

Pressure on electricity supplies: a reminder to prepare for possible load-shedding and loss of electric utilities

Periods of cold weather are characterised by low temperatures, sometimes combined with snowfall and/or wind. Synonymous with high electricity consumption and technical incidents, they are often the cause of power failures and can disrupt telecommunication networks.

The coming winter will be a time when the French electricity system is in transition and energy supply under pressure. Under the assumption of the most unfavourable conditions (very cold winter and adverse supply scenario), the operator RTE (*Réseau de Transport d'Électricité*, or electricity transmission network) has announced 20 to 28 high electricity demand days with inevitable power cuts if consumption is not reduced significantly (press conference of 14 September 2022). However, this is not the most likely scenario.

Various measures are in place to alleviate these difficulties, such as shifting the power consumption of private households on a voluntary basis or rapid power cuts among major industrial customers (contractual outages). However, if these measures prove to be inefficient, RTE implements load shedding, i.e. temporary targeted and controlled outages, on private households and industrial customers. Unprecedented local power cuts lasting up to two hours are being considered for this winter. To prepare for this, the Ecowatt forecast service lets you know the amount of electricity consumption in France in real time and with 4-day forecasts. Everyone is now asked to reduce consumption especially during periods of high consumption, namely between 8 a.m. and 1 p.m. and 6 p.m. and 8 p.m.

Whatever their nature, prior preparation is essential as an outage can result in property damage and significant operating losses, particularly if a continuous process stops suddenly (e.g., glass factory) and if all the back-up facilities are not operational.

ARIA 49142 – 16/01/2017 – LOIRE-ATLANTIQUE

Neighbours next to a chemical packaging company detected a smell of chlorine emanating from the wastewater systems [...] The chlorine leak occurred following a shutdown of the site's automatic treatment plant. The facility's control board was out of order following the malfunction of the UPS supplying it with electrical power. The UPS system shut down following a period of extreme cold which caused the batteries to overheat and fail.

The operator was able to connect the processing plant to another power source and resume treatment of the free chlorine-rich effluent. The UPS was replaced and installed in a heated cabinet to protect it from freezing temperatures.

ARIA 53326 – 08/03/2019 – BOUCHES-DU-RHÔNE

A power outage caused the emergency shutdown of several companies operating at a petrochemical complex. In accordance with safety procedures, products in process on the site were flared by one of the companies. Since the complex's steam-generating plant was also involved, flaring was not optimal, and large plumes of smoke were visible from outside the site. The operator activated the emergency response plan at 10:30 a.m. The personnel of a neighbouring site were locked down.

The analyses conducted verified that local residents were affected by the nuisances (particularly olfactory), sometimes experiencing symptoms. The loss of the main power supply of the complex was caused by a cabling error during work on the network.

Restoring power to the networks was complicated by lack of network identification.

ARIA 53010 – 23/01/2019 – OISE

A power outage on the public electricity distribution network caused a wind farm to shut down. Following this, one of the 2 wind turbines began to rotate at excess speed. This situation lasted 40 minutes and resulted in the delamination of a blade (longitudinal shearing across the thickness of the blade). The resulting imbalance folded the 66-m mast in two at around 2:40 pm. Debris was thrown over a 300 m radius. The firemen set up a 500 m safety perimeter.

Load shedding in France

Load shedding, or load reduction, involves switching off customers' power to prevent saturation of the network. It notably occurs:

- When the order is given, to accommodate peaks in consumption;
- If a power or electrical current threshold is exceeded;
- When there is a deviation in the frequency of the supplied voltage;
- When power consumption exceeds that in the subscription contract.

Energy consumption rises significantly during extremely cold weather, while impairing safety margins needed to cope with peak demand. Additional problems can arise, such as the availability of power generation facilities that are likely to be shut down for maintenance activities. Strong winds can also damage overhead power transmission lines.

Ecowatt

An electricity forecast service that provides real-time consumption levels in France.

Green alert: sufficient electricity capacity for normal consumption

Orange alert: electricity production is under some strain but close to expected consumption

Red alert: not enough electricity to cover our needs

Registration for power outage alerts is available to all for free.

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ARIA 55468 – 08/05/2020 – SEINE-MARITIME
200 tonnes of molten glass spilled into a retention at a glassworks site. The **emergency response plan** was activated. The operator evacuated the 63 employees present and called the fire-fighters. One hour and 30 minutes later, the **retention system overfilled** without environmental impact. **One hour before the pouring of the glass, the site lost power** due to a fault in the cables outside the site. The emergency generators started but stopped without obvious cause.

ARIA 58727 – 26/01/2022 – ALPES-MARITIMES

A **fire broke out** in the high-voltage substation of a sorting centre for waste transit. Smoke escaped from the premises. The operator stopped the activity and established a safety perimeter. Fire-fighters, police and the high-voltage (HV) network manager intervened to secure and control the situation without the use of water. The HV lines were taken out of service, and the **site was powered by two generators** to continue the activity. Work to restore the substation to service was scheduled.

Four hours earlier, the electricity distribution system manager **shut down the power supply to the centre to perform pruning**. The operator was not informed of this procedure. When the operator restarted the electricity, the **high-voltage substation did not support the electrical load** causing a fire inside the substation involving the high-voltage cells.

Three months later, new HV cells and a transformer were commissioned.

ARIA 58750 – 10/03/2022 – SEINE-MARITIME

During the night, **fire outbreaks** occurred on the distillation unit of a refinery after the **loss of electrical power to a part of the refinery units**. The **emergency response plan** was activated. **The operator and a neighbouring company locked down their personnel**. The departmental road was closed to traffic. Smoke and odours were perceptible around the site.

During normal operation, the electrical substation supplying these facilities is connected to **2 redundant and independent sources**. One is external and the other internal (self-produced electricity using turbines), each serving as a backup for the other. On the day of the incident, the internal power supply was being transferred to the external one in order to perform preventive maintenance for 24 hours. **A fault on one of the 4 cables of this power supply** caused a power outage.

The units were restarted 3 days later.

Feedback from the consequences of power outages on industrial facilities, particularly during extremely cold weather, has provided the following valuable lessons:

- ✓ **It is important to identify all the site's electrical equipment and utility networks.** The equipment's information must be updated when changes are made to the installations and must also take into account their dependence on the power supply and the consequences of stopping and restarting power supply. The other utility networks (such as the supply of steam and compressed air) should not be overlooked as they are usually dependent on the power grid;
- ✓ **Identify the direct effects** (e.g.: shutdown of compressors and flare usage, shutdown of lift pumps and overflowing) and **unforeseen and delayed effects** (e.g.: equipment shutdowns, restarting of installations) of a power outage;
- ✓ **Ensure that installations are safe and secure** in the event of a power outage and, if necessary, implement compensatory measures (e.g., generator set). One must not forget that a power outage can make a facility's defence system unusable (e.g. firefighting);
- ✓ **Prioritise the installations** within the site that are dependent on electrical power in order to **assign** the residual electrical power, **if necessary**. A decision must sometimes be made to place some installations in standby mode while others are shutdown. Such a decision is subject to keeping the units safe and keeping effluent processing operational;
- ✓ **Supervise the possible use of generators**, and consider the possibility of carbon monoxide poisoning (due, for example, to increased use or the stoppage of ventilation). Also take into account the **duration of compensatory measures** (e.g., batteries);
- ✓ **Implement a dedicated organisation** that is activated as soon as an extreme cold weather warning is issued and/or an Ecowatt alert;
- ✓ **Conduct periodic exercises** in order to detect anomalies during the implementation of compensatory measures to offset a power failure.