COMPLIANCE AUDIT REPORT
CREOS LUXEMBOURG S.A.

16. – 17.10.2012

COMPLIANCE AUDIT CONDUCTED IN HEISDORF BY THE
ENTSO-E RG CE SG COMPLIANCE MONITORING &
ENFORCEMENT
AT THE CONTROL CENTRE OF THE ENTSO-E MEMBER
CREOS
DISCLAIMER

The present Compliance Audit Report is based on the information as provided by the audited company. This report is in no way a guarantee that security and reliability on the system of the audited company and/or on the whole synchronously interconnected system of the Regional Group Continental Europe (RGCE) is ensured. This report cannot be considered as a certification of whatever form. Finally, this report does not as such have any impact on the compliance, by the audited company and/or by any other member of ENTSO-E, with the RGCE Operation Handbook and/or any other relevant applicable standard.
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1 EXECUTIVE SUMMARY

1.1 COMPLIANCE MONITORING IN ENTSO-E RGCE

The mission of the ENTSO-E System Operation Committee Regional Group Continental Europe (RGCE) is to improve the reliability and security of the interconnected power system in the Continental Europe through developing and enforcing RGCE Operation Handbook (OH) standards, monitoring the interconnected power system and assessing its future adequacy. The RGCE member TSOs are subject to compliance with all approved OH standards. The Compliance Monitoring Program (CMP) is the RGCE program that monitors and assesses compliance with these standards via:

- the annual process of self-assessment, which is applied to all TSOs, as well as
- the annual process of mandatory on-site compliance audits, which is applied to a certain number of TSOs chosen on a rotating base either directly (in case of doubts that a certain TSO complies with OH Standards) or by random.

SG Compliance Monitoring & Enforcement (CME) is in charge of performing above mentioned two processes. The 2012 is the third year of conducting mandatory compliance audits. SG CME performed four voluntary compliance audits in 2008-2009 and twelve mandatory audits in 2010-2011.

1.2 AUDITED TSO

The RGCE member TSO Creos was chosen for a Compliance Audit in 2012. CME conducted the audit on 16 - 17.10.2012 at the control centre of Creos in Heisdorf, Luxembourg.

1.3 AUDITED OH STANDARDS

The Compliance Audit encompassed 17 standards of Operation Handbook Policy 5 which are related to Emergency Operations. In 2011 Creos made compliance declarations in the self-assessment process for all standards which will be checked against their evidence during the audit.

1.4 RESULTS

A comprehensive presentation of Creos, Creos’ grid and visiting Creos’ control room in Heisdorf helped the auditors to better understand the special position of Creos.

In Creos’ HV grid there is no bigger generation unit and the Luxembourgian domestic energy production was 13 % of annual demand in 2011 and the peak demand was 770 MW in 2011. The two biggest power plants in Luxembourgian area are unfortunately connected to foreign grid, The pumped hydro power plant of SEO at Vianden (1096 MW) is connected directly to Amprion grid and the thermal gas power plant CCGT of Twinerg (395 MW) is connected via Sotel grid to Elia grid.

Creos was well prepared for the Audit. The Creos representatives provided necessary documentation and answered questions in a competent way and gave detailed explanations.

CREOS is fully compliant with 6 audited standards, sufficiently compliant with 3 standards and noncompliant with 4 standards of 17 audited standards. Audit team decided that 4 standards of 17 audited standards, related to over/under frequency management, black start capability tests and LFC modes, are not applicable for Creos while these services are outsourced to Amprion.

The table 1 describes Creos’ compliance declaration in self assessment questionnaire 2011 and compliance audit questionnaire 2012 with compliance level suggestion by CME audit team after reviewing the evidence for the audited standards. Upgrades are highlighted with green and downgrades with red colour. Standards which kept their declaration level are not highlighted.
### Table 1: Compliance level changes for the audited OH standards

<table>
<thead>
<tr>
<th>OH Standard</th>
<th>Self assessment questionnaire 2011</th>
<th>Compliance audit questionnaire 2012</th>
<th>On site compliance audit 2012</th>
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<tr>
<td>P5-A-S1</td>
<td>FC</td>
<td>FC</td>
<td>NC</td>
</tr>
<tr>
<td>P5-A-S2</td>
<td>FC</td>
<td>FC</td>
<td>NC</td>
</tr>
<tr>
<td>P5-A-S3</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-B-S1</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-B-S3.1</td>
<td>SC</td>
<td>FC</td>
<td>NC</td>
</tr>
<tr>
<td>P5-B-S5.2</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-B-S6.3</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>P5-B-S6.4</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>P5-B-S6.4.1.1</td>
<td>SC</td>
<td>SC</td>
<td>SC</td>
</tr>
<tr>
<td>P5-B-S6.4.1.2</td>
<td>SC</td>
<td>FC</td>
<td>NC</td>
</tr>
<tr>
<td>P5-B-S6.4.1.3</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
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<tr>
<td>P5-C-S1.2</td>
<td>FC</td>
<td>FC</td>
<td>SC</td>
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<tr>
<td>P5-C-S1.2.1.1</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
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<tr>
<td>P5-C-S1.2.1.2</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-C-S1.2.1.3</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>P5-C-S2.3</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>P5-C-S3.6</td>
<td>FC</td>
<td>FC</td>
<td>SC</td>
</tr>
<tr>
<td>P5-C-S3.7</td>
<td>Compliance level evaluation is not performed by the audit team (see section 4.18)</td>
<td></td>
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</tbody>
</table>
2 Audit Representatives

The Audit Team has the task to prepare and perform the Compliance Audit as well as to develop the corresponding audit report. The audit team composition is given on table 2. The TSO subject to a compliance audit may object any member of the Audit Team on the basis of a conflict of interests or the existence of other circumstances that could interfere with the impartial performance of his or her duties. The audited TSO is obliged to express its concerns with the proposed team member four weeks prior to the team’s arrival on-site. The Creos didn’t make any such objection. The Creos staff present during the compliance audit is given on table 3.

**Table 2. CME Audit Team for Creos**

<table>
<thead>
<tr>
<th>Audit Team role</th>
<th>Company or association</th>
<th>Name</th>
<th>Email address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audit Team Leader</td>
<td>ELES</td>
<td>Gorazd Sitar</td>
<td><a href="mailto:gorazd.sitar@eles.si">gorazd.sitar@eles.si</a></td>
</tr>
<tr>
<td>Audit Team Member</td>
<td>IPTO SA</td>
<td>Yiannis Tolias</td>
<td><a href="mailto:tolias@admie.gr">tolias@admie.gr</a></td>
</tr>
<tr>
<td>Audit Team Member</td>
<td>50Hertz</td>
<td>Ana Cigará Romero</td>
<td><a href="mailto:Ana.CigaranRomero@50hertz.com">Ana.CigaranRomero@50hertz.com</a></td>
</tr>
<tr>
<td>Compliance Monitoring Advisor</td>
<td>ENTSO-E Secretariat</td>
<td>Lasse Konttinen</td>
<td><a href="mailto:lasse.konttinen@entsoe.eu">lasse.konttinen@entsoe.eu</a></td>
</tr>
</tbody>
</table>

**Table 3. Creos Audit Staff**

<table>
<thead>
<tr>
<th>Function in the company</th>
<th>Title</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Area Manager</td>
<td>Head of Dispatching Department</td>
<td>Carlo Bartocci</td>
</tr>
<tr>
<td></td>
<td>Head of High Voltage Dispatching</td>
<td>Paul Hulten</td>
</tr>
</tbody>
</table>
**3 Audit Plan**

**3.1 General Procedures**

The purpose of this chapter is to help and provide guidance to your organization regarding the oncoming Compliance Audit. The audit will cover a chosen set of Operation Handbook (OH) standards equivalent to those monitored within the Compliance Monitoring Program 2011 self-assessment process.

Please submit the completed Audit Worksheet by email to the ENTSO-E Secretariat and send carbon copies to all Audit Team members three weeks before the first audit day. On table 4, you may find the complete schedule of the audit process for your company.

All documentation (evidence) required for the onsite audit of each standard must be available as a hard copy or in electronic format at the audit location. The Control Area Manager and/or other responsible expert personnel must be available during the audit to provide guidance to the Audit Team on where to look in the documentation for compliance to the OH standard and, if requested, to give further explanation on criteria and procedures implemented.

