



2006

10-Year Transmission System  
Assessment

# Summary Report

November 2006



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

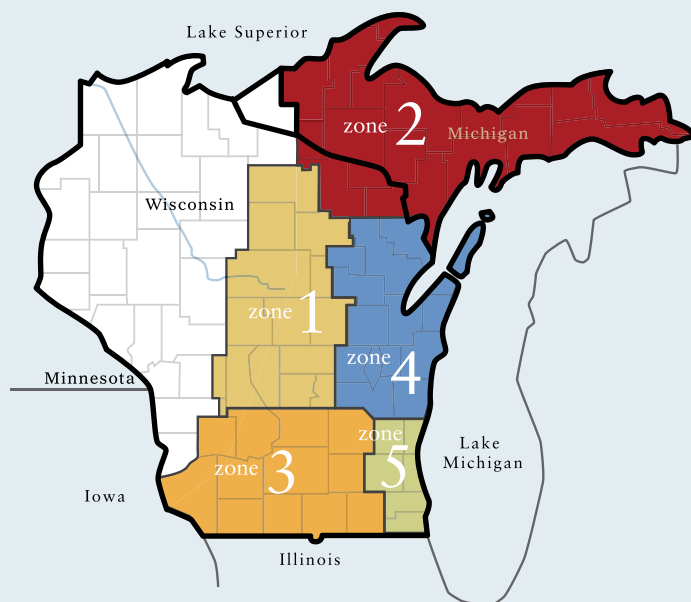
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## ATC at a glance

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

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## Table of contents

2	Understanding electric transmission	
4	Planning to meet future needs	
6	Involving the public in our plans	
9	Plans and proposals for the transmission system by zone:	
	North Central Wisconsin – <b>Zone 1</b>	10
	Michigan’s Upper Peninsula, Northern Wisconsin – <b>Zone 2</b>	14
	South Central, Southwest Wisconsin and North Central Illinois – <b>Zone 3</b>	18
	Northeast Wisconsin – <b>Zone 4</b>	22
	Southeast Wisconsin – <b>Zone 5</b>	26



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## About this Report

### Planning for a reliable future

For the sixth year, we have produced a 10-Year Transmission System Assessment. This assessment, developed by our transmission planners, covers the years 2006 through 2016. Our planners continually are conducting engineering studies on the electric transmission system looking for potential problems that may affect the future performance of the system.

In this year's assessment, our studies identify and prioritize **\$3.1 billion in future projects needed over the next 10 years** to improve the adequacy and reliability of the electric transmission system for our customers and all electricity users in the region we serve. That's in addition to more than \$1 billion that we've invested since 2001.

In this report, you can find out about the vital role transmission plays in our everyday lives, the conditions driving the need for transmission upgrades and expansion, the criteria for siting transmission facilities, considerations for the environment, your opportunities to influence projects, the importance of improving access on the transmission grid, and projects potentially impacting your community.

This Summary Report and our Full Report also are available at [www.atc10yearplan.com](http://www.atc10yearplan.com)



# Understanding electric transmission

The electric transmission system serves as the vital link in bringing power to people, businesses and communities. It connects electric generation with electric distribution systems; it provides access to diverse and more economic sources of power; and it plays a critical supporting role in the vitality and growth of communities and businesses.

## The value of electric transmission to...

**Everyday life** – At home or work, in schools, hospitals, libraries and airports, electricity quietly plays a major part in bringing convenience, automation, efficiency, technology and security to people’s lives and livelihoods.

**Power producers and power users** – The transmission system is the necessary connection between where power is produced and where power is used. The transmission grid is a network of high-voltage wires that link the many sources of electric generation to the lower-voltage electric distribution systems that deliver power to homes and businesses via a local utility.

**The region** – A reliable transmission network provides access to many sources of power, whether they are local or regional. Having multiple paths to get power from producers to consumers lessens the chance that consumers will be negatively affected by planned or unplanned outages. Multiple major transmission lines also give power generators and local utilities the flexibility to access regions where they can sell and buy electricity to help keep overall costs affordable for everyone.

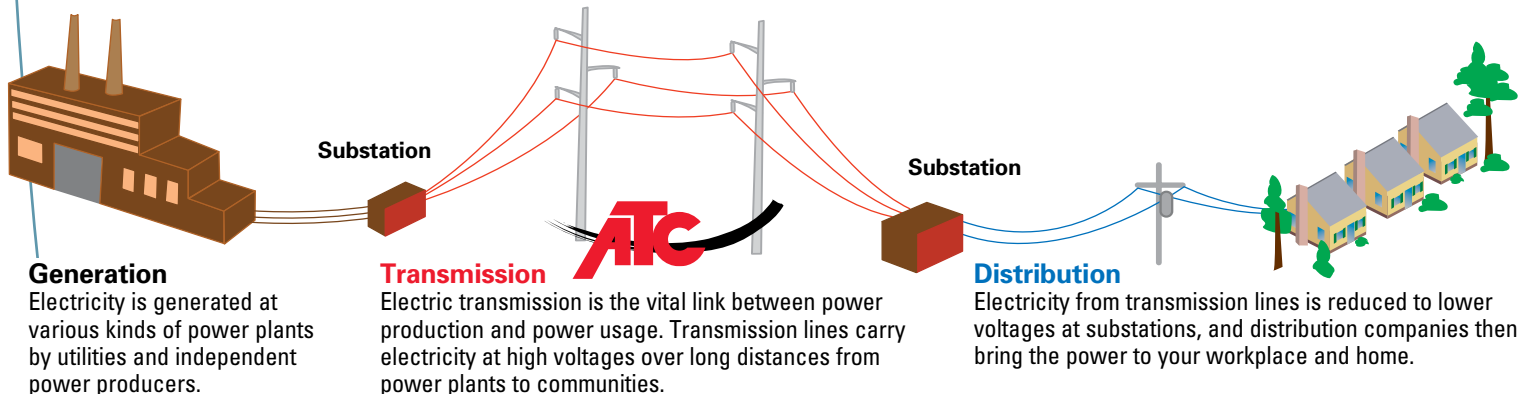
**Green power** – Transmission provides the link to electricity produced by renewable resources such as solar, wind or water. The transmission system moves the electricity from remote areas where it’s generated to populous urban centers where it’s used.

**Economic growth** – Areas growing in the number of residents and businesses must have an adequate supply of power. Electric transmission provides the pathway for the power into communities.

## How the electric system works

The electric system is comprised of three components: generating plants, transmission lines and distribution facilities.

ATC is a public utility that owns and operates the transmission system, which carries electricity from generating plants to load centers or areas where a considerable amount of electricity is needed.





## A responsibility to ensure electric system reliability

As a **public utility** whose infrastructure serves as the link in transporting electricity to millions of energy users, we have **duties and responsibilities** to:

- **operate** the transmission system reliably,
- **assess** the ability of the system to adequately meet current and future needs,
- **plan** system upgrades to meet those needs in the most efficient, effective and economic ways,
- **construct** upgrades in time to meet those needs,
- **maintain** the transmission equipment and surroundings to minimize the risk for failures.

We operate, assess, plan, construct and maintain the transmission system according to regional and national industry criteria designed to result in reliable system performance. Our transmission planners continually assess the performance of the system, focusing particularly on areas of past challenges or future growth. Each year we issue this report to share information on electric system needs and potential projects.

As part of the planning that occurs throughout the year, we proactively seek input from customers, regulators, community officials, residents and others in an effort to strike the right balance between the need for a safe and reliable system, and the potential impacts on costs, landowners and the environment.

Our responsibility as a regional transmission company is to evaluate the transmission needs of many customers, recommend solutions that address multiple problems and lessen impacts, and do so in a cost-effective way. We have an obligation to provide the necessary infrastructure and reliable service required to enable and support the economic development vital to the health of the communities we serve.

### Our progress

Since we were formed in 2001 as a utility solely focused on electric transmission, we have invested more than **\$1 billion** to:

- **upgrade** more than 809 miles of transmission line,
- **improve** 90 electric substations and
- **build** 20 new transmission lines (78 miles)

A more reliable transmission system has given us the ability to:

- reliably deliver up to 12,765 MW of electricity to customers in Wisconsin, Michigan, and Illinois
- maintain a 99.95 percent availability rating of transmission equipment for use in delivering power to customers,
- support 828 MW of new electric usage,
- connect 2,669 MW of new generation at 11 sites, and
- increase the ability of our system to import power by 1,000 MW.





## Planning to meet future needs

A reliable supply of electricity is a necessity in today's society. But the reality is that **the transmission system is operating at the limits of its capabilities** primarily because the system is being used in vastly different ways than it was just ten years ago. Throughout our service territory, increased electricity usage, more power transactions between utilities, new power producers and the condition of existing facilities are driving the need for new and/or upgraded facilities. Our studies have shown that, in general, it is not possible to provide for new usage, or continue to meet existing usage, without new and/or significantly upgraded transmission facilities. Consequently, we have been, and are, developing reinforcements to the transmission system that will serve customers reliably for years to come. We conduct this long-term planning because it generally can take about 8 years to plan, secure approvals, construct and put into service new transmission lines.



### **Transmission system planning considers needs at several levels**

As a transmission-only utility, we take a broad view of the transmission system. In assessing our transmission system, we begin by looking at singular issues or customer requests, and then study how those transmission system needs interact on the system in a broader planning area, then overall on the entire ATC system. We also work closely with the Midwest Independent Transmission System Operator, the regional organization overseeing the regional grid, to **coordinate our infrastructure planning efforts** with those occurring on a regional and national level. Our analysis further considers the needs and impacts of neighboring utilities.

### **Many factors drive expansion plans**

Our planning integrates requests for new transmission service and for interconnection of new power producers and consumers, as well as the needs for supporting continued safe and reliable service and accommodating growth for existing customers. In some cases, more than one factor will signal the need for system expansion. The most common expansion drivers are outlined at right along with a summary of solutions that we have completed and have planned to address transmission system issues.



## Transmission system expansion drivers

### Load growth

Demand for electricity is projected to grow more than 2 percent annually across our service territory through 2016. Load growth in some areas is projected to grow by as much as 8 percent.

### Interconnections

As the capacity of the transmission system is more fully utilized when local growth occurs, the distribution system is stretched to its available limits, requiring new interconnections to the transmission system.

### Transmission service requests (TSRs)

Power producers seeking to buy or sell electricity may make a transmission service request to gain access to the transmission system, although this is not necessarily required in the MISO Day 2 energy market. We evaluate those requests to determine whether the transmission system will operate reliably if the request is granted. If the request can't immediately be granted, we will identify transmission system reinforcements needed to grant the request.

### Transmission service limitations

Various situations exist on the transmission system that limit our ability to grant requests for service. Depending on the frequency, the cost, and/or the risk of reconfiguring the system, it may be prudent to expand the transmission system to avoid these types of events.

