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SEM MARKET AUDIT

Independent Market Auditor's
Report for the year ended 31
December 2015

31 March 2016





Market Auditor Report – notice re distribution and publication

This notice concerns the Market Auditor Report to the Commission for Energy Regulation (CER) and Utility Regulator for Northern Ireland (UR) (together the Regulatory Authorities (the RAs)) on the SEM Market Audit for the 12 months ended 31 December 2015 dated 31 March 2016 (the “Report”).

This notice does not apply to the RAs or Parties to the Code who have signed the “Terms of Release to the Parties to the Code” letter (including their employees acting within the scope of their employment duties).

The requirement for the SEM Market Audit is set out in the Single Electricity Market (SEM) Trading & Settlement Code (“the Code”) designated on 3 July 2007 and as amended from time to time. This Report was prepared by Deloitte (a partnership established in Ireland and with its registered address at Deloitte & Touche House, Earlsfort Terrace, Dublin 2, Ireland) (“Deloitte”).

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1 Introduction

1.1 Background

The Single Electricity Market (“SEM”) was developed by the Commission for Energy Regulation (“The Commission” or “CER”) and the Utility Regulator for Northern Ireland (“UR”), together the Regulatory Authorities (“RAs”). The Single Electricity Market Operator (“SEMO”) is responsible for the operation of the SEM. The Trading and Settlement Code (“TSC” or “the Code”) was developed as part of the process of establishing the SEM and constitutes the trading and settlement arrangements for the SEM. The Code was designated on 3 July 2007 and since then has been subject to Modification via the processes set out therein.

The Regulatory Authorities have engaged Deloitte as SEM Market Auditor to undertake a Market Audit of the SEM as required under the Code. The requirement for a Market Audit is set out in section 2 of the Code in paragraphs 2.131 to 2.143. Specifically

- The Market Auditor is appointed by the Regulatory Authorities;
- The Market Auditor shall conduct an audit of the Code, its operation and implementation and the operations, trading arrangements, procedures and processes under the Code at least once a year; and
- The Regulatory Authorities shall consult with Parties on the terms of reference for the audit, and specify and publish annually the precise terms of reference for the Market Audit.

The scope of the Market Audit is set out in the “Terms of Reference for the Market Audit SEM-15-052” published on 14 August 2015 in accordance with paragraph 2.136 of the SEM TSC. The scope of the Market Audit for the period of 1 January 2015 to 31 December 2015 of operation of the market focuses on SEMO compliance with the relevant aspects of the Code and its Agreed Procedures. The scope for SEMO excludes activities undertaken by the Transmission System Operators (“TSOs”), Meter Data Providers and other participants as set out in the TSC and Agreed Procedures. The scope also excludes the operation of certain components of the MSP Pricing Engine covering the operation of the Unit Commitment, Economic Dispatch and calculation of Shadow Prices.

The scope separately established a limited expansion to include examination of certain activities of the TSOs in relation to the issuing of dispatch instructions on an Agreed Upon Procedures (“AUPs”) basis, under International Standard for Related Services (“ISRS”) 4400 issued by the International Auditing and Assurance Standards Board (“IAASB”). The detailed AUPs were agreed with the RAs in December 2015. These AUPs do not form part of our Market Audit Opinion (Section 2). The factual findings arising from these AUPs are presented in Appendix A to this Report.

The terms of our services in which we act as Market Auditor and the respective areas of responsibility of the Regulatory Authorities, SEMO, other parties and ourselves are set out in our engagement letter to the Regulatory Authorities.

Unless otherwise specified, words and expressions used in this Report have the same meaning as defined in the Code.

1.2 Requirement for Market Audit

The requirement for a Market Audit of the Code is set out in section 2 of the Code in paragraphs 2.131 to 2.143. As specified in the “Terms of Reference for the Market Audit SEM-15-052” published on the 14th August 2015 it covers the 12 months from 1 January 2015 to 31 December 2015, including resettlement of previous settlement dates performed within this period.

The “Terms of Reference for the Market Audit” also required that the Market Auditor perform interim audit procedures to cover the first six months of the audit period. Significant Issues and Other Matters noted during the course of our interim and final audit procedures are included in Sections 3 and 4 of this Report; in some cases these issues had been resolved prior to 31 December 2015.

1.3 Report Structure

Section 2 contains our Market Audit Opinion. The Market Audit Scope was agreed by the Regulatory Authorities in accordance with the “Terms of Reference for the 2015 Market Audit SEM-15-052” published on the 14th August 2015.

It has been agreed with the Regulatory Authorities that materiality should be expressed based on an appropriate percentage level of the estimated annual market value of energy traded in the All-Island Market. The percentage level has been set at 0.25% of estimated annual market value of energy traded in the All-Island Market. Planning materiality for the Market Audit has therefore been set at €4.44m (prior period €4.83m) and it will be for Parties to the Code themselves to evaluate the financial impact of any errors or matters arising on their own businesses.

