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2005 Michigan Capacity Needs Forum
Transmission/Distribution Subgroup
Transmission Capabilities Determination Studies

Background

Phase 1 of the transmission capabilities determination study will be to analyze the amount of existing import capability into the study areas. For the purposes of this study, Michigan will be broken into three areas that approximately coincide with the ITC, METC and ATC footprints in the state. An area's ability to serve load within a targeted loss of load expectation will first be determined for each area without any support from outside that area. The "no outside support" LOLE will determine an area's capacity needs as if an area had no transmission interconnections. The phase 1 transmission capabilities determination study results will determine the amount of support available to an area via the transmission system (transfer capability into an area). The phase 1 transmission capabilities determination study results will be integrated with the results of "no outside support" LOLE analysis to identify overall area capacity need improvements to meet 1 day in 10 year LOLE reliabilty. That is, an area's ability to serve load with a LOLE of less than a target level will be determined considering the generation sources internal to that area and the transmission transfer capability into that area.

Phase 1 will only examine where we are relative to the target LOLE and will not speak to the amount of transmission capacity that might be needed to achieve a desire "economic" goal. Phase 2 will analyze possible transmission system enhancements to achieve certain capacity targets. The capacity targets to be analyzed include achieving a (an):

1) Incremental increase so that 0% of an area's identified capacity shortfall is met via transmission improvements (assumes 100% will come from "local" generation, no action is necessary for the transmission/distribution subgroup for this scenario).
2) Incremental increase so that 50% of an area's identified capacity shortfall is met via transmission improvements (assumes the other 50% will come from "local" generation, this study would not be needed for those area's determined to have sufficient existing capacity).
3) Incremental increase so that 100% of an area's identified capacity shortfall is met via transmission improvements (this study would not be needed for those area's determined to have sufficient existing capacity). In other words, without any additional generation, transmission is added such that the target 1 day in 10 year LOLE is met.
4) Total import for an area that is 1/4 of that area's total load + losses.
5) Total import for an area that is 1/3 of that area's total load + losses.

These analyses are intended to determine the transmission needed to meet reliability needs (for a given assumption on generation additions) and to provide some different transmission system capabilities so that other groups may analyze the comparative economics of these different transmission system capabilities. The Transmission/Distribution Subgroup recognizes that it may need to analyze additional target total import levels if warranted by the economic analysis results.

Major Assumptions

1) "The market will provide" – there will be sufficient generation capacity outside MI available as a source
2) There is sufficient transmission capacity outside of the MI CNF T/D subgroup study area (AEP, ATC, FE, ITC, MAIN and METC) to allow the outside generation capacity to get into the study area
3) Any transfer capability impacts of additional generation in MI are either negligible or would be mitigated by transmission upgrades (in other words, new generation and associated transmission added will not change transfer capabilities)
4) All "planned" and "proposed" projects listed in Appendix A of the 2005 MISO Transmission Expansion Plan are implemented
5) The T/D subgroup is not responsible for analyzing economics or making a determination as to which scenario is better (for example 100% local generation vs. 100% transmission)
6) The T/D subgroup will strive to propose the "best" transmission upgrades without consideration for assignment of costs for those facilities. Limited consideration may be given to facility constructability – however, in general, some uncertainty over the ability to construct would not preclude inclusion of a conceptual future project
7) If a 2014 case is preformed, a reasonable approximation of the projected 2014 summer peak conditions in MI is achievable by altering the 2009 peak MI CNF case by changing loads in the study area (AEP, ATC, FE, ITC, MAIN and METC) to 2014 levels and by adding any "planned" or "proposed" projects scheduled to be added in the study area between 2009 and 2014.
8) A reasonable approximation of the projected 2009 & 2014 off-peak conditions in MI is achievable by ….

Phase 1

Purpose

Phase 1 will determine the existing import capabilities into 1) ITC, 2) METC, 3) ATC (zone 2) and 4) MECS (the combined ITC/METC) under projected 2009 and 2014 conditions with sensitivities to prevailing conditions in the surrounding areas.

