NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

ITCS Transfer Study Scope Canadian Analysis

February 2025

Purpose

This study part is concerned with calculation of current total transfer capability of the Canadian province-to-province interfaces and will be provided to Canadian regulators. Additionally, this study will include the corresponding U.S. to Canadian interfaces which were not calculated in Part I. This document is intended to describe the assumptions and procedures to calculate the current total transfer capability between each pair of neighboring transmission planning regions in Canada.

Study Tool

PowerGem TARA software will be used for steady state thermal and voltage analysis.

Base Case Assumptions

Cases created through the MOD-032 process will be used as a starting point. Planning Coordinators (PC) and Transmission Planners (TP) will be provided with an opportunity to review these cases and supply updates using IDEV files. Updates should focus on:

- New generation - Generation with a signed ISA should be included in the future year cases. This does not exclude the modeling of other queue generators in these cases.
- Planned retirements - Generation that has retired or has announced retirement should be removed from the appropriate cases
- Load forecast
- Dispatch
- Line Ratings
- Expected long term facility outage
- Transmission system topology
- Base firm interchange across interfaces

Initial Solution Parameters[1]

Once all updates have been applied to the case, the following solution options will be used:

- Fixed Slope Decoupled Newton-Raphson
- Area Interchange Enabled

[1] https://www.rfirst.org/wp-content/uploads/2023/07/MMWG_Procedural_Manual_v35.pdf, https://www.wecc.org/Administrative/2023%20Data%20Preparation%20Manual.pdf

- Tap Adjustment – Stepping
- Switched Shunt Adjustments – Enable All
- Adjust Phase Shifters
- Adjust DC taps

Eastern Interconnection

The cases listed below from the Multiregional Modeling Working Group (MMWG) 2023 series will be used. These are assembled with a non-coincident 50/50 load level and are available in PSSE v35 formats.

- 2024 Summer Peak
- 2024/25 Winter Peak

The Canadian Province of Québec is tied to the Eastern Interconnection by DC ties. Transfers from Québec to neighboring provinces and the United States will be based on DC tie ratings.

Western Interconnection

The table below lists the cases WECC will be producing for the study years. These cases were built prior to and used for ITCS. These are assembled with a non-coincident 50/50 load level and are available in PSSE v34 and PSLF v22 formats.

- 2024 Heavy Summer
- 2024/25 Heavy Winter

Contingencies

Standard set of contingencies to support NERC and local planning criteria. Transfer capability analysis shall include N-1 contingencies. The following NERC standard TPL-001-5.1 contingencies will be used for the transfer studies:

Three types of NERC Category P1 contingencies (100 kV and above) will be used:

- P1-1: Loss of individual generators
- P1-2: Loss of a single transmission line, operating at 100 kV or above
- P1-3: Loss of a single transformer, with a low side voltage of 100 kV or above

Solution Parameters

The options below will be selected in the TARA program to import the case and run transfer analysis:

- Enable Tap adjustment
- Enable Phase Shifter adjustment
- Enable shunt adjustment - All

- Area interchange control - No
- Adjust DC taps

Total Transfer Capability

For this study, the Total Transfer Capability (TTC) is the sum of the Base Transfer Level (BTL) and First Contingency Incremental Transfer Capability (FCITC) as shown in the simple equation below:

TTC = BTL + FCITC

FCTIC can be calculated dependent upon the specifics of the transfer methodology, TARA's TrLim (Proportional Thermal Transfer) is the approach to be used in the study to provide the FCITC.

The BTL for each interface was derived, where available, from the scheduled interchange tables provided with each of the study cases. This interchange was compared to the desired interchange for each area provided in the study cases as a cross-check. Where required, adjustments were made to account for additional schedules and market re-dispatch based on load ratio where a Balancing Authority spanned multiple Transmission Planning Regions (TPRs). For each area in the study cases, where the detailed scheduled interchange tables were unavailable, BTL was approximated using the actual line flow across each interface and cross-checked against the scheduled interchange.

Transfer Directions

Non-simultaneous transfer analysis will be performed based on the source and sink definitions identified below for each of the study areas. Only US Entities that have the connection with the Canadian Provinces will be included in the source/sink areas. Definitions for each source/sink can be found in Appendix I.

	To														
From	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	Washington	Wasatch Front	SPP N	MISO W	MISO E	NYISO	ISO New England
British Columbia		x							x						
Alberta	x		x							x					
Saskatchewan		x		x							x				
Manitoba			x		x							x			
Ontario				x		x						x	x	x	
Quebec					x		x								x
New Brunswick						x		x							x
Nova Scotia							x								
Washington	x														
Wasatch Front		x													
SPP N			x												
MISO W				x	x										
MISO E					x										
NYISO					x	x									
ISO New England						x	x								

To more accurately reflect the ability of a study area to simultaneously import power from multiple adjacent study areas (neighbors), total import interfaces were also analyzed.

