COMPLIANCE AUDIT REPORT
TERNA - RETE ELETTRICA NAZIONALE SPA

22. – 23.5.2012

COMPLIANCE AUDIT CONDUCTED IN ROME BY THE
ENTSO-E RG CE SG COMPLIANCE MONITORING &
ENFORCEMENT
AT THE CONTROL CENTRE OF THE ENTSO-E MEMBER
TERNA
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.
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EXECUTIVE SUMMARY .................................................................</td>
</tr>
<tr>
<td>1.1</td>
<td>COMPLIANCE MONITORING IN ENTSO-E RGCE .........................................</td>
</tr>
<tr>
<td>1.2</td>
<td>AUDITED TSO ..................................................................................</td>
</tr>
<tr>
<td>1.3</td>
<td>AUDITED OH STANDARDS .....................................................................</td>
</tr>
<tr>
<td>1.4</td>
<td>RESULTS .........................................................................................</td>
</tr>
<tr>
<td>2</td>
<td>AUDIT REPRESENTATIVES ....................................................................</td>
</tr>
<tr>
<td>3</td>
<td>AUDIT PLAN ....................................................................................</td>
</tr>
<tr>
<td>3.1</td>
<td>GENERAL PROCEDURES .......................................................................</td>
</tr>
<tr>
<td>3.2</td>
<td>OBJECTIVES ...................................................................................</td>
</tr>
<tr>
<td>3.3</td>
<td>SCOPE ...........................................................................................</td>
</tr>
<tr>
<td>3.4</td>
<td>METHODOLOGY ................................................................................</td>
</tr>
<tr>
<td>3.5</td>
<td>EVALUATION PRINCIPLES ..................................................................</td>
</tr>
<tr>
<td>3.6</td>
<td>CONFIDENTIALITY ............................................................................</td>
</tr>
<tr>
<td>4</td>
<td>AUDIT WORK SHEET ..........................................................................</td>
</tr>
<tr>
<td>4.1</td>
<td>P5-A-S1 APPRECIATION OF TSO SYSTEM STATES ....................................</td>
</tr>
<tr>
<td>4.2</td>
<td>P5-A-S2 INFORMATION BETWEEN CONTROL ROOMS BY THE CONSTRAINED TSO</td>
</tr>
<tr>
<td>4.3</td>
<td>P5-A-S3 INTER-TSO CONTACT LISTS FOR SYSTEM OPERATION ..................</td>
</tr>
<tr>
<td>4.4</td>
<td>P5-B-S1 INTER-TSO CO-ORDINATION ..................................................</td>
</tr>
<tr>
<td>4.5</td>
<td>P5-B-S3.1 BACK-UP OF CONTROL ROOM FUNCTIONS ................................</td>
</tr>
<tr>
<td>4.6</td>
<td>P5-B-S5.2 TIE LINES OPENING POLICY ..............................................</td>
</tr>
<tr>
<td>4.7</td>
<td>P5-B-S6.3 MANAGEMENT OF ENTSO-E RG CE OVER-FREQUENCY ...............</td>
</tr>
<tr>
<td>4.8</td>
<td>P5-B-S6.4 MANAGEMENT OF ENTSO-E RG CE UNDER-FREQUENCY .............</td>
</tr>
<tr>
<td>4.9</td>
<td>P5-B-S6.4.1.1 LOAD SHEDDING CAPABILITIES .....................................</td>
</tr>
<tr>
<td>4.10</td>
<td>P5-B-S6.4.1.2 LOAD SHEDDING CRITERION .........................................</td>
</tr>
<tr>
<td>4.11</td>
<td>P5-B-S6.4.1.3 LOAD SHEDDING PLAN – CHECKS ...................................</td>
</tr>
<tr>
<td>4.12</td>
<td>P5-C-S1.2 TSO RESTORATION PLAN ..................................................</td>
</tr>
<tr>
<td>4.13</td>
<td>P5-C-S1.2.1.1 SUCH PROCEDURES HAVE TO BE PROVED AT LEAST BY SIMULATION OR OFF-LINE CALCULATIONS .........................................................</td>
</tr>
<tr>
<td>4.14</td>
<td>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 .................................................................</td>
</tr>
<tr>
<td>4.15</td>
<td>P5-C-S1.2.1.3 BLACK START CAPABILITIES OF UNITS SHALL BE TESTED REGULARLY ON-SITE AT LEAST ONCE PER THREE YEARS ..................................................</td>
</tr>
<tr>
<td>4.16</td>
<td>P5-C-S2.3 CHOICE OF LOAD FREQUENCY CONTROLLER MODES OR STATES IN CASE OF BLACKOUT .................................................................</td>
</tr>
<tr>
<td>4.17</td>
<td>P5-C-S3.6 COORDINATION WITH DSOs FOR RECONNECTION OF SHED LOAD .................................................................</td>
</tr>
<tr>
<td>4.18</td>
<td>P5-C-S3.7 RECONNECTION OF GENERATORS AFTER ABNORMAL FREQUENCY EXCURSION .................................................................</td>
</tr>
<tr>
<td>5</td>
<td>CONCLUSIONS ....................................................................................</td>
</tr>
<tr>
<td>6</td>
<td>SIGNATURE PAGE .............................................................................</td>
</tr>
</tbody>
</table>
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 TERNA was chosen for a Compliance Audit in 2012. CME conducted the audit on 22 - 23.5.2012 at the control centre of TERNA in Rome, Italy.

1.3 AUDITED OH STANDARDS

The Compliance Audit encompassed 18 standards of Operation Handbook Policy 5 which are related to Emergency Operations. In 2011 TERNA made compliance declarations in the self-assessment process for all standards which will be checked against their evidence during the audit.

1.4 RESULTS

The audit team’s findings confirmed that TERNA is fully compliant for all the audited standards (17).

Visiting of national control centre helped the audit team to better understand organisation and processes in the TERNA’s system. The audit team expresses its satisfaction with the TERNA approach both in the preparation phase and during the on-site audit.

The table 1 describes TERNA’s 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>
</tr>
</thead>
<tbody>
<tr>
<td>P5-A-S1</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-A-S2</td>
<td>FC</td>
<td>FC</td>
<td>FC</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>FC</td>
<td>FC</td>
<td>FC</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>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-B-S6.4</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-B-S6.4.1.1</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-B-S6.4.1.2</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-B-S6.4.1.3</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-C-S1.2</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-C-S1.2.1.1</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<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>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-C-S2.3</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
</tr>
<tr>
<td>P5-C-S3.6</td>
<td>FC</td>
<td>FC</td>
<td>FC</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>
<td></td>
</tr>
</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 TERNA didn’t make any such objection. The TERNA staff present during the compliance audit is given on table 3.

<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>MEPSO</td>
<td>Antonio Ivanovski</td>
<td><a href="mailto:antonioi@mepso.com.mk">antonioi@mepso.com.mk</a></td>
</tr>
<tr>
<td>Audit team member</td>
<td>ESO EAD</td>
<td>Ivo Nishanov</td>
<td><a href="mailto:inishanov@ndc.bg">inishanov@ndc.bg</a></td>
</tr>
<tr>
<td>Audit team member</td>
<td>EMS</td>
<td>Aleksandar Petkovic</td>
<td><a href="mailto:aleksandar.petkovic@ems.rs">aleksandar.petkovic@ems.rs</a></td>
</tr>
<tr>
<td>Audit team member</td>
<td>REE</td>
<td>Jaime Sanchiz</td>
<td><a href="mailto:jsanchiz@ree.es">jsanchiz@ree.es</a></td>
</tr>
<tr>
<td>Audit team member</td>
<td>50 Hertz</td>
<td>Ana Cigarán Romero</td>
<td>Ana.Cigará<a href="mailto:nRomero@50hertz.com">nRomero@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>
<thead>
<tr>
<th>Function in the company</th>
<th>Title</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispatching and Energy Operation (CAM)</td>
<td>Deputy System Operation Director</td>
<td>Carlo Sabelli</td>
</tr>
<tr>
<td>Dispatching and Energy Operation</td>
<td>Assistant Director - Head of Control Room</td>
<td>Carrano Antonio</td>
</tr>
<tr>
<td>Sales department</td>
<td>Senior Inter TSO Cooperation specialist</td>
<td>Flavio Allella</td>
</tr>
<tr>
<td>Dispatching and Energy Operation</td>
<td>Senior Defence and Restoration Plan specialist</td>
<td>Giorgio Giannuzzi</td>
</tr>
<tr>
<td>Dispatching and Energy Operation</td>
<td>Senior System Operation engineer</td>
<td>Claudio Coluzzi</td>
</tr>
<tr>
<td>Dispatching and Energy Operation</td>
<td>CME member of Terna</td>
<td>Silvia Moroni</td>
</tr>
<tr>
<td>Audit</td>
<td>System Operation Methodologies support</td>
<td>Antonio Taranto</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.