### New generation

When a new generating facility is proposed, we conduct an interconnection or a transmission service study to determine if the existing transmission system is adequate to ensure generator stability or reliable transmission service.

### System repair or replacement

Many components of the transmission system will need to be repaired or replaced in the coming years due to condition or obsolescence. In some cases, the need to reconstruct a transmission line may provide opportunities to increase the capacity of those components and provide reliability benefits to the system.

### Economic/strategic system expansion

To remain cost competitive, utilities must have the flexibility to take advantage of trends that have the potential to lower costs. To the extent that low-cost generation development is existing or planned in an adjacent state, it may make sense for a transmission provider to construct transmission facilities that would allow its utility customers to access lower-cost generation.

## Solutions

**160 projects** planned for assuring reliability in response to load growth.

**113** T-D interconnections completed since 2001.

**195** planned over the next 10 years.

**23 projects** to meet transmission service requests completed since 2001.

**41 projects** planned over the next 10 years.

**13** transmission service limitations addressed since 2001.

**22 projects** in response to chronic transmission service limitations planned over the next 10 years.

**10** generators added since 2001 required construction of transmission facilities.

**30 planned** generators may require construction of transmission facilities over the next 10 years.

**9 projects** in our current plans address condition or obsolescence issues.

**Our Access Initiative** is a study of ways to create improved access and improve transfer capability within our system to give our customers ways to lower their costs.



## Involving the public in our plans

From the time a project is proposed to the time construction begins can be up to five years or longer. Before a project application is filed with state regulators or other permitting agencies, we ask for input from the public. **Public examination and discussion can improve projects** by involving the perspectives of those most familiar with impacted areas. We believe that by working with the people and communities we serve, we can find better solutions that provide access to the energy they need.

Depending on the work to be done, potentially impacted parties may include landowners or other community residents in the vicinity of an existing or a proposed transmission project, local public officials, utility regulators and natural resource agencies, environmental or conservation groups, customers and other interested members of the public.

Our public outreach efforts with various stakeholders typically include a variety of interactions such as one-on-one or small group meetings, public open houses, newsletters and other communication activities. The overall goal is to maintain communication with those who may benefit or be impacted by transmission system plans.

### **Determining where lines will be located**

The process of siting transmission facilities is a sensitive one. We follow a **careful and deliberate process** that provides guidance for identifying and analyzing potential options for siting and routing of transmission facilities. Through input received from agencies, the public and other stakeholders, we consider options that are appropriate for the location and issues associated with a particular project, consistent with the requirements of applicable state laws.





State legislation passed in 2003 (Wisconsin Act 89) outlined priorities for considering routes for new transmission lines in Wisconsin. In order of priority, consistent with economic, engineering, reliability and environmental considerations, **ATC must consider using:**

1. Existing utility corridors (like transmission lines)
2. Highway and railroad corridors
3. Recreational trails
4. New corridors

Consideration also must be given to sensitive areas, which generally involve public or environmental issues. **We consult with agencies regarding environmental impacts** of the proposed projects, develop resource protection goals, identify areas of special interest and conduct studies of the potential environmental impacts of transmission line construction.

After considerable input and study, we include a minimum of two possible routes in our applications to state regulators. If a project is approved, the regulators issue a written order that identifies the route the line will take and includes construction methods to meet goals established for the protection of environmental, agricultural and other important features.

## Working with landowners

Following regulatory approval, we begin the process of working with landowners to acquire easements for transmission line projects that will be located on new right-of-way. These easement acquisitions are completed before construction begins.

When a project advances to the construction phase, we must adhere to **specific laws regulating construction practices** for building transmission lines. Permits also may be required from state environmental regulatory agencies, which are part of the certification process. When we begin construction of a project, we factor in the time of the year and weather conditions as we design construction protection methods. For example, construction often is conducted during winter months when the ground is frozen to minimize soil disturbance and impacts to sensitive animal and plant life. We also use construction practices to reduce the spread of invasive species and agricultural pests and diseases.





## Looking beyond our current service area

Under the new wholesale electricity market structure, utilities can buy and sell power from adjacent areas and import the electricity via the transmission system. Having access to regional electricity markets can help **reduce overall electricity costs** and also provide connections to renewable power.

However, ATC's transmission system has been identified by state, regional and federal regulators as heavily constrained, meaning that there are limitations to accessing regional markets. In fact, Wisconsin has just five high-voltage transmission lines linking our system to the regional grid. As a comparison, Illinois has 24 and Minnesota has 18. As a consequence of our constrained system, our customers are unable to reap the economic or reliability benefits that could be achieved through expanded connectivity with adjacent regions and better internal transfer capability.

The focus of our Access Initiative studies has been to evaluate ways to **strengthen transmission ties to areas beyond our service area** that can impact future reliability and lower overall electricity costs. After evaluating five geographic directions, we are pursuing the development of a new high-voltage transmission line, called Rockdale-Paddock, which follows existing rights-of-way from the Dane County area south to Illinois. If approved, this new line would be in service in 2011. With this project and others planned for completion by 2015, we estimate that our import capability will increase from approximately 2,000 MW to approximately 3,000 MW, giving our customers greater access to regional electricity markets.

### Understanding transmission costs

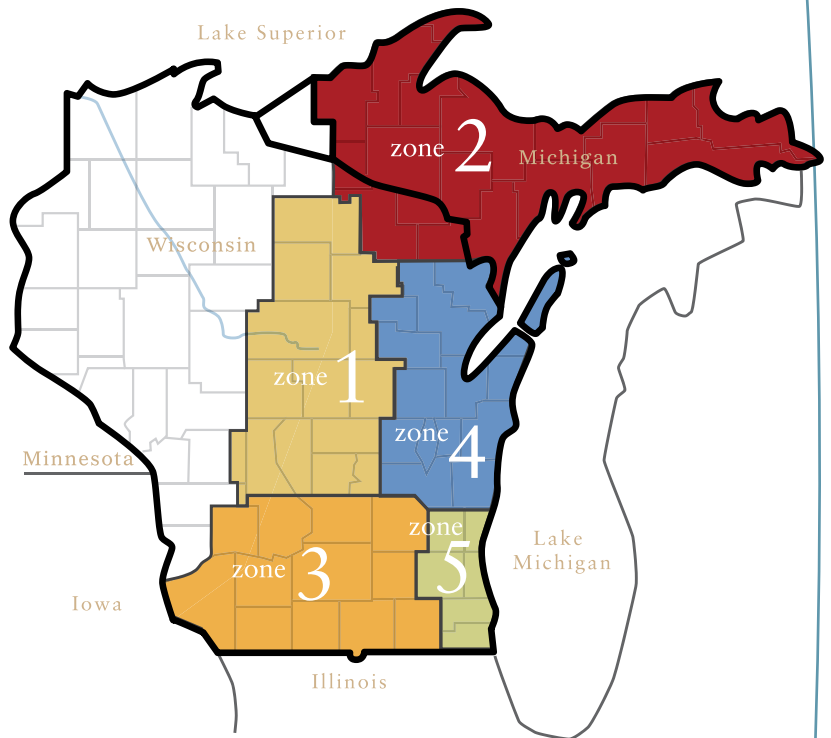
Improving the reliability of the transmission system and expanding its ability to access other markets benefits all electricity users. And it's all electricity users who pay for these improvements. Yet, electricity users don't receive a bill from ATC. Rather, ATC's customers are utilities, independent power producers and power marketers doing business in Wisconsin and Upper Michigan. These entities pay ATC, through the Midwest Independent Transmission System Operator, for transmission delivery service to move their power between generators and distribution systems.

Retail electricity users pay for transmission through their local utility. Transmission costs are approximately **6 percent of the total electric bill**. The transmission costs are proportionately small, in part, because ATC's costs are spread over many utilities' retail customers in this region.



# Plans and proposals for the transmission system

For planning purposes, we divide our service area into **five zones** representing distinct geographic or usage areas. Within each zone (shown right), we compile and assess the transmission system needs.



## Project classifications

Within each zone, we have recommended projects to address system limitations. These projects are classified into one of three possible categories – **Planned, Proposed or Provisional** – depending upon the stage a project may be in. These categories are consistent with those used by the Midwest Independent Transmission System Operator.

	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	Not filed	Not filed
<b>Project status</b>	Project in construction planning phase or under construction	Project identified as preferred alternative	Placeholder project; not necessarily a preferred project alternative
<b>System solution included in power flow models</b>	Project included	Project not included	Project not included

# North Central Wisconsin

## Transmission system characteristics in Zone 1

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

- an east-west 345-kV line from Stevens Point extending to the Appleton area,
- a 345-kV line extending from the Weston Power Plant to Stevens Point,
- a 115-kV network in the northern portion of the zone and
- a 138-kV and 69-kV network in the southern portion of the zone.

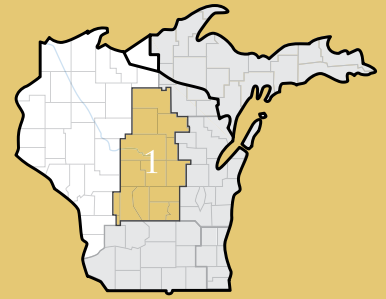
There are a number of transmission system performance issues in Zone 1 including generator instability, voltage instability, overloaded lines and equipment, low system voltages and the inability to import more power from neighboring states. Driving these issues are steady or rapid load growth in certain areas, ATC customer needs to import additional power and the construction of a new power plant in the Wausau area.

## Transmission system limitations in Zone 1

In the analysis of Zone 1 for 2007, we identified low voltages, transmission facility overloads and potential generator instability. In addition, when power imports from Minnesota are high, heavily loaded facilities continue to result in the system operating with very little margin.

The most notable low voltages occur in the area north of Wausau toward the Michigan border (the Rhinelander Loop). The most notable facility overloads occur on 115-kV lines, also in the Rhinelander Loop. We are implementing a number of projects to reinforce the Rhinelander Loop. A new transmission line providing a new source to the area will be needed by 2008, and a second source will be needed beyond the 2020 timeframe.

Accommodating new generation under construction at the Weston Power Plant will require significant system reinforcements in Zone 1. Low voltages and overloaded facilities in and around the Wausau area and in the Berlin-Ripon area will necessitate a combination of reinforcements.