In preparation for the audit, please organise your supporting compliance documentation which is the evidence for your compliance for audited standards. If possible, please try to provide English versions of the documents. Otherwise please translate the main title, index and last update of the document for the Audit Team. Previously mentioned preparations must be completed prior to the start of the audit. The ENTSO-E RGCE SG CME would like to emphasize the importance of preparation for the audit. All documentation will be considered as confidential audit records and treated as such. The Audit Team will prepare a public report of its audit findings.

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<td><strong>Objection or concern about audit team personnel</strong></td>
</tr>
<tr>
<td><strong>Submittal of the completed Audit Worksheet to the Audit Team by CREOS</strong></td>
</tr>
<tr>
<td><strong>Initial draft of the audit report based on the Audit Worksheet sent to CREOS by the Audit Team</strong></td>
</tr>
<tr>
<td><strong>Opening meeting of the Audit Team and CAM of CREOS</strong></td>
</tr>
<tr>
<td>(1) Introduction of the Audit Team members,</td>
</tr>
<tr>
<td>(2) Description of how the on-site audit will be conducted,</td>
</tr>
<tr>
<td>(3) Discussion on how confidential information will be handled,</td>
</tr>
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<td>(4) Discussion on data access required by the Audit Team,</td>
</tr>
<tr>
<td>(5) Announcement that the CREOS will be asked to provide feedback on the audit process and results,</td>
</tr>
<tr>
<td>(6) Presentation of the TSO and TSO’s organization</td>
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<tr>
<td>(7) Visit at the control room</td>
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<tr>
<td><strong>Start of the OH standards’ review</strong></td>
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</tbody>
</table>
### 3.2 Objectives

The objective of Compliance Audits in 2012 is to check chosen set of standards from OH Policy 5. These standards were also monitored in the 2011 regular compliance process via the self-assessment questionnaire. Furthermore, before performing the Compliance Audit, the Audit Team makes recommendations to the audited TSO to prepare the evidence or documentation on compliance with the audited OH standards.

### 3.3 Scope

The scope of a compliance audit encompasses issues which are directly related to the compliance of the audited TSO with the investigated RGCE OH standards and issues which make a general background for the implementation of the OH at the audited TSO.

#### Directly related issues

Issues directly related to the audited RGCE OH standards:

- Existence of TSO’s addenda and/or non-compliance declarations/non-compliance self-reports
- Follow-up of the TSO’s mitigation plans to remove the declared non-compliances
- Self-assessment questionnaires of 2011 stored at the ENTSO-E Secretariat related to audited TSO concerning the audited OH standards
- Audit Worksheet (AW) 2012
- Information and explanations which the Audit Team receives on site

#### General background
The compliance audit also encompasses issues of general nature listed below:

- General policies of the audited TSO rules and procedures for the control centre(s) related to the audited standards
- Procedures to control the application of the audited OH standards and their follow-up
- Procedures to improve the compliance with the audited OH standards
- TSO’s internal report related to the implementation of the audited OH standards
- TSO’s internal audits and/or documentation concerning implementation of OH standards
- TSO’s internal bodies (forums, panels) for the implementation of the OH standards

3.4 METHODOLOGY

The CME group prepared an audit schedule defining the chronological order of the compliance audit, which the audited TSO accepted without comment. The audit team reviewed the existing material on the audited TSO and its neighbouring TSOs already collected through the self-assessment process in the 2011 self-assessment questionnaires. It also processed (assessed) the answers in the 2012 Audit Worksheet filled in by the audited TSO.

The methodology includes audit criteria and expectations based on best practices. The adopted criteria are objective, measurable (if possible), complete and relevant to the objectives. At defining the audit methodology, the auditors identify the potential sources of audit evidence and estimate the amount and type of evidence needed.

The audit team uses an Audit Worksheet (see chapter 4) for reviewing the audited OH standards. The purpose of the AW is to ensure consistency and fairness. By using the AW the Audit Team documented the material reviewed and the observations made. One of the main reasons for an on-site visit is to review the existing documentation and to interview the staff. Thus, the auditors obtain “objective evidence” which support the self-assessed declarations of the audited TSO. The audit team determine whether the evidence presented by the TSO is sufficient. They do this by assessing the relevance, validity and reliability of the information and documentation presented.

It is the responsibility of the audited TSO to provide evidence of compliance with all audited OH standards. In most cases the evidence is in written form like documents, plans, programs or records. In some cases the evidence is a review of computerized records or additional supporting material provided at interviews with the staff of the audited TSO.

3.5 EVALUATION PRINCIPLES

Preparatory phase – activities in charge of Audited TSO

- Inspection of the exact wording of each audited OH standard and of additional questions formulated by the CME
- The TSO must fill in the audit questionnaire and submit to the audit team before the audit
- Identification of documents and other material the TSO has to present to the auditors in order to demonstrate its compliance level with each OH standard

Preparatory phase – activities in charge of CME Audit team

- Identification of compliance level declaration inconsistency with neighbouring TSOs (Self-assessment questionnaire 2011 cross-border check regarding compliance level declarations)
- Analysis of the explanations and comments which the audited TSO made in the self-assessment 2011 and audit questionnaires 2012 in written form in order to evaluate the quality of explanations and comments.
- Identification of the missing explanations in the self-assessment 2011 and audit questionnaire 2012
• Analysis of the improvements achieved during the implementation of mitigation and improvement plans declared in the MLA Addendum/Addenda, in the self-assessment questionnaire 2011 and in the Audit Worksheet 2012 in case of non compliance and sufficient compliance

Audit phase

• Request to the audited TSO to give additional explanations, especially related to standards which were not or not fully addressed by documents and other material mentioned in the self-assessment questionnaire 2011 and audit questionnaire 2012.
  o The goal is to improve the quality of the explanations
• Request to the audited TSO to present that evidence and, if necessary, additional evidence, in printed or electronic form
  o The goal is to improve the quality of the presented evidence
  o The presented material must be relevant to the audited OH standard at all,
• Request to the audited TSO to remark the titles of all presented documents, their relevant chapters and even relevant passages
• Request to the audited TSO to provide further written explanations related to the presented material

3.6 CONFIDENTIALITY

By signing this report the audit team members assure that they will maintain the confidentiality of information obtained during the compliance audit and drafting of the audit report. Moreover, they express their readiness to sign a supplementary confidentiality agreement, if the audited TSO assert such a claim.
4 Audit Work Sheet

4.1 P5-A-S1 Appreciation of TSO System States

Preparatory Phase

Self-Assessment Questionnaire 2011

P5-A-S1
Appreciation of TSO system states. The system state is determined by the constrained TSO according to its N-1 security assessment, based on potential influence on neighbouring systems taking into account the efficiency of remedial actions.

Compliance Level: FC

Explanation for the full compliance declaration:
The SCADA system in the operation center is able to monitor the network state in real time. Due to the fact that the HV grid is very small compared to other TSOs and that no large generators are connected to the Creos Grid, a N-1 security calculation was not necessary. As the SCADA system is currently being upgraded, a N-1 security calculation will nevertheless be implemented.

Additional Questions
Do you have tools/procedures to assess system state of your own system in real time? yes

Audit Questionnaire 2012

P5-A-S1 Appreciation of TSO System States. The system state is determined by the constrained TSO according to its N-1 security assessment, based on potential influence on neighbouring systems taking into account the efficiency of remedial actions.

Compliance level FC ☒ SC ☐ NC ☐

Concise explanation and list of evidences for declared compliance level:
The SCADA system in the operation center is able to monitor the network state in real time. Due to the fact that the HV grid is very small compared to other TSOs (only 127 km 220 kV line no 400 kV) and that no large generators are connected to the Creos Grid, a N-1 security calculation was up to now not necessary. As the SCADA system is currently being upgraded, a N-1 security calculation will nevertheless be implemented.
Do you have a mitigation plan to the standard?  Yes ☐ No ☐

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for a mitigation plan, comments:


Do you have tools/procedures to assess system state of your own system in real time?
Yes ☒ No ☐
List of evidences, comments:

SCADA documentation; visit of control room

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
NC

Explanation for the suggested compliance level:
Creos SCADA does not have N-1 security analysis tool at the moment. The future upgrade of SCADA will include also security analysis tools. Creos relies on its dispatchers’ experience to assess system security situation. A human estimate can give adequate results for the security analysis due to Creos’ small grid size. Creos does not have written criteria for appreciation of system states. They rely on dispatcher assessment on the system state. “Agreement on Grid and System Operation Management between Creos and Amprion” chapter 3.5.4. states that Amprion and Creos are both responsible for system security in their own grid area.