Section 3 contains our Report of Significant Issues, setting out matters identified during the course of the audit which, while not material in the context of the audit and not resulting in a qualified Audit Opinion, may have a significant impact on Parties to the Code. Where, in our judgement, matters arising may be significant to individual parties such matters have been included in the Significant Issues Report with sufficient detail so as to allow the Regulatory Authorities and Parties to the Code to evaluate the impact of the cause and circumstances of matters reported. Qualitative and quantitative factors were taken into account when determining the significance of an issue. From a quantitative perspective, in line with the prior period, a threshold of one tenth of the annual materiality value has been applied as a general guideline in determining whether a matter should be included in the Significant Issues Report. The resolution response for each of these points was provided by SEMO, other than where specifically noted.

Section 4 contains details of Other Matters Arising which we wish to bring to the attention of the market. They do not represent issues of significant noncompliance and accordingly there is no requirement to report these matters under the terms of the “Terms of Reference for the 2015 Market Audit SEM-15-052” published on the 14th August 2015. However, we include this section as we believe it may assist the Regulatory Authorities and Parties to the Code to judge for themselves the relative significance of all points reported.

Section 5 contains the Follow up on Prior Period Issues, which were brought to your attention in the prior period SEM Independent Market Auditor’s Report, some of which have been resolved and where the points have not yet been resolved they have been referenced into sections 3 and 4 with a current year update.

1.4 Market Operator Monthly Reporting

SEMO is obliged under Clause 2.144 of the Code to issue a Market Operator Monthly Report to the Regulatory Authorities on the performance of SEMO and Parties to the Code. The Monthly Report includes details of the type and status of all Code breaches identified by SEMO and whether the breaches represent deadlines that have not been met, system faults or errors, and whether these breaches have been resolved or remain outstanding at the end of each month. The Market Operator Monthly Reports are available on the SEMO website.

SEMO is required to perform a materiality assessment, using set criteria which are described in the Monthly Reports. The materiality threshold applied is significantly lower than materiality defined for Market Audit purposes.

While the breaches reported in the Monthly Reports represent noncompliance with the Code, we have not repeated in this document those which are below the audit materiality threshold.

2 Market Auditor Opinion

Independent Market Auditor's Assurance Report to the Commission for Energy Regulation ("The Commission" or "CER") and the Utility Regulator of Northern Ireland ("UR") (together "The Regulatory Authorities")

We have performed assurance work over the extent to which the Single Electricity Market Operator ("SEMO") has complied with the Trading and Settlement Code ("Code") and relevant Agreed Procedures as defined in the "Terms of Reference for the 2015 Market Audit" published by the Regulatory Authorities on the 14th August 2015 during the 12 month period ended 31 December 2015.

This report is made solely for the Regulatory Authorities, as a body, in accordance with paragraph 2.133 of the Code. Our work has been undertaken so that we might state to the Regulatory Authorities those matters we are required to state to them in an auditor's report and for no other purpose. To the fullest extent permitted by law, we do not accept or assume responsibility to anyone other than the Regulatory Authorities and the Parties as a body, for our work, for this report, or for the opinions we have formed. Parties to the Code may only rely on this report if they have agreed in writing to be bound by the conditions under which it has been prepared, in line with the engagement letter.

Unless otherwise specified, words and expressions used in this report have the same meaning as defined in the Trading & Settlement Code.

Responsibilities of the Single Electricity Market Operator, Regulatory Authorities and Parties to the Code (together the "Responsible Party")

The Trading & Settlement Code is a legal agreement which, inter alia, sets out the terms of the trading and settlement arrangements for the sale and purchase of wholesale electricity on the island of Ireland between participating generators and suppliers ("Single Electricity Market"). The Code defines the Rules and Agreed Procedures which are required to be followed by the signatories to the Code ("Parties") who are bound by its provisions.

The functions of the Regulatory Authorities are set out in the Electricity Regulation Act 1999, the Northern Ireland (Miscellaneous Provisions) Act 2006 and in the Code. In the context of the Market Audit the role of the Regulatory Authorities as the Responsible Party is to appoint the Market Auditor and agree the terms of the Market Auditor's appointment, consult on and issue the Terms of Reference for the Market Audit, and receive Market Audit Reports.

SEMO is responsible for the operation of the Single Electricity Market ("SEM") under the Code as set out in paragraphs 2.117 to 2.125 therein and for complying with the requirements of the Code and Agreed Procedures as listed in appendix d to the Code, insofar as they are applicable to SEMO.

The responsibilities of the Parties in respect of the Market Audit are set out in paragraph 2.139 of the Code, which requires parties to provide without charge to the Market Auditor in a timely manner, subject to any obligations of confidentiality, such information as is reasonably required by the Market Auditor to enable the Market Auditor to comply with the functions and obligations and Terms of Reference for the purposes of conducting the audit and preparing and finalising the Audit Report. A person may only become a Party to the Code in accordance with the terms of the Code and the Framework Agreement.

