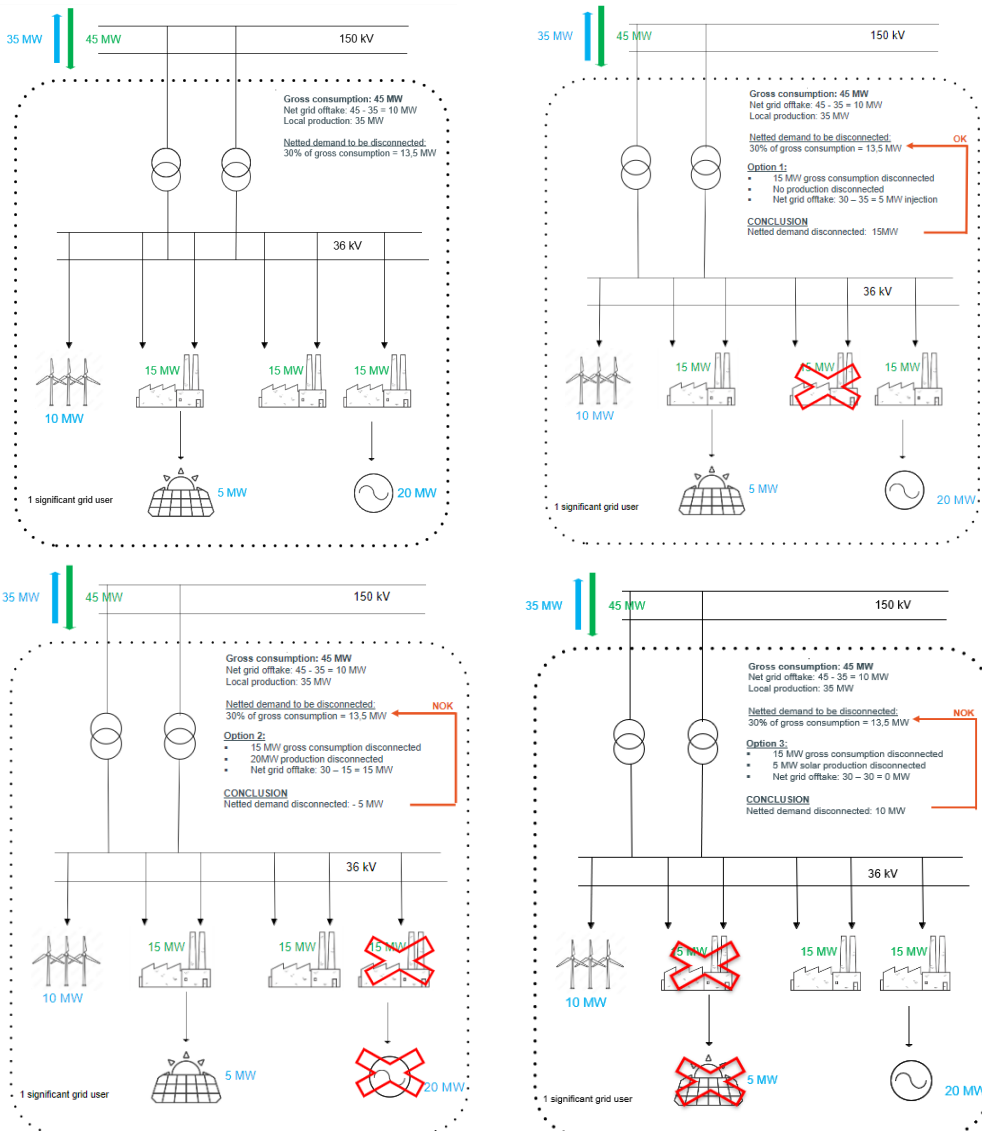


# FAQ about the LFDD plan for transmission connected demand facilities and CDS

Last updated by Elia on 27/03/2024 based on existing regulation.

- 1) What is the real required consumption reduction in case of LFDD activation? 30% of the site nominal or **instantaneous consumption**?

The netted demand to be disconnected is 30% in one step or (6% + 24%) if technically feasible in two steps, of the **instantaneous gross consumption**, at the moment of a frequency collapse in the electricity system. See examples below to further explain what is meant by netted demand to be disconnected:



- 2) How should an annualized gross consumption in MWh be converted to a volume commitment in MW?

Not on an annual basis in MWh. But the gross consumption (in MW) just before switch-off. No conversion should be made between MWh and MW.