Creos is non compliant to the standard as the standard explicitly demands for N-1 assessment and appreciation of system state which are not present at the moment.

Mitigation plan with deadline:
Creos already has an offer by Psi (the SCADA system vendor) to include N-1 security analysis tool into the system in the context of currently ongoing upgrade of the SCADA system. Creos will order this tool and it will be implemented by the end of 2013.

Together with Amprion, Creos will review chapter 3.5.4 of the Agreement on Grid and System Operation Management concluded between Creos and Amprion to include written criteria for the appreciation of system states. This implementation will be finished by mid 2013 at the latest.

4.2 P5-A-S2 INFORMATION BETWEEN CONTROL ROOMS BY THE CONSTRAINED TSO

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

<table>
<thead>
<tr>
<th>P5-A-S2</th>
</tr>
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<tbody>
<tr>
<td>Information between control rooms by the constrained TSO. The constrained TSO has to inform at least all direct neighbouring TSOs about the state of its own system.</td>
</tr>
<tr>
<td>Compliance Level: FC</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Amprion</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
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</table>

Explanation for the full compliance declaration:

The Creos SCADA System is connected to the Amprion control center via TASE 2. Amprion is able to see in real time our complete HV Grid and Creos is able to see the first mesh in the Amprion grid. Creos also delivers input values to the realtime alarm and awareness system (RAAS) of Amprion.

Additional Questions

Do you have procedures with direct neighbours for information on system states? yes

AUDIT QUESTIONNAIRE 2012

P5-A-S2 INFORMATION BETWEEN CONTROL ROOMS BY THE CONSTRAINED TSO.
The constrained TSO has to inform at least all direct neighbouring TSOs about the state of its own system.

Compliance level FC ☒ SC ☐ NC ☐

Concise explanation and list of evidences for declared compliance level:

The Creos SCADA System is connected to the Amprion control center via TASE 2. Amprion is able to see in real time our complete HV Grid and Creos is able to see the first mesh in the Amprion grid. Creos also delivers input values to the realtime alarm and awareness system (RAAS) of Amprion. Agreement on Grid and System Operation Management, chapter 3.5 signed in May 2012.

Do you have a mitigation plan to the standard? Yes ☒ No ☐

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for
a mitigation plan, comments:

--------------------------------------------------------------------------------------------------------------------------

Do you have procedures with direct neighbours for information on system states?

<table>
<thead>
<tr>
<th>Neighbour</th>
<th>Yes</th>
<th>No</th>
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<td>Amprion</td>
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</table>

List of evidences, comments: Agreement on Grid and System Operation Management, chapter 3.5 signed in May 2012

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
NC

Explanation for the suggested compliance level:
Amprion can observe whole Creos 220 kV grid in its SCADA and Creos can see first loop in Amprion's grid in its SCADA. Creos informs failure of a critical element in their grid to Amprion. The Creos' critical elements are defined in "Agreement on Grid and System Operation Management between Creos and Amprion", 26.9.2012, annex 5a "Grid elements with inter-regional relevance". The chapter 3.5.4 defines common actions on "Measures taken to restore the (N-1) grid security".

Creos does not have written rules for appreciation of system states which makes it impossible to communicate them to Amprion.

Mitigation plan with deadline:
Together with Amprion, Creos will review chapter 3.5.4 of the Agreement on Grid and System Operation Management concluded between Creos and Amprion to include written criteria for the appreciation of system states. This implementation will be finished by mid 2013 at the latest.

Deadline: 30.06.2013
4.3  **P5-A-S3** INTER-TSO CONTACT LISTS FOR SYSTEM OPERATION

**PREPARATORY PHASE**

**SELF-ASSESSMENT QUESTIONNAIRE 2011**

<table>
<thead>
<tr>
<th><strong>P5-A-S3</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter-TSO Contact lists for system operation. Inter-TSO agreements shall include a list of functional positions directly involved in the system operation to be contacted at any time with phone numbers, fax numbers and e-mail addresses that shall be provided by all TSOs and regularly updated. This list includes desks of control rooms and the relevant staff. All critical information about real-time operation shall be sent to these TSO counterparts.</td>
</tr>
</tbody>
</table>

| **Compliance Level:** FC |

**Amprion**

**Explanation for the full compliance declaration:**

Creos has a contact list to Amprion, Sotel and Elia with functional positions which are involved in system operation. This list is an annex to our internal "Manuel de gestion de crises" (Crisis management handbook) and is also part of annex 17 of the Agreement on Grid and System Operation Management with Amprion.

**Additional Questions**

Does your control room have contact lists for immediate communication with neighbouring TSOs?

**Amprion**

yes

**AUDIT QUESTIONNAIRE 2012**

**P5-A-S3** INTER-TSO CONTACT LISTS FOR SYSTEM OPERATION. Inter-TSO agreements shall include a list of functional positions directly involved in the system operation to be contacted at any time with phone numbers, fax numbers and e-mail addresses that shall be provided by all TSOs and regularly updated. This list includes desks of control rooms and the relevant staff. All critical information about real-time operation shall be sent to these TSO counterparts.

<table>
<thead>
<tr>
<th><strong>Compliance level</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>FC ☒ SC ☐ NC ☐</td>
</tr>
</tbody>
</table>
Concise explanation and list of evidences for declared compliance level:

Creos has a contact list to Amprion, Sotel and Elia with functional positions which are involved in system operation. This list is an annex to our internal "Manuel de gestion de crises" (Crisis management handbook) and is also part of annex 17 of the Agreement on Grid and System Operation Management with Amprion.

Do you have a mitigation plan to the standard? Yes ☐ No ☐

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for a mitigation plan, comments:

--------------------------------------------------------------------------------------------------------------------------

Does your control room have contact lists for immediate communication with neighbouring TSOs?

<table>
<thead>
<tr>
<th>Neighbour</th>
<th>Yes</th>
<th>No</th>
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<td>Amprion</td>
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</table>

List of evidences, comments:

AGREEMENT ON GRID AND SYSTEM OPERATION MANAGEMENT SIGNED BETWEEN AMPRION AND CREOS and crisis management handbook

Do you regularly (e.g. once per year) update your contact list and send it to the neighbouring TSO?

<table>
<thead>
<tr>
<th>Neighbour</th>
<th>Yes</th>
<th>No</th>
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<tbody>
<tr>
<td>Amprion</td>
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</tbody>
</table>
List of evidences, comments: idem

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
"Agreement on Grid and System Operation Management between Creos and Amprion" annex 17
"Communication links" contains inter-TSO contact lists for system operation. The contact lists are updated on need basis. Creos control room had up-to-date version of the lists.
4.4 P5-B-S1 INTER-TSO CO-ORDINATION

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

P5-B-S1
Inter-TSO co-ordination. For emergency issues TSOs have to agree in writing on bilateral/multilateral procedures with all their neighbours.

Compliance Level: FC

Amprion

Explanation for the full compliance declaration:
The related rules and procedures are defined in the Agreement on Grid and System Operation Management with Amprion.

Additional Questions

Do you have written agreements concluded with all adjacent TSOs which take into consideration emergency procedures?

Amprion
yes

AUDIT QUESTIONNAIRE 2012

P5-B-S1 INTER-TSO CO-ORDINATION. For emergency issues TSOs have to agree in writing on bilateral/multilateral procedures with all their neighbours.

Compliance level  FC ☒  SC ☐  NC ☐

Concise explanation and list of evidences for declared compliance level:
The related rules and procedures are defined in the Agreement on Grid and System Operation Management with Amprion.

Do you have a mitigation plan to the standard? Yes ☐  No ☐

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for
Which emergency issues do you consider in your bilateral/multilateral procedures? (e.g. changes of network topology, cross-border re-dispatching, counter-trading, transaction curtailment, emergency energy assistance…)

change of network topology, emergency energy assistance

List of evidences, comments:

AGREEMENT ON GRID AND SYSTEM OPERATION MANAGEMENT SIGNED BETWEEN AMPRION AND CREOS

Do you have written agreements concluded with all adjacent TSOs which take into consideration emergency procedures?

