Manitoba Hydro

Available Transfer Capability Implementation Document

(ATCID)

Disclaimer

This ATCID is prepared for informational purposes only to comply with NERC Standard MOD-001-1 and MOD-028-1 and to support application of the provisions of the Manitoba Hydro Open Access Transmission Tariff (OATT). Manitoba Hydro may revise or terminate this document at any time at its discretion without notice. It is the user's responsibility to use the most recent version of this document in conjunction with the Manitoba Hydro OATT and other applicable documents, including, but not limited to, the applicable NERC Reliability Standards as they may be revised from time to time. In the event of a conflict between this document and the Manitoba Hydro OATT, the Manitoba Hydro OATT will prevail, and nothing in this document shall be interpreted to contradict, amend or supersede the Manitoba Hydro OATT.

Version/Review Control:

Version	Date	Signing Authority	Brief Description of Change/Review
1.0	April 1, 2011	M.D. Rheault, L.A. St Hilaire	Documentation of current practices.
2.0	May 16, 2011	M.D. Rheault, L.A. St Hilaire	Added reference to Seams Operating Agreement to section 6.4 and posting on OASIS of ATCID in section 7. Minor typographical corrections.
2.1	Jan 12, 2012	M.D. Rheault, L.A. St Hilaire	Updated Saskatchewan practice as per agreed upon terms for the Winter 2011-12 studies. Changed additional wording to add clarity.
3.0	July 23, 2014	M.D. Rheault	Reviewed complete document and updated to document new process.

Table of Contents

1. Introduction

1.1. Manitoba Hydro Posting Interfaces

Manitoba Hydro has the following three interfaces in which Manitoba Hydro offers transmission services:

- Manitoba -USA interface
- Manitoba-Ontario interface
- Manitoba -Saskatchewan interface

This document describes Manitoba Hydro's current practice of calculating Total Transfer Capability (TTC) and Available Transfer Capability (ATC) for these interfaces.

1.1.1. Manitoba -USA interface

The Manitoba - USA interface consists of four tie lines, namely:

- D602F - 500kV line from Dorsey Station to Forbes Station
- L20D - 230 kV line from Letellier Station to Drayton Station
- R50M - 230 kV line from Richer South Station to Moranville Station
- G82R - 230 kV line from Glenboro South Station to Rugby Station

The Manitoba – USA interface is modeled in either direction depending upon the flow: MHEX_N (flow into MHEB) or MHEX_S (flow into USA).

1.1.2. Manitoba-Ontario interface

The Manitoba - Ontario interface consists of two transmission lines:

- K21W - 230 kV line from Whiteshell Station to Kenora Station
- K22W - 230 kV line from Whiteshell Station to Kenora Station

Each of these lines has a phase shifter that controls the flows within a +/- 25 MW bandwidth. The Manitoba - Ontario interface is also modeled in either direction depending upon the flow condition: MH-ONT-E (flow into Ontario) and MH-ONT-W (flow into Manitoba).

1.1.3. Manitoba -Saskatchewan interface

The Manitoba - Saskatchewan interface is made up of three transmission lines:

- R7B - 230 kV line from Reston Station to Boundary Dam Station
- R25Y - 230 kV line from Roblin South Station to Yorkton Station
- P52E - 230 kV line from The Pas Ralls Island Station to E.B. Campbell Station

The Manitoba - Saskatchewan interface is also modeled in either direction depending upon flow condition: MH-SPC-E (flow into Manitoba) and MH-SPC-W (flow into Saskatchewan).

1.1.4. Other Interfaces

In addition to these posted interfaces, Manitoba Hydro has 115 kV line SK1, which connects Manitoba Hydro to Hydro One (Ontario). It is not considered a market facility in the Ontario market. This line is normally open at the provincial boundary between Manitoba and Ontario. The primary use of this line is to serve isolated load. During forced or planned outages on either side of the provincial boundary, SK1 may be used to provide service to load, which otherwise would not be served during the outage. Therefore, Manitoba Hydro does not consider this facility as an interface and does not post TTC or ATC.