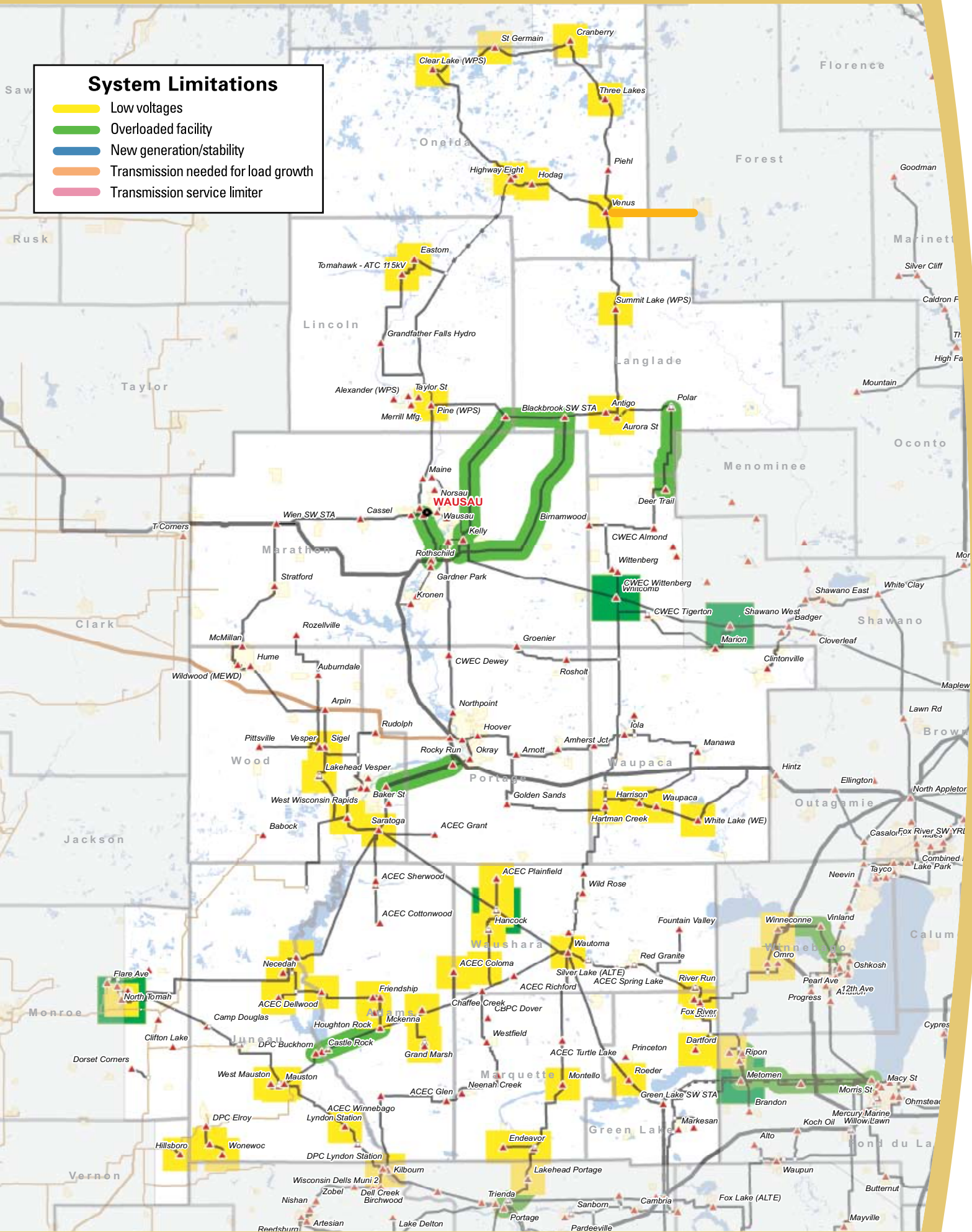
## Zone 1

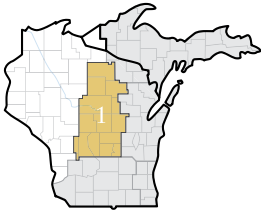
### Zone 1 includes the Wisconsin counties of:

- Adams
- Forest (southwestern portion)
- Fond du Lac (northwest 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

### System Limitations

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



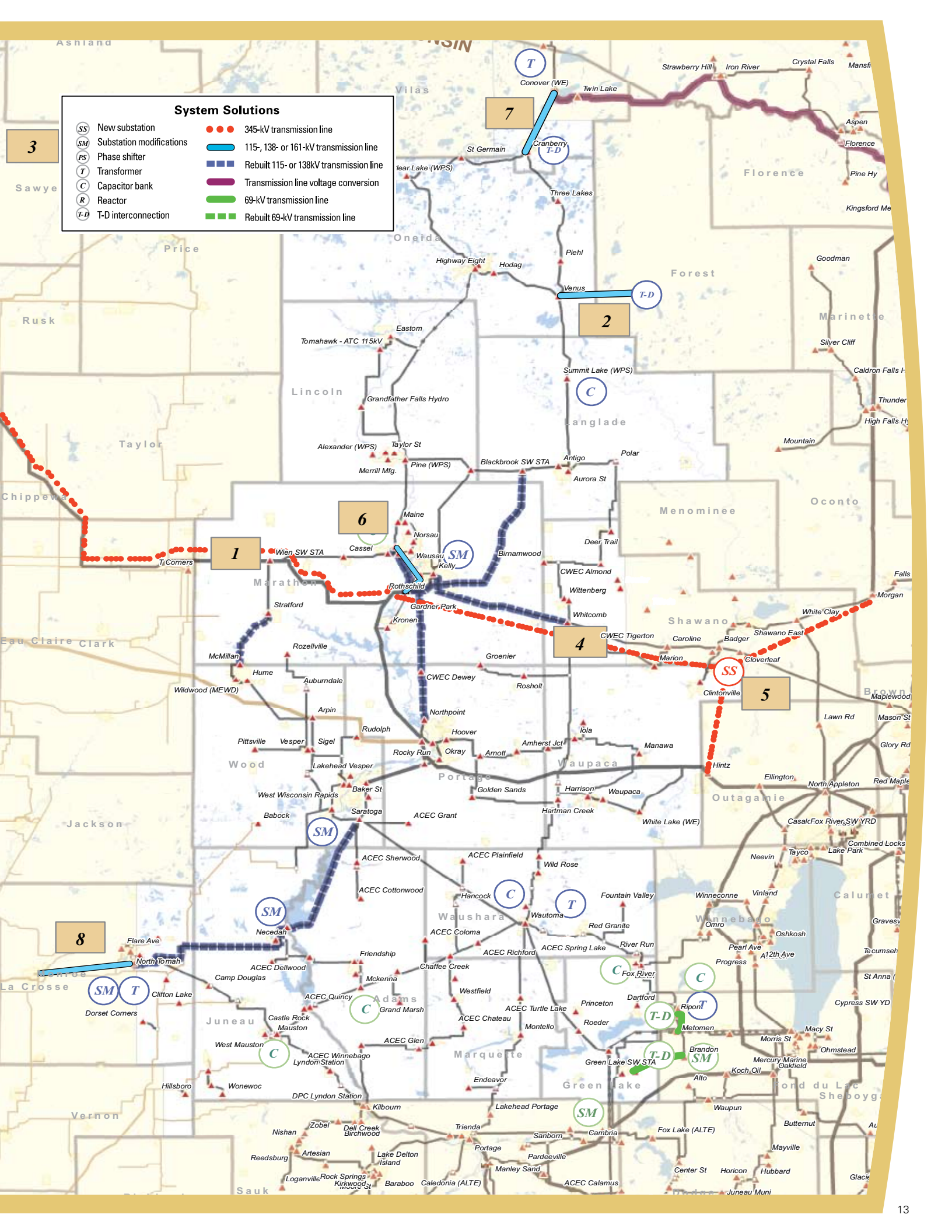


# North Central Wisconsin – Zone 1

We have implemented eight projects in Zone 1 since the 2005 Assessment Update, most notably the construction of the new 345/115-kV Gardner Park Substation. Studies conducted for prior assessments indicate the potential for generation at Weston Power Plant becoming unstable if certain disturbances on the transmission system occur. The expansion of the Weston Substation, in conjunction with the construction of the new Gardner Park Substation to accommodate the planned Arrowhead-Gardner Park 345-kV line, remedies this issue.

Our current plans in Zone 1 include more than 34 projects between 2006 and 2016. These projects are in various stages of development. The most notable planned and provisional projects in Zone 1, along with their projected year of completion and the factors driving the need for the projects, are listed below. There are currently no projects in the proposed stage of development.

	Project description	In-service year	Need driver
	<b>Planned projects</b>		
1	Arrowhead-Stone Lake-Gardner Park 345-kV line	2006/2008	Improves reliability, helps increase import capability, reduces reliance on operating guides, lowers system losses
2	Construct Venus-Metonga 115-kV line	2007	Transmission-distribution interconnection
3	Stone Lake 345/161-kV Substation	2008	Improves operation of Arrowhead-Gardner Park line, improves reliability in northwestern Wisconsin
4	Gardner Park-Central Wisconsin 345-kV line	2009	Needed to deliver output of Weston 4 generation
5	Central Wisconsin 345-kV Substation	2009	Needed to deliver output of Weston 4 generation
6	Weston-Sherman St.-Hilltop 115-kV line rebuild to include a new Gardner Park-Hilltop 115-kV line	2007	Addresses potential overloads of existing line, needed to accommodate output of Weston 4 generation
7	Cranberry-Conover 115-kV line	2008	Along with Conover-Plains 138-kV line upgrade (Zone 2), addresses low voltages/voltage collapse in Rhinelander Loop area, improves Wisconsin-Michigan UP transfer capability, improves voltages in western UP
	<b>Provisional projects</b>		
8	Monroe County-Council Creek 161-kV line	2010	Addresses low-voltage situation in the area, improves import capability, avoids need to reconfigure system during emergencies



**System Solutions**

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

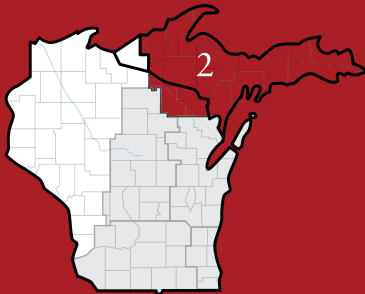
# Michigan's Upper Peninsula and Northern

