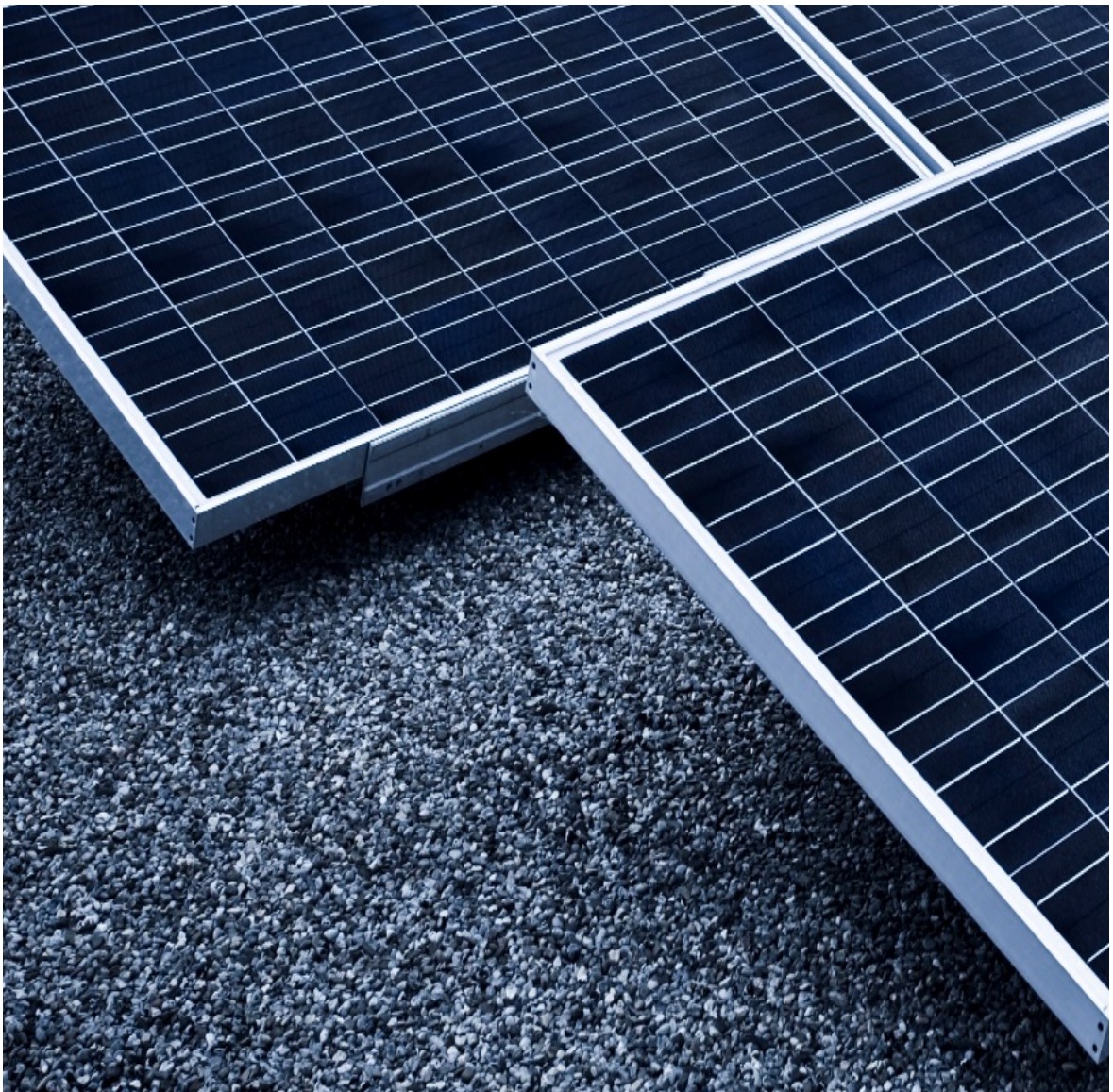
Independent Assurance Report on compliance with specified elements of the Scheduling and Dispatch process for the 12 month period ended 31 December 2020

Use of this report

This report is intended solely for the use of the Directors of EirGrid plc and SONI Limited. While we acknowledge that this report will be published on the EirGrid (www.eirgridgroup.com), SONI (www.soni.ltd.uk), and SEMO (www.sem-o.com) websites, it (as per the terms set out in the click through) is for information purposes only and it should not be relied upon by anyone other than the Directors of EirGrid plc and SONI Limited. We accept no liability (including for negligence) to anyone else in connection with this document



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20 September 2021

Dear Ladies and Gentlemen,

Independent Assurance Report on compliance with specified elements of the Scheduling and Dispatch process for the 12 month period ended 31 December 2020

Introduction

1. We have been engaged by EirGrid plc and SONI Limited ("The Transmission System Operators" ("TSOs")) to provide an Independent Assurance Report ("Assurance Report") in respect of compliance with specific regulatory requirements as they relate to specified elements of the scheduling and dispatch process for the period 1 January 2020 to 31 December 2020 ("the period"), in order for the TSOs to complete the required reporting to the Commission for Regulation of Utilities (CRU) in Ireland and the Utility Regulator (UR) in Northern Ireland (each the "Regulator") to satisfy the EirGrid plc and SONI Limited Licence obligations as set out in paragraph 9 of Condition 10A and Condition 22A of their Transmission System Operator licence agreements respectively.

Scope of work

2. The specified elements of the scheduling and dispatch process that are included in the scope of this report have been grouped into six "pillars". These are set out in the table below under the column "In scope items". The criteria that have been used to measure The Transmission System Operators' compliance with the specified elements of the scheduling and dispatch process have been set out in the table below, and are hereinafter referred to as "The Requirements". We have assessed the extent to which The Transmission System Operators, in specified elements of their scheduling and dispatch process, have complied with The Requirements for the period.

