

DRAFT

June 12, 2008 revision: Added section 1 - Summary to the paper.

June 24, 2008 revision: combine Summary and Introduction; clarification of evaluation and scheduling design; clarification of CMSC implications

October 9, 2008 revision: Add update to linked wheel volumes under section 2 "Background". Add settlement side payment to section 6 "Linked Wheel Congestion Pricing Proposed Design – Settlements".

1. Summary

A linked wheel transaction occurs when a market participant simultaneously imports electricity into Ontario and exports the same quantity out of Ontario.

This paper presents the basis of a proposed design to achieve congestion pricing and economic based scheduling and dispatch of linked wheel transactions. The paper also identifies several potential design issues for achieving congestion pricing and economic dispatch of linked wheels. These issues are centred on how congestion pricing and economic dispatch of linked wheels can be accomplished in Ontario's constrained physical scheduling and unconstrained schedule pricing regime.

The treatment of linked wheel transactions is of primary concern to market participants who import and export electricity. However, if changes are made to the scheduling and dispatch of linked wheel transactions, there may be consequential changes to market prices and uplift charges paid by Ontario consumers.

This paper is intended to initiate stakeholder discussion regarding the design and justification for congestion pricing and economic dispatch of linked wheel transactions.

This initiative began in September 2007 as a market rule amendment submission from a stakeholder in the trading sector and has since been discussed at the last 4 meetings with the Intertie Trading Standing Committee. More detailed can be found on the stakeholder engagement page at http://www.ieso.ca/imoweb/consult/consult_se45.asp

2. Background

A wheeling through transaction is a simultaneous import of energy into Ontario and export of energy from Ontario by a market participant (i.e. the market participant moves energy from one neighbouring jurisdiction, through the Ontario grid and into another neighbouring jurisdiction).

The linked wheeling through transaction was introduced in the Ontario market prior to market commencement to provide a means for a market participant to move energy from one jurisdiction through Ontario to another jurisdiction and ensure that the import energy is not diverted from the market participant's intended customer in the export market.

Prior to March 2008, to effect a linked wheeling through transaction, the market participant was required under the market rules to:

- Submit an import offer, priced at -MMCP (-\$2000/MW), and an export bid, priced at +MMCP (+\$2000/MW); and
- Identify the import and export as linked through the NERC tag

The IESO evaluates separately the import and export legs of a linked wheeling through transaction, but under the existing market rules, the IESO is required to schedule and dispatch the import and export (including application of constraints) such that both the import and export quantities are equal to the lower quantity that would otherwise have been scheduled and/or dispatched. Linked wheel transactions are not eligible for CMSC payments (refer to market rules Ch 9 sec 3.5.8)¹.

In September 2007, a market participant requested an amendment to the market rules to enable the "economic dispatch of linked wheels²". The market participant asserted that the current treatment exposes a market participant conducting a linked wheel to significant and unacceptable financial risk if there is congestion on the interties. The market participant cited neighbouring jurisdictions use of 'congestion pricing' as a more appropriate treatment. Under a 'congestion pricing' model, the market participant would indicate maximum price they are willing to pay for the linked wheel to flow, where that price is measured as the difference between the sink intertie zone price and the source intertie zone price. The markets in New York, PJM and MISO were cited as examples where such a 'congestion pricing' construct is used.

In consultation with the Inter-Jurisdictional Trading Standing Committee (IJTSC), the IESO implemented an 'interim' solution to address, to some extent, the financial risk issues identified by the market participant in MR-00338. The 'interim' solution was to change to the offering requirements for the import leg of the linked wheel. Market participants are now permitted to offer the import leg at any price between -50 \$/MW to -MMCP (-\$2000/MW). All other requirements and treatment are unchanged. The interim solution was implemented in March 2008.

¹ Refer to market rule amendment MR-00315 published on the IESO web site at the following link:
http://www.theimo.com/imoweb/pubs/mr2006/MR_00315-R00-BA.pdf

² Refer to market rule amendment submission MR-00338 published on IESO web site at the following link:
<http://www.theimo.com/imoweb/pubs/mr2007/MR-00338-Q00.pdf>

~~Since~~Between January and mid-July 2008, there ~~was~~has been a significant increase in linked wheel transactions through Ontario relative to previous years. Prior to 2008, the average volume of linked wheel transactions on a monthly basis was less than 50 GWh. For the first ~~six~~four months of 2008, the monthly volume of linked wheel transactions has been between 200 GWh and ~~1000~~650 GWh. In mid July 2008, the NYISO changed its tariff to prohibit certain linked wheels. The effect of the NYISO tariff change was to reduce the linked wheel volume through Ontario by a factor of over 10.