<table>
<thead>
<tr>
<th>Table 4. Schedule for the Compliance Audit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submittal of the audit material on behalf of the Audit Team</td>
</tr>
<tr>
<td>Objection or concern about audit team personnel</td>
</tr>
<tr>
<td>Submittal of the completed Audit Worksheet to the Audit Team by Terna</td>
</tr>
<tr>
<td>Initial draft of the audit report based on the Audit Worksheet sent to Terna by the Audit Team</td>
</tr>
<tr>
<td>Opening meeting of the Audit Team and CAM of Terna</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>
<tr>
<td>(4) Discussion on data access required by the Audit Team,</td>
</tr>
<tr>
<td>(5) Announcement that the Terna 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>
</tr>
<tr>
<td>(7) Visit at the control room</td>
</tr>
<tr>
<td>Start of the OH standards’ review</td>
</tr>
<tr>
<td>Continuation of the OH standards’ review</td>
</tr>
</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.
  - 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
  - The goal is to improve the quality of the presented evidence
  - 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

<table>
<thead>
<tr>
<th>P5-A-S1</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

Compliance Level: FC

Explanation for the full compliance declaration:
The system state is assessed at any stage, from operational planning in to real-time, based on security risk assessment, taking into account internal or regionally coordinated remedial actions. The monitoring is done through voltage monitoring at the main nodes, on-line AC load-flow and security analysis (automatically run every 1 min, data recorded every 15 min) and Wide Area Measurement Systems that assess dynamic instability and dynamic waveform monitoring. Thermal overloading of elements of the system, abnormal voltage and frequency states are alarmed by SCADA. (Ref. Code for transmission, dispatching, development, and security of the grid Chapter 10 ‘Defence of Security’)

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 X SC NC

Concise explanation and list of evidences for declared compliance level:
Terna’s procedures and Grid Code describe the different system states predictable.
The system state is determined by the state estimator in the SCADA system (automatically run every 1 min and archived every 15 minutes) and through voltage monitoring at the main nodes. Security assessments is based on an on-line AC load flow calculation and N-1 security analysis performed automatically every 15’ with the software CRESO. The results of N-1 calculation (both snapshot and 15-minutes-forecast data) are stored in a dedicated DB. The visualization and reports are provided by the web-tool TOSCA. A synthetic overview of provisional and actual N-1 security violations and performance on the quality of the system is provided weekly by the Dispatching Function reporting system (PRED). Dynamic stability is monitored with a Wide Area Measurement System. Analysis of different scenarios is performed by the software DSA (Dynamic
Security Assessment). This tool provides a dynamic security assessment on a set of predefined critical exceptional contingencies (e.g., disconnection from continental EU-system, internal network separation on critical sections, busbar-faults, operation of SPS, cascading events, etc.)

The security analysis is regularly carried out individually by Terna during all operational phases.

Furthermore, by agreement security assessment on the Northern Italian interconnection is jointly managed with all Neighbours. The Pentalateral Procedure includes a list of network elements whose trip has to be monitored.

Moreover, with the purpose to enhancing operational security and enabling a better coordination among TSOs in terms of interconnected operation and implementation of coordinated remedial actions, Terna joined Coreso regional coordination company in November 2010. Coreso is now fully integrated in the operational processes of Terna Dispatching Centre in matter of security assessment since Inter-TSO agreements signed with all neighbouring TSOs of the IT Northern Interconnection contain the remedial actions prepared in advance to enhance security and the external grid potential influencing the system state.

Measurements of the observability area available in the SCADA system and defined in the Inter-TSOs Agreements signed with all neighbours.

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 tools/procedures to assess system state of your own system in real time?

Yes X No ☐

List of evidences, comments:

Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security' (10.4.4 CES management procedure in the different operating states) and Annex B “Details of Management Procedures”

Grid Code Annex 6 “Remote control and data acquisition criteria”

On line tools available in the Control Room:

- TOSCA: advanced tool to support control room activities (monitoring of system state and optimization), overview presentation and technical requirements
- DSA: software for dynamic simulations with calculations of various scenarios, overview presentation and technical requirements (http://dsa.servizi.prv/dsa/home.action)
- CRESO integrated system for simulating electrical systems in steady-state and OPF and ORPF assessment, overview presentation and technical requirements
- WAMS monitoring system for monitoring dynamic variations based on Phasor
Measuring Unit (PMU), overview presentation and technical requirements
- SCTI-Pascal: SCADA system and state estimator, overview presentation and technical requirements

Inter-TSO agreements:
- IO406DC “Pentalateral Instruction”
  - annex a03IO406DC_r02 “Security Limits for N-1 criterion assessment”
  - annex a04IO406DC_r00 “Flow Chart of Actions envisaged in the ID-RT stage”
- IO407DC “Trilateral Instruction”
  - annex m01IO407DC_r07 ‘380kV common scheme template’
  - annex m02IO407DC_r13 ‘220kV common scheme template’
- Agreement on Operating Rules between Terna and HTSO concerning the 400 kV HVDC connection Galatina (I) – Arachthos (GR) 28 May 2002

Information letter about Coreso’s mandate by Terna (TE/P20110012779 – 28/07/2011)
Coreso’s press release on Terna partnership (November 2010)

Reports on system security:
- PRED: weekly reports (http://pred/)
- TOSCA: daily reports (http://tosca/)

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
Italian Grid Code 10.4.4 CES management procedure in the different operating states” and “Annex B, Details of management procedures” contain commonly agreed security criteria with neighbouring TSOs. Regulator approved Italian Grid Code 10.1.B.1 has definition of all system states. Audit Team reviewed electronic versions of all previously mentioned documents.

Audit Team checked Terna SCADA which had state estimator and N-1 security analysis implemented. Pentalateral agreement annex 3 “Security Limits for N-1 criterion assessment” contains neighbouring TSO grid elements which are included to Terna N-1 analysis.
4.2 **P5-A-S2 INFORMATION BETWEEN CONTROL ROOMS BY THE CONSTRAINED TSO**

**PREPARATORY PHASE**

---

**SELF-ASSESSMENT QUESTIONNAIRE 2011**

| **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

<table>
<thead>
<tr>
<th>APG-Austrian Power Grid AG</th>
<th>swissgrid</th>
<th>RTE</th>
<th>ELES</th>
<th>HTSO/DESMIE</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

**Explanation for the full compliance declaration:**

The communication is based on pre-established multi-lateral procedures that determine the conditions in which it has to be activated, the available internal actions (topology changes, generation pattern changes with redispatching, transfer capacity reduction or curtailment, etc.), the possible external means that can be solicited. The Procedures envisages the coordination actions in D-1 and real time to be implemented in case of detected critical operational condition. The appropriate telecommunication facilities (phone, fax) that are to be used are regularly tested and the information templates (pre-formatted messages, grid schemes) that are to be exchanged are regularly updated and improved at least on yearly basis. (Ref. documents: IO406DC 'Pentalateral Instruction' and IO407DC 'Trilateral Instruction', m03IO407DC_r01 'Urgency Fax template', m01IO407DC_r07 '380kV common scheme template', m02IO407DC_r13 '220kV common scheme template', m01IO407DC_r07 '380kV common scheme template', m02IO407DC_r13 '220kV common scheme template', Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security', 'Agreement on Operating Rules between Terna and HTSO concerning the 400 kV HVDC connection Galatina (I) – Arachthos (GR) 28 May 2002')

**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**

<table>
<thead>
<tr>
<th>FC</th>
<th>SC</th>
<th>NC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>X</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Concise explanation and list of evidences for declared compliance level:**

Inter-TSO agreements signed with all neighbouring TSOs of the IT Northern Interconnection containing instructions for critical situations and procedures for exchanging information.

Communication facilities include recorded phone and fax template with pre-formatted messages and grid schemes.
Deployment of the ENTSO-E crisis communication platform for the exchange of information among non neighbouring TSOs.

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 with direct neighbours for information on system states?