Responsibilities of the Market Auditor

The requirements for the Market Audit are set out in paragraphs 2.131 to 2.143 of the Code, in particular paragraph 2.133 of the Code which sets out that “the Market Auditor shall conduct an audit of the Code, its operation and implementation and the operations, trading arrangements, procedures and processes under the Code”. It is our responsibility as Market Auditor to execute the Market Audit as required under the Code and as set out in the Terms of Reference for the 2015 Market Audit. In the context of this engagement the terms ‘Audit’ and ‘Market Audit’ mean a reasonable assurance engagement performed in accordance with the International Standard on Assurance Engagements 3000 (Revised) “Assurance Engagements Other Than Audits or Reviews of Historical Financial Information”.

The Terms of Reference for the 2015 Market Audit expressly excludes operation of certain components of the MSP Pricing Engine from the scope of the Market Audit. The excluded components are the operation of Unit Commitment, Economic Dispatch and calculation of Shadow Prices. However, the scope includes certain procedures over the SEMO decision process and approvals for the use of the Mixed Integer Programming (“MIP”) solver in place of Lagrangian Relaxation (“LR”).

The following functions performed by the Regulatory Authorities, Data Providers and other Parties or their agents under the Trading & Settlement Code are also excluded from the scope of the Market Audit including, inter alia:

- Generation metering;
- Dispatch instruction logging;
- Metering and aggregation of eligible and profiled customer demand;
- Provision by Parties of Technical and Commercial Offer Data;
- Loss adjustment factors, generator unit technical characteristics and other data provided by Transmission System Operators / Distribution System Operators; and
- Settlement, capacity and other parameters provided by the Regulatory Authorities.

We draw attention to the Market Operator Monthly Reports which list all Code breaches identified by SEMO. Other than where the impact of the issue exceeds the audit materiality threshold, we do not repeat the list of breaches in this document. The Market Operator Monthly Reports are issued by SEMO and are available on its website.

Basis of assurance opinion

We conducted our assurance work in accordance with the International Standard on Assurance Engagements 3000 “Assurance Engagements Other Than Audits or Reviews of Historical Financial Information”. That standard requires that we plan and perform our work to obtain appropriate evidence about the subject matter of the engagement sufficient to support an opinion providing reasonable assurance when evaluated against the identified criteria. In the context of the Market Audit the subject matter consists of relevant activities of SEMO which are evaluated against the relevant paragraphs of the Code and applicable Agreed Procedures as set out in the Terms of Reference for the 2015 Market Audit.

Our assurance work includes examination, on a test basis, of evidence relevant to the Code and Agreed Procedures including the review of risks, control objectives and controls associated with SEMO’s performance of their duties and operation of the settlement arrangements. Our testing of the controls comprised review of documentation, corroborative enquiry with key SEMO staff and, on a sample basis, testing the operation of controls and the validity and accuracy of the calculations underlying settlement output.

We planned and performed our assurance work so as to obtain all the information and explanations which we considered necessary in order to provide us with sufficient evidence to give reasonable assurance that SEMO have complied with the Code and relevant Agreed Procedures as defined in the Terms of Reference for the 2015 Market Audit.

We comply with the independence and other ethical requirements of the Code of Ethics for Professional Accountants issued by the International Ethics Standards Board for Accountants, or equivalent code, which is founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behaviour.

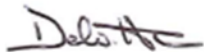
We apply International Standard on Quality Control 1 and accordingly maintain a comprehensive system of quality control including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

For the purpose of our opinion a qualification, in terms of material non-compliance with the Rules and relevant Agreed Procedures of the Code, would arise if we considered the breach to be of such significance that it undermined the robust operation of the settlements process.

We have prepared a Report of Significant Issues which is attached to this opinion setting out matters identified during the course of the audit which, while not material in the context of the audit, may have a significant impact for Parties to the Code. Our opinion should be read in conjunction with the Report of Significant Issues, but is not qualified in respect of matters contained therein.

Opinion

On the basis set out above and subject to the exclusions noted in the Responsibilities of the Market Auditor section above, in our opinion, during the period from 1 January 2015 to 31 December 2015 the Single Electricity Market Operator (“SEMO”) has, in all material respects, complied with the Code and relevant Agreed Procedures as set out in the “Terms of Reference for the 2015 Market Audit” published by the Regulatory Authorities on the 14th August 2015.

A handwritten signature in cursive script, appearing to read 'Deloitte', written in dark ink.

Deloitte
Chartered Accountants
Dublin, Ireland

31 April 2016

3 Report of Significant Issues

No significant issues identified.