## Transmission system characteristics of Zone 2

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

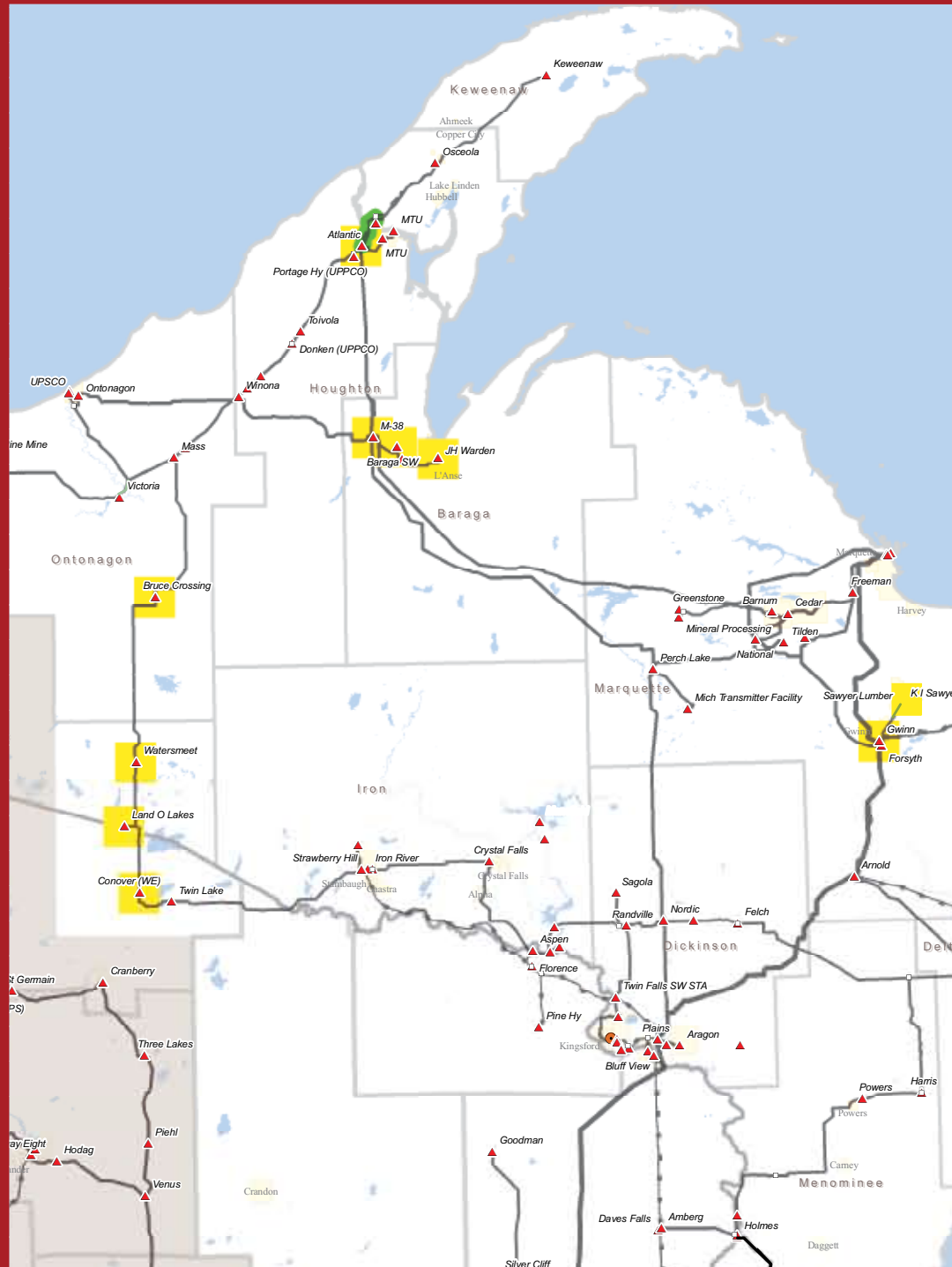
- a north-south 345-kV line extending from near Marquette to the Iron Mountain area and southwest to the Oconto area,
- 138-kV lines from Arnold to the Manistique area,
- a 138/69-kV network in the western portion of the zone and
- a 69-kV network in the eastern portion of the zone.

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 system voltages and the chronic limitations to transmission service. Primary drivers of these issues include a mismatch of low-cost generation to load in the Upper Peninsula and aging facilities in poor or obsolete condition.



### Zone 2 includes the counties of:

- 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)





# n Wisconsin – Zone 2

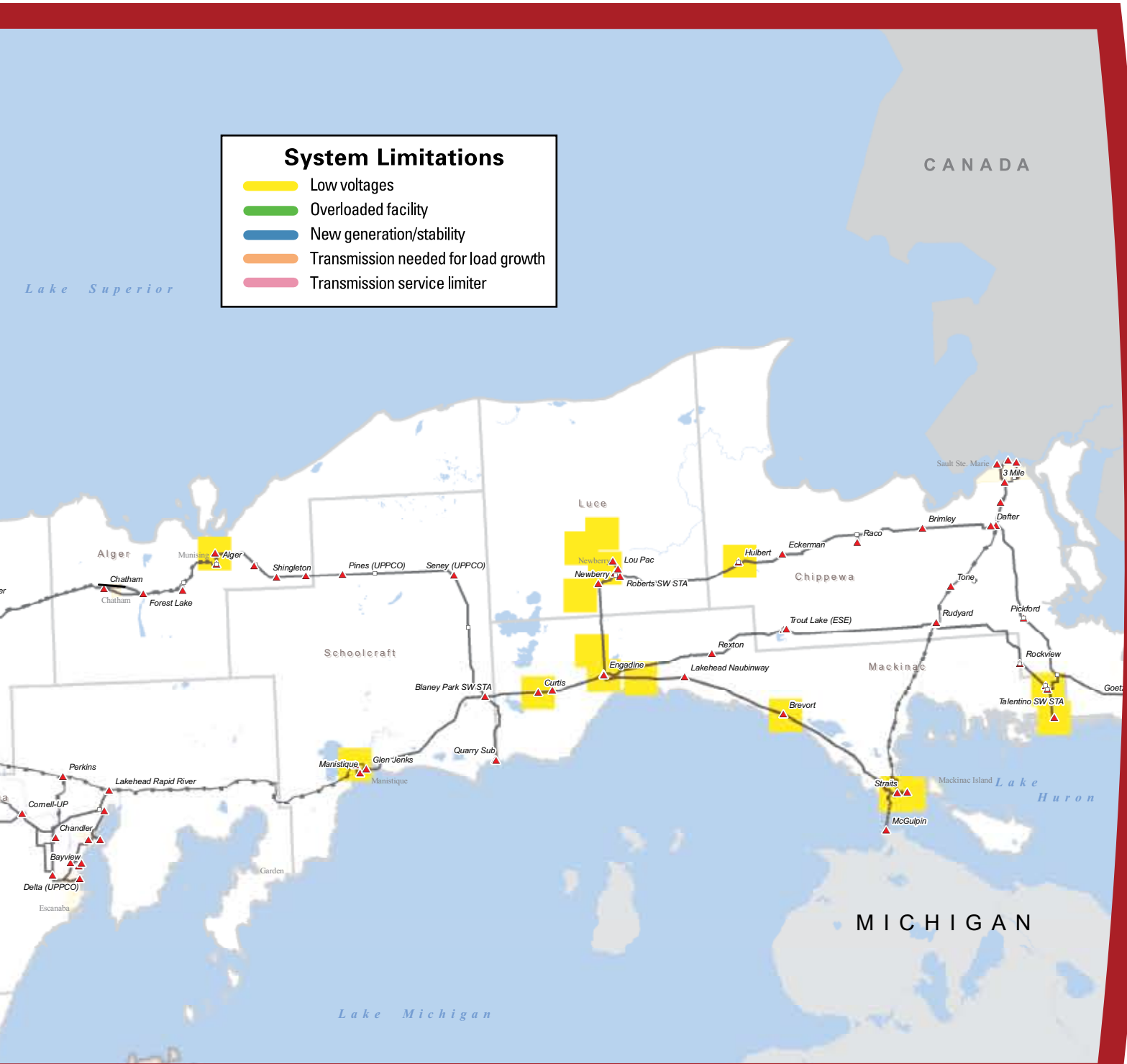
## Transmission system limitations in Zone 2

In the 2007 analysis of Zone 2, we identified low voltages, transmission facility overloads and transmission service limitations. In addition, heavily loaded facilities during off-peak periods, especially when the Ludington Pumped Storage Facility in Lower Michigan is pumping, continue to keep the system working with very small operating margins.

Areas in the western and far eastern Upper Peninsula are most vulnerable to low voltages. The most notable areas

experiencing transmission service limitations include the Plains-Stiles 138-kV line and the Hiawatha-Indian Lake 69-kV line. Both of these lines were addressed for the near term with projects completed in 2006.

The potential for generation at Presque Isle Power Plant becoming unstable after certain disturbances on the transmission system has been a long-standing limitation and the reason for an automated tripping scheme in place at Presque Isle. We are evaluating alternatives to this complex scheme.

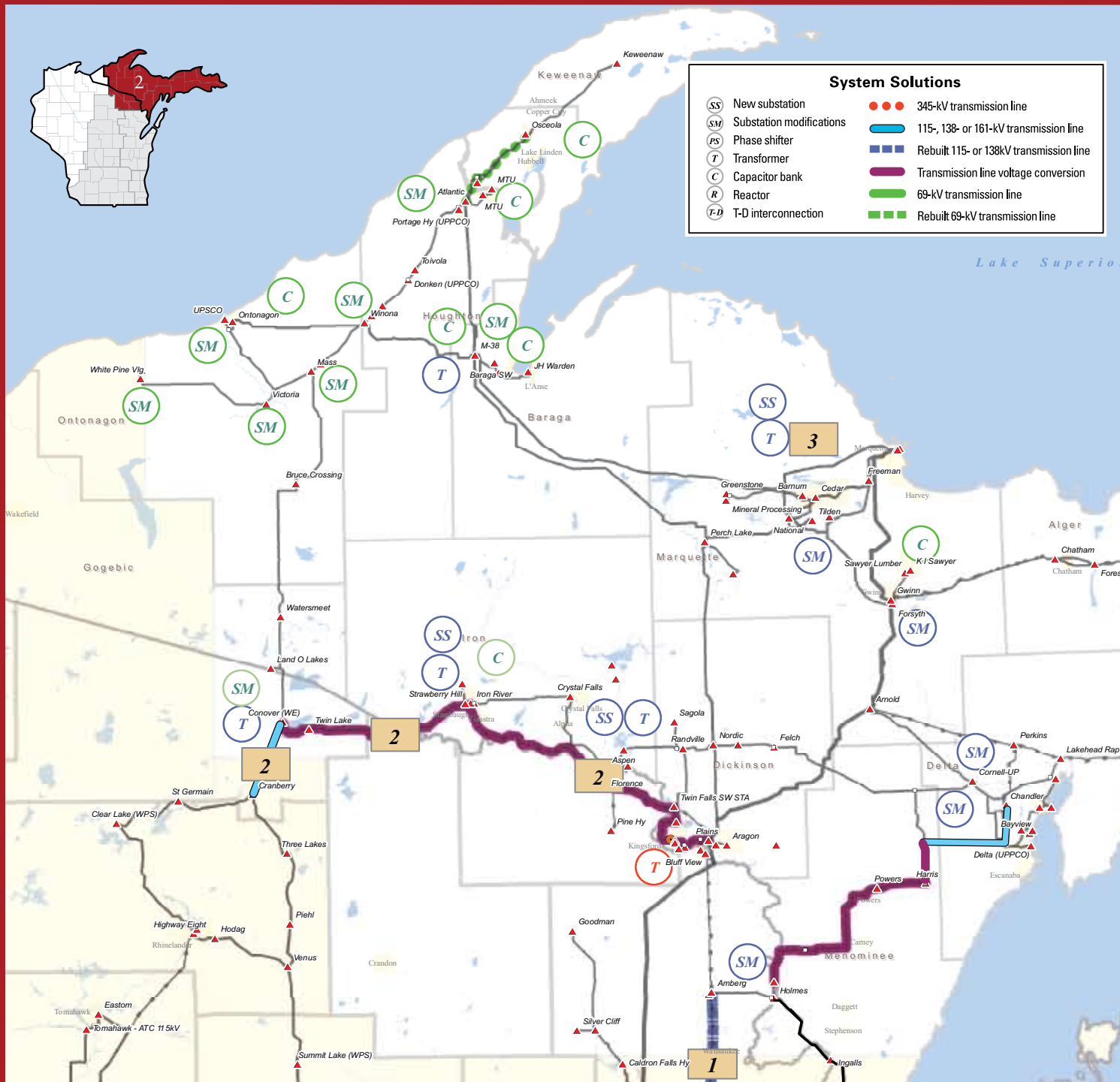


# Michigan's Upper Peninsula and Northern

## Transmission projects in Zone 2

ATC completed one project in Zone 2 since the 2005 Assessment Update. This involved rebuilding the Hiawatha-Indian Lake 69-kV line to double-circuit 138-kV standards. Initially, one circuit is being operated (at 69 kV), but a project to convert both circuits to 138-kV operation is being considered for the 2010 timeframe.

