

# NORDIC AND BALTIC GUIDELINES FOR HVDC STATISTICS

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## 1 Introduction

This guideline is developed to ensure equal understanding and uniform reporting for the Nordic and Baltic HVDC Statistics. All relevant definitions, categories and examples in order to report correctly can be found in this document.

The goal of the HVDC statistics is to show how each HVDC link is utilized and unavailable. HVDC links are important components for a stable operation, for security of supply and are essential infrastructure for commercial power trade in the European energy markets. It is therefore important to keep the HVDC links in operation as much of the time as possible and it has high value to monitor the availability and utilization of these links.

The amount of HVDC links are rapidly increasing and countries get more and more dependent of them. Not just the transfer of energy has interest, but also many of the functionalities like system adequacy, active and reactive power management, flexibility and stability enhancements are of great value.

The HVDC report shows how each HVDC link has operated during the year with amount of import and export of power and how much the link has been unavailable because of planned maintenance, unplanned maintenance, disturbances and limitations. The report shows also, how much the link has not transferred power when capacity were available.

The value of the HVDC report is to monitor the utilization of the links every year to identify trends and compare with other HVDC links. Compared to the CIGRE reports the limitations caused by events in the AC grid is also covered in this report, which gives an understanding of how much the HVDC links are affected by the AC grid on both sides of the link. The reports are public and therefore not showing all details. Some detailed event data are collected not for publishing purposes but for enabling deeper analysis by the members' asset management specialists regarding reasons, fault types and origin. For such deeper investigations, the detailed data from each link can be analyzed with a confidentiality agreement.

The first stand-alone HVDC statistics for utilization and unavailability is from statistical year 2012, and covered only the Nordic power systems. From year 2010 and 2011 the HVDC statistics were part of the 'Nordic Grid Disturbance and Fault Statistics' report. In 2014, the Baltic power system was also covered in the report.

The report is made by DISTAC subgroup under Regional Group Nordic, RGN. Therefore, shorter names used are "DISTAC report" and "DISTAC statistics" for the Nordic and Baltic Reports.

## 2 Scope and limitations

The purpose of this guideline is to lay down the definitions, instructions and examples, which are necessary to ensure uniform classification and calculation methods/formulas, so it is possible to compare with other HVDC links.

The scope of HVDC statistics is a macro view on the *availability* and *utilization* of each HVDC link, including total outages, limitations and maintenance. This also includes limitations based on maintenance in the AC grid, which affect a HVDC connection. Disturbance outages are covered more thoroughly than other events.

DISTAC HVDC statistics has a different scope than the CIGRE HVDC statistics, which are more focused on outages, faults and disturbances of the HVDC links. This means that CIGRE is more detailed regarding asset management issues, i.e. what happens at the HVDC station, and includes transients, commutation failures, thyristor failures and so on.

In general, DISTAC has the macro view and CIGRE has the micro view but most of the data is the same for both reports. Nowadays, some asset related additional data is collected also in DISTAC in order to enhance the analysis possibilities of HVDC outages and limitations from asset management perspective. Thus, in order to fill in the DISTAC data set comprehensively, co-operation between operations and asset management experts is a pre-requisite.

## 3 Definitions and Calculations

There are eight categories, which are used in the Nordic and Baltic Guidelines for HVDC Statistics (*DISTAC HVDC Statistics*) to determine the utilization and unavailability of a HVDC link. Figure 3.1 shows the categories and how they are connected to map how the HVDC links are used each year. This chapter will describe all the categories.

The utilisation of HVDC link can be calculated by using the data received from SCADA, grid operation, market departments, Urgent Market Messages (UMMs) of the Nord Pool AS, Nordic TSOs Unavailability Collection System (NUCS) and measurements on each side of a link. The process of collecting data for these statistics is described in chapter 6.

