Nova Scotia Power System Operator (NSPSO)

Market Procedure

MP-11

Scheduling and Dispatch

Issue: 04.0

Effective Date: 2016 02 26

Scheduling and Dispatch

Contents

Forms

MPF-11-01.
MPF-11-02.

1 Document Control and General Provisions

1.1 Issue and revision History

Issue	Date	Reason for Issue
01	2016-02-26	Original
02	2016-09-22	WMAC review and markup
03	2017-09-08	Document Review Committee
04	2020-12-21	Updated sections 3.2.1.3, 3.2.1.4, and 3.2.2.2 as per FAM audit recommendation. Corrected minor typographical errors.

1.2 Contact for queries and submissions

For queries concerning the application or interpretation of this Market Procedure, and for submission of documents required under this procedure (unless noted otherwise)

contact:

Name: Market Administrator

Phone: 902 428 6527

Address: 5 Long Lake Drive
Halifax, Nova Scotia
B3S 1N8

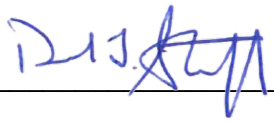
E-mail: nspsoadmin@nspower.ca

1.3 Incorporation of general provisions

The general provisions set out in part 3 of Market Procedure 01, General Market Procedure, are incorporated into this Market Procedure (unless superseded by explicit wording to the contrary in this Market Procedure).

1.4 Document Approval

David Stanford, Sr. Manager, Energy Control Center Operations

Signature: 

2 Overview of this procedure

This Market Procedure is based on the fact that all Generation Market Participants have submitted a Day Ahead schedule in a timely manner to the Nova Scotia Power Inc. System Operator (NSPSO) and that this Schedule has been approved by the NSPSO.

2.1 Definitions / Abbreviations

- Nova Scotia System Operator - NSPSO
- Hourly Loading Blocks - HLB – format for submitting schedules
- New Brunswick Power Corporation System Operator – NBPSO
- Hourly Dispatch Data – includes price, quantity, type of energy (reserve, AGC or scheduled) and unit limitations
- Incremental Blocks – Block of data that is above the scheduled dispatched value.
- Decremental Blocks – Block of data that is below the scheduled dispatched value.
- Hour Ending – HE – HE1 = 00:00:00 to 01:00:00
- Nova Scotia Power Inc. Power Production – NSPI PP.
- Open Access Transmission Tariff - OATT
- Firm Point to Point Transmission – section 1.17 of NSPI OATT.
- Non Firm Point to Point Transmission – section 1.32 NSPI OATT
- Network Transmission Service – section 1.25 NSPI OATT
- Bundled Service – section 1.4 NSPI OATT
- ($MW_{HR\ \text{“he”},\ S}$) – Megawatts (MW) scheduled (S) for the hour ending __.
- ($MW_{HR\ \text{“he”},\ B0}$) - Lower Limit of MW for Block 0 (B0) or scheduled block.
- ($MW_{HR\ \text{“he”},\ N1}$) – MW increase (N1)
- ($MW_{HR\ \text{“he”},\ D1}$) – MW decrease (D1)
- Quick Start Capability – ability to start and reach full capability in 10Min.
- Automatic Generator Control – AGC - A
- Operating Reserve – OR
- Ten Minute Spinning Reserve – 10S

- Ten Minute Non-Spinning Reserve – 10N
- Thirty Minute Reserve – 30
- Daily Energy Limit - DEL
- Block Indicator – Identifies blocks of increment or decrement and shows Ancillary services (AGC and Reserve, DEL). (A for AGC or OR)
- OR $_{\text{HR "he", 10S}}$ - Block Indicator Operating Reserve, Hour ending, Ten Minute Spinning.

2.2 Purpose of this Market Procedure

The purpose of this Market Procedure is to describe the process and format for the submission of both the Day Ahead Schedules and Hourly Loading Blocks (HLB's) to the NSPSO by Generation Market Participants.

