Market Rule Amendment Proposal

PART 1 – MARKET RULE INFORMATION

Identification No.:	MR- 00264-R00
Subject:	**Day-Ahead Market**
Title:	**Day-Ahead Market Operations**

Nature of Proposal:	☐ Alteration	☐ Deletion	☒ Addition

Chapter:	12 (new)	Appendix:	
Sections:	1, 3, 4 and 5		
Sub-sections proposed for amending:			

PART 2 – PROPOSAL HISTORY

Version	Reason for Issuing	Version Date
1.0	Submitted for Technical Panel Review	October 13, 2004
2.0	Submitted for Technical Panel Review	October 28, 2004
3.0	Incorporate Technical Panel Comments and Post for Stakeholder Review and Comment	November 5, 2004

Approved Amendment Publication Date:	
Approved Amendment Effective Date:	

PART 3 – EXPLANATION FOR PROPOSED AMENDMENT

Provide a brief description of the following:

- The reason for the proposed amendment and the impact on the *IMO-administered markets* if the amendment is not made
- Alternative solutions considered
- The proposed amendment, how the amendment addresses the above reason and impact of the proposed amendment on the *IMO-administered markets*.

Summary

These proposed market rule amendments set out the IMO obligations relating to the determination of day-ahead market prices and schedules, timelines for the operation of the day-ahead market, and the release and publishing of day-ahead market results. It describes at a high level the DAM calculation engine, its purpose, inputs and outputs, and its multiple passes. A more detailed description of the DAM calculation engine including the rules specifying its mathematical formulation is provided in MR-00265.

Background

In consultation with market participants and other stakeholders, the IMO has developed a high level design for a day-ahead market. The IMO-Board has endorsed proceeding with the development of a day-ahead market and has directed the IMO to proceed with the detailed design and market rule amendments for the day-ahead market consistent with the high-level design.

Discussion

This market rule amendment proposal on the subject of market operations provides sections 1, 3, 4 and 5 for a proposed new Chapter 12, entitled "Day-Ahead Market Operations". This rule amendment proposal MR-00264 is mainly on the subject of the DAM calculation engine: its inputs, the multiple passes of the calculation engine, their optimisation objectives, and the various outputs of the calculation engine. It describes the determination of the financially binding constrained schedules and uniform market prices for the day-ahead market. It is a companion document to rule amendment proposal MR-00265 that describes the calculation engine in much greater detail for the proposed appendix of the new Chapter 12.

This MR-00264 rule amendment proposal contains the following provisions by section:

Section 1, Introduction, contains an overview of the day-ahead market under the following subject headings, along with suitable references to other market rules for further information.

- Purpose and Application:

This describes at a very high level what the chapter is about (scope, submission of data, Dam calculation engine and its determination of prices and schedules, publication of data etc).

- Scope of the Day-ahead Market;

Day-ahead market transactions include both physical transactions that balance actual transactions in the real-time market, and virtual transactions whereby market participants can buy and sell energy that is neither consumed nor generated. The IMO uses the day-ahead market to schedule sufficient facilities to meet forecast Ontario load and operating reserves for the next day.

- Reconciliation with Real-Time Market Operations;

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The quantities bought and sold in the day-ahead market for physical transactions are reconciled with actual market participant performance in the real-time market.

- Production Cost Guarantee;

Market participants who receive schedules in the day-ahead market may be eligible for a production cost guarantee for costs associated with their underlying bids or offers of energy should revenues earned in the real-time market not exceed their production costs as set out in their bids and offers. This provision applies to physical transactions, both to generation facilities and to price responsive loads.

- Adherence to Schedules and Treatment of Dispatch Data;

Market participants who receive a day-ahead market schedule for physical transactions must, whether or not they are eligible for a production cost guarantee, keep the IMO informed of their intended operation through their participation in the pre-dispatch processes and real-time dispatch processes described in Chapter 7 of the market rules. The dispatch data from the day-ahead market is translated and transferred to the pre-dispatch scheduling process (see MR-00268-R00, Day-Ahead Market – Real-Time Market Integration).