In its investigation of the congestion pricing constructs used in neighbouring jurisdictions, the IESO has determined that the constructs are similar in many respects. They all allow market participants to submit single transaction offers for a linked wheel, specifying the congestion price they are willing to pay to have a specified MW level transaction flow. They all allow linked wheel transactions to be offered and scheduled day-ahead and in real-time. There are apparent differences in the requirements for linked wheels not scheduled day-ahead but offered in real-time: PJM and MISO require such linked wheels to be offered as 'price-takers', while New York does not have any offer pricing restrictions.

3. Linked Wheel Congestion Pricing Proposed Design – Market Participant Offers

Market participants wishing to transact a linked wheel would submit a single offer for the linked wheel that would specify:

- The source boundary entity and control area³
- The sink boundary entity and control area³
- The NERC transaction tag
- Two to twenty price-quantity pairs, where the price in each p-q pair indicates the maximum difference between the sink intertie zone price and the source intertie zone price that the participant is willing to pay to have the corresponding MW quantity flow as a linked wheel.

4. Linked Wheel Congestion Pricing Proposed Design – Evaluation and Scheduling in Pre-Dispatch

A linked wheel transaction ~~offer~~bid would be evaluated in pre-dispatch as a single transaction, not as a separate import and a separate export.

Quantity 'X' of a linked wheel transaction would be scheduled in pre-dispatch when:

- Linked wheel ~~offer~~bid price for the quantity 'X' \geq (sink pre-dispatch intertie zone price *minus* source pre-dispatch intertie zone price); and
- Applicable tie line limits not binding.

³ Source and sink would be neighbours to Ontario i.e. New York, Michigan, Quebec, Manitoba or Minnesota

The linked wheel would be evaluated in both the pre-dispatch constrained and unconstrained sequences, so that other transactions and internal resources are appropriately scheduled in both sequences.

Evaluation and scheduling would be done on the basis of the measured benefit of the transaction:

- Benefit of import transaction measured as “source pre-dispatch intertie zone price *minus* import offer price”.
- Benefit of linked wheel transaction measured as “linked wheel ~~offer~~-bid price *minus* (sink pre-dispatch intertie zone price *minus* source pre-dispatch intertie zone price)”
- Benefit of export transaction measured as “sink pre-dispatch intertie zone price *minus* export bid price”.

Linked wheel, import and export transactions, as well as internal supply and consumption, evaluated simultaneously and scheduled, subject to the following constraints:

- Linked wheel injection MW quantity at source equal to linked wheel withdrawal MW quantity at sink;
- Benefit of individual transaction is positive;
- Source intertie line capacity not exceeded; and
- Sink intertie line capacity not exceeded.

The linked wheel transaction quantity scheduled in the pre-dispatch constrained sequence would be carried forward to real-time, assuming that check-out with neighbouring jurisdiction is successful.

Potential Design Issue:

Intertie zone prices determined in the pre-dispatch unconstrained sequence are used to determine intertie congestion price (ICP) and therefore the real-time intertie zone prices. See following equations:

$$ICP = \text{Pre-dispatch Unconstrained Sequence Intertie Zone Price} - \text{Pre-dispatch Ontario Uniform Price}$$

$$\text{Real-time Intertie Zone Price} = \text{Ontario Uniform MCP} + ICP$$

What are the implications of a linked wheel being scheduled in the pre-dispatch constrained sequence at a potentially different MW quantity than the pre-dispatch unconstrained sequence and the resulting carryover of that constrained schedule quantity and unconstrained ICPs to real-time? Is it possible for the linked wheel to have significantly different schedules in the pre-dispatch unconstrained and constrained schedules under the proposed design? If yes, what are implications of such a difference?

5. Linked Wheel Congestion Pricing Proposed Design – Scheduling in Real-Time

Pre-dispatch constrained schedule quantity carried forward to real-time constrained and unconstrained sequences, assuming check-out with neighbouring jurisdictions is successful.

Potential Design Issue:

How is the linked wheel scheduled in the pre-dispatch constrained schedule transferred to real-time? As a 'price taker' import (@-2000\$/MW) and a 'price taker' export (@2000\$/MW) so that the real-time constrained and unconstrained schedules have the same scheduled quantity? Some other transfer mechanism? What are the implications of the transfer mechanism on the linked wheel itself? Is it still exposed to real-time congestion risk as measured by the real-time unconstrained schedule? What are the implications of the transfer mechanism on other import and export transactions and domestic resources?