<table>
<thead>
<tr>
<th>Neighbour</th>
<th>Yes</th>
<th>No</th>
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<tr>
<td>Amprion</td>
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</table>

List of evidences, comments:

Agreement on Grid and System Operation Management signed between Amprion and Creos

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:

FC

Explanation for the suggested compliance level:
"Agreement on Grid and System Operation Management between Creos and Amprion" chapter 3.4.9 defines "emergency switching operations" which allow switching of network elements prior informing neighbouring TSO. Also annex 7 "Voltage limit values" and annex 8 "Congestion values and settings of protection systems" defines critical voltage and current on tie-lines between Creos and Amprion.
Creos does not have any additional written bilateral measures for emergency actions with Amprion. Audit Team suggests elaborating the procedure on chapter 3.4.9. with Amprion.
4.5 **P5-B-S3.1 BACK-UP OF CONTROL ROOM FUNCTIONS**

**PREPARATORY PHASE**

**SELF-ASSESSMENT QUESTIONNAIRE 2011**

**P5-B-S3.1**

Back-up of control room functions. The control room functions shall be backed up to face any damage to the main installations. This shall be activated within less than three hours and tested for operation at least once a year.

**Compliance Level:** SC

**Actions taken to reach compliance:**

The SCADA system is duplicated physically in Heisdorf and a back-up system is located on another geographical site. This back-up system is in cold stand-by and has to be activated manually as well as the switching of the gateways and the telecommunication lines. We estimate that it will take 3 hours to have the cold back-up system fully operational. The back-up system (cold stand-by) has not been tested yet (risk of switching from the active system to the cold stand-by is judged as too high). Creos is currently upgrading its SCADA system. In the wake of this process, the cold stand-by will be eliminated and replaced by a hot-standy. The automatic switching from one site to another site should then be feasible within minutes. It should also be mentioned that SCADA clients exists in Schifflange, Roosevelt (City of Luxembourg) and Wiltz. From all these sites it is possible to control the HV grid.

**Deadline:** 1\2013

**Additional Questions**

Do you have a back-up of control room functions in separate locations?  yes

**AUDIT QUESTIONNAIRE 2012**

**P5-B-S3.1 BACK-UP OF CONTROL ROOM FUNCTIONS.** The control room functions shall be backed up to face any damage to the main installations. This shall be activated within less than three hours and tested for operation at least once a year.

**Compliance level**  
- FC  
- SC  
- NC

Concise explanation and list of evidences for declared compliance level:

The SCADA system is duplicated physically in Heisdorf and a back-up system is located on another geographical site. This back-up system is in cold stand-by and has to be activated manually as well as the switching of the gateways and the telecommunication lines. We estimate that it will take 3 hours to have the cold back-up system fully operational. The back-up system (cold stand-by) has
not been tested yet (risk of switching from the active system to the cold stand-by is judged as too high). Creos is currently upgrading its SCADA system. In the wake of this process, the cold stand-by will be eliminated and replaced by a hot-standy. The automatic switching from one site to another site should then be feasible within minutes. It should also be mentioned that SCADA clients exists in Schifflange, Roosevelt (City of Luxembourg) and Wiltz. From all these sites it is possible to control the HV grid.

Do you have a mitigation plan to the standard? Yes ☐ No ☐

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for a mitigation plan, comments:

---

Do you have a back-up of control room functions in separate locations?

Yes ☒ No ☐

List of evidences, comments:

- Scada documentation

How often do you test such ability?

not yet tested

List of evidences, comments:

---

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:

NC

Explanation for the suggested compliance level:

Creos has not a written procedure on transfer of control centre functions and has not tested the back up control room. All dispatchers have visited the back up control room which is in cold standby mode.

Due to missing tests and procedures the back up control room cannot be proved as operational which makes Creos non compliant to the standard.

Mitigation plan with deadline:

Written procedures for transferring the control centre functions to the back-up control room will be delivered by end of 2013. These procedures will be mainly influenced by the currently ongoing process of upgrading the SCADA system. The testing of these procedures will be done during the first semester of 2014. Deadline: 30.06.2014
4.6 **P5-B-S5.2 Tie lines opening policy**

**Preparatory phase**

**Self-assessment questionnaire 2011**

<table>
<thead>
<tr>
<th>P5-B-S5.2</th>
<th>Tie lines opening policy. Disconnection from the synchronous system will be considered the ultimate remedial action and will only be undertaken after coordination with the neighbouring TSOs ensuring that this action will not endanger the remaining synchronous area. Keeping the interconnection in operation as long as possible is of utmost importance, but shall be consistent with the operating constraints. Therefore any manual emergency opening of tie lines shall be announced in advance, predefined and duly prepared in a coordinated way with the neighbouring TSO. Opening of a tie line has to be assessed and agreed upon in advance in a transparent way.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance level:</td>
<td>FC</td>
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<tr>
<td>Ampron</td>
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<tr>
<td>Explanation for the full compliance declaration:</td>
<td>The procedures for switching the tie lines are described in the The basic philosophy is to use as long as possible the supporting effect of the interconnected system (as long as interconnected grid operation is possible. Creos will only open the tie line recloser when no voltage is supplied from Ampron (horizontal grid sectioning).</td>
</tr>
<tr>
<td>Additional questions</td>
<td>Is your tie line opening policy (automatic or manual) coordinated with all concerned neighbouring TSOs?</td>
</tr>
<tr>
<td>Ampron</td>
<td>yes</td>
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</tbody>
</table>

**Audit questionnaire 2012**

**P5-B-S5.2 Tie lines opening policy.** Disconnection from the synchronous system will be considered the ultimate remedial action and will only be undertaken after coordination with the neighbouring TSOs ensuring that this action will not endanger the remaining synchronous area.

Keeping the interconnection in operation as long as possible is of utmost importance, but
shall be consistent with the operating constraints. Therefore any manual emergency opening of tie lines shall be announced in advance, predefined and duly prepared in a coordinated way with the neighbouring TSO.

- Opening of a tie line has to be assessed and agreed upon in advance in a transparent way; automatic opening may be performed when given events occur and if certain thresholds are exceeded (e.g. overload damage of the equipment).
- Urgent opening can be carried out in case of physical danger to human beings or installations without prior information to neighbouring TSOs involved.

**Compliance level**

<table>
<thead>
<tr>
<th>FC</th>
<th>SC</th>
<th>NC</th>
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Concise explanation and list of evidences for declared compliance level:

The procedures for switching the tie lines are described in the AGREEMENT ON GRID AND SYSTEM OPERATION MANAGEMENT SIGNED BETWEEN AMPRION AND CREOS. The basic philosophy is to use as long as possible the supporting effect of the interconnected system (as long as interconnected grid operation is possible). Creos will only open the tie line recloser when no voltage is supplied from Amprion (horizontal grid sectioning).

**Do you have a mitigation plan to the standard?**

Yes ☐  No ☐

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for a mitigation plan, comments:

--------------------------------------------------------------------------------------------------------------------------

Is your tie line opening policy (automatic or manual) coordinated with all concerned neighbouring TSOs?

<table>
<thead>
<tr>
<th>Neighbour</th>
<th>Yes</th>
<th>No</th>
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List of evidences, comments:

AGREEMENT ON GRID AND SYSTEM OPERATION MANAGEMENT SIGNED BETWEEN AMPRION AND CREOS chapter 3.4.9 switching in emergency cases
AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
"Agreement on Grid and System Operation Management between Creos and Amprion" chapter 3.4.9 defines "emergency switching operations". Creos wants to keep tie-lines closed at the latest possible moment due to nature of their grid structure as it has low amount of production. Amprion and Creos have installed overcurrent protection on tie-lines but otherwise disconnection is manual.
4.7 **P5-B-S6.3 MANAGEMENT OF ENTSO-E RG CE OVER-FREQUENCY**

**PREPARATORY PHASE**

**SELF-ASSESSMENT QUESTIONNAIRE 2011**

<table>
<thead>
<tr>
<th>P5-B-S6.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management of ENTSO-E RG CE over-frequency. In case the system frequency is still higher than a dedicated threshold (50.2 Hz), TSOs shall take additional manual (or automatic if available) actions to decrease the frequency (i) through starting pumped-storage power plants or (ii) decreasing the level of generation of active power by activating extra primary reserve if available (next steps under the leadership of the frequency leader - refer to §C).</td>
</tr>
</tbody>
</table>

**Compliance Level:** N / A

**Explanation for the not applicable declaration:**
Creos has no means for load frequency control. This task is taken over by Amprion. See also reply to Standard P5-B-S6.1.

