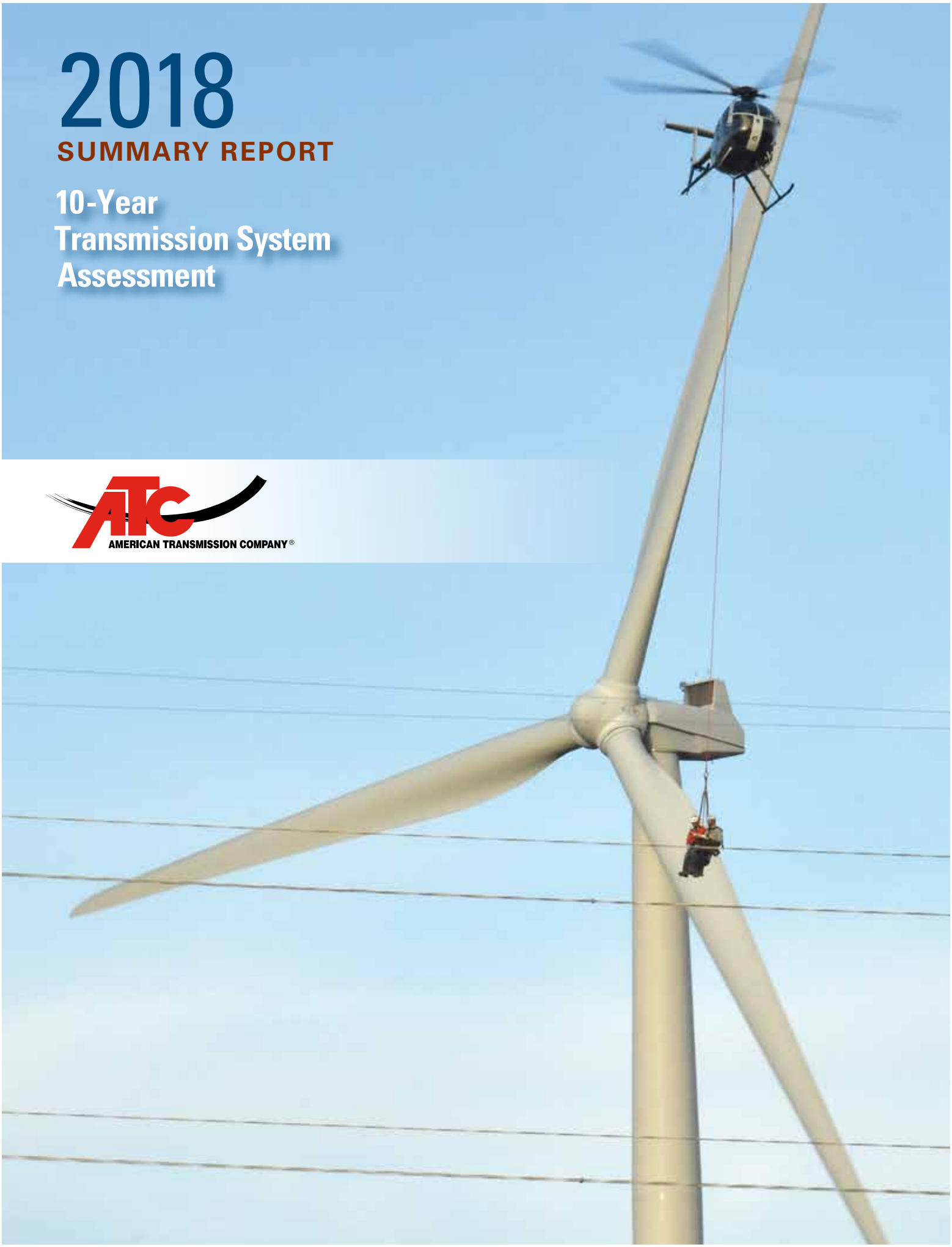
2018
SUMMARY REPORT

10-Year Transmission System Assessment

AMERICAN TRANSMISSION COMPANY®

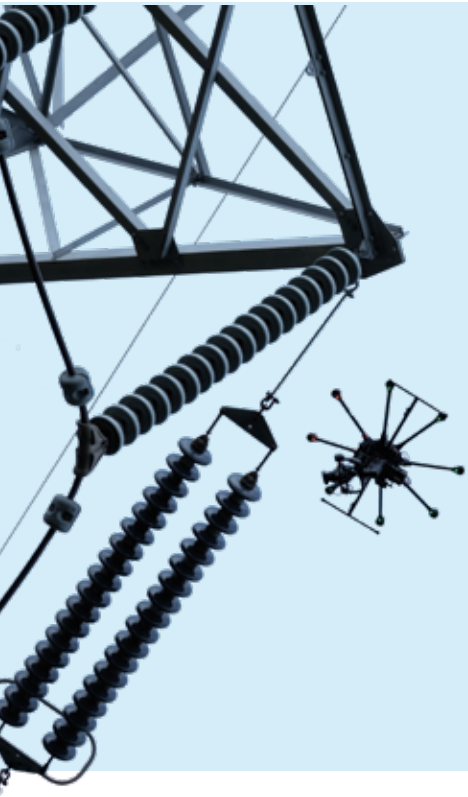


Agility, flexibility needed to plan for

Long-term transmission planning has always been a complex undertaking, but it was relatively consistent in the days of steady load growth and a stable generation mix. But conditions in the early 21st century are no longer as predictable as they were in the past, adding new challenges to the process.

As a transmission-only electric utility, we collaborate with our customers to determine needed replacements, expansions and connections to the grid. Recent changes in generation and the energy marketplace have required us to be flexible and agile in our planning to accommodate customer needs.

In today's marketplace, our customers expect us to respond quickly. In fall 2017, Foxconn selected Wisconsin for its first U.S.-based manufacturing facility for flat-screen technology. The Mount Pleasant Tech Interconnection Project was developed to respond to the needs of a facility that would constitute the largest load at a single substation in ATC's service territory. We filed an application in January to build a new substation and associated transmission lines with the Public Service Commission of Wisconsin, which approved the project in July. Construction will start this fall and the project will be in service in late 2019.



Transmission investments

Projections from past and current Transmission System Assessments

	2014	2015	2016	2017	2018
Specific Network Projects	$1.4B	$1.4B	$1.3B	$0.7B / $1.0B*	**$0.5B**
Regional Multi-Value Projects	$0.5B	$0.5B	$0.5B	$0.4B	**$0.3B**
Asset Maintenance	$1.2B	$1.4B	$1.4B	$1.4B	**$1.5B**
Other Capital Categories	$0.2B / $0.8B	$0.4B / $1.2B	$0.4B / $1.2B	$0.3B / $0.8B	**$0.5B / $1.1B**
Total 10-Year Capital Cost	$3.3B / $3.9B	$3.7B / $4.5B	$3.6B / $4.4B	$2.8B / $3.6B	**$2.8B / $3.4B**

*The Specific Network Projects range in 2017 reflects the fact that Northern Area Reliability Assessment projects in the 10-Year Assessment project list and in the MISO Transmission Expansion Plan database may be replaced by generation being considered in the Midcontinent Independent System Operator generation queue.

changing energy marketplace

Upper Michigan Energy Resources Corp., a subsidiary of WEC Energy Group, proposed in early 2017 to add 180 megawatts of generation at two sites in the Upper Peninsula. The project was approved later that year, and construction began immediately. This allowed us to scale back projects identified in our Northern Area Reliability Assessment. UMERC's two plants are located near existing transmission infrastructure and will require two new substations and only a short segment of transmission line to connect the facilities.

