

AMERICAN TRANSMISSION COMPANY

10-YEAR TRANSMISSION SYSTEM ASSESSMENT

SUMMARY REPORT – AUGUST 2002





American Transmission Company

... and our mission

At American Transmission Company, we are responsible for delivering power to local utility companies. We own and operate transmission systems that transport energy to parts of Wisconsin, Michigan and Illinois — energy that local utility companies then provide to their customers.

As a transmission-only company, we provide access to the energy generated at power plants. As the graphic on page three shows, when electricity leaves a power plant, its voltage is increased at a step-up substation. The energy enters the transmission grid from many generators. The energy is then drawn from the grid by many users, primarily the distribution companies. Once there, the voltage is stepped down at another substation and distribution power line that carries the electricity to its final destination.

ATC was created based on legislation passed by the Wisconsin legislature in 1999. It was recognized that the transmission infrastructure was weak and that this weakness threatened day-to-day reliability and long-term viability. One of ATC's primary goals is to identify needs of the system and strengthen the transmission infrastructure. We recognize that the ability to do so requires a strong planning process that involves all stakeholders.

ATC is committed
to ensuring the
reliable and safe
delivery of electricity.

We operate our company by ensuring that customer need and public input drive our business and our planning process. What does this mean for consumers, stakeholders, landowners and the environment?

- **It means our information is your information.**

We share information about the transmission system's capabilities and the projected demands on the system so you know what we know about our system.

- **It means we will be a source for innovative, responsive solutions.**

We respond to energy needs by proposing infrastructure improvements that balance need with community impact. We strive to use new and advanced technology to address the need for energy transmission efficiently and effectively. As needs change so, too, will our plans. If an alternative solution effectively addresses an impending need for transmission, we will defer or cancel the proposed transmission projects.

- **It means we will work with you and the local and state authorities to ensure that needed facilities get built.**

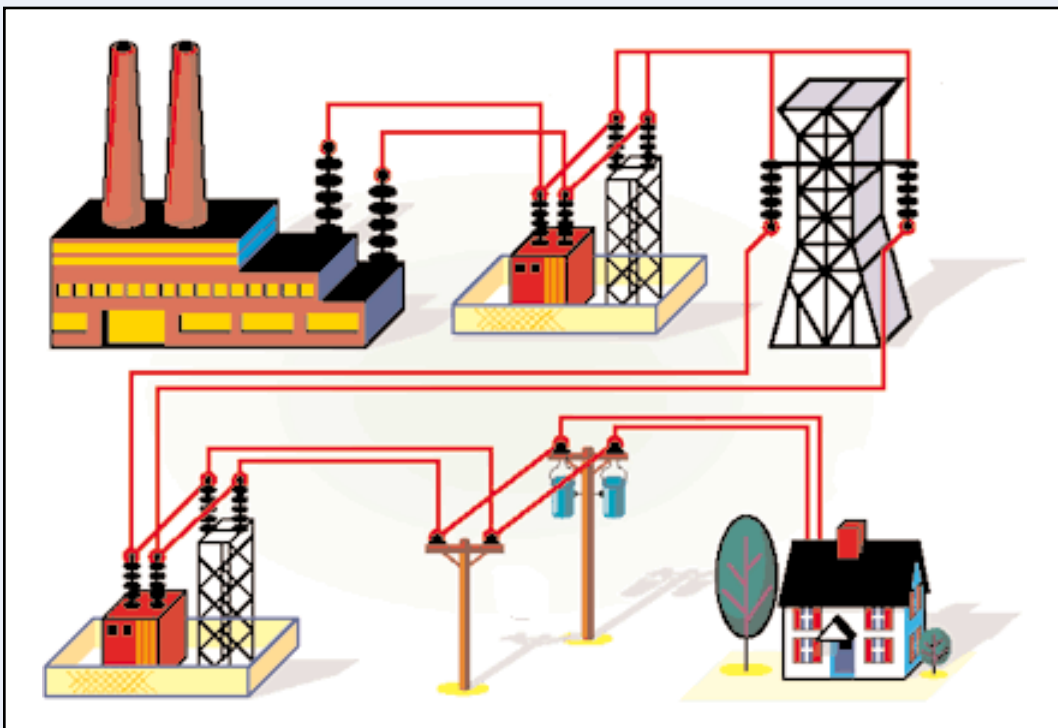
- **It means we will involve you in the process and listen to you.**

Your needs and interests will shape our planning process and transmission system. We partner in an open and interactive planning process whereby our proposed transmission projects are customized to meet community energy needs as well as land-use and environmental priorities. As viable alternatives to proposals arise, together they will be considered.

- **And, it means we will be environmentally responsible.**

We recognize that transmission facilities impact the natural environment. We respect the environment and take every appropriate measure to protect the environment throughout the planning, construction, maintenance and operation of our transmission system.

Through continued development of our approach, we endeavor to do things the right way. By working closely with the communities we serve and interested stakeholders, we seek to find better solutions to provide access to the energy needed, both now and for long-term growth and viability.



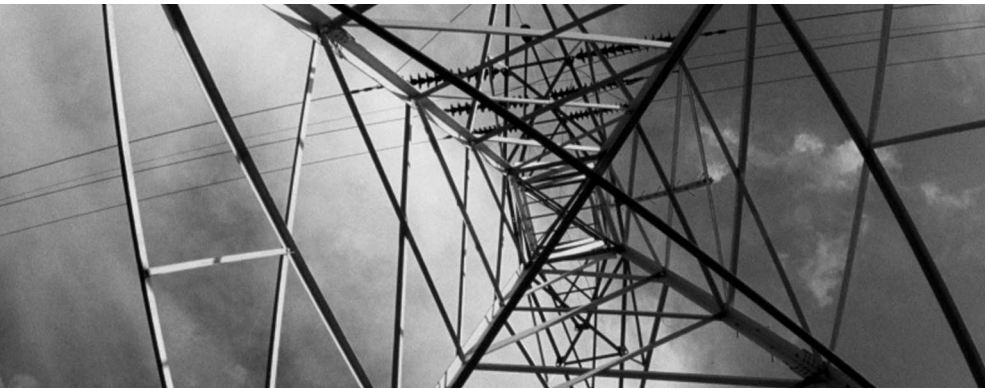


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Our Approach

American Transmission Company delivers power to local utility companies. We own, operate and maintain electric transmission lines and other equipment that transport power to parts of Wisconsin, Michigan and Illinois. We deliver energy to local electric companies who, in turn, supply it to their customers.

We believe it is important that this summary of our 10-Year Transmission System Assessment be user-friendly for consumers, stakeholders and policy makers. We have organized our findings and project proposals so readers can easily find information related to specific areas – as well as information about ATC and how our planning process works.

The full report provides a foundation for public discussion and a starting point for cooperative efforts to shape final plans

You can read specific information regarding a community or district in the Planning Zones Section. For each Planning Zone, you will find the:

- **Transmission System Characteristics**

The transmission system's current capabilities.

- **Transmission System Limitations**

The transmission system's constraints and their effect on the network's ability to reliably meet projected demand.

- **Transmission System Solution Alternatives**

ATC possible solutions for overcoming limitations and meeting current and future demand.

You will find a map of the Planning Zones on page 12 to help identify communities and zones.

As you prepare to examine the Assessment's findings, you may also find it helpful to have some perspective on ATC's goals for the report, information about our public planning process, our assessment criteria, our commitment to protecting the environment, and how our planning and assessment processes are coordinated with organizations beyond our borders which recognizes the regional nature of the transmission grid.

Goals

ATC had three goals in conducting the analysis and preparing the conclusions in this Assessment.

1. To quantify current and long-term demands on the transmission network.
2. To identify current and long-term constraints affecting the transmission network's ability to reliably meet demand.
3. To develop and present ATC's possible alternatives and solutions for overcoming constraints and meeting needs.

Public Planning Process

Because it can take up to five years or more to obtain necessary approvals and complete construction activities, long-term planning is crucial to maintaining a transmission system that can meet the evolving needs of the communities we serve.

Crucial to effective long-term planning is a comprehensive and well-organized process for assessing needs, exploring solutions,

incorporating public input and implementing decisions. ATC has developed such a process. It is a unique four-level, nine-step planning process for long-term planning. The process encompasses four levels of planning analysis:

- **Base:** Planning at the base level addresses single energy issues.
- **ATC Planning Zone:** Planning at the zone level focuses on interactions between individual reserves within a zone.
- **ATC System:** Planning at this level assesses the overall system's needs and interaction issues.
- **Regional/National:** Planning at this level allows ATC to evaluate how its system fits into the regional and national situation.

Using these levels, ATC follows nine planning and public input steps:

1. We identify needs and develop solutions for each planning level.
2. We evaluate needs and solutions at each level against those at the next level.
3. Based on steps one and two, we identify what we consider to be the most effective overall plan for addressing local and regional needs.*
4. We present the results of this planning process to the public

approximately every six months in our 10-Year Transmission Assessment report or update. The report provides a foundation for public discussion and a starting point for cooperative efforts to shape final plans.

5. We host public meetings and conduct outreach in each zone to exchange information and ideas with interested stakeholders, including customers, elected officials, regulators, landowners and other members of the community. As part of this process, we present our findings of need and proposed solutions, invite public input and facilitate exploration of proposed solutions and consideration of alternatives.
6. We integrate information and outcomes from this information-sharing into our four-level planning analysis process (noted above).
7. As regulatory filing dates approach, we focus our public outreach and communication on specific projects to refine the solutions.

Crucial to effective long-term planning is a comprehensive and well-organized process for assessing needs, exploring solutions, incorporating public input and implementing decisions. ATC has developed such a process.





Our priority is to
safely and reliably
deliver electricity.

8. We defer or cancel proposed projects if, during this planning process, needs are addressed effectively through alternative solutions.
9. As needs require, we will proceed with projects that have been subjected to and customized by this planning and public-input process to meet our responsibility to provide a reliable transmission system.

*Note: ATC performs the first three levels of planning for its service areas and then works closely with the Midwest Independent Transmission System Operator to incorporate solutions that serve the broader regional planning process.

This 2002 Assessment is built from ATC planning activities and interaction with the public during 2001 and early 2002. In addition, our two previous Assessments, 2001 planning zone meetings and other customer and stakeholder discussions have contributed significantly to this assessment.

Assessment Criteria

We examined the changes that have occurred since the publication of our 2001 Assessment Update that bear on our planning process. Since issuing our last report, ATC completed approximately 20 studies in response to requests for transmission and interconnection services. These studies identify a number of transmission projects that will be necessary to provide the services requested. ATC follows accepted industry system performance criteria designed to ensure a reliable system.

Three types of remedies emerge from our evaluations for addressing limitations inherent in the current system and for meeting growing need. These remedies include:

1. Adding or replacing equipment at existing facilities
2. Rebuilding older transmission equipment to increase their capacity and to improve operation
3. Constructing new transmission facilities

For long-term transmission needs, we often identify placeholder solutions, which will be further discussed with customers and other interested parties to develop and refine the most appropriate solutions for the community, the environment, local utilities and ATC. These discussions will be ongoing and will help ATC refine and coordinate projects.

Finally, all our proposals and conclusions are premised upon a commitment to meet several core company standards. ATC strives to provide quality service to our customers. We set the highest standards for honesty and social responsibility in our work. We include members of our communities as well as our customers in our planning process. We design our projects to maximize financial and environmental sustainability. We respect our employees and our customers and treat them with the dignity they deserve.

For a copy of the 2002 ATC 10-Year Transmission System Assessment Full Report, please visit our Web site at www.atcllc.com.

Protecting the Environment

We recognize that transmission impacts the environment. One of the most important considerations we apply in our planning decisions is environmental protection. In all aspects of our business, ATC seeks to demonstrate a commitment to environmental sustainability by:

- Applying best practices, cost-effective technologies and, where appropriate, environmental mitigation and enhancement to reduce environmental impacts associated with construction and maintenance of transmission facilities.
- Working toward the development and implementation of an environmental appraisal process that ensures ATC's ability to meet its environmental goals.
- Involving employees in environmental stewardship.
- Providing employees with education and training to be effective environmental stewards.
- Addressing transmission-related environmental issues with regulators and other stakeholders through partnerships and collaborative working relationships.
- Complying with all applicable laws, regulations and orders.

Beyond Our Borders

ATC is a member of two organizations that foster a coordinated and reliable transmission system throughout the country. Our membership in these organizations adds a broader component to our assessment and system evaluation processes.

The Midwest ISO is one of the Regional Transmission Organizations created in conjunction with the Federal Energy Regulatory Commission orders governing operation of the nation's interconnected transmission system. ATC coordinates its assessment activities with MISO.

ATC's transmission system assessment complies with Mid-American Interconnected Network guidelines for reliable operation of the transmission system, development of transmission system models for future years and seasons, and exchanging information related to these issues.

MAIN is one of nine reliability councils that comprise the North American Electric Reliability Council. NERC sets standards for reliable planning and operation of the

transmission system and applies punitive measures for non-compliance with those standards. ATC participates in the NERC program and strives to meet the planning standards set by the NERC.