**Additional Questions**

- Do you have procedures to limit the output power of power plants? **no**
- Do you have procedures to start pumps in case of over-frequency? **no**

**AUDIT QUESTIONNAIRE 2012**

**P5-B-S6.3 MANAGEMENT OF ENTSO-E RG CE OVER-FREQUENCY.** In case the system frequency is still higher than a dedicated threshold (50.2 Hz), TSOs shall take additional manual (or automatic if available) actions to decrease the frequency (i) through starting pumped-storage power plants or (ii) decreasing the level of generation of active power by activating extra primary reserve if available (next steps under the leadership of the frequency leader - refer to §C).

**Compliance level**

- FC [ ]
- SC [ ]
- NC [ ]

Concise explanation and list of evidences for declared compliance level:

Compliance level: not applicable. Creos has no means for load frequency control. This task is taken over by Amprion. See also reply to Standard P5-B-S6.1.

**Do you have a mitigation plan to the standard?**

- Yes [ ]
- No [x]

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for
a mitigation plan, comments:

Do you have procedures to limit the output power of power plants?
Yes ☐ No ☒
List of evidences, comments:

Do you have procedures to start pumps in case of over-frequency?
Yes ☐ No ☒
List of evidences, comments:

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
N/A

Explanation for the suggested compliance level:
The Luxembourgian domestic energy production was 13% of annual demand in 2011. Creos acquires over/under frequency management from Amprion as an ancillary service.

"Vereinbarung über Inanspruchnahme von Netzinfrastruktur und der Bereitstellung von Systemdienstleistungen sowie deren Abrechnung", from 17.11.2008 defines Creos' acquirement of primary, secondary, tertiary reserves, load frequency control and voltage control from Amprion.

The standard is not applicable to Creos as it has outsourced under-/over-frequency management to Amprion.
PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

P5-B-S6.4
Management of ENTSO-E RG CE under-frequency. In case the system frequency is lower than a dedicated threshold (49.8 Hz), TSOs shall take additional manual (or automatic if available) actions to increase the frequency (i) through stopping pumped-storage power plants or (ii) increasing the level of active power generation by activating extra primary reserve if available (next steps under the leadership of the frequency leader - refer to §C).

Compliance Level: N / A

Explanation for the not applicable declaration:
Creos has no means for load frequency control. This task is taken over by Amprion. See also reply to Standard P5-B-S6.1.

Additional Questions

Do you have procedures to increase the output power of power plants? no

Do you have procedures to stop pumps in case of under-frequency? no

AUDIT QUESTIONNAIRE 2012

P5-B-S6.4 MANAGEMENT OF ENTSO-E RG CE UNDER-FREQUENCY. In case the system frequency is lower than a dedicated threshold (49.8 Hz), TSOs shall take additional manual (or automatic if available) actions to increase the frequency (i) through stopping pumped-storage power plants or (ii) increasing the level of active power generation by activating extra primary reserve if available (next steps under the leadership of the frequency leader - refer to §C).

Compliance level FC SC NC

Concise explanation and list of evidences for declared compliance level:

Compliance level: not applicable. Creos has no means for load frequency control. This task is taken over by Amprion. See also reply to Standard P5-B-S6.1.

Do you have a mitigation plan to the standard? Yes No

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for
a mitigation plan, comments:

Do you have procedures to increase the output power of power plants?
Yes ☐ No ☒
List of evidences, comments:

Do you have procedures to stop pumps in case of under-frequency?
Yes ☐ No ☒
List of evidences, comments:

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
N/A

Explanation for the suggested compliance level:
The Luxembourgian domestic energy production was 13% of annual demand in 2011. Creos acquires over/under frequency management from Amprion as an ancillary service.

"Vereinbarung über Inanspruchnahme von Netzinfrastruktur und der Bereitstellung von Systemdienstleistungen sowie deren Abrechnung", from 17.11.2008 defines Creos’ acquirement of primary, secondary, tertiary reserves, load frequency control and voltage control from Amprion.

The standard is not applicable to Creos as it has outsourced under-/over-frequency management to Amprion.
4.9 P5-B-S6.4.1.1 LOAD SHEDDING CAPABILITIES

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

P5-B-S6.4.1.1

Load shedding capabilities. For cases where there is a major frequency drop, automatic function for load shedding in response to a frequency criterion must be installed in order to prevent a further frequency drop and the collapse of the system.

**Compliance Level:** SC

**Actions taken to reach compliance:**

UFLS relays are installed on all 65/20 kV transformers, but they are not activated because they are not in line with the national load shedding plan which requires that household consumers should be shedded as a last resort measure. The national load shedding plan (which has been agreed by all Luxembourgish DSO and by Creos), makes a distinction between foreseeable power shortages and under frequency load shedding. Creos, as the operating party in this plan, seek to switch off first industrial customers (as they represent nearly a quarter of the complete electricity consumption in Luxembourg) and then only as a last resort the private customers. At this stage we are not in a position to differentiate, on the 20 kV level, between a household, a hospital or a small or medium enterprise (SME). Therefore, Creos will stepwise implement UFLS relays at the industrial customer substations and then modify the relays on the 65/20 kV transformers in order to obtain a higher degree of selectivity on the level of the 20 kV infeeders. This is a problem of manpower and budget.

In addition it should be mentioned that by the means of UFLS in the first phase of the ENTSO-E load shedding plan, only a maximum of 80 MW can be shedded, which is probably of no great help for Amprion. A deadline to reach compliance here has not yet been fixed.

**Deadline:**

**Additional Questions**

Do you have automatic UFLS installed in your system? yes

AUDIT QUESTIONNAIRE 2012

P5-B-S6.4.1.1 LOAD SHEDDING CAPABILITIES. For cases where there is a major frequency drop, automatic function for load shedding in response to a frequency criterion must be installed in order to prevent a further frequency drop and the collapse of the system.

**Compliance level**

- FC
- SC
- NC
Concise explanation and list of evidences for declared compliance level:

UFLS relays are installed on all 65/20 kV transformers, but they are not activated because they are not in line with the national load shedding plan with requires that household consumer should be shedded as a last resort measure. The national load shedding plan (which as been agreed by all Luxembourgish DSOs and by Creos), makes a distinction between foreseeable power shortages and under frequency load shedding. Creos, as the operating party in this plan, seek to switch of first industrial customers (as they represent nearly a quarter of the complete electricity consumption in Luxembourg) and than only as a last resort the private customers. At this stage we are not in a position to differentiate, on the 20 kV level, between a household, a hospital or a small or medium enterprise (SME). Therefore, Creos will stepwise implement UFLS relays at the industrial customer substations and then modify the relays on the 65/20 kV transformers in order to obtain a higher degree of selectivity on the level of the 20 kV in feeders. This is a problem of manpower and budget. In addition it should be mentioned that by the means of UFLS in the first phase of the ENTSO-E load shedding plan, only a maximum of 80 MW can be shedded, which is probably of no great help for Amprion. A deadline to reach compliance here has not yet been fixed.

Do you have a mitigation plan to the standard?  Yes ☒  No ☐

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for a mitigation plan, comments:

in a first phase it is foreseen to equip the largest industrial clients at the level of their own substations with UFLS relays.

Do you have automatic UFLS installed in your system?

Yes ☒  No ☐

List of evidences, comments:

List to be provided by HV Asset Service

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
SC

Explanation for the suggested compliance level:
The "Plan de délestage des réseaux électriques du Grand-Duché de Luxembourg" which is issued by Luxembourgian Ministry of Economic Affairs on 30.6.2010 forbids automatic load shedding in Luxembourg. Creos has ULFS relays installed in all 65/20 kV transformers but they are not in operation due to previously mentioned regulation. Creos has a plan for manual load shedding based on three steps set by Ministry of Economic Affairs.

The three manual load shedding steps are:
1. 140,9 MW
2. 74,9 MW
3. 35.6 MW

Creos is missing automatic load shedding but due to small demand in its grid and manual load shedding plan it is sufficient compliant as it cannot endanger the Continental synchronous system.

**Improvement plan with deadline:**

Creos will implement ULFS relays in industrial customer substations so as to be compliant to the minimum ENTSO-E requirement of being able to shed at least 5% of the total load at 49.2 Hz. This will be done till the end of 2013.