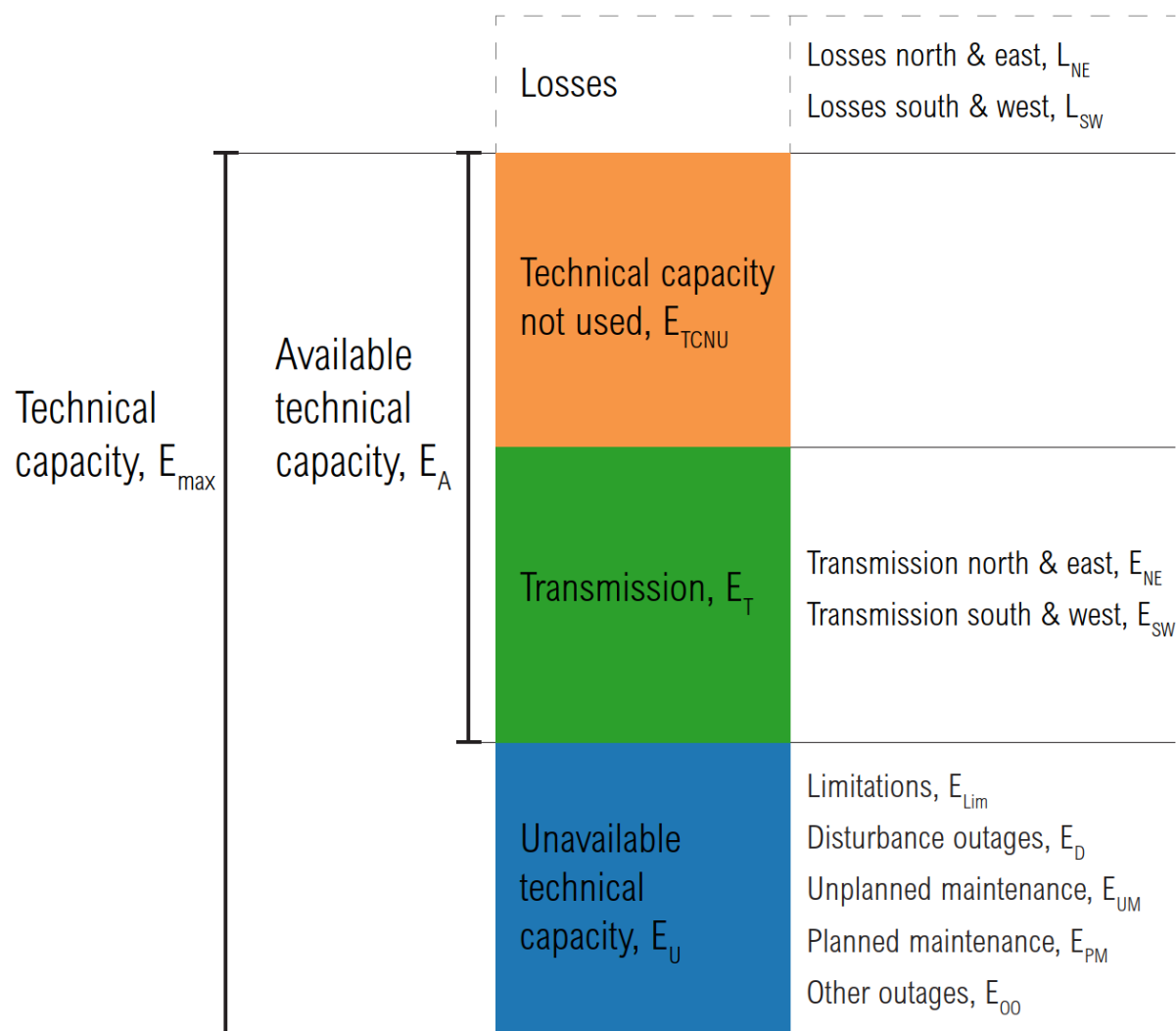


Figure 3.1 The utilisation categories used in the DISTAC HVDC statistics

### 3.1 Technical capacity, $E_{max}$

The technical capacity  $E_{max}$  of the HVDC link is the maximum energy that can be transmitted from the AC grid to the converter station on the exporting side, excluding all HVDC link losses:

$$E_{max} = P_R \cdot 24 \cdot d \tag{3.1}$$

$P_R$  is the rated power capacity and  $d$  is the number of days in the reported time period (month or year). In Figure 3.1,  $E_{max}$  is represented as the total height of the column.

The technical capacity is a theoretical value that can be divided into **available ( $E_A$ ) or unavailable ( $E_U$ ) technical capacity**.

## 3.2 Unavailable technical capacity, $E_U$

Unavailable technical capacity ( $E_U$ ) is due to outages or limitations. An outage is when a component is disconnected from the system and the transfer capacity is reduced to zero. There are different types of outages that are more explained in their own chapters:

- **Disturbance outages ( $E_D$ )** are *total outages* due to a fault on the HVDC link or in the AC grid causing a *total outage* of the link. This is when the protection trips the link. In rare cases it could also be done manually by the operator (fire, malfunction of protection etc.), but in most cases the manual disconnections would fit to the category unplanned maintenance. When a disturbance is over (successfully energized), there might be some events with unplanned maintenance regarding fault tracing and repairing cable or components connected to the original disturbance.
- **Unplanned maintenance outages ( $E_{UM}$ )** is when the link is manually disconnected for emergency or urgent repair. Repairing of cable or equipment after a disturbance ends (successfully energized). Also, maintenance with very short warning is in this category. In general, unplanned maintenance is a situation where the outage cannot wait until next scheduled maintenance period.
- **Planned maintenance outages ( $E_M$ )** are *total outages* due to all technically motivated actions on the HVDC link or in the AC grid intended to retain an entity in, or restore it to, a state where it can perform its required function. This contains annual maintenance, preventive maintenance, and replacement of equipment or update control system. Also, maintenance or repair where the component can be left in operation and re-scheduled, if needed.
- **Other outages ( $E_{OO}$ )** are *total outages* due to any other reason except those mentioned above. This could for example be when the markets do not need the transmission capacity of the link and the link is disconnected. Can also be because of black start tests and other type of tests that require an outage.