Generation retirements have a large impact on the transmission grid. We anticipate that more than 30 percent of the coal-fired generation in our service territory will be retired by the end of 2019. With the retirement of the Kewaunee Nuclear Station in 2013, we canceled a pair of 50-mile, 138- and 345-kV lines that had been in the planning stages for several years – the change in generation allowed the need to be satisfied instead with a new substation that went into service this year. The announced closing of the Pleasant Prairie Power Plant in southeastern Wisconsin meant that another transmission connection into northern Illinois was no longer needed, and the Wisconsin-Illinois Electric Reliability Project was canceled.

We also work with our customers to evaluate cost-effective non-transmission solutions when examining the condition of our aging assets. Recently, we made the decision to retire a 69-kV line in northeastern Wisconsin that was in poor condition when we determined, with Wisconsin Public Service, that the local distribution company's two substations served by the line could be tied into a nearby rebuilt 138-kV line for about half the cost.

These examples demonstrate the dynamic nature of the electric industry today. That's why it's prudent to conduct an annual review of market conditions and transmission needs. Our 10-year forecast calls for a slight decrease in capital expenditures from last year, with $2.8 to $3.4 billion in system improvements. This document contains a summary of ATC's planning initiatives, and an overview of asset renewal and network-driven projects in each of our planning zones.

For more detailed information, please visit **www.atc10yearplan.com**.

Jim Vespalec
Director, Asset Planning & Engineering

Ron Snead
Vice President, System Planning

Regional and economic planning

ATC is an active participant in a variety of efforts to address regional and inter-regional planning initiatives 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 Midwest Transmission Expansion Plan 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 inter-regional planning stakeholder advisory committee, which typically examines economic projects that could benefit both Regional Transmission Organizations and qualify for cross-border cost-sharing.

Major projects update

BADGER COULEE

This fall, we expect to energize the 180-mile, 345-kV Badger Coulee transmission line, one of MISO's 17 Multi-Value Projects designed to deliver significant benefits to electric consumers throughout the Upper Midwest. A portion of the project from the Cardinal Substation to the North Madison Substation was placed in service in fall 2017. 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 proposals that address the delicate, shifting balance between generation, load and transmission in the northern portion of our service area.

The North Appleton-Morgan project was placed in service in September 2018, ahead of schedule and under budget. It includes 345-kV and 138-kV lines from our North Appleton Substation in Outagamie County to the Morgan Substation in Oconto County, Wis. Both substations have been expanded and additional work was required at 11 other substations. A new substation, Benson Lake in Marinette County, was placed into service in July 2017. It includes a large voltage-control device. North Appleton-Morgan was approved by the Public Service Commission of Wisconsin in May 2015, with an authorized cost of $328 million.

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Major projects update *continued*

The Mount Pleasant Tech Interconnection Project will serve up to 230 MW of load, the largest load connected to a single substation on our system.

CARDINAL – HICKORY CREEK

ATC, ITC Midwest LLC and Dairyland Power Cooperative filed an application in April with the Public Service Commission of Wisconsin for a 102- to 120-mile, 345-kV transmission line connecting Dubuque County, Iowa, to Dane County, Wis.

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

- improving electric system reliability locally and regionally,
- delivering $23.5 million to $350.1 million in net economic benefits, and
- connecting to other 345-kV transmission lines in the Upper Midwest and helping to enable 25 gigawatts of cost-effective renewable energy to be delivered to communities in the region.

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

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 line on 1950s-vintage wood poles 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,
- the update at terminal-end substations of jumpers, selective bus conductor, and disconnect switches.

Construction is scheduled to complete in January 2021.

MOUNT PLEASANT TECH INTERCONNECTION

This project is designed to support Foxconn, which upon completion will be one of the largest manufacturing facilities in the nation with a campus build-out anticipated to be approximately 22-million square feet. The initial projected electric usage would be 200 megawatts at this manufacturing facility, with an additional 30 MW of expected economic growth in the surrounding area. The electric load required for Foxconn's operations will be the largest connected to ATC's transmission system at a single substation.

The project cost is estimated to be about $117 million and includes:

- constructing a new 345-/138-kV Mount Pleasant Substation,
- looping the Racine – Pleasant Prairie 345-kV line into the new substation,
- stringing a new Racine – Pleasant Prairie 345-kV circuit in the vacant position on existing structures and looping this new circuit into the new substation,
- reconfiguring the Racine Substation 345-kV bus,
- rerouting the Pleasant Prairie and Bain 345-kV line,
- uprating the Elm Road – Racine 345-kV line, and
- constructing four new 138-kV underground lines (~400 feet) from the Mount Pleasant Substation to serve a customer-owned substation.

ATC submitted the CPCN application in late January 2018 to the Wisconsin Public Service Commission, which approved the project in July. Construction is underway. All electrical infrastructure has an expected in-service date of late 2019.

MACKINAC – MCGULPIN 138-kV SUBMARINE CABLE REPLACEMENT

ATC has plans to replace the two 4-mile, 138-kV submarine transmission lines connecting the Upper Peninsula of Michigan to lower Michigan at an estimated cost of $105 million.

The Mackinac – McGulpin 138-kV submarine cable replacement project was submitted for MISO review in the MTEP18 planning cycle. The project was developed for the following reasons:

- Two 138-kV submarine circuits were damaged by an anchor strike on April 1, 2018.
- Three working cables have been reconfigured to form one 138-kV circuit.
- The project will restore the eastern UP to the level of reliability it had before the April 1 event.
- The integrity of the remaining cables is of concern.
- The remaining cables contain a mineral-oil based dielectric fluid; a submarine cable failure could result in a fluid leak into Lake Michigan and Lake Huron.

As proposed, the project is estimated to be in service in 2021.

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Major projects update *continued*

BAYPORT – PIONEER

The rebuild of a 69-kV transmission line in northeastern Wisconsin, along with associated substation work, will be submitted to the Wisconsin Public Service Commission in spring 2019 at a cost of $51.7 million. Approximately 22 miles of line on 1910s-vintage wood poles running between Bayport Substation and Pioneer Substation will be rebuilt. The line will serve three distribution substations in Brown County and Oconto County.

The Bayport-Pioneer asset renewal project consists of the following:

- rebuilding the line between Bayport and Pioneer substations with double-circuit structures,
- stringing both Bayport-Pioneer lines, combine, and operate as one line at 138-kV,
- converting Suamico and Sobieski substations to 138-kV operation, and
- de-energizing the Pulliam-Bayport 69-kV section of line.

The project is scheduled to be in service in December 2021.

JUNEAUTOWN INTERCONNECTION

The Juneautown Interconnection Project is a 138-kV distribution-transmission interconnection needed to meet We Energies' growing reliability and economic needs.

The cost of the project is estimated to be $34.1 million and includes:

- a new Juneautown 138 / 13.2-kV gas-insulated substation,
- looping the 138-kV line between Haymarket and Harbor substations to feed the new substation, and
- routing the new line segments through new underground corridors.

