

TLRi vs ADQh Code Application for Export Curtailments for Adequacy

Inter-Jurisdictional Standing Committee
November 22, 2010



- Methodologies were reviewed in June 2010
- A request was made of the IESO to provide 2 examples of the methodology used to determine TLRi vs ADQh.

August 14, 2009

November 22, 2010

- A methodology paper was circulated for comment with a new proposed methodology which the IESO would like to use moving forward.

- TLRi
 - Used when adequacy issue is caused by internal constraints
 - removes transactions only from the constrained schedule
 - Transactions eligible for CMSC
- ADQh
 - Used for system wide adequacy issue, market schedule deficiency
 - removes transactions from both schedules
 - Transactions not eligible for CMSC

- In Real time the Control Room will, based on their knowledge of the system and all current constraints, make an assessment of what is bottled
 - This assessment is made on an ongoing basis with input of everyone in the room – in order to be prepared to respond to contingencies
 - This assessment is made every 5 minutes when the CR blocks or allow dispatches to be sent
- The Operator will apply TLRi to the curtailments which equal the amount of bottled MWs and will apply ADQh to the remaining

- PRICE – If TLR_i was used, the export MWs will have remained in the Market Schedule
 - If the unconstrained price did not reach \$2000 and the market did not solve short, or
 - If the unconstrained price did reach \$2000, but there are generator offers not scheduled and the market did not solve short
- This is a signal that the Market schedule was adequate to support the exports and the adequacy issue was in the constrained schedule only

Calculate bottled MWs as the sum of:

- the difference between all unconstrained schedules versus constrained schedules, including imports, this represents MWs that are available and economic but are limited due to internal system constraints; and
- any additional MWs offered that were not scheduled, but would not have been available due to system constraints

Calculate bottled MWs on a Zone by Zone Basis

- Calculate the MWs available to “export” from each zone by comparing the Generation Capacity available for dispatch in the area to the demand in the area.
- Look at any transmission limitations to “export” that energy to calculate the number bottled
- Plus any imports that were constrained off from entering that zone

Sum all Zones for the total bottled MW amount

Example 1: August 14, 2009

- Forecasted Peak Demand: 21 686 MW in HE 14, with 1289 MW of exports forecasted
- Transmission Outages: Porcupine T8, Essa T3, Cherrywood Breaker
- 9:40: IESO added 350 MW into He 12, 14, 15, 300 MW into HE 13, 16,17 and 400 MW into HE 18-21
- 10:57: IESO added 100 MW into HE 18-21
- 13:59: IESO removed 100 MW from HE 18-24
- 12:01: high risk limits in effect constraining LFE to 110 MW
- 16:37: IESO added 200 MW HE 19 to 21
- 15:05-17:24: derate at Beck 400 MW
- 17:49: 129 MW of exports curtailed for HE 18 int 12, 874 MW of exports curtailed for HE 19 with TLRi

Urgent SSR Report for 2009/08/14 generated on 2009/08/14 14:01

System Advisory/Summary

[System Advisory/Summary](#) [Hourly Details H1-12](#) [Hourly Details H13-24](#) [Transmission Interfaces](#) [SAA Notes](#)

Forecast Supply Energy(MWhr)	Forecast Demand Energy(MWhr)	Forecast Excess(Shortfall) Energy(MWhr)	Energy Shortfall Hours(Yes/No)
626561	450200	178953	No

System Advisory Notices-Title	Date/Time Issued	Start Date/Time	End Date/Time	Comment
Major Change Advisory - generation	2009/08/14 14:00	2009/08/14 13:59	2009/08/14 13:59	A generating unit of greater than 250MW capacity has returned to service 9 hours early.
System Emergency Advisory - high-risk operating state	2009/08/14 09:01	2009/08/14 15:00	2009/08/14 22:00	Updated Storm Forecast: Forecast changed to start 3 hours later. High risk limits are being forecast in the Mackenzie x Lakehead zone from HE 11 to HE 22. The impacts of respecting high risk limits in this zone with all elements in service are as follows: TWM (Transfer West of Mackenzie) limit will have a 150 MW penalty applied TEM (Transfer East of Mackenzie) limit will have a 275 MW penalty applied
System Emergency Advisory - high-risk operating state	2009/08/14 09:00	2009/08/14 16:00	2009/08/14 21:00	Updated Storm Forecast: Forecast changed to start 2 hours later. High risk limits are being forecast in the Lakehead x Marathon zone from HE 15 to HE 21. The impacts of respecting high risk limits in this zone with all elements in service are as follows: EWtW (East West transfer West) limit will have a 100 MW penalty applied LFE (Lakehead Flow East) will be activated with 110 MW limit

