Risk Preparedness Plan

Regulation (EU) 2019/941 of the European Parliament and of the Council of 5 Jun 2019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC (Article 13)

Competent Authority: Directorate-General for security of energy supply and energy infrastructures of the Italian Ministry of Ecologic Transition

Member States in the Region: Italy, France, Switzerland, Austria, Slovenia[1].

Summary of the electricity crisis scenarios[2]
Scenarios with similar characteristics have been merged and reclassified into six clusters, in order to make the document easier to understand.
Cluster n°1
Crisis scenario 1: Cyberattack – entities connected to electrical grid A cyber-attack against critical Information and Communication Technology (ICT) systems, to power station and major (industrial) loads (e.g.: central SCADA, substation SCADA, EMS, load-frequency control system, data storage, scheduling system, operating systems) could cause outages of lines, transformers, power plants, etc. with possible overloading on remaining lines and transformers and/or direct loss of supply. With standardized ICT components used in various systems and devices of an energy grid, vulnerabilities in one ICT components might cause common failures with a systemic impact on the grid. In case of late detection of an attack, the attacker could act as any employee working within these systems and may manipulate lines, transformers or change set points of load frequency devices and also able to deny access of regular users to the system. If the attacker takes the control of the system, he could be able switch off a particular load or an entire area.
Crisis scenario 2: Cyberattack – entities not connected to electrical grid The operators are increasingly using network automation technologies to manage the electrical grid. The risks on security of supply are increased accordingly and a potential operational disruption could be caused by a cyber-attack against the ICT systems of market participants not directly linked physically to the electrical grid (e.g.: market actors, power exchange platforms, market makers). During this scenario, the attacker can manipulate market conditions, offers, and bids on the electrical energy exchange platform. If the attacker could create and sending manipulated schedules to other partners - they can also stop sending any schedules to others. In this way the power stations will follow manipulated schedules and cause the frequency/system balance to be in danger, moreover TSO (Terna) is no longer able to balance the system with available reserve power with the risk of a blackout.

[1] The other Region involving Greece and Montenegro as Member States has been neglected in these scenarios due to their interconnection through HVDC cables, which electrically decouple the two grids with respect to disturbances. Any separation of the aforementioned interconnections does not significantly affect the Italian electricity system.

[2] The number of each scenario refers to the list of scenarios included in the document sent to the EU commission.

Another potential risk is that the decision-making process might be influenced indirectly via the energy wholesale markets. A disruption or fraud on the energy organized marketplaces might impact the energy stability as planned capacity might not be available if the planning is based on wrong data or information.

Crisis scenario 17: Cyberattack – Loss of ICT systems for real-time operation

In case of an attack against a substantial part of telecommunication infrastructure used for power system or electricity market operation or more ICT systems used in real-time planning and operation of the power system or energy market operation, this can obtain the disrupt, desynchronize, or impact data communications necessary for communications and controls causing load instability with the risk of a blackout.

Moreover, substation local telecommunication networks without security measures apt to identify and prevent cyberattacks could allow an attacker to manipulate multiple substations over time without discovery.

Once inside the digital operations of a substation, an attacker with the necessary skills and tools could disrupt, desynchronize, or impact data communications necessary for communications and controls causing load instability. In these networks, the risk of a coordinated cyber-attack powerful enough to disrupt a portion of the grid is greater.

Cluster n°2

Crisis Scenarios 3 & 4: Critical Assets (3) and Control Centre (4) Physical Attack

The threat of terrorism makes it reasonable to assume that the electric infrastructure is permanently in danger. Due to the infrastructure interdependency, a direct or indirect attack on critical assets, or on control centres, can create economic damages, threaten human life and induce terror in the population.

Different types of attack scenarios can be distinguished. The electrical infrastructure is a target if the main purpose is to damage, to a higher or lower degree, an individual or several components of the system which may be critical for the system operation. Examples are the attacks with conventional weapons on critical autotransformers or the use of explosive to break down transmission towers. Similarly, control centres of TSO, DSOs and Producers could be a critical target for terrorist attack to create a negative long-lasting consequence on the TSO and/or DSOs network control capabilities. Moreover, the set of facilities which are functional to the information and communication technologies (ICTs), supporting the power system control, can also be attacked to indirectly affect the power system operation.

These negative conditions could cause multiple tower and transmission line faults that could lead to overloads and ultimately cascading effect. The damage of critical autotransformers can cause the outage of a large number of customers in case they supply an urban area. Moreover, the resulting fire jeopardize the use of the effected substation. Finally, the attack to a control centre or the damage of the ICT structures hampers the capability to control the power system leading to local or general blackouts.

Cluster n°3

Crisis scenario 8: Volcanic eruption

The scenario would be initiated by the eruption of an active volcano that is possible to produce a significant volume of ash. It is likely that such an eruption would be preceded by seismic activity in the immediate surrounding area.

The damage to grid infrastructure in the local Region (due to earthquakes, flooding, ash, lava flow, etc.) could potentially cause permanent local outages. Ash dispersal could impact open air substations (of both TSO and DSOs) significantly and may build up on insulators, particularly if wet, causing permanent short circuits. The damage to additional infrastructure due to long-distance ash fall can cause further local issues and restrict the ability to restore/repair the damaged electric substations and power lines. The scenario could cause widespread disturbances and outages in the affected areas. Prolonged ash dispersion can reduce solar power production effecting the system power balance.

Crisis scenario 9: Storm

The scenario involves exceptionally strong wind gusts or local thunderstorms, causing vortexes, lightning strikes and potentially affecting electrical infrastructure components. The storm could affect several grid components. The incremental repairing actions could take time due to storm-damaged roads and the fact that some sites are difficult to reach during adverse weather (transmission lines crossing mountains, woods, etc.). The large extension of the damaged area could cause shortages of spare parts and personnel.

The previous events could impact the potential vulnerability of the grid integrity. Examples of consequences include damages on lines due to wind and falling trees, damage to substations due to flying debris, transmission/distribution towers collapse. That causes transmission interconnectors operating close to their security limits, internal and international transmission violations, outages of some internal local areas, eventually a cascading effect with losses of transmission or distribution infrastructure, grid separation potentially leading into load shedding or local/national brownouts.