A **Limitation ( $E_{Lim}$ )** is a condition when the transmission capacity of an HVDC link is limited, i.e. the power transmission capacity of the link is less than the rated power. A limitation of the HVDC link can either come from the AC grid (internal bottlenecks and security of supply with internal revisions), or from the HVDC part (seasonal, electrode current within limits when operated in bi-pole or other). A limitation can be planned or unplanned, depending on the root-cause and urgency of the event.

The mathematical description of the **unavailable technical capacity  $E_U$**  is the part of technical capacity that is *not* available for transmission due to outages (disturbance, maintenance, other) and limitations:

$$E_U = E_D + E_M + E_{OO} + E_{Lim} = P_R(h_D + h_M + h_{OO}) + P_{Lim} \cdot h_{Lim} \quad (3.2)$$

Both outages and limitations are described in more details in the following chapters.

### 3.2.1 Disturbance outages, $E_D$

A disturbance outage is when there is a fault on the HVDC link or in the AC grid that immediately causes a total outage of the link. Trip by protection is the most common case, but it can also be manually disconnected due to urgent matters like safety or other emergency or risk mitigation reasons. A total outage of the HVDC system is when the link can no longer transfer electrical energy. This category means "Forced outage" classification by CIGRE.



After the disturbance it is possible that some additional events of unplanned maintenance will appear regarding fault tracing, repairing etc. until the link is fully repaired and operational again. However, if the HVDC system cannot by reasonable risk be re-energized until the repair is done, also the repair time shall be included in the disturbance outage duration time.

For disturbance outages it is of essence to know the origin of event (guidelines, see chapter -), and the type and category of fault that lead to the disturbance, (guidelines, see chapter 6.9).

The energy transfer  $E_D$  are calculated by multiplying the rated power  $P_R$  by the duration of the outage, respectively  $h_D$ :

$$E_D = P_R \cdot h_D \quad (3.3)$$

### 3.2.2 Unplanned maintenance outages, $E_{UM}$

An unplanned maintenance outage is when the HVDC link is not in service because of urgent maintenance, inspection, fault tracing or repairing after disturbances or other faults that cannot wait until a maintenance outage can be planned and (re-)scheduled. Unplanned implies that the outage is to be taken asap (as soon as possible), due to increased risk of re-trip or further damage. How to report such fault events will be based on the following possible cases:

- If there is no possibility to re-energize the HVDC system after a disturbance until the fault is located and repaired, the repair time will be counted into the disturbance event (if it is evident that there will be a re-trip);
- If the HVDC system can be (or is) re-energized with only an increased risk of re-trip or equipment damage but with repair still to be done urgently, then the repair time after the first disturbance event can be reported as a second event (unplanned maintenance);
- If the repair can wait (some time – like days) and can be re-scheduled, it should not be reported as unplanned maintenance, but as planned maintenance. This might occur, when the owner wants and decides to do (immediate) fault tracing or urgent repair on short warning, even though there is not an emergency situation forcing him to do so.

Also unplanned maintenance category implies “Forced outage” classification by CIGRE.

The loss of energy transfer  $E_M$  is calculated by multiplying the rated power  $P_R$  by the duration of the outage, respectively  $h_M$ :

$$E_M = P_R \cdot h_M \quad (3.4)$$

### 3.2.3 Planned maintenance outages, $E_M$

A planned maintenance outage is when the HVDC link is not in service because of annual and preventive maintenance. Planned maintenance outage implies that the outage can be scheduled and re-scheduled. This category means “Scheduled outage” classification by CIGRE. Examples are:

- Manual disconnection;
- Annual maintenance;
- Preventive maintenance or testing;
- Replacement of equipment or update of e.g. control system;
- Maintenance that is not emergency or urgent repair;
- Maintenance or repair where the component can be left in operation and re-scheduled if needed; and
- Repairing of a non-critical fault when market allows for immediate outage (get a short outage to repair or test when the outage does not affect the market based on the forecast, with possibility to take it back into operation rapidly, if needed).

The loss of energy transfer  $E_M$  is calculated by multiplying the rated power  $P_R$  by the duration of the outage, respectively  $h_M$ :

$$E_M = P_R \cdot h_M \quad (3.5)$$

### 3.2.4 Other outages, $E_{OO}$

Other outages are when the outage doesn't fit in either Disturbance or Maintenance, e.g. due to other types of external reasons (market situation, testing or very unusual events).

Some guidelines for the reporting of other outages are given in chapter 6.10.

