Options for Administered Settlement

A Consultation Paper

30th June 2009

TABLE OF CONTENTS

1. INTRODUCTION

Administered Settlement "means the process of setting an Administered Price or an Administered Schedule as set out in Section 6 of the Code". The main legal provisions concerning Administered Settlement are set out in paragraphs 6.247 to 6.259 of the Code. In short, Administered Settlement is used to set the price of the market and to determine the schedule of the market in cases where the normal process cannot be followed.

The General Principles of Administered Settlement are described in paragraph 6.247. It states:

"In implementing Administered Settlement, the Market Operator shall, insofar as reasonably practicable, adopt a balance between the following principles to:

1. make use of all available data, and limit to the maximum extent practicable the use of estimated values;
2. operate within the Settlement timescales, and be subject to the Settlement Query and Settlement Dispute provisions as set out in Section 6;
3. seek results which are as close as possible to those which would have been calculated under the normal Settlement processes;
4. obtain the prior written approval of the Regulatory Authorities for the detailed calculations and methodology used; and
5. publish details of the calculations and methodology used as soon as practicable thereafter. "

Administered Settlement is required under two cases of Force Majeure as detailed in section 6 of the Trading and Settlement Code (TSC) - Market Scheduling and Pricing Software Failure (MSP Failure) (clauses 6.249 to 6.255) and Electrical System Collapse (ESC) (clauses 6.256 to 6.259). This paper outlines the methodology that would be applied by the Market Operator to carry out Administered Settlement, including Administered Scheduling and Pricing.

The primary objective of Administered Settlement is to ensure adequate cash flow in the Single Electricity Market (SEM) in the event of an MSP Failure or ESC. In the former case, it is to ensure that Market Schedule Quantities (MSQs) and System Marginal Prices (SMPs) are set using a pre-defined method.

In all situations, the Market Operator will use best endeavours to price and settle the SEM using the best information available at the time. When more accurate data is available the Market will be repriced, as appropriate, and resettled. In particular, following the restoration of the MSP Software, it will be used to produce the corrected Ex-post Initial Market Schedules.

It should be kept in mind that the likelihood of either event occurring is very low. The Central Market Systems (CMS) were designed with a high degree of redundancy and this reduces the risk of complete MSP Failure. There are dual sites in Dublin and Belfast, both with instances of the MSP Software running. Similarly, ESC is mitigated by the System Operators' well-developed operational procedures and experience.

However, to ensure that the SEM is prepared for all eventualities, this paper will address, in turn, the methodologies that would be employed in the instance of either event occurring. It

outlines some options and seeks Market Participants views on which option they would regard as being most appropriate.

2. MSP FAILURE

MSP Failure occurs when the MSP Software fails to produce a Valid MSP Solution for reasons related to the functioning of the MSP Software. In addition, it is expected that MSP Software will not be able to produce a Valid MSP Solution before 17:00 on that Trading Day.

The MSP Software produces the SMPs and MSQs that are then used to settle the market. In addition, it is also used to determine the Interconnector Unit Nominations (IUNs) and Dispatch Quantities (DQs). As such, in the event of a MSP Failure, the Market Operator is obligated to produce MSQs and SMPs (also IUNs and DQs) using an alternative method.

The methods which the Market Operator believes are appropriate are:

- Option 1 – Use a 'previous schedule'
- Option 2 – Use a 'previous schedule' and set all Modified IUNs (MIUNs) to zero
- Option 3 – Use a pre-developed simplified version of the MSP

The calculations used in Option 1 & 2 are included in Appendix A and the calculation used in Option 3 is included in Appendix B.

All options are used to produce the Ex-ante Indicative (EA) and Ex-post Initial (EP2) Schedules; it is proposed that Ex-post Indicative (EP1) Schedules are not calculated in the case of MSP Failure.

Depending on the time of day when the MSP Failure occurs, it may be necessary to produce Administered Scheduling and Pricing for the EA and EP2 runs. These are calculated each day. Until the MSP Software has been restored, the Market Operator will calculate both EA and EP2.

2.1. OPTION 1: USE A 'PREVIOUS SCHEDULE'

For this option the Market Operator would take the SMPs and MSQs from a "previous day" and publish these on the web for that Trading Day's schedule.

The 'previous day' refers to a similar day in the past that would be used (e.g. If the MSP Failure occurred on Wednesday, Tuesday may be the most appropriate schedule to use, whereas for a Saturday the previous Saturday may be more appropriate). In any event the Market Operator will produce a calendar of days to be used in case of MSP Failure in advance.