Cases to be used

The starting point MI CNF case will be the 2009 MTEP phase 2 summer peak case. At the time of the 2009 MTEP phase 2 summer peak case development, it contained all of the planned and proposed projects to be implemented in the MISO footprint. Subsequent to the development of this case, additional planned and proposed projects have been identified. In addition, the 2009 MTEP phase 2 summer peak case contained "mock" generation in the ITC footprint. This "mock" generation was included in order so that load could be served in the ITC footprint with available generation given the ECAR base case development rules on including transfers in cases. The starting point MI CNF case will thus be the 2009 MTEP phase 2 summer peak case modified to remove the "mock" generation, adjusted to reflect the latest load forecast, enhanced by adding in the incremental planned and proposed projects with area interchanges adjusted as necessary to support these changes as well as to allow the modeled phase shifters to be at their target flow levels.

Note the cases listed below would be needed to support the scenarios that have been proposed. The MI CNF Transmission/Distribution Subgroup may decide to deviate from the previously proposed scenarios thus altering the cases needed.

Case Name	General	Transmission Topology	ITC Load & Losses (MWs)	METC Load & Losses (MWs)	ATC zone 2 Load & Losses (MWs)
09s_0	Starting point MI CNF Case	0 MWs Flow Michigan to Ontario (regulated by PARs)	13,343	11,865	870
09s_1500	Starting point MI CNF Case	1500 MWs Flow Michigan to Ontario (regulated by PARs , B3N and J5D @250, L4D and L51D @ 500)	13,343	11,865	870
09s_ese	Starting point MI CNF Case with ESE Hydro plant out	xxx MWs Flow Michigan to Ontario (regulated by PARs)	13,343	11,865	870
09s_off	Off-peak conditions (starting point case to be determined)	xxx MWs Flow Michigan to Ontario (regulated by PARs)			
09s_off_lud	Off-peak conditions with Ludington pumping (starting point case to be determined)	xxx MWs Flow Michigan to Ontario (regulated by PARs)			
14s_0	Starting point MI CNF Case Modified to get 2014 peak conditions (need for this case to be determined)	0 MWs Flow Michigan to Ontario (regulated by PARs)			

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Case Name	General	Transmission Topology	ITC Load & Losses (MWs)	METC Load & Losses (MWs)	ATC zone 2 Load & Losses (MWs)
14s_1500	Starting point MI CNF Case Modified to get 2014 peak conditions (need for this case to be determined)	1500 MWs Flow Michigan to Ontario (regulated by PARs , B3N and J5D @250, L4D and L51D @ 500)			
14s_ese	Starting point MI CNF Case Modified to get 2014 peak conditions with ESE Hydro plant out (need for this case to be determined)	xxx MWs Flow Michigan to Ontario (regulated by PARs)			
14s_off	Off-peak 2014 conditions (need for this case to be determined, if used starting point case to be determined)	xxx MWs Flow Michigan to Ontario (regulated by PARs)			
14s_off_lud	Starting point MI CNF Case Modified to get off-peak 2014 conditions with Ludington pumping (need for this case to be determined, it used starting point case to be determined)	xxx MWs Flow Michigan to Ontario (regulated by PARs)			

Contingencies to be Analyzed

Contingencies would be applied in ITC, METC, ATC, AEP and FE. Contingencies for all facilities 100 kV and above would be analyzed in ITC, METC, ATC, AEP and FE. In addition, 69 kV facility contingencies would analyzed in the UP.

Contingency	Rating Applied	Used in transfer capability determination	Used in voltage analysis	Used to identify possible cascading under maximum transfer conditions
None	SN	Y	Y	N
Single Generator (dispatched off) [1]	SN	Y	Y	N
Single Generator (tripped) [2]	SE	Y	Y	N
Single Transmission	SE	Y	Y	N
Single Transmission + Single Generator (dispatched off) [3]	SE	Y	Y	N
Double Circuit Tower	N	N	N	Y
Breaker Fault/Failure	N	N	N	Y
Bus Section[5]	N	N	N	Y
Single Transmission + Single Generator (tripped)	N	N	N	Y
Double Transmission[4]	N	N	N	Y
Double Generator[5]	N	N	N	Y

Cases would be set up at the transfer level as determined in the transfer capability analysis. Contingency analysis would be performed on these cases to determine if any voltage criteria would be violated. PV curves may be developed on those scenarios with identified voltage violations. Time permitting, more stringent contingencies would be applied to these cases to determine if these indicate that possible cascading conditions might exist.