An application for a Certificate of Authority was filed with the Public Service Commission of Wisconsin in January 2018 and was approved in August. Construction is scheduled to begin in fall 2019. The facilities are scheduled to be in service approximately 12 months after construction begins.

By focusing on life-cycle cost, our asset management program helps us efficiently maintain and upgrade our older transmission assets.

Our progress

One of ATC's top priorities has always been electric reliability. With that focus, ATC has strengthened the grid to enable 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 and maintenance is crucial to developing the replacement strategy of the assets. Asset renewal is mainly driven by public and worker safety, regulatory compliance, reliability, condition and operational performance.

Due in large part to our asset management efforts, ATC consistently achieves better reliability performance than our industry peers in all voltage classes.

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

Over the past ten years, we have:

- upgraded more than 895 miles of transmission line,
- improved 105 electric substations,
- built 25 new transmission lines (367 miles)
- connected 1,980 MW of new generation at 12 sites,
  - Includes 430 MW of renewable generation at 6 sites
- saved customers millions in reduced energy costs with access to the marketplace and lower line losses,
- 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 creating a smooth-flowing electrical highway to more reliably serve our customers. This involved finding the logical places in our service area to develop transmission projects. Major, network-driven projects accounted for significant investment in our 345-kV system. As we were making our network more interconnected and reliable, we also analyzed 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 assets 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 and if 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 occur at 10-Year Assessment stakeholder meetings and MISO System Planning Meetings.

COMMON NEEDS THAT DRIVE SYSTEM IMPROVEMENTS INCLUDE:

- **New or retiring generation** – changes in the generation impact on the transmission system, the location and amount of power flowing as well as system stability
- **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, resilient 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 transmission system needs.

PROJECT CLASSIFICATIONS

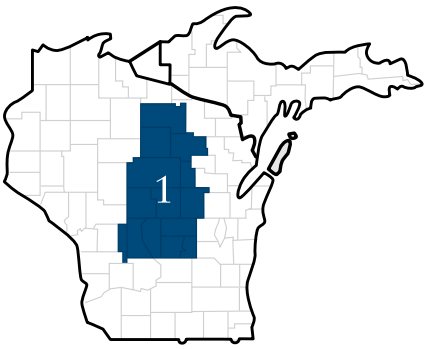
Network and asset renewal projects have targeted in-service dates that are designed to address system limitations and condition needs. The network projects are classified into one of three possible categories – Planned, Proposed or Provisional, depending upon the stage of the project.

	Planned	Proposed	Provisional
Status of ATC planning activities	Studies complete	Studies not complete	Studies not complete
Application for regulatory approval	Application pending or order issued	None	None
Project status	Project in construction planning phase or under construction	Project identified as preferred alternative	Project is not necessarily the preferred 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 the Village of Arpin through Stevens Point extending to the Appleton area,
- 345-kV line extending from Stevens Point, north to Wausau, and east toward Shawano County,
- 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 0.5 percent annually between now and 2027. Employment is projected to grow at 0.9 percent annually between now and 2027. 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

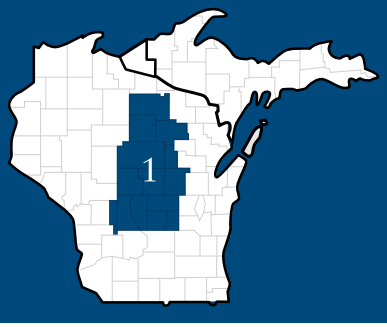
Peak electric demand typically occurs during the summer months, with some winter peaks appearing in the northern portion of the zone. Primary electricity users in Zone 1 include several large paper mills and food processing plants.

Electric load is forecasted to grow approximately 0.4 percent annually through 2028.

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
	Planned Projects		
1	Wild Rose – Harrison 69-kV line (Y-19) partial rebuild	2020	Condition and performance
2	Chaffee Creek – Lincoln Pump Station 69-kV line (Y-18) rebuild	2021	Condition and performance
3	Wautoma – Chaffee Creek 69-kV line (Y-49) rebuild	2021	Condition and performance

*Additional projects may be found in the full 10-Year Assessment at **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 or reactor** — Relieves low voltages or high voltages
- **T-D** — **T-D interconnection** — Supports local growth

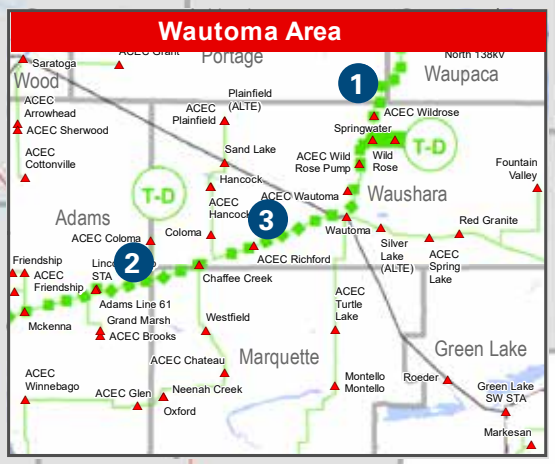
TRANSMISSION LINE KEY

- 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

EXISTING TRANSMISSION LINES KEY

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

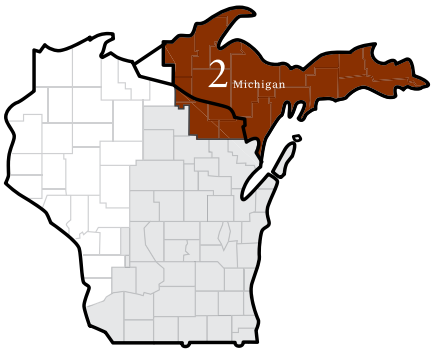
Lines of proposed projects on the map are for illustrative purposes only and do not reflect actual routes. For information on project status and routes, see **atc-projects.com**.


Wautoma Area
Saratoga
Wood
Portage
North 138kV
Waupaca
ACEC Arrowhead
ACEC Sherwood
ACEC Cottonville
Plainfield (ALTE)
ACEC Plainfield
ACEC Wildrose
Springwater
T-D
Sand Lake
ACEC Wild Rose Pump
Wild Rose
Fountain Valley
Hancock
ACEC Hancock
ACEC Wautoma
Waushara
Adams
Coloma
Wautoma
Red Granite
ACEC Coloma
ACEC Richford
Silver Lake (ALTE)
ACEC Spring Lake
Friendship
ACEC Friendship
Chaffee Creek
ACEC Turtle Lake
Adams Line 61
Grand Marsh
Westfield
Mckenna
ACEC Brooks
ACEC Chateau
Marquette
Green Lake
ACEC Winnebago
ACEC Glen
Neenah Creek
Montello
Montello
Roeder
Green Lake SW STA
Oxford
Markesan
1
2
3