PAR settings for Transfers

Given the nature of interfaces controlled by Phase Angle Regulators (PAR), and the individual intent in operational and design characteristics for each of these devices, the setpoints for the PAR must be modeled

prior to the transfer being applied. The control mode selected for the PAR will affect the TTC that is obtained due to tap setting adjustments made to the PAR during the transfer. The chosen control mode should be understood and verified with the relevant entities for the interface prior to the transfer being applied. Cases in which a contractual schedule exist are adjusted to any desired setpoint prior to transfers being applied. For transfers to be assessed using particular PAR settings, such as a full transfer in the intended direction, the desired tap settings must be applied in a separate base case prior to the transfer being applied.

Monitored Facilities

The following criteria were used to create monitored element files including:

- All elements in the sending and receiving subsystems
- All elements rated 230 kV and above within 5 buses from either the sending and/or receiving subsystems
- All elements rated 345 kV and above within 10 buses from either the sending and/or receiving subsystems.
- All transmission facilities included in the Intra- and Inter- regional Interface definitions.
- Reported limits with Outage Transfer Distribution Factor (OTDF) ≥ 3%
- For base conditions, normal ratings (RATE-1) at > 100 %
- For contingency conditions, emergency ratings (RATE-2) at > 100 %
- Thermal and voltage limits
- Interface thermal/voltage limits
- Known transient stability limits

Voltage Analysis

A voltage screening will be performed for each transfer direction at the valid FCITC limit found. A case will be exported with the valid transfer amount built in. This case will be screened for N-1 voltage violations using category P1 contingencies.

Modeling of Transfer Participation

Each transfer will be simulated until a valid thermal limit is reached while enforcing the sending system's PMAX[2]. If the transfer does not report any limits, the transfer will be simulated without enforcing the sending system's PMAX. Not respecting PMAX values may lead to invalid limits being reported such as overloads on GSU's or lines leaving the plant substation. These will be ignored. The participating units in the sending system are scaled proportionally to PMAX – PGEN. Offline units are enabled to participate in the transfer. On the receiving end, generation is scaled down proportional to PGEN – PMIN. Offline units are not allowed to participate in the receiving end.

[2] The upper limit on the total amount of active power available for dispatch, specified in MW.

Export Subsystem File Criteria

To determine the total transfer capability between planning areas based on the transmission topology in the study model, the command SCALE ALL FOR EXPORT INCLUDE OFFLINE will be used for export subsystems. Any individual generating unit that meets the criteria below will be excluded from participation.

- The generator is not expected to be in commercial operation during the study period - mothballed, retired, non-existent, under construction
- It has a bad PMAX value in the model - PMAX = default 9999, non-zero PMAX of SVC
- Other generators specified by the Transmission Planner

Import Subsystem File Criteria

The command, SCALE ALL FOR IMPORT will be used for import subsystems. In certain instances, generators may be excluded from participation, e.g., declared future day retirement generations.

TARA Transfer Analysis Options

The options below will be selected when performing the transfer analysis:

- Enable AC Verification on all transfers
- Add Contingency Events in the reporting options
- Enable - Ignore initial overloads which have negative DFAX such that increasing transfer will fix the overload
- Enable – Report initial overloads
- Report 50 constraints per path
- 5 - Max times to report same branch under different contingencies
- Results will include the TRLProp, Warn_Cont, Warn_Sum, Warn_List, CaseSum, and LogFile reports at a minimum

Appendix I

Source & Sink Definitions

The control area name and numbers for each of the source/sink used in the transfer analysis are listed below.