The energy transfer  $E_{OO}$  are calculated by multiplying the rated power  $P_R$  by the duration of the outage, respectively  $h_{OO}$ :

$$E_{OO} = P_R \cdot h_{OO} \quad (3.6)$$

### 3.2.5 Limitations, $E_{Lim}$

A Limitation is a condition when the transmission capacity of an HVDC link is limited, i.e. the power transmission capacity of the link is less than the rated power. The limitation is always motivated from a technical perspective, but not always concerning the link itself. The most common causes of limitations are:

- faults on any HVDC link component as long as they do not cause a total outage;
- faults on any HVDC link component that lead to power down-ramping or blocking of the converter, but not a circuit-breaker trip;
- for bipolar links can one pole be limited when the other pole is out in order to keep a low electrode current;
- faults, congestions, maintenance or outages in the AC grid causing a limitation in the transmission capacity of the link;
- seasonal variations on the transmission capacity of the HVDC link; and
- link capacity reserved as power reserves.

As can be understood from the above, limitations can be the loss of transmitted power by anything between 0 and 100% of the rated power, and limitations can be either planned or unplanned depending on the root-cause and the urgency of the event.

Guidelines for the reporting of limitation type, direction and cause are given in chapter 6.11.

Limitations are calculated by multiplying the **available power capacity during the limitation ( $P_{Lim}$ )** by the **duration of the limitation in hours ( $h_{Lim}$ )**:

$$E_{Lim} = P_{Lim} \cdot h_{Lim} \quad (3.7)$$

## 3.3 Available capacity, $E_A$

The counterpart to Unavailable technical capacity  $E_U$  (explained in Chapter 3.2) is the **available technical capacity  $E_A$** .  $E_A$  consists of the remaining of the **maximum technical capacity  $E_{max}$** . This equals the capacity used for **transmission ( $E_T$ )** and **technical capacity not used  $E_{TCNU}$** .

$$E_A = E_{max} - E_U = E_T + E_{TCNU} \quad (3.8)$$

The transmission  $E_T$  consists of import and export of energy, and import and export losses. The technical capacity not used shows how much available technical capacity which is not used on the link. It is the rest that remains when all other categories are mapped and calculated.

### 3.3.1 Transmission, $E_T$

The capacity used for transmission ( $E_T$ ) is the sum of transmitted energy in both directions (like exported and imported), i.e. the energy from north to south or east to west ( $E_{SW}$ ) plus the energy from south to north or west to east ( $E_{NE}$ ):

$$E_T = E_{SW} + E_{NE} \quad (3.9)$$

**Transmission  $E_T$**  is the sum of transmitted energy in both directions excluding losses:

**Energy  $E_{NE}$**  is energy transferred from the HVDC link to AC connection point on the north or east side of the HVDC link. It does not include the **losses  $L_{NE}$** ; the sum of energy losses in all of the HVDC link components during energy transfer in this direction (earlier called "export" in DISTAC reports).

**Energy  $E_{SW}$**  and **losses  $L_{SW}$**  are explained likewise, but with the opposite direction (earlier called “import”).  $E_{NE}$  from one side of the link equals  $E_{SW}$  considered from the opposite side of the link.

### 3.3.2 Technical capacity not used, $E_{TCNU}$

Technical capacity not used ( $E_{TCNU}$ ) is what remains when all other categories are mapped and calculated. The content of this category is complex and consists of both technical and market related details. The most important of these are:

- When bidding differences between the markets on each side of the HVDC link are too small to promote transmission, in spite of technical availability. The link is still available and can be used for balancing or transmitting emergency power, and hence not disconnected.
- Any limitations lasting less than ten minutes (does not include total outages):
- Ramping time: When the power flow is changed the capacity is fully released to the market. Note that, depending on the type of converter technology, the nominal voltage, and hence the full transmission capacity, may not be obtained immediately;
- Commutation failures may interrupt the power transmission. In the CIGRE statistics, commutation failures are categorized as 'transient disturbances';
- Emergency power is not usually used for more than ten minutes for a given event. Longer lasting disturbances will be registered as outages or limitations.

**Technical capacity not used ( $E_{TCNU}$ )** can now be calculated:

$$\begin{aligned}
 E_{TCNU} &= E_{max} - E_U - E_T \\
 &= E_{max} - [P_R(h_D + h_M + h_{OO}) + P_{Lim} \cdot h_{Lim}] \\
 &\quad - [E_E + L_E + E_I + L_I]
 \end{aligned}
 \tag{3.10}$$

## 3.4 Commissioning (Trial operation)

New HVDC links will have a commissioning phase (Trial operation) where it is tested and operated. The new link will be shown in the report with monthly utilization and unavailability, where the rest is capacity not used. An example is shown in Figure 3.2. New links are not part of the comparisons with other HVDC links and historical use if they have been in operation less than 1 year. Reporting the trial period is voluntary.

Figure 6.3.13 presents the availability and utilisation of Skagerrak 4 for 2014. Skagerrak 4 has been in commercial operation since 29 December 2014 and in test operation since late August 2014. In Norway it is connected to Kristiansand (bidding zone NO2) and in Denmark to Tjele (bidding zone DK1). The transmission capacity is 700 MW.