- 3) How is **gross consumption** correctly defined?

If the grid user can prove the instantaneous value of his gross consumption just before the frequency collapse:

Gross Consumption = electricity consumption of all **Installations** at the grid user's site at the moment the frequency decreases until 49 Hz, minus the electricity consumption of the auxiliary facilities of electricity generating plants or other facilities identified as significant high-priority grid users in Elia's System Defense Plan, if any of them are available at the grid user's site.

Example: the frequency collapse occurs at 11:32h. If the grid user can demonstrate his gross consumption (in MW) at 11:32h, this value is taken as reference.

If the grid user can NOT prove the instantaneous value of his gross consumption just before the frequency collapse, then the most suitable value is the following:

Gross Consumption = [electricity consumption of all **Installations** at the grid user's site during the quarter-hour prior to the quarter-hour in which the LFDD obligation is to be performed in MWh, minus the electricity consumption of storage units operating in charging mode and minus the electricity consumption of the auxiliary facilities of electricity generating plants or other facilities identified as significant high-priority grid users in Elia's System Defense Plan ] / [0.25 h]

Example: the frequency collapse occurs at 11:32h. Suppose the measured gross consumption from 11:15h to 11:30h was 25MWh. Then the reference gross consumption is:  $25\text{MWh}/0.25\text{h} = 100\text{MW}$ . This is in line with Annex 11 of the connection contract and with the requirements of the network code E&R.

"**Installation**" means, for the purposes of the Connection Contract, any Connection Facility, Co-Contractor's Installation or direct line and, if applicable, any Electricity Generation Unit, Energy Storage Facility, Consumption Facility and/or, if the Co-Contractor is also the CDS Operator, any CDS User's Installation connected downstream to the Co-Contractor's Installations.

- 4) How to implement this for companies with a seasonal or day/night consumption profile?

Grid users can choose to either set a unique value or to dynamically adjust their demand to be disconnected according to seasonal or day/night consumption. If dynamically adjusting is not feasible, grid users should rather focus on their maximum gross consumption to determine their netted demand to be disconnected.

- 5) What is the exact calculation method that grid users should apply to determine ex-ante their demand facilities to be disconnected so that 6% and 24% can be approached as good as possible?

The grid user should approach the 6% and the 24% (or the 30% in one step if technically unfeasible to disconnect in two steps) as closely as possible. Given the low frequency thresholds (48.3 Hz and 48.1 Hz), an over-reaction (too

much switching off) in these conditions is less problematic for grid stability than an under-reaction (too little switching off), which is thus definitely to be avoided. Consequently, the 6% and 24% should be interpreted as minimum values. Small over- and undershoots will presumably offset each other among different grid users.

- 6) How does Elia consider companies which expand or decrease / cease to exist.

Gross consumption (in MW) just before the frequency collapse event will remain the reference to determine the netted demand to be disconnected. Grid users should adjust their demand volumes to be disconnected in accordance with their total load expansion or contraction.

If a company does no longer consume any more power because of a (temporary) stop, the netted demand to be disconnected is also (temporary) zero.

- 7) How does Elia consider the 30% during **major Shutdowns & Turnarounds** where the industrial site requires only an essential baseload?

If a frequency collapse occurs during a SD & TAR, 30% of the remaining instantaneous gross consumption must be disconnected.

- 8) During **major Shutdowns & Turnarounds**, can the grid user pass its obligation temporarily to another LFDD group member?

The grid users' LFDD obligation (in terms of MW) will be reduced during SD & TAR (see previous answer). Temporary transfer of LFDD obligations during TAR is not recommended for administrative simplification.

If the grid user is precisely servicing the interruptible plant, then he should (temporary) set another plant as interruptible consumption, if possible.

- 9) What if the immediate shutdown command of 6% (or even 30%) leads to the **complete shutdown of the process** resulting in a decrease of 100% power? E.g. 100 MW (= 90MW process + 10MW motive power) --> 30% shutdown should lead to 100MW → 70 MW but will in practice lead to 100MW → 10MW (90MW trip completely due to nature of the shutdown). **Is this a problem?**

See also answer 5. Any structural over-reaction should be avoided. In such case Elia recommends making the "excessive volumes" available to other grid users via an LFDD group.

- 10) Should grid users determine what the **net offtake** is with renewable generation with **solar and wind** or without? The power to be switched off will be very volatile. How should grid users deal with that?