Another criteria bearing on ATC's Assessment analyses are the needs of neighboring utilities. As part of a larger transmission system that is interconnected and interdependent, ATC recognizes the importance of coordinated planning with neighboring utilities as a necessary and prudent component of our planning process. ATC has initiated discussions with Commonwealth Edison, Dairyland Power Cooperative and Minnesota Power, and plans to initiate discussions with Northern States Power and Consumers Power. These discussions are intended to lead to joint evaluations of common system needs, constraints and alternative solutions, where appropriate.

Our planning and assessment processes take into consideration local needs, regional zone needs, system-wide needs and regional and national transmission issues. Solutions identified through our assessment and planning processes at each of these levels is evaluated in relation to those in all other levels until we have identified the most effective overall comprehensive plan.



Glossary of terms

Capacitor banks:	System elements which support the voltages necessary to provide reliable service to customers.	Operating guides:	Procedures that transmission operators take when certain events occur on the system that may compromise system reliability.
Contingency:	Outage of a transmission line, generator, or other piece of equipment which affects the flow of power or the transmission network.	Overloads:	Power flowing through the wires/equipment is more than they can carry without damage.
Heavy loads:	Lots of power being consumed; high demand for electricity. High volume of electricity on a line, transformer or other piece of the transmission system.	Parallel path flows:	When electricity flows from a power plant over the transmission system, it obeys the laws of physics and flows over the paths of least resistance. Though there may be direct connection between a power plant and a particular load area, some of the power will flow over other network lines.
Import/export:	Ability of the transmission system to bring power into or out of an area in order to serve load.	Power flows:	Electricity moving through lines or other transmission equipment.
Line rebuilds:	Removing an existing line and replacing it with a new, higher capacity line.	Reliable:	Meets standard industry and specific ATC performance criteria.
Load:	All the devices which consume electricity and make up the amount of system demand for power at any given moment; like factories, distribution substations, etc.	Serve load:	Reliably deliver the electricity needed to meet what customers would like to use at any given time.
Loading relief:	A system reinforcement or action that results in lower power flows on the equipment that is heavily loaded or overloaded.	Shed load:	Reduce the level of power flowing in order to prevent major equipment damage or widespread outages.
Low voltages:	Can occur in parts of the system that are heavily loaded or which have heavy reactive loads. Think of a clothes line pulled taut with nothing hanging on it, but which then tends to sag when more and more clothes are attached.	Substation:	Place where transmission lines connect to each other and where protective equipment is located. Also where transformers are located to "step" the voltage up or down in order to put power into or take power out of the transmission network.
Network:	A system of interconnected lines and equipment.		

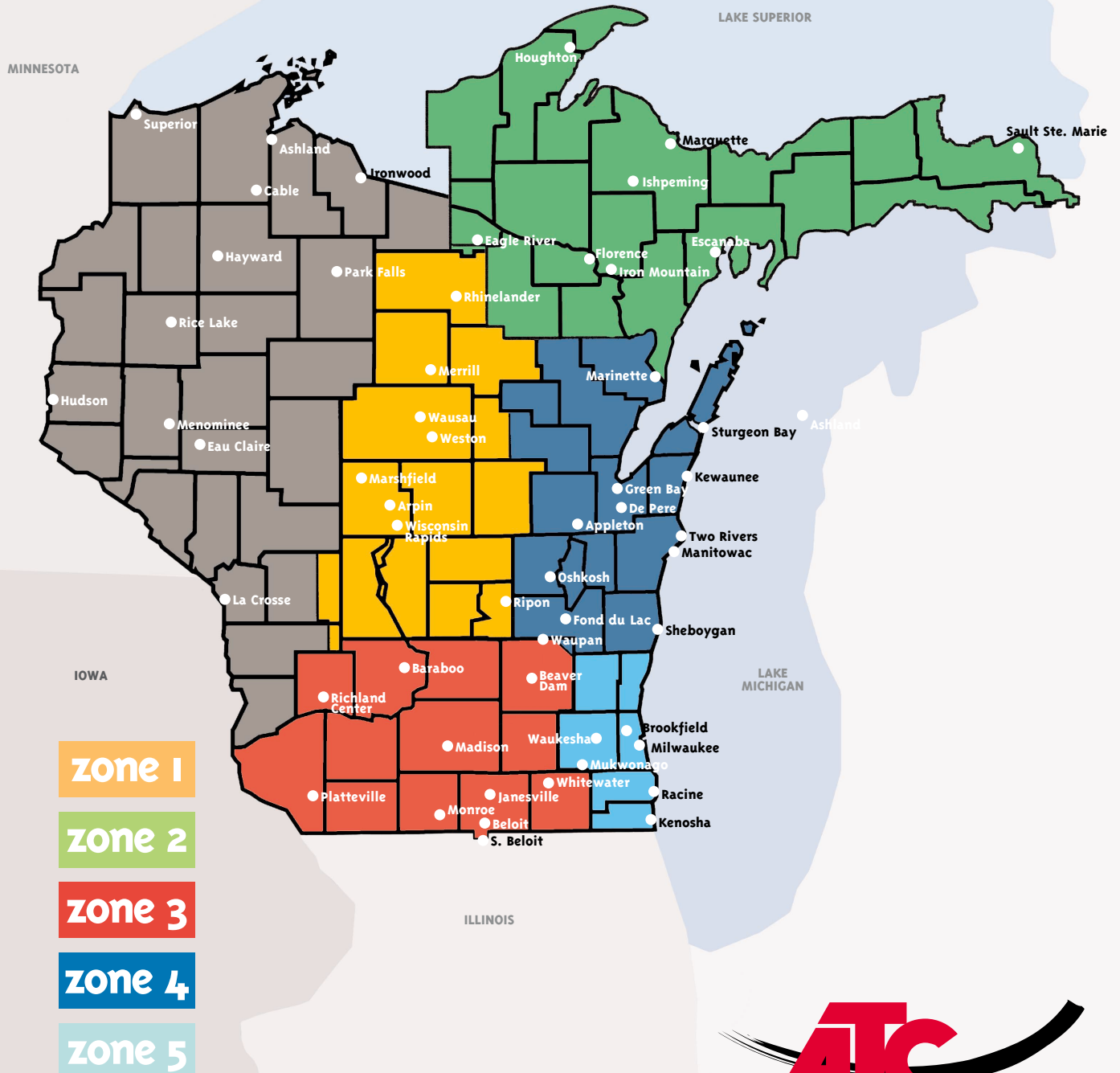
Glossary of terms

T-D interconnection:	Transmission to Distribution interconnection; place where distribution substations connect to the transmission system.
Thermal overloads:	Power flows on lines or equipment that exceeds their capacity limits.
Transformer:	Device that changes voltage levels.
Transmission loading relief:	A procedure used to limit power flows on lines or equipment, when they could overload if an outage of another system element occurred. The result is an interruption of specific power transactions that contribute to the power flow of the affected equipment.
Upgrades:	Make the transmission system element able to carry more electricity than it currently can.
Voltage collapse:	Can occur after a contingency where the voltage dips low enough and cannot recover quickly enough. Protective equipment automatically opens lines and/or transformers, causing load to be shed.
Voltage stability:	System is able to maintain the proper voltages needed to serve load.



ATC Planning Zones

Planning Zones were created to track locational energy issues. ATC has five zones: North Central Wisconsin, Michigan's Upper Peninsula and Northern Wisconsin, South Central/Southwest Wisconsin and North Central Illinois, Northeast Wisconsin and Southeast Wisconsin.



North Central Wisconsin

Population centers:

Wausau, Marshfield, Wisconsin Rapids, Rhinelander and Stevens Point

Counties:

Adams, Green Lake, Juneau, Langlade, Lincoln, Marathon, Marquette, Oneida, Portage, a portion of Shawano, Waupaca, Waushara and Wood

Largest electricity users:

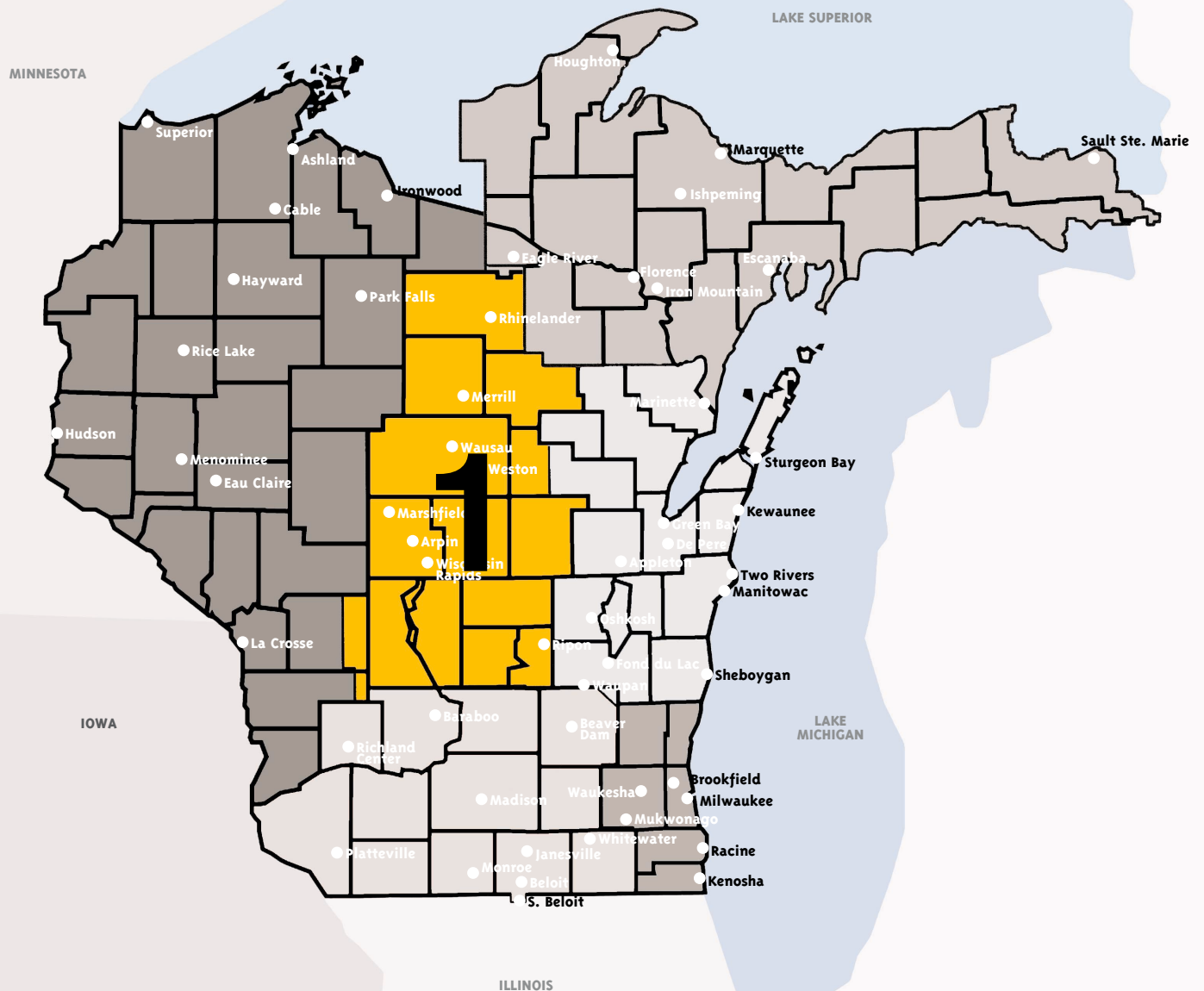
Residential and commercial consumers, large food processing plants and paper mills

Peak electricity use:

Summer, occasional peaks during the winter in northern areas

Land use:

