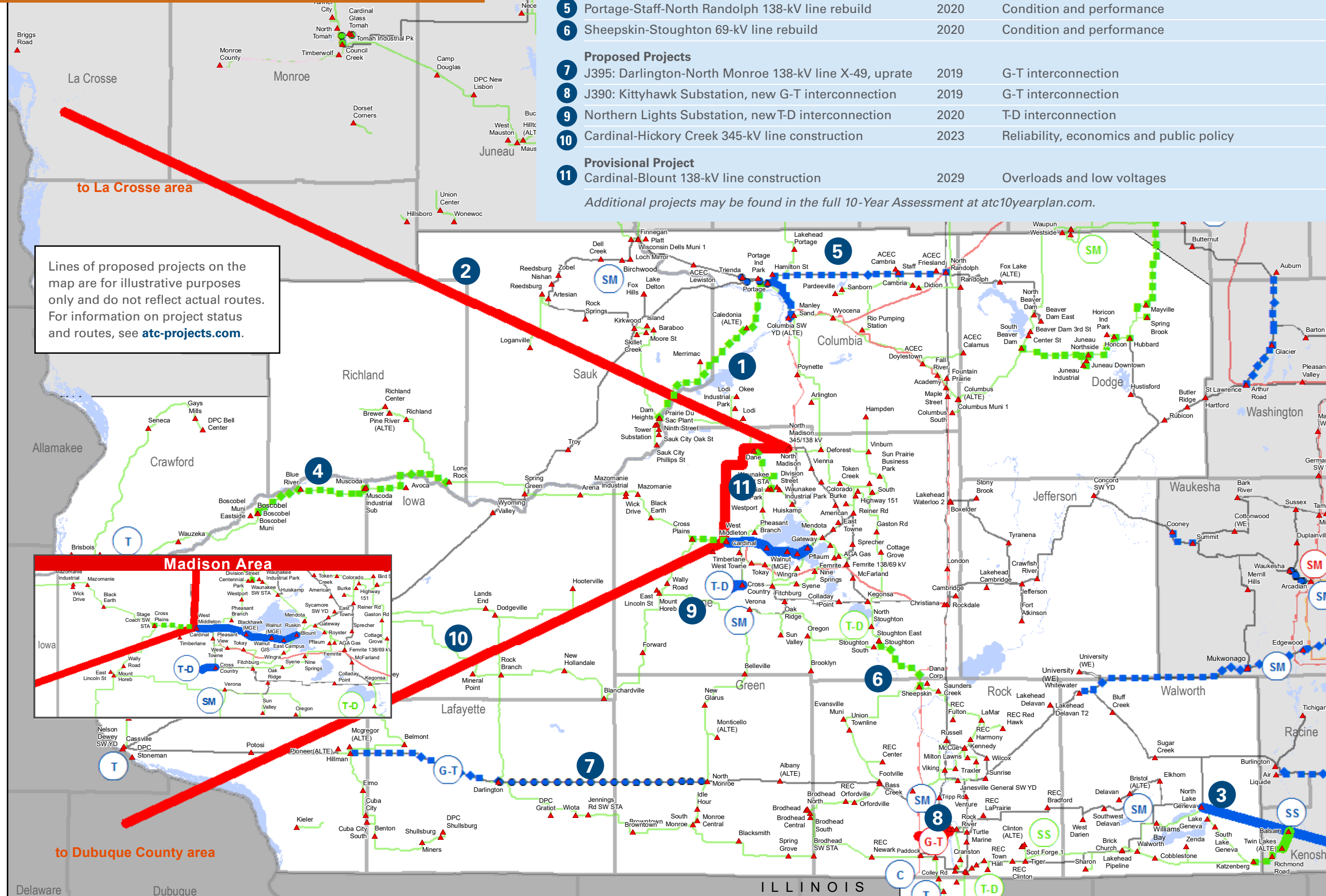
**TRANSMISSION LINE KEY**

- 345-kV transmission line
- 115-, 138- or 161-kV transmission line
- 69-kV transmission line
- Rebuilt 115- or 138-kV transmission line
- Rebuilt 69-kV transmission line
- 115- or 138-kV transmission line rating upgrade
- 69-kV transmission line rating upgrade