The net offtake is not used as a reference to determine the volume of demand to be disconnected.

The demand to be disconnected is 30% of **gross consumption**.

Disconnection of solar, wind or other local production units (CHP) should be avoided as much as possible. (see examples in answer 1). When production is disconnected together with consumption, the netted value (demand-production) should be considered.

The grid user should disconnect preferably only electrical consumer devices such as e.g. electrical heating, lighting, electric motors driving conveyors, pumps, ventilators, compressors, ... and leave production units such as PV, wind, cogeneration unaffected as far as technically possible.

- 11) If you **don't take anything net from the grid**, will there be any signal to switch off?

If zero grid offtake is the result of equal production and consumption on the site then: Yes, there will be a signal to

disconnect 30% of the gross consumption, independent from the net offtake from the grid.

If there is no grid offtake because the site has been shut down then: no, nothing should be disconnected.

- 12) How is the "**gross instantaneous consumption**" value based on quarter-hourly data determined? Grid users' own on-site measurements are not going to produce the exact same number as Elia's. Measurement errors and measurement time intervals may vary slightly.

The grid user has access to the measurements registered by Elia on the connection point. Considering local production measurements allows the grid user to determine its gross instantaneous consumption.

- 13) Is an 'official' quarter-hourly consumption value given with the order to switch off, from which the consumer can **derive the exact amount of power to be switched off**??

No, Elia will only send a pulse signal when the frequency drops under a certain limit (at 48.3 Hz and at 48.1 Hz). The demand facilities to be disconnected are to be determined ex-ante by the grid user so that 6% and 24% can be approached as good as possible.

- 14) In case of **multiple site connections**, is the 6% and 24% to be fulfilled per connection or per site?

The 6% and 24% obligation refers to the instantaneous gross consumption of the grid user's site and is independent from the number of connection points between the site and the transmission grid.

- 15) What is the **time duration** of a possible load disconnection event?

The expected time duration is between 15 minutes and 30 minutes.

After an event that triggered an LFDD activation which did not lead to a total system collapse, Elia's operators will perform a safety check together with the "frequency leader" of the European grid.

As soon as the system is considered sufficiently stabilized, Elia will contact the individual grid users by phone, to give permission to restart their load that was disconnected.

- 16) What becomes the consumption reduction if the site consumption is already reduced (for instance by activation of R3) at the time of the LFDD activation? Is it expected that **R3 reserves** on sites will already have been activated when the LFDD plan would be triggered due to grid frequency = 48.3 Hz ?

In such case, the grid user should be able to reduce 6% and 24% of the remaining gross instantaneous consumption if the frequency goes below the respective thresholds.

Example: a grid user consumes 110 MW of which 20 MW is offered as mFRR demand reserves.

On day D, Elia activated the 20 MW mFRR. The remaining gross consumption is 90 MW. The grid user should be able to disconnect 27 MW if the frequency drops below the threshold values.

During periods when no mFRR is activated, the grid user should be able to disconnect 33 MW (30% of 110 MW)

Activating demand reduction reserves does not exempt the grid user from its LFDD obligation for the remaining gross consumption.

Following a frequency decrease, it might take much more time to activate R3 reserves after Elia's request compared to an LFDD activation which should go very fast.

- 17) Will a grid user incur penalties for not meeting mFRR obligation because of a LFDD activation?

If, as a result of an LFDD activation, the customer can no longer meet its mFRR obligations, Elia will not impose penalties for this and activate other reserves. After all, the grid user did help avoid a blackout.

18) At times of low grid frequency, are **electrolysis** processes allowed to go to minimal power use?

In the new draft European demand connection code, “new” electrolysis process are supposed to start reducing their consumption with decreasing frequency between 49.80 Hz and 49.0 Hz. This means before the LFDD plan is activated.

19) **BESS (batteries)** probably inject during moments of scarcity because of interesting market prices.

Batteries in charge mode should reduce their power consumption as soon as the frequency drops below 49.80 Hz. If the frequency has dropped to 49.0 Hz, then the battery should have reduced its power consumption to zero.

Batteries in injection mode should increase injection with decreasing frequency (up to maximum).

This means that battery consumption reduction should not be counted toward the LFDD requirement, but battery consumption should also not be counted toward the grid user's gross consumption.

20) How the LFDD plan applies to **CDS**? What is the obligation and what are the expectations for both the CDSO and/or present grid users with regards to load reduction?