		"The Requirements"	
Pillar #	**In scope items**	**Criteria EirGrid**	**Criteria SONI**
1	Priority Dispatch and Cross Zonal Actions	**Transmission System Operator Licence ("TSO Licence")** Condition 10A - Para. 4(a)/(b) & 5(f),(i) **Other requirements:** SEM-11-062 Principles of Dispatch and the Design of the Market Schedule in the Trading and Settlement Code SEM Committee Decision Paper	**TSO Licence** Condition 22A - Para. 4(a)/(b) & 5(f),(i) Condition 9A **Other requirements:** SEM-11-062 Principles of Dispatch and the Design of the Market Schedule in the Trading and Settlement Code SEM Committee Decision Paper

Pillar #	In scope items	Criteria EirGrid	Criteria SONI
2	Dispatch Instructions	**TSO Licence** Condition 10A - Para. 2, 4 and 5 **Other requirements:** SEM-19-065 Trading and Settlement Code Scheduling and Dispatch Parameters for 2020 Decision Paper Grid Code CC. 8.2.1	**TSO Licence** Condition 22A - Para. 2, 4 and 5 **Other requirements:** SEM-19-065 Trading and Settlement Code Scheduling and Dispatch Parameters for 2020 Decision Paper Grid Code CC. 5.3.1
3	Merit Orders	**TSO Licence** Condition 10A - Para. 3 **Other requirements:** Grid Code SDC 1.4.7.3 / SDC1.4.7.4 and SDC2.4.2.14	**TSO Licence** Condition 22A - Para. 3 **Other requirements:** Grid Code SDC 1.4.8.3 / SDC1.4.8.4 and SDC2.4.2.14
4	Operational Constraints	**TSO Licence** Condition 10A - Para. 4(a)(b) & 5(d)	**TSO Licence** Condition 22A - Para. 4(a)(b) & 5(d)
5	Constraint Flagging	**Trading and Settlement Code – Part B** Flagging of Accepted Bids and Offers E.3.3.1 Trading and Settlement Code Part B, Appendices, APPENDIX N: Flagging and Tagging, System Operator and Non-Marginal Flagging Paragraph 1-5	**Trading and Settlement Code – Part B** Flagging of Accepted Bids and Offers E.3.3.1 Trading and Settlement Code Part B, Appendices, APPENDIX N: Flagging and Tagging, System Operator and Non-Marginal Flagging Paragraph 1-5
6	IT General Controls required to support the areas noted in items 1-5 above	While not specifically discussed in the regulations, the TSOs' maintenance of IT General Controls over key systems supporting items 1-5 above is key to the overall testing approach.	

3. For the avoidance of doubt, certain parts of the scheduling and dispatch process are not covered in the scope of this report. These are further detailed in our approach document entitled, "Scheduling and Dispatch process Assurance Engagement approach for the 12 month period ended 31 December 2020" ("The Supplement") that is appended to this report.

4. The Supplement provides a detailed description of the approach we have adopted to the assurance engagement. In particular, it describes those aspects of the specified elements of the scheduling and dispatch process that we have tested and those which are outside the scope of this assurance engagement. This report should be read in conjunction with the Supplement.

5. We have completed our work in accordance with the Letter of Engagement, agreed between ourselves and the Transmission System Operators on 20 April 2021.

6. The Letter of Engagement includes a clause limiting the total liability of PricewaterhouseCoopers to the Transmission System Operators, to a maximum of 3 times fees (excluding VAT) or €300,000, whichever is greater.

7. We have relied on our own knowledge and skills in interpreting The Requirements. We are not legal advisors and have not taken independent legal advice and shall therefore have no responsibility to The Transmission System Operators were a court to interpret or construe The Requirements in a different way from us.

8. Unless the context otherwise requires, words and expressions defined in The Requirements have the same meanings in this report as in the Requirements. The versions relevant to our opinion are:

    a. EirGrid Transmission System Operator Licence, 10 March 2017

    b. SONI's Licence to Participate in the Transmission of Electricity, 15 February 2019

    c. EirGrid Grid Code Version 8, 14 June 2019 and Version 8.1, 11 August 2020

    d. SONI Grid Code 22 October 2018 and 8 October 2020

    e. Trading and Settlement Code – Part B Versions 20, 21 and Mod_09_19

Respective responsibilities of The Transmission System Operators and the Scheduling and Dispatch Auditor

The Transmission System Operators are responsible for the items set out below:

9. Defining appropriate criteria against which to assess the Transmission System Operators' performance in relation to the specified elements of the scheduling and dispatch process and applying these consistently (The Requirements).
10. Ensuring that those criteria are relevant and appropriate to the Transmission System Operators and the users of the specified elements of the scheduling and dispatch process.
11. Ensuring that the Transmission System Operators comply with all regulations applicable to the specified elements of the scheduling and dispatch process.
12. Designing, implementing and maintaining internal control procedures that provide adequate control over information in respect of the specified elements of the scheduling and dispatch process.
13. Selecting and applying appropriate policies, and making estimates that are reasonable in the circumstances in respect of the specified elements of the scheduling and dispatch process.
14. Addressing all day to day queries received from participants and/or Regulators.
15. Determining the best way to operate the specified elements of the scheduling and dispatch process having due regard to the safe operation of the grid, including any security considerations.
16. Ensuring that all data published in relation to the specified elements of the scheduling and dispatch process on the EirGrid (www.eirgridgroup.com), SONI (www.soni.ltd.uk), and SEMO (www.sem-o.com) websites is complete and accurate, subject to known system issues and defects as published by SEMO on the Known Issues Report.
17. Retention of sufficient, appropriate evidence to support the operation of the specified elements of the scheduling and dispatch process.

Responsibilities of the Scheduling and Dispatch Auditor

18. It is our responsibility to perform appropriate work to enable us to express an opinion on The Transmission System Operators' compliance with The Requirements in respect of the specified elements of the scheduling and dispatch process.

Independence and Quality Control

19. We complied with the Chartered Accountants Ireland Code of Ethics, which includes independence and other requirements founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behaviour, and which is at least as demanding as Part A and Part B of the IESBA Code of Ethics.
20. We apply International Standard on Quality Control (Ireland) 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.

Basis of assurance and scope of work

21. We have performed the reasonable assurance engagement in accordance with the requirements of International Standard on Assurance Engagements 3000 (Revised), *'Assurance engagements other than audits or reviews of historical financial information'* issued by the International Auditing and Assurance Standards Board.
22. We have planned and performed our work in accordance with The Supplement, which is appended to this report.
23. In reaching our conclusion we assessed the risk of a material breach of the way The Transmission System Operators operated the specified elements of the scheduling and dispatch process compared with The Requirements, whether caused by fraud or other irregularity or error and determined the adequacy of procedures established by The Transmission System Operators to eliminate or reduce such risks.

Opinion

24. Based on our procedures, in our opinion, in all material respects, The Transmission System Operators have complied with The Requirements as they relate to the specified elements of the scheduling and dispatch process during the 12 month period ended 31 December 2020.

Use of this report

25. This report is intended solely for the use of the Directors of EirGrid plc and SONI Limited. While we acknowledge that this report will be published on the EirGrid (www.eirgridgroup.com), SONI (www.soni.ltd.uk), and SEMO (www.sem-o.com) websites, it (as per the terms set out in the click through) is for information purposes only and it should not be relied upon by anyone other than the Directors of EirGrid plc and SONI Limited. We accept no liability (including for negligence) to anyone else in connection with this document.

