



Le réseau
de transport
d'électricité



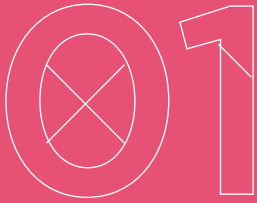
2020

RELIABILITY REPORT



01 — BRIEF SUMMARY	5
1.1 Combined with an analysis of 2020 key performance indicators, the year's results show a satisfactory level of operational reliability in spite of the COVID-19 public-health crisis	6
1.2 Safety impact of the public-health crisis	7
02 — SIGNIFICATIVE SYSTEM EVENTS (ESS)	8
03 — SUPPLY-DEMAND BALANCE AND FREQUENCY CONTROL	12
3.1 Control of supply-demand balance placed under strain by the COVID-19 public-health crisis	13
3.2 Continuously improving frequency control of the European power system, with newly emerging phenomena to be monitored	15
04 — CONTROLLED RELIABILITY RISKS	18
4.1 Grid stability	19
4.2 Voltage collapse	20
4.3 Grid flow management	21
4.4 Restoring power to the grid following a major blackout	23
05 — HIGH-VOLTAGE THRESHOLD OVERRUNS ON THE RISE	24
06 — RELIABLE AND AVAILABLE RELIABILITY-RELATED EQUIPMENT	27
6.1 Equipment used in main control rooms	28
6.2 Telecommunication and IT systems	30
6.3 Emergency response system (ORTEC)	31
07 — INCREASINGLY STRONGER EUROPEAN COOPERATION	32
7.1 Continued implementation of network codes	33
7.2 Regional security coordinators	34
7.3 The Clean Energy Package: challenges in reconciling reliability with the running of the electricity market	35
7.4 Major incidents having occurred in Europe in 2020	36
08 — RELIABILITY AUDITS AND INTERNAL CONTROL	37
09 — APPENDICIES	39





Brief summary



1.1 COMBINED WITH AN ANALYSIS OF 2020 KEY PERFORMANCE INDICATORS, THE YEAR'S RESULTS SHOW A SATISFACTORY LEVEL OF OPERATIONAL RELIABILITY IN SPITE OF THE COVID-19 PUBLIC-HEALTH CRISIS

TOGETHER WITH OTHER POWER-SYSTEM PLAYERS, RTE HAS IMPLEMENTED THE MOST EFFECTIVE POSSIBLE SOLUTIONS IN ORDER TO MITIGATE THE EFFECTS OF THE PUBLIC-HEALTH CRISIS ON CONTINUITY AND RELIABILITY OF POWER SUPPLY, AS WELL AS TO ESTABLISH OPTIMAL CONDITIONS FOR THE WINTER OF 2020/2021 AGAINST A BACKDROP OF HIGH UNCERTAINTY REGARDING ELECTRICITY CONSUMPTION AND AVAILABLE OUTPUT CAPACITY.

THE PUBLIC-HEALTH CRISIS HAS HIGHLIGHTED DEEP-ROOTED TRENDS THAT HAVE BEEN EMERGING OVER THE PAST FEW YEARS AND POTENTIALLY INCURRING RISKS FOR POWER-SYSTEM RELIABILITY: LESS INVOLVEMENT OF CONTROLLABLE GENERATION CAPACITIES IN THE ENERGY MIX COMPOUNDED WITH AN AMPLIFICATION OF TROUGHS AND A DROP IN POWER CONSUMPTION.

Specific focal points in 2020:

- **A further increase in the number of Significant System Events (SSE).** This trend is the result of an increasingly adjusted power system, with a generation fleet now offering fewer opportunities in terms of **flexibility and system services**, compounded by an increase in flow variability in parallel with changes in the energy mix. **By reducing the availability of the generation power system, the public-health crisis has contributed significantly to this increase;**
- **Since 2015, the steady narrowing of reliability margins on the supply-demand balance.** Beyond the specific circumstances of 2020, this situation – which aligns with RTE's forward-estimate analysis – reinforces **the importance of availability and sustained performance of the controllable generation power system**, while waiting for new renewable power technologies to provide equivalent system services;
- **The number of high-voltage ceiling overruns increased yet again, amplified this year by the public-health crisis, which had a significant impact on power consumption.** At the peak of the crisis, the impact of lockdown measures sometimes exceeded 15% on a like-for-like basis (power consumption in equivalent weather conditions). Power consumption therefore dropped not only due to a decrease in economic activity but also due to mild temperatures in winter and spring;

Faced with these risks, RTE – **together with other stakeholders** in France (CURTE, DGEC, CRE, distribution systems) or in Europe (ENTSO-E) – took numerous measures to maintain high levels of reliability:

- Support with the development of **power-generation flexibility and modulation potential of renewable energy sources** in order to help maintain a supply-demand balance and ensure safe grid operations (flow management, system services).

Market mechanisms and contractual arrangements for access to the grid should continue to support this development in order to harness other operators' **flexibility reserves and service offerings**, in coordination with distribution system operators.

Some of the high-voltage issues could be improved by changing setpoint values (tangent phi) on HV(A) generation facilities, more specifically wind. Occurring from time to time throughout the year, these changes are still being under-used;

- Ongoing measures to **maintain sufficient margins in terms of supply-demand balance** while continuing to improve the quality of power-system frequency (activation of new flexible products incorporated into calls for tender led by RTE, certification of new reserve capacities such as storage facilities or aggregate demand response, implementation of European trading platforms, etc.);
- **Enhanced cooperation between transmission system operators and European coordination centres**, leveraging the implementation of services covered by European network codes;
- **Increased cross-border flow capacity;**
- Expansion of plans to **install voltage compensation systems** and implementation of actions to increase the role of distributed generation in controlling voltage.

1.2 RELIABILITY IMPACT OF THE PUBLIC-HEALTH CRISIS

During the COVID-19 public-health crisis, RTE – as a critical infrastructure utility – implemented its **business continuity plan (BCP)**, designed to cope with flu pandemics. A country-wide entity, deliberately separate from RTE's normal emergency response organisation (ORTEC) oversaw the implementation of this plan. **The BCP was continuously adjusted to accommodate changes in the epidemic's development in order to protect the health and reliability of RTE and contract personnel while at the same time continuing to discharge our duties as a public utility.** In addition to standard measures applying to all workers (teleworking, precautions to stop the virus from spreading, job prioritisation, procedure changes), **additional measures were taken for essential workers:** physical separation of staff working for the load dispatch centre, talent pools composed of workers capable of fulfilling essential roles, sharing of good practices within ENTSO-E. The BCP also featured a step involving on-site isolation of workers required for operating the grid, but this arrangement was not needed.

The pandemic also **affected the supply-demand balance**. The unprecedented nature of measures taken to curb the spread of the virus (lockdown, restrictions affecting the economy, etc.) brought about a significant drop in consumption as well as difficulties in forecasting changes in consumption (25 significant forecasting gaps in 2020 as against fewer than 10 on average over the previous 4 years).

At the peak of the public-health crisis (second and third weeks of lockdown), the impact of lockdown measures sometimes exceeded 15% on a like-for-like basis (power consumption in equivalent weather conditions). This impact dropped off in the following weeks owing to a partial resumption of economic activity, including the industrial sector. By the end of April, the impact on nation-wide power consumption was estimated at around only 10%. The **amplification of consumption troughs** (dropping to a record low of 29 GW on Sunday 10 May) also significantly affected the ability to control high voltages.

Last but not least, year 2020 was strongly affected by **numerous maintenance overruns and deferrals** across France's nuclear fleet, a direct result of the public-health crisis. This resulted in an additional loss of 34 TWh compared with 2019 (3.9 GW on average throughout the year).

Decisions were made to shut down power plants for reasons unrelated to maintenance over the spring and summer of 2020, in order to save on fuel so as to retain generation potential for peak generation periods.



02

Significative System Events (SSE)



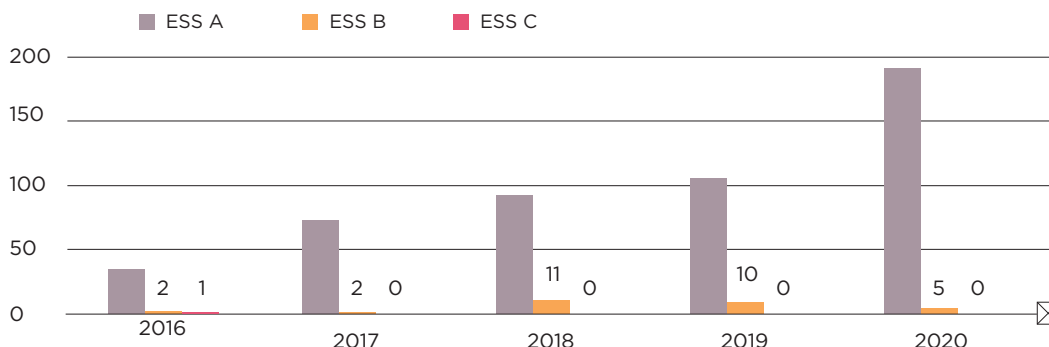
Significant System Events – SSE rating grid

Once a year, RTE evaluates the system's operational reliability by classifying all rated Significant System Events (SSE) on a severity scale ranging from 0 and A to F. These events reflect the occurrence of incidents with one or more causes. RTE's more differentiated classification system aligns with the 4-level ENTSO-E Incident Classification Scale (ICS). The tracking of SSEs over a number of years is an effective means of identifying low-level trends, whilst also making it possible to sustainably measure the effectiveness of all actions taken to improve operational reliability.

Events rated from A to F are considered as having a proven impact on reliability: the scale rises incrementally from A (localised, single and controlled) to F (widespread incident). Level-0 events are considered as having no proven direct impact on reliability (low-level trends) and undergo trend analyses.

