



section

8

Generation Developments in Wisconsin and Upper Peninsula of Michigan

Summary

- Description of generation interconnection/transmission service process
- Current ATC generation queue
- Transmission associated with proposed generation interconnections
- Implication of generation development

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 current status (as of 6/1/03) of ATC's portion of the MISO 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. This dynamic situation is a challenging aspect of the transmission planning environment, as regular changes in the generation planning environment must be correspondingly accommodated.

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.

Interconnection impacts are assessed through an interconnection study, which has two stages. The first stage, 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. If problems are identified in the impact study, a second stage study, called a “facilities study”, is conducted to identify and evaluate possible solutions. Power flow analyses may also be conducted as part of the interconnection study to provide additional insights in designing solutions.

Delivery impacts are assessed through one or more transmission service studies, which also have two stages. Similar to the interconnection study, possible delivery problems are identified in the impact study stage and solutions are identified in the facilities study stage. Either a generation developer or a potential customer of the new generator may request a transmission service study. Transmission service studies focus mostly on thermal overload or voltage level impacts of moving the power from generator to load.

The results of both the interconnection study and transmission service study are needed to develop a comprehensive picture of the transmission facilities that will be required for a proposed generator. This is why ATC included in its Assessment models only those proposed generators for which interconnection studies and transmission service studies have been completed and for which transmission service has been offered and confirmed. ***Providing some information about connection facilities for proposed generators that have requested interconnection studies but have not yet requested transmission service is one purpose of this section of the Assessment.***

The first portion of this section provides the status of the generation queue within ATC's service territory. The second portion of this section describes the transmission system additions associated with various proposed generation projects for which ATC has completed final interconnection studies. The third portion of this section describes some of the implications associated with interconnecting generation at various locations within ATC's service territory.

Current ATC Generation Queue

Table VIII-1 lists the proposed generators in the generation queue for the ATC service territory as of June 1, 2003. This table lists each proposed generation project and summarizes them by zone and megawatt amount. These proposed projects are also shown by approximate location in Figure VIII-1. In addition, project requests previously in the generation queue which have been cancelled or removed from the queue since August 2002 (because the developer withdrew the request or missed contractual milestones) are summarized in Table VIII-2.

Link to Publicly Posted Generation Queue:
<http://oasis.midwestiso.org/documents/ATC/queue.html>

Table VIII-1 Proposed Projects in the Generation Queue as of June 1, 2003

ZONE	QUEUE NO.	COUNTY	PROJECT CAPACITY	INTERCONNECTION VOLTAGE	GENERATOR TECHNOLOGY AND FUEL	DEVELOPER PROJECTED IN SERVICE DATE
1	GIC011/G49	Portage	950 MW	345 kV	combined cycle/gas	6/05
1	GIC014/G62	Wood	755 MW	345 kV/138 kV	simple cycle/gas	7/05
1	GIC044/G144	Marathon	500 MW	345 kV	steam/coal	6/08
1	G254	Portage	590 MW	345 kV/138 kV	combined cycle/gas	6/05
1	G268	Wood	189 MW	115 kV	simple cycle/gas	3/05
1	G323	Oneida	5.6 MW	115 kV	diesel/oil	6/03
1	G324	Oneida	19.6 MW	115 kV	diesel/oil	6/03
1	G325	Oneida	16.8 MW	115 kV	diesel/oil	6/03
1	Total		3026 MW			
2	Total		0 MW			
3	GIC004/G35	Rock	453 MW	138 kV	simple cycle/gas	6/04
3	GIC020/G72	Rock	150 MW	138 kV	simple cycle/gas	6/04
3	GIC029/G96	Dane	105 MW	69 kV	simple cycle/gas	2/05
3	GIC047/G148	Juneau	19.5 MW	69 kV	simple cycle/gas	6/03
3	GIC049/G96	Dane	45 MW	69 kV	simple cycle/gas	2/05
3	G281	Green	130 MW	138 kV	wind turbine	6/04
3	G282	Lafayette	130 MW	138 kV	wind turbine	6/04
3	G288	Walworth	100 MW	138 kV	wind turbine	12/04
3	G289	Rock	100 MW	138 kV	wind turbine	12/04
3	G306	Dodge/Fond du Lac	200 MW	138 kV	wind turbine	12/04
3	G338	Dodge	54 MW	138 kV	simple cycle/gas	12/04
3	Total		1486.5 MW			
4	GIC007/G44	Outagamie	600 MW	345 kV	combined cycle/gas	6/05
4	GIC010/G48	Fond du Lac	725 MW	345 kV	simple cycle/gas	6/05
4	GIC015/G63	Manitowoc	90 MW	345 kV	nuclear	5/04, 5/04
4	GIC034/G103	Sheboygan	530 MW	345 kV	simple cycle/gas	6/04
4	GIC035/G111	Brown	85 MW	138 kV	simple cycle/gas	6/03
4	GIC050/G165	Kewaunee	35 MW	345 kV	nuclear	1/04
4	G225	Outagamie	60 MW	138 kV	simple cycle/gas	5/04
4	G240	Manitowoc	55 MW	69 kV	simple cycle/gas	9/05
4	G322	Brown	10 MW	138 kV	diesel/oil	6/03
4	G326	Marinette	2.8 MW	138 kV	diesel/oil	6/03
4	G327	Marinette	19.6 MW	138 kV	diesel/oil	6/03
4	G332	Shawano	80 MW	138 kV	wind turbine	12/05
4	G333	Shawano	80 MW	138 kV	wind turbine	12/05
4	G334	Calumet	80 MW	138 kV	wind turbine	12/05
4	G335	Fond du Lac	160 MW	345 kV	wind turbine	12/05
4	Total		2612.4 MW			
5	GIC002/G14	Ozaukee	1000 MW	138 kV	combined cycle/gas	6/05, 6/08
5	GIC012/G51	Milwaukee	1950 MW	345 kV/138 kV	steam/coal gasification	6/08, 6/09, 6/11
5	GIC012/G167	Kenosha	1200 MW	345 kV	steam/coal gasification	6/08, 6/09, 6/11
5	GIC027/G93	Ozaukee	200 MW	138 kV	combined cycle/gas	6/05, 6/08
5	Total		4350 MW			

