



Coupled Operational Dry Run - Summary Report

April 1 - April 30, 2002

Issue 1.0

This document summarizes the conduct and results of the Coupled Operational Dry Run conducted April 1-30, 2002, as the final stage in the commissioning of the IMO-Administered Markets.

Disclaimer

The posting of documents on this website is done for the convenience of *market participants* and other interested visitors to the *IMO* website. Please be advised that, while the *IMO* attempts to have all posted documents conform to the original, changes can result from the original, including changes resulting from the programs used to format the documents for posting on the website as well as from the programs used by the viewer to download and read the documents. The *IMO* makes no representation or warranty, express or implied, that the documents on this website are exact reproductions of the original documents listed. In addition, the documents and information posted on this website are subject to change. The *IMO* may revise, withdraw or make final these materials at any time at its sole discretion without further notice. It is solely your responsibility to ensure that you are using up-to-date documents and information.

This document may contain a summary of a particular *market rule*. Where provided, the summary has been used because of the length of the *market rule* itself. The reader should be aware, however, that where a *market rule* is applicable, the obligation that needs to be met is as stated in the “*Market Rules*”. To the extent of any discrepancy or inconsistency between the provisions of a particular *market rule* and the summary, the provision of the *market rule* shall govern.

Document ID	IMO_REP_0076
Document Name	Coupled Operational Dry Run - Summary Report
Issue	Issue 1.0
Reason for Issue	Initial Release
Effective Date	May 27, 2002

Document Change History

Issue	Reason for Issue	Date
1.0	Initial release	May 29, 2002

Related Documents

Document ID	Document Title

Table of Contents

Table of Contents	i
List of Tables	iv
Table of Changes	v
Executive Summary	1
1. Introduction	3
1.1 Purpose	3
1.2 Scope	3
1.3 Who Should Use This Document.....	3
1.4 Conventions.....	3
1.5 How this Document is Organized	3
2. Overview	5
2.1 Review Process	5
2.2 Purpose & Definition	5
2.3 CODR Success Criteria	6
3. CODR Success Criteria	10
3.1 Compliance of <i>Market Participants</i> (Criterion 1)	10
3.2 Prudential Performance of <i>Market Participants</i> (Criterion 2).....	10
3.3 <i>Meter Service Providers</i> ' Performance (Criterion 3)	11
3.4 Schedule Timeliness (Criteria 4, 5 & 6)	11
3.5 <i>Dispatch</i> Criteria (Criteria 7, 8, 23 & 25)	12
3.5.2 <i>Dispatch Instruction</i> Timeliness (Criterion 7)	12
3.5.3 Participant Response to Receipt of <i>Dispatch instructions</i> (Criterion 8)	12
3.5.4 Ability to Maintain Adequate Control (Criterion 23).....	13
3.5.5 <i>Dispatch</i> Accuracy (Criterion 25).....	13
3.6 <i>Settlement statements</i> (Criteria 9, 10, 26 & 29).....	13
3.6.2 Timeliness of <i>Settlement statements</i> (Criteria 9 & 10).....	14
3.6.3 Variances between <i>Preliminary & Final Statements</i> (Criterion 26).....	14
3.6.4 <i>Notices of Disagreement</i> (Criterion 29)	14
3.7 <i>Invoices</i> (Criteria 11, 16, 17 & 18)	15
3.7.2 Timeliness of <i>Invoices</i> (Criterion 11)	15

3.7.3	Ability to <i>Invoice</i> Non-ready Load <i>Market Participants</i> (Criterion 16, 17 & 18)	15
3.8	Load forecasts and Security Assessments (Criterion 12, 13 & 24)	15
3.8.2	Forecast and Assessment Timeliness (Criteria 12 & 13)	16
3.8.3	Accuracy of Forecast (Criterion 24)	16
3.9	Dispute Resolution (Criterion 14)	16
3.10	IMO Systems & Procedures (Criterion 15)	16
3.11	<i>Interconnection Agreements</i> (Criterion 19)	16
3.12	Systems Availability & Capacity (Criteria 20 & 21)	17
3.13	Back-up Centre (Criterion 22)	17
3.14	Call Success to <i>Revenue Meters</i> (Criterion 27)	17
3.15	Metering <i>VEE Process</i> (Criterion 28)	18
3.16	Market Suspension (Criteria 30 & 31)	18
3.16.2	No Unreasonable Suspension Requirement (Criterion 30)	18
3.16.3	Suspension/Resumption Procedures Functional (Criterion 31)	18
3.17	Participant Suspension (Criterion 32)	19
3.18	<i>Outage</i> Assessments (Criterion 33)	19
3.19	<i>Transmitters'</i> Performance (Criterion 34)	19
4.	General Observations	20
4.1	Scope of Operations Tested	20
4.2	Market Communications	20
4.2.1	IMO Help Centre	20
4.2.2	Website	21
4.2.3	Communications Processes	21
4.3	Price Discovery	21
4.4	Adjustments to Scheduling and <i>Dispatch</i>	22
4.4.1	<i>Intertie</i> Ramp Limit	22
4.4.2	Voltage Reduction	22
4.4.3	Fixed Penalty Factors During <i>Dispatch Scheduling</i> Optimization	22
4.4.4	Ramp Rate Increases	23
4.5	<i>Transmission Rights Auction</i>	23
4.6	System <i>Outages</i> – Planned & Unplanned	24
4.7	Testing during CODR	24
4.7.1	Funds Transfer Dry Run	24
4.7.2	Inter-jurisdictional Trading	25
4.7.3	Fail-over/Fall-back/Fall-forward Testing	25
4.7.4	Mock Market Suspension/Resumption	26
4.8	Exceptions to Stability Period	26
4.9	Transitional Obligations	27
4.10	Market Surveillance	27

5. CODR Conclusions	28
5.1 Highlights and Key Successes	28
5.2 Reservations – Areas to Monitor Going Forward	28
5.2.1 Compliance of <i>Market Participants</i>	29
5.2.2 Prudential Performance of <i>Market Participants</i>	29
5.2.3 Submission and Processing of Notices of Disagreement	29
5.2.4 Submission and Processing of Disputes	29
5.2.5 Inter-jurisdictional Trading	29
5.2.6 <i>Settlement of Active Transmission Rights</i>	30
5.2.7 Participant Suspension/de-Activation	30
5.3 Summary	30
Appendix A: Criterion 2	A-1
Appendix B: Criteria 4, 5, 6, 7, 8	B-1
Appendix C: Criteria 12, 13	C-1
Appendix D: Criteria 20, 23, 24, 25	D-1
Appendix E: Criterion 27	E-1
Appendix F: Criterion 33	F-1
References	1

List of Tables

Table 2-1: CODR Success Criteria.....6

Table of Changes

Reference (Section and Paragraph)	Description of Change

Executive Summary

The purpose of this document is to summarize the results of the Coupled Operational Dry Run (CODR) of the *IMO-administered markets* and present conclusions regarding the success of CODR. This document is to be used to communicate the conclusions regarding the success of CODR to the *IMO Board*, the Market Commissioning Task Force (MCTF), and the general public.

The purpose of Coupled ODR was to demonstrate that the *IMO-administered markets* work when coupled to the physical operations based on the *Market Rules*. The success of Coupled ODR was a prerequisite to the live market operation.

Coupled ODR dictated and directed live physical operations. Once CODR began, trading ran 24 hours per day, seven days a week (24x7). This entailed production of near term security and *adequacy* assessments, submission of *bids* and *offers*, production of schedules and prices, and communication and execution of *dispatch instructions*. It also entailed daily *revenue meter* readings, and production of *settlement statements* and not-to-be-paid *invoices*. During CODR, *market participants* were to operate in the manner that they would anticipate in the live market following *market rules*. The market and physical operations reacted in response to participant's *bids* and *offers*.

CODR was scheduled and ran from April 1st to April 30th 2002, and was immediately followed by the opening of the *IMO-administered markets* on May 1st, 2002.

Overall CODR exercised and demonstrated successful operations in almost all of the aspects that were possible to 'prove' during the period. These included:

- Positive performance against all of the 34 *IMO Board* approved success criteria, not only overall but through-out the CODR period for almost all criteria;
- System stability and participant connectivity to *IMO* systems was well established;
- Significant learning in areas not previously tested interactively with *market participants* – e.g. *operating reserve* activation, participant reaction to market signals, prudential monitoring, and submission of *TR market deposits*. The CODR period served as a transition to the new rules and business philosophies;
- A successful *Transmission Rights Auction* for rights in late April, including all aspects of the process (from submission of *TR market deposits* through to financial *invoice*);
- A successful end-to-end exercise of market suspension and resumption;
- Demonstration of the *IMO's* ability to communicate events, market data and system status to the market using the internet (Corporate website, Public Reports, participant MPI etc); and
- Demonstration of the *IMO's* ability to make changes to systems in the live production environment with minimum disruption to *market participants* and business processes.