Our current plans in Zone 2 include more than 40 projects between 2006 and 2016 to address issues. These projects are in various stages of development. The most notable planned, proposed and provisional projects in Zone 2, along with their projected year of completion and the factors driving the need for the projects, are listed at right. In-service years designated as "TBD" mean we are developing the appropriate project completion date.



# n Wisconsin - Zone 2

	Project description	In-service year	Need driver
<b>Planned projects</b>			
1	Stiles-Amberg double-circuit 138-kV line rebuild	2006	Improves reliability, helps increase import capability, reduces reliance on operating guides, lowers system losses
2	Cranberry-Conover 115-kV line and Conover-Iron River-Plains rebuild & conversion to 138 kV	2008	Part of Cranberry-Conover project (Zone 1) for Rhinelander Loop, improves voltage profile in the area, addresses aging facilities with condition issues
<b>Proposed projects</b>			
3	Relocate Cedar Substation (North Lake)	2008	Improves reliability in the area, addresses aging facilities in poor condition
4	Hiawatha-Pine River 69-kV line rebuild & conversion to 138 kV	2009	Addresses potential overloads of existing lines in the area, addresses aging facilities in poor condition, improves voltage profile in the area, accommodates future expansion in the area
<b>Provisional projects</b>			
5	Convert Hiawatha-Indian Lake double-circuit 69-kV line to 138-kV operation	TBD	Addresses chronic transmission service limitation, improves voltage profiles in the area, enhances value of another provisional project
6	Replace the existing Straits Substation (Mackinac)	TBD	Improves reliability in eastern UP, addresses substation facilities in poor condition, provides for future expansion
7	Blaney Park-Munising 69-kV line rebuild & conversion to 138 kV	2012	Addresses low voltages in the area, improves stability of Presque Isle generation, addresses aging facilities in poor condition



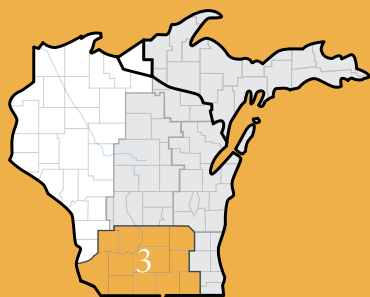
# South Central/Southwest Wisconsin and

## Transmission system characteristics in Zone 3

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

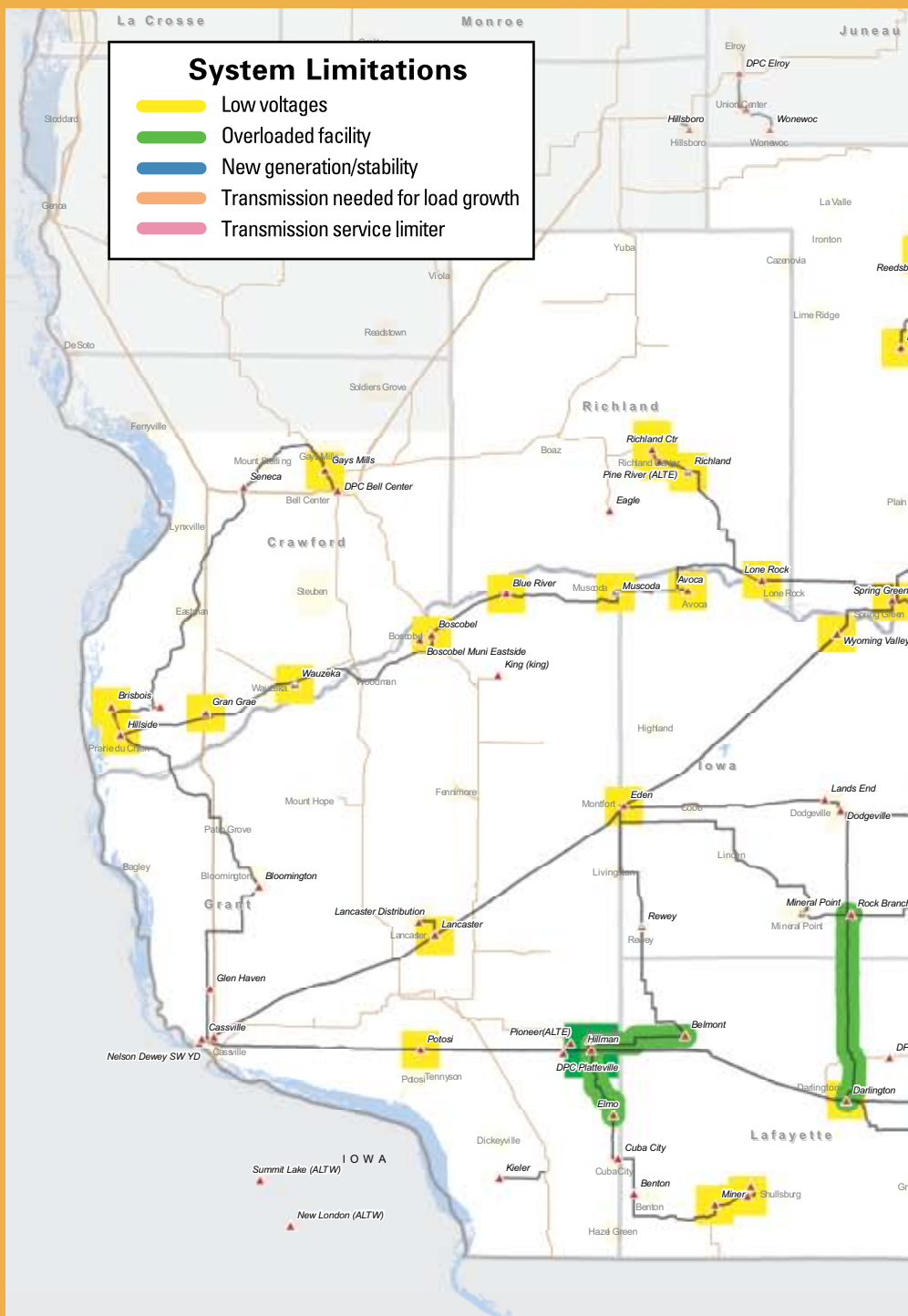
- a north-south 345-kV line from Illinois extending to Columbia Power Plant
- a north-south 345-kV line from Illinois extending to Paddock Substation
- an east-west 345-kV line from Fond du Lac to Columbia Power Plant and
- 138-kV and 69-kV facilities throughout remainder of the zone.

There are a number of transmission system performance issues in Zone 3 including voltage instability, generator instability, limited import capability, chronic transmission service limitations, overloaded lines and equipment, and low system voltages throughout the zone. The causes of these emerging problems include steady or rapid growth in certain areas, two new power plants and parallel path flows from new generation in northern Illinois.