- Congestion Management;

The day-ahead market has similar provisions as the real-time market concerning congestion management.

- Virtual Transactions;

Virtual transactions are settled at the same time as physical transactions.

Section 2, Data Submissions for the Day-Ahead Market (see MR-00267-R00)

Section 3, DAM Calculation Engine, details the IMO obligation to determine day-ahead market schedules and prices using the DAM Calculation Engine as specified in this section and in Appendix 12.1. This section 3 also contains a high level description of the DAM calculation engine under the following subject headings:

- Purpose of the DAM calculation engine;

Its purpose is to determine day-ahead market schedules and prices.

- Optimisation Objective of the DAM calculation engine;

The DAM calculation engine has the same optimisation objective "to maximise the gains from trade" as the real-time market. The "gains from trade" is the difference between the value of the electricity produced (as measured by the bids (i.e. demand) for energy) and its cost of production (as measured by the offers (i.e. supply) of energy).

- Inputs of the DAM calculation engine;

These provisions outline data inputs to the DAM calculation engine with the detail contained in Appendix 12.1. The input data includes: dispatch data (bids and offers) from market participants, the IMO's forecast of Ontario load, data to support the modelling of transmission (IMO-controlled grid), certain parameters in common with the dispatch algorithm used to determine market prices and schedules in the real-time market, and outputs from the prior day-ahead market results required to maintain continuity from one day's results to the next.

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- Multiple Passes of the DAM calculation engine;

These are the five passes of the calculation engine that are required to provide an optimised set of day-ahead market results. Passes 1 and 2 are intermediate passes that serve as inputs to subsequent passes. Passes 3 and 5 provide the results. Pass 3 provides the schedules (constrained schedules as they include consideration of transmission constraints) and pass 5 provides market prices (uniform market prices as they do not include consideration of transmission constraints). Pass 4 is used by the IMO to assess the reliable operation of the transmission system (IMO-controlled grid) and for other information purposes. Appendix 12.1 describes the passes in greater detail and specifies their mathematical formulation (see MR-00265-R00, DAM Calculation Engine)

- Outputs of the DAM calculation engine.

The many outputs of the DAM calculation engine and what they are used for are described. Some are published, some are used for settlement purposes, and some are used to schedule facilities to meet next day forecast load requirements.

Section 4, Day-ahead Market Schedules and Prices contains high level provisions under the following subject headings:

- Timelines;

The timelines for the operation of the day-ahead market are set out. The bid/offer window opens at 6:00, closes at 10:00 and the results are published by 14:00 (all times Eastern Standard Time).

- Uniform Day-ahead Market Prices;

These provisions set out that the market price for energy and operating reserve is the uniform price determined in pass 5 and places constraints on market prices (e.g. no more then the maximum market clearing price (MMCP) etc). These are similar to provisions for the real-time market.

Section 5, Releasing and Publishing Day-ahead Market Information, contains provisions on the publishing of day-ahead market public information results and on the release to market participants of their individual confidential information results. It enumerates the various market results released. Information that is made public (e.g. by publishing on the IMO web site) includes market prices and information that is in aggregate form. This approach maintains the confidentiality of individual market participant information, but maintains transparent market operations by making market prices and aggregate information equally available to all market participants.

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The following proposed amendments, while not shown as "tracked changes" are entirely new proposed amendments to the market rules.

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Chapter 12

Day-Ahead Market Operations

1. Introduction

1.1 Purpose and Application

1.1.1 The *market rules* governing the operation of the *day-ahead market* are set out in this Chapter, including:

- the scope of the *day-ahead market*;

- the submission of *dispatch data* into the *day-ahead market* by *market participants*;

- the operation of the *DAM calculation engine* including the determination of financially binding schedules and prices; and

- the release and publication of the results from the *day-ahead market*.

1.1.2 The rules in this Chapter apply to the *IMO* and any *market participant* authorised under the *market rules* to participate in or submit *dispatch data* into the *day-ahead market*.

1.1.3 The manner in which the outputs from each pass of the *DAM calculation engine* are used for settlement purposes is described in section 3 of Chapter 9.