Venus
Metonga
Forest
Eastom
Tomahawk - ATC 115kV
Skanawan SW STR
Tomahawk
Summit Lake (WPS)
Lincoln
Grandfather Falls
Grandfather Falls Hydro
Langlade
Oconto
Mountain
Pine (WPS)
Ackley
Antigo
Aurora St
Polar
Maine
Menominee
Deer Trail
Hilltop (WPS)
Sherman St
Cassel
Sunnyvale
Wien SW STA
T Corners
Birnamwood
Brooks Corners
Middle Vlg
Marathon
Kelly
Weston SW YD
Morrison Ave
Gardner Park
Cedar Creek
Wittenberg
CWEC Wittenberg
Stratford
Mosinee Paper Mill
Kronen
Whitcomb
CWEC Tigerton
Shawano
East Shawano
West Shawano
Highway 22
Badger
Cloverleaf
Caroline
Belle Plaine
Marion
Clintonville
Clark
Rozellville
McMillan
Guenther
Groenier
CWEC Dewey
Wildwood (MEWD)
Hume
Mill Creek
Auburndale
Roshoit
Roshoit CWEC
Richfield
Arpin
Northpoint
Portage
CWEC Iola
Iola
Rudolph
Rocky Run
Hoover
Pittsville
Vesper
Sigel
Whiting Ave
Arnott
Amherst Jct
CWEC Sannes
Waupaca
Manawa
Wood
Lakehead Vesper
Consulated Water Power (rrn)
West Wisconsin Rapids
Okray
Plover
Coyne St
Sheridan (ALTE)
Harrison North 138kV
Werner West
Hintz
Werner
Outagamie
Wisconsin Rapids
Golden Sands
Hartman Creek
Ellington
Jackson
Port Edwards
Baker St
Vulcan Chem
Hollywood
Saratoga
ACEC Grant
Harrison 69kV
Waupaca
White Lake (WE)
Apple Hill
Casaloma
Butte Des Morts
Northside
Neevin
Tayco
Winnebago
ACEC Arrowhead
ACEC Sherwood
ACEC Plainfield
Plainfield (ALTE)
ACEC Wildrose
Wild Rose
Springwater
Badger West
ACEC Cottonville
Sand Lake
ACEC Wild Rose Pump
Waushara
Fountain Valley
Hancock
ACEC Hancock
ACEC Wautoma
Winneconne
Woodenshoe
Mears Corners
Warrens
Big Pond
Adams
Wautoma
ACEC Spring Lake
Red Granite
Sunset Point
Omro
Bowen St
Pearl Ave
Oshkosh
Tunnel City
Cardinal Glass Tomah
North Tomah
Council Creek
Tomah Industrial Pk
Timberwolf
Monroe County
Monroe
Necedah
ACEC Dellwood
ACEC Coloma
Silver Lake (ALTE)
ACEC Richford
River Run
Ellinwood
Omro Industrial Park
Fox River
Berlin
Fitzgerald
Aviation
Juneau
Friendship
Lincoln Pump STA
ACEC Friendship
Chaffee Creek
Houghton Rock
Adams Line 61
Camp Douglas
Mckenna
Grand Marsh
Westfield
ACEC Brooks
ACEC Turtle Lake
Dartford
Ripon Ind Park
Ripon
Fond Du Lac
Marquette
Green Lake
Northwest Ripon
Roeder
Metomen
Rosendale
Forest
Sadoff Co
Dorset Corners
DPC New Lisbon
DPC Buckhorn
ACEC Quincy
Castle Rock
Hilltop (ALTE)
West Mauston
Mauston
ACEC Chateau
Montello
Montello
Green Lake SW STA
Mercury Marine
Brandon
Fairwater
Markesan
Mackford Prairie
Koch Oil
South Fond Du Lac SW YD
Oakfield
Alto
Lyndon Station
ACEC Winnebago
ACEC Glen
Neenah Creek
Oxford
Union Center
Hillsboro
Wonewoc
DPC Lyndon Station
Endeavor
ACEC Roslin
Waupun Westside
Forward Energy Center
Wisconsin Dells
Wisconsin Dells Muni 2
Wisconsin Dells Muni 1
Platt
Finnegan
Kilbourn
Dell Creek
Loch Mirror
ACEC Lewiston
Lakehead Portage
ACEC Cambria
ACEC Friesland
North Randolph
Fox Lake (ALTE)
Vernon
Reedsburg Nishan
Zobel
Birchwood
Trienda
Hamilton St
Staff
Didion
Randolph
Reedsburg
Artesian
Fox Hills
Lake Delton
Portage Ind Park
Portage
Pardeeville
Sanborn
Cambria
Mayville
Spring Brook
Rock Springs
Island
Baraboo
Kirkwood
Skillet Creek
Loganville
Manley Sand
Wyocena
Caledonia (ALTE)
Columbia SW YD (ALTE)
Rio Pumping Station
Beaver Dam 3rd St
Center St
Beaver Dam East
Horicon Ind Park
Juneau Northside
Horicon
Hubbard
Sauk
Merrimac
ACEC Doylestown
ACEC Calamus
South Beaver Dam
Juneau Downtown
Richland
Poynette
Columbia
Fall River
Fountain Prairie
Academy
Maple Street
Columbus Muni 1
Columbus (ALTE)
Dodge
Juneau Industrial
Hustisford
Butler Ridge
Rubicon
Crawford
Richland Center
Gays Mills
Seneca
DPC Bell Center
Brewer
Richland
Pine River (ALTE)
Okee
Lodi Industrial Park
Lodi
Arlington
Hampden
Columbus South
Dam Heights
Ninth Street
Troy
Sauk City Phillips St
Sauk City Oak St
North Madison 345/138 kV
North Madison
Dane
1
2
3

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 deteriorated 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 2027, 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 Keweenaw County (Michigan) is projected to have the highest growth rate in employment.

Electricity usage

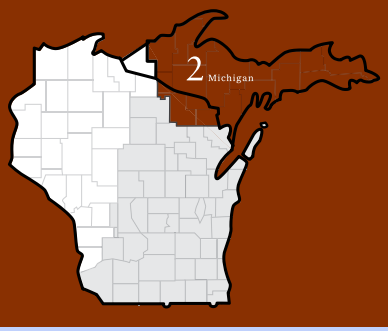
Zone 2 typically experiences peak electric demand during the winter months. Ore mining and paper mills are the largest electricity users in the zone.

In the recent past, there have been some load reductions in Zone 2. From these reduced levels, electric load is forecasted to increase by 0.4 percent annually through 2028. 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.