A detailed listing of each success criterion can be found in Section 3 of the document. Section 4 contains general observations of factors and occurrences that should be considered in discussion of the outcome and learning of CODR, and final determination of its success.

There are some areas of market operations that cannot be deemed wholly demonstrated based on the CODR experience, generally due to incomplete exercising of process or lower than expected volumes. Final conclusions regarding these areas of market operations will not be possible until after market opening. Each of these areas will undergo special scrutiny in the initial days of operation of the live market. The areas are:

- Compliance of *market participants* (indications were positive, but still bear monitoring)
- Prudential performance of *market participants* (process of monitoring and *margin calls* demonstrated, but participant response to real financial transfers outstanding)
- Submission and processing of *Notices of Disagreement* (exercised with low volumes only)
- Submission and processing of Disputes (not exercised)
- Inter-jurisdictional trading (limited to 1MW transfers for a small number *market participants* during CODR)
- *Settlement* of active *transmission rights* (not demonstrated in CODR as *settlement* timelines outside of CODR period)
- Participant suspension/de-activation (not exercised during CODR).

Further information on each of these can be found in Section 5.2 of the document.

Overall, the *IMO* considers the Coupled Operational Dry Run exercise conducted April 1-30, 2002 to have been successful, and a prudent and productive precursor to the opening of the market on May 1, 2002.

– End of Section –

1. Introduction

1.1 Purpose

The purpose of this document is to summarize the results of the Coupled Operational Dry Run (CODR) of the *IMO-administered markets* and present conclusions regarding the success of CODR. This document is to be used to communicate the conclusions regarding the success of CODR to the *IMO Board*, the Market Commissioning Task Force (MCTF), and the general public.

1.2 Scope

The scope of this document is all components of CODR.

1.3 Who Should Use This Document

All *market participants* and persons interested in the results of the CODR should review this document. In addition, the *IMO* Program Implementation Committee (PIC) should ensure follow-up across the *IMO* regarding lessons learned, areas to monitor and changes required as a result of CODR.

1.4 Conventions

The standard conventions followed for this document are as follows:

- The word 'shall' denotes a mandatory requirement;
- Terms and acronyms used in this document that are *italicized* have the meanings ascribed thereto in Chapter 11 of the "*Market Rules*";
- Double quotation marks are used to indicate titles of legislation, publications, forms and other documents.

1.5 How this Document is Organized

This document contains the following sections:

- Section 2 Overview – defines the purpose and scope of CODR, and lists the Success Criteria;
- Section 3 CODR Success Criteria – details performance against each of the success criteria;
- Section 4 General Observations – addresses factors and occurrences during CODR that should be considered in addition to the success criteria; and

- Section 5 Conclusions – draws final conclusions regarding the Coupled ODR.

– End of Section –

2. Overview

2.1 Review Process

This document was written by the *IMO* Commissioning Team, and reviewed both internally within the *IMO* and by members of the Market Commissioning Task Force (MCTF).

2.2 Purpose & Definition

CODR was immediately preceded by the Production Environment Validation (PEV) period, which ran from January 28th to March 31st, 2002. The PEV allowed all *market participants* to establish connectivity with the *IMO* systems, and review their production data set prior to the initiation of CODR. It also provided a prolonged and steady flow of realistic market data for *market participants* to feed into their own systems and businesses processes for internal testing prior to CODR. CODR was the last step in the commissioning of the *IMO-administered markets*.

As extracted from the “CODR Plan”... (which was written in the future tense):

“The purpose of Coupled ODR is to demonstrate that the *IMO-administered markets* work when coupled to the physical operations based on the *market rules*. The success of Coupled ODR will be a prerequisite to the live market operation

...Unlike Uncoupled ODR where the simulation of *IMO-administered market* activities (*bids* and *offers*, scheduling, metering, *settlement*) was detached from the actual physical operation of the Ontario electricity grid, Coupled ODR will dictate and direct live physical operations. *Dispatch instructions* will be carried out as per *market rules* throughout CODR.

Revenue metering for CODR will be based on *meter* reads from the live system. This will consist of polling the existing *meters*, and polling new *meters* installed specifically for the market. *Meter Service Providers* will be active for all *meters* being polled for CODR *settlement* purposes as per *market rules*.

The Commercial Reconciliation system will produce *preliminary and final statements* based on *physical allocation data* and *physical bilateral contract data* from the real-time and *operating reserve markets*. Not-to-be-paid *invoices* will be created for *market participants*. The exchange of funds for actual *energy* produced and consumed will be handled through the existing *settlements* system that will be run in parallel with the Commercial Reconciliation system.

... Once CODR begins, trading will run 24 hours per day, seven days a week (24x7). This will entail production of near term security and *adequacy* assessments, submission of *bids* and *offers*, production of schedules and prices, and communication and execution of *dispatch instructions*. This will provide the required input data for *settlement* activities.

During CODR, *market participants* will operate in the manner that they would anticipate in the live market following *market rules*. As the name implies, CODR is a dry run of the market processes and not a scripted test. Scenarios and scripts will not be run during CODR. The market and physical operations will react in response to participant's *bids* and *offers*."

CODR was scheduled from April 1st to April 30th 2002, and was immediately followed by the opening of the *IMO-administered markets* on May 1st, 2002.

2.3 CODR Success Criteria

The *IMO Board*, on recommendation from the *IMO* and the MCTF, approved thirty-four success criteria to be used to determine the success of the CODR. Each criterion was assigned to the *IMO* for measurement, according to the standards established for the criterion type. The CODR success criteria, extracted from the "CODR Entry/Exit (Success) Criteria" document, are listed in **Table 2-1: CODR Success Criteria**.

Table 2-1: CODR Success Criteria

	Criteria	Type	Measure(s)	Measuring Party
1.	Compliance of (Commissioning) <i>Market participants</i> during CODR satisfactory	Performance	Critical - Other – Summary of compliance incidents reported	<i>IMO</i>
2.	Prudential performance of (Commissioning) <i>Market participants</i> during CODR satisfactory	Performance	Critical - Other – Summary of prudential-related notifications reported	<i>IMO</i>
3.	<i>Meter Service Providers</i> able to meet market obligations	Performance	Critical - Other – Summary report of meter trouble reports generated and response rate for closure	<i>IMO</i>
4.	<i>Pre-dispatch schedule</i> produced according to <i>market rule</i> timelines	Performance	Critical - timeliness	<i>IMO</i>
5.	<i>Real-time schedule</i> produced according to <i>market rule</i> timelines	Performance	Mandatory - timeliness	<i>IMO</i>
6.	Provisional <i>market schedule</i> and prices published according to <i>market rule</i> timelines	Performance	Critical - timeliness	<i>IMO</i>
7.	<i>Dispatch instructions</i> issued according to <i>market rule</i> timelines	Performance	Mandatory - timeliness	<i>IMO</i>

	Criteria	Type	Measure(s)	Measuring Party
8.	<i>Market participants</i> able to respond to <i>dispatch instructions</i> according to <i>market rule</i> timelines	Performance	Mandatory – timeliness	IMO
9.	Issuing of <i>preliminary settlement statement</i> according to <i>market rule</i> timelines	Performance	Critical - timeliness	IMO
10.	Issuing of <i>final settlement statement</i> according to <i>market rule</i> timelines	Performance	Critical - timeliness	IMO
11.	Issuing of <i>invoices</i> (both physical and financial markets) according to <i>market rule</i> timelines	Performance	Critical - timeliness	IMO
12.	Publication of load forecasts according to <i>market rule</i> timelines	Performance	Important - timeliness	IMO
13.	Publication of security and <i>adequacy</i> assessments according to <i>market rule</i> timelines	Performance	Important - timeliness	IMO
14.	Dispute resolution procedures are functional	Performance	Critical - Other - Summary report on disputes raised during CODR	IMO
15.	IMO Systems and procedures are functional	Performance	Critical – Availability Demonstrated	IMO
16.	Not ready <i>distributor</i> can be invoiced	Performance	Demonstrated	IMO
17.	Not ready <i>wholesale customer</i> can be invoiced (direct or required embedded)	Performance	Demonstrated	IMO
18.	Not ready <i>wholesale seller</i> can be invoiced (direct or required embedded)	Performance	Demonstrated	IMO
19.	<i>Interconnection agreements</i> functioning as anticipated and required	Performance	Demonstrated	IMO
20.	EMS/MIS and related systems reliability meets or exceeds the standard	Performance	Mandatory – availability	IMO
21.	MIS system has adequate capacity to handle all production users	Performance	Demonstrated	IMO