The SSE rating grid comprises 5 columns: Operation, Grid, Operating equipment, Generation and Distribution.

With 192 level-A and 5 level-B events, **year 2020 once again saw a rise in the number of Significant System Events (SSE).**



Total SSE above A

When a level-A or level-B SSE occurs, the level of system reliability is not significantly challenged and remains under control (SSE grid ranging from A to F in increasing order of reliability-related severity).

This trend, which has continued since 2017, is the result of **an increasingly adjusted power system, running parallel with changes in the energy mix and amplified this year by the circumstances of the public-health crisis**, with:

- A generation fleet providing less **system-service flexibility** than in the past (growing proportion of

renewables not yet contributing to flexibilities and system services, compounded by a decrease in **the number and proportion of contributing nuclear power plants because of the public-health crisis**. **As a consequence, the number of SSEs pertaining to the required availability and flexibility of generation facilities rose from 7 in 2015 to 42 in 2019 and 8 in 2020;**

- Flow variability in terms of **direction and intensity**. The number of SSEs reported due to temporary overruns of allowable flows on RTE facilities rose from 0 in 2015 to 36 in 2020 (40 in 2019).

Items standing out in year 2020:

— **A significant drop in the number of level-B SSEs** (more reliability-critical than A-level SSEs), falling from 10 to 5;

— **Low availability of the generation fleet (specifically nuclear) throughout the year:**

- with, in the early part of the year, weaker reliability performance due to **lower availability of the fleet in Western France**, compounded by drops in output due to industrial action;
- and then, as of **spring, lower availability of the nuclear fleet due to maintenance overruns resulting from the public-health crisis, nuclear fuel-saving efforts in preparation for the winter**

and environmental restrictions in the middle of summer.

Year 2020 also saw the shut-down of Fessenheim nuclear power plant.

These circumstances **led to a resurgence of strained conditions regarding the supply-demand balance and an increased number of downward trends in the voltage-control plan, generating a total of 66 SSEs;**

- **occasional and controlled actuations of overload protection systems on the French grid and no longer at the borders**, partially due to fast and deep flow variations when changing cross-border exchange schedules and the generation production.

Operational reliability of the power system

As things stand today, electrical energy is not stored on a large scale and power transmission structures are not infinite in capacity.

Maintaining high levels of reliability goes hand in hand with maintaining a 24/24 balance between supply and demand, as well as carrying electricity flows from power plants to consumer centres. This entails controlling power-system changes and responses to a wide range of undesired occurrences (short circuits, unexpected changes in supply or

demand, unforeseen unavailability of generation or transmission infrastructure, etc.), by minimising the risk of country-wide or massive black-outs.

The onset of a major incident is always characterised by four main phenomena which, irrespective of their initial causes, occur consecutively or simultaneously throughout the incident.

These phenomena are:

Cascading overloads

- In the event of overruns on one or more lines due to multiple or beyond-design incidents:
 - automatically de-energised lines
 - electricity flow switched to other lines
 - risk of further overloads, etc. (cascading overloads)
- RTE constantly applies a flow risk-management policy to prevent such cascades from occurring due to a simple fault.

Voltage collapse

- In the event of multiple failures and more specifically in the event of failures involving generation or voltage control systems, voltage may drop and a ripple effect may occur.
- RTE constantly applies a voltage risk-management policy to prevent such collapses from occurring due to a simple fault.
- RTE has also equipped the grid with automation systems designed for targeted load-shedding in order to curb the impact of any voltage drops in the event of an unfavourable generation and consumption plan or in the event of an unforeseen fault on multiple generation units.

Significant frequency variation

- In the event of unforeseen faults affecting generation and exceeding frequency control margins, the risk of an overall drop or increase in frequency may arise. In the event of major faults, these drops could result in load shedding.
- Through the use of frequency containment and automatic restoration reserves for controlling and restoring frequency in the event of faults on the largest connected generation unit, RTE and Europe's other synchronous TSOs are able to prevent such situations.
- In the event of beyond-design incidents, the defence plan (together with metric-frequency shedding) is able to curb the effects of a large drop in frequency.

Loss of synchronism

- In the event of a short-circuit near a power plant, the affected power generator's speed could potentially increase.
- Stability studies conducted by RTE in different operating configurations have identified solutions for preventing these localised frequency changes.
- In the event of synchronism losses potentially resulting in beyond-design incidents and potentially compounded by technical problems on power plants, RTE's defence plan keeps protection relays in operation so as to guard against open-loop conditions associated with loss of synchronism. These protection mechanisms curb the spreading of any synchronism losses to other parts of the grid.

System reliability is defined as the ability to:

- Ensure normal operation of the power system (normal frequency range, normal voltage range, normal current range, short-circuit power) in rated conditions and in the event of an unforeseen fault, in accordance with risk-management rules.

- Curtail the number of incidents and prevent major incidents.
- Mitigate the consequences of major incidents when they do occur.



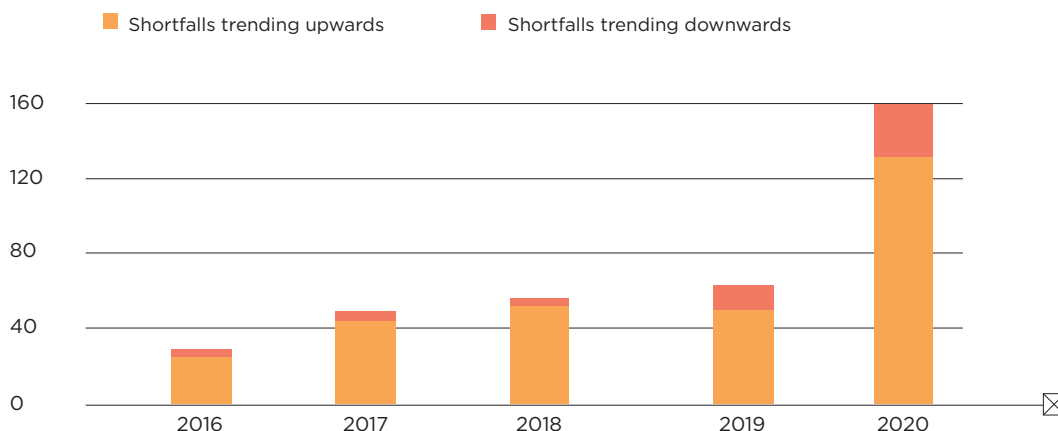


Supply-demand balance and frequency control



3.1 CONTROL OF SUPPLY-DEMAND BALANCE PLACED UNDER STRAIN BY THE COVID-19 PUBLIC-HEALTH CRISIS

In 2020, 160 situations were recorded where available margins were lower than required volumes, tantamount to more than double the average of the past three years.



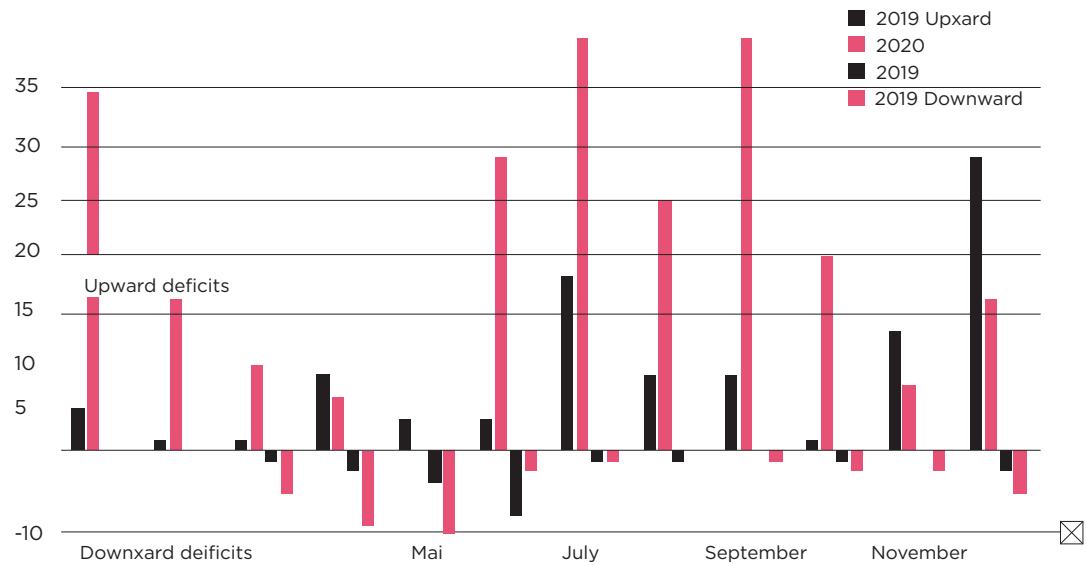
Shortfalls in supply-demand balance (SDB)

The generation fleet's low availability levels throughout the year account for the unprecedented magnitude of this increase.