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

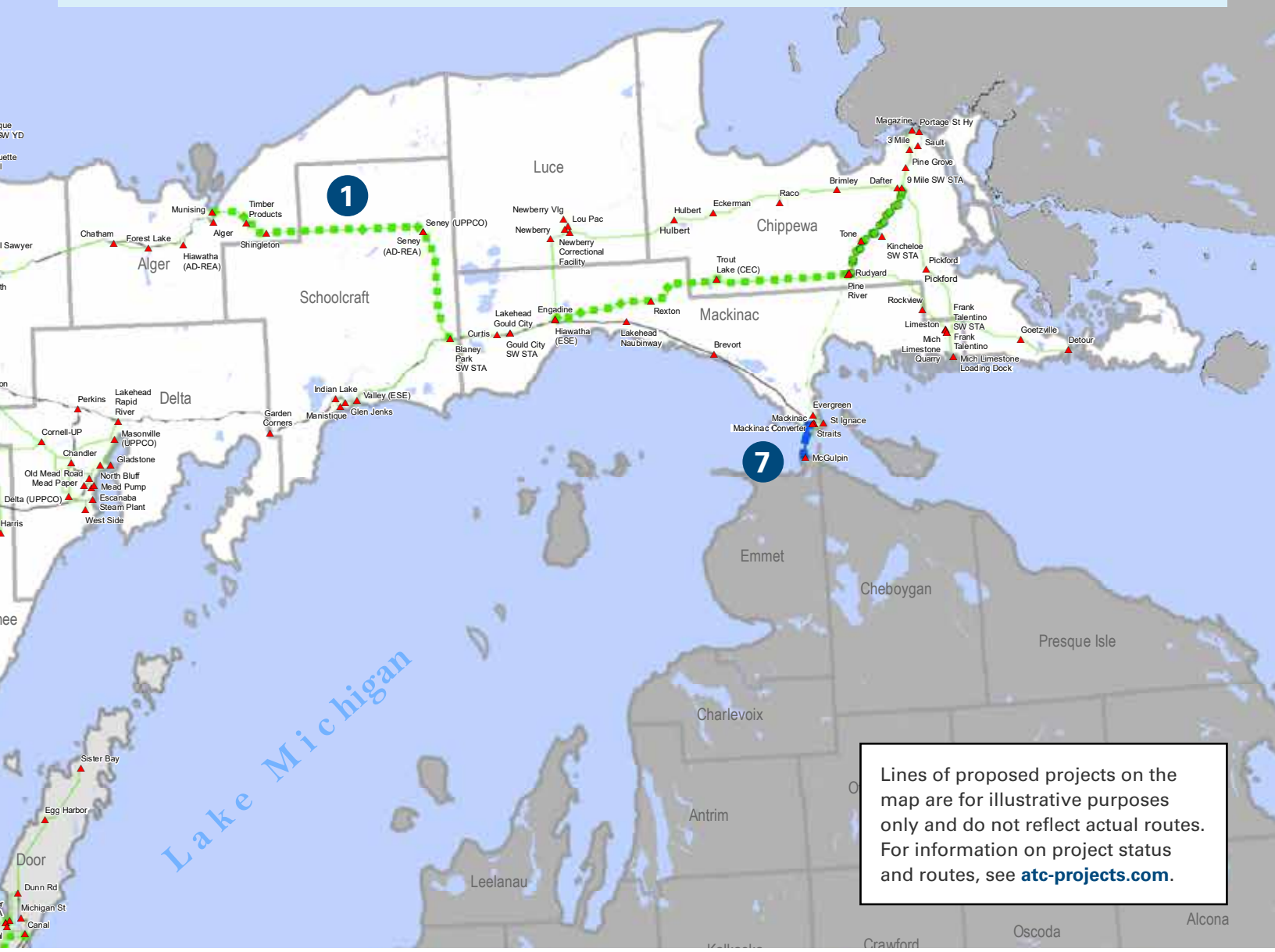
- 345-kV transmission line
- 115-, 138- or 161-kV transmission line
- 69-kV transmission line
- Transmission line voltage conversion
- Rebuilt 115- or 138-kV transmission line
- Rebuilt 69-kV transmission line
- 115- or 138-kV transmission line rating upgrade
- 69-kV transmission line rating upgrade

EXISTING TRANSMISSION LINES KEY

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

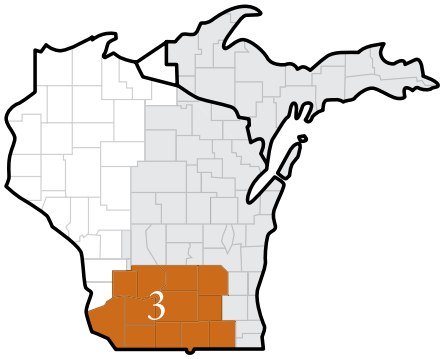
	PROJECT DESCRIPTION	IN-SERVICE YEAR	NEED DRIVER
	Planned Projects		
1	Munising-Blaney Park 69-kV line (Inland) rebuild	2019	Condition and performance
2	J703: Huron Substation, new G-T interconnection	2019	G-T interconnection
3	J704: Silver River Substation, new G-T interconnection	2019	G-T interconnection
4	Plains – Arnold 138-kV uprate	2019	Network integration transmission service request
	Proposed Project		
5	J711-Silver River Substation, network upgrades	2020	G-T interconnection
	Provisional Projects		
6	Lakota – Winona 138-kV conversion	2021	Overloads and low voltages
7	Mackinac – McGulpin 138-kV submarine cables (9901, 9903), replacement	2021	Condition

Additional projects may be found in the full 10-Year Assessment at ***atc10yearplan.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 2027, 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 and employment.

Electricity usage

Electric load is forecasted to grow approximately 0.7 percent annually through 2028 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.

SYSTEM SOLUTIONS KEY

SUBSTATION KEY

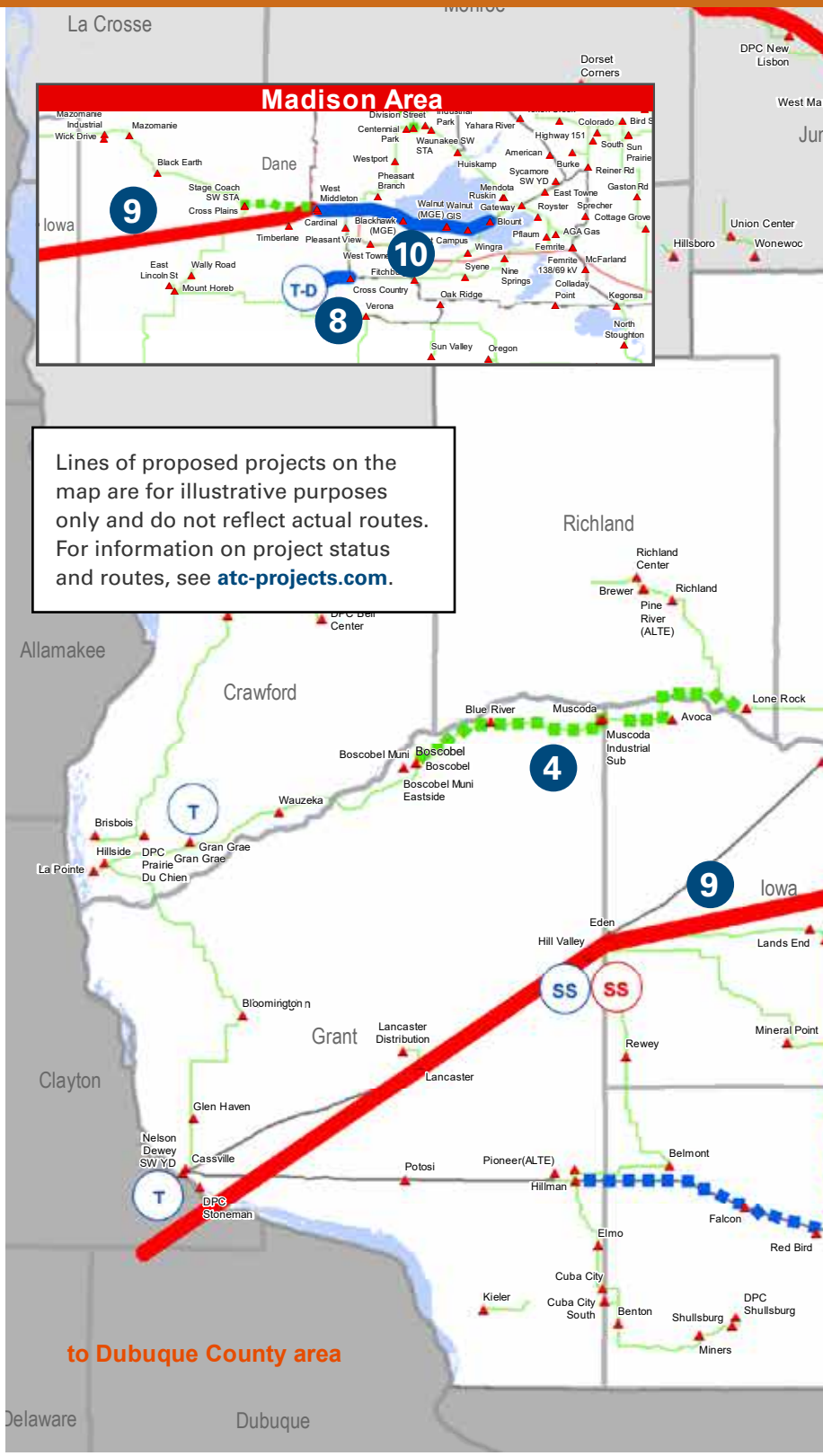
- **SS** — **New substation** — Supports transmission system expansion
- **SM** — **Substation modifications** — Upgrades equipment ratings to avert facility overloads
- **T** — **Transformer** — Supports local growth and improves voltage levels
- **C** — **Capacitor bank** — Relieves low voltages or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