Elia recommends for reasons of simplification that the CDS, which has a connection agreement with Elia, fulfills the LFDD obligation as one entity. The CDSO is encouraged to agree internally with individual CDS grid users which consumer installations should be disconnected.

21) The implementation of the LFDD plan will require some relays installation/upgrades. Who will support the **related costs**?

The frequency relays will be purchased by Elia and installed by Elia preferably in Elia's substation. The trip orders will be passed to the grid user through the interface cubicle.

The grid user distributes the trip signal to the individual consumer installations that should be disconnected. These related costs have to be born by the grid user.

22) Is a **remuneration** provided for this voluntary shutdown at 49 Hz?

No. Low frequency shutdown is an emergency measure from the system defense plan for which no remuneration is provided, neither to grid users connected to the distribution grid nor to grid users connected to the transmission grid.

23) What are the **finances or consequences** if we (can't) comply with these regulations, are there any exceptions?

There are no explicit fines. Elia implements a legal obligation to adequately protect the system. From this follows an obligation for transmission-connected demand facilities, CDS and DSOs. Failure to comply could potentially result in damages to Elia, Grid Users and other third parties who rely on the grid being properly protected. In this case liability claims may potentially be brought by Elia (on a contractual base) or third parties on the basis of common law liability rules (extra contractual).

24) Elia will contact the grid user **2 years in advance** with regard to which time reference point?

Elia will send a letter to the grid user on date DD/MM in year Y, to announce that the LFDD installation should be ready for a commissioning test on date DD/MM in year Y+2.

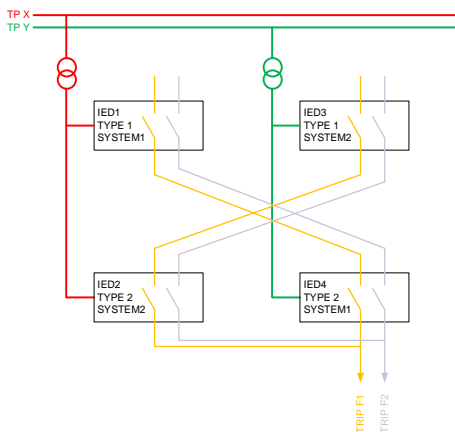
- 25) What **precautions** will be taken to avoid the LFDD relays operate in case of incidental frequency decrease not linked to a grid balance default? (short circuit situations, grid incidents...)

Elia will apply the same concept as currently in use for disconnecting load in public distribution systems. (See image below)

Two independent voltage measuring transformers are used. Each of them serves as input to two different frequency relays that calculate the frequency of the voltage waveform and compares this with the pre-defined frequency threshold.

Both ways need to draw the same conclusion before giving the trip order.

The relays are blocked in case of low voltage (short circuit), to avoid unwanted trips.



Moreover, the grid user may install additional crosschecks to avoid unwanted tripping of his feeders, provided the total tripping time can be respected. For example, the grid user may install a device which blocks the disconnection of the load if there is no frequency drop.

- 26) Does Elia effectively expect frequency drops to 49 Hz in 2026. What does Elia think are the **causes of** that?

A frequency drop is a result of a totally unexpected (major) incident. Elia and other European TSOs make every effort to avoid it but cannot completely rule out the possibility that it could ever happen.

The last major frequency drop to 49 Hz dates back to 2006 and resulted from an unexpected splitting of the European power grid into several parts.

- 27) Will the arrival of the additional wind turbines in the North Sea and by extension in Europe create **more fluctuations in the grid**, resulting in possible LFDD activations?

Frequency volatility may increase due to the decrease in "rotational inertia" in the European grid and the continuous increase of fluctuating renewable energy sources.

Elia plans installing synchronous condensers and imposing "synthetic inertia" capabilities in "grid forming" inverter-based resources to avoid too much frequency fluctuations.

- 28) What are the expectations regarding **probability and duration of situations with 49.0 Hz** (are these based on modeling/simulations)?

A frequency drop to 49.0 Hz is very exceptional. The last time this happened in Belgium was in 2006. The second last time was in 1982. Even a frequency drop to 49.80 Hz has happened only once in the last 5 years.

Elia cannot rule out that due to the decrease in "rotational inertia" in the European grid, frequency volatility may increase.