1.2. Manitoba Hydro Posting Horizon

Manitoba Hydro posts TTC and ATC for the following time horizons in the time increments described in the table below.

Horizon	Time Range	Increment
Operating *	0 – 48	Hourly
Planning I	49 – 168	Hourly
Planning II	8 – 31	Daily
Study	2 - 36	Monthly

* Operating horizon includes current day and next day information (scheduling horizon and beyond).

1.3. Source and Sink Information

Manitoba Hydro lists the following source and sink points on the MHEB OASIS:

Source	**Sink**	**Description**
ALTE	ALTE	Alliant Energy East
ALTW	ALTW	Alliant Energy West
AMIL	AMIL	Ameren – Illinois
AMMO	AMMO	Ameren – Missouri
BREC	BREC	Big Rivers Electric Corp
CIN	CIN	Cinergy Corporation
CONS	CONS	Consumers Energy
CWLD	CWLD	Columbia Water & Light
CWLP	CWLP	City Water, Light & Power
DECO	DECO	ITC Transmission

Source	Sink	Description
DPC	DPC	Dairyland Power Cooperative.
GRE	GRE	Great River Energy
HE	HE	Hoosier Energy
IPL	IPL	Indianapolis Power & Light
MDU	MDU	Montana-Dakota Util. Co.
MEC	MEC	MidAmerican Energy Co
MGE	MGE	Madison Gas and Electric
MHEB	MHEB	Manitoba Hydro Electric Board
MISO	MISO	Midwest ISO
MP	MP	Minnesota Power
MPC	MPC	Minnkotta Power Cooperative
MPW	MPW	Muscatine Power and Water
NIPS	NIPS	Northern Indiana Public Service Company
NSP	NSP	Xcel Energy
OTP	OTP	Otter Tail Power
IESO	IESO	Independent Electricity System Operator
SIGE	SIGE	Southern Indiana Gas & Electric Company
SIPC	SIPC	Southern Illinois Power Cooperative
SMP	SMP	Southern Minnesota Municipal Power Agency
SPC	SPC	Saskatchewan Power Corporation
SPCN	SPCN	Saskatchewan Power Corporation-Island Fall
UPPC	UPPC	Upper Peninsula Power Co.
WEC	WEC	Wisconsin Energy Corporation
WPS	WPS	Wisconsin Public Service Corporation

1.4. POR & POD Information

When making a transmission service reservation on the MHEB OASIS, the following POR/PODs are used:

POR/POD Name	POR/POD Type	Model Mapping
MHEB	POR/POD	Manitoba Hydro
MHEB.IMO	POR/POD	The Manitoba - Ontario Border
MHEB.MAPP	POR/POD	The Manitoba - USA Border for MAPP transactions
MHEB.MISO	POR/POD	The Manitoba - USA Border for MISO transactions
SPC	POR/POD	3-230 kV interconnections to Saskatchewan at the Manitoba - Saskatchewan border.
MHEB.IF **	POR/POD	2-115 kV interconnections at Manitoba Hydro Border station connecting Saskatchewan.

** Note: MHEB.IF POR/POD was created in preparation of this path becoming available for transmission service in January 2015. No ATC calculations are presently performed for the Island Falls interface. In January, when the new interface is operational Hydro will update the ATCID.

2. Calculation of Total Transfer Capability (TTC) & Transmission Reliability Margin (TRM)

2.1. Modeling data

Manitoba Hydro is a member of the MRO (Midwest Reliability Organization) model building group. Group members are responsible for submitting modeling information for their transmission system. The modeling information includes, but is not limited to, forecast peak load for the period, facility ratings, unit commitment & dispatch order, long term planned outages, new facilities installed on the system, facilities retired from the system, and expected power transfer with neighboring area. Once the MRO receives modeling information from all the members, the MRO prepares a powerflow model and distributes this model among its members. This power flow model is commonly called the "MRO model". The MRO powerflow model contains modeling data & topology for the entire Midcontinent Independent System Operator, Inc. (MISO) footprint and the transmission system immediately adjacent to and beyond the MISO footprint. All the outages that affect to Manitoba Hydro transfers can be implemented in this model. Manitoba Hydro uses the MRO model in its TTC & TRM calculation after making certain local and remote adjustments related to each interface.