	Criteria	Type	Measure(s)	Measuring Party
22.	Back-up operation centre is operational	Performance	Demonstrated - if/as required	IMO
23.	<i>Dispatch</i> systems and procedures maintain adequate control (meet or exceed performance standards)	Performance	Mandatory - Sustained - As per <i>IMO</i> Operating targets This includes <i>NERC</i> violations targets and standards.	IMO
24.	Accuracy of average hourly day-ahead forecast is within standard	Performance	Critical - Other - Report specifying variance for each forecast from actual. Standard is defined as 2.5%.	IMO
25.	<i>Dispatch</i> accuracy	Performance	Critical - Other: Summary report of queries against the <i>dispatch</i> , and resolution/findings of the <i>IMO</i> in response to queries.	IMO
26.	Variances (differences) between <i>preliminary</i> and <i>final settlements</i> acceptable	Performance	Critical - Other – Trend of errors measured in quantity and dollars is at acceptable level or decreasing	IMO
27.	Call success rate of <i>revenue meters</i> meets industry standard	Performance	Critical - Other – Industry standard being 90%.	IMO
28.	Metering <i>VEE process</i>	Performance	Critical – timeliness Ability of <i>IMO</i> to complete <i>meter</i> edits by end of 1 st <i>business day</i> following agreed resolution with <i>MSP</i>	IMO
29.	Frequency and volume of <i>Notices of Disagreement</i> during CODR acceptable	Performance	Critical - Other – Summary report on number, nature and status of disagreements submitted	IMO
30.	No unreasonable requirement for market suspension during CODR (i.e. none caused through failure to operate under ‘normal’ conditions)	Performance	Demonstrated	IMO
31.	Market start-up, suspension and resumption procedures are functional	Performance	Demonstrated - if/as required	IMO
32.	Participant suspension and re-entry procedures are functional	Performance	Demonstrated - if/as required	IMO

	Criteria	Type	Measure(s)	Measuring Party
33.	<i>Outage</i> assessments completed as per <i>market rule</i> timelines	Performance	Critical – timeliness <i>Outages</i> must be approved or rejected two working days in advance	<i>IMO</i>
34.	<i>Transmitters</i> able to fulfill obligations under the <i>market rules</i>	Performance	Critical - Other – Summary report of <i>outage</i> submissions and timeliness of restorals	<i>IMO</i>

– End of Section –

3. CODR Success Criteria

In determining the results of the CODR, the focus is on the success criteria as defined by the “CODR Entry/Exit (Success) Criteria” document. The performance factors were measured by the *IMO* during CODR, as defined by the “CODR Plan”, for the duration of CODR. Each week performance against the success criteria was determined, and communicated internally and to the MCTF. Note that *planned outages* were not factored into the success criteria statistics, as these events were for the most part identified in advance of CODR, were critical for market opening, and could not be scheduled at any other time.

This section examines each of the success criteria, and presents the results of the appropriate measurements. Note that the 34 success criteria have been grouped according to subject, as indicated in the section headers. The detailed reports for the performance factors are available in **Appendices A-F**.

All of the 34 *IMO* Board-approved criteria were met by the Coupled Operational Dry Run.

3.1 Compliance of *Market Participants* (Criterion 1) – Met

Compliance of all *market participants*, including the *IMO*, was monitored by the *IMO* throughout CODR, and incidents of potential non-compliance were reported to the Market Assessment and Compliance Division (MACD). MACD reviewed each reported incident, and as appropriate brought them to the attention of the *market participant*, in order to test the processes surrounding compliance, and to establish better understanding of the nature of obligations and the circumstances affecting compliance. Among the matters considered were failure to follow *dispatch instructions* (particularly with respect to hydraulic generating units), and failure to promptly contact the *IMO* after a *forced outage*.

Overall it was felt that the CODR period demonstrated the *IMO*’s ability to monitor compliance, and illustrated general participant capability to operate within the *market rules*.

3.2 Prudential Performance of *Market Participants* (Criterion 2) – Met

The prudential monitoring process was in place throughout CODR. This process resulted in 121 *margin calls* and 89 warnings being issued.

The numbers of *margin calls* and warnings were higher than expected, especially during the first 2 weeks of CODR (88 and 73 respectively). Contributing factors were the higher prices during the end

of PEV (March) and the first 10 days of CODR, inadequate *trading limits* specified by *market participants*, and lack of *physical bilateral contracts* being entered (to reduce the buyer's *actual exposure* accordingly). It is worth noting that the number of *margin calls* and warnings was significantly lower during the last 2 weeks of CODR (33 and 16 respectively) as prices decreased and *market participants* adjusted their limits appropriately.

CODR provided a valuable learning experience in this area for all *market participants*, and overall it was felt that the prudential performance of *market participants* provided assurance that *market participants* will be capable of operating within their prudential limits, although this cannot be truly determined until after the market opens.

3.3 **Meter Service Providers' Performance (Criterion 3)** – Met

There were 7 *Meter Service Providers (MSPs)* active during CODR. Performance of the *MSPs* was measured by the timeliness of their response to Meter Trouble Reports (MTRs) issued by the *IMO*. MTRs are to be responded to within 2 *business days*. Those that are not responded to within 6 *business days* are eligible for further *IMO* estimation according to Chapter 6 of the *market rules*.

Statistics for April were:

Total Number of MTRs issued:	3620
Total Number late responses (2-5 <i>business days</i>):	1376
Total Number eligible for Estimation according to Chapter 6:	1625

In the early stages of CODR one of the larger *MSPs* encountered system access problems. The monthly totals were significantly impacted by this situation. Once the problem was solved, the backlog of MTRs diminished to an acceptable level, and all *MSPs* were responding to the MTRs in a timely manner by the last week of April. Thus the criterion is deemed to be met successfully. It should also be noted that while there was an average of 149 MTRs issued per day at the start of CODR, by the end of CODR the average reduced to 92.

3.4 **Schedule Timeliness (Criteria 4, 5 & 6)** – Met

The ability of the *IMO* to produce schedules prior to the deadline for publication was measured by the timestamp of the schedule transfer to the Market Operations System. This applies to each of the *Pre-dispatch schedule* (C-4), *Real-time schedule* (C-5) and provisional *market schedule* and prices (C-6). Note that measurements exclude *planned outage* periods (see Section 4.6 – *System Outages*).

The *Pre-dispatch schedule* performance target was 95%. There were 720 *Pre-dispatch schedules* in CODR, (30 days * 24 *Pre-dispatch schedules* per day), out of which 23 were not measured due to *planned outages* (see Section 4.6). There was only one schedule that was published late (April 29th), resulting in actual performance of 99.9%.

The *Real-time schedule* performance target was 98%. There were 8640 *Real-time schedules* in CODR (30 days * 288 *real-time schedules* per day), of which 276 were not measured due to *planned outages*. There was only one schedule that was published late (April 29). Actual performance was 99.99%.

The provisional *market schedule* and prices performance target was 95%. Actual performance was 100%.

3.5 Dispatch Criteria (Criteria 7, 8, 23 & 25)

– Met

There were 4 criteria related to *dispatch*: timeliness of instructions, participant response to receipt of instructions, adequate control, and *dispatch* accuracy.

3.5.2 Dispatch Instruction Timeliness (Criterion 7)

– Met

New or changed *dispatch instructions* are to be issued every 5 minutes, all day, every day. The performance target was 98%; actual performance achieved was just over 99%.

Out of the 8640 intervals during the 30-day CODR period, 72 intervals (less than 1%) were missed. Missed *dispatch* were attributed to unplanned system *outages*

Note that 42 of these misses (over half) occurred on April 2nd (second day of CODR) due to *IMO* testing that was not expected to impact the production systems. Since then there were 5 instances where intervals were missed, with the maximum number of consecutive missed intervals being 13.

3.5.3 Participant Response to Receipt of *Dispatch instructions* (Criterion 8)

– Met

Dispatch instructions sent by the *IMO* tools are automatically acknowledged by the receiving system to confirm receipt. In addition to this automatic acknowledgement, *market participants* must respond to either accept or reject each *dispatch instruction*.

The performance target for tool acknowledgement was 95% for each participant, and 95% overall. The performance target for participant response was 100% of the instructions that were acknowledged by the tool. These measurements were for automatic *dispatch* (i.e. within Ontario) only. They do not include manual *dispatch* for *intertie* transactions.

During CODR participant receipt of *dispatch instructions* was acknowledged 100%. Participant response to instructions was 100%.