1.2 Scope of the Day-Ahead Market

1.2.1 The *IMO* shall administer a *day-ahead market* for *physical transactions, virtual transactions* and to schedule sufficient *facilities* to meet *forecast Ontario load* and *operating reserve* requirements for each *dispatch day.*

Reconciliation with Real-Time Market Operations

1.2.2 The *IMO* shall reconcile quantities of either *energy* bought and sold or *operating reserve* sold by a *market participant* in the *day-ahead market* by way of *physical transactions* with the actual performance of the *market participant* in the *real-time market* in the manner described in section 3 of Chapter 9. *Physical transactions* in the *day-ahead market* are settled concurrently with transactions in the *real-time market.*

Production Cost Guarantee

1.2.3 A *market participant* who receives a *day-ahead market* schedule for *physical transactions* shall be eligible for a production cost guarantee for costs associated with the underlying *bids* or *offers* of *energy*. The conditions under which a *market participant* would receive a production cost guarantee payment and the circumstances whereby a *market participant* would lose its right to such payments are described in section 3 of Chapter 9.

Adherence to Schedules and Treatment of Dispatch Data

1.2.4 *Market participants* who receive a *day-ahead market* schedule for *physical transactions* shall, whether or not they are eligible for a production cost guarantee, keep the *IMO* informed of their intended operation through their participation in the pre-dispatch processes and real-time dispatch process as described in sections 5 and 6 of Chapter 7, respectively. The *dispatch data* for those *market participants* that receive schedules in the *day-ahead market* is translated, as described in sections 3.3.1A, 3.3.1B and 3.3.1C of Chapter 7, and transferred to the pre-dispatch scheduling process described in section 5 of Chapter 7.

Congestion Management

1.2.5 Like the *real-time market*, the *day-ahead market* uses the *unconstrained IMO-controlled grid model* to determine uniform *market prices* and the *constrained IMO-controlled grid model* to determine *constrained schedules*. This methodology of determining *market prices* and *constrained schedules* with different models of the *IMO-controlled grid* gives rise to a need for congestion

management settlement credits. The conditions under which a market participant would receive a congestion management settlement credit are described in section 3 of Chapter 9.

Virtual Transactions

1.2.6   *Market participants* that receive a schedule for *virtual transactions* in the *day-ahead market* incur no obligation to perform in the *real-time market* in respect of those transactions. *Energy* is neither consumed nor generated through *virtual transactions. Virtual transactions* are settled concurrently with *physical transactions* in the *day-ahead market.*

2. Data Submission for the Day-Ahead Market

(place holder for MR-00267)

3. DAM Calculation Engine

3.1   Purpose of the DAM Calculation Engine

3.1.1   The *IMO* shall use the *DAM calculation engine* to determine various schedules and *market prices* for the *day-ahead market* as outlined in this section 3 and described in greater detail in Appendix 12.1.

3.2   Optimisation Objective of the DAM Calculation Engine

3.2.1   The optimization objective for the *DAM calculation engine* shall be "to maximise the gains from trade", the same optimisation objective that applies to the *real-time market* as described in section 4.3 of Chapter 7. This optimisation objective shall be applied over the 24 hours of the next *dispatch day* within each pass of the *DAM calculation engine* described in section 3.4 using the methodology set out in Appendix 12.1.

3.3   Inputs to the DAM Calculation Engine

3.3.1   The *IMO* shall use the following as inputs to the *DAM calculation engine.* These inputs are described in greater detail in Appendix 12.1*:*

3.3.1.1   *dispatch data* and other information provided by *market participants* in accordance with section 2;

3.3.1.2   the *forecast Ontario load* for each hour of the next *dispatch day*;

3.3.1.3   data required to support both the constrained IMO-controlled grid model and unconstrained IMO-controlled grid model;

3.3.1.4   the parameters set out in section 4.4.6 of Chapter 7 that govern the *maximum market clearing price*, *maximum operating reserve price* and penalty functions for the violation of constraints; and

3.3.1.5   any outputs from the *DAM calculation engine* obtained from the previous *dispatch day* that are required in order to extend the continuity of multi-hour block schedules from the previous *dispatch day* to the next *dispatch day,* or to respect inter-temporal constraints associated with *bids* and *offers,* such as but not necessarily limited to, minimum run times, minimum down times, minimum load reduction times and minimum time between load reductions.