Margin deficits chiefly affected **upward margins** (131 events compared with 50 the previous year), more specifically in January against a backdrop of industrial action affecting generation, as well as during summer against a backdrop of low availability levels across the nuclear fleet due to **maintenance overruns resulting from the public-health crisis, fuel-saving efforts in preparation for the winter and environmental restrictions in the middle of summer. The rise in the number of reported declining margins caused by more frequent imbalances one day ahead can be ascribed to the fact that with the change in market mechanisms and the larger number of exchanges, they are able to rebalance themselves more easily and more immediately.**

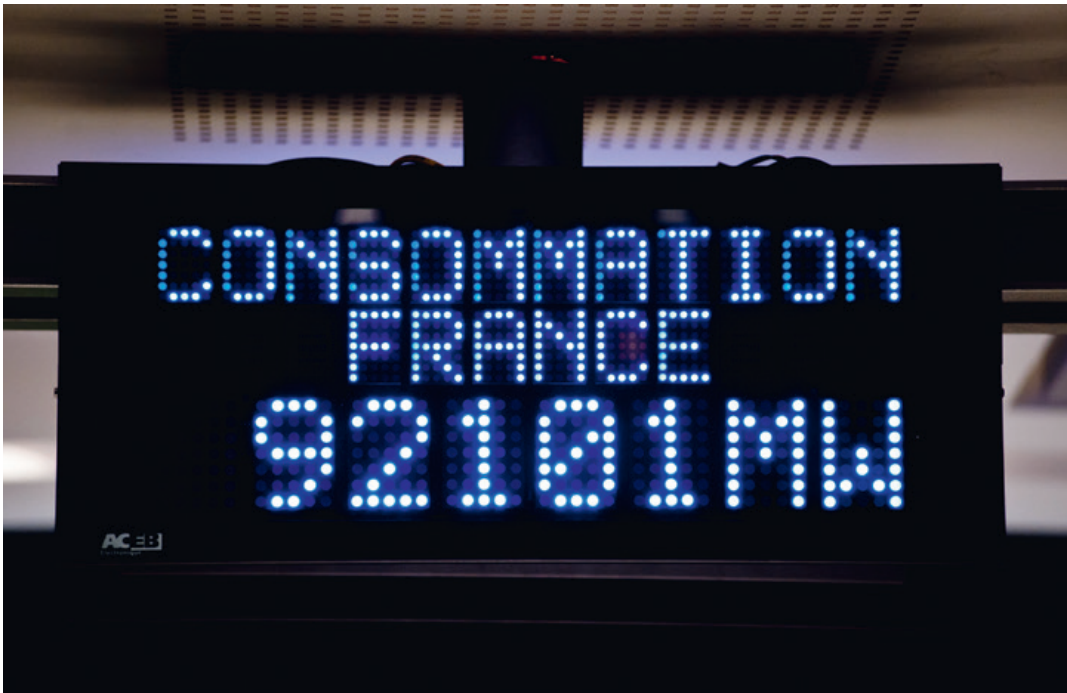
Year 2020 will also have seen a **sharp increase in the number of situations where the volume of downward adjustment capacities was lower than expected:** 29 situations reported as against 13 in 2019 and 4 in 2018.

These deficits mainly occurred in the spring and were due to low consumption levels observed during the public-health crisis, as well as a **growing shortage of controllable and flexible capacities** (growing proportion of renewables not yet contributing to the adjustment mechanism and this year, **a drop in the number and proportion of adjustable nuclear units** due to the public-health crisis and the utility's winter-planning strategy).



Upward and downward margin deficit notifications

This situation is consistent with the **forward-estimate analysis, which describes a balanced and adjusted power system with narrower margins than in the past.**



3.2 CONTINUOUSLY IMPROVING FREQUENCY CONTROL OF THE EUROPEAN POWER SYSTEM, WITH NEWLY EMERGING PHENOMENA TO BE MONITORED

With 41 large and lasting frequency deviations in 2020, **Europe's frequency control continues to show an improving trend, starting in 2019**. Most deviations were trending downward (when output is lower than usage, causing frequency to drop).

To varying degrees, France was a contributing factor to 36 of the 41 deviations observed in 2020.

The precautions taken by all TSOs across Europe, in which RTE was actively involved, had a positive impact on the number of deviations.

Nevertheless, the drop in the number of frequency deviations (whether upward or downward) in no way detracts from the risks they could incur for the European power system.

The phenomenon of **on-the-hour frequency deviations**, characterised by frequency drops of more than 100 MHz over short periods of time when changes are made to generation schedules synchronised hourly on the hour in Europe, is still being observed (160 deviations of more than 100 MHz this year).

Two of these deviations, occurring around midnight in the month of July, were reported as SSEs. In both cases, the deviation was greater than 100 MHz for a period of more than 5 minutes, with 30% being ascribed to RTE.

The contractual framework governing **generation units working under an additional remuneration system** (around 5 GW as at the end of 2020, mostly renewables) encourages them to shut down when the day-ahead market price is negative, in order to avoid paying in order to generate power.

Synchronised shutdowns at these volumes, which become substantial, generated **frequency deviations on two occasions for the first time** in December, forcing RTE to make real-time adjustments to restore balance. From now on, extra caution will need to be exercised during negative market-price periods: the volumes in question amount to around 1500MW, tantamount to France's most powerful nuclear generation unit.

These events once again highlight the importance of scheduling, predictability, observability and last but not least, the controllability of renewables and their contribution to the supply-demand balance.

Whilst meeting the criteria set by network codes, France's power system has also reported **more frequent deficits regarding automatic frequency reserves** in the past few years.

In 2020, RTE introduced a new method for distributing automatic restoration over one day at a like-for-like average volume, so as to more closely match real requirements. However, **scheduling by players in charge of automatic restoration reserve was deficient for 19% of the time** as against 17% in 2019 and 8% in 2018 (ineffective financial incentive scheme).

Furthermore, even if **the total annual containment reserve deficit decreased** (6 days of failure as against nearly 14 days in 2019), the excess volume of this reserve dropped due to lesser availability of generation capacity resulting from the public-health crisis.

With regard to power-system reliability, these scheduling deficits decreased as real time came closer. Nevertheless, they must remain a focal point for purposes of frequency control.

However, it is still generally difficult to **restore the required reserves in real time on the balancing market, considering the decrease in available reserves**. This challenge is amplified when power plants providing system services are shut down for downward adjustment purposes in order to balance supply and demand.

In order to address these issues, RTE has implemented measures and held discussions with stakeholders in France (CURTE, CRE, etc.) and in Europe (going beyond the existing mutually supportive procedures with TSOs in the European Union, Switzerland and the United Kingdom):

- **Over year 2020, growing importance of containment frequency control certification for storage facilities (batteries) and aggregate demand response;**
- In 2020, ongoing efforts to incorporate **storage capacity into the adjustment mechanism;**
- **Contractual incentive**, set up as part of the 2020 bidding process for manual frequency restoration and replacement reserves (to be renewed in 2021), to provide products that can be activated at short notice and for short periods, to preventively cover changes in cross-border trading arrangements occurring on the hour.

Discussions are underway on a specific call for tender in 2023, as well as on contractual arrangements for downward fast control reserves starting in 2022. Since the introduction of the additional remuneration system for renewable energy generators, the latter can participate in the balancing market, thereby making the consolidation of these reserves a viable option.

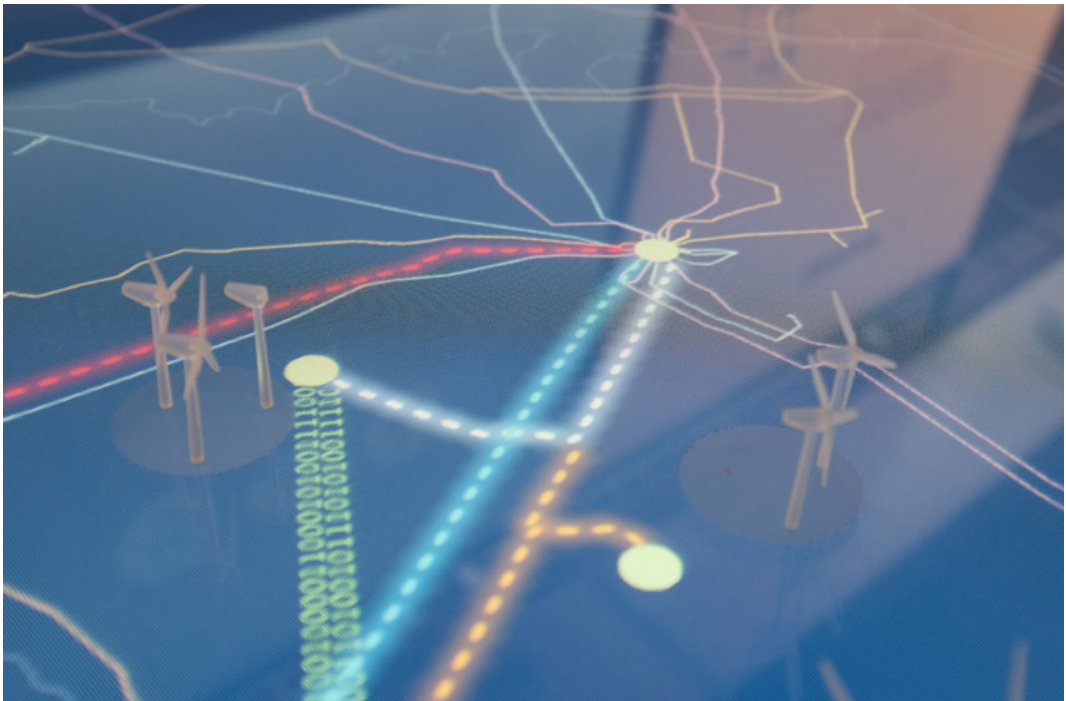
- **As of 1st January 2021 – further to a joint and proactive decision by TSOs – closer tracking of each TSO's contribution to frequency control** during cross-border on-the-hour exchanges, through the use of indicators capable of prompting action plans if pre-defined thresholds are exceeded;
- **A change to the method used for dimensioning the secondary reserve, including European network code recommendations**, which will come into effect in late 2021.

With the implementation of the European Electricity Balancing Code, RTE will benefit from additional flexibility resources on the balancing mechanism at European level.

With a view to Europe-wide harmonisation, this code seeks to pool reserves and reduce costs as well as establishing real-time cross-border mechanisms in order to generate automatic reserves and control the supply-demand balance in real time.