4.10 P5-B-S6.4.1.2 LOAD SHEDDING CRITERION

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

<table>
<thead>
<tr>
<th>P5-B-S6.4.1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load shedding criterion. At 49.0 Hz the automatic load shedding of customer consumption shall start and will reach at least 5% as the first step. The total control area consumption has to be considered in the stepwise percentages to shed on the basis of individual evaluations by TSOs.</td>
</tr>
</tbody>
</table>

Compliance Level: SC

Actions taken to reach compliance:

see reply to standard P5-B-S6.4.1.1

Deadline:

Additional Questions

Do you respect the first stage of load shedding of at least 5% of the total customer consumption at 49Hz?

no

AUDIT QUESTIONNAIRE 2012

P5-B-S6.4.1.2 LOAD SHEDDING CRITERION. At 49.0 Hz the automatic load shedding of customer consumption shall start and will reach at least 5% as the first step. The total control area consumption has to be considered in the stepwise percentages to shed on the basis of individual evaluations by TSOs.

Compliance level

FC □ SC □ NC ☐

Concise explanation and list of evidences for declared compliance level:

5% of the consumption passing through the 2 tie lines to Amprion represents less than 30 MW. This very low value will probably not be of any significance in this context but it will cause economic damage to the concerned companies. We propose to start at 48.5 Hz with the load shedding of the entire industrial consumption which represents approximately 133 MW

Do you have a mitigation plan to the standard? Yes ☐ No ☐

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for a mitigation plan, comments:
**AUDIT PHASE**

**COMPLIANCE AUDIT 2012**

**Compliance Level suggestion by the audit team:**
NC

**Explanation for the suggested compliance level:**
Creos does not have automatic load shedding which makes it noncompliant.

Creos plans to have automatic load shedding at 48,5 Hz even though standard demands it at 49 Hz. Creos tries to minimise financial cost of load shedding for their customers and feel that they can be effective at 48,5 Hz. Audit Team gives recommendation to Creos to follow the standard as it is written.

**Mitigation plan with deadline:**
Creos will follow the standard as it is written and modify its UFLS relays on industrial customers’ sites accordingly.

4.11 P5-B-S6.4.1.3 LOAD SHEDDING PLAN – CHECKS

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

<table>
<thead>
<tr>
<th>P5-B-S6.4.1.3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Load shedding plan - checks. TSOs organise in common with DSOs (or with other involved parties) the regular checking (at least once a year) of the load shedding plan in order to ensure the predicted load shedding when applied.</td>
<td></td>
</tr>
<tr>
<td><strong>Compliance Level:</strong> FC</td>
<td></td>
</tr>
<tr>
<td><strong>Explanation for the full compliance declaration:</strong></td>
<td></td>
</tr>
<tr>
<td>The national load shedding plan has been elaborated and agreed upon by all Luxembourgish TSO and DSOs. Creos is the sole operating authority in this context. Creos has a detailed list of the relevant customers, but most of them are equipped with UFLS.</td>
<td></td>
</tr>
<tr>
<td>There are no Questions defined for this company and this policy!</td>
<td></td>
</tr>
<tr>
<td><strong>Additional Questions</strong></td>
<td></td>
</tr>
</tbody>
</table>

AUDIT QUESTIONNAIRE 2012

P5-B-S6.4.1.3 LOAD SHEDDING PLAN – CHECKS. TSOs organise in common with DSOs (or with other involved parties) the regular checking (at least once a year) of the load shedding plan in order to ensure the predicted load shedding when applied.

**Compliance level**

| FC | SC | NC |

Concise explanation and list of evidences for declared compliance level:

The national load shedding plan has been elaborated and agreed upon by all Luxembourgish TSO and DSOs. Creos is the sole operating authority in this context. Creos has a detailed list of the relevant customers, but most of them are equipped with UFLS.

Do you have a mitigation plan to the standard? **Yes** ☑ **No** ☐

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for a mitigation plan, comments:

--------------------------------------------------------------------------------------------------------------------------
**Do you have the load shedding plan?**

Yes ☒ No ☐

List of evidences, comments:
- National load shedding plan

**Do you check the load shedding plan with DSOs at least once a year?**

Yes ☒ No ☐

List of evidences, comments:
- Annexes to the national load shedding plan

**AUDIT PHASE**

**COMPLIANCE AUDIT REPORT**

**CREOS**

16. – 17.10.2012

Compliance Level suggestion by the audit team:
- FC

Explanation for the suggested compliance level:
The "Plan de délestage des réseaux électriques du Grand-Duché de Luxembourg" which is the national load shedding plan has an update history from 2009 and 2010. The updates from 2011 have been issued with Excel Workbooks to keep process simple.
4.12 P5-C-S1.2 TSO RESTORATION PLAN

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

P5-C-S1.2

TSO restoration plan. Each TSO has to prepare in advance and update regularly a restoration plan. This restoration plan includes a bottom-up approach and a top-down approach.

Compliance Level: FC

Explanation for the full compliance declaration:

see reply to standard P5-C-S1.1

Additional Questions

Does your restoration plan include a bottom-up approach and a top-down approach? yes

Do you update regularly your restoration plan? yes

AUDIT QUESTIONNAIRE 2012

P5-C-S1.2 TSO RESTORATION PLAN. Each TSO has to prepare in advance and update regularly a restoration plan. This restoration plan includes a bottom-up approach and a top-down approach.

Compliance level FC □ SC □ NC □

Concise explanation and list of evidences for declared compliance level:

Creos restoration plan

Do you have a mitigation plan to the standard? Yes □ No □

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for a mitigation plan, comments:

--------------------------------------------------------------------------------------------------------------------------
Do you have restoration procedures?

Yes ☑️ No ☐

List of evidences, comments:
- Creos restoration plan

Does your restoration plan include a bottom-up approach and a top-down approach?

Yes ☑️ No ☐

List of evidences, comments:
- Creos restoration plan

Do you update your restoration plan regularly?

Yes ☑️ No ☐

List of evidences, comments:
- Following yearly trainings at DUtrain (simulations)

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
SC

Explanation for the suggested compliance level:
Creos has a top down approach in their restoration plan which is verified with DuTrain simulation. The restoration plan is updated at least once per year usually after bi-annual simulation training with Amprion. Current version is from 1.4.2012 and it was tested in June 2012.

There is no bottom up plan as Creos does not have any black start capable units. Creos cannot endanger the Continental synchronous system with its current practice which makes it sufficiently compliant.

Improvement plan with deadline:
Chances are very low that there will be any new additional large power plant in Luxembourg. Creos has elaborated a bottom-up plan with Twinerg and the pumped storage power plant of Vianden and tested it together with SEO (the owner and operator of the pumped storage power plant of Vianden) at Dutrain facilities. In theory it could work, but it is extremely complex to handle and would require both the consent of Elia and Amprion and would depend on the existing situation in case of a black-out. Creos will integrate this bottom-up plan in its restoration plan by the end of January 2013.

Deadline: 31.01.2013
4.13 P5-C-S1.2.1.1 SUCH PROCEDURES HAVE TO BE PROVED AT LEAST BY SIMULATION OR OFF-LINE CALCULATIONS

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

P5-C-S1.2.1.1

Such procedures have to be proved at least by simulation or off-line calculations.

Compliance Level: FC

Explanation for the full compliance declaration:

see reply to standard P5-C-S1.1

Additional Questions

Do you test your restoration plan by simulation or by off-line calculations? yes

AUDIT QUESTIONNAIRE 2012

P5-C-S1.2.1.1 SUCH PROCEDURES HAVE TO BE PROVED AT LEAST BY SIMULATION OR OFF-LINE CALCULATIONS

Compliance level: FC ☒ SC □ NC □

Concise explanation and list of evidences for declared compliance level:

Simulation at DUtrain facilities and simulations in the Psi SCADA System (off-line calculation).

Do you have a mitigation plan to the standard? Yes ☐ No ☐

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for a mitigation plan, comments:

How do you test your restoration plan?

Training sessions at DUtrain and off-line calculations with the Psi SCADA system.
List of evidences, comments:

| Debriefing of training units at Dutrain |

**AUDIT PHASE**

**COMPLIANCE AUDIT 2012**

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
Creos has at least two DTS sessions per year with Amprion at DuTrain where the current common restoration plan is verified.
P5-C-S1.2.1.2 Each TSO has to evaluate the number of units capable of black start and islanded operation to contribute to the restoration and to get knowledge of units in house load operation.