Largely rural with agricultural and forested areas





Zone 1

north central wisconsin

TRANSMISSION SYSTEM CHARACTERISTICS

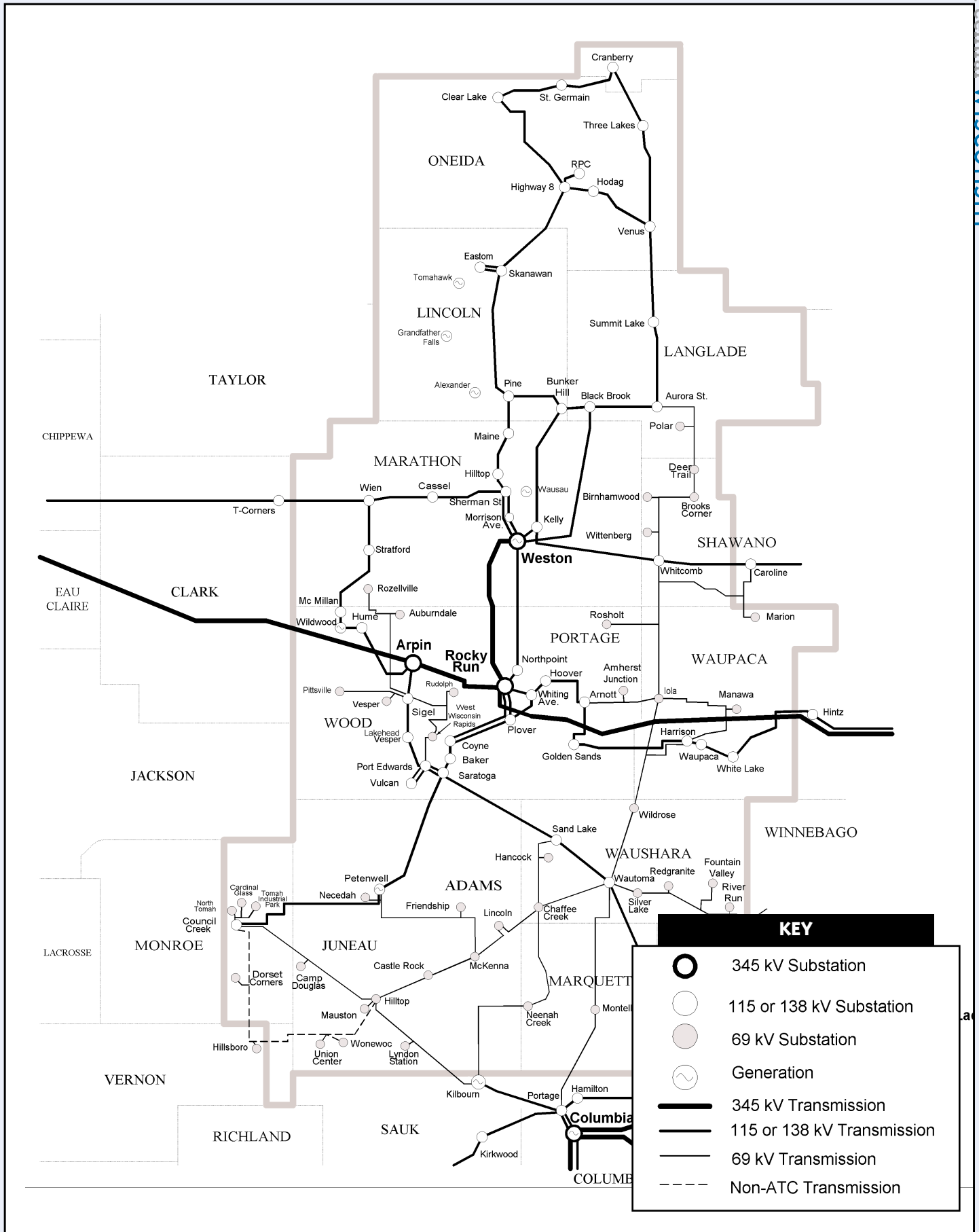
ATC delivers power in Zone 1 with various transmission facilities, including:

- Arpin-Rocky Run-North Appleton 345 kV line
- Weston-Rocky Run 345 kV line
- 115 kV network in the northern portion of the zone
- 138/69 kV network in the southern portion of the zone

There are a variety of transmission system performance issues in Zone 1, including voltage instability, overloaded lines and equipment and the need for additional capability to import power from other regions.

Proposed new generation in Zone 1 could have a profound effect on the need for new transmission lines in the area. At least three large potential generation projects have requested interconnection studies in Zone 1. As the planning for those projects progresses, new transmission needs undoubtedly will be identified. Approaches to this issue are in the conceptual stage and are presented in the Zone 1: Transmission Solutions section of this document.

Zone I Transmission System





Zone I

north central wisconsin

TRANSMISSION SYSTEM LIMITATIONS

Low voltages and overloads

In Zone I, the system exceeded performance criteria limits for low voltages and overloads. Other factors limiting the system included heavy flows on certain facilities during non-peak periods and difficulties keeping the system intact during outages on the Eau Claire-Arpin 345 kV line.

The area affected most by low voltages and overloads was the Rhinelander Loop. Addressing these issues will require a combination of new lines, uprates of existing lines and new capacitor banks.

In summer 2001, the transmission system couldn't deliver the needed power so, consequently, some load was involuntarily shed on the Rhinelander Loop. This event highlights the high load growth in this area as well as the system's susceptibility to severe overloads and low voltages. It was originally assumed that a new 115 kV line proposed as part of the Arrowhead-Weston project would mitigate these problems. When that part of the project was not approved by the PSC, it became necessary to explore alternative system reinforcements.

Also affecting potential solutions for the Rhinelander Loop are requests for new transmission-distribution interconnections. These interconnections are adjacent to the Rhinelander Loop and will require new transmission lines to the new interconnection points.

Until long-term solutions are in place on the Rhinelander Loop, the system is vulnerable to overloads, low voltages and voltage collapse. ATC, working with Wisconsin Public Service Corp., has developed an interim plan for minimizing these risks.

The approved Arrowhead-Weston project will lessen or eliminate the need for complex operating guides, meet additional capability needs and improve system stability in Zone I. Achieving targeted import capability with the Arrowhead-Weston project, however, will require upgrading select facilities. Since the earliest projected in-service date for the Arrowhead-Weston project is late 2005, it will be necessary to continue using operating guides in the near future.

north central **WISCONSIN**



Zone I

north central wisconsin

TRANSMISSION SYSTEM SOLUTION ALTERNATIVES

ATC has identified an integrated approach to solving projected transmission limitations within Zone 1. ATC's approach is based on the following solutions:

- Implement the Arrowhead-Weston project to increase import capability, lessen or eliminate the need for operating guides and improve system stability
 - Upgrade select facilities to support Arrowhead-Weston import capabilities, including,
 - Constructing a 345 kV switchyard at Weston
 - Replacing existing 345 kV/115 kV transformer at Weston
 - Reconductoring the Wein-McMillan 115 kV line
 - Rebuilding the Kelly-Whitcomb and the Weston Northpoint 115 kV lines
 - Upgrading the Weston-Kelly, the Rocky Run-Whiting Ave. and Whiting Ave.-Hoover 115 kV lines
 - Install a phase-shifting transformer at the Council Creek 69 kV bus. This project is scheduled to be in-service by early 2004 and, until Arrowhead-Weston's completion, it will serve as an interim mitigation measure for heavy flows on 69 kV and 138 kV facilities in the western edge of Zone 1.
- Implement additional transmission reinforcements for the Rhinelander Loop prior to and after 2009
 - Convert the Pine-Eastom 46 kV line to 115 kV
 - Construct a new 115 kV line from Skanawan to Highway 8

north central Wisconsin



Zone I

north central wisconsin

- Construct a new 138 kV line from Venus to Plains, which is planned for 2007. This primary alternative will mitigate low voltages and overloads on the Loop and provide a transmission source for two new T-D interconnection requests. The Venus to Plains line should provide necessary support through approximately 2010, but the Loop will require an additional source soon thereafter to ensure reliability. A new Cranberry-Conover 138 kV line coupled with conversion of the Conover-Plains 69 kV line to 138 kV is considered a primary alternative for this purpose that will also improve system voltages in the western portion of Michigan's Upper Peninsula.
- Install additional capacitor banks planned for Hodag in 2007 and for Clear Lake in 2009. These additions will help improve voltages in the Rhinelander Loop area.
- To address overloads elsewhere within Zone I
 - Uprate both Weston-Sherman St. circuits by 2007
 - Uprate the Metomen-Ripon 69 kV line by 2007
 - Add a second 138/69 kV transformer at Metomen by 2007
- To address other low voltage issues
 - Install capacitor banks at Berlin by 2007 and Winneconne by 2008
- To meet new T-D interconnection requests
 - A new 115 kV line from St. Germain to Boulder Junction
 - A new 69 kV line from a new substation near Endeavor to an intersection with the existing Portage-Wautoma 69 kV

Summary of Transmission Limitations and Solutions:

- The Rhinelander Loop will require additional reinforcement prior to and after 2009. Short-term, the new 138 kV line from Venus to Plains will provide this reinforcement.
- Ensuring Arrowhead-Weston import capabilities will require upgrades to other facilities in the area.
- Upgrading and installation of new lines/capacitors will address other Zone I needs.

Michigan's Upper Peninsula and Northern Wisconsin

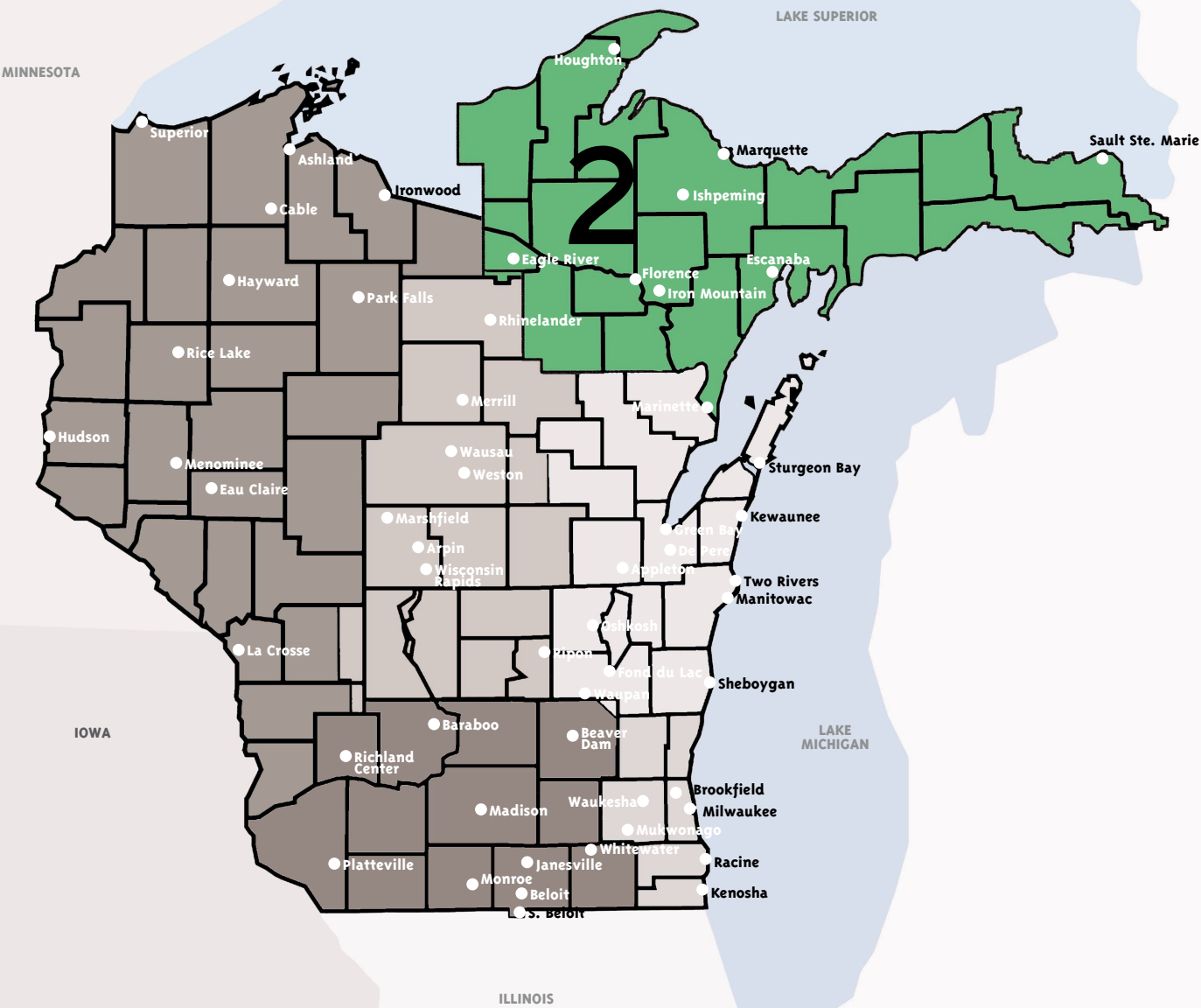
Populations centers: Escanaba, Houghton, Iron Mountain, Sault Ste. Marie, Michigan and Florence, Wisconsin

Counties: In Michigan: Alger, Baraga, Chippewa, Delta, Dickinson, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon, and Schoolcraft
In Wisconsin: Florence, Forest, portions of Marinette and Vilas

Largest electricity users: Ore mining and paper mills

Peak electricity use: Winter

Land use: Predominantly rural and heavily forested





Zone 2

michigan's upper peninsula and northern wisconsin

TRANSMISSION SYSTEM CHARACTERISTICS

ATC delivers power in Zone 2 with the following major transmission facilities:

- Morgan-Plains-Dead River 345 kV line
- Plains-Stiles 138 kV line
- 138 kV facilities linking Michigan's upper and lower peninsulas

There are a variety of transmission operational issues in Zone 2. The system has limited import and export capability, aging lines and infrastructure throughout Michigan's Upper Peninsula, and complications related to parallel path flow around Lake Michigan. Low voltages occur during certain high load and contingency conditions.



michigan's upper peninsula and northern wisconsin





Zone 2

michigan's upper peninsula and northern wisconsin

TRANSMISSION SYSTEM LIMITATIONS

Low voltages and overloads

ATC assessments indicate that transmission limitations in Zone 2 include low voltages and line and transformer overloads.*

The assessments identified overloads under various contingencies for one of the two Hiawatha-Indian Lake 69 kV lines. This line is the most chronic transmission service limiter on the ATC system. Low voltages were identified at Valley, Manistique, Blaney Park and Hiawatha substations.