More specifically, RTE is involved in three projects aiming to set up European platforms, namely TERRE (Trans European Replacement Reserve Exchange) for managing the 30' replacement reserve, MARI (Manually Activated Reserves Initiative) for managing fast control reserves (15') and PICASSO (Platform for the International Coordination of the Automatic frequency restoration process and Stable System Operation) for managing automatic frequency restoration reserves. **RTE was connected to the TERRE platform in early December of 2020.**

However, **RTE is particularly mindful of compatibility between standard European products and the flexibility now being offered by France's generation fleet.** RTE believes that frequency could be jeopardised if product actuations are synchronised at European level without meeting the expected delivery profile in terms of dynamics.



Margins and margin restoration

In order to maintain a constant supply-demand balance on the power system while at the same time controlling frequency, RTE has the following means at its disposal:

- **frequency containment and automatic restoration reserves** (also known as frequency system services) essentially supplied by controllable generation units, which are primarily used for responding to unforeseen generation or consumption problems occurring on the grid;

- **replacement reserve** aimed at restoring, in terms of depth and duration, the supply-demand balance, as well as restoring system services if the latter have been used up in unforeseen adverse situations.

Upward and downward operating margins are calculated for these different types of reserve.

Their levels (and consequently **the supplies available on the balancing market**) must meet minimum requirements, which depend on timeframes:

- The **'15 margin** is designed to address at all times and within 15 minutes at most, the loss of the largest generation unit connected to the grid (upward margin), or the loss of the biggest consumer or export on a direct-current line (downward margin).
- The 2 and 8-hour balancing margins aim to address unforeseen issues that may arise in the coming hours: deviation from consumption forecasts, technical problems, incorrect forecasting of wind and solar output, etc.

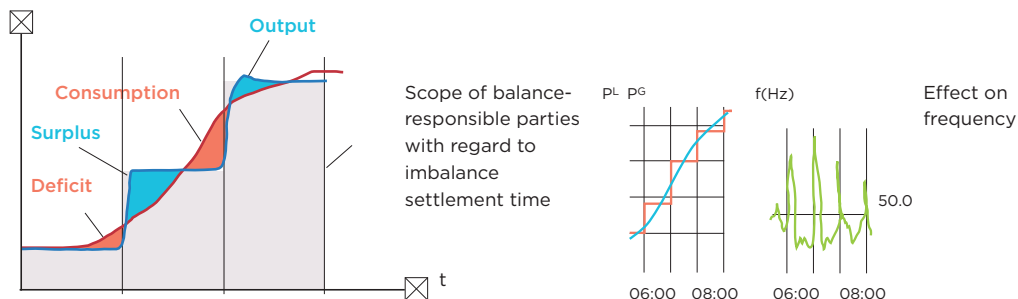
When these conditions are not met, RTE issues an alert message (the day before), a degraded-mode notification (in real time) and where applicable, a safeguard message (also in real time).

Just as the upward actuation of capacities may increase the level of available system services (by starting up generation units), downward actuations can diminish this level by causing the shutdown of units contributing to system services.

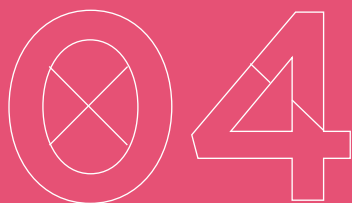
On-the-hour frequency deviations

On-the-hour frequency deviations occur when generation schedules or cross-border trading arrangements are changed on the hour. These trading arrangements reflect market product transactions between players on the European electricity market.

This means that on the hour, electrical output generated by certain European facilities changes very quickly and is (momentarily) decorrelated from demand (power consumption + trading), which for its part, is continuous. The supply-demand balance is consequently affected for a few seconds or minutes: frequency varies significantly for as long as it takes the automatic control mechanisms to respond (resulting in the usage of all or some primary and secondary reserves). If an event affecting the supply-demand balance (such as the loss of a generation unit) occurs at the same time, this can amplify frequency variation and, in some cases, actuate the French interruptibility mechanism, not to mention metric-frequency shedding in the most serious conditions.



When power consumption increases, frequency drops slowly just before the change of hour, reflecting the power deficit, and quickly increases just afterwards, following the start-up of quick-response facilities such as hydro plants.



Controlled reliability risks



4.1 GRID STABILITY

Stability losses due to synchronism losses

In 2020, only one operating occurrence (level-B SSE) was reported where an unforeseen issue could have caused a stability loss on the nuclear generation fleet, as against three in 2019 and six in 2018.

Efforts undertaken with the affected generator in 2019 and rolled out in 2020 were effective in driving proactivity and coordination. Two tense situations were therefore avoided thanks to these efforts.

Performance of the protection plan

Grid stability is improved through the swift eradication of short circuits on grid structures.

In 2020, 96% of the 347 faults on the 400 kV system were eradicated in line with expectations (between 96 and 98% since 2015).

Positive results on the 225-kV grid, a key requirement for grid stability, have also contributed to this high level of reliability.

The availability rate of differential busbar protection devices has been instrumental in swiftly and selectively eradicating faults occurring on substations (infrequent but with a high risk for reliability). This year, the availability rate stood at 99.9% (this rate has been higher than 99.2% since 2015).

In 2020, no events occurred affecting protection devices associated with open-loop conditions and loss of synchronism.

Cross-zone frequency oscillations

In 2020, no cross-zone frequency oscillations were observed on the European grid.

A cross-zone frequency-oscillation detection project is currently undergoing feasibility trials. The purpose of this project is to immediately detect oscillations and advise operators on how to absorb them.

Loss of synchronism (local frequency oscillations)

In rated operating conditions, Europe's interconnected power generators operate at the same frequency (around 50 Hz): this is known as "synchronised grid operation" with the grid forming the "synchronising link" between power generators.

This balance may be disrupted if short circuits occur; the latter cause the rotational speed of power generators to increase. If the short circuit is not eradicated quickly enough or if the generator was not in a sufficient stable initial state, power plants may be unable to align with general grid frequency: this results in a loss of synchronism. If this phenomenon persists, it spreads to other power generators. In order to prevent the phenomenon from spreading, synchronism-loss protection devices actuate and split the grid into pre-defined zones in order to isolate the affected zone.

In order to maintain the stability of interconnected power generators, RTE conducts specific studies at various time intervals and takes the required preventive measures:

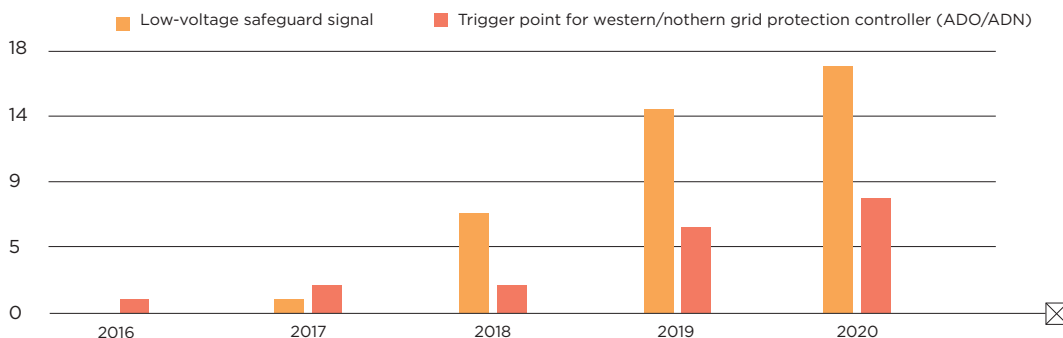
- Determination and compliance with maximum time limits set for the eradication of short circuits.
- Restriction of generator operating ranges in terms of active and reactive power in order to maintain greater initial stability.
- Adjustment of operating plans and optimised scheduling of infrastructure withdrawals from service.
- Performance monitoring of generator control and protection systems.

Cross-zone frequency oscillations

Cross-zone oscillations are complex electromechanical phenomena that occur between two or more parts of Europe's power system, which oscillate at low frequency (around one Hertz) in an anti-phase pattern and which cause active-power oscillations,

specifically on interconnecting lines. They pose a real risk to reliability in Europe if they approach frequency modes specific to those of the European power system.

4.2 VOLTAGE COLLAPSE



Voltage plan degradation

Following on from the last quarter of 2019 and as a consequence of an unfavourable output plan in the west of France (power plants undergoing maintenance outages or limited in their ability to supply reactive power, drop in output due to industrial action), consumption levels – while far from being particularly high – **reached the ADO and ADN trigger points a number of times** in the first quarter of 2020.

As power-plant availability levels in the north-west of France were higher in the early part of the 2020-2021 winter period, these controllers did not have to be turned on.

These controllers were preventively turned on eight times in early 2020. However, their actuation threshold, which results in targeted automatic shedding, was never reached. The risk of voltage collapse remained under control without requiring recourse to post-market resources.

On the positive side, the **volume of reactive capacity limits on nuclear plants**, which can be challenging when it comes to managing high and low voltages, **reached its lower point in more than 10 years.**

Voltage collapse

Grid voltage is controlled from multiple reactive power sources (power plants, capacitors, reactance, Static VAR Compensator, etc.) spread across the grid. In any given zone, reactive power sources may no longer meet requirements if transmission structures or power plants become unavailable, for instance.