26. The maintenance and integrity of the websites referenced in 25 above, is the responsibility of The Transmission System Operators. The work that we carried out does not involve consideration of the maintenance and integrity of those websites and, accordingly, we accept no responsibility for any changes that may have occurred to this report since it was initially presented on those websites.

27. This report has been prepared on the expectation that The Transmission System Operators will have sufficient experience of the specified elements of the scheduling and dispatch process to understand the scope of our work performed without further background explanation and to evaluate the contents of this report in the context of the scope of our work.

Yours faithfully

PricewaterhouseCoopers

Dublin

Chartered Accountants

Scheduling and Dispatch process Assurance Engagement approach for the 12 month period ended 31 December 2020

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Objective and scope of the Scheduling and Dispatch process assurance engagement

1. The objective of our assurance engagement was to form an independent opinion based on our work as to the compliance of EirGrid plc and SONI Limited ("The Transmission System Operators" ("TSOs")), in all material respects, with The Requirements (refer to paragraph 5 below) as they relate to specified elements of the scheduling and dispatch process for the 12 month period ended 31 December 2020 ("the period").

2. The reasonable assurance engagement was performed in accordance with the requirements of International Standard on Assurance Engagements 3000 (Revised), '*Assurance engagements other than audits or reviews of historical financial information*' issued by the International Auditing and Assurance Standards Board.

3. This approach has been prepared by PricewaterhouseCoopers ("PwC") and accepted by The Transmission System Operators as the basis for the current period's engagement, as set out in the contractual arrangements in place between PwC and The Transmission System Operators.

4. The "scheduling and dispatch process" is the overall process resulting from the multiple inputs, processes and outputs which enable The Transmission System Operators to operate a secure system and efficient balancing market. It is a continuous process managed in a coordinated manner from The Transmission System Operators' Control Centres using a range of operational systems, processes and procedures.

5. The specified elements of the scheduling and dispatch process that are included in the scope of this report have been grouped into six "pillars". These are set out in the table below under the column "In scope items". The criteria that have been used to measure The Transmission System Operators' compliance with the specified elements of the scheduling and dispatch process have been set out in the table below ("The Requirements"). We have assessed the extent to which The Transmission System Operators, in specified elements of their scheduling and dispatch process, have complied with The Requirements for the period.

		"The Requirements"	
Pillar #	**In scope items**	**Criteria EirGrid**	**Criteria SONI**
1	Priority Dispatch and Cross Zonal Actions	**Transmission System Operator Licence ("TSO Licence")** Condition 10A - Para. 4(a)/(b) & 5(f),(i) **Other requirements:** SEM-11-062 Principles of Dispatch and the Design of the Market Schedule in the Trading and Settlement Code SEM Committee Decision Paper	**TSO Licence** Condition 22A - Para. 4(a)/(b) & 5(f),(i) Condition 9A **Other requirements:** SEM-11-062 Principles of Dispatch and the Design of the Market Schedule in the Trading and Settlement Code SEM Committee Decision Paper
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Pillar #	In scope items	Criteria EirGrid	Criteria SONI
3	Merit Orders	**TSO Licence** Condition 10A - Para. 3 **Other requirements:** Grid Code SDC 1.4.7.3 / SDC1.4.7.4 and SDC2.4.2.14	**TSO Licence** Condition 22A - Para. 3 **Other requirements:** Grid Code SDC 1.4.8.3 / SDC1.4.8.4 and SDC2.4.2.14
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6	IT General Controls required to support the areas noted in items 1-5 above	While not specifically discussed in the regulations, the TSOs' maintenance of IT General Controls over key systems supporting items 1-5 above is key to the overall testing approach.	

6. In agreement with The Transmission System Operators, and for the purposes of clarity, items excluded from the scope of our assessment include:

- The algorithms associated with the optimisation engines, which produce the Long-Term Scheduling ("LTS"), Real Time Commitment ("RTC") and Real-Time Dispatch ("RTD") schedules, used in the scheduling and dispatch process.
- The Imbalance Pricing process which takes place after the scheduling and dispatch process has ended.
- Validation of data submitted to The Transmission System Operators by participants.
- Inputs such as forecasts which are provided by third parties.
- Inputs such as transmission and generator outage plans.
- The derivation of operational constraints.
- Actions taken with market participants by The Transmission System Operators to resolve performance issues during the scheduling and dispatch process.
- Resolution and validation of known system issues and defects which were not resolved in advance of the Revised Market Arrangements go-live[1].
- An assessment of the compliance of The Transmission System Operators in relation to any regulations other than those specifically referenced in the table above as documented in paragraph 5 of this document.
- Any regulations which are cross referenced within the regulations listed as the criteria but not specifically identified as criteria themselves, other than those specifically referenced in the table above as documented in paragraph 5 of this document.

[1] There were no known system issues and defects which were a factor in the completion of the testing procedures performed over the specified elements of the scheduling and dispatch process during the current period.

- Validation that data published in relation to the specified elements of the scheduling and dispatch process on the EirGrid (www.eirgridgroup.com), SONI (www.soni.ltd.uk), and SEMO (www.sem-o.com) websites is complete and accurate unless specifically included in testing procedures, for example, Operational Constraint Updates are specifically included and referenced in procedures 32-35 of this document.

- An assessment of the compliance of The Transmission System Operators with the Regulation on Wholesale Energy Markets Integrity and Transparency (REMIT).

- An assessment of the engineering decisions that The Transmission System Operators make when actioning internal operating procedures relevant to the specified elements of the scheduling and dispatch process.

- Validation that system security has been maintained at all times.

Approach

7. Our approach consisted of the following, in respect of The Transmission System Operators' operation of the specified elements of the scheduling and dispatch process:

a) obtaining an understanding of the internal operating procedures that The Transmission System Operators have in place that relate to the use of specified elements of the scheduling and dispatch process and/or the Information Technology General Controls ("ITGCs") supporting the relevant computer systems as defined in paragraph 40 below ("the in scope systems");

b) testing on a sample basis, to the extent we considered necessary to support our opinion over The Transmission System Operators' compliance with The Requirements as they relate to the specified elements of the scheduling and dispatch process, the operation of the ITGCs supporting the relevant computer systems and/or internal operating procedures during the period; and

c) testing on a sample basis, to the extent that we considered necessary to support our opinion over The Transmission System Operators' compliance with The Requirements as they relate to the specified elements of the scheduling and dispatch process, certain data processed by the relevant computer systems and internal operating procedures during the period.

8. We designed our testing to provide reasonable assurance that in our opinion, in all material respects, The Transmission System Operators have complied with The Requirements as they relate to the specified elements of the scheduling and dispatch process during the period.