In order for the NSPSO to dispatch generating facilities in real time with appropriate consideration to generation capabilities, generation cost, and within environmental constraints. NSPSO requires data relating to the capabilities, limitations, and generation cost of each Dispatchable Generating Facility for each relevant hour.

Hourly Dispatch is an instruction by the NSPSO that a Dispatchable Generating Facility be operated at a particular level of output which may or may not differ from the level that was submitted in the Generation Market Participants Day Ahead Schedule. Possible reasons for variances from the Day Ahead Schedule levels would include (but are not limited to):

- the actual system load varies from the forecast used to create the Day Ahead Schedule;
- a transmission constraint prevents the implementation of Dispatch as submitted in the Day Ahead Schedules;
- voltage support or reactive power requirements require re-dispatch;
- a Generating Facility suffers a Forced Outage or otherwise fails to fulfill its schedule;
- the actual output of Intermittent Generating Facilities varies from the scheduled output;
- the NSPSO needs to correct accumulated inadvertent energy flows on the interconnection with New Brunswick; or

- the New Brunswick Power Corporation System Operator (NBPSO) initiates activation of Operating Reserve, or either party requests emergency support in accordance with the interconnection agreement between Nova Scotia Power Inc. and the New Brunswick Power Corporation;
- the NSPSO may re-dispatch one or more Dispatchable Generating Facilities as required.

2.3 Market Rules – References

This Market Procedure is established in accordance with paragraph 4.6.1.5 of the Market Rules and published by the NSPSO in accordance with paragraph 1.5.1.1 of the Market Rules.

The requirements described in this Market Procedure comply with the requirements of section 4.6 of the Market Rules.

2.4 Scope and Application

This Market Procedure describes the process for Generation Market Participants to provide Day Ahead Schedules and HLB's that allow the NSPSO to effectively dispatch Generating Facilities in a cost effective manner while respecting the operating limits, environmental obligations and capability of the generation units or the transmission system.

Day Ahead Schedules must be provided according to the timelines outlined in 3.1 of this procedure and must indicate the capability of each of the Generation Market Participants Dispatchable Generation Facilities for the purposes of meeting reserve requirements for the Nova Scotia Power System.

Hourly dispatch data will consist of the price and quantity information that is required by the NSPSO to determine the appropriate dispatch of available resources to respond to changes in customer load, generation or transmission limits intraday.

Units may be dispatched up or down by NSPSO on a real time basis depending on energy requirements as a result of changes in actual load variance compared to scheduled load and for changes to any transmission limits. Transmission limits may change for any of the following, but not limited to, equipment outages, dynamic reactive reserve requirements or voltage requirements.

Price and quantity information is to be provided hourly in the form of HLB's which are available to the NSPSO for optimization of the system. These HLB's will indicate hourly dispatch ranges (blocks) for the Dispatchable Generation Facility and the associated generation cost of each block. HLB's will be used as a loading priority for each hour of the day.

Increment and decrement Dispatch Data is described in detail in Section 3.

2.5 Responsibilities of Parties under this Market Procedure

The NSPSO is responsible to:

- dispatch all generation and transmission facilities within their operational limits and maintain acceptable voltage levels in accordance with good utility practices and regulatory requirements;
- dispatch all generation and transmission facilities in a manner that maintains, and mitigates threats to, system security;
- notify Generation Market Participants in the event of a system emergency;
- validate and approve the Day Ahead Schedule and HLB's submitted by the Generation Market Participants within a reasonable timeframe as outlined in 3.1 of this procedure;
- notify the Generation Market Participants submitting dispatch data that the Day Ahead Schedule and HLB's are acceptable within the timeframe specified by this procedure;
- notify all Generation Market Participants submitting dispatch data if their Day Ahead Schedule and/or HLB's are unacceptable within the timeframe specified in 3.1 of this procedure and clearly identify the reason;
- provide dispatch instructions to the Dispatchable Generation Facility via the communication protocol provided by the Generating Market Participant which operates that Dispatchable Generation Facility.
- use the approved and validated HLB's as the dispatch loading priority for dispatching units.;
- dispatch the generation unit or facility output as required for changes to the forecasted load or for system security using the loading priority which was established by submission of the HLB's.
- amalgamate all submitted HLB's from all Generation Market Participants in the Market;
- honour must-run schedules