There is a potential power deficit in the expected wind production due to high wind speed shutdown and/or wind turbine damages. Electrical energy support from other TSOs may be required.

Other secondary dependencies include a potential electricity market impact, the decrease of power reserves, the reduction of transmission paths (reducing also distribution security margins) and capacity and restrictions on exports.

Crisis scenario 11: Heavy precipitation and flooding

The scenario is initiated by heavy rain lasting for a long period. This could cause flooding, landslides of transmission/distribution towers, substations and power plants, weakening of tower foundations as well as difficulties to travel for personnel inducing a higher response time and their lower availability. There could also be consequences on hydro power production due to the need to perform a controlled release of water in order to alleviate the flooding.

There could be unexpected loss of load in the areas where the flooding impacts transmission and/or distribution infrastructure. The scenario can lead to cascading effects especially affecting tie-lines.

Electrical energy support from other TSOs may be required. There could be reduced reserves for balancing purposes and/or reduced capability of re-dispatching power to control the scenario.

Crisis scenario 12: Winter incident

Weather conditions consisting of humidity and wind of sufficient strength could cause overhead line conductors and towers icing. Heavy snow in some areas could lead to the formation of sticky-snow sleeves on conductors. Ice and snow could also accumulate on trees adjacent to overhead lines, causing them to fall and collide with conductors causing permanent damages. There are potential avalanche risks in mountainous Regions involving transmission and distribution towers.

These conditions could cause multiple tower and power line faults that could lead to overloads on the remaining circuits, compounded by potential high demand due to low temperatures. Islanding as result of fragmentation of the network caused by these faults is possible.

The fault repair duration could extend beyond the immediate storm timescale: some roads and areas are impracticable and existing maintenance stock can be insufficient to replace all the damaged equipment. The reaction time of line crews increases because of blocked roads and dangerous environments.

Crisis scenario 16: Multiple failures caused by extreme weather condition

The initiating event may involve multiple failures caused by the extreme adverse weather condition. In particular, multiple network components start failing unexpectedly in a short period, including power plants.

The possible impacts on the infrastructure are the loss of critical grid elements, possible cascading effects and system instability. There could be the partial loss of availability of ancillary services leading to a risk of blackout. There could be possible additional cross-border border impacts, such as the congestion of the interconnection tie lines.

Crisis scenario 30: Earthquake

The scenario would be initiated by a significant magnitude earthquake occurring. The earthquake could damage transmission/distribution infrastructure and power plants. It may also cause a fault or failure of essential grid elements such as large auto-transformers suppling urban areas. If major substations are affected, it could massively degrade the TSO and DSOs normal operational performances. If operational control centres are hit, the system supervision and control could be jeopardized leading to a system blackout.

There could be a massive reduction of transmission capacity in the earthquake area, and the possible inability to balance the system. In case of damaged hydro power plants (pump and reservoir storages) or other generation units, there could be a power deficit and an insufficient number of ancillary services. There may be unusual power flows. Possibly the load shedding could be adopted to keep system controlled and in operation.

Damage to road infrastructure could impact repair times due to access restrictions. There may be limited or no access to the transmission tie lines which leads to reduced intra and cross-border capacities.

Crisis scenario 31: Forest fire

Forest fires could start and spread because of the wind combined with a dry period. The fires cannot be controlled for a few weeks. They could be aggravated by strong wind and lighting spreading or creating new fires. Uncontrolled wildfires may initiate unavailability or inoperability of some generation units or transmission and distribution infrastructure. This may trigger structural degradation or a massive violation of security operative standards, which may lead to cascading effect.

Several high, medium and low voltage power lines and substations are tripped off because of burning trees falling on the electrical grid infrastructure. Other power lines might be disconnected due to the firefighters' work to control the fires. There may be the need to a load reduction and to apply the load shedding, as well as reduced availability of redispatch. A lack of generation capacity, together with a lack of transmission capabilities, lead to a scarcity situation, including power balancing. There may be non-fulfilment of the operative security criterion and the power re-dispatching may be applied.

There could be the postponement of the maintenance or repair of affected power lines due to difficult working conditions for personnel (up to the limitation in transfer capacity), as well as asset degradation and direct damage to overhead lines, including interconnectors. The wind, associated with the reduced number of available lines, complicates the system operation.

Cluster n°4

Crisis Scenario 27: Pandemic

A pandemic disease differs from the other major threats as it is an event involving people and whose most distinctive vulnerability regards the loss of critical staff in charge to guarantee the safe management of the electricity system and market. These people are experienced employees supervising and controlling the power system, those who perform the maintenance of the transmission/distribution grids and power plants and, generally, all who actively operate in normal and emergency status to manage the power system and to restore power following outages caused by faults and weather or other natural events.

The increasing loss of these personnel due to the spread of the disease could shift the operational issues to keep the system in service, toward less-trained or less-experienced individuals then the increase of the risk of permanent outages and the possible evolution of the system status into large blackouts.

The TSO have already experienced a mild pandemic along the last decades (i.e. A/H1N1 outbreak) which had very limited effects and have not been representative of the scenario being faced during the COVID19 pandemic. That forced the TSO, DSOs and Producers to establish a new set of procedures specifically tailored for such a disease.

Cluster n°5

Crisis scenario 10: Cold spell

This scenario foresees an increase in demand due to extreme cold weather. Water could freeze in reservoirs inducing hydro power plants to decrease the power production. Lack of wind could be an additional event. There could be combined cycle generation constraints due to the reduced capability of the cooling modules. Some network components are exposed to possible failure (I.e.: SF6 gas insulating substations) and global system reliability decreases. The situation lasts for several days or weeks.

Crisis scenario 13: Fossil fuel shortage

The initiating event occurs in the period of a year with high domestic fuel demand and low stock. The initiating event leads to one or more consequences that follow, such as an intentional prolonged disruption of fossil fuel production, fuel supply system failure for technical reasons or due to malicious activity, supply limitation due to trade-related or political reasons, adverse weather conditions, etc. In the case of imported fuel, transit states may limit available amount further, in order to ensure their own fuel supply. A prolonged supply limitation causes power shortage, limited availability of reserves, voltage stability support and insufficient system inertia.

