



### *Generation Interconnections*

The size and location of new or expanded power plants can have significant impacts on the transmission system. These impacts can range from very positive (adding voltage support in a weak area of the system) to very negative (aggravating loading problems and/or causing generator instability). Information on the status, as of July 1, 2007, of ATC's portion of the Midwest Independent System Operator generation interconnection queue is provided in this section. There continues to be significant activity in ATC's portion of this queue, ranging from newly proposed generation projects to cancellation of previously proposed generation projects.

There are two key aspects in determining the total impacts a proposed new generator may have on the transmission system:

- impacts of interconnecting the new generator to the transmission system and
- impacts of using the transmission system to deliver power from the new generator.

Per the Midwest ISO Attachment X process, interconnection impacts are assessed using up to three interconnection studies. The first study, called a *feasibility study*, includes a determination of thermal overload or voltage level impacts created by the new generator. The second study, called an *impact study*, includes a determination of whether the proposed generator and other nearby generators will remain stable under various disturbance situations, like line trips and equipment failures. It also includes a fault study analysis to determine whether existing system equipment can accommodate the increased short circuit fault duty caused by the new generator. It also identifies solutions for any thermal, stability or fault duty problems. If problems are identified in the impact study, a third study, called a *facility study*, is conducted to settle on solutions and provide cost and time estimates for construction. Delivery impacts are assessed during the interconnection study process using the Midwest ISO deliverability methodology, which determines whether a new generator is deliverable to the Midwest ISO Day 2 market and to what percent if not wholly deliverable. Whatever portion of the new generator that is deliverable may then be used as a Network Resource by Network Customers through the Midwest ISO's Module E Resource Adequacy procedures.

The results of the interconnection studies are needed to develop a comprehensive picture of the transmission facilities that will be required for a proposed generator. This is why we included in our Assessment models those proposed generators for which interconnection studies have been completed.

The first portion of this section provides the status of the generation queue within our service territory. The second portion of this section describes the transmission system additions associated with various proposed generation projects for which final interconnection studies have been completed. The third portion of this section describes



some of the implications associated with interconnecting generation at various locations within our service territory.

### **ATC Generation Queue**

Since ATC's inception, ten new generators have gone into service and one uprate to an existing generator has been completed, totaling 2,780 MW. These generators are shown in Table PR-27.

Table PR-28 lists the proposed generators in the generation queue for our service territory as of July 1, 2007. This table lists each proposed generation project and summarizes them by zone and MW amount. These proposed projects also are shown by approximate location in Figure PR-9. As shown, the total capacity of proposed generators in the queue is 5,213.5 MW. Of that proposed capacity, 44 percent reflects new coal units; wind units reflect 43 percent; combined cycle (natural gas) units reflect 12 percent; and the remaining 1 percent is comprised of simple cycle (natural gas) turbines (see Figure PR-10). Of this generation, 37 percent is proposed in Zone 5, 23 percent in Zone 3, 22 percent in Zone 4, 12 percent in Zone 1, and 6 percent in Zone 2.

The developer's projected in-service date listed in Table PR-28 is the last official commercial operation in-service date provided by the developer for that request. A developer may, per the Midwest ISO's Attachment X procedures, suspend their Interconnection Agreement which may delay the project. A developer is not required to update their official in-service date as part of this suspension.

The following requests have been suspended:

- G282 – 99 MW wind farm, Line X-14 in Lafayette County, Wisconsin
- G366 – 80 MW wind farm, Friesland Substation in Columbia County, Wisconsin
- G376 – 160 MW wind farm, Line X-4 in Green Lake County, Wisconsin
- G384 – 99 MW wind farm, Line Y-51 in Manitowoc County, Wisconsin
- G427 – 98 MW wind farm, Cypress Substation in Fond du Lac County, Wisconsin
- G483 – 50 MW wind farm, Line Y-33 in Green County, Wisconsin
- G546 – 100 MW wind farm, Line 6541 in Walworth County, Wisconsin

Generation interconnection requests previously in the generation queue, which have been cancelled or removed from the queue since January 31, 2007 (because the developer withdrew the request or missed contractual milestones), are summarized in Table PR-29.