4 Other Matters Arising

Issue	Effect	SEMO Response
1. Error in calculation of Billing Period currency cost		
<p>In performing our testing for the period following the SEM R.2.7.0 release in October 2015 we identified an issue in the calculation of billing period currency cost. In particular when calculating the denominator for the calculation in 6.136 / 6.136A used to allocate the billing period currency cost on the basis of market share the data for generator units is not included.</p> <p>This issue was also identified independently by SEMO, as well as identifying that Make Whole Payments were excluded from the calculation, and both issues fixed from week 44 onwards.</p> <p>Both issues arose as a result of changes made to the calculation of Make Whole Payments per Mod_12_14 in the Autumn release.</p>	<p>The error in the calculation of the market share denominator causes the market size to be under-calculated by approximately 50%, resulting in currency cost approximately double the correct value for each week and overall a net overpayment to participants and overall a net overpayment to participants, with a value of approximately £120k over the four affected billing periods.</p>	<p>SEMO sought clarification from our vendor on this matter. Our vendor confirmed this was a defect. A fix was provided in the November 2015 wash up release. SEMO carried out an impact assessment of the issue and communicated via a conference call with Market Participants on 27/01/2016.</p> <p>It was agreed that SEMO would apply corrections as part of M+4 resettlement for the four billing weeks affected.</p>

Issue	Effect	SEMO Response
2. Approach to Testing of Market System Changes		
<p>As noted in points 1 and 3, three defects in the Market Systems became apparent following the Autumn Release of SEM R.2.7.0, two of which have been confirmed by the vendor as definitely arising as a result of changes in that release. In all cases these were not detected by testing performed prior to the release go-live. In both cases regression testing did not fully cover the market system functionality, but rather was performed in isolation specific to the changes.</p> <p>While enhancements have been made to the testing processes within SEMO as a result of the observations made in the prior year Market Audit report and it is recognised that testing cannot be expected to identify all exceptions, given the issues noted, management should consider making further changes to the testing approach, particularly in respect of the coverage of end-to-end regression testing and the selection of scope for regression testing.</p>	<p>The specific impact of the defects noted is included in points 1 and 3.</p> <p>Investigation, quantification and resolution of the defects (introduced in SEM R2.7.0), including materially assessment and associated resettlement activities, will require considerable time input from SEMO resources.</p>	<p>We welcome the acknowledgement that enhancements have been made to the testing processes within SEMO. We are also in agreement with the point noting that testing cannot be expected to identify all exceptions.</p> <p>Specifically with regard to Regression Testing, a test regression pack is executed to ensure there is no adverse impact to the systems as a result of the introduction of change. This pack evolves from release to release in the context of the changes that are being / have been introduced. Having investigated further, SEMO will expand the boundary of the release regression pack for future releases. This is not a change to the testing strategy and approach adopted by SEMO, rather an adjustment to an existing process. This can be accommodated with minor additions to the existing regression test suite, tailored to the specific release scope.</p>
3. Calculation of Dispatch Quantity for Variable Price Taker Units		
<p>In performing our testing for the period following the SEM R.2.7.0 release in October 2015 we identified discrepancies in the calculation of dispatch quantity (DQ) for variable price taker (VPTG) units for trading periods when the unit becomes constrained.</p> <p>Table 5.1 of the TSC requires that the DQ is calculated as: <i>Time weighted average of (Outturn Availability when not instructed below X MW, Min{X MW, Outturn Availability} when instructed below X MW)</i>. For the examples noted it appears that the calculation is applying the minimum rule for the whole period rather than just when constrained below X MW.</p>	<p>The calculation of DQ for the affected periods and units is incorrect, resulting in errors in the calculation of uninstructed imbalances payments (constraint payments are unaffected due to the requirement for a zero decremental price as per 5.16). For the date tested the impact was quantified as less than €1000.</p>	<p>SEMO sought clarification from our vendor on this matter. Our vendor confirmed this is a defect. SEMO has requested additional detail on the issue in terms of the period affected and the triggers.</p> <p>SEMO intend to apply a fix in the June 2016 release. SEMO is in the initial stage of analysing the impact of this defect. The outcome of this analysis will inform a decision on what corrective action may be required.</p>