Table VIII-2 Requests Previously in the Generation Queue which have been Withdrawn/Removed between August 2002 and June 1, 2003

ZONE	QUEUE NO.	COUNTY	SIZE	VOLTAGE	TYPE	DATE
1	G295	Portage	500 MW	345 kV	Coal	6/08
1	G302	Green Lake	160 MW	138 kV	Wind	11/04
1	G321	Marathon	7 MW	115 kV	Diesel	6/03
2	---	---	---	---	---	---
3	GIC008/G045	Rock	99 MW	69 kV	Gas	6/03
3	GIC023/G076	Grant	52 MW	69 kV	Gas	6/04
3	GIC026/G087	Grant	200 MW	161 kV	Gas	6/05
3	G303	Columbia	100 MW	138 kV	Wind	11/04
3	G306	Dodge/Fond du Lac	200 MW	138 kV	Wind	12/04
4	GIC000.1/G001	Brown	75 MW	138 kV	Gas	1/04
4	GIC001.1/G013	Manitowoc	99 MW	69 kV	Gas	6/03
4	GIC041/G131	Brown	500 MW	138 kV	Coal	6/07
4	G224	Outagamie	60 MW	138 kV	Gas	6/04
4	G249	Shawano	110 MW	138 kV	Gas	6/04
4	G320	Kenosha	8.4 MW	138 kV	Diesel	6/03
5	GIC001/G007	Kenosha	1100 MW	345 kV	Gas	6/04
5	GIC013/G054	Waukesha	375 MW	345 kV	Gas	6/03
5	GIC003	Waukesha	350 MW	345 kV	Gas	11/04
5	GIC016	Racine	545 MW	138 kV	Gas	6/04

Transmission Associated with Proposed Generation Interconnections

For a specific generator in the active queue as of June 1, 2003 and having an interconnection agreement, but not yet meeting transmission service criteria for inclusion in the Assessment models, Table VIII-3 lists the transmission system reinforcements identified in the final generation interconnection study. For a generator with a

completed interconnection study but without an interconnection agreement, Table VIII-4 lists the transmission system reinforcements identified in the final generation interconnection study. Note that these reinforcements may not include facilities that would be needed to grant a transmission service request to move the generated power to a specific customer.

Table VIII-3 Generation Interconnection Requests With an Interconnection Agreement and a Final Facilities Study, But With No Transmission Service Agreement

QUEUE NO.	PROJECT NAME	TRANSMISSION REINFORCEMENTS REQUIRED FOR INTERCONNECTION ONLY ¹	REQUESTED IN SERVICE DATE
GIC007/G44	Fox Energy	Construct new 345 kV switchyard; loop North Appleton-Point Beach 345 kV line into new switchyard	6/2005
“	“	Construct a new Fox Energy- Forest Junction 345 kV line; add a 345/138 kV transformer at Forest Junction	6/2005
GIC011/G49	Plover	Construct new 345 kV switchyard; loop North Appleton-Rocky Run 345 kV line into new switchyard	6/2005

¹ Transmission Service studies will need to be completed to determine additional reinforcements that may be needed to deliver firm power from the generator. Upgrades listed do may not include any facilities needed for transmission service.