Link to publicly posted generation queue:

[http://oasis.midwestiso.org/documents/ATC/Cluster\\_8\\_Queue.html](http://oasis.midwestiso.org/documents/ATC/Cluster_8_Queue.html)



*Transmission associated with proposed generation interconnections*

Prior to the start of the MISO Day 2 Market, transmission service for new generators was handled separately through an OASIS transmission service request(s). For generators listed below that had studies completed prior to Day 2 start-up, system reinforcements were identified through both generator interconnection and transmission service studies.

*Implications of generation development*

Availability of fuel, water and transmission interconnections are among the key aspects to be considered when siting generation.

From a transmission perspective, the ability of the transmission system to accommodate new generation is a function of stability, power flow and short circuit analyses. For certain generation technologies, harmonics and voltage fluctuations may need to be considered as well. In most instances, new generation will require certain transmission system reinforcements to interconnect and deliver the generation output. In a few specific instances, new generation can be beneficial to the transmission system, perhaps even deferring or eliminating the need for transmission reinforcements that would be necessary absent the new generation. The ability of generation to defer or eliminate the need for transmission reinforcements also can be a function of the generation location, number of generators and/or expected generator capacity factor.

In this section, a very general zone-by-zone evaluation of the likelihood of needing or deferring transmission reinforcements for various generator locations is provided. The purpose of these evaluations is to provide a very cursory indication to the generation market of the likely magnitude of the impact and the transmission reinforcements that would likely be needed by general location.

*Zone 1*

Within Zone 1, generation has been proposed in various locations, but most of the proposals have involved generation located in the vicinity of the 345-kV infrastructure. Based on studies that we have conducted for proposed generation interconnections and transmission service from this area to date, some transmission reinforcements are likely to be required for any significant (>100 MW) generation development. The extent and nature of the reinforcements largely would be a function of where the power from the generation is to be delivered.

The northern portion of Zone 1, the Rhinelander Loop, is a potential candidate for moderate-sized (up to 150 MW, depending on location) generation development, provided generator stability can be maintained, and provided it can be located in the northern portion of the Loop. Whether this generation would be cost-effective as a transmission-deferral



mechanism would depend on a number of factors. The need for additional reinforcements outside of the Loop would be a function of where the power from the generation is to be delivered.

The infrastructure in the southern portion of Zone 1 consists of five 138-kV lines and several 69-kV lines. Only smaller generation projects (<25 MW) could be accommodated with minimal transmission reinforcements. The existing infrastructure in this portion of Zone 1 is not suitable for any significant generation development.

*Zone 1 completed generation studies:*

Request	Size	Type	County, State
GIC044	500 MW	Coal	Marathon County, Wisconsin
G522	550 MW	Coal	Portage County, Wisconsin
G523	550 MW	Coal	Marathon County, Wisconsin
G588	55/60 MW	Combustion turbine	Wood County, Wisconsin

*Zone 2*

We have completed studies of three generation interconnection requests in Zone 2. Although these three requests are no longer active in the queue, they have helped us build a base of knowledge similar to what we have in other zones relating to likely generation interconnection impacts.

The most logical generation locations from a transmission infrastructure standpoint would be near the existing Presque Isle Power Plant or the Plains Substation due to the number of 138 kV lines emanating from these substations. However, any significant generation development at or near the Presque Isle Power Plant likely would require transmission reinforcements or additions due to the existing stability and thermal issues there. The completion of the Northern Umbrella Plan, however, will result in a much more robust 138-kV network at Plains Substation that could accommodate a reasonable amount of generation in the future at or near Plains.