Preparatory Phase

Self-Assessment Questionnaire 2011

P5-C-S1.2.1.2

Each TSO has to evaluate the number of units capable of black start and islanded operation to contribute to the restoration and to get knowledge of units in house load operation.

Compliance Level: FC

Explanation for the full compliance declaration:

The pumped storage plant of Vianden is the only power plant which has black start capability. It is not connected to the Creos grid. Therefore the restoration process of the Creos grid is included in the restoration process of Amprion (Agreement on Grid and System Operation Management).

Additional Questions

Have you evaluated your needs for black start units? yes

Audit Questionnaire 2012

P5-C-S1.2.1.2 Each TSO has to evaluate the number of units capable of black start and islanded operation to contribute to the restoration and to get knowledge of units in house load operation.

Compliance level

FC ☑ SC □ NC □

Concise explanation and list of evidences for declared compliance level:

The pumped storage plant of Vianden is the only power plant which has black start capability. It is not connected to the Creos grid. Therefore the restoration process of the Creos grid is included in the restoration process of Amprion (Agreement on Grid and System Operation Management).

Do you have a mitigation plan to the standard? Yes ☑ No □

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for a mitigation plan, comments:
### Have you evaluated your needs for black start units?

Yes ☒ No ☐

List of evidences, comments:

| 2 CCGT of about 400 MW with black start capability would be nice to have 😊 |

### AUDIT PHASE

#### COMPLIANCE AUDIT 2012

**Compliance Level suggestion by the audit team:**

FC

**Explanation for the suggested compliance level:**

Creos has evaluated the amount of units with black start capability and in house load operation in Luxembourg. They have pumped storage plant at Vianden (1096 MW) which is black start capable, but it is connected to Amprion's grid. Creos does not have black start capable units in their grid.
4.15 P5-C-S1.2.1.3 BLACK START CAPABILITIES OF UNITS SHALL BE TESTED REGULARLY ON-SITE AT LEAST ONCE PER THREE YEARS

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

<table>
<thead>
<tr>
<th>P5-C-S1.2.1.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black start capabilities of units shall be tested regularly on-site at least once per three years.</td>
</tr>
<tr>
<td><strong>Compliance Level:</strong> N / A</td>
</tr>
<tr>
<td><strong>Explanation for the not applicable declaration:</strong></td>
</tr>
<tr>
<td>Creos has no power plants connected to its Grid.</td>
</tr>
<tr>
<td><strong>Additional Questions</strong></td>
</tr>
<tr>
<td>Do you test the black start capabilities of units at least once per three years? <strong>no</strong></td>
</tr>
</tbody>
</table>

AUDIT QUESTIONNAIRE 2012

<table>
<thead>
<tr>
<th>P5-C-S1.2.1.3 BLACK START CAPABILITIES OF UNITS SHALL BE TESTED REGULARLY ON-SITE AT LEAST ONCE PER THREE YEARS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compliance level</strong></td>
</tr>
<tr>
<td>Concise explanation and list of evidences for declared compliance level:</td>
</tr>
<tr>
<td>Compliance level: not applicable. Reason: no power plant, no test.</td>
</tr>
</tbody>
</table>

**Do you have a mitigation plan to the standard?**  Yes ☐  No ☒

In case of an existing Addendum or a Non Compliance Declaration, list of evidences for a mitigation plan, comments:

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**Do you test the black start capabilities of units at least once per three years?**

Yes ☐  No ☒

List of evidences, comments:
No power plant, no test

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
N/A

Explanation for the suggested compliance level:
Creos does not have black start capable units in its grid which makes it not applicable to the standard.
4.16 P5-C-S2.3 CHOICE OF LOAD FREQUENCY CONTROLLER MODES OR STATES IN CASE OF BLACKOUT

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

**P5-C-S2.3**

Choice of Load Frequency controller modes or states in case of blackout. In case of blackout, the load frequency secondary control mode switching depends on the reenergisation strategy. For the bottom-up strategy, it is up to the TSO to choose the load frequency secondary controller in stopped control state (or in frequency control mode) in order to share the contribution to frequency regulation with all the units of the control area. For the top-down strategy, the frequency secondary controller shall be in stopped control state in the area that called for reenergising.

**Compliance Level:** N / A

**Explanation for the not applicable declaration:**

Creos has no load frequency control means.

**Additional Questions**

Do you have procedure which defines the choice of the load frequency secondary controller depending on the reenergisation strategy?  

**AUDIT QUESTIONNAIRE 2012**

**P5-C-S2.3 CHOICE OF LOAD FREQUENCY CONTROLLER MODES OR STATES IN CASE OF BLACKOUT.** In case of blackout, the load frequency secondary control mode switching depends on the reenergisation strategy.

For the bottom-up strategy, it is up to the TSO to choose the load frequency secondary controller in stopped control state (or in frequency control mode) in order to share the contribution to frequency regulation with all the units of the control area.

For the top-down strategy, the frequency secondary controller shall be in stopped control state in the area that called for reenergising.

**Compliance level**  

- FC
- SC
- NC

Concise explanation and list of evidences for declared compliance level:

**Compliance level: not applicable.** Reason: due to a lack of power plants, Creos has no frequency control possibilities.
Do you have a mitigation plan to the standard?  Yes ☐ No ☒

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for a mitigation plan, comments:

--------------------------------------------------------------------------------------------------------------------------

Do you have procedure which defines the choice of the load frequency secondary controller depending on the reenergisation strategy?

Yes ☐ No ☒
List of evidences, comments:

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
N/A

Explanation for the suggested compliance level:
Creos has ancillary services agreement with Amprion "Vereinbarung über Inanspruchnahme von Netzerfrastructure und der Bereitstellung von Systemdienstleistungen sowie deren Abrechnung", from 17.11.2008 which defines Creos' acquirement of primary, secondary, tertiary reserves, load frequency control and voltage control from Amprion.

The standard is not applicable for Creos as it has outsourced its LFC to Amprion.
4.17 P5-C-S3.6 COORDINATION WITH DSOs FOR RECONNECTION OF SHED LOAD

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

P5-C-S3.6

Coordination with DSOs for reconnection of shed load. TSOs have to coordinate the reconnection of shed load with DSOs. Local and remote reconnection of customer’s loads has to be agreed in advance in cooperation between the TSO and its DSOs. Automatic reconnection has to be avoided.

Compliance Level: FC

Explanation for the full compliance declaration:

As Creos is as well the sole TSO in Luxembourg and the most important DSO and the sole operating authority in case of load shedding resp. reenergising, there should be no problem with switching on unexpected high loads. Automatic reconnection is prohibited in our internal procedures.

Additional Questions

Do you have procedures for reconnection with DSOs which are connected to TSO’s grid and are involved in load shedding? yes

Are you in a position to avoid automatic reconnection of loads after load shedding? yes

AUDIT QUESTIONNAIRE 2012

P5-C-S3.6 COORDINATION WITH DSOs FOR RECONNECTION OF SHED LOAD. TSOs have to coordinate the reconnection of shed load with DSOs. Local and remote reconnection of customers’ loads has to be agreed in advance in cooperation between the TSO and its DSOs. Automatic reconnection has to be avoided.

Compliance level FC ☒ SC ☐ NC ☐

Concise explanation and list of evidences for declared compliance level:

As Creos is as well the sole TSO in Luxembourg and the most important DSO and the sole operating authority in case of load shedding resp. reenergising, there should be no problem with switching on unexpected high loads. Automatic reconnection is prohibited in our internal procedures.

Do you have a mitigation plan to the standard? Yes ☐ No ☒

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for
Do you have procedures for reconnection with DSOs which are connected to TSO’s grid and are involved in load shedding?

Yes ☒ No ☐

List of evidences, comments:

National load shedding plan

Are you in a position to avoid automatic reconnection of loads after load shedding?

Yes ☒ No ☐

List of evidences, comments:

SCADA documentation. No automatic reconnection process. This is done manually following the national load shedding plan.

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
SC

Explanation for the suggested compliance level:
Creos is the biggest DSO in the Luxembourgian grid which allows it to manage load reconnection after load shedding. The Sotel industrial grid is connected to Belgian grid and it is not connected to Creos’ grid. Creos can disconnect all DSOs which reconnect their load without Creos’ permission.