Crisis Scenario 28: Heatwave

There is a heat wave in a large part of Europe with record-breaking temperatures for several days. Most European rivers reach low water levels due to the extended dry period. At the same time, there is a high demand for electricity, mainly in Southern Europe with high electricity flows. This scenario causes the following prolonged effects on the power system:

- significant increase of water temperatures of reservoirs and rivers (close to the maximum allowed temperature for thermal generation due to environmental restrictions),
- reduction of surface water level in reservoirs and rivers due to low or no rainfall,
- demand increase in air conditioning due to heat waves,
- decline in generation due to the limited capacity to cool thermal generation (a limited level of surface water and/or too high of temperatures of water there),
- reduction of hydro generation availability,
- decline in generation due to limited transmission capacity on the transmission and distribution systems - extremely low generation on wind turbines (heat waves mean little to no wind),
- reduction of import and transmission capacities due to limited powerline thermal capacity,
- congestions on national lines cause problems with ensuring secure operation of the power system,
- reduction of import capacities due to congestions on cross-border lines (limited ability to import from other TSOs),
- some key generators are in scheduled or unscheduled maintenance,
- stress on distribution networks, mainly on underground cables.

Definitively, the lack of generation capacity together with the lack of import capabilities lead to a scarcity condition that could trigger the application of planned load reductions and/or load shedding.

Crisis Scenario 29: Dry period

In case of an extremely dry period characterized by low rainfall, I.e.: no precipitation for several weeks up to some months, reservoirs of all hydro power plants could be almost empty. The low water levels imply a general low hydro production ending to a critical number of hydro power plants out of operation. Several thermal power production units could decrease the power production or must shut down because of insufficient cooling means. Lack of generation capacity together with lack of import capabilities could lead to a scarcity situation. The peak demand may exceed the maximum generation and import capacity causing severe adequacy problems.

Crisis scenario 32[3]: Large energy import unavailability

This scenario is the consequence of other crisis scenarios negatively influencing TSOs exporting power to connected areas within the same Region. Specifically, an exporting TSO could experience cold spell, fuel shortage, extended strikes and similar events causing a relevant reduction of inner power production which is compensated with the

[3] Additional scenario not included in the ENTSO-E ones.

violation of the scheduled power export for the same amount of the deficit. Then, importing TSO must face a production deficit even though there are not critical events in the controlled power system.

Cluster n°6

Crisis scenario 23: Strike, riots, industrial action in power supply chain

This scenario represents an escalation of events which may involve social disputes of some kind that lead to industrial action at scale. It also may include riots, blockades or other massive social unrest regardless of motivation or inspiration. As a direct consequence, staff in the energy sector (energy fuel mining, power plants, transmission and distribution) refuse to work, work to rule or are prevented from work. There could be a staff shortage in the power plant control rooms as well as in control centres of the TSO, DSOs and producers. There may be possible limitations on power generation, due to security concerns or fuel supply issues. Social disturbance on a large scale will lead to unusual energy demand patterns, thus making power system behaviour less predictable causing a possible shortage of power reserve. Planned and emergency maintenance activities in the energy sector may be prolonged for a considerable time reducing the system reliability and creating the condition for local outages. If power plants are impacted by staff or fuel shortages, the risk of generation inadequacy increases.

Roles and responsibilities of the competent authority and delegated entity

Competent Authority (Ministry of Ecologic Transition – Directorate General for security of energy supply and energy infrastructures)

- If there is a concrete, serious and reliable information that an electricity crisis may occur, the competent authority shall, without undue delay, issue an early warning to the Commission, the competent authorities of the Member States within the same Region and, where they are not in the same Region, the competent authorities of the directly connected Member States. The competent authority concerned shall also provide information on the causes of the possible electricity crisis, on measures planned or taken to prevent an electricity crisis and on the possible need for assistance from other Member States. The information shall include the possible impacts of the measures on the internal electricity market. The Commission shall provide that information to the ECG.
- Shall, when confronted with an electricity crisis and after consulting the transmission system operator, declare an electricity crisis and inform the competent authorities of the Member States within the same Region and, where they are not in the same Region, the competent authorities of directly connected Member States, as well as the Commission, without undue delay. That information shall include the causes of the deterioration of the electricity supply situation, the reasons for declaring an electricity crisis, the measures planned or taken to mitigate it and the need for any assistance from other Member States.
- Shall communicate to the stakeholders the early warning and/or the electricity crisis status.
- In case of fossil fuel shortage, shall convene the Gas Emergency Committee in order to detect and adopt all necessary measures to mitigate and reduce the risks for the continuity of the energy supply.
- Empowers TSO, in charge of the national grid management, as responsible for the management of the crisis situation, in coordination with the other entities involved for the various criticalities that may occur (public order, travel problems, health problems, etc.) during the different crises.

Transmission System Operator (TSO - TERNA)

- Shall monitor the status of the electricity system, also in collaboration with the interconnected international transmission operators.
- Shall guarantee the dispatching of the Italian electrical system during normal and emergency conditions.
- Shall ensure the correct operation and maintenance of the National Transmission Grid (NTG).
- Shall guarantee interoperability conditions and actions that will contribute to the successful outcome of each crisis stage.
- Shall ensure the quick intervention of the due maintenance squads to allow the set of the suitable actions to face the emergency scenario from the early beginning.
- Shall prepare a significant set of spare parts and spare large components, such as autotransformers of any rated power and voltages, to be ready for quick transportation and replacement.

- Shall assume the role as point of reference and coordination of the entire NTG for the purpose of operational management of the emergency. To carry out this role, it shall closely work alongside the electricity producers, DSOs and the other relevant stakeholders for restoring supply during the emergency via alternative system configurations.
- Shall report the possible deterioration of system status and the possible activation of early warning and electricity crisis to the Competent Authority when this deterioration could have national or Regional relevance, promptly informing the Competent Authority about the activated measures.
- Shall inform the Competent Authority – with reference to the decisions taken in the "**Crisis Coordination Centre**", chaired by PCM (Prime Minister Office) for the general management national crisis, attended by Civil protection, DSOs, Producers, TLC operators, road operators, the Health Authority (in the case of the pandemic scenario), the Police Departments (in the case of the Critical Assets and Control Centre Physical Attack scenario), the Gas TSO - SNAM (in the case the fuel shortage) and other relevant entities – only about the critical decisions affecting the electrical system.
- Shall inform the Competent Authority about the activities of the Security Operation Centre (SOC).

