

MICHIGAN WIND ENERGY TRANSMISSION STUDY – PHASE II

STUDY SCOPE

DRAFT

1 Purpose

There are currently several studies already taking place or under consideration with the intent of analyzing the interconnection of wind resources within the Lower Peninsula of Michigan. These studies include:

- Michigan Wind Energy Transmission Study I (study work done)
- Michigan Wind Energy Transmission Study II
- Michigan Planning Consortium (MPC) Future Generation Working Group (FGWG)
- Michigan Wind Energy Resource Zones Board (WERZB) Transmission Study
- Various Midwest ISO Generation Interconnection Studies
- The Midwest ISO Regional Generation Outlet Study (RGOS) II

This study will combine the (1) Michigan Wind Energy Transmission Study Phase II, (2) the MPC FGWG Study and (3) the Michigan WERZB Transmission Study by utilizing various input assumptions developed via input from the MPC FGWG and Michigan WERZB as described in this scoping document.

The results of this study will be utilized to provide input into the Midwest ISO Generation interconnection studies and RGOS II depending on the various timeframes.

While this analysis will focus on thermal loading, in some areas voltage, short circuit and/or transient stability concerns can also be of considerable importance and possibly drive additional system upgrades. Because actual installed generator reactive capabilities and dynamic parameters can vary significantly between the various wind generation manufacturers and we don't have the specifics on which units may actually be installed, this study will not be utilized to determine the voltage, short circuit or transient stability implications.

2 Description of Study

This study will be focusing on the areas designated as Wind Energy Resource Zones (designated areas) by the WERZB. While project proposals will be optimized for the ITC Holdings (Michigan) area as a whole, the primary focus will be on exporting wind generation from the designated areas to the rest of the MECS control area and/or the rest of the Midwest ISO market.

2.1 Model Development

All system models will be built starting with the Midwest ISO 2009 MTEP model for 2014 with all planned and proposed Appendix A and B projects included and a Midwest ISO market security constrained economic dispatch (SCED).

2.1.1 System Topology

The METC and ITC systems will be removed from the model and the detailed ITCT and METC system "as is" model will be inserted. This detailed model includes detailed Detroit Edison (DTE) and Consumers Energy (CE) subtransmission system models and the Wolverine Power Cooperative transmission facilities. The Detroit Edison system was last updated in January of 2009 with a 2009 summer model obtained from DTE on January 8, 2009. The Consumers Energy system was updated utilizing the Midwest ISO MOD model as of December 1, 2008.

Only projects expected to be in-service prior to the end of 2009 and in close proximity to the designated areas will be added to the "as is" model for this analysis.

This would include the following projects:

Table 2.1.1.1 Capital Projects Considered for Base Case

Project	MTEP ID	Co.	Expected ISD	Include	Notes
B3N Interconnection	1308	ITC	12/31/2009	Yes	

Table 2.1.1.2 Generation Interconnection Projects Considered for Base Case

Project	MTEP ID	Co.	Expected ISD	Include	Notes
G503 Noble Wind Farm	1875	ITC	5/31/2009	Yes	Including Bad Axe to Wyatt #2

Table 2.1.1.3 Load Interconnection Projects Considered for Base Case

Project	MTEP ID	Co.	Expected ISD	Include	Notes
N/A	N/A	N/A	N/A	N/A	N/A

2.1.2 System Real Load

The 70/30 ITC Holdings peak load forecast for Michigan for the 2009 summer as of April 24, 2009 will be utilized to develop projected bus loadings within the ITC Holdings Michigan footprint. See Table 2.1.7.1 below for ITCT and METC system load totals.

2.1.3 System Reactive Load

All base cases (cases without future generation) will be screened for voltage criteria violations. If voltage violations are identified, reactive compensation devices, specifically capacitors will be placed on both the subtransmission and transmission systems in order to allow the system to maintain acceptable voltage levels (95% with all facilities in-service and 92% after any one single contingency). It is assumed that these devices would be added as necessary and identified in other short term studies.

Because the majority of the analysis for this study will be performed utilizing DC solution methodologies, voltage and reactive requirements for the future generation will not be determined. As stated above, these requirements would be heavily dependant on the types of machines actually installed.

2.1.4 Existing Generation & Interchange

Total available generation in models within the ITCT footprint is about 12,380 MW, including about 210 MW of available wind generation (all in the Thumb area). Total available generation in the model within the METC footprint is about 14,200 MW, including about 0 MW of available wind generation.

Generators in the ITCT and METC footprints along with all other generators within the Midwest ISO market will be dispatched by the Midwest ISO to economically¹ to serve load within the Midwest ISO market in the base case developed by the Midwest ISO. Any differences in total system loading caused by inserting the "as is" model for the ITCT and METC systems will be made up by utilizing the economic order list from the MTEP 09 FTP site.

Any existing wind units within Michigan will be dispatched to 100% of nameplate capability and any existing network resources in close proximity to the wind generation under study will be

¹ The Midwest ISO utilizes the PROMOD transmission planning tool to develop a security constrained economic dispatch for the entire Midwest ISO market.

dispatched on-line to allow for determination of the impacts to the system. This generation will be made up by utilizing the economic order list from the MTEP 09 FTP site

2.1.5 Michigan Ontario Interface

The ITCT system is interconnected to Canada via four tie lines located on the eastern side of the ITCT system, referred to as the B3N, L51D, L4D, and J5D. These four tie lines are (or will be) able to be controlled via phase shifting transformers.