It is likely that given the scarcity of 138-kV infrastructure in the Upper Peninsula there are virtually no other locations in Zone 2 that are ideal candidates for significant generation development. The MISO generation interconnection queue contains two proposed wind farms for Zone 2 totaling 320 MW. The studies for these requests are still in progress and required transmission reinforcements have not yet been identified.

There are areas in Zone 2, such as on the western end of the Upper Peninsula, which are or will be in need of transmission reinforcements where smaller generation projects could be beneficial in terms of deferring transmission expenditures. The allowable capacity of



such generation would depend on the location. However, other potential impacts (stability, fault duties) would need to be evaluated on a location-by-location basis.

*Zone 2 completed generation studies:*

Request	Size	Type	County, State
G567-568	165 or 300 MW	Coal	Delta County, Michigan
G583	19 MW	Biomass	Ontonagon, Michigan

*Zone 3*

In Zone 3, generation has been proposed in various locations, but over half have been in the southern-most counties in Zone 3. Generation could be beneficial in a few areas depending on the capacity of such generation and the exact location.

We are projecting that the Dane County electric system could become subject to thermal overloads, low voltages or voltage collapse, significant load shed risk, and restrictions on power imports into the county as early as 2011. We believe that extending the 345-kV network to the west side of the Madison metropolitan area, coupled with additional 138-kV reinforcements within the city and reactive support will resolve these issues over the long term.

Sauk County, though we are currently reinforcing the system, is projected to need additional transmission reinforcements in the future to ensure reliable operation. Smaller-scale generation (< 100 MW) in certain locations could be beneficial to improving the voltage profile in the area and potentially deferring transmission reinforcements. Stability analysis would need to be conducted to ensure stable operation of such generation.



Similarly, the southeast portion of Zone 3 is heavily loaded and will require transmission reinforcements in the future to ensure reliable operation. Small-scale generation in certain locations could be beneficial to changing power flow patterns and improving the voltage profile in the area.

*Zone 3 completed generation studies:*

Request	Size	Type	County, State
G281	130 MW	Wind	Green County, Wisconsin
G282	99 MW	Wind	Lafayette County, Wisconsin
G338	54 MW	Wind	Dodge County, Wisconsin
G366	80 MW	Wind	Columbia County, Wisconsin
G371	100 MW	Wind	Columbia County, Wisconsin
G483	50 MW	Wind	Green County, Wisconsin
G527	280 MW	Coal	Grant County, Wisconsin
G528	550 MW	Coal	Columbia County, Wisconsin
G546	100 MW	Wind	Walworth County, Wisconsin
G550	24 MW	Simple cycle/gas	Jefferson County, Wisconsin
G553	280 MW	Coal	Columbia County, Wisconsin
G706	99 MW	Wind	Columbia County, Wisconsin
G724	99 MW	Wind	Dane County, Wisconsin
G747	99 MW	Wind	Rock County, Wisconsin
G749	99 MW	Wind	Lafayette County, Wisconsin

*Zone 4*

Generation has been proposed in various locations in Zone 4. Generation could be beneficial in a few areas depending on the capacity of such generation and exact location. Given the nature of the issues in Zone 4, however, it is unlikely that new generation in Zone 4 will significantly alter the need for the major transmission reinforcements contemplated in that zone.

One area where generation could defer the need for transmission reinforcements is in Door County, provided such generation is small-scale (< 50 MW) and appropriately located. Currently, the northern portion of the county is served radially, and electric service is subject to interruption for the loss of the single 69-kV line serving the area. The voltage profile in Door County is projected to precipitate the need for reinforcements in the future. Small-scale generation potentially could defer certain of these reinforcements.

One area in Zone 4 that cannot accommodate any additional generation without significant transmission reinforcements is the area around the Point Beach and Kewaunee nuclear plants. In this area, existing transmission lines have little excess capacity. As the system



evolves, stability margins at those plants may become a concern. Additional generation may require transmission reinforcements to meet our stability criteria.

