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| Joint operation between the Norwegian and Swedish subsystems in the AC grid |
| Appendix 1 to SOA Annex OS (NO and SE) |
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# Background

The subsystems of Norway, Sweden, Finland and Eastern Denmark are synchronously interconnected. The subsystem of Western Denmark is connected to Norway, Sweden and Eastern Denmark using DC links. This Appendix describes the operation of the AC links between the subsystems of Sweden and Norway.

# Transmission facilities linking the subsystems of Sweden- Norway

## Transmission facilities which are owned/held by system operators at both ends

|  |  |  |  |
| --- | --- | --- | --- |
| **Facility** | **Voltage kV** | **Settlement point** | **Remarks** |
| Ofoten-Ritsem | 400 | \*) |  |
| Nedre Røssåga-Gejmån-Ajaure | 220 | \*) |  |
| Nea-Järpströmmen | 400 | \*) |  |
| Hasle-Borgvik | 400 | \*) | Included in Hasleconstraint |
| Halden-Loviseholm | 400 | \*) | Included in Hasleconstraint |

\*) See Settlement agreement concerning balancing energy, system services and transmission losses.

## Other transmission facilities

|  |  |  |  |
| --- | --- | --- | --- |
| **Facility** | **Voltage kV** | **Settlement point** | **Remarks** |
| Sildvik-Tornehamn | 130 | Torneham | Vattenfall is the owner on the Swedish side |
| Eidskog-Charlottenberg\* | 130 | Charlotteberg | Ellevio is the owner on the Swedish side |

\* This transmission facility is not included in the grid on the Swedish side. The transmission capacity is included in the trading capacity between NO1 and SE3.

# Electrical safety for facilities under 2.1

## General

The common ground for the electrical safety work of the system operator companies within ENTSO-E Regional Group Nordic is constituted by the European standard for managing electrical high-voltage facilities EN 50 110 which governs the organisation and working methods. In addition to the standard, there are national regulations and special instructions which entail certain mutual differences between the system operators as regards dealing with operational issues from an electrical safety point of view.

## Responsibility for electrical operation/Operational management

Responsible for the electrical operation of the facility on the Swedish side is Svenska kraftnät, while on the Norwegian side it is Statnett. The power operation responsibility boundaries for electrical operation for facilities under section 2.1 lie at the national border between Sweden and Norway.

## Switching responsible operator

For each of the cross-border links, there is a specific switching agreement between the parties.

|  |  |  |
| --- | --- | --- |
| Line | Norway | Sweden |
| Ofoten-Ritsem | Regional Centre at Alta | Operations Centre in Sollefteå (DCNO) |
| Nedre Røssåga-Gejmån-Ajaure | Regional Centre at Alta | Operations Centre in Sollefteå (DCNO) |
| Nea-Järpströmmen | Regional Centre at Alta | Operations Centre in Sollefteå (DCNO) |
| Hasle-Borgvik | Regional Centre in Oslo | Operations Centre in Sundbyberg (DCSY) |
| Halden-Loviseholm | Regional Centre in Oslo | Operations Centre in Sundbyberg (DCSY) |

## Operations monitoring and control in respect of electrical safety

Same Parties as under section 3.3.

## Switching schedule

Switchings on the links are carried out in accordance with a switching schedule drawn up by Svenska kraftnät. Before the work begins, the Operations Centres shall confirm that the link is grounded and secured against switching on by exchanging switching confirmations.

## Disturbance management

### Cross-border link trips – management

The term disturbance situation here means that the operational security limits have been violated due to, for instance, long-term line faults or the loss of production. If the transmission capacities have not been exceeded during the faults, the situation will be deemed normal.

In the event of disturbances, measures in accordance with issued instructions shall, as quickly as possible, restore the line to operation within defined security limits.

### Switching schedule

In the event of faults needing switching which will affect the cross-border link, Statnett and Svenska kraftnät are to be informed before any switching is made. In the case of switching on the Swedish grid, switching schedules are to be drawn up by Svenska kraftnät.

Statnett or Svenska kraftnät may perform switching which will affect the cross-border link without coordination, in exceptional circumstances implying a violation of the operational security limits, to prevent endangering personnel safety or damaging equipment, in accordance with Article 14 of the Network Code Emergency & Restoration.

### Fault finding

Initial fault finding will be carried out differently from case to case. Generally speaking, the respective facility owner will be responsible for fault finding in consultation with the switching responsible operator.

### Fault clearance, remaining faults

Once the fault has been localized, the respective facility owner will attend to clearing the fault.

# System operation for facilities under sections 2.1 and 2.2

## Total Transmission Capacity (TTC)

|  |  |
| --- | --- |
| The total transmission capacity (TTC) on the connections is as follows (in MW) | Ambient temperature |
| Line | -20 °C | -10 °C | 0 °C | 10 °C | 20 °C | 30 °C |
| Sildvik-Tornehamn (to Sweden) | 90 | 90 | 90 | 90 | 90 | 90 |
| Sildvik-Tornehamn (from Sweden) | 50 | 50 | 50 | 50 | 50 | 50 |
| Ofoten-Ritsem (to Sweden) | 700 | 700 | 700 | 700 | 700 | 700 |
| Ofoten-Ritsem (from Sweden) | 600 | 600 | 600 | 600 | 600 | 600 |
| Nedre Røssåga-Gejmån-Ajaure (to Sweden) | 250 | 250 | 178 | 178 | 178 | 81 |
| Nedre Røssåga-Gejmån-Ajaure (from Sweden) | 300 | 300 | 300 | 300 | 300 | 250 |
| Nea-Järpströmmen (to Sweden) | 600 | 600 | 600 | 600 | 600 | 600 |
| Nea-Järpströmmen (from Sweden) | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| Hasle-Borgvik + Halden-Loviseholm (to Sweden) | 2 200 | 2200 | 2200 | 2200 | 2200 | 1915 |
| Hasle-Borgvik + Halden-Loviseholm (from Sweden) | 2150 | 2150 | 2150 | 2150 | 2150 | 2150 |
| Charlottenberg-Eidskog | 95 | 95 | 95 | 95 | 95 | 95 |