ATC is currently addressing potential Hiawatha-Indian Lake overloads by opening the 69 kV lines when a first contingency analysis predicts overloads. This is preventive action and not considered a viable long-term solution.

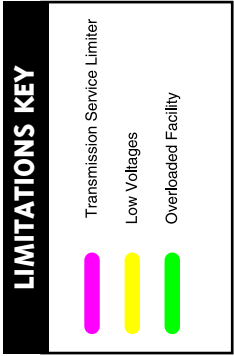
Overloads of the Presque Isle-Freeman, Freeman-Cedar, Cedar-National and Cedar-M38 138 kV circuits also were evident. Laser surveys are being conducted to determine if ratings for these existing facilities can be increased, a determination that will dictate potential solutions.

The Assessment further identified an overload of the Straits 138/69 kV transformer under various contingency conditions.

Finally, the double circuit 138 kV line from Plains to Stiles is the second most chronic limiter of transmission service on the ATC system and will require reinforcement.

*Since the 10-Year Transmission System Assessment update for 2001, published in February 2002, ATC has been conducting extensive power flow model verifications. While this process confirmed that numerous low voltages, found under contingency conditions, were proven valid and need attention, it revealed that some of the previously identified overloads and low voltages were invalid. This report reflects those findings.

michigan's upper peninsula and northern wisconsin





Zone 2

michigan's upper peninsula and northern wisconsin

TRANSMISSION SYSTEM SOLUTION ALTERNATIVES

ATC has developed a series of solutions to address projected transmission limitations within Zone 2.

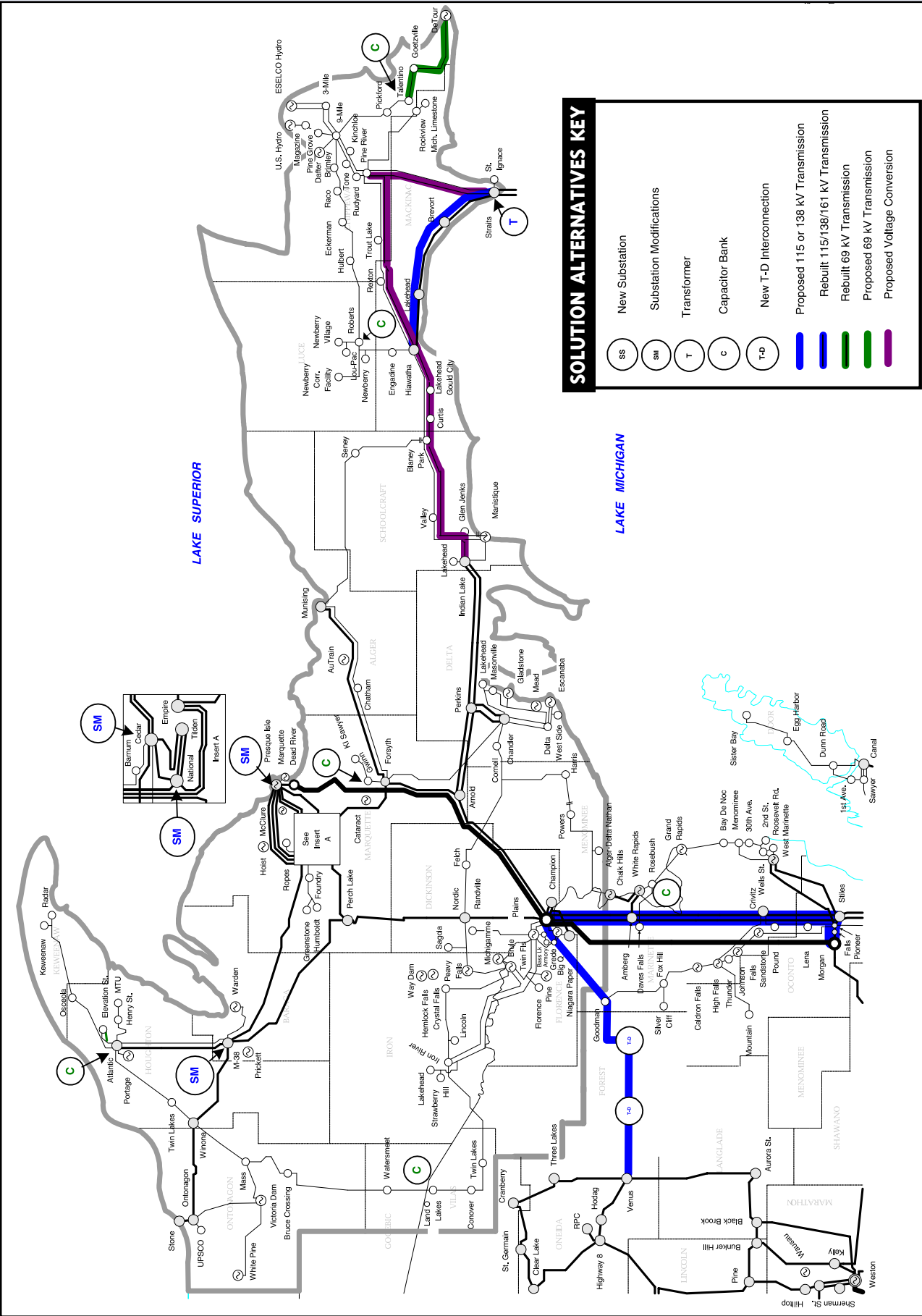
These solutions include the following:

- To avert/mitigate overloads on the Hiawatha-Indian Lake line
 - Construct a second Hiawatha-Straits 138 kV circuit by 2007 to complete two 138 kV circuits across Michigan's Upper Peninsula
- To reduce limitations on granting transmission service, improve transfer capability between Wisconsin and the Upper Peninsula of Michigan, and replace aging facilities
 - Rebuild the Plains-Stiles double circuit 138 kV line by 2006

It should be noted that the length of this line will make rebuilding time-consuming, costly and complicated. Alternatives, including transmission line projects that reduce flows on the Plains-Stiles circuits, may be preferable. This and other alternatives will require additional study and public input.

- To address other overload issues
 - Uprate 138 kV circuits south of Presque Isle Power Plant. These may include Presque Isle-Freeman, Cedar-M-38 and National Tilden 138 kV lines.

Zone 2 Transmission System Solution Alternatives



Zone 2

michigan's upper peninsula and northern wisconsin

Summary of Transmission Limitations and Solutions:

- Rebuilding one of the Hiawatha-Indian Lake 69 kV lines to double circuit 138 kV will address the most chronic transmission service limitation on ATC's system.
- A new Hiawatha-Straits 138 kV circuit will address overloads in this area.
- Upgrading 138 kV circuits south of Presque Isle Power Plant will address other overload issues.
- Rebuilding the Plains to Stiles double circuit 138 kV line will enhance import/export capability and address the second most chronic transmission service limitation on ATC's system.
- Proposed solutions for impending low voltages in Zone 2 are under consideration and will be addressed in future Assessments.



South Central/Southwest Wisconsin and North Central Illinois

Populations centers: Madison metropolitan area, Janesville/Beloit metropolitan area and South Beloit, Illinois

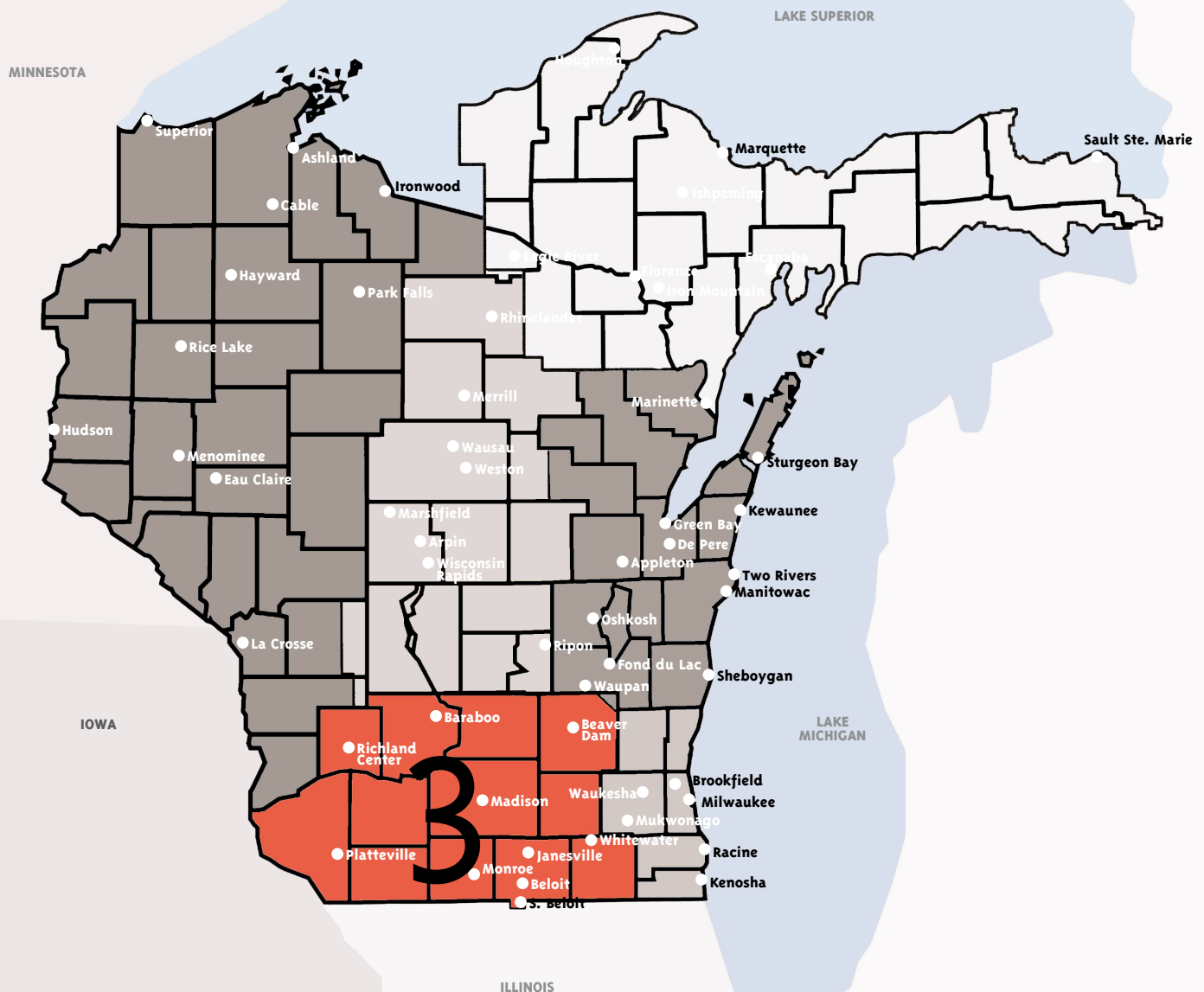
Counties: In Wisconsin: Columbia, Dane, Dodge, Grant, Green, Jefferson, Iowa, Lafayette, Richland, Rock, Sauk and Walworth

In Illinois: Portion of Winnebago

Largest electricity users: Residential and commercial consumers, manufacturing companies, food processing plants, state government and institutional loads

Peak electricity use: Summer

Land use: Primarily rural and agricultural





Zone 3

south central/southwest wisconsin
north central illinois

TRANSMISSION SYSTEM CHARACTERISTICS

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








- Columbia-North Madison 345 kV line
- Columbia-Rockdale-Paddock-Wempleton 345 kV line
- 138 kV and 69 kV facilities throughout the zone