*Zone 4 completed generation studies:*

Request	Size	Type	County, State
G240	55 MW	Steam	Manitowoc County, Wisconsin
G338	54 MW	Wind	Dodge County, Wisconsin
G353-4	160 MW	Wind	Fond du Lac County, Wisconsin
G368	200 MW	Wind	Fond du Lac County, Wisconsin
G376	160 MW	Wind	Green County, Wisconsin
G384	99 MW	Wind	Manitowoc County, Wisconsin
G410	99 MW	Wind	Kewaunee County, Wisconsin
G421	50 MW	Wind	Brown County, Wisconsin
G427	98 MW	Wind	Fond du Lac County, Wisconsin
G486	10.5 MW	Wind	Manitowoc County, Wisconsin
G507	98 MW	Wind	Fond du Lac County, Wisconsin
G590	98 MW	Wind	Calumet County, Wisconsin
G611	99 MW	Wind	Calumet County, Wisconsin

*Zone 5*

Two major generation additions have been proposed in Zone 5. The first addition is at Port Washington Power Plant, which has been approved by the Public Service Commission of Wisconsin. Two groups of units will be installed. The first phase went in service in 2005 and the second phase is under construction to go in service in 2008. Rebuilding existing transmission lines in the Port Washington area is required to support this new generation. In order to accommodate the two units of generation at Port Washington, the two Port Washington–Rangeline 138-kV lines and the three Port Washington–Saukville 138-kV lines were rebuilt in 2005. The final project is rebuilding the Saukville–Pleasant Valley–Arthur Road–St. Lawrence 138-kV line. This line rebuild project will start in fall 2007 and be completed before June 2008 at a cost of approximately \$10 million.

The other site for new generation is the Oak Creek Power Plant. The PSCW has approved two units at the Oak Creek Power Plant, with the first unit going into service in 2009 and the second unit in 2010.

Studies of other proposed generation projects that are no longer in the generation queue indicate that additional generation in certain areas of Zone 5 would pose stability problems. In particular, larger-scale generation interconnecting to the 345-kV network could pose stability issues.



# 10-Year Assessment

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

# 2007

November 2007 10-Year Assessment  
[www.atc10yearplan.com](http://www.atc10yearplan.com)

Smaller-scale generation in certain locations in Washington and Waukesha counties potentially could be accommodated without the need for transmission reinforcements if located appropriately.

*Zone 5 completed generation studies:*

Request	Size	Type	County, State
G051	1950 MW	Coal/steam	Milwaukee County, Wisconsin
GIC027	1200 MW	Combined cycle	Ozaukee County, Wisconsin
G510	90 MW	Combined cycle	Ozaukee County, Wisconsin



*Table PR-27  
Former Generator Requests Now In-Service*

<u>Date</u>	<u>Requests on-line</u>	<u>Megawatts</u>
2000	IC006 (Eden/Little Badger)	31
2001	G074 (Combined Locks)	53
6/1/2003	G111 (Pulliam CT), G148 (Petenwell/Big Pond)	105
3/19/2004	G165 & G383 (Kewaunee uprate)	43
6/1/2004	G225 (Kaukauna CT)	60
6/15/2004	G035 & G072 (Riverside)	655
5/1/2005	G096 & G160 (West Campus)	150
6/1/2005	G044 (Fox Energy)	602
6/2/2005	G103 (Sheboygan)	370
7/16/05	G014 & G093 (Port Washington)	600
9/1/2006	G510 (Port Washington increase)	45
4/1/2007	G240 (Manitowoc)	54
5/2007	G550 (Concord uprate)	12