This method is the simplest and could be implemented immediately. It also produces a reasonable schedule as it is an actual historical schedule for a similar day. While there may be differences between the outputs of the units on the day, the impetus would be on maintaining business continuity and a cash flow in the market.

All EP2 schedules would be rerun when the MSP Softwares return to service.

There are no development costs with this option. Testing costs would be incurred but could be absorbed by SEMO. How Participants would like the data to be published will determine the cost associated with this component.

2.2. OPTION 2: USE A 'PREVIOUS SCHEDULE' AND SET ALL MIUNS TO ZERO

This option is identical to option 1 above with the further step of setting MIUNs to zero to limit unintended Interconnector Trades.

This option would ensure that the Interconnector Users are not unduly exposed if changes occurred between the Ex-ante and the repricing of the Trading Day following the restoration of the MSP Software.

There are no development costs with this option. Testing costs would be incurred but could be absorbed by SEMO. How Participants would like the data to be published will determine the cost associated with this component.

Until such time as one of the options is approved and implemented, the Market Operator proposes to use Option 2 in the event of an MSP Failure between now and then.

2.3. OPTION 3: USE A PRE-DEVELOPED SIMPLIFIED VERSION OF THE MSP

In this option, the production of the SMPs and MSQs are based on the processes and algorithms described in Appendix N of the TSC with the following main exceptions:

- All Inter-temporal constraints shall be relaxed except those that relate to Energy Limits and Pumped Storage Reservoir Limits. Inter-temporal constraints are those that link different Trading Periods (e.g. ramp rates).
- All Cost Recovery constraints shall be relaxed. Cost Recovery constraints are those in the Uplift calculation that ensure that all costs submitted as part of Commercial Offer Data are recovered through the SMP. Any costs not recovered through the SMP will be recovered through Make Whole Payments.

The details of the calculation proposed are included in Appendix B.

This option assumes that all the data (all Participant Offer data, TSO data, IA data and MDP data) is available to the Market Operator for the Trading Day. It assumes that only the MSP Software has failed but all other Market Operation systems are fully available.

All days would be repriced when the MSP Softwares return to service.

This option tries to make use of available data specific for that Trading day. However, this is still an estimate of the Market Schedules as inter-temporal and uplift calculations are ignored. It is significantly more complex than Options 1 and 2 and would be the most costly of the options to deliver, estimated at over €100,000 and possibly significantly more. It would also have implementation time of at least 6 months.

3. ELECTRICAL SYSTEM COLLAPSE

In the case of an ESC all Generation has ceased in part of the Transmission System and there is no electricity supply such that Black Start procedures as set out in the Grid Code are initiated.

In that event the Market Operator, based on the assumptions outlined below, would produce the Market Schedule and Market Quantities as normal. Where data is not available the Pricing and Settlement Schedules would be postponed until the data is available.

For the Settlement of the Trading Days affected by the ESC, the Market Operator will utilise the SMPs and MSQs produced via the MSP Software for Trading Periods outside the ESC.

For periods in the ESC, section 6.256 to 6.259 of the TSC shall be invoked and Generators will be settled based on their Meter Generation and the highest bid Market Offer Price of generators operating in that Trading Period.

SMPs are to be calculated based on the highest offer price (submitted prior to the collapse) for a generator whose metered output is greater than zero. There is also a need to run the MSP to get those quantities that are not within the Electrical System Collapse period however this may be problematic. Further testing of the Central Market Systems may need to be performed to ensure that the Trading Periods outside the ESC (before & after) are correct.

The calculation utilised in the collapse period is as outlined in TSC rules contained in Appendix C of this paper.

It is assumed that:

- the Central Market Systems are fully functional and the Market Operator would be able to produce all schedules, via the Central Market Systems.
- The System Operator(s) notify the Market Operator of the start and end of the electrical collapse i.e. Trading Period and Date.
- All Pricing Schedules for Trading Days prior to and post the ESC are produced. In the case where a full dataset has not been received for that day, the Market Operator may defer such schedules onto such time as it has the full dataset.
- Corrected data will be consumed into the system under normal M+4 and M+13 resettlement.
- All SMPs and MSQs on the Trading Day of ESC will be calculated as normal; however, when the Trading Day is being settled the Trading Periods affected by the ESC will be calculated in accordance with Section 6 of the TSC.

No repricing will result from carrying out Administered Settlement due to an ESC.

4. CONCLUSIONS

The process for Administered Settlement is considered here in the event of either MSP Failure or ESC occurring. These are unlikely events considering the extent of mitigation measures in place for both risks (e.g. dual site redundancy for the former and operating reserve for the latter).