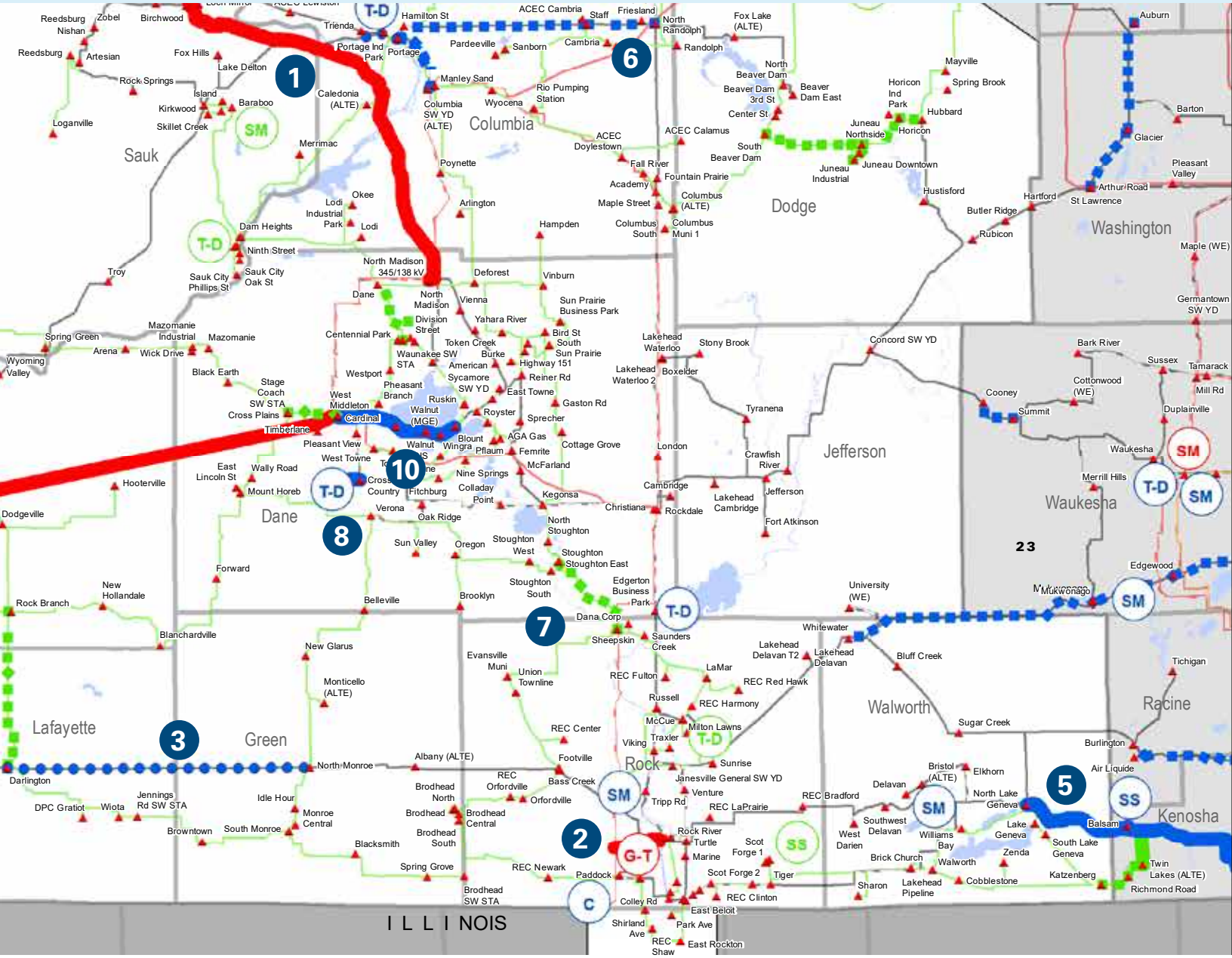
- 69 kV
- 115 kV
- 138 kV
- 161 kV
- 230 kV
- 345 kV



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**.

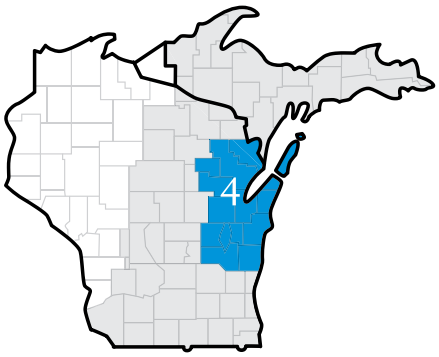
	PROJECT DESCRIPTION	IN-SERVICE YEAR	NEED DRIVER
	Planned Projects		
1	Badger Coulee: Briggs Rd – North Madison – Cardinal 345-kV line construction	2018	Reliability, economics and public policy
2	J390: Kittyhawk Substation, new G-T interconnection	2019	G-T interconnection
3	J395: Darlington – North Monroe 138-kV line (X-49), Uprate	2019	G-T interconnection
4	Lone Rock – Boscobel 69-kV line (Y-124) rebuild	2019	Condition and performance
5	Spring Valley – North Lake Geneva 138-kV line construction	2019	Overloads and low voltages, provide network service
6	Portage – Staff – North Randolph 138-kV lines (X-6), (X-98), rebuild	2020	Condition and performance
7	Sheepskin – Stoughton 69-kV line (Y-12) rebuild	2021	Condition and performance
	Proposed Projects		
8	Northern Lights Substation, new T-D interconnection	2020	T-D interconnection
9	Cardinal – Hickory Creek 345-kV line construction	2023	Reliability, economics and public policy
	Provisional Project		
10	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**.*



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.

Several area projects are related to the underlying condition and performance of assets in Zone 4.