In the frequency range between 49.80 Hz and 49.00Hz, Europe-wide automatic operations such as:

- Pump stations operating in pump mode are automatically shut down.
- Voltage in distribution networks is reduced by 5% to temporarily reduce consumption.
- Batteries (+EV, Heat Pumps and electrolysis) reduce their charge mode or increase their discharge mode according to the decreasing frequency.
- All rotating reserves on production units are released according to the declining frequency, even on the units that do not participate in market-based primary reserves.

Only when this is all used up and the frequency drops further to 49.0 Hz, the LFDD plan is activated. The probability of this happening is very small.

29) Will this disconnection be automated with **frequency relays** or is this a **manual** shutdown?

LFDD deals with automated disconnection based on frequency relays.

Elia provides the frequency relays and transmits the shutdown order to the grid user, who in turn transmits it to the breakers(s) that interrupt consumption.

The time between falling below the frequency threshold and interrupting consumption should not exceed 0.2 seconds by law.

30) Is participation on a **voluntary** basis or will this become **mandatory** after the approval by the minister?

LFDD participation is mandatory: 30% of gross instantaneous consumption should be prepared for disconnection either in two steps (6% at 48,3Hz and 24% at 48,1Hz) or in 1 step (48,3 Hz or 48,1Hz to be decided by Elia) if it is technically unfeasible to disconnect in two steps.

The grid user is free to disconnect a volume between 0% and 30% at 49,0 Hz on voluntary basis.

31) We are a **Seveso company** and absolutely cannot shut down power or parts of the plant. We do **not** see this **obligation** as **feasible** within our company without compromising safety.

No exception is provided for Seveso companies.

**LFDD grouping** allows transferring the obligation to other grid users. The group members can share the net consumption to be disconnected (30% of the group's gross consumption) by mutual agreement.

Elia understands the concerns. Elia's primary goal is to immediately stop a sudden frequency collapse and avoid a blackout. Elia does this by providing sufficient (netted) demand that can be disconnected, as defined at European level.

Interruption times are much smaller compared to a grid restoration after a total blackout. Although the optimal economic conditions cannot be maintained, in this way we avoid worse.

With the 30% rule, Elia treats all transmission-connected demand facilities in a non-discriminatory manner.

32) May an **LFDD group** also be formed with another company without any other link at all?

Yes.

33) Is Elia not going to install frequency relays on sites that are not participating themselves, but who are part of an LFDD group?

Correct.

34) How could any LFDD grouping proceed practically?

Through bilateral or multilateral contacts between individual grid users.

35) Why is Elia not bringing grid users into contact with each other to form LFDD Groups?

Elia wants to remain independent and neutral towards each grid user.

36) Could the “Febeliec” federation perhaps facilitate this?

This might be a good idea.

37) Should LFDD Groups be used if a company shifts the obligation across its own facilities at other sites?

Yes, because this impacts the number of relays Elia must provide and their location.

38) Is there a **price set per interruptible MW** that or is such price to be agreed on between parties?

Elia does not specify a price per interruptible MW.

Elia does not intervene in price-agreements between parties that want to cluster their LFDD obligations.

39) **Do emergency generators or batteries** also count as switching off or reducing power?

Yes, if the emergency generator can realize the same effect as a demand reduction within the specified reaction time of 0.2 seconds.

40) Are there provisions regarding ev. **priority return to service** when 49Hz situation stabilizes again?

Hospitals that were disconnected in distribution networks will be given the highest priority in returning to service. Elia grid users who voluntarily offer interruptible power at 49 Hz could also be returned to service with priority. Elia needs to discuss this with the public authorities if this is relevant.

41) To which step are voluntary interruptible volumes at 49,0Hz **deducted** from (1st 6% or 2nd 24%):

Voluntarily disconnected volumes at 49.0 Hz are first deducted from the 6% obligation at 48.3 Hz. The portion above 6% is deducted from the 24% obligation at 48.1 Hz.

42) Will load be interrupted during **testing** of the frequency relays and other hardware to be installed?

It is not intended to interrupt the grid users' load during a commissioning test. External frequency signals are injected into the LFDD relay to verify that the shutdown command is correctly transmitted by Elia and arrives at the interface cabinet, within the acceptable response time. The grid user must verify that the shutdown command is correctly transmitted to the one or more breakers within his site within the acceptable response time. The circuit breaker opening time is added to the response time based on constructor data. Thus, no load interruption during the test!

43) What if an LFDD interruption of 30% is technically not feasible and no LFDD group is available:

In such exceptional cases a case-by-case exception could be analyzed with the FOD Economy.