To ensure sufficient cash flow to Market Participants in the instance of one of these events occurring, options for contingency processes are included here for consideration. These processes have been developed to be used for a period of a few days. However, the processes are sufficiently robust to enable them to be used for periods longer than this if required.

In the event of MSP Failure, for the purposes of setting the MSQs and SMPs, the Market Operator proposes a number of options – Option 1, Option 2 and Option 3. Options 1 and 2 essentially use a previous Trading Day's SMPs and MSQs in place of that which would have been produced by the MSP Software. Option 2 is the same as Option 1 except that it sets the MIUNs to zero, limiting any exposure to BETTA prices.

Option 3 uses the input data that would apply for a particular MSP Software run but uses a simplified stack model in place of the unavailable MSP Software. The added complexity of this method would mean that a system would be required to implement this method. Such a system would be costly and would take a number of months to develop (min 6). Increased integration to the Central Market Systems would increase the cost and delivery timelines significantly.

The Market Operator seeks approval for one of these options to include in the final process. Market Participants are invited to comment on the proposed options. Until such a decision is reached, in the event of MSP Failure, the Market Operator will implement Option 2.

In the event of ESC, the calculation of MSQs and SMPs is quite clearly defined in the TSC for the periods covered by the ESC. Included here is some more detail on how it would work in practice considering the disruptive nature of such an event. The Market Operator will apply the Administered Settlement calculations as set out in the TSC for Trading Periods affected by the ESC. For days around the ESC, some schedules may have to be deferred until complete data has been provided to and accepted by the Market Operator.

Again, the Market Operator seeks the view of Market Participants with regard to the process for Administered Settlement in the event of an ESC.

Preparedness plans maintain continuity throughout disruptive events. The Market Operator will strive to minimise the adverse impacts that result from these events using the processes outlined here. We look forward to receiving Market Participants comments in this regard and will make efforts to incorporate them where possible.

APPENDIX A: OPTIONS 1 & 2 'PREVIOUS DAY' METHOD

The following methodology applies when none of the instances of the MSP Software are available.

HIGH-LEVEL ASSUMPTIONS USED WITHIN 'PREVIOUS DAY' METHOD

Outputs from 'PREVIOUS DAY' Method

A.1 The MO shall use 'PREVIOUS DAY' Method to calculate the following values:

1. the Administered SMPh for each Trading Period h;

2. the Administered MSQuh for each Generator Unit u in each Trading Period h;

A.2 The 'PREVIOUS DAY' Method is based on the premise that the outcome of MSP Schedule for TD will resemble that of a similar previous day.

HIGH-LEVEL PROCESSES ASSOCIATED WITH OPERATION OF 'PREVIOUS DAY' METHOD

'PREVIOUS DAY' Method Run Types

A.3 There shall be two 'PREVIOUS DAY' Method Run Types:

1. EA 'PREVIOUS DAY' Method Runs; and

2. EP2 'PREVIOUS DAY' Method Runs (including subsequent Settlement Reruns).

A.4 EA 'PREVIOUS DAY' Method Runs shall be performed in relation to each Trading Day by the MO, after GC and before the start of the relevant Trading Day as set out in paragraph 4.62 of the TSC, in order to determine, on the basis of the requirements set out elsewhere in this Appendix A in relation to EA 'PREVIOUS DAY' Method Runs:

1. indicative values of Administered SMP;

2. indicative values of Administered MSQ for each Generator Unit; and

3. values of Modified Interconnector Unit Nominations for each Interconnector Unit.

A.5 EP2 'PREVIOUS DAY' Method Runs shall be performed in relation to each Trading Day by the MO, in accordance with the Settlement Calendar and paragraphs 4.64 and 4.65 of the TSC, in order to determine, on the basis of the requirements set out elsewhere in this Appendix A in relation to EP2 'PREVIOUS DAY' Method Runs, the following values used in Initial Settlement and in subsequent Settlement Reruns;

1. values of Administered SMPs;

2. values of Administered MSQs for each Generator Unit; and

3. values of Administered DQs.

A.6 For both EA 'PREVIOUS DAY' Method Runs and EP2 'PREVIOUS DAY' Method Runs, the MO shall chose a previous day that most reasonably matches the day that the schedule applies to.

A.7 The MO will not be obliged to rerun the 'PREVIOUS DAY' Method for any particular Trading Day solely as a consequence of a rerun of the 'PREVIOUS DAY' Method for the preceding Trading Day.