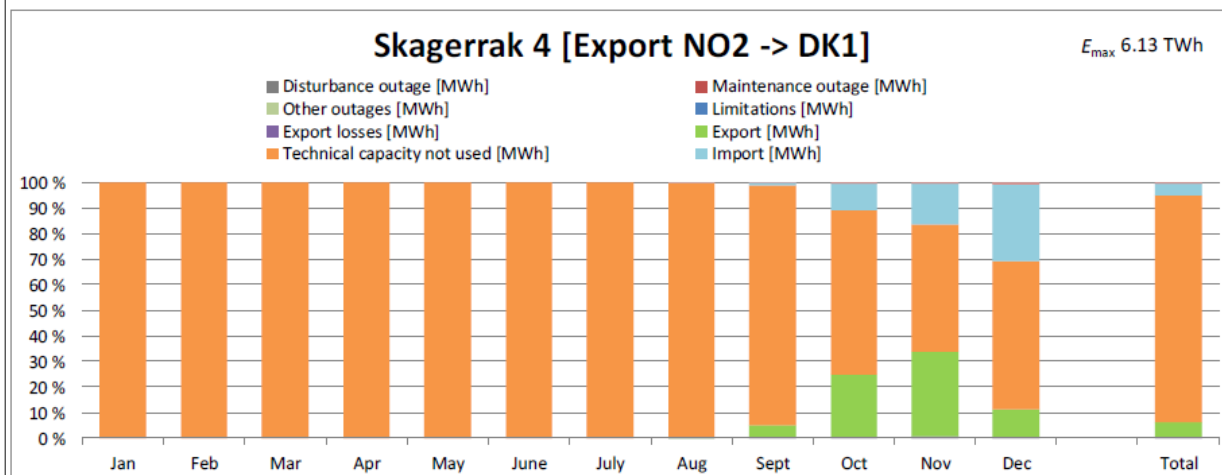


FIGURE 6.3.13 PERCENTAGE DISTRIBUTION OF THE AVAILABILITY AND UTILISATION CATEGORIES DEFINED IN CHAPTER 4 ACCORDING TO MONTH FOR SKAGERRAK 4 IN 2014

Figure 3.2 example of a new HVDC link in commissioning phase

### 3.5 Schematic presentation of HVDC links

Figure 3.3 and Figure 3.4 present schematic presentations of an HVDC link with line commutated converters (LCC) and with voltage source converters (VSC). Figure 3.3, Figure 3.4, Figure 3.5, and Figure 3.6 also show definitions for the origin of an event. The origin of each event is used for categorizing a disturbance or a limitation for statistical purposes. The figures also show how the terms 'local' and 'remote' are defined and the locations of the circuit breakers and measurement points for transferred energy on a link.

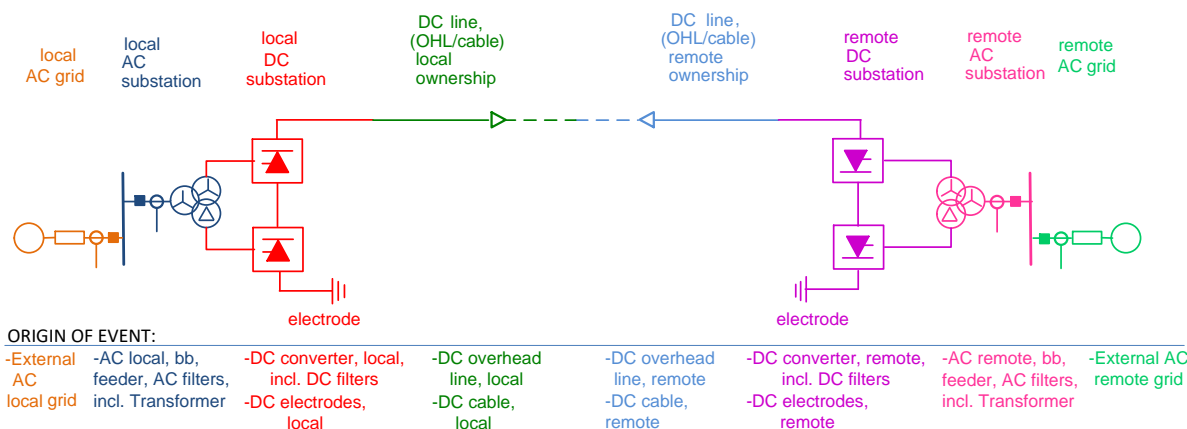
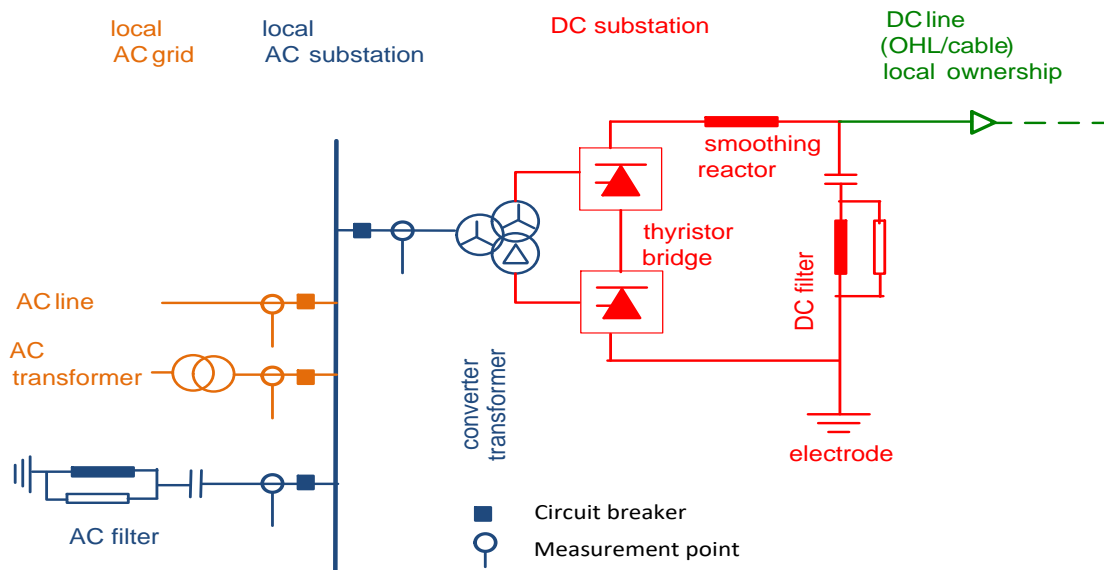