3.4   Multiple Passes of the DAM Calculation Engine

3.4.1   The *day-ahead market* clearing process uses five separate sequences (each, a pass) using the *DAM calculation engine* to determine the financially binding *constrained schedules* and *unconstrained schedules* and corresponding *market prices* of the *day-ahead market. Pass 1* to *pass 4* yield *constrained schedules* that include consideration of transmission constraints. *Pass 5* yields an *unconstrained schedule* without consideration of transmission constraints. The multiple passes of the *DAM calculation engine* and their interrelationships are illustrated in Figure 1 of Appendix 12.1. Financially binding *constrained schedules* and *market prices* are determined in *pass 3* and *pass 5,* respectively.

3.4.2   The following is a brief functional overview including the objectives of the five passes of the *DAM calculation engine.*

3.4.2.1   ***Pass 1***: The objective of *pass 1* is to determine the optimum set of *generation facilities*, *price responsive loads* and imports necessary to meet the <u>load bid</u> into the *day-ahead market,* exports and *operating reserve* requirements specified by the *IMO*, taking into account all transmission limitations, including *intertie* transfer limits. *Pass 1* produces a *constrained schedule* based on all *bids* and *offers* for *physical transactions* and *virtual transactions* in the *day-ahead market*. The results of *pass 1* serve as inputs to *pass 2*.

3.4.2.2   ***Pass 2***: Maintaining the *facility* commitments from *pass 1* (*generation facilities*, imports and *price responsive loads*), the objective of *pass 2* is to determine an optimal set of additional resources to meet <u>*forecast Ontario load*</u>, export commitments from *pass 1* and *operating reserve*

requirements specified by the *IMO* for the next *dispatch day*, taking into account all transmission limitations, including *intertie* transfer limits . The optimization in *pass 2* is based on *offers* and *bids*, costs of production and load reduction that are modified as described in section 3.3F of Chapter 9 and in Appendix 12.1. No *virtual transactions* are considered in this pass. The results of *pass 2* serve as inputs to *pass 3*.

3.4.2.3   **Pass 3**: Maintaining the *facility* commitments from *pass 2*, the objective of *pass 3* is to produce an optimum set of *constrained schedules* for all committed and available *facilities* to meet <u>load bid</u> into the *day-ahead market, exports* and all *operating reserve* requirements specified by the *IMO* taking into account transmission limitations, including *intertie* transfer limits. *Pass 3* uses the *facility* commitments from *pass 1* and *pass 2* to determine a set of constrained hourly schedules to satisfy the load bid into the *day-ahead market*. The *constrained schedules* for *physical transactions* determined in *pass 3* are financially binding and shall be used for *settlement* purposes as described in section 3 of Chapter 9. In addition, *pass 3* produces locational marginal prices for information purposes only. *Constrained schedules* determined in *pass 3* for *price sensitive loads* and *virtual transactions* are not financially binding and are not used for *settlement* purposes.

3.4.2.4   **Pass 4**: Maintaining the *facility* commitments from *pass 2*, the objective of *pass 4* is to produce an optimum set of *constrained schedules for all* committed and available *facilities* to meet <u>forecast Ontario load</u> for the next *dispatch day*, exports and all *operating reserve* requirements, taking into account transmission limitations, including *intertie* transfer limits. No *virtual transactions* are considered in this pass. The *constrained schedules* determined in *pass 4* are used by the *IMO* in analysing the reliable operation of the *IMO-controlled grid* on the next *dispatch day* and for information purposes by *market participants*. In addition, *pass 4* produces locational marginal prices for information purposes only. The *constrained schedules* produced by *pass 4* are not used for *settlement* purposes.