6. Linked Wheel Congestion Pricing Proposed Design – Settlements

Energy:

Energy payment = real-time unconstrained schedule sink intertie zone price *minus* real-time unconstrained source intertie zone price⁴

Potential Design Issue

As noted above, what are the implications of a linked wheel transaction, scheduled in the constrained 'world' but settled on the basis of the unconstrained 'world', with no recourse to CMSC, as noted below? Should linked wheels be settled on the constrained schedule prices? Would that also suggest that imports and exports should also be settled on constrained schedule prices?⁵ [See proposed side payment discussion below.](#)

Intertie Offer Guarantee (IOG):

Not eligible. There is no "offer" price in the sense contemplated for use in IOG.

Congestion management Settlement Credit (CMSC):

Not eligible – no change from current practice. Rationale for no CMSC payments in MR-00315 still valid in this proposed design. The purpose of CMSC is to compensate a market participant for the change in the participant's operating profit resulting from the transaction schedule in the real-time constrained sequence compared to the operating profit implied by the transaction schedule in the real-time unconstrained sequence. If the linked wheel transaction schedule is the same in both real-time sequences (as would be the case if the linked wheel schedule from pre-dispatch is included as a 'price taker' in both real-time sequences), there would be no change in operating profit, and hence no CMSC.

[Linked Wheel Guarantee Payment](#)

[It is proposed that linked wheels would be eligible for a marker side payment that would keep the participant financially whole to the operating profit implied by the linked wheels schedule in the hour-ahead pre-dispatch unconstrained sequence.](#)

⁴ Energy payment could be a credit if real-time unconstrained schedule sink intertie zone price is less than real-time unconstrained schedule source intertie zone price.

⁵ The Market Pricing Working Group (MPWG) will be addressing the issue of locational prices for intertie transactions as one of the MPWG 2008 priorities.

Such a side payment is justified for the following reasons:

- A market participant wishing to conduct a linked wheel must bid so as to be scheduled in both hour-ahead pre-dispatch sequences.
- The market participant is, through its bid, trying to manage the financial risk established in the hour-ahead pre-dispatch unconstrained sequence. Changes from the hour-ahead pre-dispatch to real-time are beyond the control of market participants.
- Side payments are justified given the general benefits that linked wheels provide to the market: increased liquidity, revenues to Ontario through uplift and transmission payments. In addition, side payments are also justified on the basis that more economic dispatch of linked wheels would result in more economically efficient dispatch of other transactions and domestic resources.

Transmission Fee:

Pay Transmission export fee – no change from current practice as linked wheel still using Ontario transmission system.

Failure charges:

Subject to intertie failure charges – no change from current practice.

Other market charges:

No change from current practice.

7. Cost of Implementation and Justification

The IESO has estimated the cost of making the system changes to enable the above design to be in the order of \$500,000 (NTD: this cost estimate does not include IESO costs for system changes to effect the proposed side payment.). Changes would be required to the following market systems:

- Market Participant Interface (MPI) to allow the single transaction linked wheel offers
- Dispatch Scheduling Optimizer (DSO) to evaluate the linked wheel as single transaction against the applicable intertie zone prices
- Settlements.

As noted in other documents related to this issue, linked wheels may or may not contribute to Ontario market efficiency and also may or may not contribute to regional market efficiencies⁶. Assuming that an examination of impact on market efficiencies would be speculative at best, the IESO suggests that an estimate of the changes in linked wheel

⁶ Refer to Technical Panel material published on the IESO web site at the following location: http://www.ieso.ca/imoweb/pubs/tp2007/tp207-2a_MR-00338-Q00_Cover_Memo.pdf

activity and the resulting impact on Ontario consumer market charges could be used to justify the \$500,000 expenditure. The export leg of a linked wheel transaction currently pays the IESO Administration Fee (~0.7 \$/MWh) and the transmission export fee (1.0 \$/MWh), which go towards paying the costs of the IESO transmitters that would otherwise be paid by Ontario consumers.

Accepting that premise, an increase in linked wheels of 294 GWh/a (or 24 GWh/month) would be required to contribute \$500,000 that would otherwise need to be collected, eventually, from Ontario consumers. ~~Given the current level of linked wheel transactions through Ontario (between 200 GWh and 650 GWh per month), an increase of 24 GWh/month is not an unreasonable expectation if the proposed design changes are made.~~