Note that this criterion is NOT the measurement of operating compliance with *dispatch instructions* (see criterion 1).

3.5.4 Ability to Maintain Adequate Control (Criterion 23)

– Met

Dispatch systems and procedures were monitored to ensure that adequate control was maintained throughout CODR. Requirement standards were as per *IMO* operating targets. Four aspects were measured:

- 1) CPS 2 violations $\geq 94\%$, actual achieved was 96.3%;
- 2) DCS – recover from reportable events in ≤ 10 minutes. No incident reported;
- 3) OR recovery: 10 minute in ≤ 10 minutes. No incident reported; and
- 4) OR recovery: 30 minute in ≤ 4 hours. No incident reported.

CPS 2 violations, a measure of system control, were troublesome early on in CODR due largely but not entirely to *Market Participant* non-compliance of *dispatch instructions* resulting in excessive manual intervention by *IMO* Shift Operation's staff. A number of tool enhancements were delivered during CODR to help minimize the impact of this non-compliance and significant improvements were subsequently noted by the 3rd week of CODR, with significantly less manual intervention required on the part of the *IMO* Shift Operations staff.

3.5.5 Dispatch Accuracy (Criterion 25)

– Met

The *dispatch* scheduler must be able to operate in a highly sustained fashion (288 times per day, every day) without incident. In this case, an incident is defined as a scheduling error, which is any calculation or output produced by the scheduler that is inconsistent with the inputs as per the *market rules*, and/or that the *IMO* declares to be a *dispatch scheduling error*.

There were 2 instances of incorrect *dispatch* solutions during CODR, which were both associated with an algorithm error in the *dispatch* tool (i.e. there was one problem, that occurred twice). The problem was an incorrect co-efficient generated for a northwest resource that caused suspect *dispatch* during OR shortfalls. A fix was implemented and no further occurrences were recorded.

3.6 Settlement statements (Criteria 9, 10, 26 & 29)

– Met

There were 4 criteria related to *settlement statements*: timeliness of *preliminary* and *final statements*' publication, variances between *preliminary* and *final statements*, and frequency and volume of *Notices of Disagreement*.

3.6.2 Timeliness of Settlement statements (Criteria 9 & 10)

– Met

The ability of the *IMO* to produce the *preliminary* and *final settlement statements* prior to the deadline for publication was measured by the timestamp on the statements' transfer to MOS MIM. Statements for the physical and financial markets were measured separately, as per their respective calendars.

There were 6165 *physical market preliminary settlement statements*, and 5372 *final settlement statements*, issued to *market participants* during the 30 days of CODR. There was one day when the publication deadline was missed - April 22 (for *trading days* April 8 (Preliminary) and March 19 (Final)). This was due to a processing error within the *IMO* – the statements were in fact generated, but they were not published to *market participants*. Processing changes were implemented to avoid recurrence. This was the only such incident. The performance target for timeliness was 95% - actual performance was 96.7%.

A total of 12 *preliminary* financial market *settlement statements* were issued to *market participants* on April 15th and 12 final financial market *settlement statements* were issued on April 19th. These statements were all issued on time. The performance target for timeliness was 95% - actual performance was 100%.

3.6.3 Variances between Preliminary & Final Statements (Criterion 26)

– Met

This criterion was to be measured by tracking the number of reported errors, and the corresponding number of *notices of disagreements* for which the cause of the disagreement was determined, and a solution identified within the period between the *preliminary* and *final statements*. In fact, due to the minimal number of *Notices of Disagreement* received, the following measurement was made.

This criterion was measured by tracking the errors discovered, and the corresponding volume of variances between *preliminary* and *final statements* for the *physical markets*. The measurement was made against statements for the *trading days* from March 1st to March 31st. The variance average was 1.1% of the dollar volume of the *settlement statements*.

3.6.4 Notices of Disagreement (Criterion 29)

– Met

Prior to CODR, the *IMO* communicated to *market participants* that while *NODs* would be acknowledged during the first 2 weeks of CODR, only *NODs* pertaining to April *settlement statements* would be investigated.

A total of 25 *NODs* were received during CODR, excluding test *NODs*. Two of these were duplicates, bringing the actual total to 23.

As of April 30, of the 25 *NODs* related to CODR *settlement statements*, the status was as follows:

Rejected	7	(includes 2 duplicates)
----------	---	-------------------------

Resolved	5
<i>IMO Response</i>	4
Active	6
New	3

While the *NOD* process is working, less than 25 *market participants* have used the system. It is difficult from this small sample to verify that the *Notice of Disagreement* system is working for large volumes. For the *NODs* that were received, however, the process is deemed to be working and the criterion is considered to be met.

3.7 Invoices (Criteria 11, 16, 17 & 18)

– Met

There were 4 criteria related to *invoices*: timeliness of issuance, and ability to *invoice* not-ready *distributors*, *wholesale consumers*, and *wholesale sellers*.

3.7.2 Timeliness of Invoices (Criterion 11)

– Met

Physical market invoices were issued for March activity on April 15th. Financial market *invoices* were issued on April 22nd. The performance target was 95% on time – in fact all *invoices* were issued on time, for actual performance of 100%.

3.7.3 Ability to Invoice Non-ready Load Market Participants (Criterion 16, 17 & 18)

– Met

The ability for the *IMO* to *invoice* non-ready *distributors* (C-16), non-ready *wholesale consumers* (C-17) and non-ready *wholesale sellers* (C-18) by means of contingency arrangements was demonstrated by the production of *physical market settlement statements* and *invoices* for all such *market participants* during CODR.

3.8 Load forecasts and Security Assessments (Criterion 12, 13 & 24)

– Met

There were 3 criteria related to load forecasts and security assessments: the timeliness of both, and the accuracy of the load forecasts.

3.8.2 Forecast and Assessment Timeliness (Criteria 12 & 13)

– Met

These criteria were measured through the availability of the load forecasts (C-12) and security assessments (C-13) *to market participants* through the MIM reports website. The performance standard was 90% on time publication. Actual performance was 96%.

3.8.3 Accuracy of Forecast (Criterion 24)

– Met

The performance standard defined for the accuracy of the average hourly day-ahead load forecast is an error factor against actual *demand* of $\leq 2.5\%$. During CODR, the forecast error ranged from a low of 1% to a high of 6.1%. The forecast error target was missed on 6 separate days. The average error factor was 2.2%.

3.9 Dispute Resolution (Criterion 14)

– Met

The dispute resolution procedures were in place internally and externally prior to the start of CODR. No disputes were raised during CODR. While this functionality has not been exercised in its entirety, there is confidence that the procedures are in place, and the non-real-time nature of the process ensures no risk to the overall viability of the markets.

3.10 IMO Systems & Procedures (Criterion 15)

– Met

This criterion addresses all of the *IMO* systems and procedures not otherwise explicitly reference by other criteria. It includes such items as the availability of the various software systems (to both *market participants* and *IMO* staff), and the viability of any procedural work-arounds implemented during CODR.

During CODR tool and process procedures were executed effectively. As new tools or processes were enhanced, procedures were updated. Internal and external (*Market manuals*) procedures will be revised and republished on a continuous basis as necessary.

3.11 Interconnection Agreements (Criterion 19)

– Met

The *IMO* has a total of 8 *interconnection agreements* with TransEnergie (Hydro Quebec), Manitoba Hydro, International Transmission Company (ITC), MacLaren, Minnesota Power, NYISO, Niagara

Mohawk and New York Power Authority. While CODR was entered with only 5 of the agreements signed, all were drafted and available from an operating perspective.

As of April 30th, three agreements remained unsigned pending circulation and some minor changes in wording. Of the 8 agreements, only two are operational (MacLaren and NYISO). The remaining six are not operational due to unresolved issues between OPGI and/or Hydro One and their counterparties. These unresolved issues prevent cancellation of the current *interconnection agreements*. In each of the six cases, interim arrangements using the current *interconnection agreements* are in place, which allow the *IMO* and Hydro One to discharge their respective responsibilities, with no interference from or market advantage conveyed to OPGI or any other *market participant*.

3.12 Systems Availability & Capacity (Criteria 20 & 21)

– Met

The availability of the EMS/MIS and related systems, and the capacity of the MIS were monitored and measured throughout CODR.

The availability of EMS/MIS was measured through the ability to logon via the Operator's console and to access the associated data, functionality and reports. The availability was 99.5% for the period, exceeding the mandatory performance requirement of 99%.

The capacity of the MIS was demonstrated through the tracking of any reports or incidents of systems issues such as table overflow messages, excessive processing time etc. No such incidents were reported during CODR.