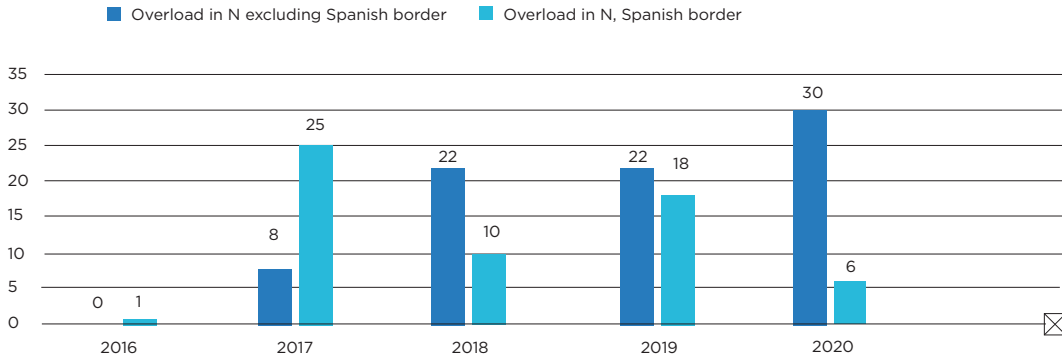
Importing deficient power from neighbouring zones causes significant voltage losses across the grid. Automatic on-load tap changers installed on the transformers of networks supplying customers are able to offset these voltage losses. However, this increases current draw, thereby further reducing the zone's voltage.

When voltage drops below a certain low voltage level called critical voltage, the transmissible power limit is reached. This leads to voltage collapse if no steps are taken.

As part of its Voltage Defence Plan, RTE has therefore installed two programmable controllers (ADO and ADN) on the grid in order to guard against the risk of voltage collapse. In the event of an incident on the grid resulting in a significant voltage drop, these programmable controllers activate a volume of localised load shedding, just enough to prevent an uncontrolled spread of grid collapse, thereby avoiding a higher volume of power outage.

4.3 GRID FLOW MANAGEMENT

Over the past four years and in normal operating conditions, there was a significant increase in the number of occasional start-ups of 225-kV and 400-kV overload protection systems. However, these issues were addressed in a timely manner and did not affect power-system reliability.



Temporary back-up current overruns

From 2017 to 2019, the Spanish border (interconnector and upstream network) accounted for approx. 50% of these flow overruns.

As trading has more than doubled between France and Spain since 2015, the zone's infrastructure load has come closer to the operating limits and the number of overload protection start-ups has increased.

Owing to more effective arrangements for dealing with changes in cross-border trading plans and the ability to forecast the east-west distribution of these exchanges, overruns have been significantly reduced: 6 in 2020 compared with 25 in 2017.

With the exception of the Spanish border, the 2020 distribution pattern shows an upward trend in infrastructure flow overruns. These overruns have been small and of short duration.

A large proportion of these overruns is due to **fast and deep flow variations associated with cross-border trading and changes made to generation plans. Over the past summer period, an atypical generation plan combined with the need to control high voltages (de-energising of lines) was also a contributing factor to this increase.**

Faced with this increase, a number of measures were taken including **forecasting of action thresholds and oversight of coordination** between the different operating centres. **Short-range grid forecasts were also revised and enhanced in order to better account for greater flow variability.**

Measures have also been taken to improve the **quality of research data exchanged with Spanish and Portuguese TSOs, including the use of a new research procedure** designed to better take account of cross-border uncertainties over the short term.

In the first half of 2021, another **programme will be implemented to facilitate the oversight and early resolution of challenges.** Other R&D work is also underway, focusing on forecasts and grid topology.

Cascading overloads

Long-lasting high levels of current inside a line result in heating which, if not controlled, can:

- Damage the line's constituent parts, potentially causing the conductor to break.
- Generate hazards affecting people and property by causing cables to expand and elongate, bringing them closer to ground level and encroaching on safety distances between the overhead line and its surroundings.

Maximum values have been determined for each structure:

- Maximum current that a line can withstand for a period of time, not limited in time, but which is reached only occasionally for limited periods of time.
- Transient current thresholds, higher than the maximum current that a line can withstand for a period of time but for much shorter limited periods (less than 20 minutes).

In order to avoid the risk of exceeding these current limits, overload protection systems are used on the 225-kV and 400 kV lines in France. If the current overload is not resolved by a certain time after the initial occurrence (from a few seconds to 20 minutes, depending on the magnitude of the overrun), the affected structure is automatically disconnected from the grid by the overload protection system.

The flow carried by the structure prior to the trip is then transferred to neighbouring structures. Depending on the extent of the phenomena, further overloads and trips could then occur. Successive load transfers potentially generating a cumulative phenomenon could, through a cascading effect, lead to the loss of a significant portion of the grid.

RTE's flow risk-management policy is designed to ensure that this type of cumulative effect cannot occur due to a simple technical fault.

Tailoring grid research processes to changeable generation and trading conditions

In order to make the right decisions, ranging from grid asset investments to short-range grid operations, grid-related research is conducted on a number of timescales. Against a backdrop of energy transition and European market integration, these research processes continue to evolve.

On longer-range timescales, the research process can draw on multi-situational studies that simulate a number of annual scenarios on a European scale and at hourly intervals, down to the output of local renewable-energy facilities.

On shorter-term timescales, the research process includes renewable energy forecasts based on weather forecasts, generation plans and expected trading transactions. These half-hourly to quarter-hourly forecasts are updated at least every hour from two days ahead up until real time.

Through the continuous sharing of this data with neighbouring TSOs and CORESO combined with the resulting coordination, power-system stakeholders are able to consolidate and update joint grid operating strategies.

R&D work supports these changes and explores new uncertainty management methods.

4.4 RESTORING POWER TO THE GRID FOLLOWING A MAJOR BLACKOUT

In 2020, 12 house-load operations were performed by nuclear power plants with a 100% success rate (100% for 11 tests in 2019, 100% for 12 tests in 2018,

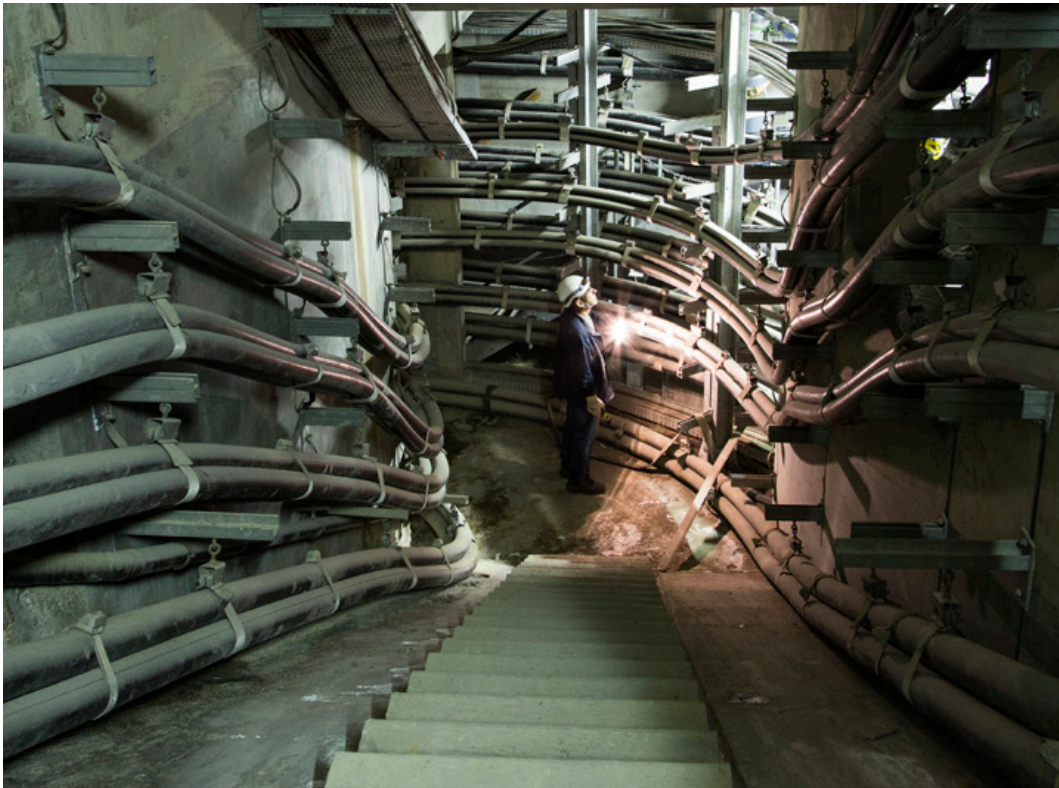
93% in 2017), and a 98% success rate over a four-year rolling period, a highly satisfactory result compared with the long-term target of 60%.

Nuclear house-load operations and structures

On a nuclear reactor, house-load operations involve the transition from normal operating conditions (entire output exported to the grid) to conditions where the power grid is isolated and where the reactor only generates the power needed for its own operation.

The successful completion of nuclear house-load operations is essential for nuclear reliability and is of paramount importance for restoring the grid and resuming the supply of power to customers as quickly as possible.

Grid restoration relies on step-by-step re-energisation of 400-kV structures known as regional structures, which connect islanded nuclear plants to substations in large consumer areas.





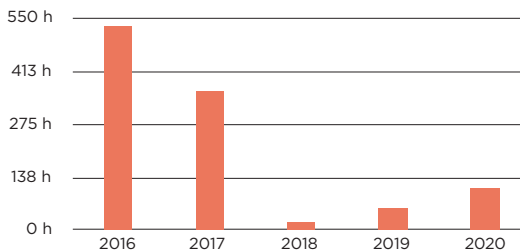
High-voltage threshold overruns on the rise



The total duration of upper voltage-threshold overruns quadrupled from 2018 to 2020.

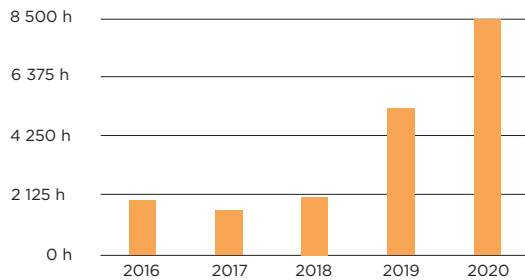
In 2020, the effort put into controlling voltage levels **reflected unprecedented conditions across the generation fleet and in terms of power consumption, with multiple overruns observed at the start of the public-health crisis, from April to June**, followed by a relative improvement in late summer.