2.2. Calculation of Total transfer Capability

Manitoba Hydro performs seasonal operating studies to calculate TTC (Total Transfer Capability), TRM (Transmission Reliability Margin), and SOL (System Operation Limits) for all the interfaces described in 1.1 considering system intact and a number of prior outage conditions. The TRM calculation procedure is described in Manitoba Hydro Transmission Reliability Margin Implementation Document (TRMID). This section describes the TTC calculation procedure.

Manitoba Hydro owns all transmission facilities in Manitoba and is the sole transmission provider for the flowgates described in this document. Therefore, a process to allocate transfer capability across lines or other owners is not required.

2.2.1. Manitoba-USA Interface

Manitoba Hydro performs its transfer calculation based on the guidelines developed in conjunction with neighboring USA entities. These guidelines include, but are not limited to, the following:

- Load level
- Interface flow levels
- Contingency
- Monitoring elements
- Source and sink adjustment

The Manitoba-USA transfer is facilitated by adjusting the power order on the Manitoba Hydro HVdc system and pre-defined loads and generators in North Dakota, South Dakota, Minnesota, and Wisconsin area. Manitoba Hydro accounts for the following flow dependencies in the calculation of TTC for the MH-USA interface:

- Flow from North Dakota to surrounding regions (NDEX)
- Flow from Saskatchewan to the USA across the Boundary Dam phase shifting transformer (B10T)
- Flow from Ontario to the USA across the International Falls transformer (F3M)
- Flow from Manitoba to Ontario
- Flow from Minnesota to Wisconsin (MWEX)

Except for the NDEX interface, all flows across other interfaces in the powerflow are set at pre-determined values. Manitoba - USA TTC is then calculated as a function of NDEX, which is the most impactive sensitivity to the Manitoba - USA transfer calculation.

Manitoba Hydro performs steady state, post contingency, transient stability, and voltage stability analysis (for North Flow conditions only) to calculate TTC. The following criteria are used to determine transfer capability for the USA interface:

- Steady state, post contingency, and dynamic voltage limits
- Steady state and post contingency thermal overload limits

- Steady state, post contingency, and transient out-of-step relay margins
- Reactive reserve margin at Dorsey
- Voltage stability limits
- Dynamic damping

The maximum steady state, post contingency, or voltage stability transfer limit which satisfies the above criteria determines the Total Transfer Capability (TTC).

2.2.2. Manitoba-Ontario Interface

Manitoba Hydro performs seasonal studies to determine transfer capability for the Ontario interface. The Manitoba - Ontario transfer is calculated by adjusting the power order on Manitoba Hydro's HVdc system and the power order on the phase shifting transformers located at the Whiteshell Station. Counteracting changes are made by adjusting generation within northwestern Ontario. Ontario transfer analysis is calculated for various levels of Winnipeg River Generation (hydraulic).

Transfer limits are determined by performing steady state and post contingency analysis. The contingency list for the Ontario transfer analysis consists of all the BES elements between Dorsey and the Ontario border.

The following criteria are used to determine transfer capability for Ontario interface:

- Steady state and post contingency voltage limits.
- Steady state and post contingency thermal overload limits

Maximum steady state or post contingency transfer limit, which satisfies this criteria, determined the Total Transfer Capability (TTC).

In addition, Manitoba Hydro also participates in the development of and respects the guidelines developed by the Manitoba-Ontario-Minnesota (MOM) Interconnection Working Group.

2.2.3. Manitoba-Saskatchewan Interfaces

Manitoba Hydro performs joint operating studies with Saskatchewan Power Cooperation (SPC) to calculate TTC for the MH - SPC interfaces. Transfer calculations are performed by adjusting the power order of the Manitoba Hydro HVdc system and pre-defined loads and generators in Saskatchewan.

