

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 payment to section 6 “Linked Wheel Congestion Pricing Proposed Design – Settlements”.

October 20, 2008 revision: re-draft as Working Group recommendation to Technical Panel, outlining two settlement options.

November 3, 2008 revision – remove settlement payment option. Update implementation costs (section 7)

November 10, 2008 revision – incorporate solution to transfer of transactions to real-time design issue (section 5.0)

[March 25, 2009 revision – change energy settlement to be on the basis of the pre-dispatch unconstrained sink and source intertie zone prices \(section 6.0\)](#)

1. Summary

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

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 both the Technical Panel and the Inter-Jurisdictional Trading Standing Committee (IJTSC). At the request of the Technical panel, a Working Group of inter-jurisdictional traders, with IESO support, was formed in August 2008 to develop a recommended design for the economic scheduling and dispatch of linked wheel transactions. This paper is the product of the Working Group efforts.

This paper presents the recommended design to achieve congestion pricing and economic based scheduling and dispatch of linked wheel transactions. The paper identifies how linked wheel transactions should be bid, evaluated, scheduled and settled.

The paper also identifies remaining design issues that should be considered if the decision is made to move forward with the proposed congestion pricing and economic dispatch of linked wheels.

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.

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 wheels"². 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

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>

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.

Between January and mid-July 2008, there was 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 months of 2008, the monthly volume of linked wheel transactions has been between 200 GWh and 1000 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. Recommended Linked Wheel Economic Dispatch 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.

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

4. **Recommended Linked Wheel Economic Dispatch Design – Evaluation and Scheduling in Pre-Dispatch**

A linked wheel transaction 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 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.

The linked wheel would be evaluated separately in both the pre-dispatch constrained and unconstrained sequences, so that other transactions and internal resources are appropriately scheduled in both sequences. This will also ensure that intertie congestion prices (ICPs) are determined correctly in the pre-dispatch unconstrained sequence.

Evaluation and scheduling of intertie transactions (imports, exports and linked wheels) 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 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 subject to check-out with neighbouring jurisdiction to determine the transaction quantity that will flow.

5. **Recommended Linked Wheel Economic Dispatch Design – Scheduling in Real-Time**

The pre-dispatch constrained schedule quantity that passes check-out, is carried forward to real-time constrained sequence. The pre-dispatch unconstrained schedule quantity is carried forward to real-time unconstrained sequence. The pre-dispatch scheduled quantities would be transferred to the real-time sequences such that the linked wheel schedule is fixed for the dispatch hour, as they are under the existing market rules.

6. **Recommended Linked Wheel Economic Dispatch Design –Linked Wheel Settled on Basis of Pre-Dispatch Unconstrained Sequence Prices**

Energy:

Energy payment = [pre-dispatch unconstrained schedule sink intertie zone price *minus* pre-dispatch unconstrained source intertie zone price] *times* real-time constrained schedule quantity⁴

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.

Design Issue – Internal Congestion and Transmission Losses Charges

The pre-dispatch constrained sequence intertie zone prices include pre-dispatch congestion on the interties, the internal (i.e. Ontario) congestion between the interties and the internal (i.e. Ontario) transmission losses between the interties. On that basis, it may not be appropriate that linked wheels be subject to uplift charges for Ontario CMSC and transmission losses as they are today. However, the existing uplift charges are determined on the basis of real-time conditions, not pre-dispatch. Is internal congestion forecasted in the pre-dispatch constrained sequence a reliable indicator of real-time internal congestion?

Other market charges:

No change from current practice. Refer to discussion above regarding the internal congestion and transmission losses design issue.

7. **Cost of Implementation**

The IESO has estimated the following implementation costs:

- ~500 k\$ to make changes to the Market Participant Interface (MPI) to allow the single transaction linked wheel offers and Dispatch Scheduling Optimizer (DSO) to evaluate the linked wheel as single transaction against the applicable intertie zone prices;
- ~200 k\$ to make changes to the Commercial Reconciliation System (CRS) to effect the proposed settlements;
- ~160 k\$ to make changes to other IESO market systems affected by the proposed change.

⁴ Energy payment could be a credit if pre-dispatch constrained schedule sink intertie zone price is less than pre-dispatch constrained schedule source intertie zone price i.e. the linked wheel is flowing against congestion.

There is also a possible additional implementation cost of ~90 k\$ to develop and use an interim settlement tool if the CRS changes cannot be made at the same time as the other system changes. In addition, given the lack of design detail regarding the proposed change, it is prudent to add a 30% contingency to the cost estimate. As a result, the IESO estimates a total implementation cost of between 1 M\$ to 1.3 M\$.