**EXISTING TRANSMISSION LINES KEY**

- 69 kV
- 115 kV
- 138 kV
- 161 kV
- 230 kV
- 345 kV

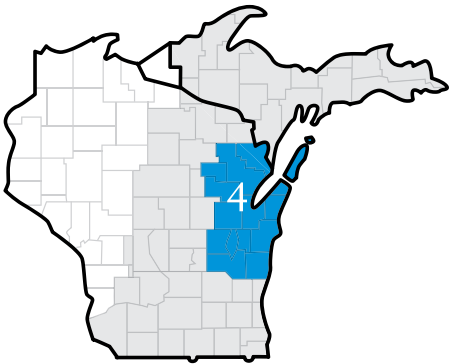
Lines of proposed projects on the map are for illustrative purposes only and do not reflect actual routes. For information on project status and routes, see [atc-projects.com](http://atc-projects.com).



to Dubuque County area

# NORTHEAST WISCONSIN

## Zone 4



### Transmission system characteristics in Zone 4

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

- four 345-kV lines extending from the Point Beach Nuclear Plant,
- two 345-kV lines extending from the Edgewater Power Plant to South Fond du Lac and Cedarsauk,
- two additional 345-kV lines connecting the South Fond du Lac Power Plant to Columbia and Fitzgerald,
- four 345-kV lines connecting the Gardner Park, Werner West, Morgan, and Plains Substations,
- four 345-kV lines from North Appleton to Kewaunee, Fox River, Werner West and Fitzgerald, and
- a 138-kV network throughout the zone.

### Transmission system limitations in Zone 4

In our analysis of Zone 4, we found high voltages in Calumet County and impending low voltages in Brown County. In addition, other ongoing studies have identified several voltage and thermal limitations. The most severe limitations occur during both peak and off-peak periods.

### ELECTRIC SYSTEM OVERVIEW

#### Increases expected in population, employment

Population in Zone 4 is projected to grow at 0.6 percent annually between now and 2026. Employment is projected to grow at 1.0 percent annually between now and 2026. Brown County is projected to realize the largest increase in population and employment. Calumet County is projected to have the highest growth rate in population, and Sheboygan County is projected to have the highest growth rate in employment.

#### Electricity usage

Peak electric demand typically occurs during the summer months, although the northern portion of Zone 4 typically experiences nearly equal summer and winter peaks. Paper mills and foundries in and around the Green Bay and Appleton metropolitan areas are some of the largest electricity users in the zone.

Electric load is forecasted to grow at approximately 0.4 percent annually through 2027. Also, locally generated electricity is declining in the area with smaller, coal-fired generators most at risk. This includes generation owned by industries, municipalities and utilities.

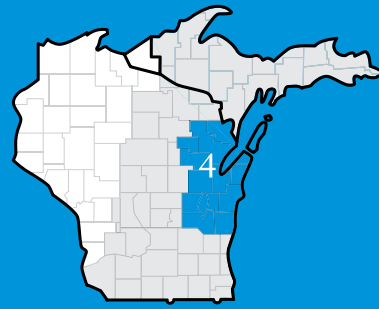


### COUNTIES INCLUDED IN ZONE 4 – NORTHEAST WISCONSIN

Brown | Calumet | Dodge (northeastern 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)

# NORTHEAST WISCONSIN

## Zone 4



### TRANSMISSION PROJECTS IN ZONE 4

The most notable planned, proposed and provisional network projects and asset renewal 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 Creekview Substation: 138-kV line construction to serve T-D interconnection	2017	T-D interconnection
2 Bay Lake: North Appleton-Morgan 345-kV and 138-kV line construction	2018	Overloads and low voltages
3 Branch River 345-kV Substation construction	2018	Accommodate new generation
4 Ogden St.-Bayshore 69-kV line construction	2018	Provide network service
5 Edgewater Substation, reconfiguration	2020	Condition and performance
6 Cedar Ridge Wind Generation-Mullet River 138-kV line rebuild	2020	Condition and performance
7 Goodman-Caldron Falls 69-kV line rebuild	2020	Condition and performance
8 Butte des Morts-Neevin-Woodenshoe-Mears Corners-Sunset Point 138-kV line rebuild	2021	Condition and performance
9 Finger Road-Canal 69-kV line rebuild	2021	Condition and performance
<b>Provisional Projects</b>		
10 Morgan-Plains 345-kV loop into new Thunder 345-kV substation.	2023	Overloads and low voltages
11 Morgan-Thunder 138-kV project	2023	Overloads and low voltages
12 Aviation-North Fond du Lac 138-kV line rebuild	2025	Overloads