To Sweden in the Hasle constraint: The transmission capacity is 1,600 MW without production shedding. For every 100 MW of production, production shedding increases the transmission capacity by 50 MW. The maximum production shedding is 1,200 MW, corresponding to 2,200 MW of capacity.

The transmission capacity will be reduced due to a high Oslo load, in accordance with the following table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Oslo load [MW] | 3300 | 4800 | 5400 | 6000 | 6300 |
| Capacity [MW] | 2200 | 2200 | 1600 | 1000 | 0 |

## Routines for determining the transmission capacity

The transmission capacity between Norway and Sweden shall be jointly determined on a daily basis by the Parties.

## Trading capacity (Net Transmission Capacity - NTC)

When determining the trading capacity of the links, the transmission capacity shall be reduced by the Transmission Regulating Margin (TRM).

The TRM of the Hasle constraint is normally 150 MW.

## Operation monitoring and control in respect of system operation

Operation monitoring of capacities and transmission constraints, which can affect exchanges, are conducted in accordance with the below:

|  |  |  |
| --- | --- | --- |
| Line | Norway | Sweden |
| Sildvik-Tornehamn | National Centre in Oslo | Vattenfall Eldistribution’s Operations Centre in Trollhättan |
| Ofoten-Ritsem | National Centre in Oslo | Svenska kraftnät´s Operations Centre in Sollefteå |
| Nedre Røssåga-Gejmån-Ajaure | National Centre in Oslo | Svenska kraftnät´s Operations Centre in Sollefteå |
| Nea-Järpströmmen | National Centre in Oslo | Svenska kraftnät´s Operations Centre in Sollefteå |
| Hasle-Borgvik | National Centre in Oslo | Svenska kraftnät´s Operations Centre in Sundbyberg |
| Halden-Loviseholm | National Centre in Oslo | Svenska kraftnät´s Operations Centre in Sundbyberg |

## Voltage regulation

The basic principle for voltage regulation is governed by section 7 point 7.5 in the agreement.

### Voltage regulation on the Norwegian side

Voltage is monitored by the National Centre in Oslo and Regional Centres in Alta and Oslo. If the Regional Centres do not have sufficient resources to maintain the voltage within the given limits, the National Centre will be contacted.

The following voltage levels are applied:

|  |  |  |  |
| --- | --- | --- | --- |
| Substation | Minvoltage (kV) | Normal operation range (kV) | Maxvoltage (kV) |
| Ofoten | 400 | 400-415 | 425 |
| Nedre Røssåga | 235 | 240-250 | 250 |
| Nea | 380 | 410-415 | 420 |
| Hasle | 380 | 410-415 | 420 |
| Halden | 380 | 410-415 | 420 |

### Voltage regulation on the Swedish side

The Operations Centre in Sollefteå (DCNO) is responsible for voltage regulation in the northern parts of the grid, and the Operations Centre in Sundbyberg DCSY is responsible for voltage regulation in the southern parts of the grid. If the Operations Centres do not have sufficient resources to maintain the voltage within the given limits, Svenska kraftnät's Operations Centre shall be contacted.

The following voltage levels are applied:

|  |  |  |  |
| --- | --- | --- | --- |
| Substation | Minvoltage kV | Normal operation range kV | Maxvoltage kV |
| Ritsem | 395 | 400-415 | 420 |
| Ajaure | 230 | 235-250 | 255 |
| Järpströmmen | 395 | 400-415 | 420 |
| Borgvik | 395 | 400-415 | 420 |
| Loviseholm | 395 | 400-415 | 420 |

### Co-ordination of voltage regulation

In normal operation, the goal is the higher voltage within the normal operation range. In conjunction with operational disturbances and switching, the respective operations centres in Sweden and Norway can agree on action to maintain the voltage within the given intervals.

## Outage planning

Svenska kraftnät shall plan the following in consultation with Statnett:

* Outages or other measures on the Swedish network impacting upon the transmission capacity of the links between Sweden and Norway.
* Outages causing a major reduction of the transmission capacity in constraints 1 or 2, or the West Coast constraint in Sweden.
* Control facility works at Borgvik, Grundfors, Järpströmmen, Porjus, Ritsem, Loviseholm, Skogssäter and Vietas.

Statnett shall plan the following in consultation with Svenska kraftnät:

* Outages or other measures on the Norwegian network impacting upon the transmission capacity of the links between Sweden and Norway.
* Outages entailing that, on the Norwegian network, there is no link between Ofoten and Røssåga.
* Outages entailing that, on the Norwegian network, there is no link between Røssåga and Nea.
* Outages entailing that, on the Norwegian network, there is no link between Nea and Hasle.

## Disturbance situation

The term disturbance situation here means that the operational security limits have been violated due to, for instance, long-term line faults or the loss of production. If the transmission capacities are not exceeded during the faults, the situation will be deemed to be normal.

In the event of operational disturbances, measures in accordance with the issued instructions shall, as soon as possible, restore the link to operation within defined security limits.