3.4.2.5   **Pass 5**: Maintaining the *facility* commitments from *pass 2*, the objective of *pass 5* is to produce the optimum set of *unconstrained schedules* for all committed and available *facilities* to meet the load *bid* into the *day-ahead market,* exports and all *operating reserve* requirements taking into account only *intertie* transfer limits. No internal transmission constraints are considered. *Pass 5* determines financially binding uniform *market prices* and *unconstrained schedules* that are used for *settlement* of all *physical transactions*, other than imports that are scheduled in *pass 2*, and all *virtual transactions* scheduled in *pass 5*, all as described in section 3 of Chapter 9. The *unconstrained schedules* and uniform *market prices* from *pass 5* together with the *constrained schedules* from *pass 3* are

used in the determination of congestion management settlement credits as described in section 3.3E of Chapter 9.

3.5 Outputs of the Day-Ahead Market Calculation Engine

3.5.1 As described in more detail in Appendix 12.1, the *DAM calculation engine* determines the *constrained schedules* and *unconstrained schedules* and *market prices* as set out in this section and shall be used by the *IMO*:

    3.5.1.1 to *publish* various sub-sets of this data as set out in section 5;

    3.5.1.2 for *settlement* purposes as set out in Chapter 9; and

    3.5.1.3 to schedule sufficient *facilities* to meet *forecast Ontario load* for each *dispatch day* .

3.5.2 The outputs from *pass 1* of the *DAM calculation engine* are:

    3.5.2.1 data required by the *settlements* process to determine:

    a. the *settlement hour* in which a *generation facility* or import transaction was scheduled at a particular level; and

    b. the *settlement hour* in which a *price responsive load* was scheduled to provide a quantity of *load reduction;* and

    3.5.2.2 the *facility* commitment decisions and applicable *constrained schedules* for each hour in the next *dispatch day* to be used as inputs into *pass 2* of the *DAM calculation engine*.

The results of *pass 1* are used as input to subsequent passes of the *DAM calculation engine*.

3.5.3 The outputs from *pass 2* of the *DAM calculation engine* are:

    3.5.3.1 data required by the *settlement process* to determine:

    a. the *settlement hour* in which a *generation facility* or import transaction was scheduled at a particular level to provide *energy*;

    b. the *settlement hour* in which a *price responsive load* was scheduled to provide a quantity of *load reduction*; and

    c. the *forecast Ontario load* used by *pass 2* for each applicable *settlement hour*;

    3.5.3.2 the *facility* commitment decisions and applicable *constrained schedules* for each hour in the next *dispatch day* to be used as inputs into *passes* 3, 4 and 5 of the *DAM calculation engine*; and

3.5.3.3   *constrained schedules* for import transactions that are not subsequently scheduled in *passes* 3 or 5 of the *DAM calculation engine,* which shall be used for *settlement* purposes.

Pass 2 results are used as inputs to subsequent passes of the *DAM calculation engine*.

3.5.4   The outputs from *pass 3* of the *DAM calculation engine* are:

3.5.4.1   *constrained schedules* for *generation facilities*, *price responsive loads*, imports and exports for *physical transactions* for *energy* and each class of *operating reserve* for each hour of the next *dispatch day*, which shall be used for *settlement* purposes; and

3.5.4.2   hourly locational marginal prices for the *day-ahead market* based on the *constrained schedules* determined in *pass 3* for *energy* and each class of *operating reserve,* which are provided for information purposes only.

Pass 3 results yield the *constrained schedules* of the *day-ahead market* for the next *dispatch day* and shall be *published* as described in section 5.

3.5.5   The outputs from *pass 4* of the *DAM calculation engine* are:

3.5.5.1   hourly *constrained schedules* for *generation facilities*, *price responsive loads* and imports that meet the forecast *energy* and *operating reserve* requirements which are used by the *IMO* in analysing the reliable operation of the *IMO-controlled grid* during the next *dispatch day*; and,

3.5.5.2   hourly locational marginal prices of the *day-ahead market* based on the *constrained schedules* determined in *pass 4*, which are provided for information purposes only.

The *pass 4* results shall be *published* by the *IMO*.