Creos is lacking formal agreements with Luxembourgian DSOs on reconnection rules after load shedding which makes it sufficient compliant.

Improvement plan with deadline:
Article 4.5 of the “Plan National de délestage” on Reconnection of customers, states that Creos as coordinating grid operator has to judge when a reconnection of customers is again feasible in due respect of safe network operation. Article 4.5. also states that this reconnection will happen step by step, taking into account the risks and the priority rules defined in Article 5.3. (which means that the last customer having been shed is the first one to be reconnected.

Audit Team comment regarding improvement plan:
Creos supplied necessary documentation to complete their improvement plan and achieve FC status after onsite audit during Audit Report drafting process but due to CME Audit practices the Creos compliance level for the standard in the report will remain SC.
4.18 **P5-C-S3.7 RECONNECTION OF GENERATORS AFTER ABNORMAL FREQUENCY EXCURSION**

**PREPARATORY PHASE**

**SELF-ASSESSMENT QUESTIONNAIRE 2011**

| P5-C-S3.7 |
| --- | --- |
| Reconnection of generators after abnormal frequency excursion. The TSO has to coordinate the reconnection of generators tripped due to abnormal frequency excursion. In this case of loss of generation, the TSO reconnects generators, based on the instructions of frequency leader, keeping adequate margins of the downward balancing reserve sufficient at least to cope with the next generation power to reconnect. The reconnection of generators is managed step by step in order to minimize the impact on the frequency deviation and the reserve margins. The process of reconnecting generators has to be done stepwise in blocks of maximum power defined by the TSO with respect to the operating reserve of the own TSO's grid. The TSOs define the criteria for reconnection and disconnection with the constraint to avoid over-frequency conditions. For installation connected to DSOs grids the local and remote reconnection has to be agreed in advance in cooperation between the TSO and DSOs for the main units. Automatic reconnection of all generators has to be forbidden when in accordance with legislation. |

**Compliance Level:** N / A

**Amprion**

**Explanation for the not applicable declaration:**

There are no power plants connected to the Grid of Creos.

**Additional Questions**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you able to coordinate the reconnection of all generators connected to the TSO’s grid,</td>
<td>no</td>
</tr>
<tr>
<td>Are you able to coordinate the reconnection of all generators connected to the DSOs’ grids except small distributed generation, in coordination with DSOs?</td>
<td>no</td>
</tr>
</tbody>
</table>

**AUDIT QUESTIONNAIRE 2012**

**P5-C-S3.7 RECONNECTION OF GENERATORS AFTER ABNORMAL FREQUENCY EXCURSION.** The TSO has to coordinate the reconnection of generators tripped due to abnormal frequency excursion.
In this case of loss of generation, the TSO reconnects generators, based on the instructions of frequency leader, keeping adequate margins of the downward balancing reserve sufficient at least to cope with the next generation power to reconnect. The reconnection of generators is managed step by step in order to minimize the impact on the frequency deviation and the reserve margins. The process of reconnecting generators has to be done stepwise in blocks of maximum power defined by the TSO with respect to the operating reserve of the own TSO’s grid.

The TSOs define the criteria for reconnection and disconnection with the constraint to avoid over-frequency conditions.

For installation connected to DSOs grids the local and remote reconnection has to be agreed in advance in cooperation between the TSO and DSOs for the main units. Automatic reconnection of all generators has to be forbidden when in accordance with legislation.

**Compliance level**

- FC
- SC
- NC

Concise explanation and list of evidences for declared compliance level:

Compliance level: not applicable. There are no power plants connected to the Grid of Creos.

**Do you have a mitigation plan to the standard?**

- Yes [ ]
- No [x]

In case of an existing Addendum or a Non Compliance Declaration; list of evidences for a mitigation plan, comments:

--------------------------------------------------------------------------------------------------------------------------

**Are you able to coordinate the reconnection of all generators connected to the TSO’s grid?**

- Yes [ ]
- No [x]

List of evidences, comments:

--------------------------------------------------------------------------------------------------------------------------

**Are you able to coordinate the reconnection of all generators connected to the DSOs’ grids except small distributed generation, in coordination with DSOs?**

- Yes [ ]
- No [x]

List of evidences, comments:
AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
Although the 2012 Onsite Audit Program includes this standard within those to be audited onsite, the audit team omits finally any statement on the compliance level of this standard.

During the onsite audit the audit team focused on the dispersed generation aspects, the critical issue concerning this standard according to the SG CME criteria. However, in the RG CE Plenary it was later decided (in the meeting on November 28th, 2012) that this standard does not apply to non-conventional dispersed generation but only to conventional large generation units connected to TSO grids.

The audit team considers that re-evaluation of the compliance with this standard is not feasible for the following reasons:

- an assessment about the compliance level based on unfocussed onsite gathered materials would be unfair
- an assessment about the compliance level based on additional information provided ex-post by the TSO, not onsite, would be a biased process
- it is not possible to repeat the onsite audit process for this standard, due to the large effort required both from the audit team and the audited TSO.

Thus, the audit team decided not being in condition to state an audited compliance level for this standard.

The audit team recognises reconnection of generators after abnormal frequency excursions as a critical issue for the security of supply, especially in the light of the increasing penetration of dispersed generation. Therefore the audit team suggests the development of the necessary efficient rules intended to promote the secure operability of the synchronous zone by the RG CE Plenary. From a technical point of view, it is important to remind that the issue is well taken into account by the SG SPD (which is analysing the problem and looking for solutions at the Continental Europe level) and, the Draft Network Code for Requirements for Grid Connection Applicable to all Generators (Article 8(1)(g), 26 June 2012 version).

---

1 The Relevant TSO shall define while respecting the provisions of Article 4(3) the conditions under which a Power Generating Module shall be capable of connecting automatically to the Network. These conditions shall include:
- frequency ranges, within which an automatic connection is admissible, and a corresponding delay time
- maximum admissible gradient of increase of Active Power output Automatic connection is allowed unless determined otherwise by the Relevant Network Operator in coordination with the Relevant TSO.
5 CONCLUSIONS

Creos was well prepared for the Audit. The Creos representatives provided necessary documentation and answered questions in a competent way and gave detailed explanations. A comprehensive presentation of Creos, Creos’ grid and visiting Creos’ control room in Heisdorf helped the auditors to better understand the special position of Creos. The audit staff had used approximately 100 hours in preparation for the audit.

In Creos’ grid there is no bigger generation unit and the Luxembourgian domestic energy production was 13 % of annual demand in 2011 and the peak demand was 770 MW in 2011. The two biggest power plants in Luxembourgian area are unfortunately connected to foreign grid. The pumped hydro power plant of SEO at Vianden (1096 MW) is connected directly to Amprion grid and the thermal gas power plant CCGT of Twinerg (395 MW) is connected via Sotel grid to Elia grid.

CREOS is fully compliant with 6 audited standards, sufficiently compliant with 3 standards and noncompliant with 4 standards of 17 audited standards. Audit team decided that 4 standards of 17 audited standards related to over/under frequency management, black start capability tests and LFC mode are not applicable for Creos while these services are outsourced to Amprion.

The audit team considers that an evaluation of the compliance with the P5-C-S3.7 standard is not feasible, as explained in the relevant section in the audit work sheet (section 4.18).

The non-compliances are mostly related to the standards linked to SCADA system (n-1 security analyses, system states and back-up functions). Creos plans to solve those non-compliances in the next year, when the implementation of the upgraded SCADA system will be finished.

The most critical topic, which was discussed with Creos, is load shedding. At the moment Creos is not in a position to fulfil the standards related to load shedding while the national load shedding plan confirmed by the Luxembourgian Ministry of Economic Affairs does not allow Creos to disconnect the households automatically. Creos has a plan for manual load shedding with an amount of one third of the demand. Audit team proposed to Creos to follow the standard what means to change the national load shedding plan and to start implementing the load-frequency protection relays in the system.

While Creos has a small demand (peak in 2011 was 770 MW), a few small production units in its grid and only two doubled 220 kV tie-lines to Amprion it is assumed that Creos can not endanger the synchronous Continental Europe.

The audit team wishes to express its gratitude to the Creos company management for fulfilling all preconditions for an excellent and successful audit.
6 SIGNATURE PAGE

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