<table>
<thead>
<tr>
<th>Neighbour</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTE</td>
<td>X</td>
<td>☐</td>
</tr>
<tr>
<td>Swissgrid</td>
<td>X</td>
<td>☐</td>
</tr>
<tr>
<td>APG</td>
<td>X</td>
<td>☐</td>
</tr>
<tr>
<td>Elec</td>
<td>X</td>
<td>☐</td>
</tr>
<tr>
<td>HTSO</td>
<td>X</td>
<td>☐</td>
</tr>
</tbody>
</table>

List of evidences, comments:

Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security' (10.4.4.5 Procedure for recording communications)

ENTSO-E Crisis communication Tool Platform

Inter-TSO agreements:

- IO406DC “Pentalateral Instruction”
  - m02IO406DC “ID-RT Warning Fax Template”
- IO407DC “Trilateral Instruction”
  - m03IO407DC_r01 “Urgency Fax template”
  - a01IO407DC “Examples of communication under restoration conditions”
- Agreement on Operating Rules between Terna and HTSO concerning the 400 kV HVDC connection Galatina (I) – Arachthos (GR) 28 May 2002
- Bilateral agreements on network and system operation management of the interconnections

Example of Pentalateral and Trilateral applications by fax

AUDIT PHASE
COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
Audit Team reviewed Italian Grid Code, chapter 10.4.4.5 “Procedure for recording communications” which describes procedures for informing neighbouring TSOs in case of constrained situation. Pentalateral agreement with all neighbouring TSOs has specific instructions for communication among constrained TSOs. TERNA also showed information exchange fax templates during constrained situation.

TERNA and its neighbours exchange their real-time grid data (power flow and circuit breaker status).
4.3 **P5-A-S3 INTER-TSO CONTACT LISTS FOR SYSTEM OPERATION**

## PREPARATORY PHASE

### SELF-ASSESSMENT QUESTIONNAIRE 2011

**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.

**Compliance Level:** FC

<table>
<thead>
<tr>
<th>APG-Austrian Power Grid AG</th>
<th>swissgrid</th>
<th>RTE</th>
<th>ELES</th>
<th>HTSO/DESMIE</th>
</tr>
</thead>
</table>

**Explanation for the full compliance declaration:**

Pentalateral signed agreement including phone numbers, fax numbers and e-mail addresses of the desks of the control room to be contacted. Detailed list of Operators in shift is also made available to all neighbours. The references are regularly updated (when needed but at least once per year). (Ref. document: IO406DC ‘Pentalateral Instruction’, a02IO407DC ‘List of Operators in shift confidential’ and ‘ITA APG TERNA Annex 17 Communications’)

**Additional Questions**

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

<table>
<thead>
<tr>
<th>APG-Austrian Power Grid AG</th>
<th>swissgrid</th>
<th>RTE</th>
<th>ELES</th>
<th>HTSO/DESMIE</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

### 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.

**Compliance level:** FC X SC □ NC □

Concise explanation and list of evidences for declared compliance level:

For RTE and Swissgrid, the list of functional positions with phone numbers, fax numbers and e-mail addresses is included in the inter-TSO agreements as an annex.

For APG, Eles and HTSO, the updated list is sent by e-mail to neighbouring TSOs.
The lists are regularly updated and exchanged when needed but at least once per year. Deployment of the ENTSO-E Escalation Management list to exchange of information among non neighbouring TSOs.

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:

---

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>
</tr>
</thead>
<tbody>
<tr>
<td>RTE</td>
<td>X</td>
<td>☐</td>
</tr>
<tr>
<td>Swissgrid</td>
<td>X</td>
<td>☐</td>
</tr>
<tr>
<td>APG</td>
<td>X</td>
<td>☐</td>
</tr>
<tr>
<td>Els</td>
<td>X</td>
<td>☐</td>
</tr>
<tr>
<td>HTSO</td>
<td>X</td>
<td>☐</td>
</tr>
</tbody>
</table>

List of evidences, comments:

For RTE and Swissgrid, IO407DC “Trilateral Instruction” inter-TSO agreement:

- a02IO407DC-r15 “List of operators in shift"

For APG, Els and HTSO, updated list of functional positions with phone numbers, fax numbers and e-mail addresses received by e-mail from neighbouring TSOs.

Bilateral agreements on network and system operation management of the interconnections (es. Terna-APG Annex 17 Communications)

ENTSO-E Escalation Management list available in the control Room

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>
</tr>
</thead>
<tbody>
<tr>
<td>RTE</td>
<td>X</td>
<td>☐</td>
</tr>
<tr>
<td>Swissgrid</td>
<td>X</td>
<td>☐</td>
</tr>
<tr>
<td>APG</td>
<td>X</td>
<td>☐</td>
</tr>
<tr>
<td>Els</td>
<td>X</td>
<td>☐</td>
</tr>
<tr>
<td>HTSO</td>
<td>X</td>
<td>☐</td>
</tr>
</tbody>
</table>
List of evidences, comments:

Trilateral Instruction appendix a02IO407DC-r15 “List of operators in shift” and copies of exchanged mails with the other neighbouring (APG, Eles and HTSO) TSOs to update the lists of functional positions with phone numbers, fax numbers and e-mail addresses.

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
Audit Team checked contact lists with neighbouring TSOs’ control room and other relevant people in Terna control centre.
4.4 P5-B-S1 INTER-TSO CO-ORDINATION

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

<table>
<thead>
<tr>
<th>P5-B-S1</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter-TSO co-ordination. For emergency issues TSOs have to agree in writing on bilateral/multilateral procedures with all their neighbours.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance Level: FC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>APG-Austrian Power Grid AG</th>
<th>swissgrid</th>
<th>RTE</th>
<th>ELES</th>
<th>HTSO/DESMIE</th>
</tr>
</thead>
</table>

Explanation for the full compliance declaration:
Operational procedures for emergency operation enclosed in multi-lateral procedures developed with all neighbors. With Eles, emergency conditions managed by automatic Special Protection Scheme. Bilateral agreements with all neighbors for Mutual Emergency Assistance Service to supply the service real time in case of any emergency operation. (Ref. documents: IO407DC 'Trilateral Instruction', IO406DC 'Pentalateral Instruction', a05IO406DC_r00 'Intervention diagram of the Redipuglia ATD', 'Agreement on Network and System Operation Management concerning System operation between APG and Terna', IO408DC 'Terna-Verbund Coordinated common actions for restoration', 'Agreement on Operating Rules between Terna and HTSO concerning the 400 kV HVDC connection Galatina (I) – Arachthos (GR) 28 May 2002', agreement Terna-RTE 'Rose', agreement Terna-Swissgrid 'Orange', agreement Terna-Eles 'Reserve Power')

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

<table>
<thead>
<tr>
<th>APG-Austrian Power Grid AG</th>
<th>swissgrid</th>
<th>RTE</th>
<th>ELES</th>
<th>HTSO/DESMIE</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

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 X SC □ NC □

Concise explanation and list of evidences for declared compliance level:
Inter-TSO operational agreements are developed with all neighbours including bi(multi)lateral procedures for congestion management to be implemented in case of emergency conditions (i.e. coordinated topology changes, cross-border re-dispatching, counter-trading, exchange curtailment, Intraday Capacity Allocation procedure, emergency energy assistance, Top-Down restoration process).
Agreement for the calculation of the NTC defined with all the TSOs in the Northern border. Emergency conditions on the Slovenian border is managed by automatic Special Protection Scheme. Bilateral agreements are developed with all neighbours for Mutual Emergency Assistance Service to supply the service real time in case of any emergency operation.

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:

---

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…)

Bi(multi)lateral procedures inter TSO include coordinated topology changes, cross-border re-dispatching, counter-trading, exchange curtailment, restoration process, Intraday Capacity Allocation procedure, emergency energy assistance.

Deployment of SPC (e.g. automatic load shedding) to manage exceptional multiple contingencies on the IT-FR-CH interconnection.