The Generation Market Participant is responsible to:

- submit on a daily basis, the Day Ahead Schedules required by the NSPSO in the timeframe outlined by this procedure which include an estimate of the HLB's for the Generation Market Participant's Dispatchable Generation Facility for the next day;

- ensure that the HLB's submitted are reflective of the capacity and operational or environmental obligatory limits for that Dispatchable Generation Facility;
- within the timeframe specified in 3.1 of this procedure, re-submit corrected HLB's when the original ones are rejected by the NSPSO;
- notify the NSPSO immediately when a Dispatchable Generation Facility is no longer able to operate within submitted HLB's and provide details for the reason within the provisions of any agreements between the parties;
- notify the NSPSO upon becoming aware of any circumstance where its facilities could adversely affect the security of the system;
- comply with directives made by the NSPSO to mitigate threats to the security of the system or to assist in recovery from a system security threat;
- may submit up to 30 minutes before the hour changes to the HLB's data for the hour ahead in the hourly dispatch schedule for intra-day scheduling;
- provide their Dispatchable Generation Facility a method of communication for receiving instructions by the NSPSO;
- ensure that someone is available to receive and act on dispatch requests made by the NSPSO;
- dispatch generation without degrading voltage on the system and operate within a voltage profile that is in keeping within standards outlined by the NSPSO.

2.6 Other Market Procedures

None at this time.

3 Process description

At the current time NSPSO uses a manual Re-dispatch methodology and therefore the dispatch data required is limited to two price and quantity blocks for Re-dispatch above or below the scheduled generation.

For those Generation facilities with variable costs and available for Re-dispatch, dispatch data will be provided for and according to the following re-dispatch table which describes the information required according to generation unit size.

Data is submitted to the NSPSO.

	≤40MW	Price	>40MW	Price
Incremental Block Three	N/A		SG+30MW	
Incremental Block Two	SG+10MW		SG+20MW	
Incremental Block One	SG+5MW		SG+10MW	
Scheduled Generation	SG		SG	
Decrement Block One	SG-5MW		SG-10MW	
Decrement Block Two	SG-10MW		SG-20MW	
Decrement Block Three	N/A		SG-30MW	

Facilities smaller than 40MW

For generation facilities scheduled to be running, with a maximum output less than 40 MW, dispatch data is required for each hour of the next day, including the scheduled dispatch for each hour of the day and a maximum of two incremental or decrement blocks in any combination of above or below the scheduled dispatch. The incremented and decremented quantities or blocks are to be greater than or equal to 5 MW

- For Generation facilities scheduled at full load, two decrement blocks of quantity greater than 5 MW will be accepted.
- For Generation facilities scheduled at minimum load, two increment blocks of a quantity greater than 5 MW will be accepted.
- Generation facilities not able to provide dispatch data in blocks larger than 5 MW will provide a single price and quantity block for its entire dispatchable range.

Facilities greater than 40MW

For generation facilities with a maximum output greater than 40 MW, dispatch data is required for each hour of the next day, including the scheduled dispatch for each hour of

the day and a maximum of three incremental blocks in any combination above the scheduled dispatch value or decremental blocks below the scheduled dispatch value. The incremented and decremented quantities or blocks are to be greater than or equal to 10 MW

- For Generation units or facilities scheduled at full load, three decrement blocks of quantities greater than 10 MW will be accepted.
- For Generation units or facilities scheduled at minimum load, three increment blocks greater than 10 MW will be accepted.
- Generation facilities not able to provide dispatch data in blocks larger than 10MW will provide a single price and quantity block for its entire range.

The minimum and maximum generation outputs must be clearly identified in the dispatch data table.