EA 'PREVIOUS DAY' METHOD

A.8 For all Generator Units u except Interconnector Units for all Trading Periods h in Trading Day TD:

$$(MSQ_{uh})_{TD} = (MSQ_{uh})_{prevTD} \text{ and } (SMP_h)_{TD} = (SMP_h)_{prevTD}$$

where prevTD refers to a previous Trading Day.

A.9 For all Interconnector Units u for all Trading Periods h in Trading Day TD:

Option 1: $(MSQ_{uh})_{TD} = (MSQ_{uh})_{prevTD}$

Option 2: $(MSQ_{uh})_{TD} = 0$

A.10 For all Interconnector Units u for all Trading Periods h in Trading Day TD:

$$(MIUN_{uh})_{TD} = (MSQ_{uh})_{TD}$$

EP2 'PREVIOUS DAY' METHOD

A.11 For all Generator Units u except Interconnector Units for all Trading Periods h in Trading Day TD:

$$(MSQ_{uh})_{TD} = (MSQ_{uh})_{prevTD} \text{ and } (SMP_h)_{TD} = (SMP_h)_{prevTD}$$

where prevTD refers to a previous Trading Day.

A.12 For all Interconnector Units u for all Trading Periods h in Trading Day TD:

Option 1: $(MSQ_{uh})_{TD} = (MSQ_{uh})_{prevTD}$

Option 2: $(MSQ_{uh})_{TD} = 0$

A.13 For all Generator Units u except Interconnector Units for all Trading Periods h in Trading Day TD:

$$(DQ_{uh})_{TD} = (MG_{uh})_{TD}$$

A.14 For all Interconnector Units u for all Trading Periods h in Trading Day TD:

$$(DQ_{uh})_{TD} = (MSQ_{uh})_{TD}$$

$$(DQ_{u'h})_{TD} = (SIEQ_{uh} + SIIQ_{uh})_{TD}$$

APPENDIX B: OPTION 3 ASP METHOD

The following methodology applies when none of the instances of the MSP Software are available.

HIGH-LEVEL ASSUMPTIONS USED WITHIN THE ASP METHOD

Outputs from the ASP Method

B.1 The MO shall use the ASP Method to calculate the following values:

1. the Administered SMPh for each Trading Period h;

2. the Administered MSQuh for each Generator Unit u in each Trading Period h;

B.2 The ASP Method is based on the processes and algorithms described in Appendix N with following main exceptions:

All Intertemporal constraints shall be relaxed except those that relate to Energy Limits and Pumped Storage Reservoir Limits. Intertemporal constraints are those that link different Trading Periods (e.g. ramp rates).

All Cost Recovery constraints shall be relaxed. Cost Recovery constraints are those in the Uplift calculation that ensure that all costs submitted as part of Commercial Offer Data are recovered through the SMP. Any costs not recovered through the SMP will be recovered through Make Whole Payments.

As EP2 will be rerun when the MSP Software is available again, any non-recovery of costs through SMP will be addressed then. However, Make Whole Payments will ensure Market Participants are made financially whole throughout Administered Settlement.

HIGH-LEVEL PROCESSES ASSOCIATED WITH OPERATION OF THE ASP METHOD

ASP Method Run Types

B.3 There shall be two ASP Method Run Types:

1. EA ASP Method Runs; and

2. EP2 ASP Method Runs (including subsequent Settlement Reruns).

Each Run type is described separately as they have different inputs and outputs.

B.4 EA ASP Method Runs shall be performed in relation to each Trading Day by the MO, after GC and before the start of the relevant Trading Day as set out in paragraph 4.62, in order to determine, on the basis of the requirements set out elsewhere in this Appendix A in relation to EA ASP Method Runs:

1. indicative values of Administered SMP;

2. indicative values of Administered MSQ for each Generator Unit; and

3. Interconnector Unit Nominations for each Interconnector Unit.

B.5 EP2 ASP Method Runs shall be performed in relation to each Trading Day by the MO, in accordance with the Settlement Calendar and paragraphs 4.64 and 4.65, in order to determine, on the basis of the requirements set out elsewhere in this appendix in relation to EP2 ASP Method Runs, the following values used in Initial Settlement and in subsequent Settlement Reruns;

1. Administered SMPs; and
2. Administered MSQs for each Generator Unit.
3. Administered DQs for each Generator Unit.

B.6 The MO will not be obliged to rerun the ASP Method for any particular Trading Day solely as a consequence of a rerun of the ASP Method for the preceding Trading Day.

ASP METHOD FOR EA

B.7 Load Balance

Continue the following steps until:

$$DR_h = 0$$

where DR_h is the Demand Remaining in Trading Period h.