Following a sharp drop resulting from more effective use of available resources, ceiling overruns on 400-kV lines have increased since 2018 but have remained under control (total duration of around 100 hours).



Total duration of 400-kV voltage overruns

On the 225-kV network, the number of overruns once again increased significantly, even if this increase amounted to an average of less than one hour/year/affected structure, while individual overruns remained small in terms of magnitude and short in terms of duration.



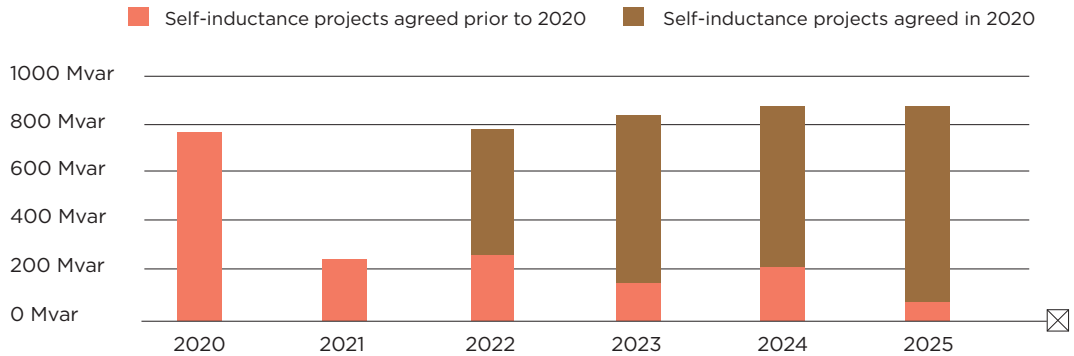
Total duration of 225-kV voltage overruns

RTE is installing numerous compensation systems to reduce high voltage levels: in 2020, another 760 Mvar of inductors were installed (self-inductance for reducing voltage). These projects were prioritised during the public-health crisis.

On the basis of research conducted in 2020, it was decided to install a further 2300 Mvar of self-inductance capacity by 2025.

More specifically, over 200 Mvar will be commissioned in the Massif Central by 2023 in order to reduce the strain on hydro plants that are currently being operated in modes that are specific to voltage control (known as synchronous compensation).





Self-inductance projects (excluding off-shore wind) per year commissioned

In 2020, **the first agreement for the construction of a photovoltaic solar farm** was signed for purposes of voltage control (80 Mvar in progress during generation and exchange periods for night-time service).

The consultation on **participation of new capacities in voltage control (wind or photovoltaic facilities connected to the distribution network, batteries, HVDC lines) is still ongoing**, whilst trials could take place over the TURPE 2021-2025 period.

As regards new capacities being connected to the distribution network, RTE – along with distributors and other players – is looking into ways of having HV(A) capacities contribute to the control of high voltages; HV(A) generation capacities capable of making occasional changes throughout the year in order to modify their reactive power output are still being under-utilised.

Voltage ceiling overruns

High voltages occur when systems or components being used to control reactive power (power plants, SVC, self-inductance) can no longer absorb the reactive power generated by the grid (capacitors, lines or cables not subjected to high loads, reactive power generated by customers, etc.). Previously observed during power-consumption troughs on summer weekends, these phenomena now occur throughout the year during periods of very low power consumption.

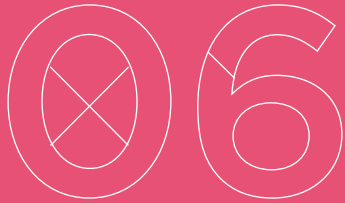
This change is due to three main factors:

- Substantial expansion of renewables on distribution networks, reducing active power extractions from the transmission grid and thereby increasing generation of reactive power by the grid. As was the case in 2019, minimum extraction volumes amounted to 23 GW in May 2020 (25 GW in 2018), dropping steadily for past several years.

- Changes in the nature of transmission grids and distribution networks, with an increasing number being built underground and therefore generating more reactive power.

- Last but not least, technological changes that consume less reactive power, with some even generating it.

From a reliability perspective, high voltages have less of a short-term impact than low voltages but can shorten equipment service life and cause damage affecting the quality of electrical power.



Reliable and available reliability- related equipment



6.1 EQUIPMENT USED IN MAIN CONTROL ROOMS

As was the case in 2019, **the availability of equipment contributing to safe grid operations** was very high in 2020.

Operating systems

In 2020, the only significant event on operating systems (level-B SSE) was the loss of operating equipment at a regional dispatch centre (sound system, secondary voltage control, northern grid protection controller (ADN)) and inability to view all generators (including the alert and safeguard system (SAS)) for more than 5 hours due to the erroneous configuration of a fire-wall.

Three other events involving the availability of operating equipment affected the operability of regional load dispatch centres (level-A SSE): 2 involved the SAS while one involved a secondary voltage control system.

These events prompted the implementation of specific action plans (resilience to equipment failures, software upgrades and configurations, proficiency training, maintenance work).

In order to address the obsolescence of currently used operating equipment, the regional operating system (SRC) and national operating system (SNC), and in order to have a single operating system, RTE

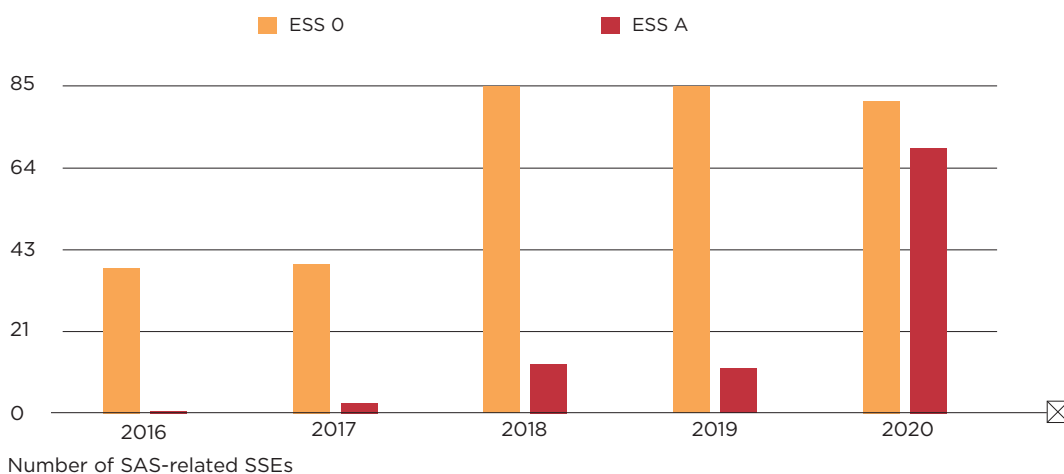
initiated a project called STANWAY with a view to replacing this obsolete equipment. Intended for use in RTE's eight control rooms, this new system is due to be commissioned in early 2022.

Commissioned in 2015, the **regional inter-dispatching support system (SIDRE)** enables operations to be transferred between several operating centres. It covers all three inter-regional zones. Training is essentially delivered through periodic transfer testing (partial or total) at regular intervals, as well as in the form of operator refresher courses. In 2020, SIDRE was used 14 times. 10 of these occasions were during incidents, thus enabling the grid to be continuously monitored and operated.

Other power-system control-room equipment

In 2020, the availability rate of SAS equipment was excellent. Only 1 level-0 SSE and 2 level-A SSEs were reported.

However, the number of SSEs **reported due to unacknowledged messages or inappropriate practices by generation facilities, distributors or RTE operators** upon the actual transmission of signals indicating critical conditions due to insufficient margins (level-A) rose from around 10 in 2019 to 65 in 2020.



This trend is due to a significant increase in the number of SAS messages sent to generation facilities as a result of difficulties in maintaining the supply-demand balance, as well as an improved method for the immediate reporting of this type of SSE.

Faced with the rising number of these SSEs over several years, RTE set up arrangements for improving the traceability of these messages and for capturing operating experience.

E-learning on the use of SAS, developed for use by our customers, will be made available on line in the course of 2021 whilst reliability training intended for our partners will be made more accessible.

Another highlight of 2020 was the launch of our SAS 2 project, seeking to replace current SAS architecture and tailor it to technological developments, whilst also facilitating the inclusion of new reliability stakeholders such as renewable-energy generators.

Safeguard and Alert System (SAS)

SAS is a system that sends out secured alerts and safety-related actions, thereby enabling degraded or high-risk conditions to be kept under control.

The system's safeguard function requires precise coordination and swift implementation of actions between dispatch centres and:

- Distributor and generator operating centres.
- RTE workers.

SAS enables RTE dispatch centre operators to transmit pre-defined signals and messages safely, accurately and quickly:

- Safeguard signals, which speed up the implementation of actions during strained conditions that could compromise power-system reliability.
- Alert messages that are used in off-normal conditions.

The **“Convergence” grid research platform** is used for conducting grid-related research ranging from development up until real time, thus making it essential for reliability. In 2020, the platform's total availability rate met expectations and amounted to 99.98%, tantamount to 2 hours of annual downtime in total. Its availability rate continues to improve as a result of the strategies agreed after the occurrence of several incidents in 2018: enhanced reliability of the application's redundancy; adjustment of business continuity and resumption plans; improved quality of impact assessments for work.

One A-level SSE and 8 level-0 SSEs relating to the availability of equipment used for analysing supply-demand balance/balancing and markets were reported compared with 2 and 12 in 2019 respectively; these malfunctions were chiefly due to the complexity and vulnerability of functional channels and recent changes to supply-demand balancing platforms. Ongoing actions are taken to enhance the reliability of these systems. Discussions are underway to overhaul the affected systems.