For the SPC transfer analysis, the Saskatchewan to USA interchange schedule across the Boundary Dam phase shifting transformer (B10T) is set to a value mutually agreed to with SPC. This value represents the maximum transfers that SPC will allow on B10T for the present season. All the other interface values are left unchanged from the MRO base model.

The Manitoba Hydro contingency list for SPC transfer analysis is derived from previous study experience and in consultation with SPC study engineers.

Transfer limits are determined by performing steady state and post contingency analysis.

The following criteria are used to determine transfer capability for SPC interface:

- Steady state and post contingency voltage limits
- Steady state and post contingency thermal overload limits
- Pre-contingency reactive power margin at certain generation stations

Maximum steady state, post contingency, or voltage stability transfer limit which satisfy this criteria determines the Total Transfer Capability (TTC).

2.3. TLAP Program/Selecting TTC & TRM for ATC posting

Manitoba Hydro updates its operating procedures related to interface operations prior to start of each season based on results of the seasonal studies. These procedures include tabulated TTC, TRM & SOL values for system intact and various prior outage conditions. These tables are generally referred as “TLAP Tables” and shared with the Manitoba Hydro Network Resource

Management group and also implemented in Manitoba Hydro Energy Management System (EMS). In the EMS, this program is commonly called the “TLAP Program”.

Manitoba Hydro’s Network Resource Management group is responsible for approving outages on the Manitoba Hydro bulk electric system, coordinating outages with neighbouring utilities, and issuing Temporary Operating Instructions (TOIs) for planned outage conditions. For outage coordination, Manitoba Hydro exchange outages with MISO, IESO and Saskatchewan Power Cooperation. The Network Resources Management group uses the TLAP tables to find the appropriate TTC, TRM and SOL for planned outage conditions and issue a corresponding TOI. When a TLAP table does not have TTC and TRM value for a particular planned outage condition involving multiple elements, a new study is performed to determine TTC and TRM and a TOI is issued.

All the Manitoba Hydro planned and real time outages are entered into the Manitoba Hydro outage management program called “Consolidated Outage and Operational Data and Logging Application (COLA)”. COLA transfers the outage data that impact transfer level into the TLAP program, which determines the appropriate TTC and TRM for the given outage based on the TLAP tables. Each hour, the TLAP program sends TTC, TRM & TRM coefficient values to MISO for the entire posting period to use in the ATC calculation.

The TLAP program makes the following assumptions in determining TTC & TRM:

- TTC, TRM and SOL values for each interface depend only on the pre-determined outages tabulated in the TLAP tables.
- When an outage affects part of the day, daily TTC is reduced for the entire day.
- When an outage affects part of the month, monthly TTC is reduced for the entire month.
- Previous year TTC and TRM values are used for posting monthly TTC value beyond the current season, until a new study is performed.

The TLAP program uses a pre-determined default low value for multiple element outages where the TLAP tables do not contain a value for TTC until a TOI is issued. When a TOI is issued,

operators overwrite the values in the TLAP program to update TTC & TRM based on new study results.

The TLAP program will also provide a real time system operating limit for use by the system operators based on prevailing system conditions.

3. Existing Transmission Commitments (ETCs)

The firm ETC for Manitoba Hydro is defined by the following formula:

$$ETC_F = NITS_F + GF_F + PTP_F + ROR_F$$

Where:

GF_F is the firm capacity set aside for Grandfathered and other Pre-Tariff Firm Transmission Service and contracts for energy and/or Transmission Service, where executed prior to the effective date of a Transmission Service Provider's Open Access Transmission Tariff or safe harbor tariff on ATC Paths that serve as interfaces with other Balancing Authorities.

PTP_F is the firm capacity reserved for confirmed Point-to-Point Transmission Service.

