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Guidance on the provision of reserves

This document describes and provides guidance for participation on markets for reserves



Svenska kraftnät

Svenska kraftnät is a state owned enterprise with the task of maintaining Sweden's electricity transmission grid, which consists of about 16,000 kilometres of 400 kV and 220 kV transmission lines with substations and interconnectors. Svenska kraftnät is also the system operator for electricity in Sweden.

Svenska kraftnät is developing the transmission grid and the electricity market to meet society's need for a secure, sustainable and cost-effective supply of electricity. In this, Svenska kraftnät plays an important role in implementing national climate policies.

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Org. No 202 100-4284

Svenska kraftnät
Box 1200
172 24 Sundbyberg
Sturegatan 1

Phone: +46 10-475 80 00
Fax: +46 10-475 89 50
www.svk.se

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Introduction

Svenska kraftnät is the system operator for electricity in Sweden, which entails responsibility of ensuring that the Swedish electricity supply is reliable and that there is a constant balance between power input and withdrawal to keep the frequency in the power system at 50 Hz.

Balancing the power system

Svenska kraftnät ensures that the consumption and production of electricity in Sweden is in balance. Production and consumption are in balance when the frequency is stable. The frequency is measured in Hertz (Hz). Due to technical reasons, the Swedish power system is designed to be in balance at an even frequency of 50 Hz.

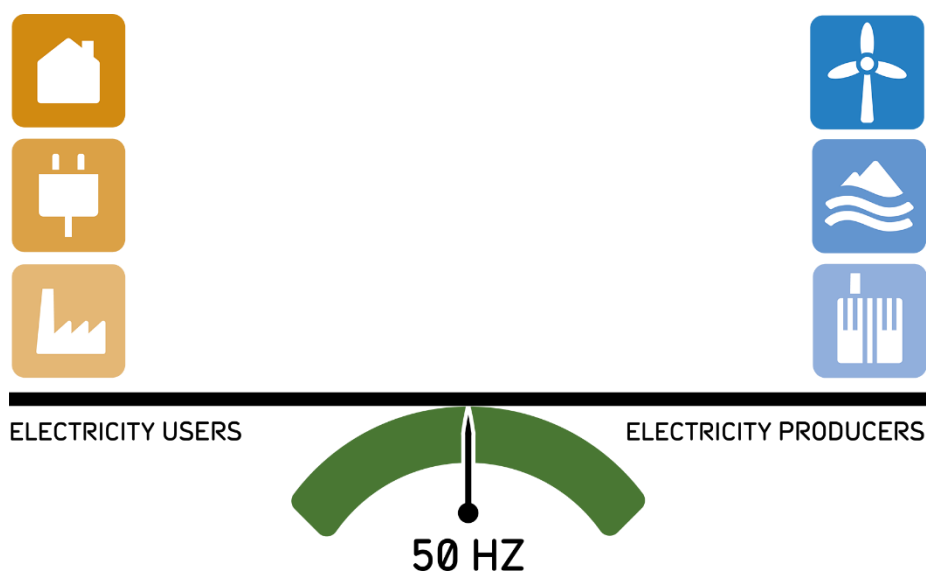


Figure 1. The electricity balance of the power system.

In order to balance the power system, Svenska kraftnät has to purchase reserves from balance responsible parties. Additional information on the balance responsibility can be found on [Svenska kraftnät's webpage](https://www.svk.se/en/stakeholders-portal/electricity-market/balance-responsibility/)¹.

¹ Visit Svenska kraftnät's webpage <https://www.svk.se/en/stakeholders-portal/electricity-market/balance-responsibility/>

The energy system is transitioning at a fast rate to include more renewable electricity production. This will bring even greater challenges in balancing the power system and therefore an increased demand of flexible resources to help mitigate these imbalances. Ensuring sufficient reserves that can help balance the power system is important to maintain operational reliability in an efficient manner.

Reserves may for instance consist of production units, units that can adapt their electricity consumption or energy storage. Svenska kraftnät wants to increase competition and the technological diversity on the reserve markets by encouraging new types of resources, such as energy storage and demand-side flexibility, to participate. The concept of demand-side flexibility is to change and/or transfer the electricity consumption over time as a response to an external signal. It can consist of different types of resources such as an individual industry or several aggregated households.