List of evidences, comments:

Inter-TSOs agreements:

- IO406DC “Pentalateral Instruction”
  - Proceeding 2 chapter 3.3 “Actions after identifying a N-1 security violation”, and chapter 4.1 “Preliminary actions after identifying a potential N-1 security violation in the Slovenian internal grid”
  - a05IO406DC-r00 “Intervention Diagram of the Redipuglia ATD”
- IO407DC “Trilateral Instruction”
  - Part 1 - chapter 9.3.2 “Step2: Constraints management approaches and information exchange”, chapter 11 “Coordinated actions in case of Islanded Operation and/or Black-Out”
  - Part 1 - chapter 9.3.3 “Step 3: Unsolved Critical Condition. Trilateral power exchange schedules modification before the Pentalateral curtailments”
  - Part 2 - Grid Management Under Critical Conditions”
- IO404DC rev. 05 1.01.2012 Mutual Emergency Assistance (Upward MEAS e Downward MEAS)
- Bilateral agreements on network and system operation management of the interconnections
- IO408 DC Terna-Verbund Coordinated common actions for restoration
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>
</tr>
</thead>
<tbody>
<tr>
<td>RTE</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Swissgrid</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>APG</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>EleS</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>HTSO</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

List of evidences, comments:
- Mutual emergency Assistance Agreements with HTSO, SwissGrid, EleS and RTE
- Examples MEAS, Pentalateral and Trilateral applications by fax
- Bilateral agreements on network and system operation management of the interconnections (i.e. with APG)
- Example of Weekly security Report "Interconnection Control"

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
Audit Team checked following agreements which fulfil the requirements of the standard:
- Trilateral contract (RTE-Swissgrid-TERNA) chapter 12 which fulfils the requirement of the standard
- Terna-Verbund coordinated common actions for restoration
- ELES-Terna Bilateral procedure for system restoration
- 400kV HVDC Italy and Greece interconnection link with operating procedures (Technical part)
4.5 **P5-B-S3.1 BACK-UP OF CONTROL ROOM FUNCTIONS**

**PREPARATORY PHASE**

**SELF-ASSESSMENT QUESTIONNAIRE 2011**

<table>
<thead>
<tr>
<th>P5-B-S3.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

**Compliance Level:** FC

**Explanation for the full compliance declaration:**

Back-up control centers available for the National and Regional's control centers redundant also for the location. The computer systems in the back-up centers have access to all the data and applications installed in the main centers.

(Ref.Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security')

**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 X SC [ ] NC [ ]

**Concise explanation and list of evidences for declared compliance level:**

Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security' (10.4.6.1 Control Systems)

The Disaster recovery is designed to back-up the control room functions in case of any damage of the switching centres, National Control Centre, Regional Control Centres, SIA-Rs or front-end SIAC source feeding the SCADA system.

The computer system in the back-up centres is redundant also for the location, have access to all the data and applications installed in the main centres and is designed to provide high level of reliability (i.e. redundancy of multiplexer I/O cards, telecommunication network element cards, power supply boards in RTUs, etc.).

- The primary system and the back-up system are always in operation and available for Dispatchers (each desk in the main Control Centre is equipped with 2 parallel consoles fed by the primary and the back-up system).
- Only one system per time (main or back-up) is enabled to send regulating commands and to feed the on/off line tools with the TM and TS coming from the field.
- In case of maintenance, failure or unavailability of the primary system, the switching procedure to the back-up system is manually activated upon approval of the head Dispatcher in shift. The manual switching procedure is performed by appointed GSC staff on duty H24/365. The switching to the DR is possible also manually and the...
switching activity is registered on the log system (example of the log is described in the operative procedure).

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 a back-up of control room functions in separate locations?
Yes X No ☐

List of evidences, comments:

- Grid Code Chapter 10 (10.4.6.3 Remote control system)
  - IO428DC rev. 00 2011-12-21 operational instruction “Activation of the Disaster Recovery for the Dispatching and maintenance process”
  - a03IO428DC rev. 00 2011-12-21 operational instruction “Coordinated procedures for Disaster Recovery activation and National Control Room evacuation”
  - a02IO428DC rev. 00 2011-12-21 operational instruction “Coordinated procedures for Disaster Recovery activation and switching centres evacuation”
  - a04IO428DC rev. 00 2011-12-21 operational instruction “Coordinated procedures for Disaster Recovery activation and Control centres evacuation”
  - “PO-Switch Regolazione” rev. 2010-01-29 operational procedure for the switching of the regulating functions to the back-up system
  - ESX 507 912 rev.01 2007-03-01 functional specification “SIAC Disaster recovery system”
  - PR_DR-SCTI_07_ESP 00002 rev. 02 2007-07-06 technical report “Enhancement of the Disaster Recovery SCADA system”

How often do you test such ability?

“Periodically; each centre is tested once per year” (IO428DC 5.2 Prove e Simulazioni)

List of evidences, comments:

- Reports on performed tests, e.g. activation of DR and simulation of evacuation plan CR Venezia (17.05.2011); activation of DR CR Firenze (05.09.2011); simulation of evacuation plan CTI Dolo (13/4/2011); activation of DR and simulation of evacuation plan CNC (18/10/2011).

- Example of the log system described in the operative procedure

AUDIT PHASE
COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
TERNA has one back up control centre in hot standby for their National Control Centre. The whole NCC system is also duplicated at NCC premises in case of hardware failure. The eight regional centres have back up scheme to cover each other.

Audit Team reviewed an exercise report on disaster recovery of NCC (transferring NCC functions to back up control centre) and regional control centres annual back up tests from 2011.
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>
</tr>
</thead>
<tbody>
<tr>
<td>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. o 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. o Opening of a tie line has to be assessed and agreed upon in advance in a transparent way.</td>
</tr>
</tbody>
</table>

Compliance Level: FC

<table>
<thead>
<tr>
<th>APG-Austrian Power Grid AG</th>
<th>swissgrid</th>
<th>RTE</th>
<th>ELES</th>
<th>HTSO/DESMIE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

Explanation for the full compliance declaration:

No special protection schemes for automatic tripping of tie-lines are implemented. The multilateral procedures agreed with all neighbours which foresee the disconnection of the tie-lines as the ultimate remedial action to be undertaken only after coordination among all TSOs in the Pentalateral region to ensure that the opening does not endanger the remaining synchronous area. (Ref. documents: IO406DC 'Pentalateral Instruction', GC annex A.9 'Defence plan of the electricity system' DRRPX04052, Operating Rules for the coordinated management of every the interconnectors)

Additional Questions

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

<table>
<thead>
<tr>
<th>APG-Austrian Power Grid AG</th>
<th>swissgrid</th>
<th>RTE</th>
<th>ELES</th>
<th>HTSO/DESMIE</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</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.

o 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.

o Opening of a tie line has to be assessed and agreed upon in advance in a transparent way.
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**  
FC X  SC  NC  

Concise explanation and list of evidences for declared compliance level:

- The disconnection of the tie-lines is considered as the ultimate remedial action to be undertaken only after coordination among all involved TSOs to ensure that the opening does not endanger the remaining synchronous area.
- Deployment of automatic device for tie-line on the Slovenian border to perform the controlled disconnection of this interconnection.

**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:

---

**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>
</tr>
</thead>
<tbody>
<tr>
<td>RTE</td>
<td>X</td>
<td>□</td>
</tr>
<tr>
<td>Swissgrid</td>
<td>X</td>
<td>□</td>
</tr>
<tr>
<td>APG</td>
<td>X</td>
<td>□</td>
</tr>
<tr>
<td>Eles</td>
<td>X</td>
<td>□</td>
</tr>
<tr>
<td>HTSO</td>
<td>X</td>
<td>□</td>
</tr>
</tbody>
</table>

List of evidences, comments:

- Grid Code annex A.9 ‘Defence plan of the electricity system’
- Inter-TSOs agreement IO406DC “Pentalateral Instruction”
  - for all borders, chapter 5 “Manual Disconnection of Interconnectors in case of security violations”
  - for manual disconnection of AT and SI border, chapter 4 “Proceeding steps for keeping security in case of violation on the Slovenian internal grid”
  - for the automatic disconnection of SI border, annex a05IO406DC_r01 “Intervention diagram of the Redipuglia ATD” and operating rules on the
automatic device installed in the 400 kV Redipuglia (IT) substation

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
Pentalateral agreement, chapter 5 “Manual Disconnection of Interconnectors in case of security violations” covers the requirements of the standard. Only ELES-Terna interconnection has automatic disconnection scheme which is described in Pentalateral agreement” chapter 4 “Proceeding steps for keeping security in case of violation on the Slovenian internal grid”. The Pentalateral agreement annex a05IO406DC_r01 “Intervention diagram of the Redipuglia ATD” describes the logic to perform the automatic controlled disconnection of the IT-SI border. Audit Team reviewed the “Operating Regulation for the transmission line 380kV Robbia – San Fiorano, 4.3. Hand over due to faults or urgent interventions” state priority on avoiding third party damages which is a prevailing practice on all Terna tie-lines.
4.7 P5-B-S6.3 MANAGEMENT OF ENTSO-E RG CE OVER-FREQUENCY

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

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

Explanation for the full compliance declaration:
SISCOM: on line tool monitoring and reporting available in the control room for the communication/signaling the start up of the pumped-storage power plants and limit the output power of power plants. (Ref. GC annex A.36 'Command System: computing requirements for communication of dispatching orders (BDE)', annex A.34 'Command System: Message Format')

Additional Questions
Do you have procedures to limit the output power of power plants? yes
Do you have procedures to start pumps in case of over-frequency? yes

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 X SC ☐ NC ☐

Concise explanation and list of evidences for declared compliance level:

In case of over-frequency situations, when the LFC contribution is already exhausted NCC activates manually power plants in order to recover the nominal frequency.