B.8 Initialisation

For all Trading Periods h in Trading Day t,

$$DR_h = Demand_h$$

where $Demand_h$ is the forecast of Demand provided by SOs for Trading Period h

B.9 For all Non Wind Price Takers and Non Wind Price Makers Under Test

For all Trading Periods h in Trading Day t

$$MSQ_{uh} = Min(NQ_{uh}, A_{uh})$$
$$DR_h = DR_h - MSQ_{uh}$$

where NQ_{uh} is Nominated Quantity and A_{uh} is the Accepted Forecast Availability Profile for Unit u in Trading Period h

B.10 For all Wind Price Takers and Wind Price Makers Under Test

For all Trading Periods h in Trading Day t,

$$MSQ_{uh} = A_{uh}$$
$$DR_h = DR_h - MSQ_{uh}$$

where $A_{uh} = Min(fO_{uh}, FA_{uh})$ where fO_{uh} is forecast Output (based on Wind Power Unit Forecast) and FA_{uh} is the Accepted Forecast Availability Profile for Unit u in Trading Period h

B.11 **For all Autonomous Wind Units**

For all Trading Periods h in Trading Day t,

$$MSQ_{uh} = O_{uh}$$
$$DR_h = DR_h - MSQ_{uh}$$

where $O_{uh} = fO_{uh}$

B.12 **For all Energy Limited Generator Units**

Iterate until:

$$\sum_h (MSQ_{uh} \times TPD) \geq 80\% \, of \; SEL_{ut}$$

where SEL_{ut} is Energy Limit for Unit u in Trading Day t.

In earliest Trading Period h of maximum DR_h and $MSQ_{uh} \leq A_{uh} - G$, where $0 < G \leq A_{uh}$

$$MSQ_{uh} = MSQ_{uh} + G$$
$$DR_h = DR_h - G.$$

where A_{uh} is the Accepted Forecast Availability Profile for Unit u in Trading Period h

B.13 **For all Pumped Storage Generator Units**

Iterate until:

$$\sum_h (MSQ_{uh} > 0 \times TPD) \geq 50\% \, of \; (PSMAXL_{ut} - PSMINL_{ut})$$

where $PSMAXL_{ut}$ and $PSMINL_{ut}$ are Maximum and Minimum Storage Capacities for Unit u in Trading Day t, expressed in terms of generation capability.

In earliest Trading Period h of minimum DR_h and $MSQ_{uh} \geq MINGEN_{uh} + P$, where $0 < P \leq MINGEN_{uh}$,

$$MSQ_{uh} = MSQ_{uh} - P$$
$$DR_h = DR_h + P$$

In earliest Trading Period h of maximum DR_h and $MSQ_{uh} \leq A_{uh} - G$, where $G = P * PSCE_{ut}$,

$$MSQ_{uh} = MSQ_{uh} + G$$
$$DR_h = DR_h - G$$

where $PSCE_{ut}$ is the Pumped Storage Cycle Efficiency for Unit u in Trading Day t, A_{uh} is the Accepted Forecast Availability Profile for Unit u in Trading Period h and $MINGEN_{uh}$ is the Accepted Forecast Minimum Stable Generation Profile for Unit u in Trading Period h

B.14 For all Interconnector Units

For all Trading Periods h in Trading Day t,

$$MSQ_{uh} = MINGEN_{uh}$$
$$DR_h = DR_h + MSQ_{uh}$$

where $MINGEN_{uh} = Max(MIUEC_{uh}, AIUECH_{uh}, 0)$ where $MIUEC_{uh}$ is the Maximum Interconnector Unit Export Capacity and $AIUECH_{uh}$ is the Active Interconnector Unit Export Capacity Holdings for Unit u in Trading Period h .

B.15 **For Predictable Price Making Generation Units not Under Test and Interconnector Units**

For u with lowest P_{uhi} and $MSQ_{uh} \leq A_{uh} - G$, where $0 < G \leq Q_{uhi}$
For all Trading Periods h in Trading Day t,

$$MSQ_{uh} = MSQ_{uh} + G$$
$$DR_h = DR_h - G$$

where A_{uh} is the Accepted Forecast Availability Profile for Unit u in Trading Period h except for Interconnector Units where $A_{uh} = Min(MIUIC_{uh}, AIUICH_{uh}, 0)$ where $MIUIC_{uh}$ is the Maximum Interconnector Unit Import Capacity and $AIUICH_{uh}$ is the Active Interconnector Unit Import Capacity Holdings for Interconnector Unit u in Trading Period h

B.16 **System Marginal Price**

$$SMP_h = Max(PFLOOR, Min(PCAP, Max(P_{uhi})))$$

where $MSQ_{uh} > MINOUT_{uh}$ and $PFLOOR$ and $PCAP$ are the Market Price Floor and Cap respectively.