3.13 Back-up Centre (Criterion 22)

– Met

The back-up *control centre* was operational throughout the CODR period. During the 4th week, a fail-over/fall-back exercise was conducted to exercise the systems located at the back-up centre. This testing successfully confirmed the redundancy of the *IMO*'s many market systems. There was no requirement to utilize the back-up centre from a staffing perspective (i.e. no need to evacuate the primary *control centre*).

3.14 Call Success to Revenue Meters (Criterion 27)

– Met

To distinguish the performance of the meters (and communications system) from the performance of MV-90 and the downstream *settlements*, the call-log of MV-90 was used to measure the call success rate of the *revenue meters*. A successful call means that the call was completed, not that the data was valid or usable.

Approximately 1785 calls were made each night by the *IMO* MV-90 system, representing all *revenue meters* active in the *IMO-administered* physical market.

Industry standard, defined as the performance requirement for this criterion, is 90%. The overall average call success rate for CODR was 92.5%, that is, above the industry standard.

3.15 Metering VEE Process (Criterion 28)

– Met

This criterion measured the *IMO*'s ability to complete *meter* edits by the end of the first *business day* following agreed resolution with the *MSP*. The performance target was 95% timeliness. There were 1313 such edits performed during CODR. All of the edits were performed within the time requirement, for a success rate of 100%.

3.16 Market Suspension (Criteria 30 & 31)

– Met

There were 2 criteria related to market suspension: no unreasonable requirement for a suspension, and procedures functional.

3.16.2 No Unreasonable Suspension Requirement (Criterion 30)

– Met

In fact there was no 'unplanned' suspension required throughout CODR (see following sub-section).

3.16.3 Suspension/Resumption Procedures Functional (Criterion 31)

– Met

A "mock" suspension/resumption exercise was conducted on April 22nd, in conjunction with the *planned outage* for the R4.2.3 software release.

The suspension/resumption exercise was considered a success by both the *IMO* and *market participants* (as per feedback from the MCTF). The operations side proceeded smoothly, including the resumption of 5-minute automated *dispatch* after the 9-hour suspension. The main area noted for improvement was communications to *market participants* and internally within the *IMO* during the suspension. Appropriate updates to the procedures and manuals are underway. See section 4.7.4 for further details.

3.17 Participant Suspension (Criterion 32)

– Met

While procedures were in place and functional should the need arise, in fact there was no cause to suspend any *market participants* during CODR.

3.18 Outage Assessments (Criterion 33)

– Met

Outage requests received by the *IMO* must be approved or rejected within two working days in advance of the actual *outage*. The performance target was 95% on time approval. During CODR there were 1776 *outage* requests processed; overall performance was 99.7%. The target was missed on only one occasion (April 5) and there was only one other day that was less than 100%.

3.19 Transmitters' Performance (Criterion 34)

– Met

There are a number of obligations placed on *Transmitters* by the *market rules*. *Transmitters* were not covered under Criterion 1 – compliance of *market participants*, thus are being addressed separately, in recognition of their importance to the overall success of the market.

The *Transmitters'* ability to submit *outage* requests and effect restorals to the system as per schedule was monitored throughout CODR.

Overall it is felt that the *Transmitters'* performance during CODR provided assurance as to their ability to meet their obligations, in support of maintaining the integrity and viability of market operations. Only one incident, minor in nature and not *interconnection*-impactive, was reported (April 7th).

– End of Section –

4. General Observations

In determining the results of the CODR, the focus is primarily on the success criteria as defined by the “Coupled Operational Dry Run Entry/Exit (Success) Criteria” document. However there are several other factors and occurrences that should be noted within a general discussion of the outcome and learnings of the Coupled ODR, to ensure all things are considered in the final determination of its success.

This section reviews the scope of operations tested, market communications during CODR, price discovery and adjustments to scheduling and *dispatch*, the *Transmission Rights Auction* held, an overview of systems *outages* experienced, testing within the CODR environment, exceptions made to the Stability Period during CODR, the Transitional Obligations for OPGI, and market surveillance during CODR.

4.1 Scope of Operations Tested

The scope of the CODR was defined in the “CODR Plan”, in terms of business processes, market software components, and market interfaces.

As planned, the full extent of business operations specified in the CODR scope, from publications of load forecasts and security assessments, to *bid* and *offer* submission to scheduling, *dispatch*, metering and *settlement* were exercised. *Meter* readings were obtained through nightly polling of all market *revenue meters*. Two *invoices* were issued during the period – one for *physical market* activity during March, the other for the *Transmission Rights Auction* held April 10-11 during the CODR. It is worth noting that the CODR included some business processes that had not previously been tested by Uncoupled ODR or the Production Environment Validation period, e.g. compliance monitoring, meter trouble reporting, and activation of *operating reserve*.

In fact, the only exceptions from full operations were as specified in the scope definition: there was no actual funds transfer related to market *invoices* issued, and the availability of inter-jurisdictional trading was limited (see sections 4.7.1, and 4.7.2 respectively).

4.2 Market Communications

4.2.1 IMO Help Centre

During the course of CODR, the *IMO* Help Centre received over 5000 inquiries, an average of 242 queries per *business day*. Both the volume and diversity of queries and issues ranged increased over that during the Production Environment Validation period prior to CODR.

A total of 66 of the Help Centre calls were forwarded through to the *IMO* IT Help Desk as problem tickets during CODR. 9 of these were classified as high priority, of which 3 were successfully closed

as of April 30th. Most participant-initiated high priority issues were related to connectivity to *IMO* systems (mostly for *NOD* and *MTR*).

4.2.2 Website

The Today's Market page introduced on the *IMO* website at the start of CODR was an instant hit with *market participants* and the general public, generating over 100,000 hits from outside the *IMO* during the month of CODR. This page contained graphics showing current *demand* and wholesale prices for the previous day, the current day (updated hourly), and the following day. This page complements the tabular display of data in the Market Data pages that were first introduced in the Uncoupled ODR.

Overall traffic to the external website ballooned, almost quadrupling over previous months' activities, with over 700,000 hits from outside the *IMO*. The website was able to accommodate the increase in traffic with no impact to performance or response time reported by users.

4.2.3 Communications Processes

Several planned and unplanned events in CODR (ranging from systems *outages* to market suspension exercises) truly exercised the communication channels to *market participants* and within the *IMO*. With various *IMO* departments using many different communication methods (telephone, voice status messages, email, SSR, website etc), CODR demonstrated the need to coordinate the communication processes. As noted in Section 4.7.4, many improvements to these processes were identified and are being incorporated into *IMO* procedures and *market manuals*.

A particular area of improvement going forwards will be the *IMO*'s process for advance notification to users of upcoming changes and *outages*. This work is underway within the *IMO*, and involves stakeholder input to the timelines and communication process.

4.3 Price Discovery

One of the key learning factors of Coupled ODR was the ability for *market participants* to see and react to *real-time scheduling* implications of different *bid/offer* strategies. Another factor was the scheduling of *Operating reserve (OR)*. This was an area that could not be exercised during previous testing phases, and is a new concept to *market participants* for operations in Ontario.

While the beginning of the CODR showed price excursions greater than would be expected in the operating market, prices did stabilize quite significantly. For the first 2 weeks of CODR the average *Hourly Ontario Energy Price (HOEP)* was \$73.58, the last two weeks the average was \$44.97. The median price for the last two weeks was \$34.84.

Price excursions were seen when incidents of tight supply (e.g. April 28, when *demand* exceeded forecast) and generation losses created unforeseen shortages in *energy* and reserve. The co-optimization of *energy* and *operating reserve*, exercised for the first time during CODR, played a significant role in creating the higher prices. Adjustments were made by the *IMO* to reduce the sensitivity of the scheduling tools, and to better reflect *OR* requirements (see following section 4.4).

As well, adjustments and learning took place on the part of *market participants* in both strategy development (initial *bid/offer* submissions) and reacting to market signals.

4.4 Adjustments to Scheduling and *Dispatch*

During the course of CODR, there were a number of adjustments made by the *IMO* to parameters and procedures related to the production of schedules and issuance of *dispatch instructions* produced by the Dispatch Schedule Optimizer (DSO).

4.4.1 *Intertie* Ramp Limit

The *IMO Board* approved implementation of a maximum net *intertie* ramp rate due to concerns of system reliability and market efficiency. A 700MW limit was implemented on April 19th, and communicated to *market participants* via a System Status Report.

4.4.2 Voltage Reduction

During the course of CODR it was observed that when offered available *operating reserve* resources fell short of the requirement levels even by small amounts, significant *dispatch* changes and *energy* price excursions occurred from one *dispatch interval* to the next. The re-dispatching of *facilities* and price excursions were due to the *dispatch-scheduling algorithm* seeking the optimum economic solution each interval. This had the potential to reduce the *reliability* of the *IMO-controlled grid* and negatively affect the *facilities* being re-dispatched.