For clarity the term “hour ending”, HE, or he, shall be used to describe the dispatch hour that ends at a designated time. So “HE1” refers to the hour that begins at 00:00:00 and ends at 01:00:00; “HE2” refers to the hour that begins at 01:00:00 and ends at 02:00:00 …. “HE24” is the hour that begins at 23:00:00 and ends at 24:00:00.

3.1 Timing

3.1.1 Initial submissions (first daily submission of day ahead schedule)

3.1.1.1 Nova Scotia Power Inc. Power Production (NSPI PP) and any other Market Participant scheduling energy under Firm / Non-Firm Point to Point or Network Integration Transmission Service (including for Bundled Service) shall submit a complete schedule for each Dispatch Day no earlier than 07:00 and no later than 11:00 on the Day Ahead.

3.1.1.2 NSPSO shall review those schedules that are submitted by 11:00 on the Day Ahead, and shall by 12:00 notify the Market Participant of any identified problems and of any changes required for purposes of system security.

3.1.1.3 Any Market Participant receiving such notification shall address the identified problems and any required changes for purposes of system security and shall by 13:00 submit a revised complete schedule.

3.1.2 Updates and changes for unit commitment

3.1.2.1 Required in conjunction with schedule updates

3.1.2.2 Permitted between 10:00 – 11:00 the day ahead

3.1.3 Updates and changes for Re-dispatch

3.1.3.1 Permitted intra-day on a rolling hourly basis provided that Re-dispatch data is submitted at least thirty minutes prior to the start of each hour such that it:

- confirms the last previously submitted data for the hour about to start (hour 1);
- confirms the last previously submitted data for the next hour (hour 2);
- updates without restriction the last previously submitted re-dispatch data for the next two hours (hours 3 and 4).

3.1.4 Standing data

3.1.4.1 HLB's Hourly Dispatch Data in respect of any hour "he" shall be carried over into hour "he+1" if the scheduled output of the Generating Facility is the same in hour "he+1" as in hour "he".

3.2 Schedules and Estimated Marginal Cost Data

3.2.1 Content of submission

3.2.1.1 Subject to subsection 3.2.2, the estimated marginal cost data in any hour comprises:

a) The scheduled Facility output in MW at the transmission Point of Receipt (i.e. after transformation to transmission voltage) ($MW_{HR\ "he",\ S}$).

b) For block 0, the MW output at the lower limit of the block ($MW_{HR\ "he",\ B0}$)

c) For block 1, the estimated cost by the Market Participant in $ / MWh

d) For block 1, the MW output at the upper limit of the block ($MW_{HR\ "he",\ N1}$)

e) For block 2, the estimated cost by the Market Participant in $ / MWh

f) For block 2, the MW output at the upper limit of the block ($MW_{HR\ "he",\ N1}$)

g) For block 3, the estimated cost by the Market Participant in $ / MWh

h) For block 3, the MW output at the upper limit of the block ($MW_{HR\ "he",\ N1}$)

i) This is also used in connection with Ancillary Services as noted in sub-section 3.2.2.

3.2.1.2 The data must respect the following relationships:

a) $5 \leq MW_{HR\ "he",\ D1} < MW_{HR\ "he",\ S} < MW_{HR\ "he",\ N1} \leq$ hourly capability

b) Except in respect of a decrement band for which BI = 1, $5 \leq \$_{HR\ "he",\ D1} \leq \$_{HR\ "he",\ N1}$ (Note that the exception if BI = 1 is made in order to recognize that minimum load costs / MWh are likely to be greater than other incremental costs / MWh.)

3.2.1.3 Decrement data is required to be provided as follows:

a) For a Dispatchable Generating Facility with quick start capability, down to 0 MW, but not below any limits imposed by environmental restrictions.

b) For a Dispatchable Generating Facility without quick start capability, and scheduled to be de-synchronized within the following hour, down to 0 MW.

c) For a Dispatchable Generating Facility without quick start capability, and scheduled to be operating throughout the following hour, down to its minimum load MW.

d) No decrement data should be submitted if a Generating Facility is scheduled to be operating at its minimum load MW, unless it is scheduled to be de-synchronized within the following hour.

e) The division of decrement data into two bands is optional upon revision of this market procedure. Data shall not be provided for decrement band 2 unless it is also provided for decrement band 1.