Issue	Effect	SEMO Response
4. Calculation of Dispatch Quantity with missing loading / de-loading rates		
<p>An error was identified in the calculation of DQ for one unit on one of the dates selected for testing. On investigation it was determined that the unit had no loading or de-loading rates within its technical offer details (despite these being a required data item). As a result our independent recalculation of the DQ could not be determined as the load up trajectory of the unit could not be calculated as per Appendix O paragraph 18. Investigation by SEMO identified that the SEMO instruction profiler had utilised the Ramp Up Rate for the unit in the absence of a loading rate.</p> <p>The validation data set corresponding to the technical offer data had been approved on 8/4/2014 by the System Operator as per 3.42F.</p> <p>SONI and the participant were made aware of the issue following identification although we note at our final visit the validation data set had still not been updated.</p>	<p>This issue represents a number of items of non-compliance with the TSC, including:</p> <ul style="list-style-type: none"> • Although potentially resulting in a DQ that is more representative of the actual unit delivery, the TSC does not include a provision to allow the Ramp Up Rate to be extended to cover the loading period in this way and hence the calculation of DQ is strictly non-compliant. • Paragraph 2.3.4 of AP04 requires SEMO to perform 'high level validation... to ensure all required data are present'. The loading / de-loading rates are required data however this issue was not identified on submission. • Paragraph 3.42F requires the System Operator to validate the validation data set. Although this activity occurred the error was not identified. • Paragraph 3.42N requires participants to review their validation data set every three months to confirm they comply with the TSC. 	<p>SEMO note and accept the points in relation to the application of ramp rates and the 'high level validation' as per the provision of AP04.</p> <p>SEMO did identify the missing parameters during the unit registration process and raised this with the System Operator. SEMO subsequently raised this following identification during the initial market audit and again following the final audit visit.</p> <p>Both SEMO and SONI have contacted the Participant on a number of occasions to request submission of revised Data. SONI continue to liaise with the affected Participant to ensure that revised data is submitted; however this is still pending at the time of drafting this response.</p> <p>SEMO will continue to liaise with SONI to ensure that revised data is submitted and validated as soon as possible.</p>
5. Data Publication Discrepancy		
<p>As part of our testing of the calculation of capacity payments for the M+4 resettlement of September 2014 we identified that the Dispatch Quantity and Eligible Availability for one interconnector unit published in the participant information reports did not match those used in the calculation of the capacity payments. Upon further investigation with SEMO it was identified that there had been a cancelled manual update of data for the affected unit resulting in a discrepancy between the data used in the calculation and the data published.</p>	<p>Although the correct data was used in the calculation of the capacity payment, the publication of incorrect data impairs validation of settlement calculations by the affected participant.</p>	<p>SEMO accept that, due to system limitations, manually entered data is not always published to Participants automatically.</p> <p>In light of I_SEM, rather than pursue an impact assessment for a potential costly system change, if requested SEMO will provide this data to the relevant Participant(s).</p>

Issue	Effect	SEMO Response
6. Failure Of A Meter Data Provider Type 3 Channel		
<p>Section 5.5 in Agreed Procedure 7: Failure Of A Meter Data Provider (MDP) Type 3 Channel Qualification outlines the procedural steps which are to be followed when such a failure occurs.</p> <p>For the sample of such failures tested, where in all cases the communication issue was with the MDP. The MDP had not used the Meter Data Provider Type 3 Channel failure form throughout the process.</p> <p>We were informed that the Meter Data Providers don't tend to use the Meter Data Provider Type 3 Channel failure form as the MDPs are usually under time constraints.</p>	<p>SEMO failed to satisfy Section 5.5 of the Agreed Procedure as per the requirements of the TSC.</p>	<p>The instances tested during the audit apply to where there was an issue with submissions from one single Meter Data Provider (i.e. there was not a general issue with the interface affecting all MDPs) – also, in each case these were relevant to MDPs internal to the EirGrid Group (i.e. EirGrid & SONI). In addition these submission issues did not impact operational timelines under the Code, nor were other SEM stakeholders affected.</p> <p>The Modification Committee confirmed that the AP Notification for Mod_09_15 AP07 Amendment to Update Process re Submission Failure was approved.</p> <p>The failure form is no longer required.</p>
7. Registered Bank Charge		
<p>When a participant is being registered in the Market, and requests SEMO to open a SEM Collateral Reserve Account on its behalf there is a requirement to “register a charge over the “SEM Collateral Reserve Account” This is the responsibility of the Participant to do so, or if not done by them, it is SEMO’s responsibility. This procedure was not performed for a number of Participants. This issue was initially reported as part of the 2012 Market Audit.</p>	<p>This represents non-compliance with the Code.</p>	<p>This is still being deliberated by the Committee and the Deed of Charge is still being finalised by the Modifications Committee.</p>

5 Follow up on Prior Period Issues

Prior Period Issue	Update	2015 Classification	Previous Classification
1. Calculation of Availability Profile and dependent quantities	The underlying defect was resolved in December 2014 and SEMO agreed a process to correct historic errors following consultation with Market Participants. Enhancements have been made to testing processes, however further issues relating to testing were encountered during software releases in 2015 (see related point 2 above).	Closed	2014:Significant issues
2. Error in Instruction Profiling	This issue was resolved as part of SEM R.3.6.6 implemented on 30 June 2015.	Closed	2014:Other
3. Calculation of Capacity Payment when no Commercial Offer Details Submitted	No further instances of this issue were noted in our testing. SEMO identified that similar instances would be dealt with manually if required.	Closed	2014:Other
4. Calculation of Eligible Availability for Pumped Storage Units	A change to address this issue is due to be included in the April 2016 Market System release.	Other	2014:Other
5. Ambiguity in Code Calculation Requirements	No specific action required.	Closed	2014:Other
6. Emergency Communication Form	No further instances of this issue were noted in our testing.	Closed	2014:Other
7. Operational Checklists	No further instances of this issue were noted in our testing.	Closed	2014:Other
8. Registered Bank Charge	Still in progress.	Other (See Point 7)	2014:Other