A rule change was effected to include the reduction in load that would result from a 3% or 5% voltage reduction to meet *operating reserve* requirements. This was introduced as an interim measure to facilitate the orderly commencement of the market, although it shall be reviewed by the *IMO* once the market is in operation to determine whether or not it represents a long-term solution.

In addition, consistent with reliability policies, *operating reserve* requirements are adjusted if a short-fall is of a temporary nature.

Refer to Chapter 5, Section 4.5 of the *market rules* for further details.

4.4.3 Fixed Penalty Factors During *Dispatch Scheduling Optimization*

Initially penalty factors (related to line losses) were changed every 5 minutes to reflect changes in system conditions. This frequency impacted the optimization of *energy* and *Operating reserve*, resulting in excessive cycling of some resources, particularly in the northwest.

A software change was implemented to allow penalty factors to be changed on an hourly, and subsequently a daily basis. This dampened the effect of penalty factors on *energy* and reserve optimization. In addition, the *IMO* removed the loss minimization between energy and operating reserve pending the development of a better, more stable method.

Fixed monthly penalty factors are now published to *market participants* to help reduce the complexity of information being forecast.

4.4.4 Ramp Rate Increases

During CODR, extreme real-time *energy* price excursions occurred when *energy demand* growth within a *dispatch interval* exceeded the capabilities of the offered *generation facilities* to ramp up within that interval to meet the *demand*. This problem was especially evident during morning load pick-up and when *inertie* transactions were changing. In these situations, *energy* prices moved dramatically higher as more and higher priced resources were selected to provide the ramping capability needed for the rapidly increasing *demand* in that given interval.

The market design and the associated real-time *dispatch* software schedule each 5-minute interval discretely. It does not optimize over longer periods of time, and does not anticipate the *demands* expected in future intervals. The price excursions that appeared in the 5-minute *market schedule* were usually not predicted in the hour-ahead *Pre-dispatch schedule*, since the hour-ahead scheduled used the *generator* ramping capability over the full 60 minutes (rather than the 5-minute interval).

In order to provide greater stability in the scheduling process and to better align the *pre-dispatch* and *real-time schedules*, a rule amendment was effected to change the definition of the Trading Period Length input to the *dispatch algorithm*. This input parameter is used to determine the maximum generation output levels of a *generation facility* at the end of the *dispatch interval*. The change was to allow the *IMO* to establish a longer Trading Period Length for the *market schedule* (unconstrained).

Refer to Chapter 7, Appendix 7.5, Section 4.13 of the *market rules* for further details.

4.5 Transmission Rights Auction

A *Transmission Rights Auction* was held April 10-11th 2002, with 13 *market participants* correctly submitting *TR market deposits* to allow them to submit *bids*. There were *market participants* who did not meet the deadline for the *TR market deposits* – these were rejected by the *IMO*, as per *market rules* and procedures. Each such case was pursued to ensure these *market participants* understand the submission requirements for the live market auction, should they desire to participate.

A problem associated with the ability to input duplicate constraints equations with differing coefficients was discovered in preparations for the auction. A suitable work-around was tested and implemented to allow the CODR *TR auction* to proceed. A permanent fix has been implemented for live market operations.

There were 216 *bids* entered, changed or deleted by the 13 *TR participants* as they experimented with the system. The auction ran successfully – all paths offered were sold to the maximum allowable by the constraints, and results were validated as correct. The *TR market clearing price* (MCP) ranged from \$0.02 to \$100.00. Post-auction reports were published on time, and all required information successfully passed on for *settlement*.

4.6 System Outages – Planned & Unplanned

A total of 7 planned and 7 unplanned *outages* were experienced during the CODR period. *Outages* counted are those incidents causing a suspension of 5-minute automated *dispatch* (specifically, the EMS/MIS, and/or MPI). There were no instances of any of the other market systems experiencing any impactful *outages* during CODR.

The 7 *planned outages* consisted of software and network upgrades, for a total of 23 hours. The final pre-market software release, R4.2.3, was installed on the production system on April 20th and April 22nd (non-real time and real-time systems, respectively). Phase 4 of the Fail-over/Fall-back testing was conducted April 25th-26th. Final network infrastructure changes were completed April 29th.

As mentioned in Section 3, *planned outages* were not factored into availability data and other CODR success criteria statistics as these events were for the most part identified in advance of CODR, were critical for market opening and could not be scheduled at any other time.

The unplanned *outages* amounted to just under 6 hours. These were result of a number of factors, including systems failures, a systems security test, and *planned outages* extending longer than scheduled. Six of the seven unplanned *outages* occurred during the first 2 weeks of CODR operations.

An important outcome of CODR was demonstration of the *IMO*'s ability to make changes to systems in the live production environment with minimum disruption to *market participants* and business processes. In the case of *planned outages*, the *IMO* was able to clearly identify the nature and duration of impact to *market participants* and business processes.

4.7 Testing during CODR

There were a number of areas that were specifically tested on the production environment during the CODR period.

4.7.1 Funds Transfer Dry Run

A second and final Funds Transfer Dry Run (FTDR) was scheduled for the week of April 8, 2002. The FTDR was to ensure that *market participants* were able to successfully transfer funds to the *IMO*, and that the *IMO* was able to successfully transfer funds back to each participant's bank account. This exercise was conducted on the production environment to directly confirm *market participants*' "live" banking information.

A total of 55 of 66 scheduled *market participants* successfully made payment to the *IMO*, all of which were successfully repaid by the *IMO*. As of the end of this testing, over 88% of all *market participants*' banking information has been confirmed by the *IMO*. The *IMO* is continuing work to address out-standing issues identified with the remaining *market participants*. Going forwards, this testing will be included as part of Ability Testing for new *market participants*.

4.7.2 Inter-jurisdictional Trading

Inter-jurisdictional trading was one facet of the market that was not possible to test to any great extent prior to CODR due to the nature of the transactions required outside of Ontario. In CODR, authorized *market participants* with agreement from OPGI were only allowed to offer 1MW injections for import. Overall nine (9) authorized *market participants* established agreement with OPGI during CODR. The increased activity at the interfaces resulted in a higher level of verification of the procedures and systems by both the *IMO* and the *market participants* than was possible during PEV.

While the increased participation created more realistic market conditions, certain inter-jurisdictional trade requirements had still not been observed or verified on the production environment during the CODR period. As such, the *IMO* conducted a special review of those outstanding requirements. The review resulted in additional testing of specific requirements on a designated *IMO* test system to confirm the correct operation of the system. Also, missing or deficient processes were highlighted and enhanced with changes to the designated procedures.

Action items were assigned for requirements that would be outstanding as a consequence of a deficiency in the systems or procedures. The action items were all progressed and tracked through the change request process (VCR) or/and the development of procedures. In the interim the following actions and workarounds were implemented for market opening until the permanent solutions (as required) are in place:

- Workaround procedure and temporary tool/spreadsheet developed for administering Inadvertent Accounting by the *IMO* (permanent tool/spreadsheet under development)
- Interim workaround procedure being developed for the scheduling of *emergency energy* at interfaces (VCR pending for permanent solution)
- Data showing congestion at various interface during CODR was noted for continued investigation to confirm system functionality
- Investigation implemented to monitor and control activity for impracticable or *emergency* modes of operation at various interfaces.

In summary, as much verification of this area was done as was possible during CODR. This will be one area of market activities under special scrutiny following market opening, to ensure all processes and *market participants* are operating as required.

4.7.3 Fail-over/Fall-back/Fall-forward Testing

The fourth phase of the Fail-over/Fall-back testing was conducted on the production environment April 25-26th, 2002. System Fall Back to the *IMO* backup site took place on April 25 as planned. The systems were allowed to run for approximately 24 hours from the backup *facilities* without any significant issues. The Fall Forward to resume operations at the primary site was also completed as planned on April 26. Nearly all of the sixteen tests were completed within their *outage* window. There were logistic challenges due to the decision to use these *planned outages* to also load final critical fixes in time for Market opening.

This was the first opportunity to perform Fall Back and Fall Forward tests for several key systems (Meter Trouble Reporting (MTR), Notices of Disagreement, and the Outbound Report Management System). The final report will provide recommendations in order to continue to fine tune the procedures.

Overall, Phase 4 of the Fail-over/Fall-back testing was considered successful as it validated that the tested systems can perform adequately for the market from the backup *facilities*.