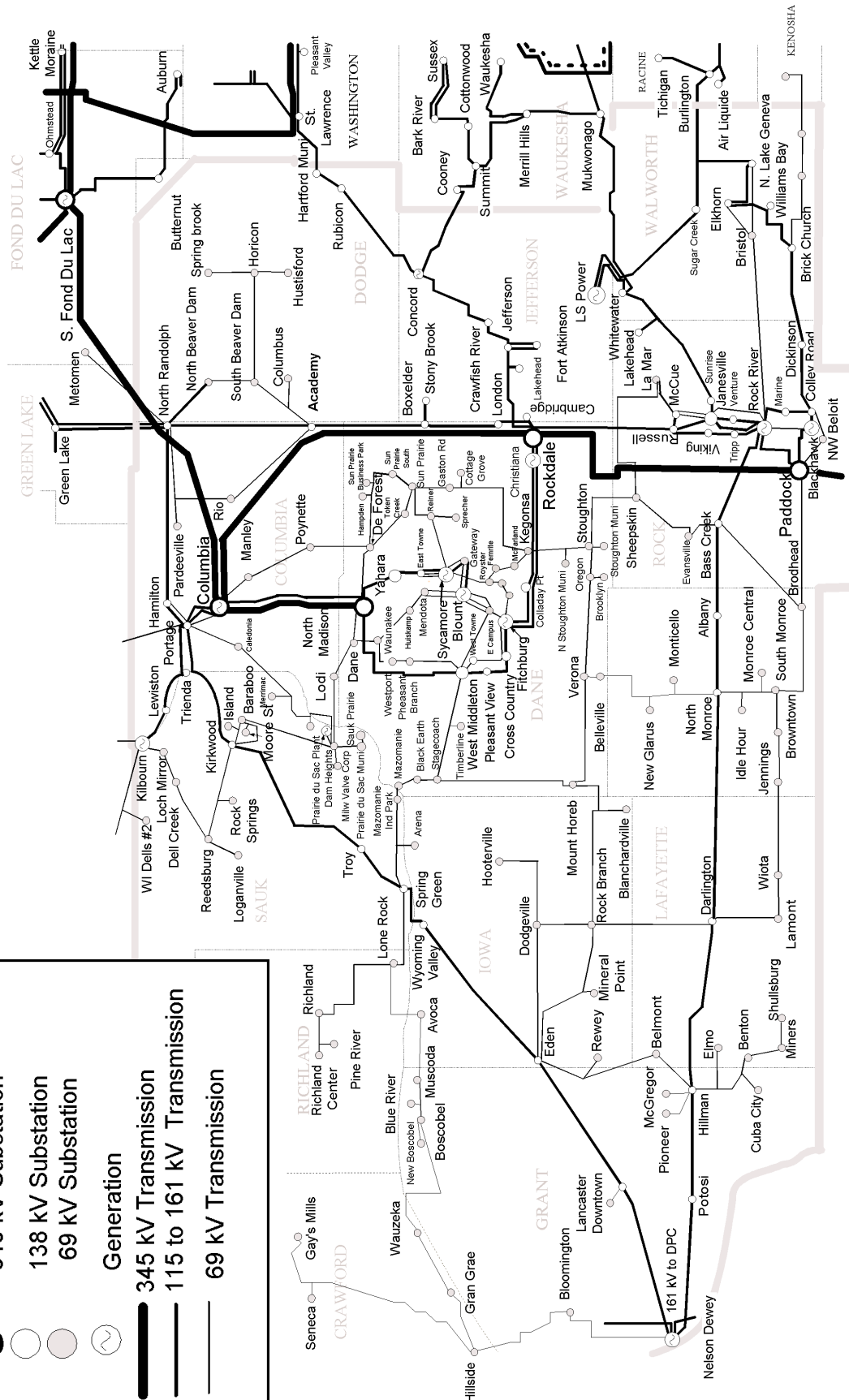
Numerous factors impact transmission system capabilities in Zone 3. Limited import capability into the Madison area, heavy power transfers affecting 138 kV and 69 kV facilities in the western portion of the zone, parallel path flows from new generation in northern Illinois and heavily loaded facilities in the eastern portion of the zone are key factors.

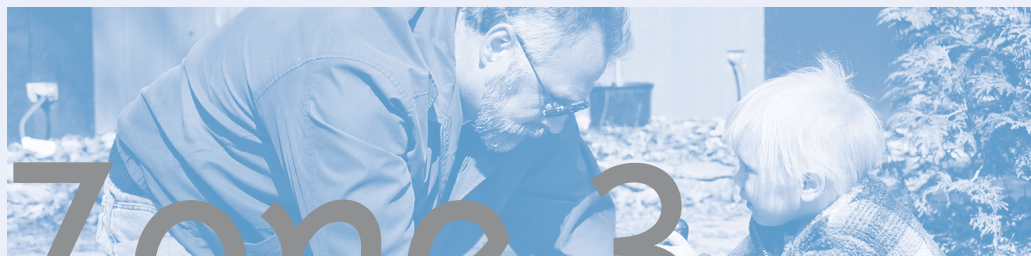


Zone 3 Transmission System

KEY

-  345 kV Substation
-  138 kV Substation
-  69 kV Substation
-  Generation
-  345 kV Transmission
-  115 to 161 kV Transmission
-  69 kV Transmission





Zone 3

south central/southwest wisconsin
north central illinois

TRANSMISSION SYSTEM LIMITATIONS

Low voltages, overloads, limitations to accommodating new generation

Areas affected by low voltages and overloads include Beaver Dam, Dodge County, Iowa County, the Madison area, Rock County, Sauk County and Walworth County. In many of these areas, transmission limitations are a byproduct of the zone's 69 kV system, which is unable to serve growing energy needs. The most prevalent example of this is in Sauk County, where the system is vulnerable to voltage collapse, overloads and low voltages.

Addressing these limitations will require new transmission lines, voltage conversions, transformer additions and line upgrades.

ATC is currently mitigating several of the zone's low voltages using existing facilities and procedures. Where mitigation is not viable, ATC is proposing alternate solutions. Beaver Dam, for instance, faces low voltages from a 69 kV system that cannot support the needs in the area beyond approximately 2006. Mitigation measures at Beaver Dam are no longer adequate, and a long-term solution has become necessary.

In addition to numerous 69 kV line overloads which affect reliability, the Madison area also faces a deficiency of strong power sources on the west side of the city where growth is most rapid. Preliminary assessment indicates that even reinforcements at 138 kV will not be effective in the long term.

Both Madison and Rock County have new generation needs that will require system improvements to enhance stability and expand capabilities. Madison-area consumers have made numerous requests for new interconnections to the transmission system from Fitchburg through Tokay and out to West Towne.

The Whitewater-Mukwonago 138 kV line is critical to importing power into Wisconsin. Over the past several years, this line has been the most chronic limiter to importing power into eastern Wisconsin. As an 80-year-old facility, however, it has been experiencing hardware and conductor failures, which are raising safety concerns, compromising its transmission service and limiting its import capacity.

Inherent in assessing limitations and solutions in the Whitewater-Mukwonago area are environmental factors. ATC is committed to pursuing an environmentally responsible solution in cooperation with state regulators and the community.

south central/southwest wisconsin and north central illinois





Zone 3

south central/southwest wisconsin
north central illinois

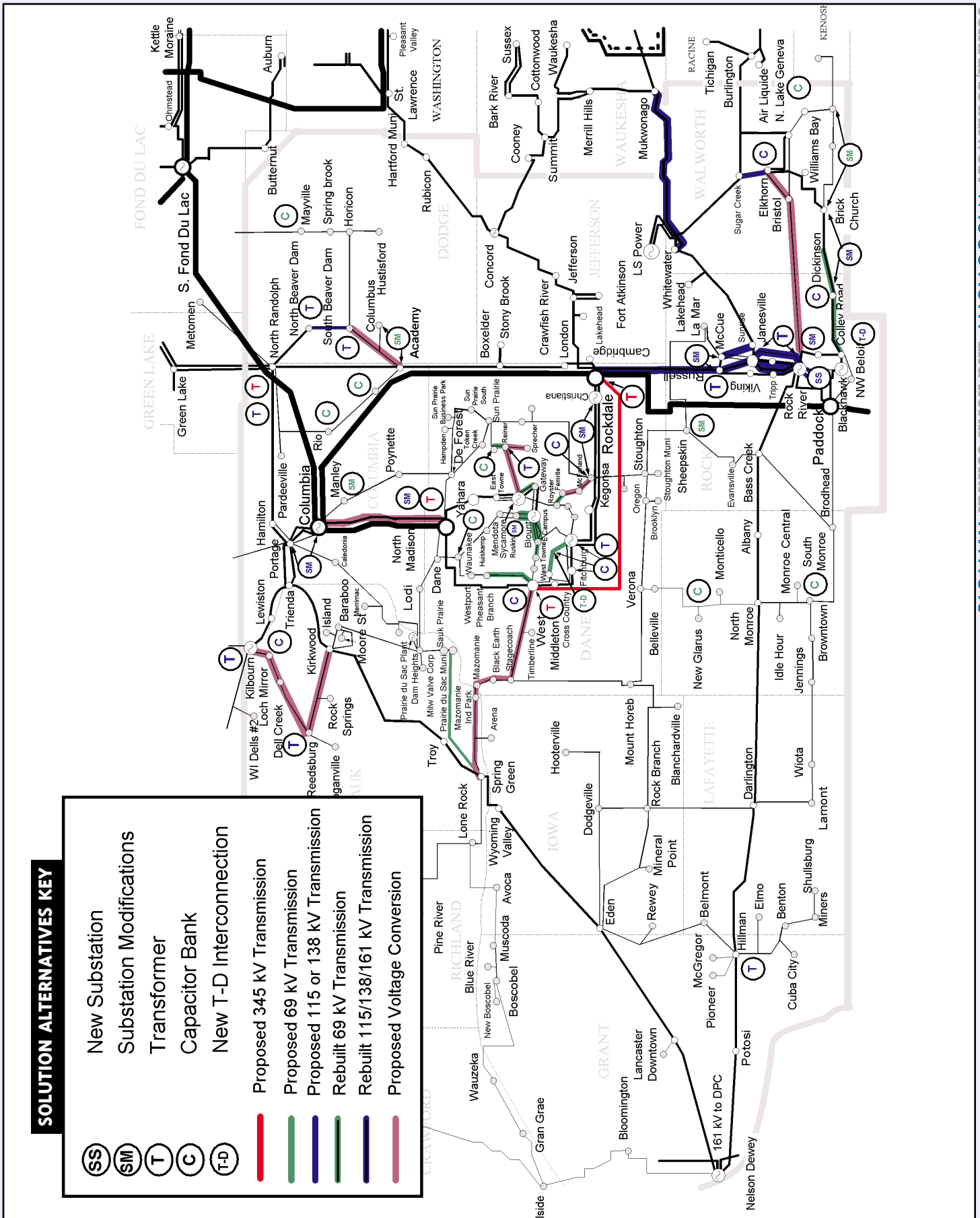
TRANSMISSION SYSTEM SOLUTION ALTERNATIVES

Based on comprehensive assessments, ATC is pursuing a range of solutions to address transmission limitations within Zone 3.

These solutions include the following:

- To address reliability and capacity for the Madison area
 - Convert the Columbia-North Madison 138 kV circuit to 345 kV and add equipment at the North Madison substation
 - Construct a new 345 kV source into the west side of Madison. One alternative would be a new Rockdale-West Middleton 345 kV circuit. Note: This alternative and others will require further evaluation and input from stakeholders and the community.
 - Install a 69 kV circuit from Fitchburg through Tokay and to West Towne by 2004 in response to customer requests for new interconnections to the transmission system
 - Reconductor various Madison 69 kV lines, including the existing East Campus-Blount 69 kV circuits by 2003, the existing Blount-Ruskin, Blount-Ruskin Tap and West Middleton-Pheasant Branch 69 kV circuits by 2004, and the Gateway-Sycamore 69kV line by 2005
 - Install a second East Campus-Walnut 69 kV circuit by 2003
 - Rebuild 69 kV circuits to 138 kV, including Kegonsa-McFarland-Femrite by 2004 and Sycamore-Reiner-Sprecher by 2006
 - Rebuild the Femrite-Royster 69 kV line
 - Uprate other lines throughout Madison as needed
- To avert overloads, improve stability and accommodate new generation in Rock County and for Riverside-related projects
 - Uprate, replace, reconductor, rebuild, convert, construct or make new installations at approximately 15 facilities/prospective facilities throughout this area of the zone
- To address reliability concerns on the Whitewater-Mukwonago line and improve transfer capability
 - Implement the 138 kV reconductor project, increasing line capacity by approximately 80 percent
 - Explore long-term solutions to the line's condition and limitations. Solutions may include, but not be limited to introducing a new 345 kV line from the Madison or Janesville/Beloit area to the Milwaukee or Kenosha/Racine area.

Zone 3 Transmission System Solution Alternatives



Zone 3

south central/southwest wisconsin
north central illinois

- To mitigate overloads in Sauk County
 - Convert the Kilbourn-Reedsburg-Kirkwood 69 kV line to 138 kV

Since this voltage conversion cannot be completed until 2004 at the earliest, interim measures are necessary to avert thermal overloads, low voltage and possible voltage collapse. ATC has developed an interim mitigation plan in cooperation with Alliant, Wisconsin Public Power Inc. and Reedsburg.

- To address stability, overload and low voltage issues
 - Install new 345 kV breakers at the Columbia power plant switchyard
 - Install new transmission lines, capacitor banks and/or transformers, including:
 - A new Elkhorn-Sugar Creek 138 kV line by 2007
 - A new Spring Green-Prairie du Sac 69 kV line by 2009
 - A conversion of the West Middleton-Spring Green 69 kV line to 138 kV by 2009
 - New capacitor banks at Birchwood, Burke, Dickinson, Elkhorn, New Glarus, Richland Center, South Monroe and Rio by 2004
 - New 138/69 kV transformers at Hillman, Fitchburg and North Randolph by 2004
 - New 138/69 kV transformer at Reiner by 2006
 - New 345/138 kV transformer at North Randolph by 2004
 - Add 138/69 kV transformer at Janesville and Rock River and uprate or reconductor four 69 kV lines in the area.
 - Complete a 138 kV loop from Academy through South Beaver Dam around the eastern edge of Beaver Dam to North Beaver Dam
 - Connect the load served off of the 69 kV system at Northwest Beloit to the 138 kV system
 - Convert the existing Turtle-Briston 69 kV line to 138 kV by 2003

Summary of Transmission Limitations and Solutions:

- A new 345 kV source into the west side of Madison will provide needed new capacity, while other system revisions will address reliability.
- Riverside-related projects will accommodate new generation needs in Rock County through line uprates, transformer replacements, line reconductors, line rebuilds, voltage conversions and capacitor bank installations throughout this area of the zone.
- The Whitewater-Mukwonago 138 kV line reconductor project will address short-term safety and import issues, increasing line capacity by approximately 80 percent.
- Converting the Kilbourn-Reedsburg-Kirkwood 69 kV line to 138 kV will mitigate overloads, low voltages and the potential for voltage collapse in Sauk County.