TERNA, the TSO in charge of the national grid management, is responsible for the management of the crisis situation as far as to electricity sector, **in cooperation with** the following independent entities which play a determinant role in the crisis management, depending on the scenario.

- ***Distribution System Operator (DSO) who:***

✓ Shall contribute, each for their own area of competence, to collect the information necessary to guarantee the electricity system monitoring.
✓ Shall ensure the correct operation and maintenance of the electrical grid of their competence.
✓ Shall guarantee interoperability conditions and actions that will contribute to the successful outcome of each crisis stage.
✓ Shall collaborate with the TSO and the other relevant stakeholders for the management of the emergency.

- ***Electricity producers* who*:***

✓ Shall provide, also upon the provisions of this document, all the information useful to the TSO for the management and dispatching of the system.
✓ Shall guarantee full availability of power plants; within this scope they shall:
  - keep the facilities in good working order in expectation to be called into operation with the established forewarning;
  - ensure an adequate backup power supply to provide the required service.

- ***Regional Security Coordinator[4] who:***

✓ Shall develop and perform coordination services in cooperation with TSOs and other RSCs, while TSOs remain responsible for operation.
✓ Shall perform adequacy assessments on the basis of the information provided by the relevant TSOs with the aim of detecting situations where a lack of adequacy is expected in any of the control areas or at regional level, taking into account possible cross-border exchanges and operational security limits.
✓ Shall deliver the results together with the actions it proposes to reduce risks to the TSOs of the region.

- ***ENTSO-E who:***

✓ Shall verify the technical cooperation between TSOs.
✓ Shall publish the Summer and Winter Outlook reports for electricity generation for the short-term system adequacy overview.

- ***Civil Protection who:***

[4] Starting from 2022, it will be the Regional Coordination Centre.

- ✓ Shall collaborate with the TSO and the other relevant stakeholders for the management and the mitigation of the emergency.
- ✓ Shall forecast and prepare for possible crisis due to weather events.
- ✓ Shall possibly institute the Crisis Coordination Centre, involving the relevant stakeholders.
- ✓ Shall monitor and coordinate the actions provided by stakeholders to ensure the support of the people.

- ***Health Authority who:***

- ✓ Shall provide quality and timely information on the spread and severity of a pandemic.
- ✓ Shall provide clear triggers for the TSO to make appropriate response decisions in the event of a severe outbreak.

- ***Police Departments who:***

- ✓ Shall guarantee the quick intervention, following the SOC alert and request, according to the Support Protocols already active and in place with the TSO.

- ***Gas TSO (SNAM) who:***

- ✓ Shall monitor the status of the gas system, in collaboration with Terna.
- ✓ Shall ensure the correct operation and maintenance of the National Transmission Grid (NTG).
- ✓ Shall guarantee interoperability conditions and actions that will contribute to the successful outcome of each crisis stage.
- ✓ Shall report the possible deterioration of the gas system status and suggest the possible activation of the natural gas system's Emergency Plan to the Competent Authority.

- ***Gas Crisis Committee who:***

- ✓ Shall be responsible for the security of Natural Gas national system, aiming to guarantee the continuity and safety of supply.
- ✓ Shall adopt temporary measures to minimize serious risks for supply, in case of energy markets crisis or serious risks for community safety or for integrity of electrical system.
- ✓ Shall provide guidelines to Gas TSO and companies involved in gas sector if strategic storages need to be used and pledge the relative agreements; also establishes rules for dispatching in emergency conditions and security obligations.
- ✓ Shall manage the emergency which might occur to national gas system.

- ***Authorities for rivers and lakes conservation (Autorità di Bacino) who:***

- ✓ Shall plan actions and guidelines aiming to preserve, defend and valorise the territory and the correct use of water source, based on specific characteristic of the environment.
- ✓ Shall protect the territory from hydrogeological instability phenomena.
- ✓ Shall monitor the water used in power plants during water emergency.

- ***Italian Computer Security Incident Response Team (CSIRT–Italia) who:***

- ✓ The Italian CSIRT shall provide information and assistance to its constituency in implementing proactive measures to reduce the risks of computer security incidents as well as responding to such incidents when they occur.
- ✓ The Italian CSIRT shall also ensure efficient cooperation at Union level participating in networks of CSIRTs.
- ✓ The Italian CSIRT shall be responsible for addressing all types of computer security incidents occurring within its constituency. It may act as coordinator and facilitator for incident response or for threats with a large-scale impact at the national level.
- ✓ In case of transnational incidents, the Italian CSIRT shall cooperate in the CSIRTs network and shall act as national technical Point of Contact (PoC) receiving and sharing useful information for mitigating and solving incidents and/or coordinating the response among national and international technical counterparts.

- ✓ The Italian CSIRT shall undertake the task to keep its constituency updated on potential vulnerabilities, possibly before they can be exploited.
- ✓ In addition, the Italian CSIRT shall liaise and shall be able to request to a matrix of other expertise and knowledge provided by other Italian government offices.

Incident Response and related processes:

- ✓ The Italian CSIRT provides assistance or advice with respect to the following aspects of incident management:
  - investigating the nature and the cause of the incident;
  - determining the initial cause (e.g. vulnerability exploited);
  - keeping contacts with other parties involved;
  - reporting to other CSIRTs;
  - supporting in response activities.
- ✓ The Italian CSIRT provides to its constituency the following proactive services:
  - announcements;
  - security-related information dissemination;
  - technology watch;
  - trend and neighbourhood watch;
  - information security risk management.
- ✓ The Italian CSIRT provides to its constituency the following reactive services:
  - alerts and warnings;
  - forensic analysis;
  - incident analysis;
  - incident response support;
  - incident response coordination;
  - vulnerability response coordination.

The level of support given by the Italian CSIRT varies depending on the type and severity of the incident or issue, the type of constituent, the size of the user community affected, and the Italian CSIRT resources at the time.

- ***Inter-ministerial Committee for the Security of the Republic (CISR) who:***

- ✓ Shall be responsible for intelligence policies, intelligence coordination and intelligence operations.
- ✓ Shall support the crisis management operations.

- ***TLC network operators who:***

- ✓ Shall supply all types of communications services (voice, data, etc).
- ✓ Shall assure the availability of internet backbones and of the Mobile Network to support communications and crisis management operations.