Four types of reserves

There are four different types of reserves with different requirements on for example endurance and response time. The automatic reserves have the fastest response time and are therefore activated first when a frequency deviation occurs. The manual reserves are used to restore the automatic reserves to ensure that they are ready to be reactivated for the next frequency deviation.

FFR (Fast Frequency Reserve)

Fast Frequency Reserve or Snabb Frekvensreserv in Swedish, has the task of handling the initially rapid and deep changes in frequency. Today, FFR is procured on an annual basis.

FCR (Frequency Containment Reserve)

Frequency Containment Reserve or Frekvenshållningsreserv in Swedish, has the task of stabilizing the frequency for any deviation and is fundamental in maintaining the balance.

FCR can be divided into three reserves:

- > FCR-N (Frequency Containment Reserve – Normal) or Frekvensreserv normal drift in Swedish (procured symmetrically for upward and downward regulation)
- > FCR-D upward (upward Frequency Containment Reserve – Disturbance) or Frekvensreserv störning – uppreglering in Swedish
- > FCR-D downward (downward Frequency Containment Reserve – Disturbance) or Frekvensreserv störning – nedreglering in Swedish

FCR-N is procured symmetrically for upward and downward regulation. FCR-D is procured as two products, one for upward regulation (FCR-D upward) and one for downward regulation (FCR-D downward).

FCR is activated automatically if the frequency deviates from the range it is meant to support. FCR is procured in advance and aims to be available at every moment of the day.

aFRR (automatic Frequency Restoration Reserve)

automatic Frequency Restoration Reserve or automatisk Frekvensåterställningsreserv in Swedish, has the task of automatically restoring the frequency to 50,00 Hz when the frequency deviates from 50,00 Hz. As the name implies, this reserve is activated automatically. aFRR is procured in advance.

mFRR (manual Frequency Restoration Reserve)

manual Frequency Restoration Reserve or manuell Frekvensåterställningsreserv in Swedish, has the task of offloading the automatic reserves and restore the frequency to 50,00 Hz. mFRR is activated manually upon request from Svenska kraftnät.

For mFRR there is a national capacity market and a Nordic regulatory market. In these markets, capacity and energy are procured and sold every hour to keep the frequency within the range of 49,90 – 50,10 Hz in the Nordic power system. Manual regulations are conducted by Svenska kraftnät's balancing service.

Table 1. Overview of the different reserves

Reserve	Purpose	Activation
FFR	Handles the initially rapid and deep (transient) frequency deviations that can occur in case of low levels of inertia in the Nordic power system.	Full activation (3 alternatives) <ul style="list-style-type: none"> - 0,7 sec (at 49,5 Hz) - 1,0 sec (at 49,6 Hz) - 1,3 sec (at 49,7 Hz)
FCR-N	Stabilizes the frequency for small changes in consumption or production.	Automatically when the frequency changes within the range 49,90 – 50,10 Hz
FCR-D upward	Stabilizes the frequency during disturbances.	Automatically when the frequency falls below 49,90 Hz
FCR-D downward	Stabilizes the frequency during disturbances.	Automatically when the frequency exceeds 50,10 Hz
aFRR	Restore the frequency to 50 Hz.	Automatically through a control signal when the frequency deviates from 50,00 Hz

mFRR	Manual reserve that offloads the automatic reserves and restores the frequency to 50 Hz.	Manually upon request by Svenska kraftnät when the frequency deviates from 50,00 Hz
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Activation of the reserves FCR-N, aFRR and mFRR is illustrated in Figure 2.