Northeast Wisconsin

Population centers:

Appleton, Fond du Lac, Green Bay, Marinette, Manitowoc and Sheboygan

Counties:

Brown, Calumet, Door, Fond du Lac, Kewaunee, Manitowoc, portion of Marinette, Menominee, Oconto, Outagamie, Shawano, Sheboygan, and Winnebago

Largest electricity users:

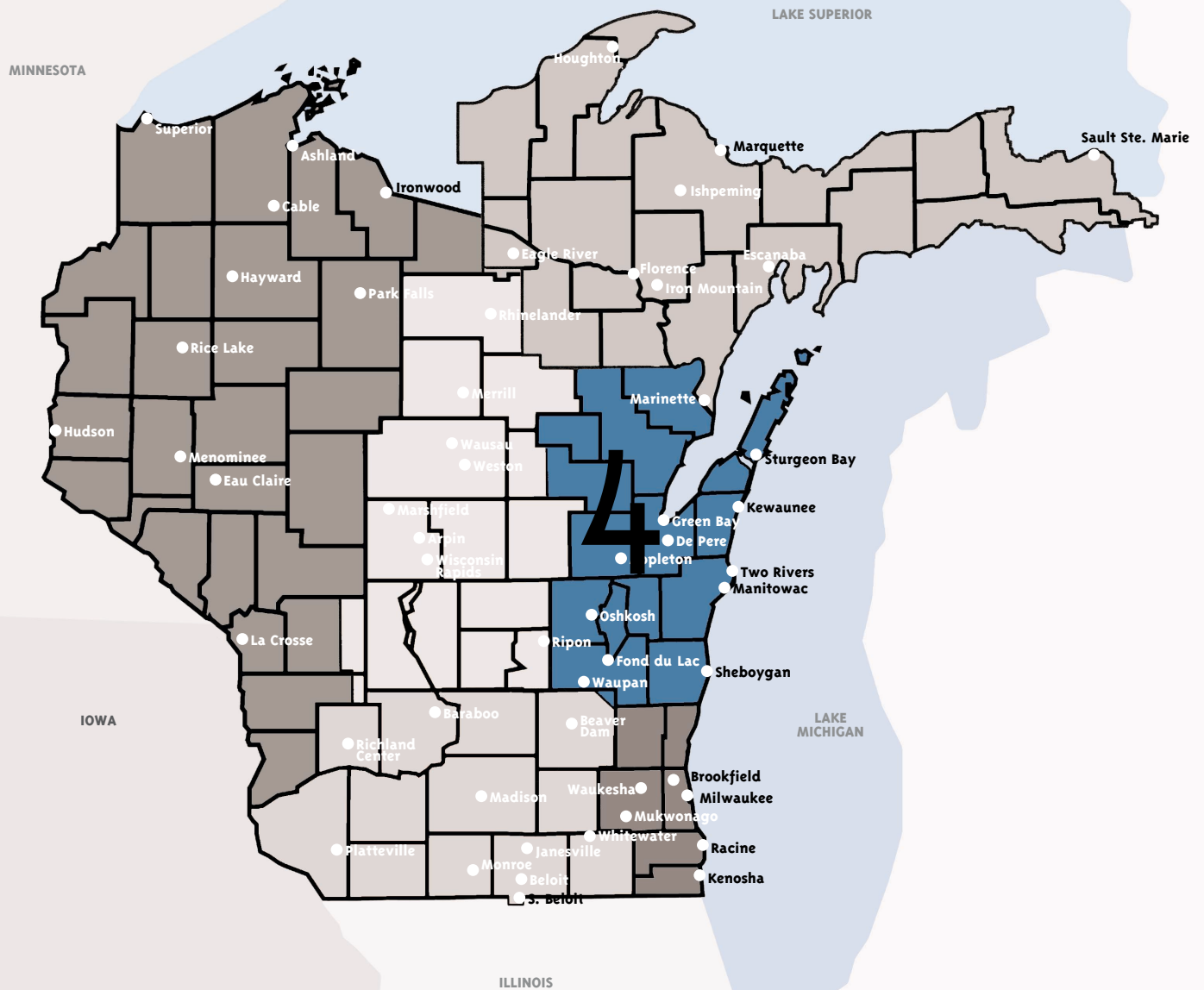
Paper mills and foundries in the Fox Valley

Peak electricity use:

Summer

Land use:

Agricultural, forest and urban areas





Zone 4

northeast wisconsin

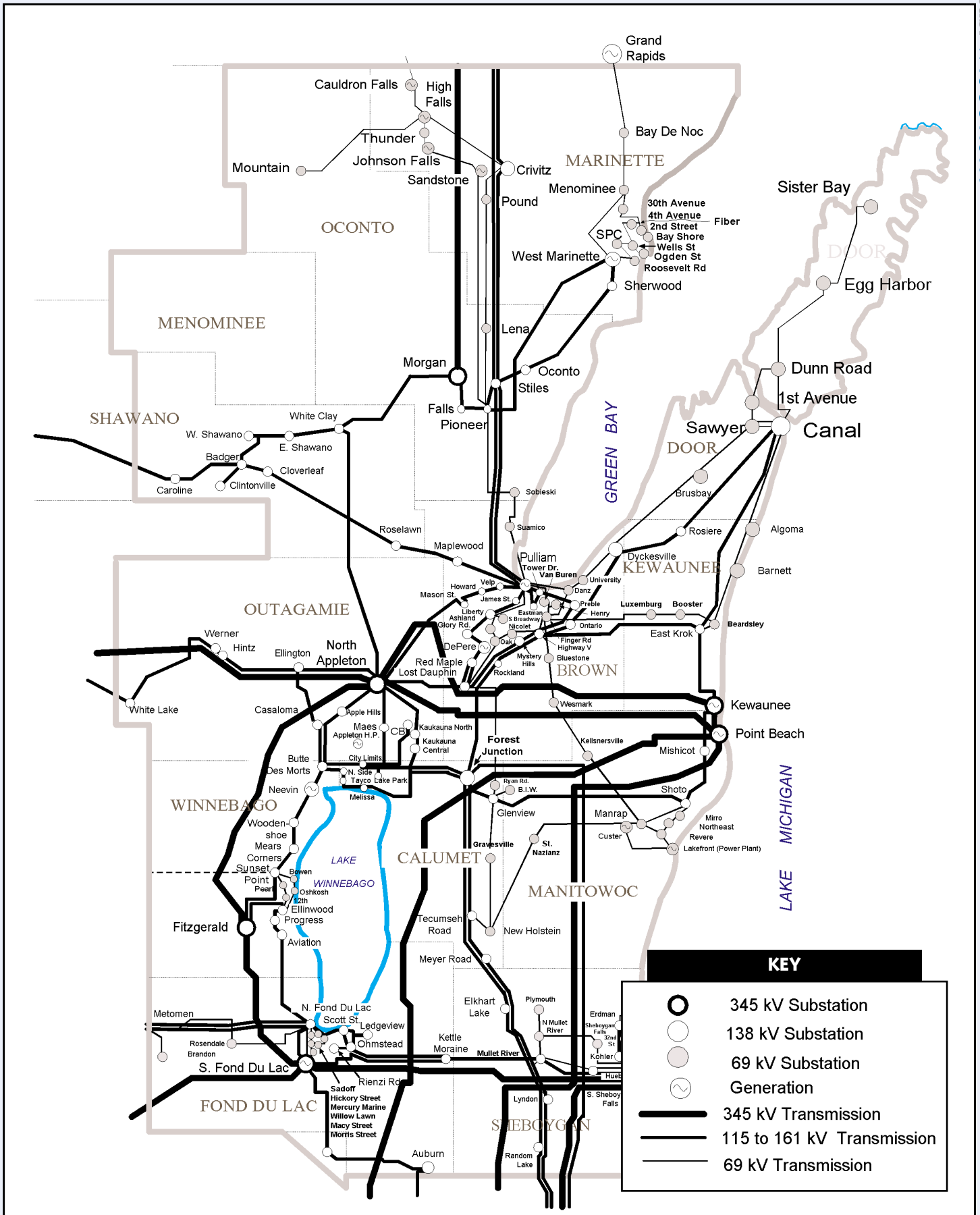
TRANSMISSION SYSTEM CHARACTERISTICS

ATC delivers power within Zone 4 with various major transmission facilities including:

- Four 345 kV lines extending from the Kewaunee and Point Beach nuclear units
- Two 345 kV lines extending from the Edgewater Power Plant
- Eastern portion of the Rocky Run-North Appleton 345 kV line
- 345 kV lines connecting South Fond du Lac to Columbia, Edgewater and North Appleton

Among the foremost factors characterizing transmission capabilities in Zone 4 are insufficient transformer capabilities in the Fox River Valley, limited import and export capability to the Upper Peninsula of Michigan, the stability response of Point Beach nuclear units, and heavily loaded, aging facilities with low voltages in Appleton, the Fox River Valley and Green Bay.

Zone 4 Transmission System





Zone 4

northeast wisconsin

TRANSMISSION SYSTEM LIMITATIONS

Low voltages and overloads

Zone 4 transmission limitations revolve around heavy loads, low voltages and overloads.

Areas affected most by overloads are the Fox River Valley, Green Bay and Sheboygan. Low voltages affect areas between Appleton and Oshkosh and throughout Door County. Heavy flows affect facilities limiting import/export capabilities between Wisconsin and the Upper Peninsula of Michigan during non-peak periods.

Addressing these limitations will require new capacitor banks, line upgrades, new and rebuilt transmission lines, new transformers and transmission line voltage conversions.

In the area west of Green Bay, there are 138 kV facilities and 115 kV facilities susceptible to heavy loading during peak and non-peak conditions. South of Green Bay, three different 138 kV circuits can be overloaded and a fourth 138 kV circuit has been the source of numerous instances of transmission loading relief. These problems will require significant transmission line rebuilds and/or construction of new transmission lines capable of resolving service and loading issues for this area.

The Morgan-Falls-Pioneer-Stiles 138 kV line and the Plains-Stiles double circuit 138 kV line is restraining import/export capability between Wisconsin and the Upper Peninsula of Michigan in Zone 4. As these lines are over 70 years old, rebuilding them would address both the capacity issue and impending physical condition of the lines.

northwest wisconsin





Zone 4

northeast wisconsin

TRANSMISSION SYSTEM SOLUTION ALTERNATIVES

ATC is pursuing an integrated system of solutions to address transmission limitations within Zone 4. Potential solutions include the following:

- To increase import/export capability to/from the Upper Peninsula of Michigan
 - Construct a new 138 kV line from Clintonville to a new Werner West substation
 - Build a new 345 kV line from Morgan to a new Werner West substation with a 345/138 kV transformer at Werner West. The new Werner West substation would interconnect with the Rocky Run-North Appleton line
 - Rebuild the Morgan-Plains and Plains-Stiles 138 kV lines