Figure 3.3 A schematic presentation of a HVDC link with line commutated converters (LCC)



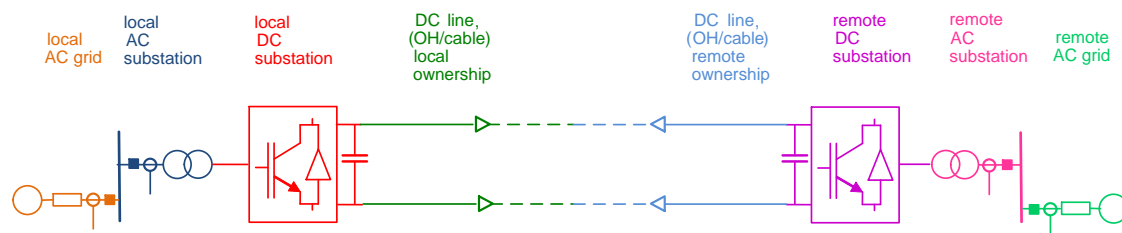
**ORIGIN OF EVENT:**

-External AC local grid	-AC local, bb, feeder, AC filters, incl. Transformer	-DC converter, local, incl. DC filters -DC electrodes, local	-DC overhead line, local -DC cable, local
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**ORIGIN OF EVENT on station level:**

- Local control center operation
- Local converter station operation
- Local control, protection and communication

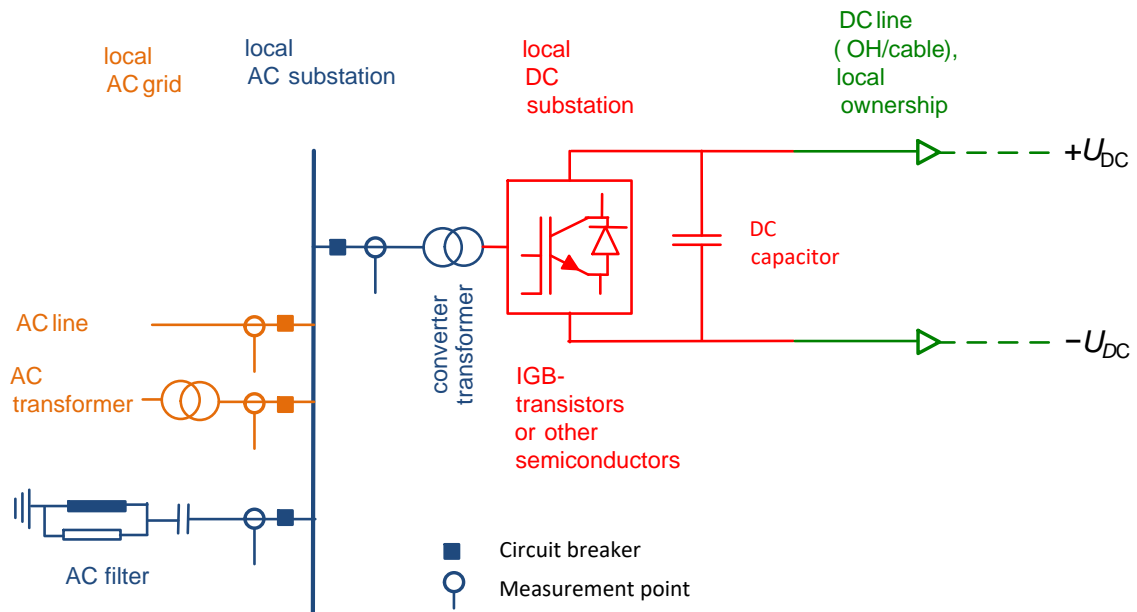
Figure 3.4 A converter station of a line commutated converter HVDC link with the connection to the AC grid