9. In undertaking our assessment, we assessed the risk of a material non-compliance with The Requirements of the areas within the scope of our assurance engagement. In areas where we have identified specific risks, or where weaknesses have been identified in the operation of specific internal controls, the tests undertaken have been supplemented by further substantive tests of detail of the relevant underlying data. Our assessment of risks is presented in Appendix A below.

10. We have selected a sample of Settlement Days for testing in the period. The selection of the particular days tested was based on our assessment of risk. It represented a mixture of "normal" days and other days where we identify unusual factors (e.g. outages, Amber Alerts, Generator Trips, weekends, peak wind days or days around a specific event) which, in our view, represent a risk as to compliance with internal operating procedures.

11. Throughout the engagement, we have considered the results of our work and the impact on the specified elements of the scheduling and dispatch process and updated our risk assessment and determined appropriate responses where additional risks have been identified.

Materiality

12. We have planned and performed our assurance engagement so as to be able to provide reasonable assurance that The Transmission System Operators have operated the specified elements of the scheduling and dispatch process in all material respects in accordance with The Requirements.

13. We considered a failure on The Transmission System Operators' part to comply with The Requirements as being material if, in our opinion, a reasonable professional person, on consideration of the TSOs' adherence to The Requirements, would form a different view as to whether the TSOs have complied with The Requirements. In applying this judgement, we have taken into account the following quantitative and qualitative factors to conclude on materiality:

a. the extent to which the actual outcome would have been different had the principles set out in The Requirements been applied;

b. the surrounding circumstances at the time(s) of any failure to comply with The Requirements;

c. the aggregate impact in the period of any failures to comply with The Requirements; and

d. the relative significance of the particular provision of The Requirements that the TSOs have failed to comply with.

More detailed description of work undertaken

14. The work that we have carried out on pillars 1-6 is set out below.

Pillar 1: Priority Dispatch and Cross Zonal Actions

The following procedures have been designed to assess the TSOs' compliance with The Requirements for Pillar 1: Condition 10A - Para. 4(a)/(b) & 5(f)/(i) of the EirGrid TSO Licence; Condition 22A - Para. 4(a)/(b) & 5(f)/(i) and Condition 9A of the SONI TSO Licence; and SEM-11-062 Principles of Dispatch and the Design of the Market Schedule in the Trading and Settlement Code SEM Committee Decision Paper.

15. **Accuracy of Participants reflected in the Market Management System ("MMS")/Resource balancing**

For a sample of participants from the Resource Balancing table maintained by the Registration team:

a. Checked that the participant was accurately reflected in MMS in line with its fuel type and where a participant is noted as a Priority Dispatch unit on the Resource Balancing table, if it was assigned the correct Priority Dispatch category in line with the hierarchy of SEM-11-062.

For a sample of participants from the LTS run:

b. Checked that participants in MMS were accurately noted as Priority Dispatch/non priority dispatch participants as per the Resource Balancing listing (maintained by Registration team).

16. **Priority Dispatch participants in LTS runs**

For a sample of Priority Dispatch participants from LTS runs:

a. Checked that the dispatchable units have been included in the schedule for their Physical Notification quantity; and

b. Checked that the non-dispatchable units have been scheduled to their forecasted availability.

17. **Dispatch Instructions for Dispatchable participants**

For a sample of dispatch instructions:

a. Confirmed that Dispatchable Priority Dispatch units have been dispatched for the same MW as their submitted Physical Notifications/Actual availability.

18. **Curtailment Events**

For a sample of Curtailment dispatch instructions ("set point") checked that:

a. There was a valid reason for the curtailment;

b. Before a curtailment event occurred, other options were considered, including but not limited to, initiating Interconnector trades or turning down conventional units to their minimum generation where applicable;

c. Wind units were curtailed in line with controllability categories (Category 1-3);

d. Units receiving a set point were included in the predefined curtailment group that was curtailed; and

e. Set points issued to Priority Dispatch units were done on a pro rata basis.

For a sample of Curtailment events:

f. Checked that a sample of wind farms/solar units which were not part of the curtailment group were not issued a set point.

19. **Constraint Events**

For a sample of Constraint dispatch instructions ("set point") checked that:

a. There was a valid reason for the constraint;

b. Before a constraint occurred, other options were considered when applicable;

c. Units receiving a set point were included in the predefined constraint group that was constrained; and

d. Set points issued to Priority Dispatch units were done on a pro rata basis.

For a sample of Constraint events:

e. Checked that a sample of wind farms/solar units which were not part of the constraint group were not issued a set point.

20. **Curtailment and Constraint Events**

Observed the Wind Dispatch Tool automatically omit wind/solar units from dispatch down events when signals are categorised by the Wind Dispatch Tool as suspect.

Pillar 2: Dispatch Instructions (+Schedules)

The following procedures have been designed to assess the TSOs' compliance with The Requirements for Pillar 2: Condition 10A - Para. 2, 4 and 5 of the EirGrid TSO Licence; Condition 22A - Para. 2, 4 and 5 of the SONI TSO Licence, SEM-19-065 Trading and Settlement Code Scheduling and Dispatch Parameters for 2020 Decision Paper and EirGrid Grid Code CC. 8.2.1 / SONI Grid Code CC. 5.3.1.

21. **Frequency (Condition 10A Para 2 / 22A Para 2 and EirGrid Grid Code CC. 8.2.1 /SONI Grid Code CC. 5.3.1)**

For the period under review, analysed if frequency remained within the normal limits set out in the respective EirGrid (CC.8.2.1) and SONI (CC.5.3.1) Grid Codes. Any periods outside of the normal operating limits were considered for inclusion in our sample selection as these dates were considered, in our view, to represent a risk as to the TSOs' compliance with internal operating procedures.

22. **Physical Notifications (Condition 10A Para 2(a)(i), 4 and 5(b) / 22A Para 2(a)(i), 4 and 5(b))**

For a sample of generators' Physical Notifications in the MMS:

a. Checked that the generator is listed on the Physical Notification listing on the Market Participant Interface ("MPI"); and

b. Checked that the Physical Notifications information used in scheduling is accurate based on the Market Participant Information submitted.

For a sample of generators reflected on the MPI Physical Notification listings:

c. Checked that the generators are listed on the Physical Notification listing in MMS.

23. **Generators declaring unavailable (Condition 10A Para 2(a)(ii) / 22A Para 2(a)(ii))**

For a sample of Generators that declared as unavailable as per submitted participant information:

a. Checked that generators that declared unavailable were not included in the LTS schedule run for period of unavailability declared;

b. Checked that generators that declared unavailable did not receive a dispatch instruction for the period of unavailability declared.