Appendix A – Agreed Upon Procedures for Transmission System Operators (Dispatch Instructions)

A.1. Scope

The 2015 SEM Market Audit Scope approved by the Regulatory Authorities extended testing on a limited basis to Transmission System Operators (“TSOs”), specifically regarding activities of the TSOs in relation to the issuing of dispatch instructions focussing on the processes in relation to making dispatch decisions including deviating from the market schedule, priority dispatch and managing short term issues such as unit trip etc. This work was undertaken on an Agreed Upon Procedures basis. This follows a similar approach to the previous Market Audits, which have included testing on an Agreed Upon Procedures (“AUPs”) basis in respect of System Operators and Meter Data Providers in relation to dispatch instructions, generation metering and interval and non-interval demand metering.

An outline of the likely procedures was included within the Market Audit Scope and this was further developed and refined into a series of testing procedures by the Market Auditor in consultation with the two TSOs, prior to finalisation and agreement with the RAs. As discussed within the consultation paper and subsequent decision paper, the extension to Scope does not seek to test compliance with these parties’ obligations under the Trading & Settlement Code, instead focusing on a narrower set of objectives covering the processes relating to the making of dispatch decisions.

A.2. Overview of TSO Dispatch Instruction Processes

As part of the planning and execution of the AUPs it was necessary to gain an understanding of the key aspects of the Dispatch Instruction processes in operation at the TSOs. A summary of these processes is provided here to provide context for the AUPs – this has been documented by the Market Auditor and shared with the TSOs to confirm factual accuracy.

Note that although there are two TSOs in the market many of the processes operated in relation to determining the Dispatch Schedule are common to both TSOs – in part as the dispatch schedule must be determined for the market as a whole given it operates as a single market and the interconnection of the two transmission systems. Actual dispatching of units is performed within jurisdiction by the relevant TSO and local operating procedures exist in relation to activities within the respective control rooms.

A key difference between the Market Schedule and Dispatch Schedule is that the Market Schedule is unconstrained (i.e. does not take into account any physical limits on the transmission of power, reserve requirements, etc.) whereas the Dispatch Schedule is constrained. The production of the dispatch schedule, which therefore drives dispatch decisions, is performed by a software tool: RCUC (Reserve Constrained Unit Commitment). This is based on the same underlying systems as used for production of the Market Schedule, but utilises a different optimisation algorithm.

RCUC can represent constraints through a series of Transmission Constraint Groups (TCGs). These are determined by the TSOs and reviewed on a monthly basis. An overview of TCGs is published on the website of each TSO. RCUC uses information from the market including bids/offers and other data submitted through the Market Participant Interface (MPI) as well as data produced by the TSO including demand and wind forecasts. Note that the Market Schedule **does not** form an input to RCUC (with the exception of Modified Interconnector Unit Nominations) – i.e. the two schedules are determined independently although based on the same market data and with the same objectives of economic unit commitment.

A documented process is in place in relation to how to perform a RCUC run and determine a dispatch schedule, requiring input from both TSOs in relation to in particular latest forecast data for demand and wind generation as well as any operational events that have occurred. RCUC is run at least four times in relation to each trading day, as follows:

- Day-ahead – run at approximately noon the previous day;
- In-day 1 – run at approximately 4am;
- In-day 2 – run at approximately 10am; and
- In-day 3 – run at approximately 8pm

Following completion of each RCUC run the dispatch schedule is published to each generator. Additional runs may be completed during the day if required – most notably if there have been significantly operational events in order to determine a revised schedule. The dispatch schedule produced from each RCUC run is then used to guide the operator's dispatch decisions until the next run is complete. The schedule includes information on reserve provision and hence will guide operator dispatch decisions in the event of operational activities such as unit trip or significant variances in demand or wind forecasts.

A.3. Findings and Basis of Reporting

The AUPs performed are outlined in the table below, including details of modifications to the planned procedures necessary during testing (see column 'Changes to AUP'). Also detailed in the table below are exceptions identified during execution of the procedures. These are exceptions compared to the AUPs and may or may not represent non-compliance with the Code. Other than as noted in the following table no exceptions were identified from performing the procedures.

The scope of our work in preparing the Report of Factual Findings below (the "Report") was limited solely to those procedures set out below. Accordingly we do not express any opinion or overall conclusion on the procedures we have performed. The RAs are responsible for determining whether the scope of our work specified is sufficient for their purposes and we make no representation regarding the sufficiency of these procedures for their purposes. If we were to perform additional procedures, other matters might come to our attention that would be reported to the RAs.

Our Report should not be taken to supplant any other enquiries and procedures that may be necessary to satisfy the requirements of the recipients of the Report.