In order to limit the data requirements, NSPI PP is not required to submit decrement data for that generation purchased under a power purchase agreement.

3.2.1.4 Increment data is required to be provided as follows:

a) For an unsynchronized Dispatchable Generating Facility with quick start capability, up to its full capability MW, but not above any limits imposed by environmental restrictions.

b) For any synchronized Dispatchable Generating Facility up to its full capability MW, but not above any limits imposed by environmental restrictions.

c) No increment data should be submitted if a Generating Facility is scheduled to be operating at its full capability.

d) The division of increment data into two bands is optional upon revision of this market procedure. Data shall not be provided for increment band 2 unless it is also provided for increment band 1.

In order to limit the data requirements, NSPI PP is not required to submit increment data for that generation purchased under a power purchase agreement.

3.2.2 Data related to capacity based Ancillary Services

3.2.2.1 AGC and load following

For any Generating Facility scheduled to be providing AGC and/or Load Following services, decrement band 1 and increment band 1 shall be used to indicate the range over which such service is being provided. In general, the value of $MW_{HR\ "he",\ S}$ shall be at the mid point of $MW_{HR\ "he",\ D1}$ and $MW_{HR\ "he",\ N1}$. The Block indicator shall be set as "A"; and $\$_{HR\ "he",\ D1}$ and $\$_{HR\ "he",\ N1}$ shall both equal 0.

3.2.2.2 Operating Reserve (10 minute spinning and 10 minute non-spinning) and Supplementary Reserve (30 minute)

a) Three parameters are required:
- OR $_{\text{HR "he", 10S}}$ the MW of 10 min spinning OR scheduled for the hour "h"
- OR $_{\text{HR "he", 10N}}$ the MW of 10 min non-spin OR scheduled for the hour "h"
- OR $_{\text{HR "he", 30}}$ the MW of 30 min reserve scheduled for the hour "h"

The total of the three classes of OR plus the energy MW scheduled may not exceed the capability of the facility for the hour or MW $_{\text{HR "he", N1}}$.

b) For any Generating Facility scheduled to be providing operating reserve, increment band 1 shall be used to cover at least the range over which the service is being provided. The Block indicator shall be set at "10S" or "10N" as appropriate.

c) For any Generating Facility scheduled to be providing supplementary reserve (30 minute operating reserve), increment band 1 shall be used to cover at least the range over which the service is being provided. The Block indicator shall be set at "30".

d) If a single increment covers both operating reserve and supplementary reserve, the block indicator should be set according to "10S" (if applicable) or "10N".

In order to limit the data requirements, NSPI PP is not required to submit Data related to capacity based Ancillary Services for that generation purchased under a power purchase agreement.

3.2.3 Form of submission and update

3.2.3.1 The input requirements are therefore:

a) Facility identifier

b) Date

c) Hour

d) Decrement 1 data: MW $_{\text{HR "he", D1}}$, $ $_{\text{HR "he", D1}}$, BI $_{\text{HR "he", D1}}$

e) Schedule data (energy and Ancillary Services): MW $_{\text{HR "he", S}}$, OR $_{\text{HR "he", 10S}}$, OR $_{\text{HR "he", 10N}}$, and OR $_{\text{HR "he", 30}}$

f) Increment 1 data: MW $_{\text{HR "he", N1}}$, $ $_{\text{HR "he", N1}}$, BI $_{\text{HR "he", N1}}$

g) Comments field (see sub-sections 3.3.2 and 3.3.4 below for required use)

Decrement 1 data and increment 1 data is not required if excluded under paragraph 3.2.1.4.