3.5.6   The outputs from *pass 5* of the *DAM calculation engine* are:

3.5.6.1   *market prices* for *energy* and each class of *operating reserve* for the *day-ahead market* for each hour of the next *dispatch day* based on the *unconstrained schedules* determined in *pass 5*; and

3.5.6.2   the hourly *unconstrained schedules* for *physical transactions* involving *energy* and each class of *operating reserve* and *virtual transactions* involving *energy* from *pass 5* and such schedules shall be used for *settlement* purposes.

Pass 5 results yield the *market prices* described in section 4.3 and shall be *published* as described in section 5.

4. Day-Ahead Market Schedules and Prices

4.1 Timelines

4.1.1 The *day-ahead market* shall operate under the following timelines on the pre-*dispatch day*:

6:00 EST   the *IMO* accepts initial *bids* and *offers* submitted by *market participants*;

10:00 EST   the window for revisions to any *bids* and *offers* closes;

by 14:00 EST   the outputs from the passes are *published* as described in section 5;

4.2 Uniform Day-Ahead Market Prices

4.2.1 The *IMO* shall use the *DAM calculation engine* to determine hourly *market prices* for the *day-ahead market* as follows:

4.2.1.1   the marginal cost for *energy* and each class of *operating reserve* determined in *pass 5* of *DAM calculation engine* for Ontario and each of the *intertie zones* shall be the *market prices* for the *day-ahead market*;

4.2.1.2   any *market price* for *energy* that exceeds *MMCP* or is less than negative *MMCP* shall be set equal to *MMCP* or negative *MMCP*, as the case may be, for *settlement* purposes;

4.2.1.3   any *market price* for *operating reserve* that exceeds *MORP* shall be set equal to *MORP* for *settlement* purposes; and

4.2.1.4. any *market price* for *operating reserve* that is negative shall be set equal to zero for *settlement* purposes.

5. Releasing and Publishing Day-Ahead Market Information

5.1   Publishing Day-Ahead Market Information

5.1.1   The *IMO* shall *publish* the following aggregate information by 14:00 EST following the completion of the *day-ahead market* results:

5.1.1.1   *Virtual transaction offers* and *bids*, total hourly quantities both cleared and not cleared in *pass 5* the *day-ahead market*.

5.1.1.2   *Physical transaction offers* and *bids* (excluding imports and exports), total hourly quantities for *energy* and each class of *operating reserve* both cleared and not cleared in *pass 3 of* the *day-ahead market*.

5.1.1.3   Imports and exports, total hourly quantities for *energy* and each class of *operating reserve* both cleared and not cleared in *pass 3 of* the *day-ahead market*.

5.1.1.4   Locational marginal prices for *energy* from *pass 3* and *pass 4*.

5.1.1.5   Total hourly c*onstrained schedules* for the additional *facilities* and imports committed in *pass 2* to meet forecast Ontario load.

5.1.1.6   Total hourly c*onstrained schedules* for load reductions from *price responsive load* committed in *pass 2*.

5.1.1.7   The uniform hourly Ontario *market price* for *energy* and each class of *operating reserve* from *pass 5* and for each of the *intertie zones*.

5.2   Releasing Market Participant Specific Day-Ahead Market Information

5.2.1   The *IMO* shall release only to the *registered market participant* for the *registered facility* to which the *bids* and *offers* relate or to the *market participant* that the *virtual transaction* relates, the following information by 14:00 EST following the completion of the *day-ahead market* results:

5.2.2.1   Hourly *constrained schedules* for each *registered facility* committed for *energy* and *operating reserve* from *pass 3*;

5.2.2.2   Hourly *unconstrained schedules* for each *registered facility* for *energy* and *operating reserve* from *pass 5*;

5.2.2.3   Hourly *unconstrained schedules* for each *virtual transaction* for *energy* from *pass 5*;

5.2.2.4   Hourly *constrained schedules* for each *registered facility* from *pass 4* for information purposes;

5.2.2.5   Hourly *constrained schedules* for imports from *pass 2*.

5.2.2.6   Confirmation of any *physical bilateral contract data* hourly amounts.

PART 5 – IMO BOARD COMMENTS

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