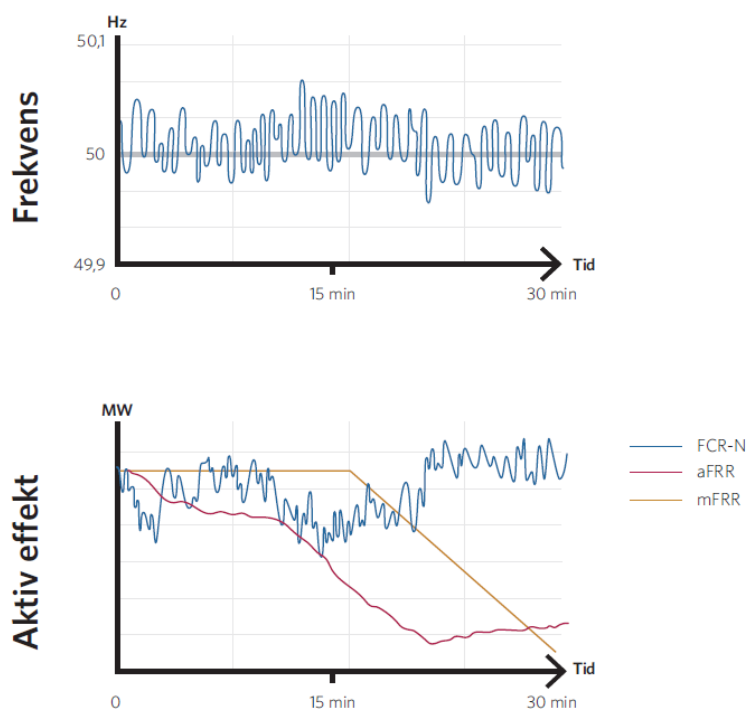


Figure 2. Activation of reserves for normal frequency deviations.

Activation of the reserves FFR, FCR-D upward, aFRR and mFRR is illustrated in Figure 3.

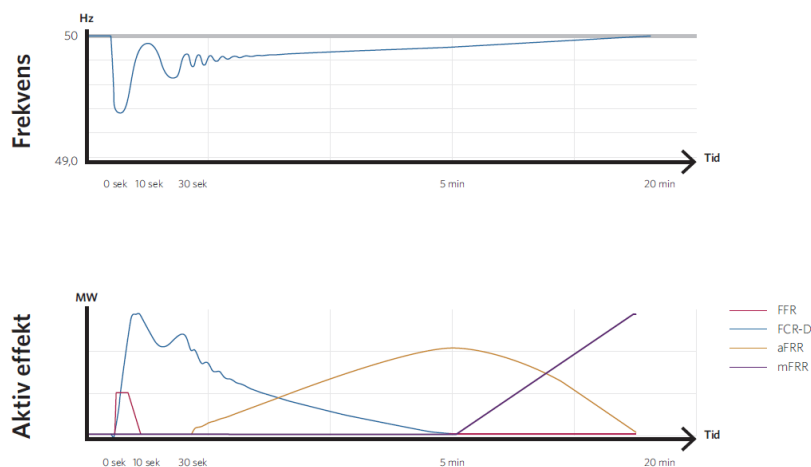


Figure 3. Activation of reserves for disturbances.

Requirements for provision of reserves

In order to provide reserves, all requirements stipulated in the current [balance responsibility agreement](#)² and associated appendices and regulatory documents must be fulfilled. See the following appendices in the balance responsibility agreement:

- > Appendix 3 – Terms for FCR
- > Appendix 4 – Terms for aFRR
- > Appendix 5 – Terms for mFRR

The balance responsibility agreement and associated appendices and regulatory documents are only available in Swedish on [Svenska kraftnäts webpage](#)³.

Any questions regarding the balance responsibility agreement or associated documents may be directed to appropriate communication channels listed in Table 2.

² Visit Svenska kraftnät's webpage <https://www.svk.se/en/stakeholders-portal/electricity-market/balance-responsibility/balance-responsibility-agreement/>

³ Visit Svenska kraftnät's webpage <https://www.svk.se/aktorsportalen/balansansvarig/balansansvarsavtalet/>

NOTE! Terms for FFR are not yet regulated in the balance responsibility agreement. Information about FFR in Swedish can be found on [Svenska kraftnät's webpage](#)⁴ or by contacting ffr@svk.se.

Plans and bids are reported to Svenska kraftnät in accordance with the current Ediel standard. Instructions for Ediel in Swedish are available for download on [Svenska kraftnät's webpage](#)⁵, all questions are directed to ediel@svk.se.

The platform ECP is also used for aFRR and mFRR. More information on electronic communication is available in Swedish on [Svenska kraftnät's webpage](#)⁶.