### Zone 3 includes the counties of:

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



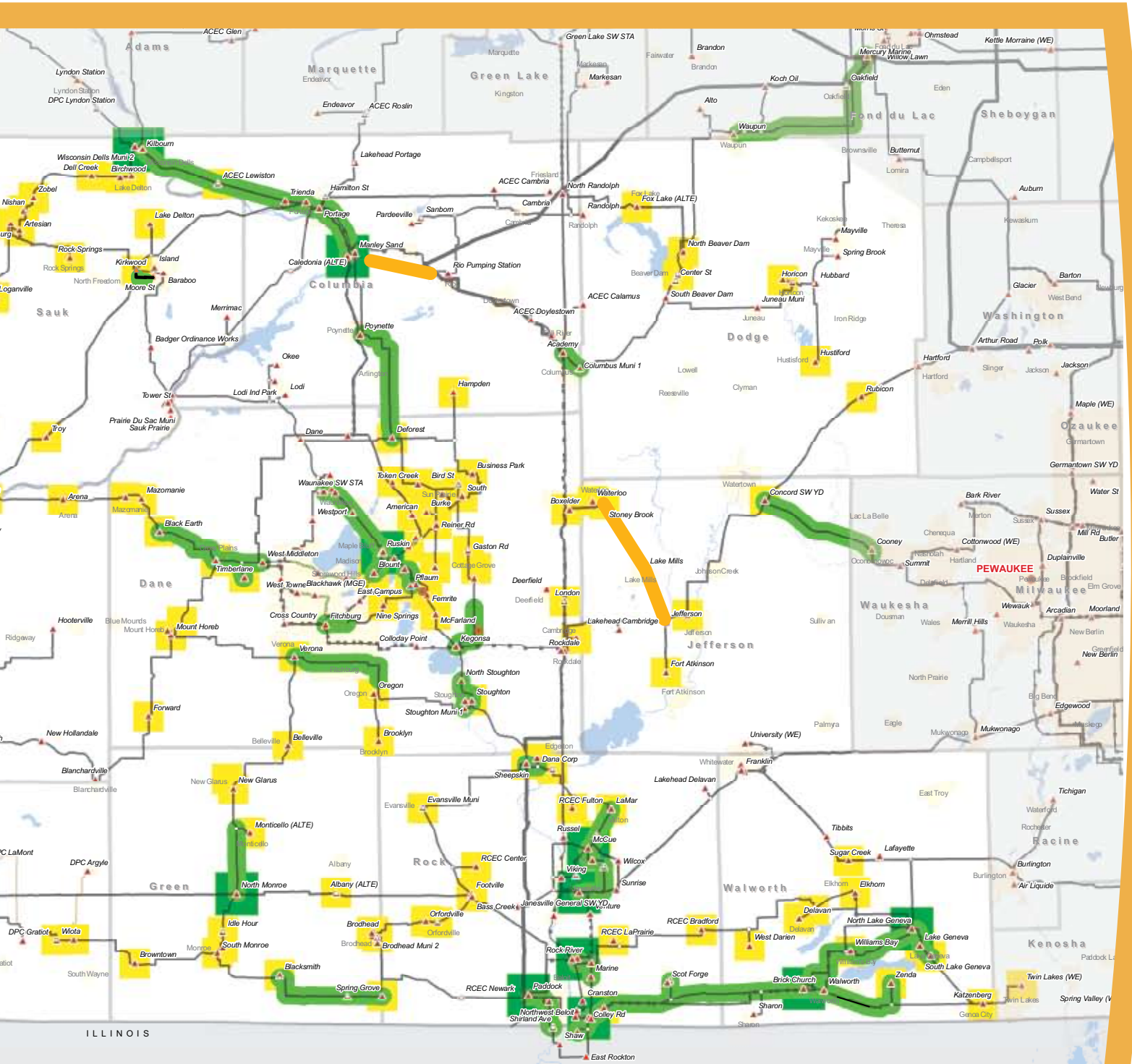
# North Central Illinois – Zone 3

## Transmission system limitations in Zone 3

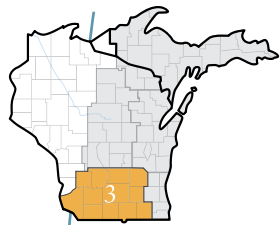
In the analysis of Zone 3 for 2007, we identified low voltages and transmission facility overloads. Low voltages are particularly serious in Dane and Green counties. The potential for voltage collapse in the Madison area is emerging and will require significant transmission reinforcements within the next 10 years. Facility overloads on 138-kV and 69-kV facilities

throughout Zone 3 are current or emerging concerns.

Electric load growth in Rock and Walworth counties is precipitating the need for reinforcements in those areas in the 2007-2011 timeframe. Load growth in southwestern Wisconsin will necessitate reinforcements to the transmission system in the 2009-2016 timeframe.



# South Central/Southwest Wisconsin

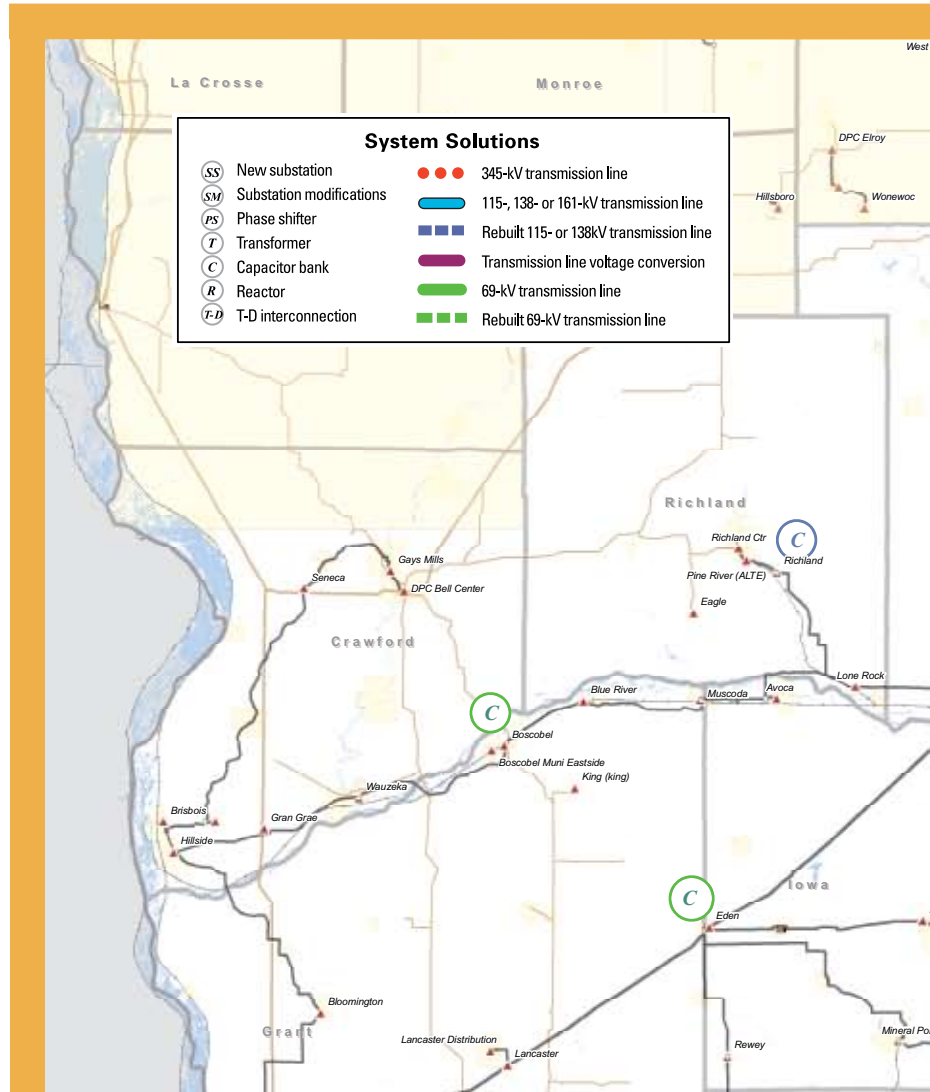


## Transmission projects in Zone 3

ATC has completed six network projects in Zone 3 since the 2005 Assessment Update, most notably the conversion of the Columbia-North Madison 138-kV line to 345-kV operation.

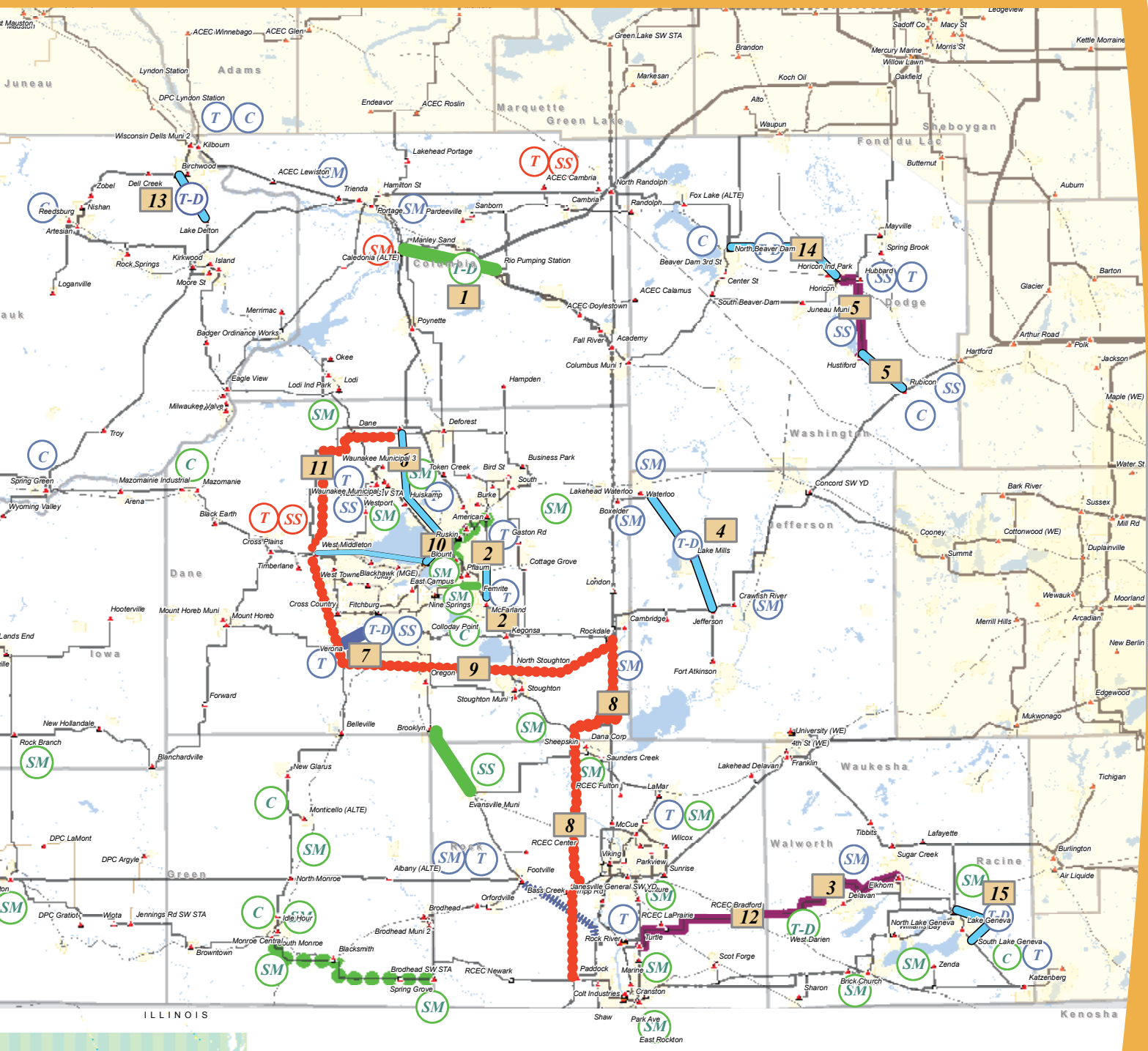
Keeping up with the rapidly increasing use of the transmission system in Zone 3 will require continued and close coordination with stakeholders. ATC's current plans in Zone 3 include more than 70 projects between 2006 and 2016 to address issues identified. These projects are in various stages of development. The most notable planned, proposed and provisional projects in Zone 3, along with their projected years of completion and the factors driving the need for the projects, are listed below.

Please note that the hardcopy of the Summary Report depicts the alternate route for Paddock-Rockdale in the figure to the right and this version depicts the preferred route.