*Additional projects may be found in the full 10-Year Assessment at [atc10yearplan.com](http://atc10yearplan.com).*

**SUBSTATION KEY**

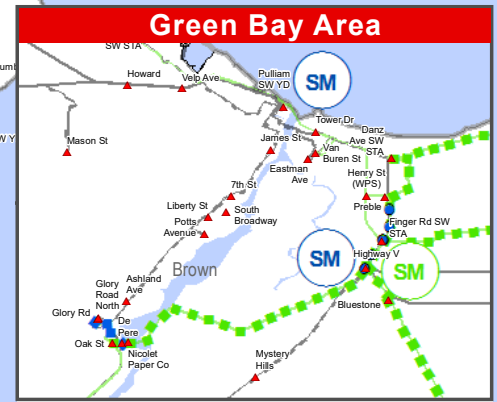
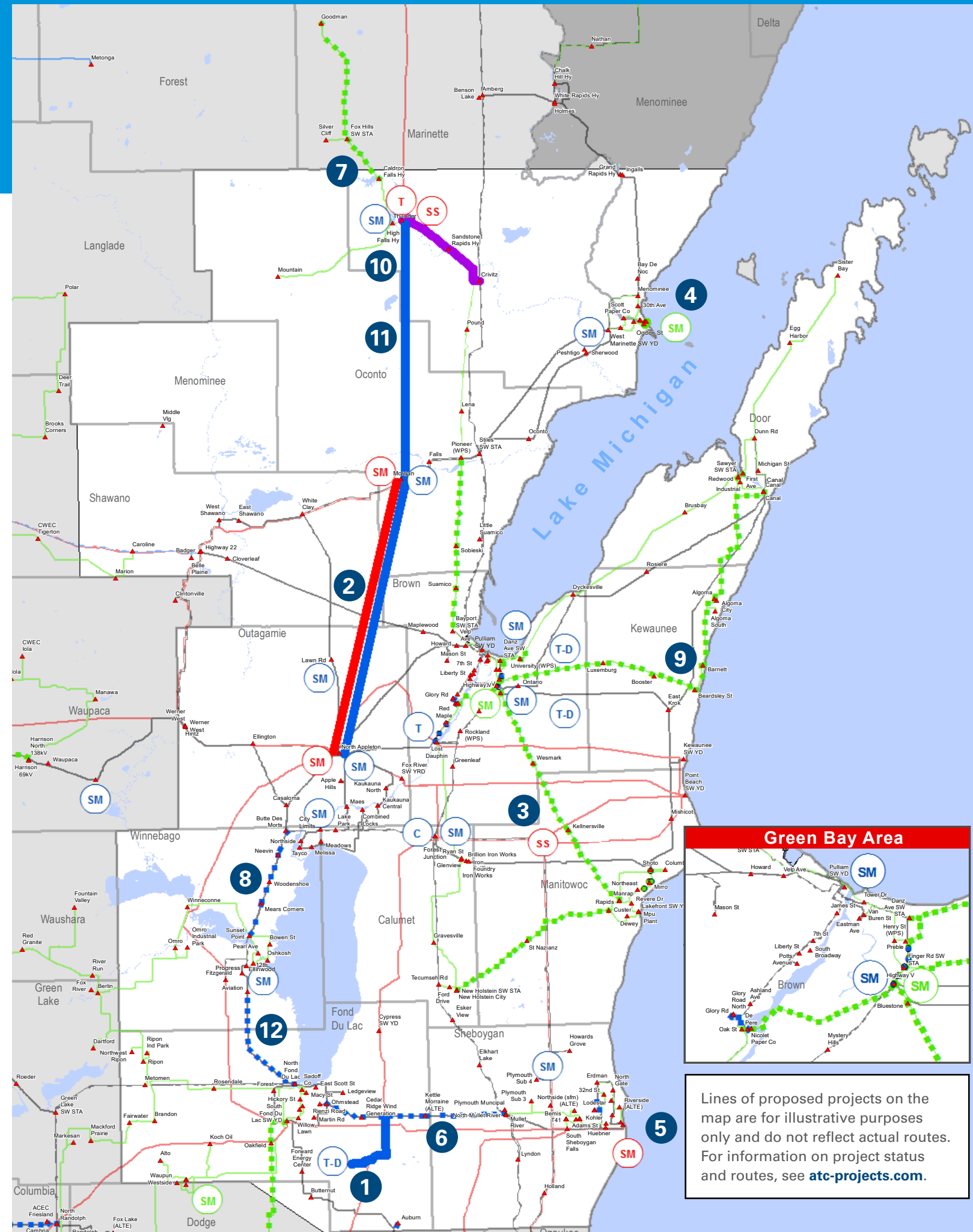
- SS** New substation  
Supports transmission system expansion
- SM** Substation modifications  
Upgrades equipment ratings to avert facility overloads
- T** Transformer  
Supports local growth and improves voltage levels
- C** Capacitor bank or reactor  
Relieves low voltages or high voltages
- T-D** T-D interconnection  
Supports local growth