A brief overview of the different reserve markets as well as general questions and answers are available on [Svenska kraftnät's webpage](#)⁷.

Prequalification

In order to participate on a market for reserves, a provider must demonstrate that the technical requirements for the specific reserve are fulfilled. This is done by completing a prequalification with approved results.

Reassessment of prequalification

Units or groups providing reserves shall be re-assessed:

- > at least once every 5 years, or
- > in case the technical requirements, requirements on endurance or the equipment have changed.

In addition, units or groups providing FCR shall be re-assessed:

- > in case of modernization of equipment related to activation of FCR.

Prequalification documents for each reserve is available on [Svenska kraftnät's webpage](#)⁸.

⁴ Visit Svenska kraftnät's webpage <https://www.svk.se/aktorsportalen/bidra-med-reserver/om-olika-reserver/ffr/>

⁵ Visit Svenska kraftnät's webpage <https://www.ediel.se/Info/edielanvisningar>

⁶ Visit Svenska kraftnät's webpage <https://www.svk.se/aktorsportalen/bidra-med-reserver/bli-leverantor-av-reserver/#:~:text=Krav%20om%20elektronisk%20kommunikation%20f%C3%B6r%20budgivning%20och%20avrop>

⁷ Visit Svenska kraftnät's webpage <https://www.svk.se/en/stakeholders-portal/electricity-market/information-about-ancillary-services/>

⁸ Visit Svenska kraftnät's webpage <https://www.svk.se/en/stakeholders-portal/electricity-market/information-about-ancillary-services/prequalification/>

Which market may the unit or group participate in?

It is possible to submit an optional application of interest if the provider is uncertain of which market the unit or group may participate in. Please note that an application of interest does not equal submitting a formal application on the provision of reserves. The application of interest allows Svenska kraftnät to perform a preliminary assessment on which markets the unit or group may participate in. After the application of interest has identified the markets and a formal application has been made to a specific reserve, the prequalification of the resource can then be initiated.

The web form used for submitting an application of interest can be found in Swedish on [Svenska kraftnät's webpage](#)⁹.

The formal application process is described below in the section *Application process*.

Application for prequalification

Participants who wish to provide reserves shall submit a formal application for prequalification. The application consists of following documents:

- > Application form for each reserve the application concerns
- > Test protocol for each reserve the application concerns (the results of the performed tests)
- > Possible attachments

All documentation associated to the application must be sent through a secure digital service. The participant shall notify Svenska kraftnät when the application is completed and ready to be submitted and Svenska kraftnät will then provide information on method of submittal.

Contact information regarding the application

Contact the appropriate e-mail listed in Table 2 to initiate the prequalification of a specific reserve.

⁹ Visit Svenska kraftnät's webpage <https://www.svk.se/aktorsportalen/bidra-med-reserver/intresseanmalan-for-stodtjanster/>

Table 2. Contact information to initiate application for prequalification for each reserve

Reserve	E-mail
FFR	ffr@svk.se
FCR-N, FCR-D upward, FCR-D downward	fcr@svk.se
aFRR	afrr@svk.se
mFRR	mfrr@svk.se

Application process

The application process with associated lead times to begin provision of FFR, FCR, aFRR or mFRR to Svenska kraftnät is described in text and bullet points as well as being illustrated in Figure 4.

1. The participant notifies Svenska kraftnät on the scheduled date for tests required to prequalify the unit/group so that Svenska kraftnät can attend.
2. If necessary, Svenska kraftnät will request a rescheduling of date.
3. The tests are performed in accordance to the test program templates.
4. The participant submits a formal application to Svenska kraftnät.
5. Svenska kraftnät reviews the application.
NOTE! Svenska kraftnät may request additional information during the review.
6. The application is denied or approved.
If the application is denied, the participant will receive information on necessary actions required in order for Svenska kraftnät to approve the unit or group.

If the application is approved, the process proceeds with registration of real time measurements and data logging.

Lead times

Confirmation of application is received within eight weeks

Svenska kraftnät will notify the participant whether or not the application is complete within eight weeks from receiving a formal application.

Completion of application must be sent within four weeks

If Svenska kraftnät requests any completing information to the application, the participant will have four weeks to submit the additional information upon receiving the request for completion.