The communication to the power plants in order to decrease production or start-up of pumps is performed by SISCOM (Sistema Comandi) tool which sends balancing orders in with a dedicated format.

For urgency it is possible also to anticipate the command to the generation units by phone and send the command message later. All the violations of frequency over 50,05 Hz or under 49,95 Hz which last more than 15 minutes are registered in the daily report and the causes investigated.

Periodical training to the dispatchers is performed through simulations of critical and
unusual situations in the dispatcher training system (OTS).

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 X No ☐

List of evidences, comments:

SISCOM, on line tool available in the control room for the communication to power plants the balancing orders and voltage regulation messages (presentation and technical requirements)

Grid Code Chapter 10 (10.4.4.5 Procedure for recording communications)


Grid Code annex A.12 'Calibration criteria of frequency relays of the electricity system

TOSCA daily report including frequency trends and violations in D-1 and D

OTS: DTS system, overview presentation and technical requirements

Example of training courses for Dispatchers

Do you have procedures to start pumps in case of over-frequency?

Yes X No ☐

List of evidences, comments:

SISCOM, on line tool available in the control room for the communication to power plants the balancing orders and voltage regulation messages (presentation and technical requirements)

Grid Code Chapter 10 (10.4.4.5 Procedure for recording communications)


Grid Code annex A.12 'Calibration criteria of frequency relays of the electricity system

TOSCA daily report including frequency trends and violations in D-1 and D

OTS: DTS system, overview presentation and technical requirements

Example of training courses for Dispatchers

AUDIT PHASE

COMPLIANCE AUDIT 2012
Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
TERNA is allowed to take any action it sees necessary to preserve system security. If frequency persists over 50.2Hz TERNA will contact relevant utilities by telephone for further instructions to mitigate the situation. Italian Grid Code 1B.3.1.2 defines frequency out of 49.9Hz - 50.1 Hz range as an alarm system state which gives TERNA authority to face with the situation with any remedial action.
4.8 P5-B-S6.4 MANAGEMENT OF ENTSO-E RG CE UNDER-FREQUENCY

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

<table>
<thead>
<tr>
<th>P5-B-S6.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>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).</td>
</tr>
</tbody>
</table>

Compliance Level: FC

Explanation for the full compliance declaration:

SISCOM: on line tool monitoring and reporting available in the control room for the communication/signaling the stop of the pumped-storage power plants and increase the output power of power plants. (Ref. GC annex A.36 ‘Command System: computing requirements for communication of dispatching orders (BDE)’, annex A.34 ‘Command System: Message Format’, annex A.37 ‘Proposal for determining a contribution to replace the primary reserve service’)

Additional Questions

Do you have procedures to increase the output power of power plants? yes

Do you have procedures to stop pumps in case of under-frequency? yes

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 X SC □ NC □

Concise explanation and list of evidences for declared compliance level:

In case of under-frequency situations, when the LFC contribution is already exhausted NCC activates manually power plants in order to recover the nominal frequency.

The communication to the power plants in order to increase production or stop pumps is performed by SISCOM (Sistema Comandi) tool which sends balancing orders in with a dedicated format.

Deployment of SPC (e.g. automatic load shedding) to manage exceptional contingencies.

For urgency it is possible also to anticipate the command to the generation units by phone and send the command message later. All the violations of frequency over 50.05 Hz or under 49.95 Hz which last more than 15 minutes are registered in the daily report and the causes investigated.
Deployment of SPC (e.g. automatic load shedding) to manage exceptional contingencies. Periodical training to the dispatchers is performed through simulations of critical and unusual situations in the dispatcher training system (OTS).

**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:

- **SISCOM**, on line tool available in the control room for the communication to power plants the balancing orders and voltage regulation messages (presentation and technical requirements)
- Grid Code Chapter 10 (10.4.4.5 Procedure for recording communications)
- Grid Code annex A.12 'Calibration criteria of frequency relays of the electricity system
- TOSCA daily report including frequency trends and violations in D-1 and D
- Terna report on the 4 November 2009 major incident
- OTS: DTS system, overview presentation and technical requirements
- Example of training courses for Dispatchers

### Do you have procedures to stop pumps in case of under-frequency?

|    | Yes ☒ | No ☐ |

List of evidences, comments:

- **SISCOM**, on line tool available in the control room for the communication to power plants the balancing orders and voltage regulation messages (presentation and technical requirements)
- Grid Code Chapter 10 (10.4.4.5 Procedure for recording communications)
- Grid Code annex A.12 'Calibration criteria of frequency relays of the electricity system
- TOSCA daily report including frequency trends and violations in D-1 and D
- OTS: DTS system, overview presentation and technical requirements
- Example of training courses for Dispatchers

**AUDIT PHASE**
**COMPLIANCE AUDIT 2012**

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

**Explanation for the suggested compliance level:**
TERNA is allowed to take any action it sees necessary to preserve system security. If frequency persists less than 49.8 Hz TERNA will contact relevant utilities by telephone for further instructions to mitigate the situation. Italian Grid Code 1B.3.1.2 defines frequency out of 49.9Hz - 50.1 Hz range as an alarm system state which gives TERNA authority to face with the situation with any remedial action.
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:** FC

**Explanation for the full compliance declaration:**


**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 X  SC ☐  NC ☐

Concise explanation and list of evidences for declared compliance level:

The UFLS devices installed shed the load gradually according to both frequency and frequency derivative criteria in order to achieve conditions for a new balance between production and demand. The load shedding plan defines the settings of each of UFLS devices (n. 1278 relays installed in the whole IT system) deployed in the DSOs grid.

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 automatic UFLS installed in your system?

Yes X No □

List of evidences, comments:

- Underfrequency Load Shedding Plan
- Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security'
- Grid Code annex A.9 'Defence plan of the electricity system'
- Grid Code annex A.41 'Peripheral unit load disconnection. Implementation Guide'
- Grid Code annex A.42 'Peripheral unit load disconnection. Profile of IEC 870-5-104 protocol'
- Grid Code annex A.53 'Technical and functional characteristics of load balancing equipment'

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
TERNA provided a list of installed under frequency load shedding relays which is incorporated to "Under frequency Load Shedding Plan" for Audit Team's review.
4.10 P5-B-S6.4.1.2 LOAD SHEDDING CRITERION
PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

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

Explanation for the full compliance declaration:

Load shedding of customer consumption starting at 49.0 Hz; a stepwise of 6-7% is applied as a first step; 50% (in total) of the nominal load is operated by load shedding relays in the range 49.0 to 48.0 Hz; frequency steps is smaller than or equal to 200 mHz; in each step of UFLS, disconnection of 10% of the load is set; maximum disconnection delay is 350 ms, including breakers operation time; frequency measurements for load shedding is maintained at a maximum inaccuracy of 100 mHz; automatic disconnection of pumps is activated below 49.8 Hz; below 49.2 Hz all pumps should be disconnected;

If 49.2 Hz < frequency < 49.8 Hz, then delay <= 10 s; if frequency <= 49.2 Hz, then delay = 0 s (Ref. Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security', GC annex A.9 'Defence plan of the electricity system' DRRPX04052, annex A.12 'Calibration criteria of frequency relays of the electricity system DRRPI04050, annex A.53 'Technical and functional characteristics of load balancing equipment DRRPI04008')

Additional Questions

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

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 X SC NC

Concise explanation and list of evidences for declared compliance level:

The strategy of load shedding, with a setting related to the frequency (4 thresholds) and its time derivative (4 thresholds), guarantees the disconnection of about 50% of the total load. The adoption of the time derivative for the first 4 thresholds aims at anticipating the load shedding in case of relevant frequency decreases.

Also the pumps are included in the load shedding plan with specific settings.

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

Yes X No

List of evidences, comments:

Underfrequency Load Shedding Plan
Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security'
Grid Code annex A.9 'Defence plan of the electricity system'
Grid Code annex A.41 'Peripheral unit load disconnection. Implementation Guide',
Grid Code annex A.42 'Peripheral unit load disconnection. Profile of IEC 870-5-104 protocol',
Grid Code annex A.12 'Calibration criteria of frequency relays of the electricity system,'
Grid Code annex A.53 'Technical and functional characteristics of load balancing equipment'

How many stages is your UFLS consisted of and what percentage of load is operated under the load shedding relays in each stage?

In the following table the 8 settings and the associated percentage of load shed for each regional control center.