	Project description	In-service year	Need driver
	<b>Planned projects</b>		
1	Columbia-Wyocena-Rio 69-kV line	2007	Transmission-distribution interconnection
2	Kegonsa-Sycamore 138-kV line	2007	Addresses low voltages, accommodates transmission service request
3	Southwest Delavan-Bristol 138-kV line (operate at 69 kV)	2007	Transmission-distribution interconnection
4	Jefferson-Lake Mills-Stony Brook 138-kV line	2008	Addresses low voltages and overloaded facilities, accommodates T-D interconnection
	<b>Proposed projects</b>		
5	Rubicon-Hustisford-Horicon 138-kV line	2008	Addresses low voltages
6	North Madison-Huiskamp 138-kV line	2008	Addresses low voltages, averts voltage collapse
7	Oak Ridge-Verona 138-kV line	2009	Improve area voltages and addresses overloads
8	Paddock-Rockdale 345-kV line	2010	Access Initiative
9	Rockdale-West Middleton 345-kV line	2011	Addresses overloads and low voltages, improves transfer capability to Madison area, averts voltage collapse, lowers system losses
10	Huiskamp-Blount 138-kV line	2012	Addresses low voltages, averts voltage collapse
11	North Madison-West Middleton 345-kV line	2016	Averts voltage collapse, addresses low voltages in the Madison area, lowers system losses, improves stability at Columbia Power Plant, improves transfer capability to Madison area
12	Rock River-Bristol-Elkhorn 69-kV to 138-kV conversion	2009	Addresses overloads and low voltages

# and North Central Illinois – Zone 3



Project description	In-service year	Need driver
<b>Provisional projects</b>		
<b>13</b> Lake Delton-Birchwood 138-kV line	2013	Addresses overloads and low voltage issues in Reedsburg loop
<b>14</b> Horicon-East Beaver Dam 138-kV line (North Beaver Dam-East Beaver Dam 138-kV line scheduled in service in 2006)	2014	Addresses potential overloads and low voltages
<b>15</b> North Lake Geneva-White River 138-kV line (South Lake Geneva-White River 138-kV line in-service date to be determined)	2012	Addresses potential overloads and low voltages, transmission to distribution interconnection

# Northeast Wisconsin

## Transmission system characteristics of Zone 4

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

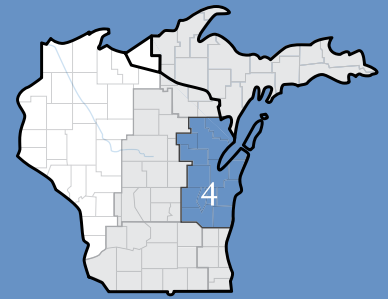
- four 345-kV lines extending from Kewaunee and Point Beach nuclear plants,
- two 345-kV lines extending from Edgewater Power Plant,
- a west-east 345-kV line extending from Stevens Point to the Appleton area,
- three 345-kV lines connecting the Fond du Lac area to Columbia, Edgewater and North Appleton,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

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

## Transmission system limitations in Zone 4

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

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



## Zone 4

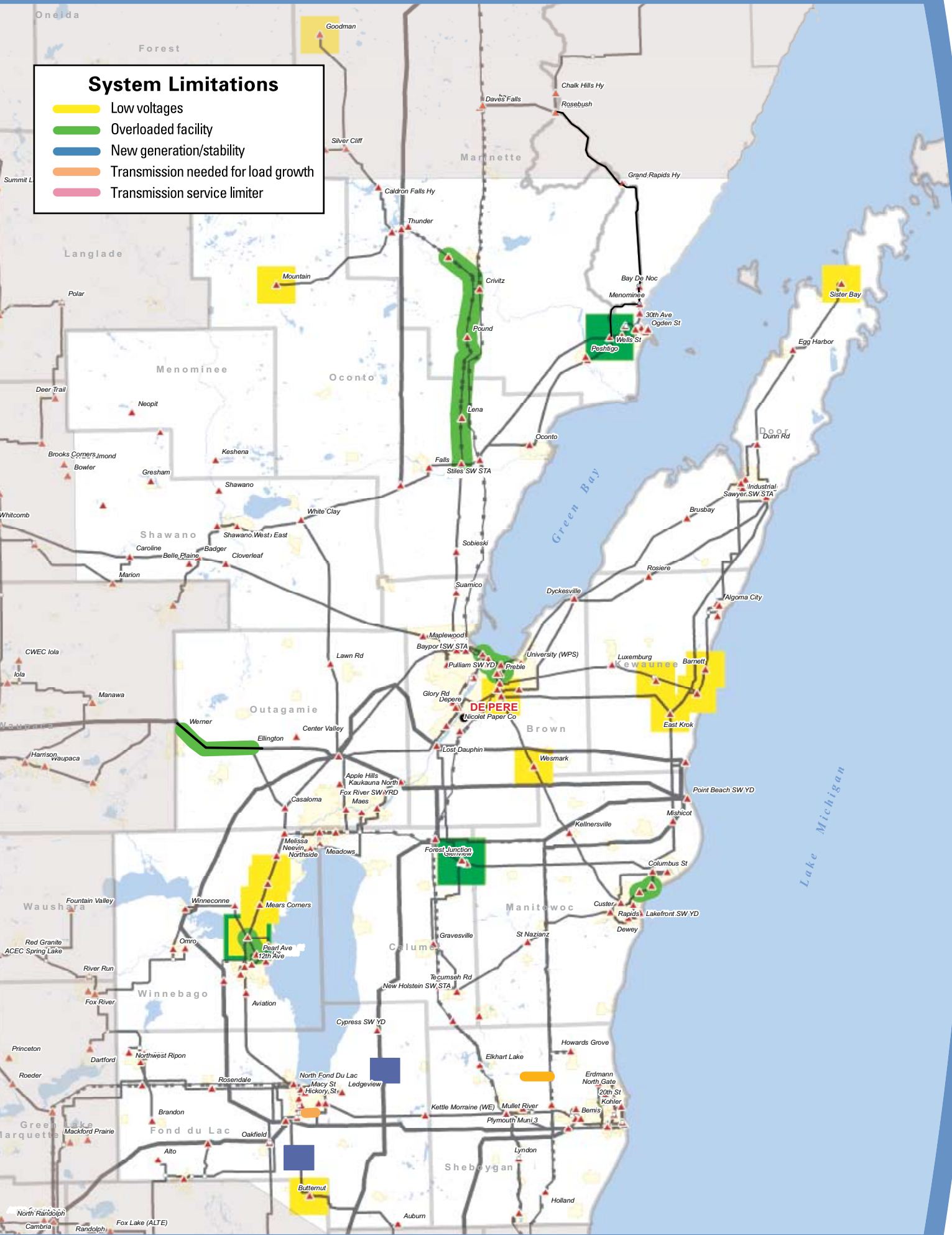
### Zone 4 includes the counties of:

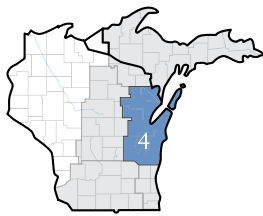
- Brown
- Calumet
- Dodge (northeast corner)
- Door
- Fond du Lac (eastern portion)
- Kewaunee
- Manitowoc
- Marinette (southern portion)
- Menominee, Mich. (southern portion)
- Menominee, Wis.
- Oconto
- Outagamie
- Shawano (eastern portion)
- Sheboygan
- Winnebago (eastern portion)



### System Limitations

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





# Northeastern Wisconsin – Zone 4

## Transmission projects in Zone 4

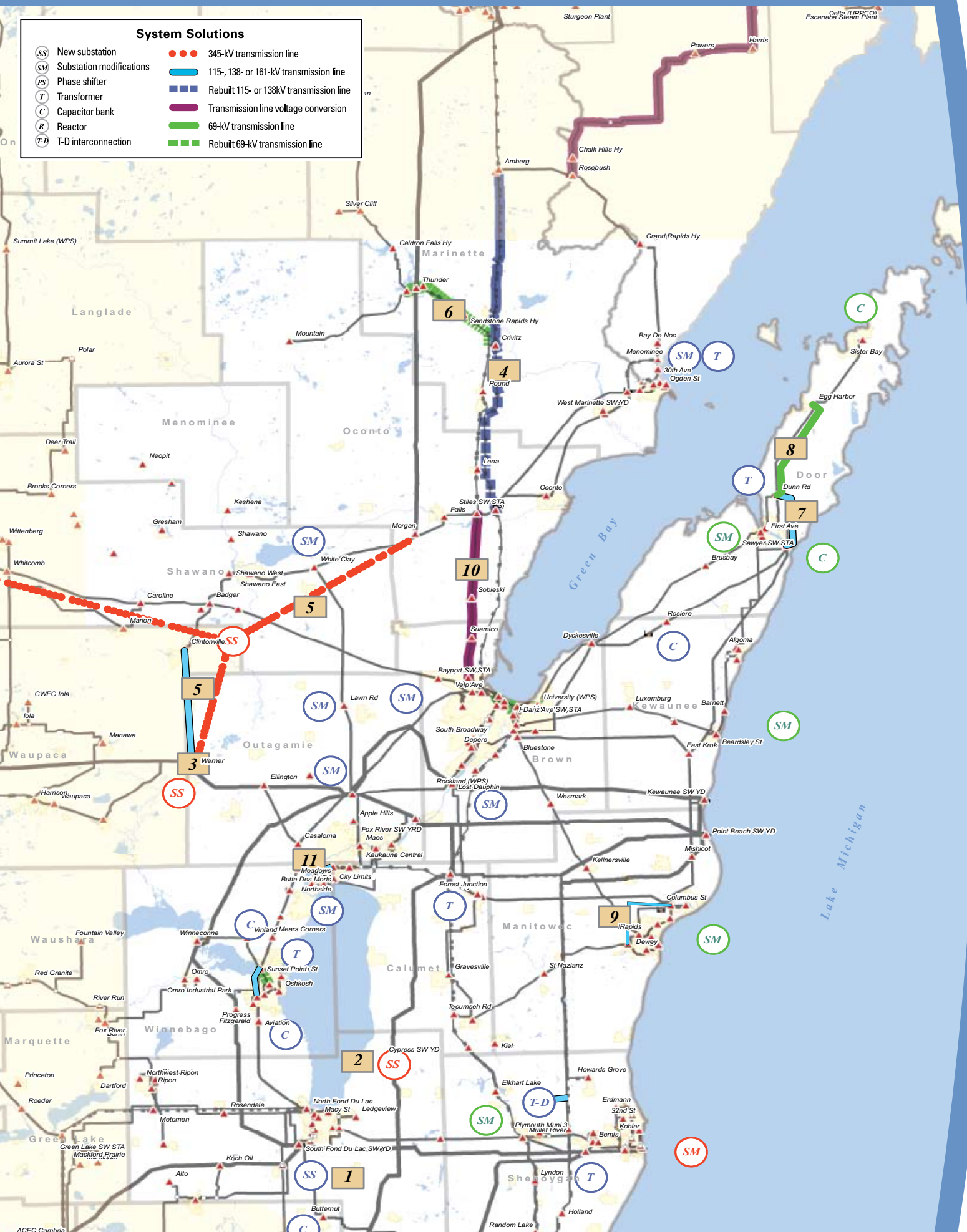
We have completed 6 network projects in Zone 4 since the 2005 Assessment Update, most notably the Martin Road transmission-to-distribution interconnection and the series reactor at Highway V.

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

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

### System Solutions

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



# Southeast Wisconsin

## Transmission system characteristics of Zone 5

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

- north-south 345-kV lines extending from Edgewater, Point Beach and Sheboygan Energy Center power plants,
- 345-kV lines from Pleasant Prairie Power Plant,
- 345-kV, 230-kV and 138-kV lines from Oak Creek Power Plant and
- numerous 138-kV lines in and around the metro Milwaukee area.