Decision on complete application within three months

Svenska kraftnät shall decide on whether the unit or group meets the criteria to prequalify within three months of confirming that the application is complete.

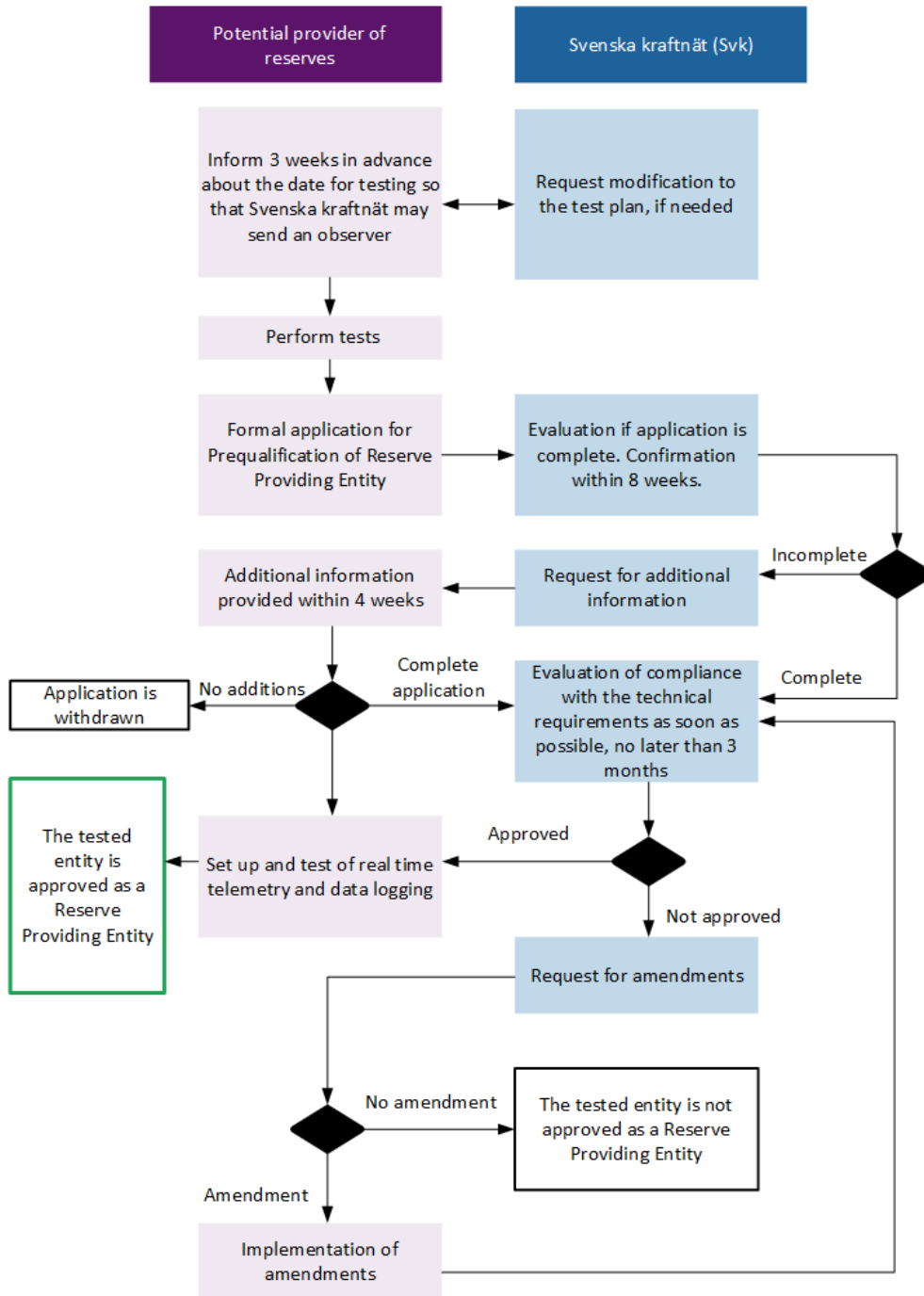


Figure 4. Application process with associated lead times to begin provision of FFR, FCR, aFRR or mFRR to Svenska kraftnät.