The procedures we performed did not constitute a review or an audit of any kind. We did not subject the information contained in our Report or given to us by the participants to checking or verification procedures except to the extent expressly stated within the procedures. This is normal practice when carrying out such limited scope procedures, but contrasts significantly with, for example, an audit. The procedures we performed were not designed to and are not likely to reveal fraud.

The procedures outlined below do not cover every obligation on the TSO under the Trading and Settlement Code in respect of dispatch instructions, but instead have been focused on those areas that are considered to have a more significant impact on overall settlement accuracy or where there is evidence from existing Market Audit work of significant volumes of errors or corrections.

A.4. Response to Factual Findings

The factual findings arising from the individual site visits have been shared with the respective TSO. Where exceptions or comments were noted, each TSO has provided a response including details of any action to be taken in respect of the matters raised, which has been provided to the RAs.

A.5. Report of Factual Findings

The following table sets out the factual findings arising from execution of the Agreed Upon Procedures. The results for each TSO were discussed with the participant to confirm their factual accuracy.

No.	Test Procedure	Changes to AUP	Findings	Exceptions / Comments
1	For a sample of 2 RCUC Governance Meetings review the meeting minutes and other supporting documentation to confirm that any changes to RCUC rules were approved in accordance with the RCUC Governance Meeting Terms of Reference.	None	The March and November RCUC Governance meetings were selected to testing. In both cases the RCUC rule changes had been approved, although we note there is no formal Terms of Reference.	N/A
2	For all changes to RCUC rules approved from the meetings sampled in (1), confirm that these were configured in RCUC within 5 working days of the meeting and that the configuration agrees to the approval received from the RCUC Governance Meeting.	None	<p>The following changes were identified:</p> <p>March 2015 Meeting:</p> <ol style="list-style-type: none"> 1) Update Export Limit on Moyle 2) Update Export Limit on EWIC 3) Temporarily reduce interruptible load 4) Change resources involved in Cork Generation rule <p>November 2015 Meeting:</p> <p>A Northern Ireland TCG for North West Generation is temporarily needed to aid system stability. Coolkeeragh is 'must run' at all times</p> <p>A RCUC run 5 days after each governance meeting was selected. All changes except the Interconnector Export limits were confirmed to have been implemented.</p> <p>It was confirmed by the assistant grid control manager that interconnector export limits are used daily to set the capacity allowed for the residual capacity units taking into account other interconnector activity.</p>	N/A

No.	Test Procedure	Changes to AUP	Findings	Exceptions / Comments
3	Obtain the most recently set of RCUC constraint rules published on the TSO websites. Compare the published rules to those configured in RCUC and confirm that the published rules completely and accurately reflect the rules within RCUC.	None	'Operational Constraints Update Version 1 December 2015' published on SONI's website was compared to the rules published and entered in RCUC as at 29/12/2015. We noted 3 differences in RCUC compared to the published rules. Explanations for these were sought from the assistant grid control manager.	<p>The following differences were noted:</p> <ol style="list-style-type: none"> 1. ROI System Stability (There must be at least 5 high-inertia machines on-load at all times in Ireland. Required for dynamic stability.) Set as 6 in RCUC. <p>On discussions with the Assistant Grid Control Manager we found a weather warning had been issued for the sample day, and changes to constraints had been deliberate to provide ROI with increased reserve. This had been approved by the On-call Engineer.</p> <ol style="list-style-type: none"> 2. ROI Replacement Reserve (Combined MW output of OCGTs must be less than 493MW (out of a total of 793MW) in Ireland at all times. Required for replacement reserve. The MW values are subject to change as availability of the units change). Set as 498MW in RCUC on 29 December, due to changes in unit availability. 3. Operation Limit for Inertia is 20,000MW, set as 23,000MW in RCUC. <p>Evidence was supplied to show that this was done to prevent oscillations occurring in the system over the Christmas holidays due to low load following issues in the prior year.</p>