4.7.4 Mock Market Suspension/Resumption

A mock market suspension/resumption exercise was conducted on April 22nd, 2002, in conjunction with a *planned outage* for software release R4.2.3 on the real-time systems. *Market participants* were notified of the suspension/resumption exercise on April 17th via the *IMO's* Calendars & Notices web page. The notice gave a time frame for the *outage* of 07:00-17:00, and an estimated duration of 2-8 hours once initiated. *Market participants* were warned that one or more of the market systems could be unavailable during the suspension.

Market systems became unavailable at 08:50 requiring the suspension of 5-minute *dispatch*. Market suspension was declared at 10:50. *IMO* systems were made available to prepare for market resumption at 14:35. One-hour notice of market resumption was given (via SSR) at 18:41, and resumption occurred at 19:30.

As a result of the timing of the suspension, a *Pre-dispatch schedule* for the following day (April 23) was not available to *market participants* until 16:00. Administrative pricing was in effect for the duration of the market suspension, and for the two hours prior to suspension when 5-minute *dispatch* was suspended in accordance with *market rules*. Pricing during the suspension was as per the declared similar day of April 8, 2002.

A review of the exercise was conducted on April 24th, following completion of related price and schedule population activities. The review showed a number of areas in need of further thought and process definition, primarily around communications with *market participants* during the suspension (availability of SSRs, website updates, price and *demand* indications, appropriate distribution lists) and also internal communications within the *IMO*. A Market Suspension Report was produced by the *IMO* for the *IMO Board* (although not actually presented), as per *market rule* requirements.

Overall the exercise was considered a success, with valuable learning on the part of all *market participants* including the *IMO*. The areas requiring improvements are all being addressed. An updated *market manual* and internal procedure for market suspension were released on April 26th.

4.8 Exceptions to Stability Period

The “Operational Dry Run Strategy” and “Coupled Operational Dry Run Plan” defined a Stability period, during which “the set of *market participants* and connections established for CODR will be maintained throughout CODR and the initial operating period of the market”. During the Stability Period no new *market participants* were to access the markets, no existing *market participants* were to change roles of either a participant or a resource, and new connections to the grid could be limited.

In fact there were a small number of exceptions to the first and second guidelines made during CODR. These exceptions were made based on the judgement of the *IMO* that the changes would add to the overall success of CODR and the market opening, while posing little or no risk to the same.

The changes made were as follows:

- Four (4) *generators* were changed from Intermittent (IGEN) to Dispatchable (REG);
- Two resources were activated as *intermittent generators* (IGEN);
- A transfer of the RMP designation for a self-scheduling resource;
- A generation resource was transferred from one market participant to another as a *self-schedule generator* (SELF);
- A new non *dispatchable load* participant was activated; and
- A new Transitional Self-Scheduling *Generator* was activated.

4.9 Transitional Obligations

As per Section 4.3.3 (Transitional Obligations) of the “ODR Strategy” document, the *IMO* defined explicit criteria that the *IMO* would use during CODR to distinguish situations within the 4 and/or 2-hour window that did not constitute a shortage of supply, but would cause unnecessary financial expense to OPGI. These situations included material change of greater than 500MW (net) occurring within the 4-hour window prior to actual *dispatch*, loss of generation in *segregated mode of operation* due to an external incident, and lost sales opportunities over the interconnects in excess of \$10,000 in less than 4 hours.

In fact, these rules were exercised only once during CODR, related to financial concerns (April 16th, 2002).

4.10 Market Surveillance

During CODR, the *IMO* maintained consistent surveillance over market activities, and investigated a large number of situations to understand market drivers and participant behaviour. The *IMO* was able to identify out of the ordinary data, analyze the circumstances involved, and explain the cause of the market outcomes. As a result, the *IMO* is confident of its capability to maintain a watch over market activities in live operations.

– End of Section –

5. CODR Conclusions

The following conclusions have been drawn from the results of the CODR.

5.1 Highlights and Key Successes

Overall the CODR exercised and demonstrated successful operations in almost all of the aspects that were possible to ‘prove’ during the period. As per previous sections, these included:

- Positive performance against all success criteria, not only overall but through-out the CODR period for almost all criteria (most significant exception being *MSP* performance);
- System stability and participant connectivity to *IMO* systems was well established;
- Significant learning in areas not previously able to be tested interactively with *market participants* – e.g. *operating reserve* activation, participant reaction to market signals, prudential monitoring, and submission of *TR market deposits*. The CODR period served as a transition to the new rules and business philosophies;
- A successful *Transmission Rights Auction*, including all aspects of the process (from submission of *TR market deposits* through to financial invoice);
- A successful end-to-end exercise of market suspension and resumption;
- Demonstrated *IMO*’s ability to communicate events, market data and system status to the market using the internet (Corporate website, Public Reports, participant MPI etc); and
- Demonstrated the *IMO*’s ability to make changes to systems in the live production environment with minimum disruption to *market participants* and business processes.

It should be noted that the availability of the Production Environment Validation period prior to CODR is considered to have been a key factor in the success of CODR. During the PEV all *market participants* were individually assisted through the process of establishing connectivity to the production environment, reviewing their data sets, *meter* readings and *settlement statements*, and formalized hand-over of scheduling responsibility to dispatchable *market participants*. This process positioned both the *IMO* and *market participants* to proceed into CODR ready and able to take advantage of the final learning period prior to market opening.

5.2 Reservations – Areas to Monitor Going Forward

As mentioned in previous sections, there were some areas of market operations that cannot be deemed wholly demonstrated based on the CODR experience, generally due to incomplete exercising of process or lower than expected volumes. Final conclusions regarding these areas of market

operations will not be possible until after market opening. Each of these areas will undergo special scrutiny in the initial days of operation of the live market.

5.2.1 Compliance of *Market Participants*

CODR demonstrated the *IMO*'s process of monitoring for, identifying and following up on incidents of potential participant non-compliance, and gave indication of participant abilities. Significant learning and efforts to comply with *dispatch instructions* was evident. While it is anticipated that all *market participants*' compliance efforts will continue, this is an area to monitor as the market opens.

5.2.2 Prudential Performance of *Market Participants*

CODR demonstrated the *IMO*'s process of monitoring, identifying and following up on incidents of *market participants* exceeding their trading limits, and gave indication of the viability of *market participants*' trading limits. The process served as a learning experience for *market participants* to set and adjust their prudentials based on current *market prices* and *energy* consumption. However, it did not necessarily demonstrate *market participants*' ability to comply with prudential requirements in the live market, particularly with respect to *margin call* responses.

5.2.3 Submission and Processing of Notices of Disagreement

While there were sufficient *NODs* submitted by *market participants* to permit the *IMO* to exercise and validate its internal processes, there were too few to enable the *IMO* to categorically state that these processes are sustainable in the live market. Only 14 participant organizations (one of which represents 24 other participant organizations) exercised the *NOD* process. The volume of activity in this area is anticipated to be much greater following publication of the first *preliminary statements* for live market operations, and *market participants* gain familiarity with the process.

5.2.4 Submission and Processing of Disputes

While *IMO* processes are defined and in operation, there was no activity in this area during CODR (as was suspected might be the case given the timelines involved).

5.2.5 Inter-jurisdictional Trading

While a limited number of *market participants* were able to make arrangements with OPGI to test the process of inter-jurisdictional trading during CODR, true participant business activity in this area did not take place during CODR. For market operations, both the number of *market participants* and the volume of transactions are anticipated to increase substantially. This will be an area where most *market participants* will be learning both process and business strategy after market opening.

5.2.6 Settlement of Active Transmission Rights

Due to the requirement for the data clear-out in conjunction with market opening, *market participants* will not see *physical market settlement statements* reflecting *TR settlement* credits related to *transmission rights* until after market opening.

5.2.7 Participant Suspension/de-Activation

As this process was not exercised during CODR, it should undergo close scrutiny the first few times it is required.

5.3 Summary

Overall, the *IMO* considers the Coupled Operational Dry Run exercise conducted April 1-30, 2002 to have been successful, and a prudent and productive precursor to the opening of the market on May 1, 2002.