Table VIII-4 Generation Interconnection Requests Without an Interconnection Agreement and with No Transmission Service Agreement, but having a Final Facilities Study

QUEUE NO.	PROJECT NAME	TRANSMISSION REINFORCEMENTS REQUIRED FOR INTERCONNECTION ONLY ²	REQUESTED IN SERVICE DATE
GIC010/G48	Fond du Lac	Construct new 345 kV switchyard at plant site; loop South Fond du Lac-Edgewater 345 kV line into new switchyard	6/2005
“	“	Construct new 345 kV switching substation; loop South Fond du Lac-Edgewater 345 kV line and Point Beach-Granville 345 kV lines into new switchyard	6/2005
GIC014/G62	Sherry Mill	Construct new 345 kV terminal at Arpin substation	6/2005
GIC034/G103	Sheboygan	Construct new 345 kV switchyard at plant site; loop Point Beach-Grandville 345 kV line into new switchyard	6/2004

² Transmission Service studies will need to be completed to determine additional reinforcements that may be needed to deliver firm power from the generator. Upgrades listed may not include any facilities needed for transmission service.

Implications of Generation Development

There are several aspects to be considered in siting generation. Availability of fuel, water and transmission are key among those. 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. 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 a transmission reinforcement can also 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 (Arpin, Rocky Run, Weston). Based on studies that ATC has 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 megawatts) generation development. The extent and nature of the reinforcements will be a function of where the power from the generation is to be delivered.

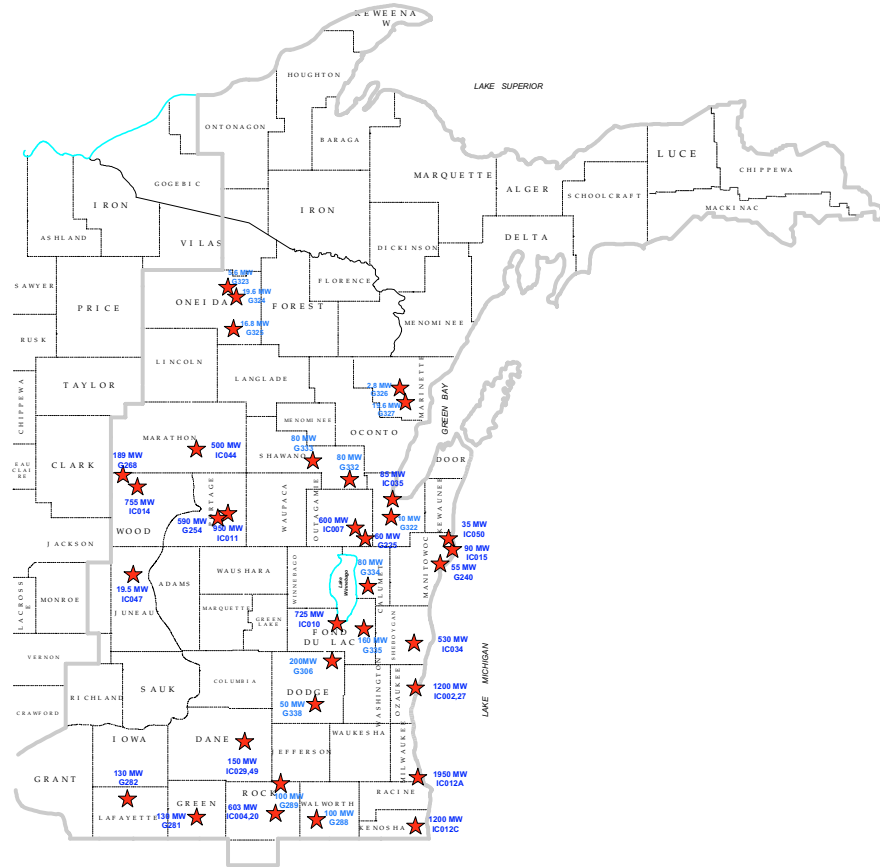
The northern portion of Zone 1, the Rhinelander Loop, is a potential candidate for moderate sized (up to 150 megawatts, depending on location) generation development, provided generator stability can be maintained and provided it can be located in the northern portion of the Loop. Generation in this area could defer the need for transmission reinforcements planned to be implemented in the 2006-07 timeframe. 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 a couple of 138 kV lines and several 69 kV lines. Only smaller generation projects (<25 megawatts) 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 Study Links:

- <http://oasis.midwestiso.org/documents/ATC/GIC011%20Study%20Report.pdf>
- <http://oasis.midwestiso.org/documents/ATC/GIC014%20Study%20Report.pdf>
- <http://oasis.midwestiso.org/documents/ATC/GIC044%20System%20Impact%20Study%20Report.pdf>
- <http://oasis.midwestiso.org/documents/ATC/GIC044%20Facility%20Study%20Report.pdf>
- http://oasis.midwestiso.org/documents/ATC/GIC044_Addendum.pdf
- http://oasis.midwestiso.org/documents/ATC/G323-324_System_Impact_Study_Report.pdf
- http://oasis.midwestiso.org/documents/ATC/G325_System_Impact_Study_Report.pdf

Figure VIII-1
Generation Interconnection Requests
as of 6/1/03



Zone 2

ATC has not completed any generation interconnection or related transmission service studies in Zone 2 and thus, does not have the base of knowledge that it has in other zones as it relates to likely generation interconnection impacts. One of the more logical locations from a transmission infrastructure standpoint would be near the existing Presque Isle plant, however, any significant development at or near Presque Isle would likely require significant transmission reinforcements.