Transmission system reinforcements needed to interconnect and deliver new generation at Port Washington and Oak Creek power plants comprise much of the expansion in Zone 5. Significant load growth in Waukesha, Walworth and Washington counties is projected to exceed the capabilities of the existing 138-kV system in those areas, signaling the need for transmission system reinforcements.

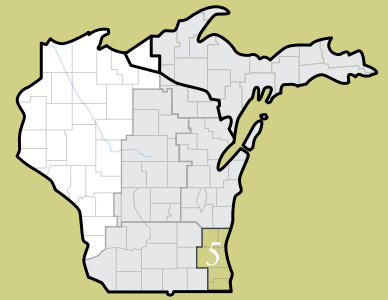
## Transmission system limitations in Zone 5

In the analysis of Zone 5 for 2007, we identified low voltages, transmission facility overloads and transmission service limitations. In addition, chronic transmission service limitations within Zone 5 need to be addressed.

The areas identified as vulnerable to low voltages are Washington County and areas west of Milwaukee. When we ran our planning models, numerous line overloads were identified throughout the zone. Most of the overloads and low voltages in Zone 5 are caused by low probability outages at substations. We are evaluating alternatives to address these issues. The low-voltage situation to the west of Milwaukee is an indication that load growth will exceed the load-serving capabilities of the 138-kV network serving that area, and the existing network will be insufficient without significant reinforcements.

Accommodating new generation at Port Washington and Oak Creek power plants is driving the need for most of the system reinforcements in the Milwaukee area.

The most chronic transmission service limitations in Zone 5 are caused by the loss of the Wempletown-Paddock 345-kV line in Zone 3. In 2005, we added a new Wempletown-Paddock 345-kV circuit and reconfigured the existing Wempletown-Paddock and Paddock-Rockdale 345-kV lines to create a Wempletown-Rockdale 345-kV line to address these limitations.



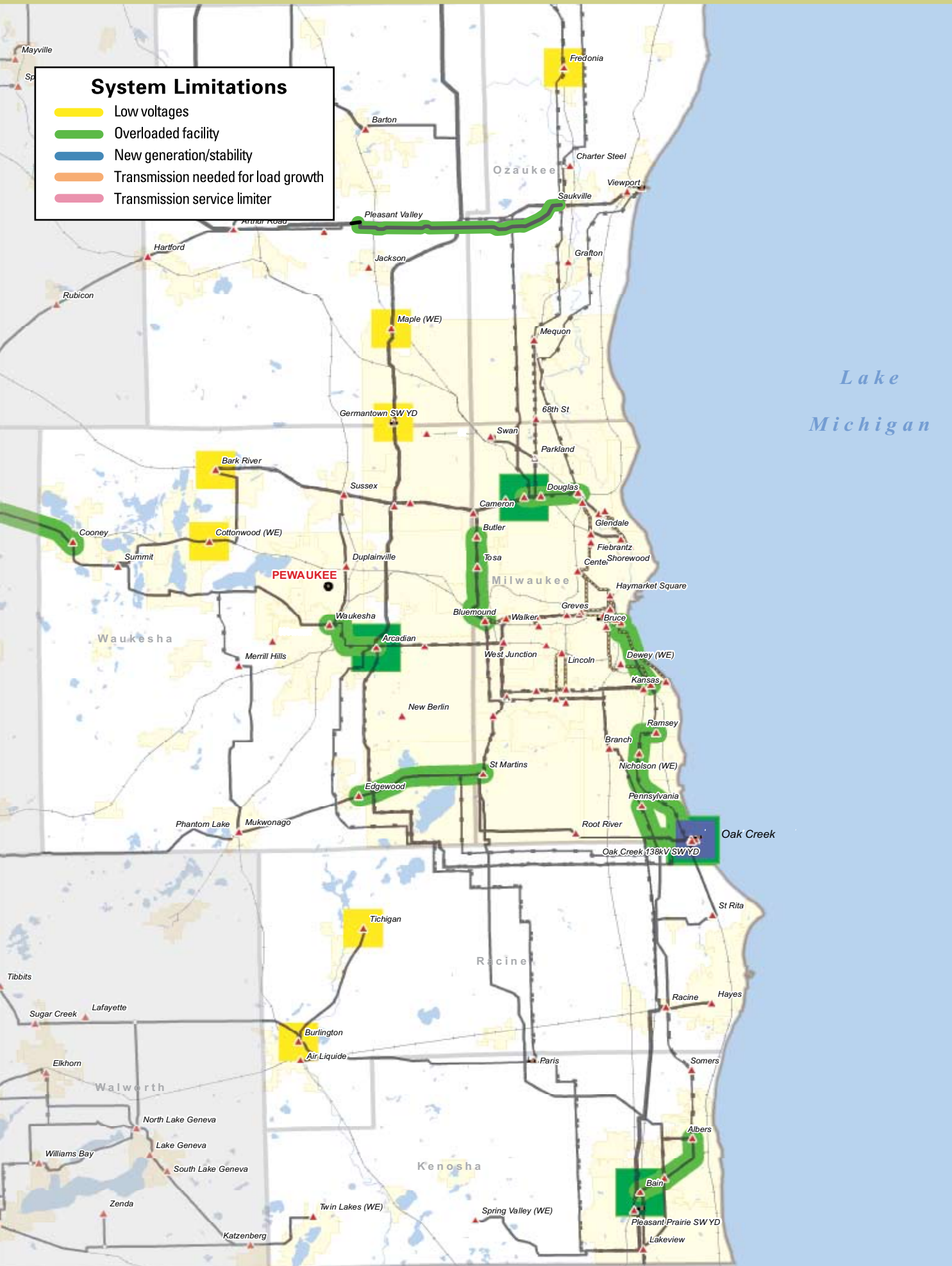
## Zone 5

### Zone 5 includes the Wisconsin counties of:

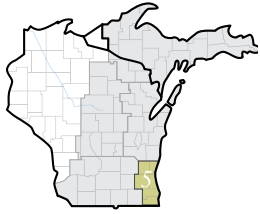
- Kenosha
- Milwaukee
- Ozaukee
- Racine
- Washington
- Waukesha

## System Limitations

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



Lake  
Michigan



# Southeast Wisconsin – Zone 5

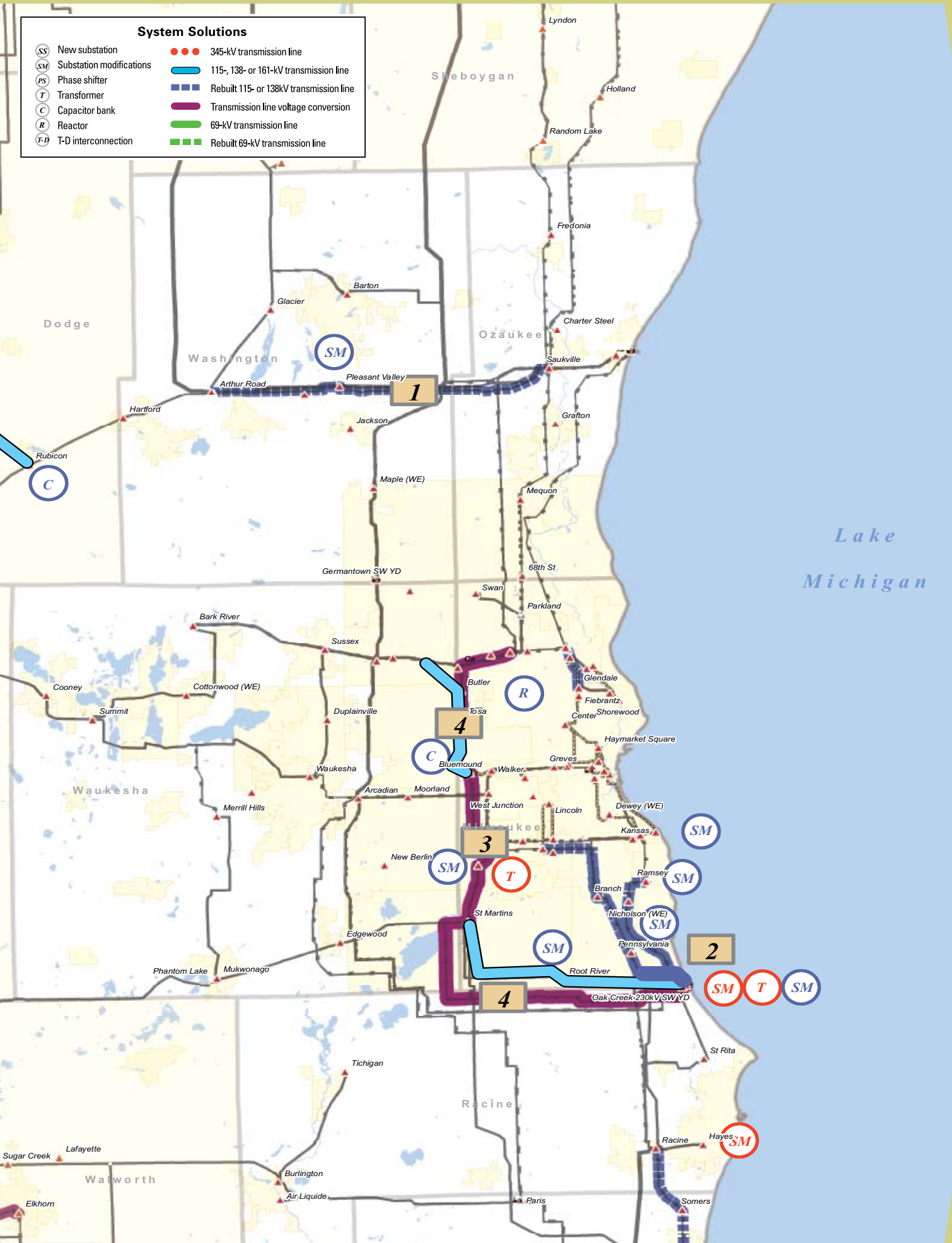
## Transmission projects in Zone 5

Our current plans in Zone 5 include more than 25 projects between 2006 and 2016. These projects are in various stages of development. The most notable planned, proposed and provisional 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	St. Lawrence-Pleasant Valley-Saukville 138-kV line reconductor	2008	Accommodates new generation at Port Washington Power Plant
	<b>Proposed projects</b>		
2	Expand 345/230/138-kV Substation at Oak Creek	2009	Accommodates new generation at Oak Creek Power Plant
	<b>Provisional projects</b>		
3	Expand Brookdale Substation (Hale)	2013	Accommodates new generation at Oak Creek Power Plant
4	Oak Creek-Hale-Granville 345-kV line	2013	Accommodates new generation at Oak Creek Power Plant

### System Solutions

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





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