First step operating at 49.0 Hz with a stepwise of 6-7% of the total customer consumption.

<table>
<thead>
<tr>
<th>Frequenza di avviamento [Hz]</th>
<th>Soglie in derivata di frequenza* [Hz/s]</th>
<th>Soglie in frequenza pura [Hz]</th>
<th>Torino</th>
<th>Milano</th>
<th>Venezia</th>
<th>Firenze</th>
<th>Roma</th>
<th>Napoli</th>
<th>Palermo</th>
<th>Cagliari</th>
</tr>
</thead>
<tbody>
<tr>
<td>49.3</td>
<td>0.3</td>
<td>49</td>
<td>8.0%</td>
<td>8.0%</td>
<td>8.0%</td>
<td>7.0%</td>
<td>7.0%</td>
<td>9.0%</td>
<td>9.0%</td>
<td></td>
</tr>
<tr>
<td>49.2</td>
<td>0.6</td>
<td>48.9</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>8.0%</td>
<td>7.0%</td>
<td></td>
</tr>
<tr>
<td>49.1</td>
<td>0.9</td>
<td>48.8</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>7.0%</td>
<td>7.0%</td>
<td></td>
</tr>
<tr>
<td>49.1</td>
<td>1.2</td>
<td>48.7</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>7.0%</td>
<td>6.0%</td>
<td></td>
</tr>
<tr>
<td>48.6</td>
<td>0.6</td>
<td>48.6</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>5.0%</td>
<td>7.0%</td>
<td>6.0%</td>
<td></td>
</tr>
<tr>
<td>48.4</td>
<td>0.6</td>
<td>48.4</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>5.0%</td>
<td>7.0%</td>
<td>6.0%</td>
<td></td>
</tr>
<tr>
<td>48.2</td>
<td>0.6</td>
<td>48.2</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>5.0%</td>
<td>7.0%</td>
<td>5.0%</td>
<td></td>
</tr>
<tr>
<td>48.1</td>
<td>0.6</td>
<td>48.1</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>6.0%</td>
<td>5.0%</td>
<td>7.0%</td>
<td>5.0%</td>
<td></td>
</tr>
<tr>
<td>Totale compartimentale</td>
<td></td>
<td></td>
<td>50.0%</td>
<td>50.0%</td>
<td>50.0%</td>
<td>45.0%</td>
<td>45.0%</td>
<td>59.0%</td>
<td>51.0%</td>
<td></td>
</tr>
</tbody>
</table>

The following table provides the 4 settings foreseen for the pumps:

<table>
<thead>
<tr>
<th>frequenza avviamento [Hz]</th>
<th>derivata frequenza [Hz/s]</th>
<th>frequenza minima [Hz]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---
List of evidences, comments:

Underfrequency Load Shedding Plan

**AUDIT PHASE**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>49.60</td>
<td>-0.05</td>
<td>49.50</td>
</tr>
<tr>
<td>49.50</td>
<td>-0.10</td>
<td>49.40</td>
</tr>
<tr>
<td>49.40</td>
<td>-0.20</td>
<td>49.30</td>
</tr>
</tbody>
</table>

**COMPLIANCE AUDIT 2012**

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
TERNA showed to Audit Team “Defence plan of the electricity system” Annex 9, chapter 6.2 “Strategy for automatic load shedding” which contains stepping plan for load shedding. TERNA has two criteria for tripping of the under frequency relays: an absolute threshold [Hz] and a gradient threshold [Hz/s]. Average load shedding in in Italy for the first step is within 7% - 9% depending on the amount of load in various regions.
4.11 P5-B-S6.4.1.3 LOAD SHEDDING PLAN – CHECKS

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

**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

**Explanation for the full compliance declaration:**

Regular checking by Terna of load shedding plan and settings once every 2 years (dynamic simulations on the most probable splitting scenarios committed to CESI as an external consultant) Regular checking by the DSOs of load shedding devices and settings at least once per 3 months (report collected by Terna once per 6 months) (Ref. Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security', GC annex A.9 'Defence plan of the electricity system' DRRPX04052)

There are no Questions defined for this company and this policy!

Additional Questions

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:

Last analysis on the Load Shedding Plan was committed to CESI external contractor in 2010; a new analysis will be performed in 2012 also to include the effect of distributed power generations.

Settings and functionalities of each UFLS device included in the Load Shedding Plan is reviewed regularly by the DSOs once per 3 months according to signed agreements. Report about this DSOs activity is sent to Terna at least once per 6 months.

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:

- Underfrequency Load Shedding Plan
- Agreement with DSOs for regular testing of UFLS devices
- Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security'
- Grid Code annex A.9 'Defence plan of the electricity system'

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

Yes [X] No [ ]

List of evidences, comments:

- Update/Check of settings from DSO respect to the Plan
- Performance evaluation of the load shedding plan respect of grid scenarios - 2010

**AUDIT PHASE**

**COMPLIANCE AUDIT 2012**

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

FC

**Explanation for the suggested compliance level:**

"Under frequency Load Shedding Plan" and Italian Grid Code Annex 9 "Defence plan of the electricity system" requires DSOs to perform load shedding checks four times a year. Audit Team reviewed one load shedding test report from "Enel Distribuzione" DSO and list of DSOs certification. Terna regional control centres supervise the testing in their region.
4.12 P5-C-S1.2 TSO RESTORATION PLAN

PREPARATORY PHASE

SELF-ASSESSMENT QUESTIONNAIRE 2011

<table>
<thead>
<tr>
<th>P5-C-S1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

**Compliance Level:** FC

**Explanation for the full compliance declaration:**

Priority for the restoration plan is the fastest possible restarting of the thermal power plant units, by means of predefined corridors (re-energization corridors), which are energized by black-start units or islanded areas of the system still in operation. In case of separation between the Italian system and the neighboring TSOs, the system restoration close to the border is carried out by means of tie-lines re-energization from bordering TSOs. The application of the restoration plan is supervised by the Regional Control Centers of Terna and coordinated by the National Control Centre, which can decide, according to the specific situation, to derogate from the plan. Terna permits, under their coordination, external players (producers, transmission operators and distributors) to start autonomous operation. Restoration procedures are updated as soon as the need arises, depending on the occurrence of topological changes and/or when new power plants with black-start capability are added to the system. (Ref. Code for transmission, dispatching, development, and security of the grid Chapter 10 ‘Defence of Security’, GC annex A.10 ‘Power recovery plan of the national electricity system DRRTX03001’)

**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**

<table>
<thead>
<tr>
<th>FC</th>
<th>SC</th>
<th>NC</th>
</tr>
</thead>
</table>

**Concise explanation and list of evidences for declared compliance level:**

Development and regular updating of restoration plan based on bottom-up and a top-down approach.

Priority for the restoration plan is the fastest possible restarting of the thermal power plant units by means of predefined corridors (re-energization corridors) which are energized by black-start units or islanded areas of the system still in operation. In case of separation between Italy and the Continental Europe system, the system restoration is carried out by tie-lines re-energization according to bilateral or trilateral agreements.

In June 2010 Terna, RTE and Swissgrid agreed a joint operational Trilateral procedure in order to coordinate the restoration of the Italian system from tie-lines. The procedure
identifies coordinated actions in case of Islanded Operation and/or Black-Out (inter-TSOs diagnosis, information exchange and cooperation) and pre-selected re-energization paths involving tie-lines:

- 2 re-energization paths from France
- 5 re-energization paths from Switzerland

Terna intends to propose similar agreements to ELES in the short run. Terna has also developed crisis management policies intended to manage the information flow from the company to external parties under crisis conditions.

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 restoration procedures?
Yes X No ☐

List of evidences, comments:

- Grid Code chapter 10.4.4.4 "Recovery operating state"
- Grid Code annex A10 "Power recovery plan of the national electricity system"
- Restoration Plan: operational procedure and criterion
- IO416DC Real Time Emergency Management rev. 11/04/2011

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

Yes X No ☐

List of evidences, comments:

- Operational procedure for the top-down approach – Criterion (Abroad recovery Lines)
- Operational procedure for the bottom-up approach - Milan area
- Bilateral agreement Terna-APG “Coordinated common action for restoration” ref. 01/01/2008
- Eles-Terna Bilateral Procedure for System Restoration
- Procedure for restoration test “Italia 1” path with RTE of January 7th 2012

Do you update your restoration plan regularly?