**TRANSMISSION LINE KEY**

- 345-kV transmission line
- 115-, 138- or 161-kV transmission line
- 69-kV transmission line
- Transmission line voltage conversion
- Rebuilt 115- or 138-kV transmission line
- 115- or 138-kV transmission line rating upgrade
- 69-kV transmission line rating upgrade

**EXISTING TRANSMISSION LINES KEY**

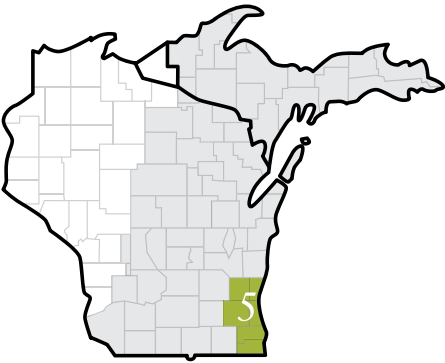
- 69 kV
- 161 kV
- 115 kV
- 230 kV
- 138 kV
- 345 kV



Lines of proposed projects on the map are for illustrative purposes only and do not reflect actual routes. For information on project status and routes, see [atc-projects.com](http://atc-projects.com).

# SOUTHEAST WISCONSIN

## Zone 5



### Transmission system characteristics in Zone 5

ATC delivers power in Zone 5 with various transmission facilities including:

- the southern portion of 345-kV lines from Point Beach and Edgewater,
- the Saukville, Arcadian, Granville, Oak Creek, and Racine 345 / 138-kV substations,
- the transmission lines emanating from the Pleasant Prairie and Oak Creek power plants,
- 230-kV facilities near Milwaukee, and
- a significant 138-kV network in the Milwaukee area, a portion of which is underground.

### Transmission system limitations in Zone 5

Transmission system performance issues in Zone 5 include heavy market flows to and from the south, resulting in high 345-kV and 138-kV line loadings and the need to monitor potential multiple contingency conditions.

### ELECTRIC SYSTEM OVERVIEW

#### Increases expected in population, employment

Population in Zone 5 is projected to grow 0.5 percent annually between now and 2026, and employment is projected to grow 1.1 percent in the same time period. Waukesha County is projected to realize the largest increase in both population and employment. Waukesha County is also projected to have the highest growth rate in employment while Ozaukee County is projected to have the highest growth rate in population.

#### Electricity usage

Peak electric demand typically occurs during the summer months. Large industrial loads in the Milwaukee metropolitan area are among the largest electricity users in the zone.

Electric load is forecasted to grow approximately 0.4 percent annually through 2027.