**ORIGIN OF EVENT:**

-External AC local grid	-AC local, bb, feeder, AC filters, incl. Transformer	-DC local, local, incl. DC filters -DC electrodes, local	-DC overhead line, local -DC cable, local	-DC overhead line, remote -DC cable, remote	-DC converter, remote, incl. DC filters -DC electrodes, remote	-AC remote, bb, feeder, AC filters, incl. Transformer	-External AC remote grid
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Figure 3.5 A schematic presentation of a HVDC link with voltage source converters (VSC)



**ORIGIN OF EVENT:**

-External AC local grid

-AC local, bb, feeder, AC filters, incl. Transformer

-DC converter, local, incl. DC filters  
-DC electrodes, local

-DC overhead line, local  
-DC cable, local

**ORIGIN OF EVENT on station level:**

- Local control center operation
- Local converter station operation
- Local control, protection and communication

Figure 3.6 A converter station of a voltage source converter HVDC link with the connection to the AC grid

## 4 Technical details of the HVDC links

The main properties of the HVDC links shall be covered in the statistics. The rated capacities are given as power flow *to* the links from the exporting side.

Following information is needed before starting to collect HVDC performance data for DISTAC:

- Name of the link;
- Name of the HVDC-stations;
- Commissioning year;
- Market connection (Y/N);
- Type of HVDC converter;
- Rated power, monopolar (MW);
- Parallel monopolar capacity (MW);
- Bipolar capacity (MW);
- Defined positive power direction (N-S, E-W);
- Total length of the link (km);
- Length of mass cable (km);
- Length of DC overhead line (km); and
- Length of DC back-to-back connection (km).



## 5 Reporting for the annual report

Each TSO shall report Unavailable Capacity  $E_U$  and Transmission  $E_T$  for each HVDC link in their area. This is done by the special excel template, where all relevant fields are filled for each outage or limitation. Transmitted energy is calculated and reported separately. Detailed data is stored on secure ENTSO-E SharePoint.

The webpage <http://distac.info/> can be used as education tool in order to learn how to report.

**Compatible with**  
 Entso-e Distac WG - Guidelines for Reporting HVDC utilization and unavailability from 2013  
 And  
 Cigre B4.04 WG - Protocol for reporting the operational performance of HVDC Transmission system from 2014

entsoe Reliable Sustainable Connected | cigre

ENTSOE - Disturbance, Statistics and Classification Work Group (DiStaCWG) [Report](#)  
 ENTSOE - Nordic Asset Management HVDC Work Group ( NordAM WG )  
 ENTSOE - Incident Classification Scale Work Group ( ICS WG / Only HVDC part )

### HVDC EVENT REPORT SHEET v 3.8

Select type of report (for reporting after 01.01.2020)  
 New  Updated

Internal ref. nr.: (Optional)

Date of event (mm/dd/yyyy) Time of event (tt:mm:ss) Choose reporting Company  
 [ ] [ ] [Choose one]

End-date of event (mm/dd/yyyy) End-time of event (tt:mm:ss) Reporting Person  
 [ ] [ ] [ ]

Select HVDC link Rated Capacity (MW)  
 [Choose one] [ ]

Select type of event  
 Maintenance outage  Disturbance outage  Other outage  Limitation

Avail. Capacity Pre event MW P direction Pre event MVar Q direction  
 [ ] [ ] [Choose] [ ] [Balance]

Available MW Capacity during the event Only for VSC-links and reporting side

Pre event condition  
 Normal operation  Monopolar  Bipolar  Commissioning  Maintenance (Disconnected)  
 Maintenance (During transmission)  Maintenance (0 MW transmission)

Origin of Event Type of Other Outage  
 [Choose one] [Choose one]

Other Outage Cause (Pri.)  
 [Choose one]

Descriptions and comments  
 [ ]

Equipment restoration  
 [Choose one]

Pre incident (ICS) Pre Scale (ICS) Pre Fault Category  
 [No pre-incident] [None] [No fault]

HVDC incident (ICS) HVDC Scale (ICS) Allready registered above  
 [(T) Transmission system] [Choose one]

Post incident (ICS) Post Scale (ICS) Post Fault Category  
 [No pre-incident] [None] [No fault]

Figure 5.1 An example of <http://distac.info>

*An example: If there is a Disturbance Outage on the HVDC link Skagerrak 2 between Norway and Denmark, both TSOs should report that disturbance. To get rid of duplicates and check if there are deviations on the reported data, all the data should be afterwards commonly “washed” by the two parties.*

## 6 Guidelines for data collection to the annual report

The required data to show the performance and utilization of each HVDC link is received by collecting information from SCADA, grid operation, market departments, Urgent Market Messages (UMMs) and measurements on each side of the link, as well as from their HVDC asset management specialists.