[System Advisory/Summary](#) [Hourly Details H1-12](#) [Hourly Details H13-24](#) [Transmission Interfaces](#) [SAA Notes](#)

Internal Transmission Interface Limitations					
Facility	Penalty Applied	Date/Time Issued	Start Date/Time	End Date/Time	Comments
FID - Flow Into Dobbin	50	2009/08/04 14:03	2009/08/04 06:30	2009/09/11 14:00	Dobbin T5 O/S
Other	0	2009/08/10 14:21	2009/08/12 06:00	2009/08/16 15:00	Lakehead T7 o/s Lakehead Area Outflow (LAO) limit = 75MW
Positive BLIP - Positive Buchanan Longwood Input	500	2009/08/06 08:47	2009/08/14 04:15	2009/08/16 17:00	W45LC O/S
FIO - Flow Into Ottawa	500	2009/08/04 14:07	2009/08/14 07:00	2009/08/14 16:00	C3S + All Terminals O/S
Chats Falls Area Generation - Chats Falls GS 230 kV Area Generation	450	2009/08/04 14:12	2009/08/14 07:00	2009/08/14 16:00	C3S + All Terminals O/S
TEM - Transfer East of Mackenzie	275	2009/08/13 23:45	2009/08/14 12:00	2009/08/14 22:00	High Risk - Mackenzie x Lakehead
TWM - Transfer West of Mackenzie	150	2009/08/13 23:45	2009/08/14 12:00	2009/08/14 22:00	High Risk - Mackenzie x Lakehead
Lakehead(Ecct)E - Lakehead East Circuit Flow East	0	2009/08/13 23:45	2009/08/14 14:00	2009/08/14 21:00	High Risk - Lakehead x Marathon Lakehead Flow East (LFE) = 110MW
EWTW - East-West Transfer West	100	2009/08/13 23:46	2009/08/14 14:00	2009/08/14 21:00	High Risk - Lakehead x Marathon

[System Advisory/Summary](#) [Hourly Details H1-12](#) [Hourly Details H13-24](#) [Transmission Interface](#)

Internal Transmission Interface Limitations					
Facility	Penalty Applied	Date/Time Issued	Start Date/Time	End Date/Time	Co
FID - Flow Into Dobbin	50	2009/08/04 14:03	2009/08/04 06:30	2009/09/11 14:00	Dc
Other	0	2009/08/10 14:21	2009/08/12 06:00	2009/08/16 15:00	La
Positive BLIP - Positive Buchanan Longwood Input	500	2009/08/06 08:47	2009/08/14 04:15	2009/08/16 17:00	W-
FIO - Flow Into Ottawa	500	2009/08/04 14:07	2009/08/14 07:00	2009/08/14 16:00	C3
Chats Falls Area Generation - Chats Falls GS 230 kV Area Generation	450	2009/08/04 14:12	2009/08/14 07:00	2009/08/14 16:00	C3
TEM - Transfer East of Mackenzie	275	2009/08/13 23:45	2009/08/14 12:00	2009/08/14 22:00	Hig
TWM - Transfer West of Mackenzie	150	2009/08/13 23:45	2009/08/14 12:00	2009/08/14 22:00	Hig
Lakehead(Ecct)E - Lakehead East Circuit Flow East	0	2009/08/13 23:45	2009/08/14 14:00	2009/08/14 21:00	Hig
EWTW - East-West Transfer West	100	2009/08/13 23:46	2009/08/14 14:00	2009/08/14 21:00	Hig



ieso

Power to Ontario.
On Demand.