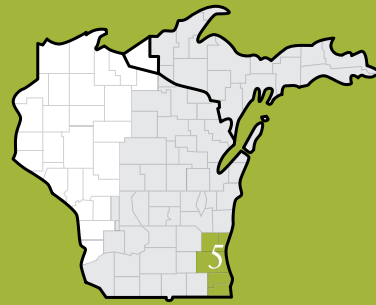


### COUNTIES INCLUDED IN ZONE 5 – SOUTHEAST WISCONSIN

Kenosha | Milwaukee | Ozaukee | Racine | Washington | Waukesha

# SOUTHEAST WISCONSIN

## Zone 5



### TRANSMISSION PROJECTS IN ZONE 5

The most notable planned, proposed and provisional network projects and asset renewal projects in Zone 5, 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 Oak Creek-Hayes 138-kV line 811 upgrade and reconfiguration	2018	Overloads
2 Spring Valley-North Lake Geneva 138-kV line construction	2019	Overloads and low voltages, provide network service
3 Mukwonago-Edgewood-St. Martins 138-kV line rebuild	2019	Condition and performance
4 Racine Substation, reconfiguration	2019	Condition and performance
<b>Proposed Projects</b>		
5 Juneautown Substation, new T-D interconnection	2020	T-D interconnection
6 SE WI Economic Development Interconnection Project*	2020	T-D interconnection
7 Southeastern Wisconsin-Northeastern Illinois Reinforcement Project	2021	Overloads
8 Port Washington-Saukville 138-kV rebuild line 762 to a double circuit	2021	Overloads

\*Project 6, the proposed Southeast Wisconsin Economic Development Interconnection Project, was not mapped when this document was finalized because the project location had not been determined.

Additional projects may be found in the full 10-Year Assessment at [atc10yearplan.com](http://atc10yearplan.com).

**SUBSTATION KEY**

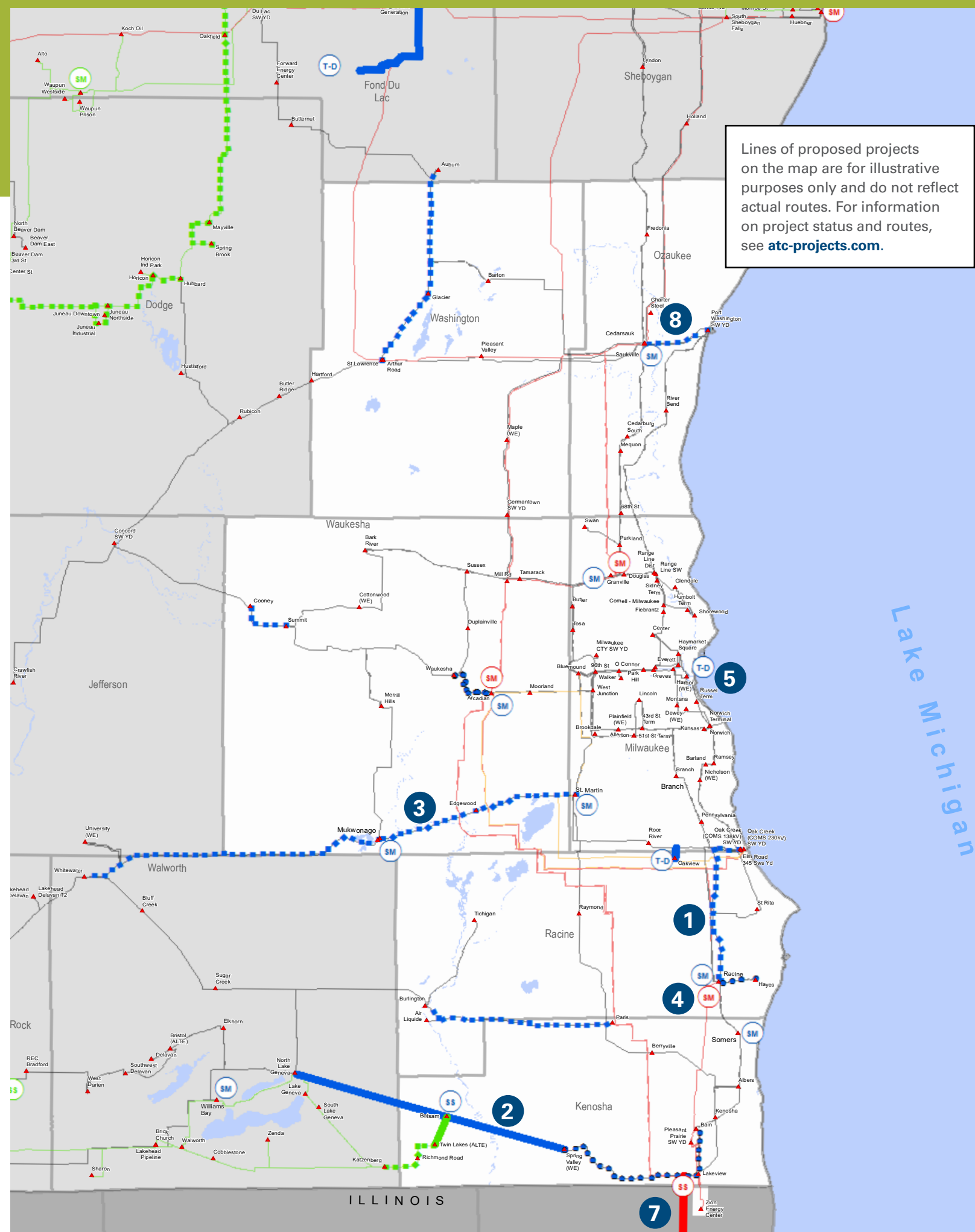
- SS** New substation  
Supports transmission system expansion
- SM** Substation modifications  
Upgrades equipment ratings to avert facility overloads
- T** Transformer  
Supports local growth and improves voltage levels
- C** Capacitor bank or reactor  
Relieves low voltages or high voltages
- T-D** T-D interconnection  
Supports local growth