3.3 Management of hydro resources

3.3.1 Background

3.3.1.1 Certain hydro Generating Facilities may be subject to firm limits on discharge over the day, e.g. to preserve reservoir limits at prescribed minimum levels for environmental reasons or to maintain AGC or Operating Reserve capabilities. Other hydro facilities may be subject to longer term targets as part of overall energy management. Finally certain facilities may be required to maintain minimum flows. These restrictions all need to be reflected in the schedule and related data submissions to the NSPSO.

3.3.2 Daily energy limits

3.3.2.1 If a hydro Generating Facility is subject to a firm energy limit for the day, then

a) The fact, the reason, and the limit should be stated in the comments field, and

b) If, due to such a limit, the dispatch by NSPSO of an increment would necessitate the later reduction of scheduled output from that facility, then that increment should have a block indicator of “DEL” representing “daily energy limit”, or

c) If, due to such a limit, the dispatch by NSPSO of an increment would breach the limit, then the increment should not be offered.

3.3.2.2 The estimated marginal cost for an increment classified as “DEL” should reflect the estimated marginal cost of the facility that would require to be run later in the day in order to offset the reduction in hydro output.

3.3.2.3 If a hydro facility is subject to a daily energy limit, then the estimated marginal cost of a decrement should reflect the estimated marginal cost of a facility that could be backed off later in the day due to the increased availability of hydro output.

3.3.3 Longer term targets

3.3.3.1 If a hydro Generating Facility is subject to a longer-term target, typically reflecting the need for capacity in a subsequent season, then the schedule should be set accordingly, but no special indicator is required.

3.3.3.2 The estimated marginal cost for an increment should reflect the estimated marginal cost of the optimum facility that would require to be run at some other time in order to offset the reduction in hydro storage.

3.3.3.3 The estimated marginal cost of a decrement should reflect the estimated marginal cost of a facility that could be backed off at some later time due to the increased availability of hydro output.

3.3.4 Minimum flow conditions

3.3.4.1 If a hydro Generating Facility is subject to a minimum flow condition, then the Market Participant should not provide any decrement that would breach such limit.

3.3.4.2 In addition, the fact, the reason, and the limit should be stated in the comments field.

3.4 Firm environmental restrictions

3.4.1.1 If an environmental restriction on a Generating Facility causes that facility to be subject to a firm energy limit for the day, then

d) The fact, the reason, and the limit should be stated in the comments field, and

e) If, due to such a limit, the dispatch by NSPSO of an increment would necessitate the later reduction of scheduled output from that facility, then that increment should have a block indicator of “DEL” representing “daily energy limit”, or

f) If, due to such a limit, the dispatch by NSPSO of an increment would breach the limit, then the increment should not be offered.

3.4.1.2 The estimated marginal cost for an increment classified as “DEL” should reflect the estimated marginal cost of the facility that would require to be run later in the day in order to offset the reduction in Generating Facility output.

3.4.1.3 If a Generating Facility is subject to a daily energy limit, then the estimated marginal cost of a decrement should reflect the estimated marginal cost of a facility that could be backed off later in the day due to the increased availability of Generating Facility output.

3.5 Determination of estimated marginal cost

Estimated Marginal Cost =

Thermal

*Marginal Cost ($/MWh) = ((((fuel cost in $/mmbtu) + (fuel adder)) * Incremental Heat Rate * Operating Factor) + (variable operating costs)) * Transmission Loss factor*

Other than Thermal

*Marginal Cost ($/MWh) = Fuel cost * Operating Factor or (Operating Factor /MWh) + (variable operating costs/MWh)* Transmission Loss Factor*

3.6 Data submission – determined by section 3.5

3.6.1 Electronic submission

All data submissions shall be in a format accepted by NSPI IT for security of information. MPF-11-01 or MPF-11-02

3.6.2 Paper Submission

Paper submission of data is not permitted unless specifically authorized on a temporary basis by the NSPSO.

Forms

MPF-11-01 - Hourly Loading Blocks for Dispatchable Generators

MPF-11-02 - Non Dispatchable Generators Schedule