Start Date/Time	End Date/Time	Comments
2009/08/04 06:30	2009/09/11 14:00	Dobbin T5 O/S
2009/08/12 06:00	2009/08/16 15:00	Lakehead T7 o/s Lakehead Area Outflow (LAO) limit = 75MW
2009/08/14 04:15	2009/08/16 17:00	W45LC O/S
2009/08/14 07:00	2009/08/14 16:00	C3S + All Terminals O/S
2009/08/14 07:00	2009/08/14 16:00	C3S + All Terminals O/S
2009/08/14 12:00	2009/08/14 22:00	High Risk - Mackenzie x Lakehead
2009/08/14 12:00	2009/08/14 22:00	High Risk - Mackenzie x Lakehead
2009/08/14 14:00	2009/08/14 21:00	High Risk - Lakehead x Marathon Lakehead Flow East (LFE) = 110MW
2009/08/14 14:00	2009/08/14 21:00	High Risk - Lakehead x Marathon

HE	Int	Energy	10N OR	10S OR	30 OR	Max 30 OR Con	Max Energy Con
18	10	\$ 118.13	\$ 75.00	\$ 75.00	\$ 74.90	\$ 6,000.00	\$ 2,526.90
18	11	\$ 116.22	\$ 75.00	\$ 75.00	\$ 74.90	\$ 6,000.00	\$ 2,513.64
18	12	\$ 64.25	\$ 30.10	\$ 30.10	\$ 30.00	\$ 99.90	\$ 143.60
19	1	\$ 1999.99	\$ 1380.96	\$ 1380.96	\$ 1380.96	\$ 37.77	\$ 73.61
19	2	\$ 240.14	\$ 100.00	\$ 100.00	\$ 99.99	\$ 30.00	\$ 65.32
19	3	\$ 226.43	\$ 100.00	\$ 100.00	\$ 99.99	\$ 27.43	\$ 62.06
19	4	\$ 169.90	\$ 75.00	\$ 75.00	\$ 74.90	\$ 26.04	\$ 60.85
19	5	\$ 135.04	\$ 75.00	\$ 75.00	\$ 74.90	\$ 25.56	\$ 60.06
19	6	\$ 129.13	\$ 75.00	\$ 75.00	\$ 74.90	\$ 13.06	\$ 46.63
19	7	\$ 74.23	\$ 30.10	\$ 30.10	\$ 30.00	\$ 4.45	\$ 37.26
19	8	\$ 70.73	\$ 30.10	\$ 30.10	\$ 30.00	\$ 4.13	\$ 36.92
19	9	\$ 64.12	\$ 30.01	\$ 30.01	\$ 30.00	\$ 4.13	\$ 36.63
19	10	\$ 63.46	\$ 30.00	\$ 30.00	\$ 30.00	\$ 4.14	\$ 35.86
19	11	\$ 62.49	\$ 30.00	\$ 30.00	\$ 30.00	\$ 4.14	\$ 37.26
19	12	\$ 36.47	\$ 4.62	\$ 4.62	\$ 4.62	\$ 4.14	\$ 37.83

Hour	Int	OR Unconstrained	OR Constrained
18	9	1520	1520
18	10	1520	1270
18	11	1520	1320
18	12	1520	1520
19	1	1520	1520
19	2	1520	1520
19	3	1520	1520
19	4	1520	1520
19	5	1520	1520
19	6	1520	1520
19	7	1520	1520
19	8	1520	1520
19	9	1520	1520
19	10	1520	1520
19	11	1520	1520
19	12	1520	1520