ELECTRIC SYSTEM OVERVIEW

Increases expected in population, employment

Population in Zone 4 is projected to grow at 0.6 percent annually between now and 2027. Employment is projected to grow at 1.0 percent annually between now and 2027. 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

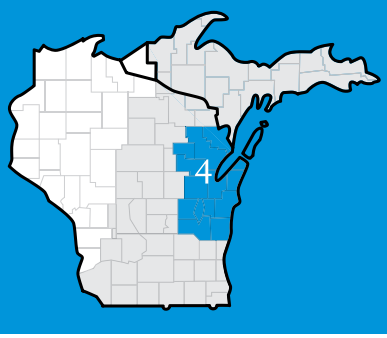
Peak electric demand typically occurs during the summer months, although the northern portion of Zone 4 typically experiences nearly equal summer and winter peaks. Paper mills and foundries in and around the Green Bay and Appleton metropolitan areas are some of the largest electricity users in the zone.

Electric load is forecasted to grow at approximately 0.3 percent annually through 2028. 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
	Planned Projects		
1	Bay Lake: North Appleton – Morgan 345-kV and 138-kV line construction	2018	Overloads and low voltages
2	Cedar Ridge Wind – Mullet River 138-kV line (X-97) rebuild	2020	Condition and performance
3	Edgewater SS, 345-kV bus reconfiguration	2020	Condition and performance
4	Goodman – Caldron Falls 69-kV line (J-88) rebuild	2020	Condition and performance
5	Butte des Morts – Sunset Point 138-kV lines (40321), (80952), (A-79), (MCRG21) rebuild	2021	Condition and performance
6	Finger Rd – Canal 69-kV line (J-10) rebuild	2021	Condition and performance
7	Ogden St. – Bayshore 69-kV line construction	2021	Provide network service
8	Hwy V – Oak St 69-kV line (Z-26) rebuild	2022	Condition and performance
	Proposed Projects		
9	Bayport area – Pioneer, rebuild as double-circuit 138-kV	2021	Condition, performance and provide network service
10	Pioneer – Crivitz (E-83/B-2), retire 69-kV and reconfigure load to 138-kV	2022	Condition, performance, and provide network service

*Additional projects may be found in the full 10-Year Assessment at **atc10yearplan.com**.*

SYSTEM SOLUTIONS KEY

SUBSTATION KEY

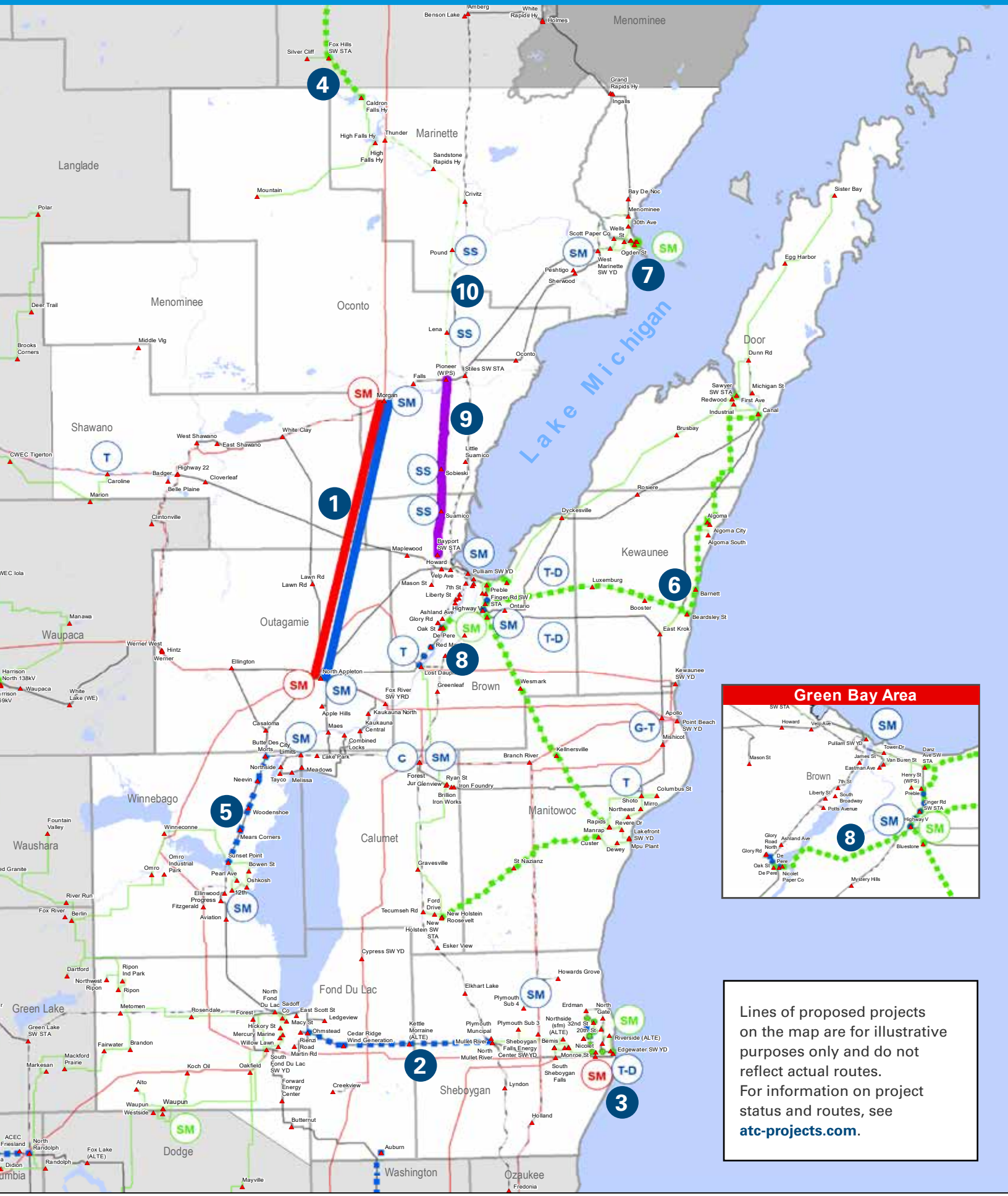
- **SS** — **New substation** — Supports transmission system expansion
- **SM** — **Substation modifications** — Upgrades equipment ratings to avert facility overloads
- **T** — **Transformer** — Supports local growth and improves voltage levels
- **C** — **Capacitor bank or reactor** — Relieves low 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
- 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
- 161 kV
- 115 kV
- 230 kV
- 138 kV
- 345 kV

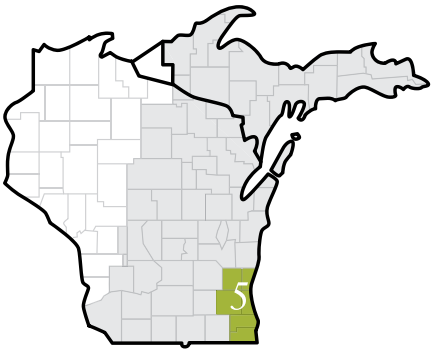


Green Bay Area

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**.