The Michigan-Ontario phase shifters will be modeled as controlling flow in all models utilized in this study and adjusted to hold flows on the Michigan-Ontario interface to specific values as described in Table 2.1.7 below.

Typically, for study purposes, total flow across this interface is distributed 1/6, 1/3, 1/3, and 1/6 across the B3N, L4D, L51D, and J5D respectively². This study will utilize this distribution.

2.1.6 Other Assumptions

One other phase shifting transformer exists within the ITCT and METC systems. The Caniff phase shifter is located in Detroit on the Caniff end of the Caniff to the Stephens 345 kV circuit. Its angle was fixed at -3 degrees in all of the models.

St. Clair unit #6 in the ITCT system can operate on either the 345 kV or 120 kV system. In this analysis, St. Clair unit #6 will be modeled in its typical operating configuration on the 345 kV system.

2.2 Study Methodologies

Two separate studies will be performed. The first will be utilized to determine one (or several) sets of system upgrades that will support the future wind in the designated areas. This will be referred to as the Systematic Transfer Analysis. The second will be utilized to determine the robustness of the upgrades identified in the first study.

2.2.1 Systematic Transfer Analysis

First contingency incremental transfer capability (FCITC) will be utilized to determine where overloads begin to develop as the wind is transferred to units within the Midwest ISO market. For this analysis, the model with 900 MW (or what ever value is set in the MTEP model) flowing from Michigan to Canada will be utilized.

2.2.2 Project Robustness Test

The projects developed in the Systematic Robustness Analysis will be inserted into all of the models developed for this analysis and tested for robustness as described below.

2.2.2.1 Interconnection & Sinks

In order to balance load and generation, as the future wind generation is placed on-line, generation throughout the Midwest ISO market will be backed down in merit order in order to allow the Michigan wind to be operated at 100% of nameplate capability. The merit order list on the MTEP 09 FTP site will be used to determine what generation will be backed down.

² This is done for study purposes and does not represent what may or may not occur in real time operations.

Both the minimum and maximum nameplate MW amounts will be tested.

2.2.2.2 Contingencies Analyzed

All single (NERC Category B) contingencies for ITCT, METC, subtransmission facilities in close proximity to the designated area(s) and selected contingencies involving the surrounding system(s) will be considered for this analysis. Single contingencies defined from operating device to operating device will be considered for the ITCT and METC systems while single branch (node to node from a loadflow modeling standpoint) contingencies will be considered for the subtransmission system(s).

The outage of any generator results in the need to increase generation elsewhere in order to keep the load and generation in balance. When generation is modeled as forced out as part of a contingency, the “make up” generation will be assumed to come from the system inertia of the Midwest ISO market.

In some instances, transmission contingencies result in load being moved, either automatically or manually, from one portion of the system to another. This is referred to as load throwover. As appropriate and practical, load throwovers will be considered in this analysis.

Per the ITCT and METC planning criteria shutdown plus contingency scenarios should be analyzed at load levels up to 85% of the system peak load. Thus all shutdown plus contingency scenarios in close proximity on the designated area(s) will be tested in the off peak models.

2.2.2.3 Monitored Facilities

All ITCT and METC facilities (including ITCT and METC tie lines) will be monitored along with all other transmission and subtransmission facilities in close proximity to the designated area(s).

2.2.2.4 AC/DC Analysis

Because, as stated above, we do not yet know the details of the interconnecting machines, the bulk of the analysis performed in this study will be performed utilizing DC analysis. AC analysis will be used to verify individual results as deemed appropriate.

2.3 Table of Cases

Table 2.1.7.1 Table of Cases

Case Name	Flow from MI into Ontario ³	ITC Load + Losses ³	ITC Generation Total ³	METC Load + Losses ³	METC Generation Total ³	Ludington Status
MTEP09_2014SP_AppAB_SCED_mecs.sav	900					6 Gen
wind_min_peak_0.sav	0					6 Gen
wind_min_peak_in.sav	1500					6 Gen
wind_min_peak_out.sav	-2500					6 Gen
wind_min_80_peak_0.sav	0					6 Gen
wind_min_80_peak_in.sav	1500					6 Gen
wind_min_80_peak_out.sav	-2500					6 Gen
wind_min_80_peak_pump_0.sav	0					6 Pump
wind_min_80_peak_pump_in.sav	1500					6 Pump
wind_min_80_peak_pump_out.sav	-2500					6 Pump
wind_max_peak_0.sav	0					6 Gen

³ All values in MWs.

Case Name	Flow from MI into Ontario ³	ITC Load + Losses ³	ITC Generation Total ³	METC Load + Losses ³	METC Generation Total ³	Ludington Status
wind_max_peak_in.sav	1500					6 Gen
wind_max_peak_out.sav	-2500					6 Gen
wind_max_80_peak_0.sav	0					6 Gen
wind_max_80_peak_in.sav	1500					6 Gen
wind_max_80_peak_out.sav	-2500					6 Gen
wind_max_80_peak_pump_0.sav	0					6 Pump
wind_max_80_peak_pump_in.sav	1500					6 Pump
wind_max_80_peak_pump_out.sav	-2500					6 Pump

3 Timeline

Table 4.1 Study Timeline

Wind Zones Study Timeline (2009)	April	May	June	July	Aug	Sep	Oct	Nov
Develop Input Assumptions (MPC)								
Develop Models								
Develop Transmission Plans								
Test & Refine Transmission Plans								
Develop Report & High Level Costs								