Eastern Interconnection

Source/Sink ITCS Assessment Area	Area Number	Area Name	Name	Region
MRO Manitoba Hydro	667	MH	Manitoba Hydro	MRO
MRO SPC	672	SPC	Saskatchewan Power Corporation	MRO
NPCC New Brunswick	105	NB	New Brunswick Power Corporation	NPCC
NPCC Nova Scotia	106	NS	Nova Scotia Power Inc.	NPCC
NPCC New England	101	ISO-NE	ISO-NE	NPCC
NPCC New York	102	NYISO	New York Independent System Operator	NPCC
NPCC Ontario	103	IESO	Ontario IESO	NPCC
NPCC Quebec	104	TE	Hydro-Quebec	NPCC
SPP North	640	NPPD	Nebraska Public Power District	MRO
SPP North	641	HAST	Hastings Utilities	MRO
SPP North	642	GRIS	City of Grand Island, NE	MRO
SPP North	645	OPPD	Omaha Public Power District	MRO
SPP North	650	LES	Lincoln Electric System	MRO
SPP North	652	WAPA	Western Area Power Administration - Upper Great Plains East	MRO
SPP North	659	BEPC-SPP	Basin Electric Power Cooperative	MRO
MISO East	218	METC	METC	RF
MISO East	219	ITCT	ITC Transmission	RF
MISO West	295	WEC	Wisconsin Electric Power Company	RF
MISO West	296	MIUP	Upper Michigan Energy Resources Corporation	RF
MISO West	600	XEL	Northern States Power (Xcel Energy)	MRO
MISO West	608	MP	Minnesota Power (Allete, Inc.)	MRO
MISO West	613	SMMPA	Southern Minnesota Municipal Power Agency	MRO
MISO West	615	GRE	Great River Energy	MRO
MISO West	620	OTP	Otter Tail Power Company	MRO
MISO West	627	ALTW	Alliant Energy - West	MRO
MISO West	633	MPW	Muscatine Power & Water (Board of Water, Electric & Communications)	MRO
MISO West	635	MEC	MidAmerican Energy Company	MRO
MISO West	661	MDU	Montana-Dakota Utilities Company	MRO
MISO West	663	BEPC-MISO	Basin Electric Power Cooperative	MRO
MISO West	680	DPC	Dairyland Power Cooperative	MRO
MISO West	694	ALTE	Alliant Energy - East	MRO
MISO West	696	WPS	Wisconsin Public Service Corporation	MRO
MISO West	697	MGE	Madison Gas and Electric Company	MRO
MISO West	698	UPPC	Upper Peninsula Power Company	MRO

Western Interconnection

Source/Sink ITCS Assessment Area	Area Number	Area Name	Name	Region
Canada	50	BCH	British Columbia hydro and power Authority	WECC
Canada	52	FBC	FortisBC, Inc	WECC
Canada	54	ALB	Alberta Electric System Operator	WECC
Oregon and Washington Region	13	PACW	PacifiCorp - West	WECC
Oregon and Washington Region	14	BPA	Bonneville Power Administration	WECC
Oregon Region	32	PGE	Portland General Electric Company	WECC
Washington Region	15	SCL	Seattle City Light	WECC
Washington Region	29	AVA	Avista Corporation	WECC
Washington Region	30	PSE	Puget Sound Energy	WECC
Washington Region	35	GCPD	PUD No. 2 of Grant County	WECC
Washington Region	36	CHPD	Chelan PUD	WECC
Washington Region	38	TWPR	Tacoma Power	WECC
Washington Region	46	DOPD	PUD No. 1 of Douglas County	WECC
Wasatch Front	18	NVE	NV Energy	WECC
Wasatch Front	60	IPC	Idaho Power Company	WECC
Wasatch Front	62	NWMT	Northwestern Energy	WECC
Wasatch Front	63	WAPA- UW	Western Area Power Administration – Upper Great Plains Region	WECC
Wasatch Front	64	SPP	NV Energy – Sierra Pacific	WECC
Wasatch Front	65	PACE	PacifiCorp - East	WECC

The table below shows the Northwest footprint (area 40), this area will be split to match the appropriate region by their Balancing Number and include all zones within that Balancing area. PACW and BPA have loads in both Oregon and Washington Region, which were split by geographic boundaries.

Source/Sink		Balancing Number	Balancing Name	Name	Region
ITCS Assessment Area	FERC Order 1000 Area				
Oregon and Washington Region	NorthernGrid	13	PACW	PacifiCorp - West	WECC
Oregon and Washington Region	NorthernGrid	14	BPA	Bonneville Power Administration	WECC
Oregon Region	NorthernGrid	32	PGE	Portland General Electric Company	WECC
Washington Region	NorthernGrid	15	SCL	Seattle City Light	WECC
Washington Region	NorthernGrid	29	AVA	Avista Corporation	WECC
Washington Region	NorthernGrid	30	PSE	Puget Sound Energy	WECC
Washington Region	NorthernGrid	35	GCPD	PUD No. 2 of Grant County	WECC
Washington Region	NorthernGrid	36	CHPD	Chelan PUD	WECC
Washington Region	NorthernGrid	38	TWPR	Tacoma Power	WECC
Washington Region	NorthernGrid	46	DOPD	PUD No. 1 of Douglas County	WECC

Source & Sink Maps

Canadian Provinces Eastern & Western Interconnections