For a sample of generators scheduled in an LTS schedule:

c. Checked that the generator did not declare as unavailable as per availability notices.

24. **Generation units not subject to central dispatch (Condition 10A Para 2(a)(iv) / 22A Para 2(a)(iv))**

For a sample of LTS schedules inspected that units not subject to central dispatch (Fixed Generation) were scheduled.

25. **Transmission System Outage (Condition 10A Para 2(b) / 22A Para 2(b))**

Observed the automated process flow of Transmission System Outages in the RTC and RTD schedules to ensure that outages were taken into account in schedules accurately.

26. **Daily forecast demand (Condition 10A Para 4 and 5(a) / 22A Para 4 and 5(a))**

For a sample of time periods in an LTS schedule:

a. Checked that the GDX Scheduled Demand Forecast reconciles to the scheduled Load Forecast as included on the selected LTS schedules.

27. **Scheduling and Dispatch Policy Parameters (Condition 10A Para 4 and 5(c) / 22A Para 4 and 5(c) and SEM-19-065 Trading and Settlement Code Scheduling and Dispatch Parameters for 2020 Decision Paper)**

For a sample of time periods within an LTS schedule:

a. Checked that the value as per the Long-Notice Adjustment Factor ("LNAF") MMS display matched the LNAF as set out in the Single Electricity Market Committee Decision paper published on the SEM-19-065 Trading and Settlement Code Scheduling and Dispatch Parameters for 2020 Decision Paper; and

b. Checked that the value as per the System Imbalance Flattening Factors ("SIFF") MMS display matched the SIFF as set out in the Single Electricity Market Committee Decision paper published on the SEM-19-065 Trading and Settlement Code Scheduling and Dispatch Parameters for 2020 Decision Paper.

28. **Generators Technical Offer data (Condition 10A Para 4 and 5(e) / 22A Para 4 and 5(e))**

For a sample of dispatch instructions:

a. Checked that generators received dispatch instructions in line with their submitted Technical Offer data (Maximum generating capability, Minimum generating capability).

29. **Interconnector Reference Programs ("ICRPs") (Condition 10A Para 4 and 5(f) / 22A Para 4 and 5(f))**

For a sample of ICRPs:

a. Checked that the ICRPs matched to the MW scheduled for the interconnectors in the LTS runs; and

b. Checked that the ICRPs were within the operating limits of the interconnectors.

30. **Operating Security Standards procedures on Training (Condition 10A Para 4 and 5(h) / 22A Para 4 and 5(h))**

For a sample of Grid Controllers:

a. Checked that an annual Performance Assessment has been completed by their reporting manager for each grid controller sampled to confirm competency to work in the Control Centre.

Pillar 3: Merit Orders

The following procedures have been designed to assess the TSOs' compliance with The Requirements for Pillar 3: Condition 10A - Para. 3 of the EirGrid TSO Licence; Condition 22A - Para. 3 of the SONI TSO Licence and EirGrid Grid Code SDC 1.4.7.3 / SDC1.4.7.4 and SDC2.4.2.14 and SONI Grid Code SDC1.4.8.3/ SDC1.4.8.4 and SDC2.4.2.14.

The strict adherence of dispatching in line with the Merit Order is not always feasible. The Grid Codes outline acceptable reasons for deviating from the Merit Order. We therefore considered if dispatch was in line with the Merit Order in the context of the Grid Codes.

If we noted in our sample of dispatch instructions tested, that a potential deviation from the merit order occurred and a more expensive unit was dispatched while a cheaper unit was available, an assessment was undertaken to confirm if the cheaper unit would have been able to respond to the same dispatch instruction based on its technical capability. If the cheaper unit would have been technically capable of responding to the dispatch instruction, we completed an assessment as to whether dispatching the more expensive unit was material to the scheduling and dispatch process as a whole.

31. **Merit Orders**

For a sample of dispatch instructions:

a. Checked that dispatch instructions were issued in line with the Merit Order (taking into account acceptable deviations from the Merit Order as outlined in the Grid Code); and

b. Checked that dispatch instructions were issued by the TSOs after market gate closure. For those noted as Long Notice actions, inspected that dispatch instructions were issued by the TSOs in line with the generator's Technical Offer Data and heat state.

Pillar 4: Operational Constraints

The following procedures have been designed to assess the TSOs' compliance with The Requirements for Pillar 4: Condition 10A - Para. 4(a)(b) & 5(d) of the EirGrid TSO Licence; Condition 22A - Para. 4(a)(b) & 5(d) of the SONI TSO Licence. Please note that the procedures included in paragraphs 32, 33, 34a and 34b below are not a specific requirement as per the TSO Licences. However, they were included in the procedures as they support the testing performed under paragraphs 34c, 34d and 35 below.

32. **Publication of weekly Operational Constraints Updates**

Checked that a sample of Weekly Operational Constraints Updates as used in the LTS schedule has been published to the SEMO website timely (before or on the effective date).

33. **Publication of Monthly Operational Constraints Updates**

Checked that a sample of Monthly Operational Constraints Updates as used in the LTS schedule has been published to the SONI/EirGrid website timely (before or on the effective date).

34. **Accuracy of Constraints taken into account in the scheduling and dispatch process**

For a sample of constraints published on the Monthly Operational Constraints Updates:

a. Checked that the constraints had been inputted into MMS for a sample of LTS runs;

b. Checked that the constraints were accurately set up in MMS (TCG Limits Constraints) for a sample of LTS runs;

c. Checked that the constraints had been accurately used/processed by the optimiser for a sample of LTS runs; and

d. Checked that the constraints had accurately been actioned and maintained by the Control Centre in real time dispatch.

35. **Completeness of Constraints published to participants**

Confirmed for a sample of constraints included in the MMS that each constraint has been published on either the Monthly or Weekly Operational Constraints Update as applicable (active constraints) or the relevant scheduling and dispatch procedure document (inactive constraints).

Pillar 5: Constraint Flagging

The following procedures have been designed to assess the TSOs' compliance with The Requirements for Pillar 5: Trading and Settlement Code ("TSC") – Part B, Flagging of Accepted Bids and Offers E.3.3.1 and TSC Part B Appendices, APPENDIX N: Flagging and Tagging, System Operator and Non-Marginal Flagging Paragraph 1-5

36. Creation of System Operator flags

TSC – Part B, Flagging of Accepted Bids and Offers E.3.3.1 and TSC Part B Appendices, APPENDIX N: Flagging and Tagging, System Operator and Non-Marginal Flagging Paragraph 1-2

For a sample of Constraints that impact on pricing in a selection of imbalance periods:

a. Confirmed that flags were created accurately in line with constraint logic; and

b. Confirmed that the Non-Energy flag listing, for use in settlement, was complete by ensuring that all units that met the constraint logic as per procedure 36a above were reflected on the listing for the constraint sampled.