ROR_F is the capacity reserved for roll-over rights for Firm Transmission Service contracts granting Transmission Customers the right of first refusal to take or continue to take Transmission Service when the Transmission Customer's Transmission Service contract expires or is eligible for renewal.

The non-firm ETC for Manitoba Hydro is defined by the following formula:

$$ETC_{NF} = NITS_{NF} + PTP_{NF}$$

Where:

PTP_{NF} is the non-firm capacity reserved for confirmed Point-to-Point Transmission Service.

$NITS_{NF}$ is the non-firm capacity set aside for Network Integration Transmission Service (i.e. secondary service, including the capacity used to serve bundled load within the Transmission Service Provider's area with external sources) on ATC Paths that serve as interfaces with other Balancing Authorities.

4. ATC posting and Transmission Service Request Evaluation

Manitoba Hydro uses the following equation to calculate firm ATC

$$ATC_F = TTC - ETC_F - TRM$$

Where:

ATC_F is the firm Available Transfer Capability for the ATC Path for that period.

TTC is the Total Transfer Capability of the ATC Path for that period.

ETC_F is the sum of existing firm Transmission commitments for the ATC Path during that period. Manitoba Hydro's firm ETCs are the summation of all firm reservations.

TRM is the Transmission Reliability Margin for the ATC Path during that period. For firm ATC calculations, Manitoba Hydro uses a Firm TRM as defined by the TRMID.

For all time points in the MISO time horizon:

$$ATC_F = TTC - TRM_{FIRM} - (NITS_F + GF_F + PTP_F + ROR_F)$$

Manitoba Hydro will use the following equation to calculate non firm ATC:

$$ATC_{NF} = TTC - ETC^1_F - ETC_{NF} - TRM_U$$

Where:

ATC_{NF} is the non-firm Available Transfer Capability for the ATC Path for that period.

[1] This ETC_F only includes the actual amount of reservations used for the given time period. ETC_F used in ATC_{NF} can be different from that of ATC_F calculation.

TTC is the Total Transfer Capability of the ATC Path for that period.

ETC_F is the sum of existing firm Transmission commitments for the ATC Path during that period.

ETC_{NF} is the sum of existing non-firm Transmission commitments for the ATC Path during that period.

TRM_U is the Transmission Reliability Margin for the ATC Path that has not been released for sale (unreleased) as non-firm capacity by the Transmission Service Provider during that period. In Manitoba Hydro's case, TRM_U=(Non Firm TRM)*COEF

Manitoba Hydro does not use Capacity Benefit Margin (CBM), Postbacks & counterflows in calculating ATC.

4.1. ATC Calculation Procedure

According to the Manitoba Hydro – MISO Coordination Agreement, MISO will perform ATC calculations and posting on behalf of Manitoba Hydro. As mentioned above, Manitoba Hydro's EMS TLAP program will generate TTC, TRM and TRM coefficient values every hour and sends the results to MISO. The TRM coefficient indicates the availability of TRM that can be released for non-firm service. A TRM coefficient of one inhibits any release of TRM while a TRM coefficient less than one enables the release of up to TRMxTRM coefficient on a recallable basis.

MISO downloads Manitoba Hydro reservations from Manitoba Hydro OASIS & Manitoba Hydro schedules from webTrans. ATC Calculator use POR to obtain the source and POD to obtain the Sink of the reservation. Impacts of the POR-POD pair on interfaces are model in the ATC calculator. During the scheduling horizon, the reservations are replaced by the schedules from the MISO physical scheduling system that affect each interface. The reservations along with the TTC and TRM values are used by the ATC calculator as described below to determine the available transfer capability for each interface. The reservations recognize any redirects that

may have taken place. The output of the ATC Calculator includes the ATC values for the interface flowgates. The Firm ATC and Non-Firm ATC are determined as follows for each of the interface:

4.1.1. Definitions:

- All times use the 24-hour format (i.e. 00:00-23:00)
- "Now" is defined as the present time (EST)
- Day 1 is from Now until the end of the present day
- Day 2 is hour 0 through 23 of the day after Day 1
- Capacity (MW) is always measured in absolute values.