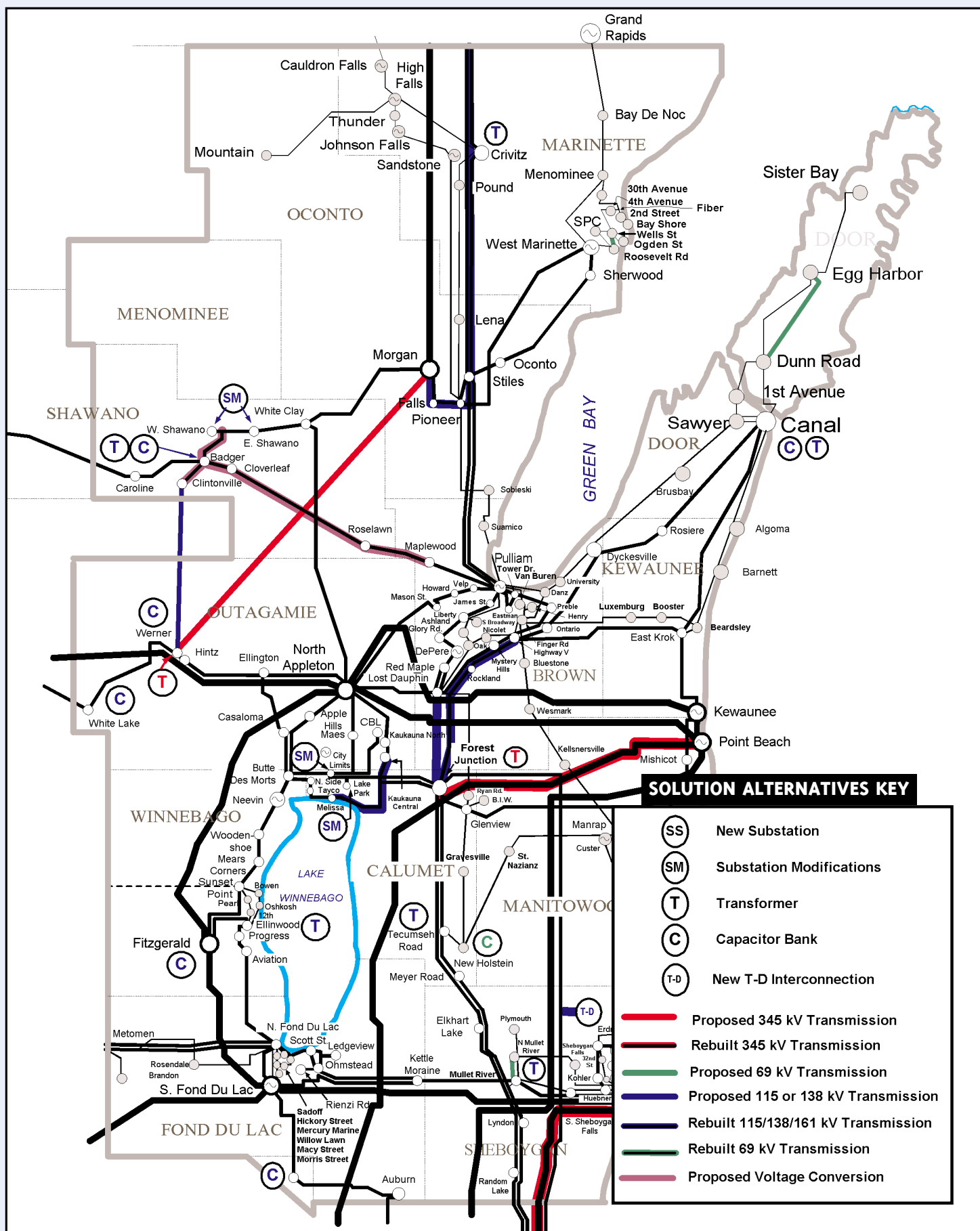
These projects would increase Wisconsin-Upper Peninsula transfer capability while improving voltage profiles west of the Fox River Valley, reducing line overloads in the Green Bay area and addressing physical deterioration of facilities.

- To resolve line loading and voltage issues in the Fox River Valley
 - Implement the Forest Junction project, which includes:
 - Rebuilding the 138 kV substation
 - Adding two 345/138 kV transformers
 - Looping the Point Beach-Arcadian 345 kV line into the substation
 - Rebuilding the Forest Junction-Highway V 138 kV line
 - Adding a Forest Junction-Lost Dauphin 138 kV circuit

This project will also improve the stability response of Point Beach units, unload Kewaunee and North Appleton transformers and improve operating/maintenance flexibility in the area.

- To address transformer loadings in the Sheboygan area
 - Install a second 138/69 kV transformer at both Mullet River and Crivitz by 2003

Zone 4 Transmission System Solution Alternatives



Zone 4

northeast wisconsin

- Replace both existing 138/69 kV transformers at Edgewater and Canal by 2003
- Install a new 345/138 kV transformer at Edgewater by 2004
- Upgrade the Ellinwood 138/69 kV transformer by 2003
- Construct a second 69 kV circuit between Mullet River and North Mullet River by 2003
- To address various other low voltage issues
 - Install capacitor banks at:
 - Butternut and Fitzgerald by 2007
 - Rosebush by 2008
 - Canal by 2009
 - Werner and White Lake by 2003
 - Upgrade the 138/69 kV transformer at Tecumseh by 2007
 - Upgrade the Lake Park-City Limits 138 kV line

Summary of Transmission Limitations and Primary Reinforcement Solutions:

- New and rebuilt lines will expand Wisconsin-Upper Peninsula import/export capability.
- The Forest Junction project will address line loading and stability issues for the Fox River Valley area.
- A series of transformer installations and replacements will help improve system reliability in the Sheboygan area.

Southeast Wisconsin

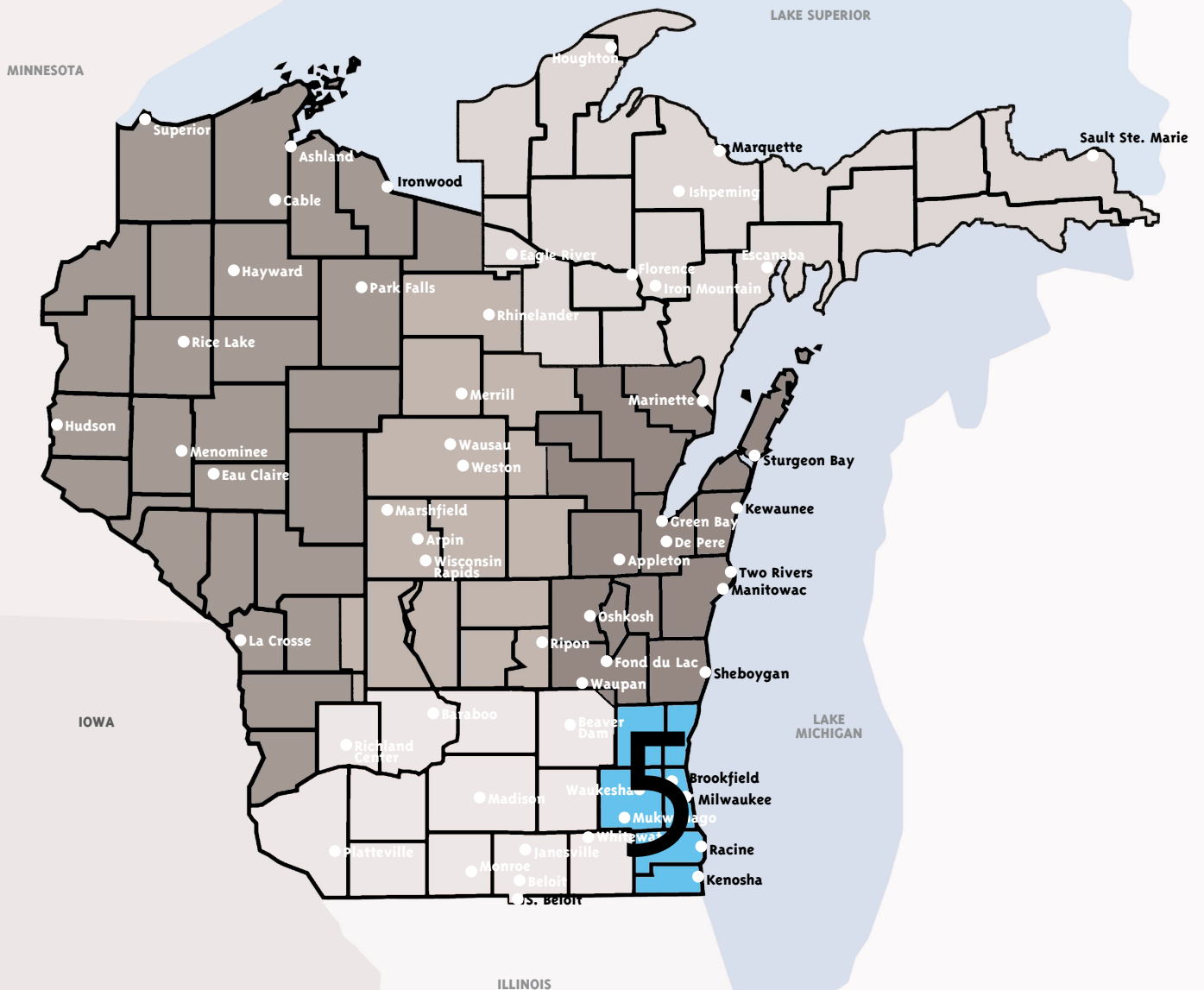
Populations centers: Milwaukee/Waukesha metropolitan area, Racine/Kenosha metropolitan area

Counties: Kenosha, Milwaukee, Ozaukee, Racine, Washington, and Waukesha

Largest electricity users: Residential and commercial consumers, large industrial load in the metropolitan areas

Peak electricity use: Summer

Land use: Mostly urban with some agricultural





Zone 5

southeast wisconsin

TRANSMISSION SYSTEM CHARACTERISTICS

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

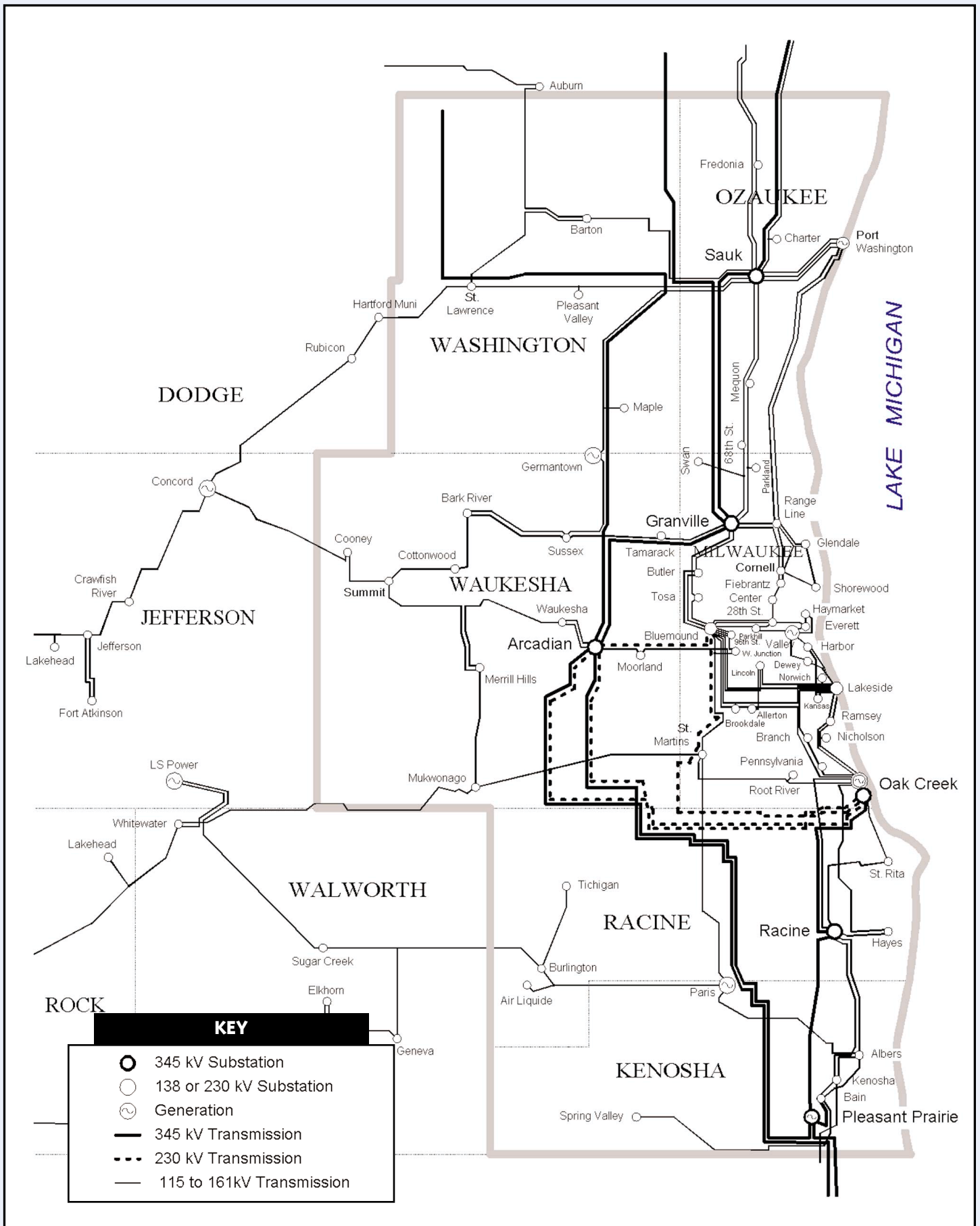
- Southern portion of 345 kV lines from Point Beach and Edgewater
- Saukville, Arcadian, Granville and Racine 345/138 kV substations
- 345 kV lines from the Pleasant Prairie Power Plant
- 345, 230 and 138 kV lines from the Oak Creek Power Plant
- Numerous 138 kV lines in the Milwaukee area

The region's new generation needs are beginning to shape expectations for current and future transmission capabilities. Several new generation projects now in the planning stages will likely influence future transmission needs.

In addition, the Wisconsin Department of Transportation plans to reconstruct the Marquette Interchange in downtown Milwaukee and may require ATC to modify or relocate transmission facilities. As WISDOT finalizes its plans, ATC will outline transmission system changes in future Assessments.