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 Oak Creek power plant,
- 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 2027, 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

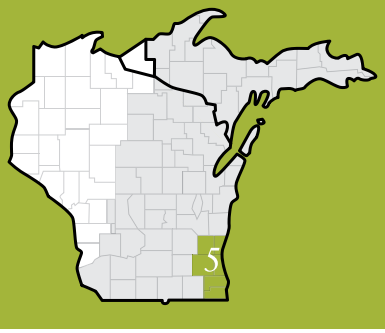
Peak electric demand typically occurs during the summer months. Large industrial loads in the Milwaukee metropolitan area are among the largest electricity users in the zone.

Electric load is forecasted to grow approximately 0.7 percent annually through 2028.

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
	Planned Projects		
1	Mount Pleasant Tech Interconnection Project	2019	T-D interconnection
2	Mukwonago-Edgewood-St. Martins 138-kV lines (3013), (671K61), rebuild	2019	Condition and performance
3	Spring Valley-North Lake Geneva 138-kV line construction	2019	Overloads and low voltages, provide network service
4	Paris-Burlington 138-kV line (8962) rebuild	2021	Condition and performance
5	St. Lawrence-Barton-Auburn 138-kV lines (8032), (9752), rebuild	2022	Condition and performance
	Proposed Projects		
6	Juneautown Substation, new T-D interconnection	2020	T-D interconnection
7	Port Washington-Saukville 138-kV rebuild line 762 to a double circuit	2021	Overloads

*Additional projects may be found in the full 10-Year Assessment at **atc10yearplan.com**.*

SYSTEM SOLUTIONS KEY

SUBSTATION KEY

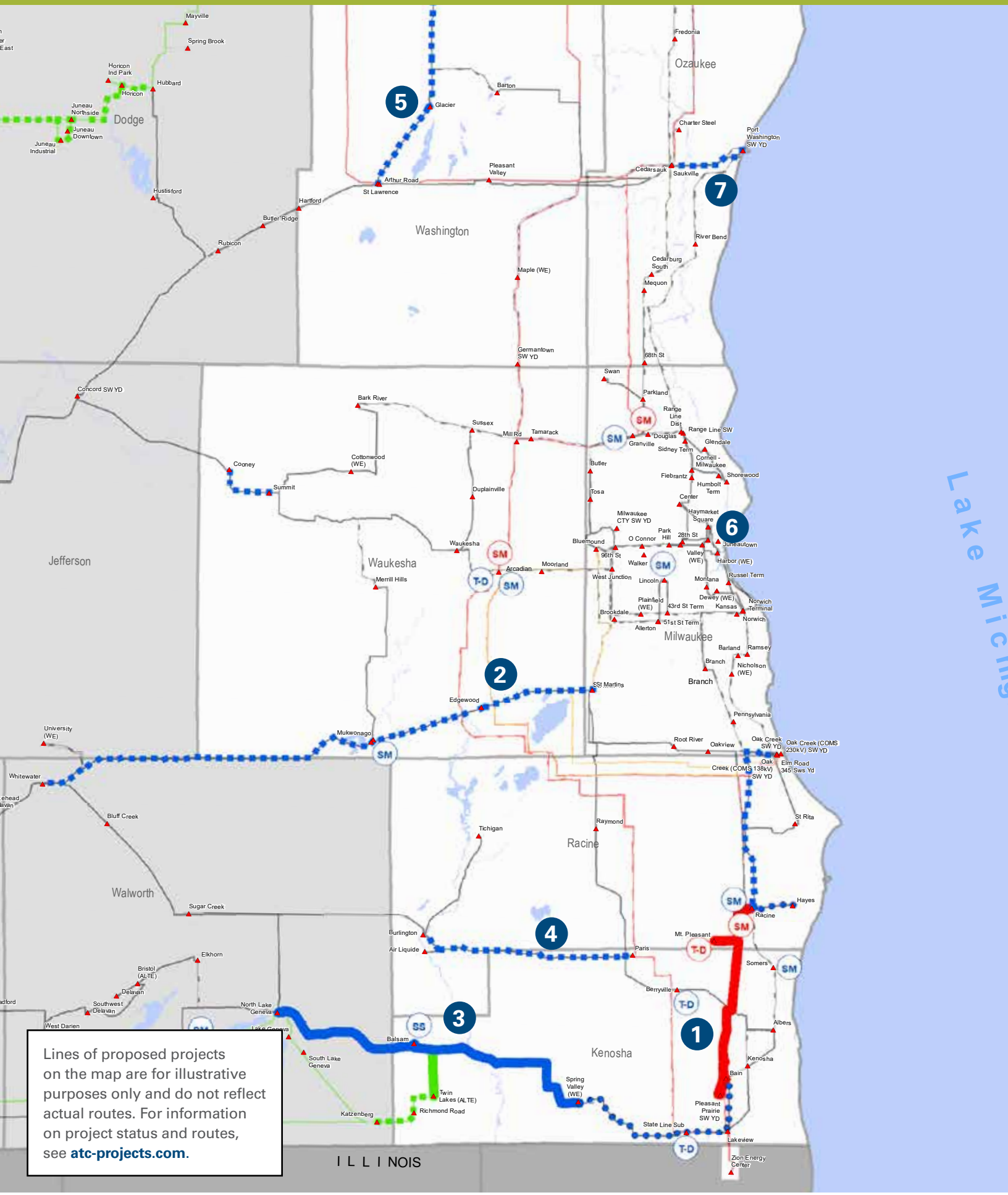
- **SS** — **New substation** — Supports transmission system expansion
- **SM** — **Substation modifications** — Upgrades equipment ratings to avert facility overloads
- **T** — **Transformer** — Supports local growth and improves voltage levels
- **C** — **Capacitor bank or reactor** — Relieves low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

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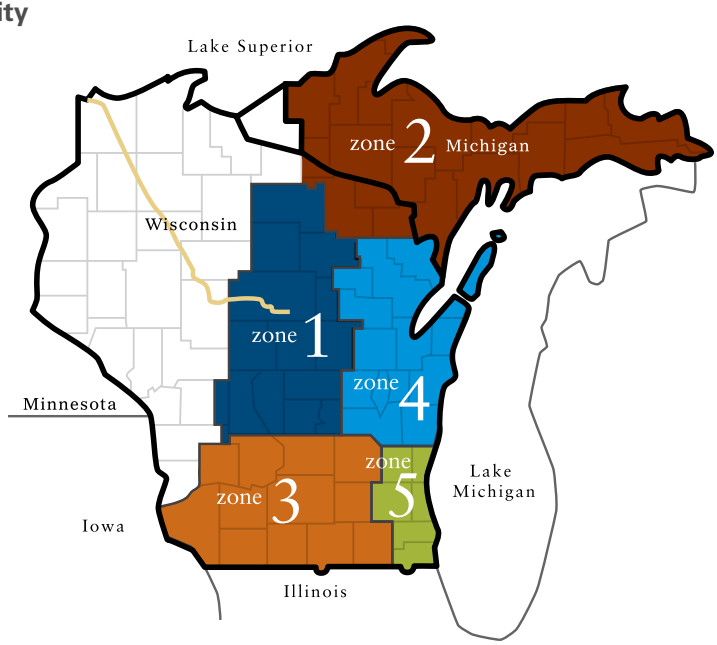
Helping to **keep the lights on,** businesses running and communities strong®

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 more than 560 substations**
- Meeting electric needs of more than **five million people** in 72 counties in four states: Wisconsin, Michigan, Minnesota and Illinois
- **$4.7 billion** in total assets



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