- ***Road network operators who:***

- ✓ Shall be responsible for road maintenance and viability at national, regional and local level.

Procedures and measures in the electricity crisis

National procedures and measures

TSO (TERNA):

All the procedures and measures described in this section comply with the European Network Codes (https://www.entsoe.eu/network_codes) and with the Italian *Transmission, Dispatching, Grid development and Security Code*, which is a document containing indications and guidelines relating to the transmission, dispatching and security services of the energy grid, drawn up in accordance with the rules established by the national legal and regulatory framework**.**

In particular, the measures for the management of power system critical scenarios are described in Chapter 10 – *Defense of Security* and in Annexes A.9 (Piano Di Difesa Del Sistema Elettrico), A.10 (Piano Di Rialimentazione e Riaccensione Del Sistema Elettrico Nazionale) of the aforementioned Italian Grid Code (https://www.terna.it/en/electric-system/grid-codes/italian-grid-code).

In the following, a synthetic description of the procedures and measures to keep the power system reliable, secure and controllable to face critical scenarios, are reported.

TERNA immediately communicates to the Competent Authority the activation of these measures for scenarios having National or Regional relevance.

Procedures and Measures against CLUSTER #1 EVENTS

In the case of an electrical risk scenario resulting from a **cyber-attack** (scenarios 1,2 and 17), [……**sensitive information**……] *following procedures and measures are in place*:

- Terna appointed a specific function (Computer Emergency Readiness Team TERNA-CERT) in order to communicate and coordinate with CSIRT[5](s) regarding the fulfilment of legal obligations.
- Terna shall notify, immediately and with the established communication protocols, the Competent authority and the CSIRT-Italia of any incident having a significant impact on continuity of provided essential services.
- Terna shall manage incoming CSIRT-Italia security alerts performing following activities:
  - assessing the typology of the alert;
  - analysing possible impacts on the system;
  - verifying technical implications through its ICT functions;
  - planning remediation activities to guarantee the normal operation of the systems;
  - starting, if necessary, the appropriate hardening and patching activities on the systems.
- Terna shall include in the notification process any information that allows the Competent authority and the CSIRT-Italia to determine also any cross-border impact of the incident.
- In order to understand the impact of an incident, Terna shall define in particular the following parameters to be taken into account:
  a) the number of users affected by the disruption of the essential service;
  b) the duration of the incident;
  c) the geographical spread with respect to the area affected by the incident.
- Within the incident management process, Terna shall ensure appropriate cooperation between the competent authorities, the CSIRT-Italia, single points of contact, the law enforcement authorities, the data protection authorities and the authorities responsible for critical infrastructures.
- Following the first notification, even during the incident response and recovery activities, Terna shall ensure adequate information flows to the competent authorities and the CSIRT-Italia (cyber situational awareness).
- At the end of the incident, Terna shall send an Incident Report with:
  a) impacted services and assets;
  b) duration and impact of the incident;
  c) the cause of the incident;
  d) the performed activities;
  e) the adopted mitigation measures;
  f) the actual status of the systems;
  g) potential additional relevant information.

- ***Early Warning***

[5] Computer Security Incident Response Team

- The Early Warning level shall be activated in the case of a malicious penetration in the ICT infrastructure of the control center that impairs the control activities provoking outages with an Energy Not Supplied above 250 MWh.
- *Early warning measures*:
    - collaboration with DSOs and the other relevant stakeholders, under the guidance of National Authorities;
    - activation of disaster recovery procedures;
    - disabling or removal of ICT services or applications to reduce impact surface;
    - disabling or removal of ICT assets or network segments/connections;
    - password Reset.

- ***Electricity crisis***

- The Electricity crisis level shall be activated if the threat that caused the Early Warning level activation persists and escalates to a level that impairs the control activities, forcing TERNA to implement the measures reported below.
- *Electricity crisis measures*: the measures implemented include, in addition to the ones illustrated for the early warning level:
    - operate the transmission grid by means of the local supervision and management of the electric substations.

Procedures and Measures against CLUSTER #2 EVENTS

- The TSO shall define the operating methods to effectively manage critical events from their potential starting to the complete resolution. The main purposes of Emergency Management for critical events are:
    - to organize the company structures in advance to deal with emergencies resulting from reasonably predictable scenarios;
    - to facilitate the correct and effective circulation of information among company structures responsible for the operational management of emergency situations.
- The activation of the procedures and measures is due to:
    - criminal events (e.g.: thefts, kidnappings, terrorist acts, etc.) that cause or may cause damage to assets or that involve the TSO personnel in service and/or contractors working on its behalf;
    - socio-political events (e.g.: public demonstrations, strikes, etc.) that compromise or may compromise the operation of the TSO assets or involve the TSO personnel in service or contractors working on its behalf;
    - actions of third parties that impede or may impede the normal course of activities at the TSO worksites;
    - intrusion by outsiders into the TSO substations and/or premises.

  All the above cases therefore could induce the following criticality:
    - operating events that cause the passage from the normal state of operation to the interruption one and that have negative evidence outside the company towards the population or towards the energy markets;
    - accidental, extended and prolonged outages of components connected to the power system.

- ***Early Warning***

- With regards to scenario 3, the Early Warning level shall be activated in case of malicious, simultaneous physical attack against two or more transmission assets (being either transmission lines or substations), of the 400 – 230 kV grid, causing permanent damages.
- With regards to scenario 4, the Early Warning level shall be activated in the case of a prolonged hostile demonstration outside the power system control centre causing the impediment of the normal access to the facility which greatly impairs the grid control activities.
- *Early warning measures*:
    - activation of a local coordinating operational team;
    - recall to service of all available personnel;
    - intervention of the concerned maintenance unit personnel, if necessary;
    - intervention of the nearby maintenance unit personnel, if necessary;
    - activation of third-party companies and contractors (transportation, repair, rent of power units, ...), if necessary;
    - participation to Civil Protection coordination centres on national and/or local level;
    - coordination with DSOs and producers;

- operational measures for fast recovery;
- activation of disaster recovery procedures for each one of the [**…sensitive information…**] TSO Control Rooms, as provided by the Network Code Emergency & Restoration.