ASP METHOD FOR EP2

B.17 **Load Balance**

Continue the following steps until:

$$DR_h = 0$$

where DR_h is the Demand Remaining in Trading Period h .

B.18 **Dispatch Quantities**

For all Generator Units u except Interconnector Units for all Trading Periods h in Trading Day TD:

$$DQ_{uh} = MG_{uh}$$

B.19 For all Interconnector Units u for all Trading Periods h in Trading Day TD:

$$DQ_{uh} = MIUN_{uh}$$

$$DQ_{u'h} = SIEQ_{uh} + SIIQ_{uh}$$

B.20 **Initialisation**

For all Trading Periods h in Trading Day t,

$$DR_h = Demand_h$$

where

$$Demand_h = \sum_u AO_{uh} + DQ_{u'h}$$

where AO_{uh} is the Actual Output of Unit u and $DQ_{u'h}$ is the Dispatch Quantity of the Interconnector Residual Capacity Unit u' in Trading Period h.

B.21 **For all Non Wind Price Takers and Non Wind Price Makers Under Test**

For all Trading Periods h in Trading Day t

$$MSQ_{uh} = Min\left(NQ_{uh}, A_{uh}\right)$$
$$DR_h = DR_h - MSQ_{uh}$$

where NQ_{uh} is Nominated Quantity and A_{uh} is the Availability Profile for Unit u in Trading Period h.

B.22 **For all Wind Price Takers and Wind Price Makers Under Test**

For all Trading Periods h in Trading Day t,

$$MSQ_{uh} = A_{uh}$$
$$DR_h = DR_h - MSQ_{uh}$$

where A_{uh} is the Availability Profile for Unit u in Trading Period h.

B.23 **For all Autonomous Wind Units**

For all Trading Periods h in Trading Day t,

$$MSQ_{uh} = O_{uh}$$
$$DR_h = DR_h - MSQ_{uh}$$

where $O_{uh} = AO_{uh}$

B.24 **For all Energy Limited Generator Units**

Iterate until:

$$\sum_h (MSQ_{uh} \times TPD) \geq 80\% \, of \; SEL_{ut}$$

where SEL_{ut} is Energy Limit for Unit u in Trading Period h.

In earliest Trading Period h of maximum DR_h and $MSQ_{uh} \leq A_{uh} - G$, where $0 < G \leq A_{uh}$

$$MSQ_{uh} = MSQ_{uh} + G$$
$$DR_h = DR_h - G$$

where A_{uh} is the Availability Profile for Unit u in Trading Period h.

B.25 **For all Pumped Storage Generator Units**

Iterate until:

$$\sum_h (MSQ_{uh} > 0 \times TPD) \geq 50\% \, of \; (PSMAXL_{ut} - PSMINL_{ut})$$

where $PSMAXL_{ut}$ and $PSMINL_{ut}$ are Maximum and Minimum Storage Capacities for Unit u in Trading Day t, expressed in terms of generation capability.

In earliest Trading Period h of minimum DR_h and $MSQ_{uh} \geq MINGEN_{uh} + P$, where $0 < P \leq MINGEN_{uh}$,

$$MSQ_{uh} = MSQ_{uh} - P$$
$$DR_h = DR_h + P$$

In earliest Trading Period h of maximum DR_h and $MSQ_{uh} \leq A_{uh} - G$, where $G = P * PSCE_{ut}$,

$$MSQ_{uh} = MSQ_{uh} + G$$
$$DR_h = DR_h - G$$

where $PSCE_{ut}$ is the Pumped Storage Cycle Efficiency for Unit u in Trading Day t, A_{uh} is the Availability Profile for Unit u in Trading Period h and $MINGEN_{uh}$ is the Minimum Output for Unit u in Trading Period h

B.26 **For all Interconnector Units**

For all Trading Periods h in Trading Day t,

$$MSQ_{uh} = MINGEN_{uh}$$
$$DR_h = DR_h + MSQ_{uh}$$

where $MINGEN_{uh} = Min(MIUN_{uh}, 0)$

B.27 **For Predictable Price Making Generation Units not Under Test and Interconnector Units**

For u with lowest P_{uhi} and $MSQ_{uh} \leq A_{uh} - G$, where $0 < G \leq Q_{uhi}$
For all Trading Periods h in Trading Day t,

$$MSQ_{uh} = MSQ_{uh} + G$$
$$DR_h = DR_h - G$$

where A_{uh} is the Actual Availability for Unit u in Trading Period h.