**Table PR-28**  
**Proposed Projects Active in the Generation Queue as of July 1, 2007**

<b>Zone</b>	<b>Queue #</b>	<b>County</b>	<b>Project capacity</b>	<b>Interconnection voltage</b>	<b>Generator technology and fuel</b>	<b>Developer projected in-service date</b>
1	G144	Marathon	550 MW	345 kV	steam/coal	6/08
1	G588	Wood	65 MW	115 kV	simple cycle/gas	3/08
1	Total		615 MW			
<b>Zone 2</b>						
2	G750	Marquette	201 MW	138 kV	wind turbine	9/09
2	G799	Houghton	120.5 MW	69 kV	wind turbine	11/09
2	Total		320.5 MW			
<b>Zone 3</b>						
3	G282	Lafayette	99 MW	138 kV	wind turbine	12/06 susp.
3	G338	Dodge	54 MW	138 kV	wind turbine	TBD
3	G366	Columbia	80 MW	138 kV	wind turbine	6/06 susp.
3	G483	Green	50 MW	69 kV	wind turbine	12/06 susp.
3	G527	Grant	280 MW	161 kV	steam/coal	3/12
3	G546	Walworth	100 MW	138 kV	wind turbine	12/08 susp.
3	G550	Jefferson	12 MW	138 kV	simple cycle/gas	6/09
3	G553 (alternate to G527)	Columbia	280 MW (not in total below)	345 kV	steam/coal	3/12
3	G706	Columbia	99 MW	138 kV	wind turbine	12/08
3	G724	Dane	99 MW	138 kV	wind turbine	9/08
3	G747	Rock	99 MW	138 kV	wind turbine	8/09
3	G749	Lafayette	99 MW	69 or 138 kV	wind turbine	8/09
3	G793	Rock	100 MW	138 kV	wind turbine	8/09
3	Total		1171 MW			
<b>Zone 4</b>						
4	G353	Fond du Lac	80 MW	345 kV	wind turbine	TBD
4	G354	Fond du Lac	80 MW	345 kV	wind turbine	TBD
4	G368	Dodge/Fond du Lac	200 MW	138 kV	wind turbine	12/07
4	G376	Green Lake/Fond du Lac	160 MW	138 kV	wind turbine	12/06 susp.
4	G384	Manitowoc/Kewaunee	99 MW	138 kV	wind turbine	10/07 susp.
4	G427	Fond du Lac	98 MW	345 kV	wind turbine	6/06 susp.
4	G507	Fond du Lac	98 MW	345 kV	wind turbine	12/07
4	G590	Calumet	98 MW	138 kV	wind turbine	12/07
4	G611	Calumet	99 MW	138 kV	wind turbine	8/08
4	G773	Brown	150 MW	138 kV	wind turbine	12/09
4	Total		1162 MW			
<b>Zone 5</b>						
5	G014	Ozaukee	500 MW	138 kV	combined cycle/gas	6/08
5	G051	Milwaukee	1300 MW	345 kV	steam/coal	6/09, 6/10
5	G093	Ozaukee	100 MW	138 kV	combined cycle/gas	6/08
5	G510	Ozaukee	45 MW	138 kV	combined cycle/gas	6/08
5	Total		1945 MW			

Notes:

1. susp = Interconnection Agreement has been suspended by the customer.
2. TBD = Customer has lifted suspension and the new in-service date is to be determined.

*Table PR-29  
 Requests Previously in the Generation Queue  
 Which Have been Withdrawn/Removed between January 31, 2007  
 and July 1, 2007*

Zone	Queue no.	County	Size	Voltage	Type	In-Service Date
1	none					
2	G567	Delta	165 MW	138 kV	steam/coal	1/11
2	G568	Delta	300 MW	138 kV	steam/coal	1/11
2	G583	Ontonagon	14 MW	69 kV	steam/biomass	6/08
3	none					
4	none					
5	G051	Milwaukee	650 MW	345 kV	steam/coal gasification	6/13