4.1.2. Firm ATC:

For all time points in MISO time horizon:

$$Firm\ ATC = TTC - TRM - summation\ of\ firm\ reservation\ capacity$$

4.1.3. Non-Firm ATC:

Following table describes the non-firm ATC calculation formula based on current time and posting horizon.

Current Time	Posting Horizon	Formula for non-firm ATC
<1500	Day 1	TTC – (TRM*COEF) – sum of all firm schedules (associated with firm reservations) at the current time – sum of non-firm reservations (use scheduled MW if available otherwise use non-firm reservation MW)
	Day 2	TTC – (TRM*COEF) – sum of firm reservations (use scheduled MW if available otherwise use firm reservation MW) – sum of non-firm reservations (use scheduled MW if available otherwise

Current Time	Posting Horizon	Formula for non-firm ATC
		use non-firm reservation MW)
	Day 3 & beyond	TTC – (TRM*COEF) – sum of firm reservations – sum of non-firm reservations
>=1500	Day1	TTC – (TRM*COEF) – sum of all firm schedules (associated with firm reservations) at the current time – sum of non-firm reservations (use scheduled MW if available otherwise use non-firm reservation MW)
	Day 2	TTC – (TRM*COEF) – sum of schedule capacity for time point if schedule refers to firm reservations – sum of non-firm reservations (use scheduled MW if available otherwise use non-firm reservation MW)
	Day 3 & beyond	TTC – (TRM*COEF) – sum of firm reservations – sum of nonfarm reservations

4.2. Approving TSRs

As stated in the MH_MISO coordination agreement, MISO responds to valid short-term TSRs (TSRs with a term of less than one year) on behalf of Manitoba Hydro. When a valid short-term TSR is received, MISO assesses whether sufficient transfer capability would be available to accommodate the service requested. This assessment is based on the calculated ATC information. Approval of weekly, hourly, and daily TSRs is based solely on the calculated ATC information. For monthly TSRs, approval is based not only on the calculated ATC information, but also involves consideration of planned outages. MISO will contact Manitoba Hydro for the necessary planned outage information.

Manitoba Hydro responds to valid long-term TSRs. In the event that insufficient transfer capability, based on the calculated ATC information, is available to accommodate a request for long-term transmission service, Manitoba Hydro will perform certain additional studies to determine whether the requested service can be accommodated. New transmission facilities or upgrades may be required to accommodate such a request. Manitoba Hydro may deny service when Manitoba Hydro determines that new transmission facilities or upgrades required to provide the requested service cannot be completed prior to the service commencement date.

Neither Manitoba Hydro nor MISO, on behalf of Manitoba Hydro, may grant a request for transmission service that would interfere with another Customer's rollover rights, even if the new request is for a different term or does not possess the same points of receipt and or the same points of delivery. Manitoba Hydro models its system as if all the existing long-term firm contracts continue their service when it evaluates any requests for new service, including service commencing several years in the future.

4.3. Scheduling

Manitoba Hydro's scheduling and interchange is controlled by the MHEB System Operator. The Operator uses an electronic scheduler that is driven by the interchange transaction system (E-Tag) specified by NERC. The electronic scheduler screens the tags and creates schedules for the three MHEB interfaces. It uses several validations to ensure that each tag follows the various rules for interchange specified by the National Energy Board and NERC.

5. Distribution of ATCID

This ATCID document, which describes existing practices at Manitoba Hydro, is posted on Manitoba Hydro's OASIS webpage:

http://www.oasis.oati.com/MHEB/index.html

A notification email is sent to those entities specified in R4 of NERC Standard MOD-001-1 whenever revisions are made to this ATCID document.

6. Data Retention for ATC Calculations

MISO retains component data (TTC, TRM, coeff, schedules, TSRs, MHEB override) for calculation of ATC in accordance with NERC requirements. Per request of MHEB, MISO can provide the archived data to MHEB.