Yes X No ☐

List of evidences, comments:

The restoration plan is updated when needed (e.g. in case of inputs from the tests which can improve the plan, dismissal of power plants or corridors included in the plan, envisaged possibility to include new corridors, etc.)
AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
Audit Team reviewed Italian Grid Code chapter 10.4.4.4 “Recovery operating state” and Grid Code annex 10 “Power recovery plan of the national electricity system” which cover general principles for restoration plan. Each 8 regions in Italy have their individual restoration plans. Audit reviewed in detail “Capitolo 2, Piano di Rialimentazione e Riaccensione, Area di Milano” (Milano region restoration plan) which contains bottom up and top down approaches. TERNA declared that restoration plans are updated as grid topology is altered or new equipment is installed to grid.
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

<table>
<thead>
<tr>
<th>P5-C-S1.2.1.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Such procedures have to be proved at least by simulation or off-line calculations.</td>
</tr>
</tbody>
</table>

**Compliance Level**: FC

**Explanation for the full compliance declaration:**

Terna provides system restoration training under realistic conditions for system operations personnel in order to build confidence and optimize effectiveness. Terna tests its restoration plan 2–3 times a year, always involving different re-energization corridors. The tests involve re-energization corridors under realistic scenarios, scheduling and implementing ad hoc grid conditions. The main objective of these tests is to verify the feasibility of the recovery lines, in particular regarding: the capability of the first centers to be restarted to perform an autonomous startup, the regulation, the capacity of thermoelectric groups to maintain ancillary services and make a stable reconnection to the load island, the coordination between units and the training of the operating personnel. (Ref. Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security') Moreover, Terna utilizes OTS (Operator Training Simulator) simulation tool, developed by CESI. The restoration plan is designed by Terna based on system studies (small-disturbance, angle instability, transient instability, frequency instability, voltage instability, thermal overloading). Tools available for simulations or off-line calculations (SICRE and DiGSilent). (Ref. Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security', GC annex A.10 'Power recovery plan of the national electricity system DRRTX03001')

**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 X SC [ ] NC [ ]

Concise explanation and list of evidences for declared compliance level:

The restoration plan is tested under realistic conditions (2–3 corridors per year). The tests involve always different re-energization paths and include both bottom-up and top-down re-energization approach.

Before the test, Terna performs ex ante off-line dynamic simulations with specific tools (SICRE/DiGSilent).

Moreover, Operations Personnel is trained with regular off-line DTS sessions performed with OTS (Operator Training Simulator) tool.
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?

The restoration plan is simulated under realistic conditions and via DTS sessions

List of evidences, comments:

<table>
<thead>
<tr>
<th>Records on performed realistic tests:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- bottom-up approach: report on the re-energization test from France (January 7th 2012)</td>
</tr>
<tr>
<td>- top down approach: reports on the re-energization tests performed in 2011 (S. Giacomo, Presenzano)</td>
</tr>
</tbody>
</table>

Reports of SICRE/DigSILENT simulations and off-line analysis

List of the training sessions performed with OTS including dates, agenda and participants

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
Two to three restoration paths are tested annually with SICRE/DigSILENT and dispatchers practice restoration plans are simulated with DTS. Top-down real time re-energisation test with RTE report on 7 January 2012 was shown to Audit Team.
4.14 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:

As a general rule, all generation units that are practically able to start without external energy supply (black start units) are selected to contribute to restoration. The black start capability of generating units is considered as a mandatory and remunerated ancillary service. Terna utilizes both hydro and gas turbine units for black-start. All black start units are involved in the restoration plan. Their location on the grid affect the definition of the restoration corridors, which are aimed primarily to the re-energization of the thermal power plants. Terna requires load rejection capability for thermal units rated power larger than 100 MW. Although not establishing a requirement for the maximum time for the generators to recover load, Terna requires thermal units subjected to full load rejection to be able to supply their in-house loads for at least 12h. Real-time information of the generators acquired by SCADA system which is designed to be resilient for the restoration process. Full reliability (redundancy) is pursued: considering main system and back-up systems, the minimum availability time of supervision and telecommunication required is 99,99%. IT connections to generating units and control centers are dedicated (point to point). (Ref. Code for transmission, dispatching, development, and security of the grid Chapter 10 'Defence of Security', GC annex A.18 'Verification of the compliance of generation units with the Operator’s technical prescription', annex A.19 'Prescriptions for verifying the performances of production units for restarting the electricity system DRRPX04051', annex A.9 'Defence plan of the electricity system' DRRPX04052, annex A.10 'Power recovery plan of the national electricity system DRRTX03001')

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 X SC □ NC □

Concise explanation and list of evidences for declared compliance level:

All the gas turbines and hydroelectric power plants must be able to start without external energy supply (black start capabilities). Their location affects the definition of the restoration corridors. The Restoration Plan includes at least two corridors for each regional control Center (max number of reenergisation paths which can be managed by in
emergency situation).

The capacity payment mechanism in force requires all plants to maintain always (also when not in operation) a suitable level of efficiency.

Terna requires load rejection capability for all thermal units with rated power higher than 100 MW.

For hydro power plants providing islanded operation capabilities, deployment of Auret automatism which operates in case of frequency deviation is higher than 500 mHz. For thermo units providing islanded operation capabilities, deployment of ILF automatism which operates in case of frequency deviation is higher than 300 mHz.

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:

---

Have you evaluated your needs for black start units?

Yes X  No ☐

List of evidences, comments:

Grid Code Chapter 10 (Annex A Power Restoration Plan)

Grid Code annex A.18 'Verification of the compliance of generation units with the Operator’s technical prescription', annex A.19 'Prescriptions for verifying the performances of production units for restarting the electricity system', annex A.9 'Defence plan of the electricity system', annex A.10 'Power recovery plan of the national electricity system

List of Black Start Plants and Load Rejection capabilities

Operational procedure for the bottom-up approach (Milan regional control centre)

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:

FC

Explanation for the suggested compliance level:

TERNA presented a list of black start capable power plants “List of Black Start Plants and Load Rejection capabilities” which contains all hydro and gas turbine units over 100 MW of installed capacity in Italian power system.
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

P5-C-S1.2.1.3
Black start capabilities of units shall be tested regularly on-site at least once per three years.

Compliance Level: FC

Explanation for the full compliance declaration:
The black start capabilities units are tested by twice a year. The load rejection capability is tested by Terna twice a year, at full and reduced load (with prevalence of reduced loads). The results of each test are communicated by Terna to the Regulator. (Ref. Code for transmission, dispatching, development, and security of the grid Chapter 10 ’Defence of Security’, GC annex A.18 ‘Verification of the compliance of generation units with the Operator’s technical prescription’, annex A.19 ‘Prescriptions for verifying the performances of production units for restarting the electricity system DRRPX04051’, annex A.10 ‘Power recovery plan of the national electricity system DRRTX03001’)

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

AUDIT QUESTIONNAIRE 2012

P5-C-S1.2.1.3 BLACK START CAPABILITIES OF UNITS SHALL BE TESTED REGULARLY ON-SITE AT LEAST ONCE PER THREE YEARS

Compliance level FC X SC □ NC □

Concise explanation and list of evidences for declared compliance level:
The black start capabilities units are self-tested by Producers twice per year. In case of negative performance, the Producer must repeat the test within 6 months. Results are communicated once per year and collected by Terna.

Our defence plan envisages regular on-site tests which are committed by Terna to CESI as an external consulter.

Every year Terna provides the Regulator the report on the tests of black start and load rejection.

(Load rejection capabilities yearly auto-certified by all Producers).

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

Yes ☒ No ☐

List of evidences, comments:

- Grid Code annex A.18 'Verification of the compliance of generation units with the Operator’s technical prescription', annex A.19 'Prescriptions for verifying the performances of production units for restarting the electricity system ', annex A.9 'Defence plan of the electricity system', annex A.10 'Power recovery plan of the national electricity system'.
- Example of test of Black Start Plants (CVA Power Plants).
- 2011 annual report provided to the Regulators (tests performed in 2010).

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:

FC

Explanation for the suggested compliance level:

TERNA presented a list of black start capable power plants “List of Black Start Plants and Load Rejection capabilities” which contains hydro and gas turbine units over 100 MW of installed capacity in Italian power system. The reviewed document contains dates for the latest successful black start tests to 2010 as regulatory reporting for 2011 test is still under developement. Audit Team also reviewed Terna’s follow up procedure for failed black start and load rejection tests.
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: FC

Explanation for the full compliance declaration:
In case of blackout, the load frequency secondary controller is in stopped control state. Coordination procedures developed with RTE, Swissgrid and APG in order to further coordinate the operation of the load frequency secondary controller. (Ref. documents: IO407DC ‘Trilateral Instruction’ and IO408DC ‘Coordinated Common Actions for Restoration’)

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 X  SC  NC

Concise explanation and list of evidences for declared compliance level:

In case of blackout, the load frequency secondary controller is set automatically in stopped control state (after three frequency cycles).