6.2 TELECOMMUNICATION AND IT SYSTEMS

Operational reliability of the power system is highly dependent on the sound operating condition of reliability-related telecom and IT systems, as well as their ability to withstand cyberattacks.

The Optical Safety System (known by its French acronym ROSE), a piece of infrastructure owned and operated by RTE, covers approximately 22 000 km of optical routes and provides secured telecom services contributing to system reliability: “high-level” remote operation, information exchanges between safeguard systems providing protection against electrical faults and reliability-related telephone systems.

In the course of 2020, two level-0 SSEs relating to the ROSE system were reported (1 in 2019).

15 level-0 SSEs regarding the use of the STS system (safety-related telephone system) were reported as against two A-level SSEs and 12 level-0 SSEs in 2019. 7 of the level-0 SSEs were due to failures or work being performed by the generator or distributor.

RTE’s new telecom network (HORUS) started operating in 2020. It will host the STANWAY application and other reliability-critical applications at two datacentres, while also serving as the associated telecom system linking these datacentres to operating centres.

The security of RTE’s IT system is vital for the operational reliability of the power system, not only in terms of industrial IT but also the IT system designed for exchanging data with customers, market players and partners.

In-house training courses on IT system security, as well as general awareness training, are being delivered.

In 2020, risk assessments, audits and tests designed to verify the IT system’s ability to withstand hacking attempts were performed on new and upgraded software programs. The purpose of this programme is to assess the company’s level of resilience to cyberattacks and to ensure the continuity of critical activities. Most of the essential IT systems have undergone detailed design studies and now carry in-house certification.

Measures designed to physically protect the rooms housing these systems have been established and implemented on high-risk electrical sites.

Cybersecurity emergencies are incorporated into the ORTEC process. In 2020, the features specific to this type of emergency were documented and set out in an emergency response procedure.



6.3 EMERGENCY RESPONSE SYSTEM (ORTEC)

In 2020, the emergency response organisation was activated on only 3 occasions in real conditions, twice in response to the Gloria storms on the 22nd of January, followed by Miriam on the 3rd of March.

Year 2020 will be remembered for an audit on the ORTEC system. The results of this audit showed that RTE's emergency response organisation exhibited a high degree of maturity with an impressive ability to respond to emergency conditions. A few areas for improvement were identified, more specifically regarding procedure use and adherence, the emergency response team's duty cycle, and oversight systems common to the whole organisation.

In spite of the challenging circumstances associated with the public-health crisis, the proficiency of emergency response personnel and the entire workforce was further enhanced through the delivery of training courses and new awareness briefs.

This proficiency is also gained through emergency drills, jointly conducted with external partners whenever possible: in addition to regional drills, an emergency drill on extremely cold weather conditions was conducted in October 2020, simulating the response to a "supply-demand balance" emergency in the event of large drops in temperature.





Increasingly stronger European cooperation

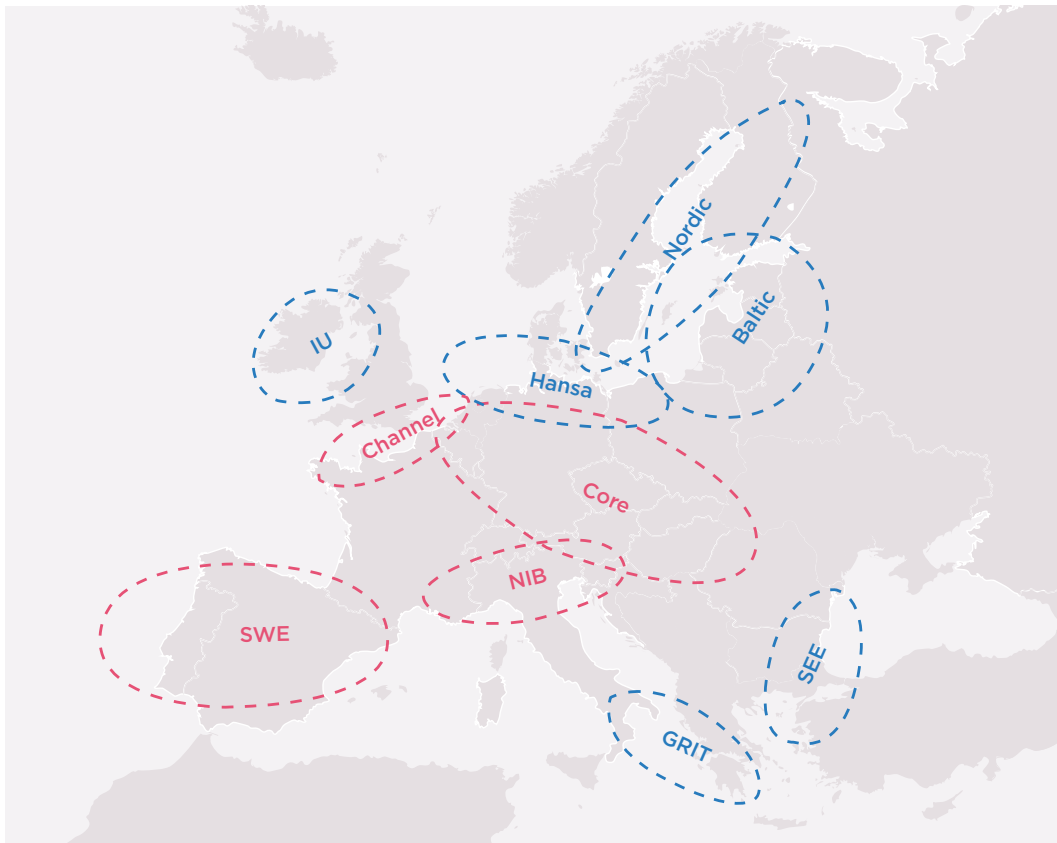


7.1 CONTINUED IMPLEMENTATION OF NETWORK CODES

In addition to their practical implementation, the major challenges associated with full **implementation of all codes** by **2021/2022** are the following:

- Approval of the broad options on **sharing of balancing offers and building of reserves, with the development of the associated platforms**, as well as sharing with French market players and the CRE;
- Establishment of **common grid models (CGM)** that will be used for all processes with other TSOs and regional security centres (RSC) in advance of real time (security, capacity calculations, etc.). This process is due to be implemented by late 2021;

- Establishment of a procedure for conducting coordinated regional reliability assessments, including countertrading and re-dispatching aspects as well as the sharing of related costs for the three capacity-calculation regions (Core, NIB, SWE⁽¹⁾). The associated methods for each of these regions were approved by regional regulators in 2020 for Channel, NIB and SWE and by the Association of European Regulators (ACER) for Core. CORESO and the involved TSOs have started implementing them, with the exception of the Channel region due to Brexit-related uncertainties.



Capacity-calculation regions

(1) The Channel region is no longer operational as a result of Brexit

7.2 REGIONAL SECURITY COORDINATORS

For the regional security coordinator CORESO, the following were key elements of year 2020:

- Continued roll-out of the five services within the TSOs: establishment of common grid models, calculation of regional trading capacities, regional security assessment with trans-national corrective actions, evaluation of short-term supply-demand balance security and coordination of isolation schedules. The latter two services have been partially operational since the spring of 2020;

- Launch of the CorNet programme supporting cooperation with the second active coordination centre in the Core and NIB regions (TSCNet), in order to optimally coordinate the implementation of services within these both of these regions;

- Definition of its future RCC status (Regional Coordination Centre), a future regional entity for Europe-wide coordination that will replace the current RSCs (Regional Security Coordinators), as stipulated by the Clean Energy Package, as well as the establishment of general principles for the new services set out in this same package.



7.3 THE CLEAN ENERGY PACKAGE: CHALLENGES IN RECONCILING RELIABILITY WITH THE RUNNING OF THE ELECTRICITY MARKET

The law sets a minimum threshold of 70% of the capacity of interconnection infrastructure to be made available for cross-border electrical-power trading. This threshold shall have to be reached by 2025.

The expected increase in cross-border trading requires enhanced coordination among European TSOs in order to comply with the operational limits of the European power system and manage the resulting congestion.

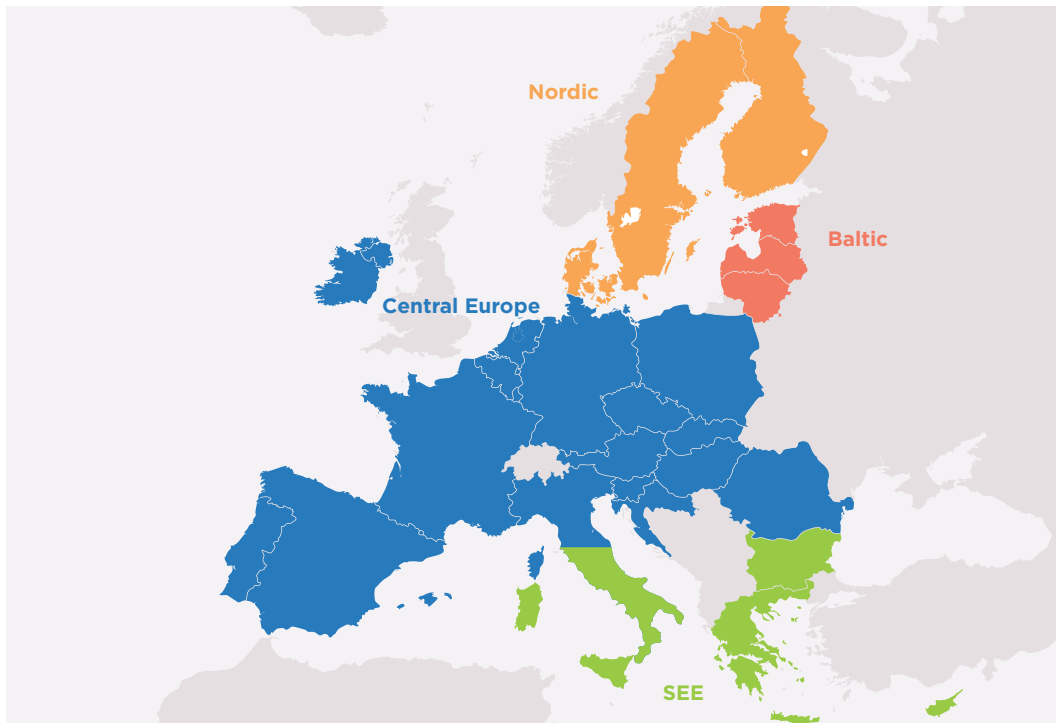
The analysis of year 2020 shows that RTE met its commitments regarding minimum thresholds required by special dispensations granted by the CRE in the CWE/Core, Northern Italy and SWE regions.