B.28 **System Marginal Price**

$$SMP_h = Max(PFLOOR, Min(PCAP, Max(P_{uhi})))$$

where $MSQ_{uh} > MINOUT_{uh}$ and $PFLOOR$ and $PCAP$ are the Market Price Cap and Floor Respectively.

Inconsistent Technical Capabilities

B.29 If Technical Capabilities applying to a Generator Unit within a run of the ASP Method are internally inconsistent so as to allow no solution for that Generator Unit within its Technical Capabilities, then the ASP Method shall disregard one or more Technical Capability limits as required to allow a solution to be found for that Generator Unit, subject to the limits that:

1. the Generator Unit shall not be scheduled to operate at a level in excess of the greatest Availability implied by any of the inconsistent Technical Capability limits, or zero where no such limit can be inferred;

2. the Generator Unit shall not be scheduled to operate at a level less than the lowest level implied by the lowest allowable level implied by any of the inconsistent Technical Capability limits, or zero where no such limit can be inferred; and

3. if Availability of a Generator Unit is greater than zero and less than the relevant Minimum Stable Generation then its Availability shall be reset to equal Minimum Stable Generation.

APPENDIX C: CODE OBLIGATIONS

The process must be compliant with the rules defined by the Code. Relevant sections of Version 5.0 of the Code are:

Force Majeure

2.330 *Where the Market Operator is affected by Force Majeure, the Market Operator shall immediately inform the Regulatory Authorities of such. Where the Market Operator is affected by an event of Force Majeure:*

1. no obligations of any Party that arose before the Force Majeure and which can reasonably be expected to be performed are suspended as a result of Force Majeure;
2. *the Market Operator in consultation with, and where required by, the Regulatory Authorities, shall do all acts to mitigate the consequences of the Force Majeure to enable it to resume the full performance of its functions and obligations under the Code;*
3. *the Market Operator shall resume full performance of its obligations under the Code on cessation of any Force Majeure and shall inform the Regulatory Authorities of this; and*
4. *the Market Operator shall be relieved of its obligations only for so long as and to the extent that the occurrence of the Force Majeure and/or its effects could not be overcome by measures which the Market Operator might reasonably be expected to take acting prudently with a view to continuing or resuming performance of its obligations as appropriate including, where applicable, the implementation of Administered Settlement.*

Missing System Operator and Interconnector Administrator Market Data Transactions and Meter Data Transactions

3.46 *The Market Operator shall not estimate or substitute System Operator Market Data Transactions, Interconnector Administrator Market Data Transactions or Meter Data Transactions except as required when Administered Settlement is in effect.*

3.47 *If for a particular Trading Period, in relation to any one of the CMS Data Transactions listed in Appendix J "Market Operator and System Operator Data Transactions" or Appendix L "Meter Data Transactions" either:*

1. no such Data Transaction has been received by the Market Operator before the applicable deadline; or

2. none of the Data Transactions received prior to the applicable deadline meets the requirements to be Validated by the Market Operator,

then, all calculation and processing by the Market Operator to which the relevant data relates shall be deferred until the valid data is provided to and accepted by the Market Operator, unless Administered Settlement is in effect.

3.48 *When processing is deferred in accordance with paragraph 3.47, the obligations of the Market Operator in respect of any consequential Data Transactions and publication shall also be deferred.*

3.49 *Notwithstanding paragraphs 3.47 and 3.48, the Market Operator shall use prudent practice to continue any provisions of the Code that it deems appropriate to avoid further delays.*

3.50 *In the event that a circumstance of the type set out in paragraph 3.47.1 arises due to a communications failure or any error affecting the System Operator, Interconnector Administrator, or Meter Data Provider outside of the Market Operator's Isolated Market System, the System Operator, Interconnector Administrator or Meter Data Provider will comply with Agreed Procedure 7 "Emergency Communications" to submit the required Data Transaction to the Market Operator within one day of the specified submission deadline in the Code.*

3.51 *Following the occurrence of the circumstances described in paragraph 3.47, the Market Operator shall, once the necessary data has been received, take steps to undertake all the necessary deferred processing as rapidly as reasonably possible and shall promptly inform all Parties of the changes to the Settlement Calendar that will result.*

3.64 *During a General System Failure, all calculation by the Market Operator of Trading Charges and Trading Payments and Settlement relating to Trading Days, or Settlement Days as appropriate, for which the necessary data cannot be accessed or processed shall be deferred, unless Administered Settlement is in effect. The Market Operator may continue processing to the extent possible in respect of any Trading Periods for which all data as required by the Code is available.*