Constrained vs Unconstrained

		Energy Bottled By Region plus Energy unavailable to dispatch due to Bottling										Imports Bottled		
HE	INT	BRUCE	EAST	ESSA	NE	NIAGARA	NW	OTTAWA	SW	TORONTO	WESTERN	MBSI	MNSI	TOTAL
19	1	0	5.2	0	346.1	0	323.6	0.3	217.2	11.7	10.5	227	90	1231.6
19	2	0	481.4	0	412.2	300.9	347.4	0	322.3	0	30.3	227	90	2211.5
19	3	0	480.3	0.9	359.2	300.9	344.5	0	404.3	0	35.5	227	90	2242.6
19	4	0	479.9	1.1	274.2	300.9	348.4	0.3	404.3	0	128.7	227	90	2254.8
19	5	0	480.3	0.4	240.4	300.9	365.1	0.6	421.1	0	139.4	227	90	2265.2
19	6	0	482.3	0.1	296.4	300.9	369.3	0	451.6	0	149.6	227	90	2367.2
19	7	0	478.1	0	384	300.9	370.4	0	497.2	31	159.8	227	90	2538.4
19	8	0	477.7	0.1	297.8	61.8	373.8	0.3	509.4	149.5	152.1	227	90	2339.5
19	9	0	477.7	0.3	390.5	61.8	378.7	0	509	165.5	150.1	227	90	2450.6
19	10	0	478.1	3.1	390.1	61.8	380	0	488.9	163.5	190	227	90	2472.5
19	11	0	477.7	3.8	388.3	61.8	386.1	0.1	438.2	107.1	230.2	227	90	2410.3
19	12	0	476.7	1.2	548.3	0	374.2	0	476.6	0	240.3	227	90	2434.3

- In looking at significant differences between the unconstrained and constrained we look hours back to see if the reasoning was due to 3 times ramp
- In this example – there were three units which contributed significantly to the difference between Unconstrained and Constrained – all of these units were fully loaded in the market schedule since HE 16 – giving the constrained schedule enough time to ramp the units at 1 times ramp if it were not constrained off for security

	NW Demand	Net Schedule	Gen Cap	EWE Limit	LFE Limit	C Off Imports	Bottled MWs
14-August 19:01:00	563	-104	1097	287	110	317	637
14-Aug-09 19:02:00	561	-104	1097	287	110	317	639
14-Aug-09 19:03:00	565	-104	1097	287	110	317	635
14-Aug-09 19:04:00	571	-104	1097	288	110	317	629
14-Aug-09 19:05:00	572	-104	1097	286	110	317	628
	NE Demand	Net Schedule	Gen Cap	EWE Flow	FS Limit	Bottled MWs	Total
14-Aug-09 19:01:00	1176	37	2372	110	1121	321	959
14-Aug-09 19:02:00	1150	37	2372	110	1058	311	950
14-Aug-09 19:03:00	1165	37	2372	110	1041	312	947
14-Aug-09 19:04:00	1175	37	2372	110	1035	308	937
14-Aug-09 19:05:00	1147	37	2372	110	1056	316	945

Average MWs bottled for Interval =948 MW

- Forecasted Peak Demand: 22409 MW in HE 17, with 140 MW of exports forecasted
- Transmission Outages: Q25BM limiting QFW, BP76 limiting Frontier, High Risk in North LFE = 110MW
- 8:29: TLR3A issued on QFW – IDC not able to provide relief
- 11:41: EEA-1 issued due to all available generation I/S and being utilized for energy or reserve. Post contingency thermal limitations on QFW and Frontier bottling internal generation and import capabilities NISL adjusted from 700 – 1000 MW
- 12: 54: NYIS and MISI import limits reduced to manage PA27 and QFW thermal limit issues
- 13:02: PD increased up to 400 MW for hours 15-24
- 14:15: Curtailed 101 MW of exports for the remainder of the hour with TLRi for IESO Adequacy

Internal Transmission Interface Limitations					
Facility	Penalty Applied	Date/Time Issued	Start Date/Time	End Date/Time	C
FIO - Flow Into Ottawa	250	2010/05/18 14:49	2010/05/18 14:00	2010/06/18 16:00	S
FID - Flow Into Dobbin	75	2010/05/19 13:08	2010/05/25 04:00	2010/05/27 19:00	F
TEM - Transfer East of Mackenzie	75	2010/05/18 18:13	2010/05/25 06:45	2010/06/01 17:00	F
EWTE - East-West Transfer East	50	2010/05/18 18:13	2010/05/25 06:45	2010/06/01 17:00	F
TEM - Transfer East of Mackenzie	275	2010/05/26 02:34	2010/05/25 14:00	2010/05/26 02:30	F
TWM - Transfer West of Mackenzie	150	2010/05/26 02:34	2010/05/25 14:00	2010/05/26 02:30	F
Lakehead(Ecct)E - Lakehead East Circuit Flow East	0	2010/05/26 02:34	2010/05/26 06:00	2010/06/07 17:00	L
EWTW - East-West Transfer West	100	2010/05/25 16:11	2010/05/26 06:00	2010/06/07 17:00	N
Lakehead(Ecct)E - Lakehead East Circuit Flow East	N/A	2010/05/26 02:34	2010/05/26 12:00	2010/05/26 17:00	F
EWTE - East-West Transfer East	105	2010/05/26 14:28	2010/05/26 14:27	2010/05/26 19:00	F