[1] Only the largest unit at a location would need to be analyzed. Units are modeled as dispatched off by taking the unit out of service as part of a contingency and redispatching the remaining units in the area to make up for the outaged generation. Only units considered in ATC zone 2 were ESE units.
[2] Only the largest unit at a location would need to be analyzed. Units are modeled as tripped off by taking the unit out of service as part of a contingency and redispatching the remaining units in the model to make up for the outaged generation. This is intended to emulate inertial pickup of units. Only units considered in ATC zone 2 were ESE units.
[3] Only the largest unit at a location would need to be analyzed. Units are modeled as dispatched off by taking the unit out of service as part of a contingency and redispatching the remaining units in the area to make up for the outaged generation. Only units considered in ATC zone 2 were ESE units.
[4] These include all combinations of single transmission contingencies not otherwise contained in another contingency list (bus section, double circuit tower, breaker fault/failure). The analysis would be more stringent than NERC category C because no manual intervention would be modeled between events. To limit the number of combinations a minimum voltage level for facilities to be considered may be applied.
[5] These include all combinations of single generator contingencies. For this analysis, all generators were considered (not just the largest unit). Thus, multiple units connected to the same power flow bus were considered. The analysis preformed was more stringent than NERC category C because no manual intervention was modeled between events.

Facilities to be Monitored

All facilities 100 kV and above would be monitored in ITC, METC, ATC, AEP and FE. In addition, 69 kV facilities would be monitored in the UP.

Transfers to be Analyzed

These are proposed scenarios. It may be necessary to consolidate some of these results in the final report.

	09s _0	09s _1500	09s _off	09s _off _lud	14s _0	14s _1500	14s _off	14s _off _lud
MAAC to ITC	X	X			X	X		
VACAR to ITC	X	X			X	X		
TVA to ITC	X	X			X	X		
MAIN to ITC	X	X			X	X		
MAAC/VACAR/TVA/MAIN to ITC	X	X			X	X		
MAIN to METC	X	X			X	X		
VACAR to METC	X	X			X	X		
TVA to METC	X	X			X	X		
MAIN to METC	X	X			X	X		
MAAC/VACAR/TVA/MAIN to METC	X	X			X	X		
NI to Presque Isle Generator in UP	X	X	X	X	X	X	X	X
MAAC to ITC/METC	X	X			X	X		
VACAR to ITC/METC	X	X			X	X		
TVA to ITC/METC	X	X			X	X		
MAIN to ITC/METC	X	X			X	X		
MAAC/VACAR/TVA/MAIN to ITC/METC	X	X			X	X		

Transfers into an area would be modeled by proportionately decreasing the output of all generation. Analyzing the Single Transmission + Single Generator (dispatched off) contingencies will model conditions for a specific unit outage.

Transfers out of an area would be done by scaling up all generation in the area. The participation points will be the same as those used in recent ECAR seasonal assessments.

Methodologies NI to Presque Isle generator transfers differ from the other transfers because there is a specific critical unit outage being studied, so the full set of Single Transmission + Single Generator (dispatched off) are not being run for these transfers. In addition, the transfers are being made to a specific set of generators in this transfer.

Results

Table	Description ("T" = transmission element, "G" = generator)
1A	Transfer capabilities
1B	Low voltages at identified transfer limits
1C	High facility loadings resulting from NERC category C outages at identified transfer limits
1D1	Limiting elements for transfers
1D2	Key contingencies for transfers
1E	Listing of planned and proposed facilities included in study
1F	Summary of Base Case Conditions

Phase 2

Purpose

Phase 2 will analyze transmission upgrades needed to achieve various targets.

Cases to be used

Same as in phase 1 with upgrade scenarios added to achieve targeted improvements.

Contingencies to be Analyzed

Contingencies analyzed in phase 1 would be augmented with any new contingencies created by virtue of transmission system changes.

Facilities to be Monitored

Facilities monitored in phase 1 would be augmented by monitoring any new facilities added by virtue of transmission system changes.

Transfers to be Analyzed

Same as in phase 1.

Results

Table	Description ("T" = transmission element, "G" = generator)
2A	Transfer capabilities for upgrade scenarios
2B	Low voltages at identified transfer limits for upgrade scenarios that achieve targets
2C	High facility loadings resulting from NERC category C outages at identified transfer limits for upgrade scenarios that achieve targets
2D1	Limiting elements for transfers for upgrade scenarios that achieve targets
2D2	Key contingencies for transfers for upgrade scenarios that achieve targets
2E	Listing of upgrade scenarios that achieve targets