- ***Electricity crisis***

- With regards to scenario 3, the Electricity Crisis level shall be activated in case a physical attack causes infrastructure damages provoking outages of domestic costumers having an Energy Not Supplied above 250 MWh.
- With regards to scenario 4, the Electricity Crisis level shall be activated in case the physical attack has the consequence of permanent damages of the control facility and/or obliges the personnel to abandon the site with the interruption of the control activities.
- *Electricity crisis measures*: in order to manage emergency situations in the most effective way, the TSO shall prepare in advance the resources, means, equipment, the components and the grid assets so as to minimize the difficulties that could arise for the selection and repair of damage caused by the physical attack. That involves, in addition to the measures described for the early warning level:
  - to evaluate the priority and the best strategy to be adopted;
  - to plan an adequate number of resources and suitable means depending on the type of attack;
  - to interact effectively and quickly both inside and outside the TSO with Prefectures, Police Departments, Regions Authorities, Civil Protection, Local Authorities, Mayors and with the Manufacturers in implementation of the Coordination Protocols / Operating Regulations in force.

  In particular, for an effective management of the crisis, the TSO shall:
  - activate the Emergency Management Teams;
  - set up of appropriate Operational Teams;
  - activate dedicated information channels with the involvement of the figures responsible for interfacing with the authorities, prefectures, police forces, civil protection (depending on the seriousness of the situation).

Procedures and Measures against CLUSTER #3 EVENTS

Based on the operating status of the electrical system, the internal Emergency Procedure is activated.

For the purpose of the adoption of Regulation (EU) 941/2019, the Alarm level of the internal Emergency Plan correspond to "Early warning crisis level" as provide for by article 14, paragraph 1, and Emergency level of the aforementioned Plan correspond to "Electricity crisis level" as provide for by article 14, paragraph 2.

- ***Early warning (Alarm)***

- The Early warning level is declared when, although critical situations are not in progress, there are signals or events that are likely to make it evolve into an Emergency. Tools for monitoring and forecasting possible crisis situations that are used to support the decision of activation of the Alarm level are:
  - weather reports provided by Civil Protection and/or Regional Natural Risk Monitoring Centers (with deterioration of weather conditions);
  - marginal or critical events in structurally weak parts of the grid (e.g. radial configuration) or in presence of critical activities/works;
  - extreme natural events which can cause extended power failures;
  - Alert, Alarm or Emergency State declarations from Institutions or other grid holders and/or users.
- *Early warning measures*: measures to be implemented in case of Alarm level declaration include:
  - warn of operational personnel in the concerned area and in the nearby areas for possible mutual support reinforcement;
  - reinforcement of availability shifts evaluation;
  - reinforcement of availability personnel on duty;
  - eventual deployment of available personnel in the critical areas;
  - maintenance works and re-energization time evaluation;
  - stop of non-strategic activities;
  - pre-alarm of third-party companies and third-party contractors;

- preliminary actions for risk containment;
- coordination with DSOs and producers;
- possible call of the internal Emergency Team.

- ***Electricity Crisis (Emergency)***

- The Electricity Crisis level is related to a situation that arises due to any event, internal or external to the TSO's grid, that represents a risk of serious disturbance for the population, personnel, equipment or the environment and which endangers the continuity of the electricity service and cannot be effectively addressed according to normal operations but requires specific coordination and/or operational reinforcements.
  Emergency, which can be preceded (or not) by Alarm, is characterized by events which can cause extended power failures of:
  - entities directly connected to the NTG;
  - critical users (hospitals, airports, railway stations, gas pumping stations…);
  - users with a relevant media impact.
- *Electricity crisis measures*: the measures related to the Emergency, in addition to the ones described for the Alarm level, are described below:
  - activation of a local coordinating operational team;
  - recall to service of all available personnel;
  - intervention of the concerned maintenance unit personnel;
  - intervention of the nearby maintenance unit personnel, if necessary;
  - activation of third-party companies and contractors (transportation, repair, rent of power units,..);
  - participation to Civil Protection coordination centres on national and/or local level;
  - operational measures for fast recovery;
  - automatic Load shedding: in case of grid separation with deficit in production, it is the quick intervention of devices sensitive to frequency and/or voltage degradation aimed to get the power-demand balance.

Procedures and Measures against CLUSTER #4 EVENTS

In case of "Pandemic" scenario 27, in accordance with the decisions of the Crisis Coordination Center, the TSO Crisis Committee is activated. This Committee is a structure formalized in a company policy, chaired by the CEO and composed of the company figures most affected by the emergency impacts, whose minutes are transmitted to the Ministry of Economic Development, the Regulatory Authority and the Department of Civil Protection (with a member of the Crisis Committee permanently seconded to the Operational Committee of the DPC).

- ***Early Warning***

- Early warning level is activated in the case of a Pandemic declaration by the Health Authority.
- *Early Warning measures:* to face the possible critical impact of the pandemic, the Crisis Committee meets (via web-call) and immediately orders the following measures:
  - communication to employees residing in the Municipalities affected by the urgent measures to contain the infection about their suspension from work with the consequent provision not to go to the places of work of competence;
  - suspension of training activities in-person and replacement with online sessions;
  - suspension of business trips not essential for business continuity purposes;
  - instructions to staff not to go to the workplace if flu symptoms are felt and to contact their medical doctors;
  - dissemination of the rules of the decalogue drawn up by the Ministry of Health and the Italian National Institute of Health which provides the fundamental behaviours to be adopted for the prevention of the contagion;
  - activation of constant information and coordination of the Employers and their delegates in order to indicate the appropriate preventive actions to limit the contagion (e.g. sanitizing gel and cleaning with disinfectants), as well as to share protocols for possible access to red zone for operating and room staff;
  - activation of constant information to the trade unions.

As a practical activation of the previous general-purpose measures, the TSO:

- shall reduce all non-urgent maintenance activities on the transmission network.
- shall apply mandatory working-from-home for all the TSO employees except system operators, maintenance operators and other critical positions, previously mentioned.
- shall allow travelling for activities supporting operation of the power system only.
- shall suspend training, enforcing e-learning.
- shall install distributors of sanitizing products in each company building.
- shall adopt specific sanitation and cleaning procedures in the Control Rooms of the National Control Center and of the Regional Control Centres.