General Principles in the Event of Administered Settlement

6.247 *Implementing Administered Settlement, the Market Operator shall, insofar as reasonably practicable, adopt a balance between the following principles:*

1. make use of all available data, and limit to the maximum extent practicable the use of estimated values;

2. operate within the Settlement timescales, and be subject to the Settlement Query and Settlement Dispute provisions as set out in Section 6;

3. seek results which are as close as possible to those which would have been calculated under the normal Settlement processes;

4. obtain the prior written approval of the Regulatory Authorities for the detailed calculations and methodology used; and

5. publish details of the calculations and methodology used as soon as practicable thereafter.

Estimation of Data in the Event of Administered Settlement

6.248 *To the extent necessary, the Market Operator may estimate any Settlement data in the event of Administered Settlement.*

Administered Settlement in the Event of MSP Failure

6.249 *In the event of MSP Failure for a Trading Day, the Market Operator will calculate an Administered Schedule for all Trading Periods for the Trading Day.*

6.250 *An Administered Schedule comprises Administered Prices for each Trading Period and Administered Quantities for each Generator Unit for each Trading Period.*

6.251 *In creating an Administered Schedule, the objective of the Market Operator shall be to reproduce, to the greatest degree practicable, the results that would have been determined by the MSP Software.*

6.252 *The SMP value for each Trading Period in the Trading Day (SMPh) will be set to equal the relevant Administered Price.*

6.253 *The Market Schedule Quantity value for each Generator Unit for each Trading Period for the Trading Day (MSQuh) will be set to equal the relevant Administered Quantity value.*

6.254 *All Settlement calculations will be made using these values for SMP and Administered Quantities.*

6.255 *In the event of Administered Settlement resulting from MSP Failure, then once the MSP Failure is corrected, the Market Operator shall procure that Settlement Reruns shall be undertaken as soon as reasonably possible in respect of the relevant Trading Periods and that revised Settlement Statements, Invoices and Self Billing Invoices in respect of the relevant Billing Period or Periods shall be issued to Participants.*

Administered Settlement in the event of Electrical System Collapse

6.256 *In the event of Electrical System Collapse, Administered Settlement will be implemented using values calculated as follows:*

$$MSQuh = \frac{MGuh}{TPD} \qquad for\ all\ Generator\ Units\ u$$

$$DQuh = MSQuh \qquad for\ all\ Generator\ Units\ u$$

$$EAuh = MSQuh \qquad for\ all\ Generator\ Units\ u$$

$$NDvh = MDvh \qquad for\ all\ Supplier\ Units\ v$$

$$\phi h = 0$$

Where

1. *MSQuh is the Market Schedule Quantity for Generator Unit u for Trading Period h;*
2. *MGuh is the Metered Generation for Generator Unit u for Trading Period h (MWh);*
3. *EAuh is the Eligible Availability for Generator Unit u for Trading Period h (MW of average power);*
4. *DQuh is the Dispatch Quantity for Generator Unit u for Trading Period h (average MW);*
5. *DQu'h is the Dispatch Quantity for the Interconnector Residual Capacity Unit u' for Trading Period h (average MW);*
6. *MDvh is the Metered Demand for Supplier Unit v for Trading Period h;*
7. *NDvh is the Net Demand for Supplier Unit v for Trading Period h;*
8. *Φh is the Ex-Post Loss of Load Probability;*
9. *TPD is the Trading Period Duration (in hours).*

6.257 *In the event of Electrical System Collapse, prior to completing the calculations set out in paragraph 6.256, relevant values of Metered Generation (MGuh) for Interconnector Units, Interconnector Residual Capacity Units and Interconnector Error Units must first be calculated as specified in paragraphs 5.85 to 5.86.*

6.258 *In the event of Electrical System Collapse, prior to completing the calculations set out in paragraph 6.256, relevant values of Metered Generation (MGuh) for Netting Generator Units must first be set to equal zero.*

6.259 *The Market Operator shall set the System Marginal Price (SMPh) to equal the highest Market Offer Price (MOPuh) for any Generator Unit for which the Market Schedule Quantity is greater than zero, and shall calculate the Market Offer Price from Commercial Offer Data submitted prior to Electrical System Collapse.*

The table below is taken from Appendix E of the Code which specifies the timing of required publications

Appendix E

Table E.1 – Data publication list part 1: updated periodically as required

Time	*Item / Data Record*	*Term*	*Subscript*
As soon a possible after calculation	***Calculations and methodology used by the Market Operator during Administered Settlement***		