**TRANSMISSION LINE KEY**

- 345-kV transmission line
- 115-, 138- or 161-kV transmission line
- 69-kV transmission line
- ▬▬▬ Rebuilt 115- or 138-kV transmission line
- ▬▬▬ Rebuilt 69-kV transmission line
- 115- or 138-kV transmission line rating upgrade
- 69-kV transmission line rating upgrade
- 230-kV transmission line rating upgrade

**EXISTING TRANSMISSION LINES KEY**

- ▬ 69 kV
- ▬ 115 kV
- ▬ 138 kV
- ▬ 161 kV
- ▬ 230 kV
- ▬ 345 kV



Lake Michigan





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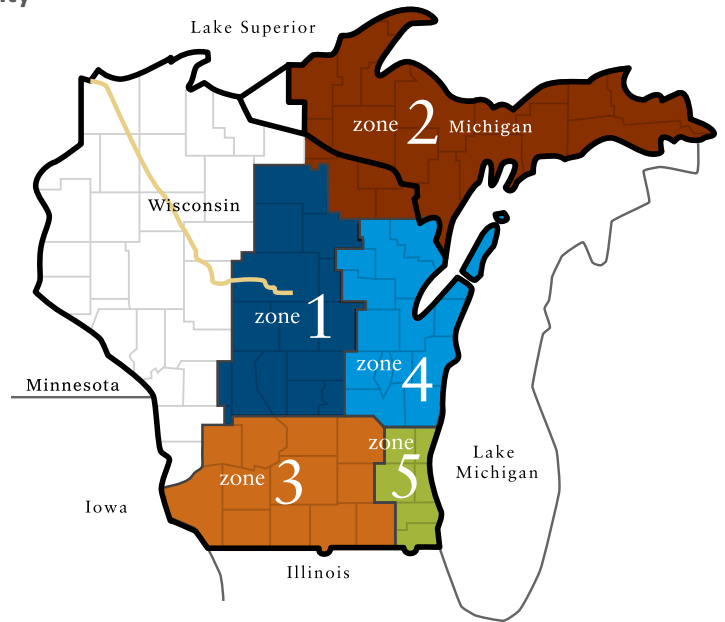
### ATC AT A GLANCE

- Formed in 2001 as the first multi-state, **transmission-only utility**
- Owner and operator of approximately **9,600 miles of transmission line and 554 substations**
- Meeting electric needs of more than **five million people** in 72 counties in four states: Wisconsin, Michigan, Minnesota and Illinois
- **\$4.4 billion** in total assets

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**Toll-free** 866-899-3204  
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More detailed information is available at [atc10yearplan.com](http://atc10yearplan.com)



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**Would you like a speaker from ATC to address your group?  
Give us a call, toll-free, at 866-899-3204, ext. 8679.**