Start Date/Time	End Date/Time	Comments
2010/05/18 14:00	2010/06/18 16:00	St. Isidore A1A2, B5D O/S
2010/05/25 04:00	2010/05/27 19:00	P3S O/S
2010/05/25 06:45	2010/06/01 17:00	K21W O/S
2010/05/25 06:45	2010/06/01 17:00	K21W O/S
2010/05/25 14:00	2010/05/26 02:30	High Risk Mackenzie X Lakehead
2010/05/25 14:00	2010/05/26 02:30	High Risk Mackenzie X Lakehead
2010/05/26 06:00	2010/06/07 17:00	Lakehead Flow EAST Limit <= 110MW M24L O/S
2010/05/26 06:00	2010/06/07 17:00	M24L O/S
2010/05/26 12:00	2010/05/26 17:00	High Risk Lakehead X Marathon. LFE limit = 110 MW.
2010/05/26 14:00	2010/05/26 20:00	High risk Mississagi x Algoma. Miss(Ecct)W - Mississagi East Circuits Flow West limit is 500 MW.
2010/05/26 14:00	2010/05/26 20:00	High risk Mississagi x Algoma. SFW Global - Sudbury Flow West Global limit is 750 MW.
2010/05/26 14:27	2010/05/26 19:00	High Risk Marathon x Mississagi

Hour	Interval	Energy	10N OR	10S OR	30 OR	Max 30 OR Con	Max Energy Con
15	1	\$ 120.24	\$ 0.56	\$ 0.56	\$ 0.56	\$ 75.00	\$ 690.22
15	2	\$ 120.32	\$ 0.56	\$ 0.56	\$ 0.56	\$ 75.00	\$ 522.60
15	3	\$ 122.45	\$ 0.56	\$ 0.56	\$ 0.56	\$ 75.00	\$ 585.65
15	4	\$ 121.73	\$ 0.56	\$ 0.56	\$ 0.56	\$ 30.10	\$ 250.68
15	5	\$ 123.06	\$ 0.56	\$ 0.56	\$ 0.56	\$ 75.00	\$ 522.59
15	6	\$ 122.45	\$ 0.56	\$ 0.56	\$ 0.56	\$ 30.10	\$ 217.27
15	7	\$ 123.65	\$ 0.56	\$ 0.56	\$ 0.56	\$ 75.00	\$ 477.91
15	8	\$ 123.65	\$ 0.56	\$ 0.56	\$ 0.56	\$ 75.00	\$ 486.42
15	9	\$ 124.55	\$ 0.56	\$ 0.56	\$ 0.56	\$ 75.00	\$ 522.09
15	10	\$ 124.55	\$ 0.56	\$ 0.56	\$ 0.56	\$ 75.00	\$ 606.51
15	11	\$ 124.55	\$ 0.56	\$ 0.56	\$ 0.56	\$ 30.10	\$ 633.30
15	12	\$ 125.88	\$ 0.55	\$ 0.55	\$ 0.55	\$ 75.00	\$ 672.62

Hour	Int	OR Unconstrained	OR Constrained
15	1	1418	1418
15	2	1418	1418
15	3	1418	1418
15	4	1418	1418
15	5	1418	1418
15	6	1418	1418
15	7	1418	1418
15	8	1418	1418
15	9	1418	1418
15	10	1418	1418
15	11	1418	1418
15	12	1418	1418

Constrained vs Unconstrained

Int	ENERGY OFFERED BUT NOT SCHEDULED BY REGION												TOTAL
	BRUCE	EAST	ESSA	NE	NIAGARA	NW	OTTAWA	SE	TORONTO	WEST	MBSI	MNSI	
3	0	0	0	0	349.1	293.4	0	0	161.50	203.20	137	78	1144.2
4	0	0	0	0	357.2	293	0.8	0	151.20	204.30	137	78	1143.5
5	0	0	0	0	336.6	291.7	0.8	0	120.00	215.40	137	78	1101.5