– End of Section –

Appendix A: Criterion 2

Prudential Monitoring		
Date	Margin Calls	Warnings Issued
1-Apr	0	0
2-Apr	26	7
3-Apr	2	11
4-Apr	1	1
5-Apr	1	0
8-Apr	37	30
9-Apr	3	6
10-Apr	2	6
11-Apr	2	11
12-Apr	14	1
15-Apr	0	0
16-Apr	0	0
17-Apr	0	0
18-Apr	17	5
19-Apr	3	7
22-Apr	0	4
23-Apr	1	0
24-Apr	9	0
25-Apr	3	0
26-Apr	0	0
29-Apr		Not monitored
30-Apr		Not Monitored
Totals	121	89

– End of Section –

Appendix B: Criteria 4, 5, 6, 7, 8

Criteria Number	CODR Performance Success Criteria																																		
	Criteria	Target	Additional Information																																
4	Pre-dispatch schedule produced according to Market Rule timelines	Critical - Timeliness (95%)	The ability of the IMO to produce the schedules prior to the deadline will be measured by the timestamp of the schedule transfer to the Market Operations System (MOS), Market Information Management (MIM), and Market Information System (MIS). The timestamp will be compared to the publication deadline.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 for 99.9	
			Record instances when schedule is NOT produced in Control Room Log																																
5	Real Time schedule produced according to Market Rule timelines	Mandatory - Timeliness (95%)	The ability of the IMO to produce the schedules prior to the deadline will be measured by the timestamp of the schedule transfer to the Market Operations System (MOS), Market Information Management (MIM), and Market Information System (MIS). The timestamp will be compared to the publication deadline.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Record instances when schedule is NOT produced in Control Room Log																																
6	Provisional Market Schedule and prices published according to Market Rules	Critical - Timeliness (95%)	The ability of the IMO to produce the schedules and prices prior to the deadline will be measured by the timestamp on the schedule transfer to the Market Information System (MIS). The timestamp will be compared to the publication deadline.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Record instances when schedule is NOT produced in Control Room Log																																
7	Dispatch Instructions issued as per Market Rules	Mandatory - Timeliness (96%)	Record instances when schedule is NOT produced in Control Room Log	4	4.2	0	0	0	2	0	0	6	13	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72 for 99.2	
			# of intervals missed/day (288)																																
8	Participants able to respond to dispatch instructions as per Market Rules	Mandatory - Timeliness (96%)	Dispatch instructions sent by the IMO are automatically acknowledged by the receiving system (to confirm receipt). In addition to this automatic acknowledgement, participants must respond to either accept or reject responses will be measured.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Record instances when MP does NOT respond to dispatch instructions in Control Room Log																																
			Record instances when MP does NOT respond (except/reject) instructions in Control Room Log	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

– End of Section –

– End of Section –

Appendix D: Criteria 20, 23, 24, 25

CODR Performance Success Criteria																																		
Criteria Number	Criteria	Target	Additional Information	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	Overall
20	Energy management system (EMS) is available, and meets or exceeds performance standards required for CODR entry	Mandatory – Availability (99%)	Availability of the EMS, MIS and related systems will be measured through the ability to log on via the Operator's console and access the associated data, functionality and reports. There is a separate GUI interface for each of EMS and MIS. The scheduled or unscheduled downtime will be tracked from the time of discovery until availability is successfully restored and confirmed by IMO operations personnel access through the console. 288 times per day (Average over period).	98.6	94.1	100.0	100.0	100.0	99.3	100.0	100.0	97.9	95.5	100.0	100.0	100.0	99.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.5
			Measure # of intervals NOT available CPS 2 Violations >= 94% (Total # incidences) Based on 144 intervals/day DCS - recover from reportable events in <= 10 minutes (Total # incidences) OR Recovery (Total # incidences) - 10 minute in <= 30 minutes - 30 minute in <= 4 hours <= 2.5% (Average over period)	95.8	96.5	95.1	96.5	91.7	97.2	88.9	95.1	89.6	94.4	97.9	97.9	97.9	93.8	88.2	95.1	98.6	97.9	97.9	99.3	100	99.3	96.5	99.3	97.9	99.3	99.3	97.9	98.6	96.6	97.2
23	Dispatch systems and procedures maintain adequate control (meet or exceed performance standards required for CODR entry)	Mandatory – sustained		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Important - Other		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Accuracy of average hourly day-ahead load forecast within standard has been demonstrated			2.2	4.8	1.2	1.4	1.1	2.7	2.0	1.4	1.9	1.6	1.5	1.9	4.0	4.2	1.7	2.0	2.8	1.6	1.0	1.8	1.1	4.2	1.9	1.1	0.8	2.5	1.5	6.1	1.9	1.2	2.2
	Dispatch accuracy has been demonstrated	Demonstrated - Report of queries against the dispatcher, and resolution of the findings of the IMO in responses to queries (MP or IMO CR)	The dispatch scheduler must be able to operate in a highly sustained fashion (288 times per day, every day) without incident. In this case, an incident is defined as a scheduling error, which is any calculation or output produced by the scheduler that is inconsistent with the inputs as per the market rules, and/or that the IMO declares to be a dispatch scheduling error. Any and all such instances of these errors will be flagged and counted as incidents with respect to this criterion (Total # incidences)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
25			Record incidences where DSO did not appear to come up with a correct solution in the IMO Control Room LOG -- These will be assessed at the CODR Daily meeting																															

– End of Section –

Appendix E: Criterion 27

CODR Call Success Rate of Revenue Meters Meets Industry Standard (Success Criteria Item 27)

Date	Failures																			Daily Exception Report			Item 27	
	No Stop Times - Connection Failures																			Meters To Be Interrogated			Meters With No Data Collected	Call Success Rate %
	01 - TIM - Other Recorder Error	07 - TIM - Mismatch Between Recorder Config.	10 - TIM - Mismatch on Recorder ID	41 - SSDR - Other Error	50 - SSDR - No New Data To Read	Not Rgstrd.	Slave With No Master	Cannot Place Call	Dial Answer Timed Out	Dial Command Did Not Evoke a Legal Resonse	Dial Error No Answer	Fatal Error	I/O Timeout	No Entry in Bilog	Line Is Busy	No Stop Time	Protocol Error	Other	Total					
March 2002																								
1-Apr-02	10	1		4																15	1798	189	170	91.4
2-Apr-02	16	2		4																22	1798	180	164	92.1
3-Apr-02	6	1	1	5																13	1798	164	142	92.8
4-Apr-02	7		1	2																10	1798	166	139	92.8
5-Apr-02	6	1	2	2																11	1798	153	129	93.4
6-Apr-02	2	1	2	3																8	1798	227	116	94.0
7-Apr-02	11	1	1	4																17	1810	146	118	94.4
8-Apr-02	10	1	1	7																19	1810	179	146	93.0
9-Apr-02	17	1	2	3																23	1807	195	163	92.3
10-Apr-02	10	1	1	4	1															17	1766	176	138	93.1
11-Apr-02	6	0	1	5																12	1766	166	137	92.9
12-Apr-02	3	2	2	2																9	1766	150	134	92.9
13-Apr-02	6	1	1	2	1															11	1770	169	154	91.9
14-Apr-02	7	1	1	4																13	1771	148	123	93.8
15-Apr-02	5		3	4																12	1771	174	161	91.6
16-Apr-02	7	1	1	2	1															12	1769	186	161	91.6
17-Apr-02	4	1	1	2	1															9	1775	195	141	92.6
18-Apr-02	9	1	2	6																18	1768	281	139	93.2
19-Apr-02	30		2	2																32	1781	419	168	92.4
20-Apr-02	7	1		6																14	1782	313	154	92.1
21-Apr-02	10		1	3																14	1782	290	150	92.4
22-Apr-02	15	1	2	2	1															21	1782	279	169	91.7
23-Apr-02	13	0	1	3	1															18	1785	234	160	92.0
24-Apr-02	4	1		6																11	1785	235	139	92.8
25-Apr-02	3		1	3	3							1								8	1784	183	126	93.4
26-Apr-02	6		1	3								3								13	1784	370	305	83.6
27-Apr-02	11		1	4																16	1788	203	135	93.3
28-Apr-02	15				3															20	1791	192	133	93.7
29-Apr-02	17		1	2																20	1791	175	137	93.5
30-Apr-02	3		2	1																6	1790	135	117	93.8
Totals	276	20	33	102	9	0	0	0	0	0	0	4	0	0	0	0	0	0					Average %	92.5
																							Maximum %	94.4
																							Minimum %	83.6
19-Apr-02	Large number of interrogation problems caused by communication problems. Heavy storms across Southern Ontario.																							
20-Apr-02	Systems were down on a planned outage to implement Market System Release 4.2.3 to various COOR Market Production systems.																							
26-Apr-02	A test switch-over from the "A" to the backup "C" system caused excessive failures. The modem pool is not identical, and will not be until the legacy system is decommissioned and modems are transferred over to the "C" system.																							

– End of Section –

[illegible]

– End of Section –

References

Document Name	Document ID
Operational Dry Run Strategy	IMP_STG_0002
Coupled Operational Dry Run Entry/Exit (Success) Criteria	IMP_TST_0087
Coupled Operational Dry Run Plan	IMP_PLN_0040

– End of Document –