No.	Test Procedure	Changes to AUP	Findings	Exceptions / Comments
4	<p>Obtain a listing of all units subject to priority dispatch from the SEMO market systems. Confirm that all units have been configured for priority dispatch within RCUC through the use of negative prices.</p>	None	<p>There are 131 wind, 5 non wind, and 5 non-dispatchable units subject to priority dispatch in the market data.</p> <p>Within RCUC a single unit is used to represent aggregate wind generation in each jurisdiction. Both of these units as well as the 5 dispatchable non-wind units are configured for priority dispatch in RCUC through the use of negative pricing.</p> <p>In addition we identified 3 additional units configured for priority dispatch units in RCUC that were not subject to priority dispatch in the market systems.</p>	<p>Follow-up with SEMO identified that the three units that were not subject to priority dispatch in the market data had received SO and regulatory consent to be priority dispatch and should have been configured as such. Because all three are predictable price-takers this will not have impacted SEMO determined Market Schedule or settlement calculations.</p>
5	<p>Perform a site-visit to each SOs control centre. Observe the activities relating to the dispatch of units for a period of up to 2 hours. In particular:</p> <p>a. Confirm an RCUC run is performed based on the expected schedule</p> <p>b. In the event of any significant events (e.g. unit trip) confirm an additional RCUC run is performed to provide an updated dispatch schedule</p> <p>c. For any deviations from the RCUC dispatch schedule obtain explanations for the deviations from the Operator</p> <p>d. Confirm all such deviations are recorded within the Operator log</p>	None	<p>An onsite visit was performed, spending two hours in each control room on 26th and 27th January 2016.</p> <p>a. In both cases we observed an in day 2 RCUC run being performed, which was in line with the documented procedures</p> <p>b. No significant event occurred</p> <p>c. A comparison of dispatch took place with no significant deviations for either entity. Units operating were consistent with the RCUC schedule, although dispatched levels were lower than per the RCUC schedule on 3 units during one of the visits due to a higher wind and lower demand than forecast in the in-day 1 RCUC run.</p> <p>d. No deviations were recorded in the log, however as all units were operating as per RCUC schedule this was as expected.</p>	<p>Whilst no exceptions were noted in testing, it was observed a high number of manual calculations were done on spreadsheets during the preparation of the RCUC run. It is recommended templates are implemented to aid demand and wind modelling to increase efficiency and reduce the risk of manual error.</p>

No.	Test Procedure	Changes to AUP	Findings	Exceptions / Comments
6	<p>Using MSQ, DI and DQ data from the SEMO market systems select a sample of 5 examples where the unit dispatch has differed from the market schedule. For each item sampled:</p> <p>a. Obtain the corresponding RCUC output and confirm whether the deviation was as a result of the RCUC schedule. In this case obtain explanations from the SO in respect of the constraints that drove the deviation.</p> <p>b. If the deviation was not as a result of RCUC schedule output review the operator logs for the relevant date and confirm the deviation from the RCUC schedule was captured and explained in the log. Obtain explanations from TSO management if required to explain the deviation.</p>	None	<p>a. A sample of 10 dispatch deviations was sampled across both jurisdictions including examples where units were scheduled and not dispatched, dispatched and not scheduled and where a running difference occurred.</p> <p>Of the 10 differences sampled, all were consistent with what was scheduled in the prior RCUC run. Out of the 10 deviations:</p> <ul style="list-style-type: none"> - 6 were caused by TCGs being enforced - 1 was due to new targets been submitted from ESB for the hydro units which are priority dispatch - 1 was due to a combination of different dispatch and market starting heat states and the impact of TCGs being enforced on other units - Dispatch differences in 2 units sampled was caused by changing conditions on the day (specifically higher demand than forecast and lower wind generation than forecast) <p>b. N/A</p>	N/A
7	<p>Using DI data from the SEMO market systems identify a sample of up to 5 examples where there has been a unit trip. For each item obtain the dispatch instructions and operator logs from the relevant TSO and review the dispatch decisions made as a result of the unit trip, including confirming that an additional RCUC run was performed if required. Confirm that all dispatch instructions were captured within the operator log. Obtain explanations from TSO management for the dispatch decisions made.</p>	None	<p>Using the data in the market (specifically TRIP instructions captured in EDIL and submitted to SEMO), 10 examples of unit trips were selected at random.</p> <ul style="list-style-type: none"> • In 7 cases the trip was sufficiently small that no operator action was needed, as the loss of generation could be absorbed through a small frequency change and/or automatic response from units with governors. • 1 trip required units that were already running to be dispatched higher. This trip was not recorded in the Operator Log, however an additional RCUC run was performed. 	<p>Trips and subsequent dispatch decisions are not consistently captured in the Operator Log. This is inconsistent with the local operating procedures within each control room and impacts on the ability of TSO management to review and assess dispatch decisions retrospectively to identify, for example, process errors or training needs.</p>

No.	Test Procedure	Changes to AUP	Findings	Exceptions / Comments
			<ul style="list-style-type: none"> 2 trips required new units to be brought on. Of these trips only 1 case was recorded in the log. No additional RCUC runs were performed. 	
8	<p>Using data from the SEMO market systems and/or Interconnector Administrator systems identify a sample of up to 2 examples where there has been a trip on either the Moyle or EWIC interconnector (stratify the sample such that examples of trips on both interconnectors are selected, if possible). For each item obtain the dispatch instructions and operator logs from the relevant TSO and review the dispatch decisions made as a result of the interconnector trip, including confirming that an additional RCUC run was performed if required.</p>	None	<p>An example of a trip on both the EWIC and Moyle interconnector was sampled. An additional RCUC run was performed following the Moyle trip. No additional run was needed on EWIC following the trip as it immediately preceded a scheduled RCUC run. Both trips lead to extra units being brought on and in both cases the trip and associated actions were recorded in the operator log.</p>	N/A

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