With particular reference to Control Rooms, the following measures shall be adopted:

- Control Rooms access is limited to operators and control staff only;
- specialized staff, at each shift change, measures body temperature to operators entering the Control rooms, using infrared thermometers;
- meals are served directly in Control Room;
- for each of the [**…sensitive information…**] TSO Control Rooms, a nearby back-up Control Room must be fully activated. Personnel rotates alternating between the main Control Room and the back up one, leaving the elapsed time of a shift for sanitizing the Room not in use. That in order to reduce contacts among operators;
- deep periodic cleaning of critical surfaces and tools in the Control Room (e.g. telephones, consoles, PC, etc, ...).

- ***Electricity crisis***

- Electricity Crisis level is activated when *the availability of the shift operators* [**…sensitive information…**] in the National Control Centre or in the Regional Control Centres *is reduced*.
- *Electricity Crisis measures:* If the aforementioned precautionary measures would not be sufficient to curb the pandemic, an emergency procedure will be adopted for the supervision and control of the power system as this activity more critical and more vulnerable than the other management activities of the electric transmission grid. In particular, the physical or IT impracticability of one of the control rooms, comparable to the unavailability due to the pandemic illness of most or all of the system operators, triggers the activation of the already planned and tested Disaster Recovery procedure.

Procedures and Measures against CLUSTER #5 EVENTS

In the case of crisis scenarios possibly leading to adequacy issues, the procedures and measures described in this section can be adopted to keep the power system controlled and to mitigate the risk of power outages.

- ***Early Warning***

- With regards to scenario 10, 28 and 29, the Early Warning level shall be activated when there is a concrete, serious and reliable information that a cold spell, heatwave or a dry period would occur within 4 working days.
- With regards to scenario 13, the Early Warning level shall be activated when the Alarm level of the Emergency Plan for Natural Gas System is activated (Annex 2 of the Decree of the Minister of the Economic Development of September 30th, 2020).
- With regards to scenario 32, the Early Warning level shall be activated when there is a concrete, serious and reliable information that a foreign Member State exporting electricity to the Italian electricity system is going to encounter cold spell, fuel shortage or similar events causing a relevant reduction of inner power production.
- *Early Warning measures:*
  - Generation units and grid elements maintenances planning to reduce possible risks for adequacy, especially during peak load periods.
  - TSO shall do risks evaluation of fuel shortage through a continuous dialogue with the Gas TSO (SNAM) also participating to Gas Emergency Committee.
  - TSO shall do risks evaluation of water shortage through a constant communication and dialogue with Autorità di Bacino (authorities for rivers and lakes conservation), who monitors the status of the main rivers and lakes in Italy.

- TSO shall do monitoring weather forecasts to detect possible extreme situations that might cause risks for adequacy (increased load as a consequence of cold spell or heat wave or reduced generation availability caused by extended dry period);
- TSO shall perform, twice a year, a control area adequacy analysis for the following summer and winter respectively, taking into account pan-European scenarios consistent with the pan-European annual summer and winter generation adequacy outlooks. Consequently, communicates to the Competent Authority the status of the electrical system and if a risk is detected, a week-ahead communication process is activated.
- TSO shall perform week ahead adequacy analysis in order to detect possible risks for adequacy in its control area.
- TSO shall optimize all internal resources in operational planning phase, such as postponement of maintenances of unit productions and grid elements, optimization of thermal powerplants with long start-up time, optimization of hydro reservoir and pumping power plants.
- If an Early Warning level is activated, the Competent authority and the TSO shall promptly publish the information on their relevant web sites.

- ***Electricity crisis***

- With regards to scenario 10, 28 and 29 of this cluster, the Electricity Crisis level shall be activated when a cold spell, heatwave or a dry period would occur causing adequacy issues.
- With regards to scenario 13, the Electricity Crisis level shall be activated when the Emergency level of the Emergency Plan for Natural Gas System is activated (Annex 2 of the Decree of the Minister of the Economic Development of September 30th, 2020).
- With regards to scenario 32, the Electricity Crisis level shall be activated when a foreign Member State exporting electricity to the Italian electricity system is going to encounter cold spell, fuel shortage or similar events causing a relevant reduction of inner power production resulting in adequacy issues.
- *Electricity Crisis measures:* When the aforementioned preventative measures fail, and only after the activation of the Regional/Bilateral procedures and measures described in the next section, the TSO could apply the following measures in order to reduce the electricity consumption:
  - Rolling blackout: if an emergency status is foreseen, Terna can ask the DSOs the activation of a planned defence procedure for load interruption by rotation (called PESSE procedure) in day D-1 to be performed in day D or, lately, with an advice of at least 30 minutes before the execution, as described in Annex A.20 (Disposizioni per la predisposizione e l'attuazione del piano di emergenza per la sicurezza del sistema elettrico (PESSE)) to the Italian Grid Code. The rolling blackout, or a rotating outage, is an intentional power shutdown for non-overlapping periods of time over different parts of the distribution costumers.
  - If no other countermeasures are available, the last measure to keep the power system controllable is to activate the manual Load shedding in real-time operation to preserve the security of the supply, as described in Chapter 8 of Annex A.9 (Piano di Difesa del Sistema Elettrico) to the Italian Grid Code.

Procedures and Measures against CLUSTER #6 EVENTS

In case of scenario 23, when staff in the energy sector (energy power plants, transmission and distribution) refuse to work and the strike has national significance, the TSO is informed in advance by the Trade Unions and the TSO can assess in advance whether these work restrictions have a significant impact on the functionality of the electricity system.

The Italian law 12 June 1990, n. 146, "*Rules on the exercise of the right to strike in essential public services and on the safeguarding of constitutionally protected personal rights. Establishment of the Commission to guarantee the implementation of the law",* identifies, among the public services essential, "*the supply of energy, energy products, natural resources and basic necessities, and the management and maintenance of related plants, limited to what concerns the safety of the same*".

This law provides that the right to strike is exercised in compliance with measures aimed at allowing the continuity of essential services, and that the administrations and essential service companies regulate in their contracts, for the indispensable functions, the modalities of the right to strike.