Figure PR-9  
 Generation Interconnection Requests  
 as of 7/1/07

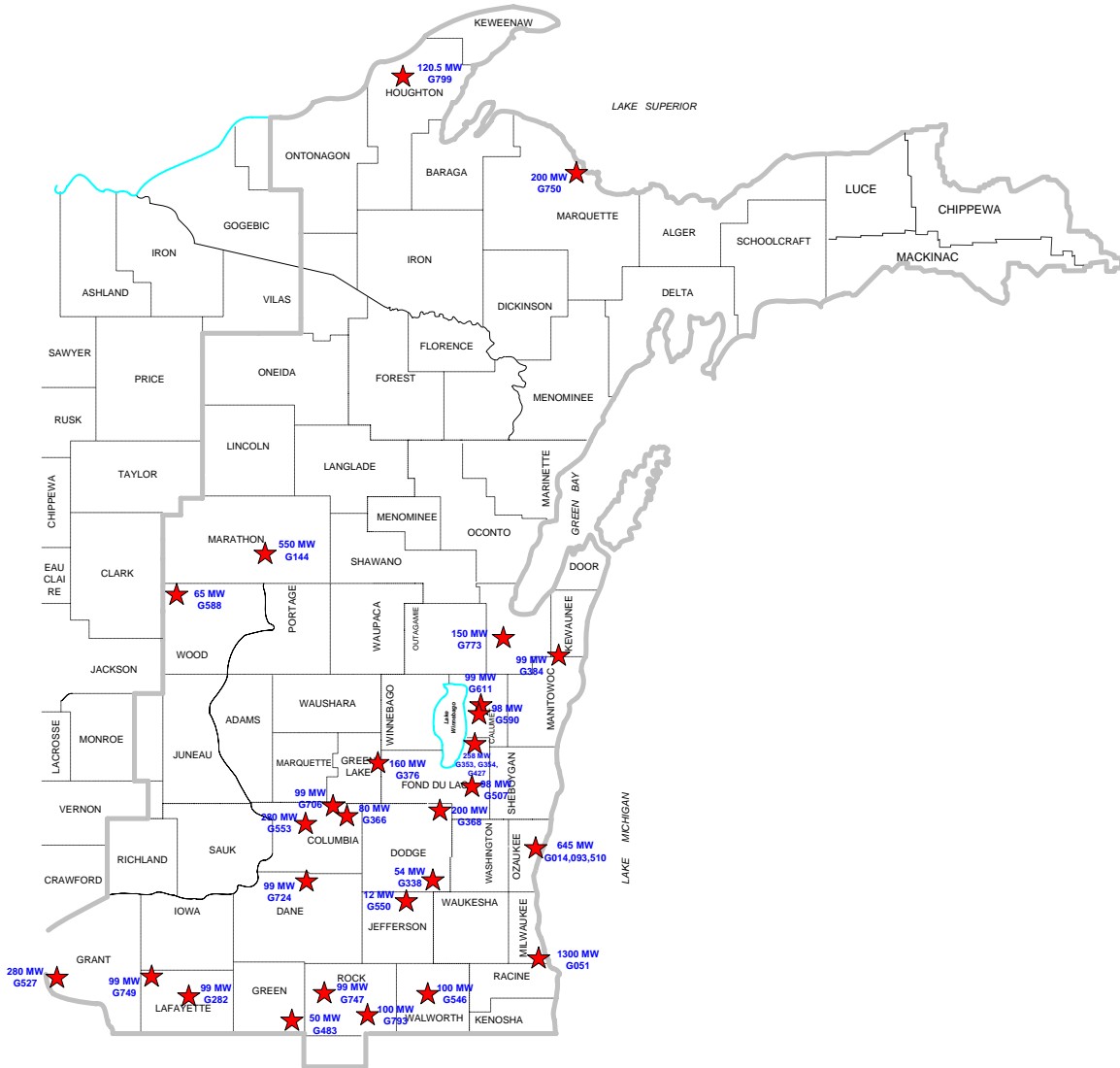


Figure PR-10

**ATC Generation Queue**

Percent of Capacity as of 2007 Assessment Update