In fact, given the scarcity of 138 kV infrastructure in the Upper Peninsula, there are virtually no locations in Zone 2 that are ideal candidates for any significant generation development. There are areas in Zone 2, such as on the western end of the Upper Peninsula, that are or will be in need of transmission reinforcements for which smaller generation projects could be beneficial in terms of deferring transmission expenditure. 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 Study Links:

None

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.

ATC is projecting that the Madison area is going to become subject to voltage instability in the next five or six years. ATC believes that extending the 345 kV network to the west side of Madison will resolve this issue over the long term. However, generation on the west side of Madison could potentially defer the need for such transmission construction provided the generation is not too large (> 200 megawatts) and appropriately located.

In Sauk County, though ATC is currently reinforcing the system, the area is still projected to need transmission reinforcements in the future to ensure reliable operation. Smaller scale generation (< 100 megawatts) 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 Study Links:

<http://oasis.midwestiso.org/documents/ATC/GIC004%20Study%20Report.pdf>
<http://oasis.midwestiso.org/documents/ATC/GIC020%20Study%20Report.pdf>
<http://oasis.midwestiso.org/documents/ATC/ic029-49summary.pdf>
<http://oasis.midwestiso.org/documents/ATC/GIC047%20Summary.pdf>

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 megawatts) 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 could potentially defer certain of these reinforcements.

Another area where small-scale generation could potentially defer the need for transmission reinforcements is in the Sheboygan area, provided the generation is appropriately located. Studies would need to be conducted to ensure stability.

One area in Zone 4 that cannot accommodate any additional generation without significant transmission reinforcements is in the vicinity of 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 would exacerbate those limitations.

Zone 4 Completed Generation Study Links:

<http://oasis.midwestiso.org/documents/ATC/GIC007%20Study%20Report.pdf>
<http://oasis.midwestiso.org/documents/ATC/GIC010%20Study%20Report.pdf>
<http://oasis.midwestiso.org/documents/ATC/GIC010%20Thermal%20Addendum.pdf>
<http://oasis.midwestiso.org/documents/ATC/GIC015%20Study%20Report.pdf>
<http://oasis.midwestiso.org/documents/ATC/GIC034%20System%20Impact%20Study%20Report.pdf>
<http://oasis.midwestiso.org/documents/ATC/GIC034%20Facility%20Study%20Report.pdf>
<http://oasis.midwestiso.org/documents/ATC/GIC035%20Report.pdf>
http://oasis.midwestiso.org/documents/ATC/GIC050_System_Impact_Study_Report.pdf
<http://oasis.midwestiso.org/documents/ATC/G225%20System%20Impact%20Study%20Report.pdf>
http://oasis.midwestiso.org/documents/ATC/G225_Facility_Study_Report.pdf
<http://oasis.midwestiso.org/documents/ATC/G240%20System%20Impact%20Study%20Report.pdf>
<http://oasis.midwestiso.org/documents/ATC/G240%20Facility%20Study%20Report.pdf>
http://oasis.midwestiso.org/documents/ATC/G322_System_Impact_Study_Report.pdf
http://oasis.midwestiso.org/documents/ATC/G326-327_System_Impact_Study_Report.pdf

Zone 5

Two major generation additions have been proposed in Zone 5, one of which has been approved by the Wisconsin PSC (Port Washington) and is expected to be in service in 2005 (Phase 1) and 2008 (Phase 2). The other proposed addition will require significant transmission reinforcements in southeast Wisconsin.

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.

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

Zone 5 Completed Generation Study Links:

<http://oasis.midwestiso.org/documents/ATC/GIC002%20Study%20Report.pdf>
http://oasis.midwestiso.org/documents/ATC/GIC012A_Facilities_Study_Report.pdf
<http://oasis.midwestiso.org/documents/ATC/GIC012A%20Phase%201%20Study%20Report.pdf>
http://oasis.midwestiso.org/documents/ATC/GIC012A_preI_restudy_stability_report_phaselI.pdf
http://oasis.midwestiso.org/documents/ATC/GIC027_Impact_Report_Rev1.pdf
http://oasis.midwestiso.org/documents/ATC/GIC027_Facilities_Study_Report.pdf