For a sample of Constraints in an RTD run:

c. Confirmed that each constraint has been published on either the Monthly or Weekly Operational Constraints Update as applicable (active constraints) or has been turned off in pricing (inactive constraints).

37. Creation of Non-Marginal flags

TSC – Part B, Flagging of Accepted Bids and Offers E.3.3.1 and TSC Part B Appendices, APPENDIX N: Flagging and Tagging, System Operator and Non-Marginal Flagging Paragraph 3

For a sample of generators Non-Marginal Flagged in a selection of imbalance periods:

a. Confirmed that the generators were operating within the correct criteria to be flagged as Non-Marginal for the RTD run.

For a sample of generators not Non-Marginal Flagged in a selection of imbalance periods:

b. Confirmed that generators were operating within the correct criteria to not be flagged as Non-Marginal for the RTD run.

For a sample of Interconnectors where a trade occured in a selection of imbalance periods:

c. Confirmed that the Interconnectors were operating within the correct criteria to be flagged/not be flagged as Non-Marginal for the time period.

For a sample of Interconnectors where a trade did not occur in a selection of imbalance periods:

d. Confirmed that the Interconnectors were not flagged as Non-Marginal for the imbalance period.

38. Publication of Methodology for determining System Operator and Non-Marginal flags

TSC – Part B, Flagging of Accepted Bids and Offers E.3.3.1 and TSC Part B Appendices, APPENDIX N: Flagging and Tagging, System Operator and Non-Marginal Flagging Paragraph 4-5

a. Checked that a Methodology for determining System Operator and Non-Marginal flags has been published to the SEMO website.

b. For a sample of System Operator and Non-Marginal Flags, checked that the published document entitled "Methodology for determining System Operator and Non-Marginal flags (Version 1.0)" includes detailed information on how System Operator Flags and Non-Marginal Flags are determined for each Operational Constraint and Unit Constraint in accordance with paragraphs 1-3.

Pillar 6: IT General Controls Testing

39. The majority of transactions regarding input and output of data are sent and processed electronically. Consequently, to the extent necessary to support the testing approach, we have tested the design and operating effectiveness of the relevant IT controls in place during the period over these areas.

40. Our testing focused on the following areas, where applicable, in respect of controls owned and operated by the TSOs over the in-scope systems - being MMS, Electronic Dispatch Instruction Logger ("EDIL"), Wind Dispatch Tool and Interconnector Management Platform ("ICMP").

a. Program development;

b. Program changes;

c. Computer Operations; and

d. Access to programs and data.

We noted an ITGC relating to user access which could not be adequately tested due to documentation issues. Furthermore, we identified a number of areas where ITGCs would be expected but were not in place during the period. As set out in Appendix A, in these cases, we were required to complete further substantive testing procedures. Based on the ITGCs which were tested and the substantive testing procedures performed, sufficient evidence was obtained to support our opinion.

Appendix A – Risk and Response

In the table below we have outlined our assessment of the key risks identified by us and the work completed to address those risks. Where relevant, we have also provided detail on the specific results of our work completed. These matters, and any comments we make on the results of our procedures thereon, were addressed in the context of our engagement as a whole, and in forming our opinion thereon, and we do not provide a separate opinion on these matters. This is not a complete list of all risks identified by our engagement.

Risk	Our Response
TSOs action to address prior year findings for the current period: The first formal assurance report that The Transmission Systems Operators were required to obtain was for the 15 month period ending 31 December 2019 and was issued on 27 October 2020, nearly ten months into the period covered by this Report. This increased the risk that observations raised as part of the first formal assurance report would still impact a substantial part of the current reporting period.	We addressed this risk by firstly obtaining a detailed understanding of the underlying subject matter. We also discussed with the TSOs the status of actions undertaken based on items reported by PwC as part of the 15 month Assurance report for the period ending 31 December 2019. From this and our testing, we noted that a number of previously identified points relating to ITGC testing were still relevant. We noted an ITGC relating to user access which could not be adequately tested due to documentation issues. Furthermore, we identified a number of areas where ITGCs would be expected but were not in place during the period. In these cases, we were required to complete further substantive testing procedures. Based on the ITGCs which were tested and the substantive testing procedures performed, sufficient evidence was obtained to support our opinion.
Recreation of Merit Orders: As per the TSOs' Licence obligations, they are required to operate a Merit Order. The TSOs implemented the requirement to operate a Merit Order by using Real Time Merit Orders within MMS, which ranks available plants in price order i.e. economic Merit Order. These Real Time Merit Orders are used by the dispatch engineer in the Control Centre as a guide for dispatching available plants at the most economical prices as and when needed while operating a safe and secure network. The Real Time Merit Orders are refreshed within MMS each 5 minutes (Online Merit Orders) and 15 minutes (Offline Merit Orders). These Real Time Merit Orders within MMS are not stored or backed up once refreshed in MMS. However, as the Real Time Merit Orders are merely a visual representation of data that is available within MMS, it is possible to recreate them by using the data sets stored in "save cases" within MMS for sample days and time periods. The recreation of this system output poses the risk that the recreated Merit Orders are not reflective of the Merit Orders used by the Control Centre in real time for the period, 1 January 2020 – 31 December 2020.	The TSOs created an excel based tool to recreate the Incremental and Decremental Online Merit Orders for sample dates/times selected by us during the in scope period. In order to recreate the Merit Orders for the time period, the following inputs, submitted by participants and available within MMS, were used: RTD Generator Status, Generator Cost Curves and Generator Operating Limits. The TSOs also created an excel based formula template to recreate the Offline Slow Start and Fast Acting Merit Orders. In order to recreate the Merit Orders for the time period, the following inputs, submitted by participants and available within MMS, were used: RTD Generator Start-up Costs, Generator Status, EDIL Real Time output and declaration data, Generator Cost Curve and Generator Operating data. The Online and Offline Merit Order Tools/formulas were tested by us by comparing the results provided by the tools/formulas to real time merit orders in the system to confirm the Merit Orders can be completely and accurately recreated. We concluded based on the testing performed that these tools were fit for purpose for use in the assurance procedures in the current year.