Zone 5 Transmission System





Zone 5

southeast wisconsin

TRANSMISSION SYSTEM LIMITATIONS

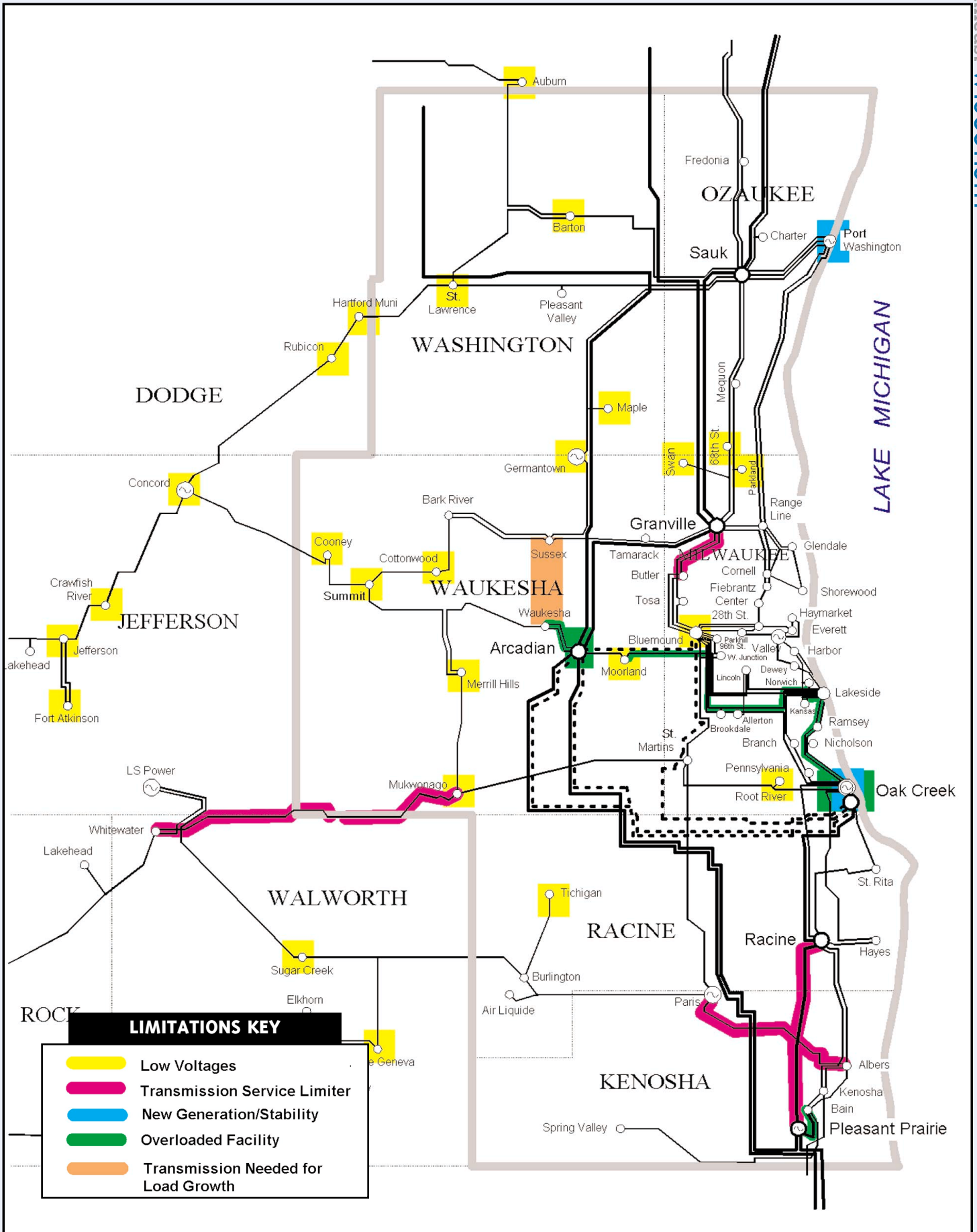
Overloads, low voltages and limitations to accommodating proposed new generation

While projects are underway to address a majority of near term Zone 5 reliability issues, a number of overloads and low voltages are impending and will require solutions in the long-term. In addition, continued load growth and significant proposed new generation throughout southeast Wisconsin, if constructed, will necessitate system reinforcement in the 2005-2011 timeframe.

Low voltages are most prominent in western Waukesha County and Jefferson County. Line overloads surface in Kenosha County, northern Milwaukee County and on the Whitewater-Mukwonago line. Please see Zone 3 for information about the Whitewater-Mukwonago line. Proposed generation at Port Washington and Oak Creek will require numerous reinforcements.



Zone 5 Transmission System Limitations





Zone 5

southeast wisconsin

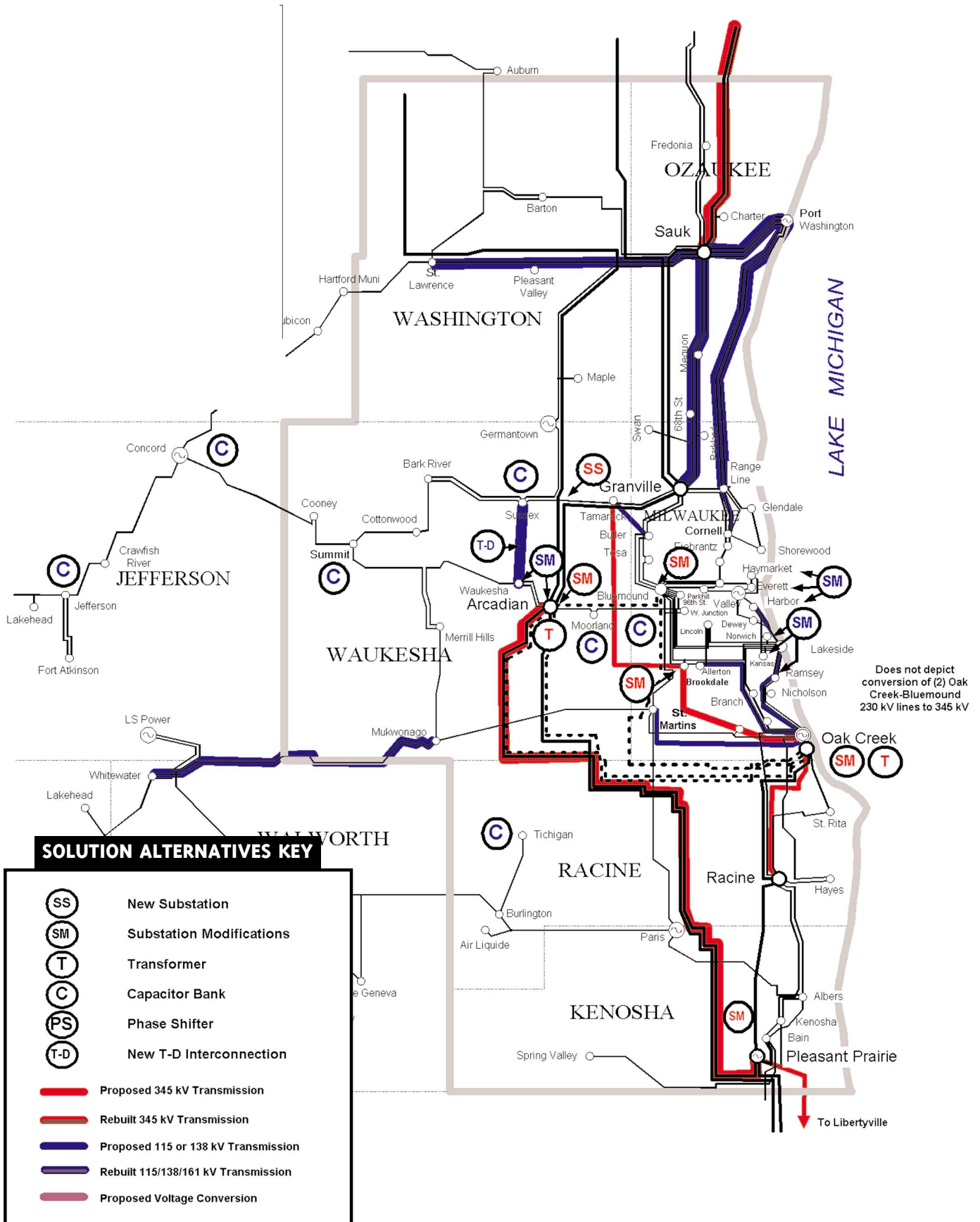
TRANSMISSION SYSTEM SOLUTION ALTERNATIVES

Various projects underway at ATC address current Zone 5 limitations. Accommodating new generation needs throughout the Milwaukee area is likely to drive Zone 5 system improvement and expansion later this decade. And impending loading and low voltage issues in the zone will require future action.

Potential solutions in Zone 5 include:

- Increase outlet line capacity to deliver proposed new generation at Port Washington
 - Rebuild five 138 kV circuits with larger conductors including two circuits to Range Line and three circuits to Saukville
- Increase outlet line capacity and construct/convert various lines to deliver proposed new generation at Oak Creek and address stability concerns
 - Construct an Oak Creek-Brookdale 345 kV line
 - Construct a Brookdale 345/138 kV substation with 1-500 MVA transformer by 2007
 - Construct a Brookdale-Granville 345 kV line by 2007
 - Convert Oak Creek-Bluemound 230 kV line (K873) to 345 kV by 2007
 - Construct Bluemound 345 kV Substation with 1-500 MVA, 345/138 kV transformer by 2007
 - Construct an Oak Creek-St. Martins 138 kV line by 2007
 - Construct Butler-Tamarack 138 kV line by 2007
 - Install Bluemound-Butler 138 kV line on new 345 kV structures by 2007
 - Reconductor Oak Creek-Ramsey 138 kV, underground segment of Harbor-Ramsey 138 kV and Oak Creek-Allerton 138 kV
 - Construct Pleasant Prairie-Libertyville 345 kV line
 - Expand Oak Creek 345 kV substation
 - Convert Oak Creek-Bluemound 230 kV line to 345 kV and reroute line into Arcadian
 - Expand Bluemound 345 kV substation
 - Replace two Arcadian 345/138kV transformers
 - Convert Oak Creek-Racine 138 kV line to 345 kV
 - Replace twenty nine 138 kV over-dutied circuit breakers at Bluemound, Harbor, Everett, and Haymarket

Zone 5 Transmission System Solution Alternatives



Zone 5

southeast wisconsin

- Resolve low voltage issues in northern Waukesha County
 - Construction of a new 345/138 kV substation at Lannon Junction, east of the Tamarack substation.
 - Evaluate need for a new 345/138 kV substation at St. Lawrence.
- Reduce general transmission limitations including low voltages and averting future overloads
 - Install capacitor banks at Summit, Tichigan and Moorland
 - Reconductor the St. Lawrence-Pleasant Valley-Saukville 138 kV line as part of the rebuild project
 - Construct a new 138 kV line from Sussex through a new substation, Duplainville, and on to Waukesha
 - Upgrade the Arcadian-Pleasant Prairie 345 kV line

Summary of Transmission System Limitations and Primary Reinforcement Alternatives:

- Zone 5 faces impending low voltage, line overload and new generation need issues.
- Accommodating new generation needs throughout the Milwaukee area will drive Zone 5 system improvement and expansion later this decade.
- Comprehensive solutions are under consideration for the heavily loaded 138 kV network in Jefferson and western Waukesha County.



Appendix

Methodology and Assumptions

The studies ATC used to reach the conclusions and recommendations in the Assessment were performed using computerized power flow analyses to identify problems and constraints in the system and to evaluate the merits of various alternative solutions. Power flow analysis simulates the projected amount of electricity that will flow to meet demand across defined elements of the transmission system under various conditions during defined periods of time.

For purposes of projections contained in this report, we utilized power flow cases representing summer peak periods in 2003 and 2009. The 2003 case was developed to assess the immediacy of needs and to establish priorities. For the purposes of projecting system needs, we assumed that 22 additional projects will be operational by June 2003.

The 2009 case was developed to assess the long-term needs and to verify that needs identified in 2003 will increase over time. We used interconnected load and resource forecast information provided by the distribution utility companies in late 2001 and reports for system-wide coincident peak loads. We projected peak load within ATC's system of 15,167 megawatts representing a 2,209 megawatts increase from 2003 or an average rate of growth of 2.66 percent. For modeling purposes, we assumed that six additional projects would be completed and placed on-line prior to 2009.

Additionally, we developed formal guidelines to determine which of many proposed generation facilities should be considered in-service for purposes of assessing the transmission system. These choices do not mean that other generation projects are not viable. These guidelines were necessitated by the volume and evolution of the interconnection requests we received since the last Assessment.

We identified the proposed new generation that would be incorporated into the model for both the 2003 and 2009 cases by selecting those generation projects for which ATC has completed the appropriate reviews and evaluations, and for which a generation developer or customer has requested and accepted transmission service approved by ATC.

To project both system and individual facility service requirements and limitations, we employed technical and system performance analyses. We follow accepted industry system performance criteria designed to ensure a reliable system. The projects we have identified in this report are designed to address the needs identified in these analyses.

For more details, please refer to the 2002 10-Year Assessment full report.





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