	NW Demand	Net Schedule	Gen Cap	EWE Limit	LFE Limit	C Off Imports	Bottled MWs
26-May-10 14:15:00	432	-140	897	110	275	215	431
26-May-10 14:16:00	435	-140	897	110	275	215	427
26-May-10 14:17:00	433	-140	897	110	275	215	429
26-May-10 14:18:00	433	-140	897	110	275	215	430
26-May-10 14:19:00	435	-140	897	110	275	215	427
	NE Demand	Net Schedule	Gen Cap	EWE Flow	FS Limit	Bottled MWs	Total
26-May-10 14:15:00	1314	0	2519	109	1300	13	444
26-May-10 14:16:00	1296	0	2519	110	1300	33	460
26-May-10 14:17:00	1304	0	2519	109	1300	23	452
26-May-10 14:18:00	1316	0	2519	110	1300	12	442
26-May-10 14:19:00	1336	0	2519	109	1300	-8	419

Average MWs bottled for Interval = 444

- If TLRi was used the exports will have remained in the market schedule
 - If price did not reach \$2000, or did reach \$2000 with available unscheduled offers and all markets solved without a shortage, TLRi is correct
- If ADQh was used the exports will have been removed from the market schedule
 - The DSO sequence will be re-evaluated with the amount of curtailed MWs in the unconstrained schedule
 - If price did not reach \$2000 and all markets were solved without a shortage, the code will be changed to TLRi
 - If the market could partially solve, the amount of MWs that the MS could not solve for will remain as ADQh, and the remaining will be changed to TLRi

NCDD Output Index | NCDD Input Index | NCDD Messages | Master Index | DFIS | DFIS | DFKID

NCDD - System Reserve Summary 14:40:52

DATE /	TIME	REQ	10-Minute Spin		REQ	10-Minute Total		REQ	Total	
			SCHED	\$/MW		SCHED	\$/MW		SCHED	\$/MW
2010/11/19	14:40	138.0	536.9	0.00	845.0	1183.0	0.00	1315.0	1315.0	0.34

NCDD Output Index | NCDD Input Index | NCDD Messages | Master Index | DFIS | DFIS | DFKID

NCDD - System Summary 14:40:52

Summary For	Time	Demand (MW)	Off-Market (MW)	Internal Gen. (MW)	No-Offer Gen. (MW)	External Gen. (MW)	Internal Ld. (MW)	Ext. Ld. (MW)	Deficit (MW)	Generation (MW)	Ref. Bus (\$/MWH)	Alarm
2010/11/19	14:40	16388.1	0.0	12902.0	1428.9	3419.0	-415.0	-1171.0	0.0	0.0	-52.00	
	14:35	16345.0	0.0	12859.0	1420.9	3419.0	-415.0	-1171.0	0.0	0.0	-52.00	
	14:30	16362.2	0.0	12866.0	1443.2	3419.0	-415.0	-1171.0	0.0	0.0	-52.00	
	14:25	16423.5	0.0	12835.0	1480.4	3419.0	-415.0	-1171.0	0.0	0.0	-52.00	
	14:20	16452.8	0.0	12884.0	1489.2	3419.0	-415.0	-1171.0	0.0	0.0	-52.00	

Page 1/1 (1 used) | Page up | Page down | First page | Last page

Alarm Legend O -Overgeneration, L -Under Generation, S - Reserve Violation
T -Transmission Constraint Violation, R- Ramp Violation, X - Multiple Violaitions

- **Inline with original principles**
 - Principle 5 – IESO [IMO] manual intervention shall impact the same RT/PD schedule (constrained or unconstrained) that would have insufficient resources as a result of the changing conditions
- **More efficient**
 - Current manual process is extremely time consuming
 - Allows us to spend more time on other priorities
- **More accurate**
 - A step towards a more accurate solution then the current manual process

- The proposed wording, as noted in the methodology paper, is to be included in Market Manual 4.3 under a new section titled: Transaction Coding.
- The section will include the following subsections;
 1. Principles of Coding
 2. Application of Interchange Schedule Codes (the existing Appendix C)
 3. Methodology for Code Application