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

Yes X No □

List of evidences, comments:
- Technical specification of load frequency control mode of SCADA System
- List of the training sessions performed with DTS including dates, agenda and participants

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
TERNA presented following documents which fulfil the requirements of the standard:
- Trilateral agreement (TERNA-RTE-Swissgrid), part 2 contains agreed actions regarding use of load frequency control modes
- Esercizio del SEC in condizioni di emergenza (2005) [Management of the Controlled Electrical System under emergency conditions], chapter 6 contains description how load frequency control modes must be handled during a blackout.
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:

DSOs are not allowed to anticipate the reenergisation of the shed load before the TSO order. Furthermore, during the reenergizing processes they must be ready to shed load, even though already reenergized, in case of unbalance between consumption and production. (Ref. Code for transmission, dispatching, development, and security of the grid Chapter 10 ‘Defence of Security’, GC annex A.10 ‘Power recovery plan of the national electricity system DRRTX03001’)

Additional Questions

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

\[\text{yes}\]

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

\[\text{yes}\]

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  

\[\text{FC X SC NC}\]

Concise explanation and list of evidences for declared compliance level:

The DSOs switching centres (PTSDs) are not allowed to anticipate the reenergisation of the shed load before the TSO order. For each re-energization corridor, the Restoration Plan provides the detailed list of pre-agreed manoeuvres in charge of DSO to achieve faster reconnection of load.

In case of unbalance between consumption and production, the PTSDs must also be prepared to reduce the load already powered.

Do you have a mitigation plan to the standard?  

\[\text{Yes X No}\]

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 X  No □

List of evidences, comments:

Operational procedure restoration Plan for the bottom-up approach (e.g. Milan area)

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

Yes X  No □

List of evidences, comments:

Grid Code Chapter 10 (Annex A Power Restoration Plan);

Grid Code annex A.10 ‘Power recovery plan of the national electricity system para 9.1

AUDIT PHASE

COMPLIANCE AUDIT 2012

Compliance Level suggestion by the audit team:
FC

Explanation for the suggested compliance level:
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: NC

<table>
<thead>
<tr>
<th>APG-Austrian Power Grid AG</th>
<th>swissgrid</th>
<th>RTE</th>
<th>ELES</th>
<th>HTSO/DESMIE</th>
</tr>
</thead>
</table>

Actions taken to reach compliance:

After a thorough investigation started at the end of May, on Terna side it was realized that the amount of photovoltaic generation in Italy rose, without notice, roughly to 7000 MW in the last quarter and it is expected to increase significantly. Those generators are almost invariably connected to the distribution grids, at MV and LV levels. This means that they are out of the regulatory scope of Terna’s Grid Code and therefore also out of the responsibility perimeter. This generation could automatically disconnect not according to the thresholds fixed at ENTSO-E level and during the day hours the premature disconnection could not be fully compensated by Terna’s defence plan. In addition such generators have the capability to reconnect automatically to the grid. Terna already formally informed ENTSO-E about the ongoing situation and ENTSO-E is willing to support. (Ref. TE/P20110010070 - 22/07/2011 'Photovoltaic generation increase in the Italian system')

Deadline: 12/2015

Temporary measures to preserve the security of interconnected system

Terna is taking actions a) Towards the Distributors to do what is in their power to avoid disconnections inside the range 51.5 – 47.5 Hz and to update continuously Terna with the amount of the installed capacity b) Towards the Italian Electro technical Commission to correct the current norms c) Toward the Italian Regulator to notify the situation. In spite of that no fast solutions are expecte. Retrofit of present generation is considered difficult to carry out.

Existing addendum for this Policy reference: No

Additional Questions

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

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

Concise explanation and list of evidences for declared compliance level:

Before the actions described hereafter the Grid Code did not allow Terna to rule generating units with rated power ≤ 10 MVA. Generating units with rated power >10 MVA are fully compliant to the standard.

Before the end of 2010 the RES installations connected to DSOs grids were negligible and not influencing the standard. Therefore no reasons for an Addendum has been envisaged at that time.

In March 2011, Terna realized that DSOs grid was affected by a fast increase of distributed and widespread renewable generation.

As a very first action limited the risk of failure of defence plans with expensive countermeasures of NTC reductions and internal redispatching in those cases that could harm the effectiveness of the defence plans. Typically in low consumption periods and daily hours.

On June 2011 Terna promptly activated the mitigation plan described hereafter. First of all sent a letter to ENTSO-E on June, 2011. This was considered a sensible solution because:

a) considered beneficial to support the efforts of ENTSO-E to promote the security of supply

b) criteria for the main units in the distribution network already exist in the Grid Code. Therefore, the RES expansion affects the amount of minor generation affecting security rather than represents an infringement to the rule

c) was formally not possible to present an addendum

Immediately after Terna obtained, for the first time since the GC has been approved, the Regulator’s determination (Delibera AEEG n. 84/2012/R/eel) that allows Terna to prescribe the Connection Requirements for distributed generation connected to MV and LV level under the responsibility of DSOs. Therefore Terna updated the new Grid Code
adding new Annex 70 which prescribes for the above mentioned generation performances fully compliant with the ENTSO-E standards. Annex 70 applies both to existing and future generators dispersed in the DSOs network.

Terna considers satisfactory and consistent with the ENTSO-E requirements the perspectives of a fast mitigation plan. In fact the same document (Delibera AEEG n. 84/2012/R/eel) prescribes an incentivised retrofitting plan for the existing generation connected to MV level with rated power higher than then 50 kW that must comply with Grid Code Annex 70 requirements within 31/3/2013. Automatic reconnection to the grid will be avoided also for these plants.

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 X No ☐

List of evidences, comments:

According to the Grid Code Annex 70, the automatic reconnection of all power plants directly connected to the TSO’s grid must be avoided.

The thermoelectric power plants must perform load rejection and in house load operation for subsequent reconnection instructed by Terna.

The normal operation of renewable plants should be initiated only after receiving the Terna command to “Restore the service”. The hydro power plants and pumping units, must restore the normal operation only after receiving the unlock command from the specific relay; the restart of the group to generation/pumping must be done without the need for local reset.

Grid Code Annex 69 ‘Criteria for the connection of production plants to the defence system of Terna’ (paragraph 7.1, 7.2 and 7.3).

Terna Analysis on the impact of the distributed and widespread renewable generation on the security of the interconnected system (year 2012).

TTF Pentalateral outcomes for the low consumption periods:

- Methodology for the NTC assessment during Low Consumption Periods
- Low consumption periods for the year 2012

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

Yes X No ☐

List of evidences, comments:

For the main units yes.
For the 300,000 dispersed generators the Grid Code Annex 70, prescribes that the distributed generation must not be reconnected to the grid unless the frequency is not recovered to the normal range for at least 5 minutes (value between 49.95 Hz and 50.05 Hz for the continental grid, and 49.9 and 50.1 for Sicily and Sardinia).

Annex 70 ‘Technical Rules for the system requirements related to distributed generation’, paragraph 7.2

Delibera AEEG n. 84/2012/R/eel

**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

The Audit Team found that TERNA is fully compliant with all the audited standards. TERNA estimates that its staff needed about 330 man hours for the preparation of the compliance audit. The Audit Team visited the TERNA control room at the beginning of the audit which helped the Audit Team to have better understanding of the work and the processes in TERNA.

TERNA was well prepared for the audit. All necessary documentation was easily available during the audit and request for additional material was promptly met. Big part of the documentation was also available to the audit team in the preparation phase with translation of most of the relevant documents in English.

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).

As a complementary outcome from the Audit Visit the Audit team suggested TERNA to check the adequacy of its current document management system in order to ensure that only approved and updated documents are the available ones in the control room based on the evidence of that the available issues in Control Room related with the Milan Restoration Plan and the RGCE OH were out of date.

In case of the TERNA Compliance Audit, all preconditions for a successful audit were fulfilled and the Audit Team wishes to express its gratitude to the TERNA company management.
6 SIGNATURE PAGE

ENTSO-E Audit Team Members:

Antonio Ivanovski (Audit Team Leader)

Ivo Nishanov (Audit Team Member)

Aleksandar Petkovic (Audit Team Member)

Jaime Sanchiz (Audit Team Member)

Ana Cigarán Romero (Audit Team Member)

Lasse Konttinen (Compliance Monitoring Advisor)

Date and Place: 06.02.2013, Brussels, Belgium