Remuneration

The pricing and remuneration can differ between the different reserves. Remuneration for capacity and energy activation, as well as price mechanism, is presented for all reserves in Table 3.

Table 3. Remuneration and pricing per reserve

Reserve	Capacity remuneration	Energy remuneration
FFR	Remuneration for FFR is described in Swedish in the document FFR marknadslösning 2023 ¹⁰	Remuneration for FFR is described in Swedish in the document FFR marknadslösning 2023
FCR-N	Pay as cleared. Prices per MW are published on Mimer ¹¹	According to up or down regulating prices. Prices are published on Mimer ¹²
FCR-D upward	Pay as cleared. Prices per MW are published on Mimer ¹²	No energy remuneration
FCR-D downward	Pay as cleared. Prices per MW are published on Mimer ¹²	No energy remuneration
aFRR	Pay as cleared. Prices are published on Mimer ¹³	According to up or down regulating prices. Prices are published on Mimer ¹⁴
mFRR	Pay as cleared. Prices per MW are published on Mimer ¹⁴	Pay as cleared* according to up or down regulating prices. Prices are published on Mimer ¹⁴

*Valid if bids are accepted for balancing

Gate closure for different reserves is presented in Figure 5. The reserves FCR-N, FCR-D upward and FCR-D downward are procured during two complementary auctions one day (D-1) ahead. The majority of the capacity for FCR is procured in the first auction, the rest is procured in the second auction. The reserve aFRR is procured D-1. The procurement of mFRR takes place on the capacity market and on the energy market. Capacity from the capacity market is procured during one

¹⁰ Visit Svenska kraftnät's webpage <https://www.svk.se/aktorsportalen/bidra-med-reserver/om-olika-reserver/ffr/bidra-med-ffr/> (in Swedish)

¹¹ Visit <https://mimer.svk.se/PrimaryRegulation/PrimaryRegulationIndex>

¹² Visit <https://mimer.svk.se/ManualFrequencyRestorationReserve>

¹³ Visit <https://mimer.svk.se/AutomatFrequencyRestorationReserve>

¹⁴ Visit <https://mimer.svk.se/ManualFrequencyRestorationReserveCM>

day (D-1) ahead. Energy bids for mFRR are cleared during the operating hour if needed. Bids for mFRR shall be submitted no later than 45 minutes before the operating hour. A called bid on the capacity market implies a commitment to submit a bid on the energy market.

The reserve FFR, which is not included in Figure 5, is procured on a yearly basis. FFR is cleared two times per week (Monday and Friday).

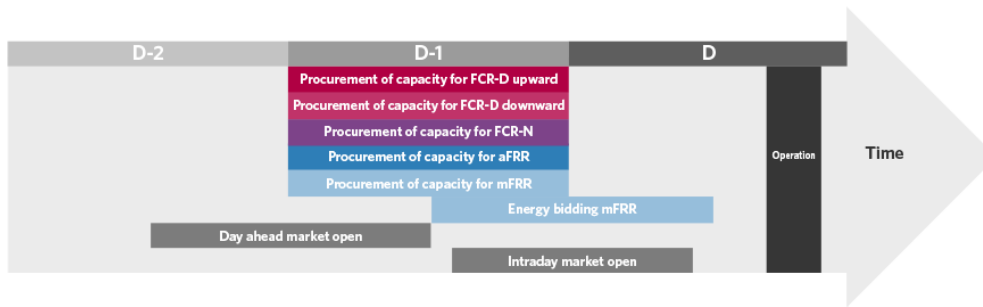


Figure 5. Procurement and pricing of reserves. The reserve FFR is not included in the figure as it is procured on a yearly basis.

More information regarding the remuneration of reserves can be found in the balance responsibility agreement².

Personal data and the principle of public access

Note that Svenska kraftnät is a government agency, which means that everything that is sent to us via e-mail, post or fax becomes a public document.

More information on how Svenska kraftnät processes personal data is available on [Svenska kraftnät's webpage](https://www.svk.se/en/about-the-website/personal-data-and-the-principle-of-public-access/)¹⁵.

¹⁵ Visit <https://www.svk.se/en/about-the-website/personal-data-and-the-principle-of-public-access/>

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