So, the contracts and the various trade union agreements provide that, when there is a strike, it must be communicated in advance and an assessment of the repercussions of this strike on essential services must be carried out.
The law provides that the trade unions communicate a strike involving the power plants having national significance. The TSO shall evaluate the compatibility of the strike with respect to the system security and adequacy and shall indicate, if necessary, to the Ministry of Ecologic Transition the power plants that cannot strike. The Ministry shall invite the trade unions to cancel or reschedule the strike and, if the trade unions refuse, the Minister shall draft workers in order to ensure the operational continuity of the plants.

- ***Early Warning***

- The Early Warning level shall be activated when, in case trade unions refuse to cancel or reschedule the strike, drafting workers will be necessary.
- *Early warning measures*:
    - The Minister of Ecologic Transition shall draft workers to ensure the operational continuity of the plants.

- ***Electricity crisis***

- The Electricity Crisis level shall be activated in the extreme case when the strike takes place notwithstanding the draft.
- *Electricity crisis measures*:
    - Terna carries out an internal optimization of the resources and, if not enough, activate the rolling blackout and/or manual load shedding already described for Cluster #5.

Regional and bilateral procedures and measures

- With Season-ahead time frame Terna performs adequacy analysis in its control and contributes to Pan-European analysis, in order to identify possible risks at European level or within its control area.
  Terna provides the Regional Security Coordinator with the information necessary to perform the cross-Regional adequacy assessments (Short Term Adequacy analysis-STA) in order to identify possible risks at European level in week-ahead timeframe.
  If STA analysis detects possible risks for adequacy, a Regional process is activated, aiming to find possible solutions to minimize the risks through bilateral coordinated countermeasures among other TSOs and RSCs.
  If extraordinary countermeasures are exhausted a Critical Grid Situation (CGS) can be triggered. In case a CGS is triggered TSO shall inform RSCs and other TSO and ENTSO-E and exchange information with possible extraordinary, coordinated countermeasures, consisting in coordinating the operational planning phase among the TSOs of the Region and aimed to solve the energy deficit, as required by art. 21 of Commission Regulation (EU) 2017/2196.
    - The countermeasures used for solving the critical situation can be the following: cancellation of grid maintenance affecting border lines, reassessment of transfer capacity, preparation for energy emergency delivery.
    - If the adequacy issues are not solved at Regional level, a European-wide procedure managed by ENTSO-E is triggered for coordination among Regions.

- In case of a severe event affecting a transmission line belonging to or near the borders with other TSOs resulting in a security issue for the interconnection, TERNA can apply countertrading measures with neighboring TSOs at the Northern borders, as required by art. 35 of Commission Regulation (EU) 2015/1222.

- If adequacy issues occur close to real time and there are not internal countermeasures available, art. 21 of Commission Regulation (EU) 2017/2196 provides that Terna can ask neighboring TSOs for emergency energy deliveries for time period in which upward or downward reserve procured in the Ancillary Services Markets is not sufficient for real time need.
  Early interruption of delivery could be requested exceptionally in case of occurrence of security violations or other adequacy issues.
  This emergency delivery is paid by the requesting TSO according to market prices in D-1.

- In case of a cyber-attack and if this event results in a security issue for the interconnection, the TSO can apply countertrading measures with neighboring TSOs.

  The NIS directive aims to guarantee an appropriate level of security of network and information systems with respect to the risk to be faced, as well as the possibility to notify the competent authority or the CSIRT of incidents having a significant impact on the continuity of the services to be provided: for this purpose, a Cross-border collaboration between EU countries (e.g., through operational EU CSIRT network) has been introduced in order to create a strategic cooperation group to address the spread of cyber-attacks.

  As part of ENTSO-E, Terna is active in sharing information on cyber incidents/attacks and to allow a proper cooperation in the management of cyber threats at European level.

Crisis coordinator

Role	*Contacts*
The Directorate-General for security of energy supply and energy infrastructures of the Italian Ministry of Ecologic Transition as Competent Authority is the Institutional Crisis Coordinator, responsible for relations with the Commission and the other Member State's Competent Authorities. **TERNA**, the TSO in charge of the national grid management, is responsible for the management of the crisis situation as far as to electricity sector, **in cooperation with** the other independent entities which play a determinant role in the crisis management, depending on the scenario.	**Mariano Grillo** Direttore generale infrastrutture e sicurezza Dipartimento per l'energia del Ministero della transizione ecologica **[…sensitive information…]** **Francesco Del Pizzo** Direttore Strategie di Sviluppo Rete e Dispacciamento **[…sensitive information…]** **Enrico Maria Carlini** Responsabile Dispacciamento e Conduzione **[…sensitive information…]**

Stakeholders consultations

The Competent Authority collected observations on the crisis scenarios identified in collaboration with the TSO (Terna) from the regulatory authority (ARERA), relevant electricity and natural gas undertakings (Elettricità futura, Energia Libera, Iren, A2A), relevant organizations representing the interests of industrial and non-industrial electricity customers (Utilitalia) and several DSOs (e-distribuzione, UNARETI, ARETI, IRETI).

The Competent Authority submitted the draft risk-preparedness plan, for consultation, to the same entities involved in the consultation of the crisis scenarios (ARERA, Elettricità futura, Energia Libera, Iren, A2A, Utilitalia, e-distribuzione, UNARETI, ARETI and IRETI). The pertinent observations, in particular those relating to the role of the DSOs, were accepted and, therefore, the Risk-preparedness Plan contains the suggestions received in the consultation.

Emergency tests

In collaboration with the other involved parties in the Restoration plan: Producers and Distribution System Operators, Terna organizes on a year basis some real restoration tests (both bottom-up on national basis and top-down restoration with neighbors).

In addition, as prescribed by the Italian grid code, Producers autonomously perform black start up and load rejection tests twice a year, sending to the TSO the test results.

The TSO also participates in the general crisis exercises organized by Civil Protection. As examples of that activity, in 2019 the TSO joined the training for the eruption of Campi Flegrei and the simulation of a crisis caused by an earthquake in the Mugello area. In 2013, the TSO organized and performed a simulation of a massive failure of the main substations supplying the city of Milan due to either a physical attack or an adverse weather condition.

Finally, Terna carries out simulations and performance tests to face the possible physical or cyber unavailability of a control center by switching from main and backup control rooms applying well-established disaster recovery procedures. Similar disaster recovery procedures are also applied for energy market managing center.