Since 2020, RTE has been developing “validation” systems designed to increase capacity in order to ensure compliance with the 70% threshold without compromising grid reliability. These systems started being rolled out in the CWE region on the 17th of February 2021. They are expected to be implemented in September 2021 within the Northern Italy region and in late 2021 within the SWE region.

Additionally, the Clean Energy Package calls for **the establishment of system operation regions**, new geographic networks within which it would be advisable to assess operational coordination between TSOs. Operation within these regions will be coordinated by new entities, the RCCs. ACER and ENTSO-E are discussing the final configuration of System Operation Regions: at this stage of discussions, **RTE should be located in the Central Europe System Operation Region, along with 21 other TSOs.**

CORES0 will be one of the two regional coordination centres (RCC) together with TSCnet.

Last but not least and pursuant to the requirements of the Clean Energy Package concerning risk preparedness within the electricity sector, each member State has been mandated to issue **a risk preparedness plan** by January 2022, **based on regional emergency scenarios** (cross-state).



Map of System Operation Regions – ACER decision of June 2021

7.4 MAJOR INCIDENTS HAVING OCCURRED IN EUROPE IN 2020

In 2020, a noteworthy event affected reliability in Europe. At the time of the Gloria storm, which caused the loss of numerous structures operated by REE,

the Spanish TSO, on the 21st of January, power was restored to a part of Catalonia via the underground direct-current line connected France to Spain.

European integration

The power transmission system is a European system. Today, 43 TSOs from 36 countries are linked together by approximately 420 interconnectors including around fifty for France's borders. The reliability of France's grid therefore partly relies on the operability of the European power system.

Network codes derived from Europe's Third Energy Package set out the main rules to be applied by all players whenever grid interconnectivity is concerned. The full set of codes has been published and now applies.

Covering different areas (operation, markets, connection), the codes support the reliability of Europe's interconnected power system within their specific scope:

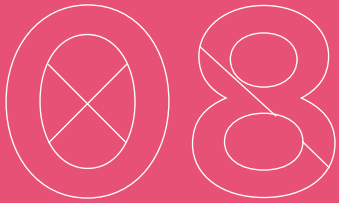
The Emergency and Restoration code sets out common rules for emergency response and grid restoration. The System Operation Guideline code comprises the common principles for grid operation.

As far as markets are concerned, reliability is a major priority of the Electricity Balancing code, which covers supply/demand balancing, and the Capacity Calculation and Congestion Management code, which seeks to coordinate short-term electricity exchanges.

Within its requirements pertaining to the connection of generation facilities, the Requirements for Generators code includes technical requirements seeking to bolster the power system's resilience.

The Fourth Package, known as Clean Energy for all Europeans, came into effect on the 5th of July 2019. By seeking to strengthen European integration and to develop renewable energy sources, it brings new challenges and opportunities for power-system reliability.





Reliability audits and internal control



AUDITS SÛRETÉ ET CONTRÔLE INTERNE

As part of the **internal control programme**, RTE annually assesses the standard of operating activities (and hence reliability performance) in the light of identified and prioritised risks, mitigations and their effectiveness. **Internal audits conducted in 2020 highlighted satisfactory reliability-management standards.**

In 2020, two reliability-related topics underwent internal audits:

- Power system operations: flows and frequency.
- ORTEC reliability audit – RTE's emergency preparedness organisation.

Within the scope of the audited topics, the conclusions of both audits highlighted extremely satisfactory standards of safe power-system operation.

internal audits

Commissioned by company management, reliability-specific internal audits are conducted once a year. Audit topics are determined in such a way as to cover the full range of reliability items over a period of three to four years, depending on the assessed risk level. Audit conclusions are

submitted to the RTE Executive Committee. Recommendations are issued in order to improve risk management. Action plans are established to address these recommendations and their progress is reviewed at Executive Committee meetings.





Appendices



APPENDIX 1: Glossary of terms

Term	Concept
Balancing mechanism (BM)	<p>Under French law, generators shall provide RTE with the available power required for balancing supply and demand. This is carried out via the Balancing Mechanism, whereby RTE pools all capacities available from market players in the form of a continuous and open mechanism, and whereby players can be compensated for their demand response capacity or their generation flexibility. On the basis of price-volume bids, RTE makes the necessary balancing adjustments by cross-comparing proposals on the basis of price until its needs are met. Provisions are made for shortages:</p> <ul style="list-style-type: none"> -for periods exceeding 8 hours, RTE demands additional proposals via alert messages; -for periods of less than 8 hours, RTE uses a "degraded mode" message to secure exceptional proposals, besides any additional proposals, and resources not offered for balancing purposes.
Primary and secondary frequency control	<p>Primary control automatically ensures that balance is restored almost immediately following any kind of unforeseen malfunction affecting supply-demand balance, through the mutual support of all partners involved in synchronous interconnection. Rules are laid down by the ENTSO-E regional "continental Europe" group, ensuring that this action then maintains the frequency within the agreed limits.</p> <p>Thereafter, secondary frequency control by the partner having initially caused the disruption automatically cancels out the residual frequency deviation relative to the reference frequency, as well as other deviations from scheduled cross-border exchanges between the different control zones.</p>
ENTSO-E	<p>Founded in the latter part of 2008, ENTSO-E (European Network of Transmission System Operators for Electricity), has been the sole association of European TSOs since the 1st of July 2009.</p> <p>The role of ENTSO-E is to strengthen cooperation among TSOs in key areas such as the development of grid codes relating to technical aspects and market transactions, coordination of European Grid operation and development, and research work.</p> <p>In accordance with its articles of incorporation, ENTSO-E's main decisions are taken at shareholder meetings. An Executive Board is responsible for general oversight and for establishing strategic guidelines. Day-to-day work is carried out by four main committees and their sub-committees, the Markets Committee (MC), the System Development Committee (SDC), the System Operation Committee (SOC) and the Research and Development Committee (RDC), along with a legal appraisal group. RTE is represented on each of these committees.</p> <p>In order to ensure the technical coordination of synchronous interconnected TSOs in continental Europe and the assessment of reliability-related commitments as set out in 8 policies and approved under the Multi-Lateral Agreement signed by members of the former association (UCTE), the SOC has set up an ad-hoc sub-committee (Regional Group Continental Europe (RGCE). See: www.entsoe.eu</p>

Term	Concept
Security telecommunication systems	<p>This security system is based on a dedicated telecommunications infrastructure essentially owned and operated by RTE, which conveys all information (voice, data) required for remote operation. These systems fulfil the following functions:</p> <ul style="list-style-type: none"> - Transmission (low level) of remote operating data from all remote substations, as well as a limited number of telephone conversations between main grid substations and substation groups; - Transmission (high level) of remote operating data and telephone conversations between substation groups and dispatch centres; - Transmission of remote operating data and telephone conversations between power plants and dispatch centres; - Transmission of remote operating data and telephone conversations between distribution network operating centres and load dispatch centres.
Generation facility performance monitoring	<p>Considering the critical nature of services rendered by generation facilities when connected to the grid, they may be required to undergo performance checks. This purpose of these checks is to assess power-plant response to primary and secondary frequency control (static current gain, scheduled reserves, response time, etc.) and to primary and secondary voltage control (agreed operating range in the U/Q diagram, response time).</p>

APPENDIX 2: Glossary of abbreviations

ADN	Northern Grid Protection Controller
ADO	Western Grid Protection Controller
ANSSI	France's national cybersecurity agency
CE	Operating centre
CF	Firewall
CNES	France's System Operations Centre
CORES0	CO-oRdination of Electricity System Operators
CSEA	Economic Oversight and Audit Committee
CSPR	Static VAR compensator (SVC)
CURTE	Transmission System Users Committee
ENTSO-E	European Network of Transmission System Operators for Electricity
EOD	Supply/demand balance
ESS	Significant System Event
GRD	Distribution network operator (DNO)
GRT	Transmission system operator (TSO)
HVDC	High Voltage Direct Current link
ICS	Incident Classification Scale
IST	Temporary back-up current
LPM	Military programming act
MA	Balancing mechanism (BM)
ORTEC	RTE emergency preparedness organisation
PCA	Business continuity plan (BCP)
PRA	Business resumption plan (BRP)
PER	Regional trading gateway: Remote operation system used by the dispatch centre
RC	Additional frequency control reserve (MA)
RCC	Regional Cooperation Centre
ROSE	Optical security system
RR	Fast frequency control reserve (MA)
RSFP	Secondary load frequency control
RST	Secondary voltage control
RPD	Public Distribution Network
RPT	National grid
RSC	Regional Services Centre
SAS	Safeguard and Alert System
SIDRE	Regional dispatcher support group
SNC	National Operating System
SRC	Regional Operating System



Le réseau
de transport
d'électricité

Immeuble Window
7C, place du Dôme
92073 Paris - la Défense Cedex
www.rte-france.com