Risk	Our Response
Engineering decisions not most economical: During the dispatch decision making process, factors beyond price (Merit Order) need to be considered including ensuring constraints are met, the required reserve is kept on the system and ensuring frequency remains within the correct parameters. Such factors are required to support overall system security. Deviating from the merit order for factors such as these may not result in the most economical decision but are required to meet the overarching obligation of system security. The ability to deviate from the Merit Order poses the risk that engineering decisions which are not the most economical are made that are not based on other security factors having arisen. This risk is heightened as the reasons for deviating from the Merit Order are not logged by dispatch engineers in real time. Therefore, evidence may not be available to support the TSOs' compliance with their obligations in relation to the Merit Order.	The strict adherence to dispatch in accordance with the merit order will not always be possible as the network needs to be operated safely and securely. For each of the 55 samples tested where the most economical unit was not dispatched a reason and supporting evidence, where required, was requested from the TSOs to explain the deviations. We completed procedures over these reasons including assessing if the deviations fell within the acceptable deviations allowed by the Grid Codes. In one instance where the TSOs were not able to provide detail of the reason for deviating from the Merit Order and a more expensive unit was dispatched while a cheaper unit was available, we undertook additional procedures which identified that the cheaper unit would have been able to respond to the same dispatch instruction based on its technical capability. We then assessed the materiality of this instance and its impact and concluded that it was not material.
Errors in manual input data relating to Constraints: The Licence Condition 10A - Para 4 (a)/(b) and 5(d) of the EirGrid TSO Licence and Licence Condition 22A - Para 4(a)/(b) and 5(d) of the SONI TSO Licence requires that constraints are appropriately scheduled and dispatched. Constraints are manually entered into the systems supporting the scheduling and dispatch process by the TSOs. Due to the manual nature of the process, there is a risk that the TSOs may inadvertently have input errors. Such errors may have an impact on the scheduling and dispatch process and result in a risk of errors in the schedules produced and subsequent dispatch instructions.	To address the risk of inaccurate or incomplete input of constraints into the scheduling and dispatch systems, we performed tests over a sample of days to agree the actual constraints in the scheduling and dispatch systems to the expected constraints published on the EirGrid (www.eirgridgroup.com) and SONI (www.soni.ltd.uk) websites in the Monthly Operational Constraints Update or the relevant scheduling and dispatch procedure document as applicable. We also agreed a sample of expected constraints to the scheduling and dispatch systems. These tests are detailed in paragraphs 34b and 35 of this document. Individual units and constraint limits are mapped to each constraint as applicable. Our test procedures included checking that the units and constraint limits associated with the constraint included in the schedules produced by the scheduling and dispatch system agreed to the expected units and constraint limits for that constraint as published in the Monthly Operational Constraints Update and that both agreed to the subsequent dispatch instructions. From the sample of 115 selected, we identified fifteen instances whereby the jurisdictional Operational Reserve Requirement differed between the scheduling and dispatch system and the expected constraints as published in the Monthly Operational Constraints Update (procedure 34b). Three instances related to a single month in the period where the jurisdictional Operational Reserve (Primary, Secondary and Tertiary Reserve) requirements in Northern Ireland per the system differed to the published Monthly Operational Constraints Update by 2MW. This difference remained until the Operational Reserve Requirements in Northern Ireland were updated to 50MW in the 31 January 2020 Monthly Operational Constraints Update. The remaining twelve instances related to jurisdictional Operational Reserve requirements in the Republic of Ireland. Two of these twelve instances related to a single month in the period where Tertiary Reserve requirements per the system differed to the published Monthly Operational Constraints Update. The remaining ten of these twelve instances related to the update first appearing in the 31 January 2020 Monthly Operational Constraints Update where the Operational Reserve Requirements per the system differed by 1MW to the published Monthly Operational Constraints.

Risk	Our Response
	Constraints will only be updated in the scheduling and dispatch systems when constraints change. Due to this specific constraint only being updated once in the in scope period during January 2020, the initial input error at that time was not identified by the TSOs and remained in place for the remainder of 2020. As procedure 34b is an intermediate step in the overall scheduling and dispatch process, we considered the results of procedures 34c and 34d to assess if the findings noted above impacted on the specific license obligations in relation to scheduling and dispatch of minimum reserve requirements: **Procedure 34c "Checked that the constraints had been accurately used/processed by the optimiser for a sample of LTS runs"** Each LTS run checked in procedure 34c is the produced unit commitment advice which runs up to 30 hours ahead in 30 minute scheduling intervals. In respect of the 15 findings noted, it was confirmed that the reserve requirement was scheduled accurately for 14 samples. For the remaining sample only one of the 56 scheduling intervals that made up the LTS run was not appropriately scheduled. The minimum reserve requirement per the Monthly Operational Constraint update was 155MW. However it was scheduled in the LTS run as 149MW. Considering all other samples selected and tested for procedure 34c, the item was considered as not material. **Procedure 34d "Checked that the constraints had accurately been actioned and maintained by the Control Centre in real time dispatch"** From the 15 findings noted it was confirmed that all minimum Reserve requirements were appropriately maintained in real time. From the assessment completed the constraints were adequately scheduled and dispatched with no material issues noted. We concluded that the incorrect mapping of units for the samples was not a material breach of the TSOs' license agreements as the minimum reserve requirements were scheduled and dispatched in accordance with the Licence Obligations.
Priority Dispatch principles not met: The Licence Condition 10A - Para. 4(a)/(b) & 5(f),(i) of the EirGrid TSO Licence and Licence Condition 9A and 22A - Para. 4(a)/(b) & 5(f),(i) of the SONI TSO Licence and SEM-11-062 requires that the priority dispatch principles are complied with. The reasons for deviating from the priority dispatch hierarchy are not logged by dispatch engineers in real time. This poses a risk that the TSOs are unable to provide evidence to support real time decisions which resulted in a deviation from the hierarchy, and consequently demonstrate adherence with the licence condition noted above.	To address the risk of priority dispatch principles in relation to Constraint and Curtailment not being followed, we performed the tests detailed in paragraphs 18 to 20 of this document over a sample of days. Our test procedures included checking that conventional units and lower priority dispatch units as per SEM-11-062 were turned down to their minimum stable generation and trades were attempted where applicable (test procedure 18b, 18c and 19b). From the 115 samples selected, we identified: **Curtailment (procedure 18b,18c):** For one Curtailment event sampled it was noted that a priority dispatch unit, lower in the SEM-11-062 hierarchy than wind

Risk	Our Response
	units, was providing 3MW to the network above its minimum stable generation at the time that the curtailment event was initiated. As this unit is lower in priority than wind units it should have been turned down to minimise the Curtailment event set point issued to the units. For two curtailment events sampled it was noted that Category I wind farms in Northern Ireland were not dispatched down to zero before Category II wind farms were curtailed. For the instances noted the Category I wind farms were providing 4MW and 11MW at the time of the curtailment events. The total installed capacity of Category I wind farms was 26.9MW. **Constraints (procedure 19b):** For two Constraint events sampled it was noted that priority dispatch units, lower in the SEM-11-062 hierarchy than wind units, were providing 4MW and 3MW to the network above their minimum stable generation at the time that the Constraint event was initiated. As these units are lower in priority than wind units they should have been turned down to minimise the Constraint event set point issued. The samples noted above would not have impacted the need for the Curtailment and Constraint events which would still have occurred and were valid at the sampled time. The only impact of the items noted above would relate to the set points issued as part of the Curtailment or Constraint event. We assessed the materiality of these instances and their impact on the scheduling and dispatch process as a whole. We recalculated set points issued to all wind farms that were included in the Constraint and Curtailment events as if the units that were lower in the SEM-11-062 hierarchy were appropriately turned down to their minimum stable generation to assess the impact against the original set points received. These impacts on individual set points were assessed as being not material. A further assessment was completed to calculate the monetary impact by using the average imbalance price and we concluded that they were not material.
Errors in manual input data relating to the Wind Dispatch Tool: Constraint and Curtailment groups are manually entered into the systems supporting the scheduling and dispatch process by the TSOs. Due to the manual nature of the process, there is an increased risk of input error by the TSOs. Such errors may have an impact on the scheduling and dispatch process and result in errors within the Constraint and Curtailment groups and subsequent set points issued to these groups.	To address the risk of errors within the manually entered Constraint and Curtailment groups used in the scheduling and dispatch process, we performed the tests detailed in paragraphs 18e and 19e of this document over a sample of days. From the 115 samples selected for procedure 19e, one instance was noted where a unit received a set point as part of a Constraint event however was not included in the Constraint group. It was noted that the station where the unit connected to was removed from the South West Constraint Group 1: Moneypoint 400/200kV on 3 April 2020, and should have been removed from the Wind Dispatch Tool. However, the unit incorrectly remained included in the group and received set points for the remainder of the in-scope period. All other wind farms connected to this station were accurately removed from the Wind Dispatch Tool at this time. To assess the impact of the incorrect set points received by this unit during the April 2020 - December 2020 period, the quarterly dispatch down reports for the wind farm were compared to the same information available for wind farms connected to the same station. Our analysis of these reports

Risk	Our Response
	identified that the wind farm in question was constrained on average 6% higher than the average of the wind farms connected to the same station during the April 2020 - December 2020 period. The estimated market impact to the unit was calculated by the TSOs' Settlement team and reviewed by PwC and was assessed as being not material to the scheduling and dispatch process as a whole.
Errors in Non-Marginal flagging for Interconnectors due to increase in trading: A precondition for a Non-Marginal flag on the Interconnectors, EWIC or Moyle, to be created is that a trade should occur. For a large part of the prior in scope period (15 months ending 31 December 2019) Interconnector trading was only enabled for Security reasons which do not include the curtailment of wind. In the current in-scope period, trading for priority dispatch was enabled. This in turn increased the risk of Non-Marginal flags being inaccurately or incompletely created for Interconnectors.	The Trading and Settlement code – Part B, Flagging of Accepted Bids and Offers E.3.3.1 and TSC Part B, APPENDIX N: Flagging and Tagging, System Operator and Non-Marginal Flagging Paragraph 3 requires that Non-Marginal flags are created for each imbalance period. To address the risk of inaccurate or incomplete Non-Marginal flags being created, we performed tests over a sample of days to confirm that flags created in the scheduling and dispatch process for generators and Interconnectors were in line with the Non-Marginal flag criteria. These tests are detailed in paragraphs 37 of this document. From the 55 samples selected, we identified one instance in test procedure 37c whereby the Non-Marginal flag for the Moyle Interconnector was noted with a flag of "1" (not flagged) instead of "0" (flagged) for one imbalance period (5 minute period). Through further investigation it was confirmed by the TSOs that the original flag criteria used to create Non-Marginal flags for Interconnectors did not take into account the "deadband" on Moyle. Deadband occurs when the Interconnector is switching from/to importing from/to exporting and, based on the Interconnector's design, cannot be scheduled anywhere between 15MW or -15MW (the deadband). The impact of this error is that for every Interconnector trade on Moyle where the Interconnector also moved through the deadband, an incorrect flag was created for a 5 minute period. We assessed the materiality of this error and concluded that it was not material.
Severe System failures (failure of the scheduling and dispatch systems and other events that prevented the TSOs from utilising the in-scope systems to complete the scheduling and dispatch processing for a continuous period of 24 hours or more): Severe System failures may require the operations staff to: - Perform certain actions and subsequently recover systems and potentially data; or - Take special decisions to ensure continuity of the scheduling and dispatch process. Such events increase the risk of error or actions that are not consistent with The Requirements.	Through discussion with The Transmission System Operators, and review of: a. SEMO publications; b. Meeting minutes of the Board of Directors; and c. System data we have identified no such severe system failures or events impacting the period.

Risk	Our Response
Operation of the scheduling and dispatch process during prolonged planned computer system outages (planned outages of the scheduling and dispatch computer systems that prevented the TSOs from utilising the inscope systems to complete the scheduling and dispatch processing for a continuous period of 24 hours or more): Scheduling and dispatch systems outages can be planned or unplanned and occur due to various reasons. Unplanned outages for a continuous 24 hour period or more are regarded as system failures. The duration of planned outages can vary and consequently The Transmission System Operators response will depend on the conditions existing during the outage. During some outages data is required to be input manually into the system and there is a greater risk of error than where this is performed electronically using a stable and proven system. Also, where an outage, including an outage of communication links, requires fall back to manual processes there is again a greater risk of error as operations staff implement processes they are less familiar with.	Through discussion with The Transmission System Operators, and review of: a. SEMO publications; b. Meeting minutes of the Board of Directors; and c. System data we have identified no such system failures or events impacting the period.

Appendix B – Glossary of terms

CRU	Commission for Regulation of Utilities
EDIL	Electronic Dispatch Instruction Logger
ICMP	Interconnector Management Platform
ITGCs	Information Technology General Controls
LNAF	Long-Notice Adjustment Factor
LTS	Long-Term Scheduling
MMS	Market Management System
MPI	Market Participant Interface
MW	MegaWatt
PwC	PricewaterhouseCoopers
RTC	Real Time Commitment
RTD	Real-Time Dispatch
SIFF	System Imbalance Flattening Factors
TSC	Trading and Settlement Code
TSOs	Transmission System Operators, EirGrid plc and SONI Limited
UR	Utility Regulator

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