Some data fields are optional and this is stated in the below chapters after each section or item point.

### 6.1 General data for each event

The following general data shall/should be filled in for each event:

- **Select type of report;**
  - o **New** (if new event is filled in),
  - o **Update** (if additional data is added or corrections are made to an event that has already been reported).
- **Internal ref. nr** (Optional);
  - o TSOs can use this reference **number** as a guidance to help finding any own internal event information, like a report or work order e.g. from its internal databases.
- **Date and Time of event** (mm/dd/yyyy) (tt:mm:ss);
- **Reporting company;** (Name of TSO from Drop-down list);
- **End-date and End-time of event** (mm/dd/yyyy) (tt:mm:ss);
- **Duration** (automatic function)
- **Reporting person:** (Name);
- **Select HVDC link:** (Name of link from Drop-down list);
- **Select station:** (Name of Station from Drop down list);
- **Rated capacity:** (Rated active power capacity in MW for the HVDC system);
- **Email:** (Email address to reporting person).

### 6.2 Pre-event data

The following pre-event condition data shall/should be filled in for each **Disturbance** event, and are optional for other events:

- **Available Capacity:** Available MW capacity during the event, e.g. 0 MW if total outage (mandatory for disturbances);
- **Pre-event MW:** Transmitted active power in MW before the event, to be used for disturbances and limitations;

- **P direction:** Select from drop-down list: power transmission direction before the event; **East / West** or **South / North** (earlier Import / Export / Balance based on the pre-event transmission situation of the reporting party) (optional);
- **Pre-event MVar:** **Reactive power generation or consumption in MVar** before the event, optional field, only for disturbances in a VSC-type HVDC system and for the reporting party side (optional);
- **Q direction:** **Reactive power direction** before the event, to select from drop-down list; **Balance / Generation** (earlier Import) / **Consumption** (earlier Export) (optional);
- **Pre-event Condition;** Each suitable option to be selected (one or more), from the list below (mandatory for disturbances):
  - o **Normal operation:** if the operation mode is fully normal;
  - o **Monopolar:** if the HVDC system with bipole topology is not used in bipole mode before the event;
  - o **Bipolar:** if bipolar operation mode is used;
  - o **Commissioning:** if commissioning work of an extension or modification project is going on before the event;
  - o **Maintenance (Disconnected):** if maintenance work is going on with the converter disconnected before the event;
  - o **Maintenance (During transmission):** if maintenance work is going with normal power transmission before the event;
  - o **Maintenance (0 MW transmission):** if maintenance work is going with 0 MW transmission, i.e. with no risk of loss of transmitted power.

## 6.3 Type of event

Each event shall be classified into one of the event types below:

- **Maintenance outage:** the outage is due to maintenance or modification work, more details follow in chapter 6.8;
- **Disturbance outage:** the outage is due to a fault, more details follow in chapter 6.9;
- **Other outage:** the outage is due to other reason(s), more details follow in chapter 6.10;
- **Limitation:** to be selected, if the event did not lead to loss of total capacity of the link, i.e. part of the power could be transmitted during the event, more details follow in chapter 6.11.

## 6.4 Origin of event

For most outages it is relevant to know the origin of events. Table 6.1 show both DISTAC origins and their Subcategories, which are now compatible with CIGRE outage codes, as far as possible (it should be noted that compatibility is not achieved in control and protection areas). The schematics in chapter 3.3 can be helpful in visualizing the different categories.

Table 6.1 Origin of event

DISTAC	DISTAC / CIGRE	Comment
Origin of event	Subcategory / Outage Code (may often need an asset specialist to choose)	
Multiple places	-	In DISTAC primary used for annual maintenance
Control center operation *)	C-P.L - Local HVDC Control & Protection *)	Control, protection or monitoring equipment of the local HVDC station, e.g. converter firing control, current and voltage regulators, converter and dc yard protections, valve control and protection, and local control sequences
	C-P.M - Master HVDC Control & Protection *)	Equipment used for inter-station coordination of current and voltage orders, inter-station sequences, auxiliary controls such as damping controls or higher level controls such as run-back/run-up power control or frequency control
	C-P.T - Control & Protection and Telecommunication *)	Equipment for coding of control and indication information to be sent over a telecommunication circuit incl. the telecommunication circuit itself (microwave, PLC or optical)
Converter station operation *)	<i>Copy of the above cells</i>	
Control, protection and communication *)	<i>Copy of the above cells</i>	
AC External grid	EXT - External AC System	
AC busbar, feeder, filters and transformer	AC-E.F - AC Filter and Shunt Bank	Incl. AC filter CTs, arresters as well as PLC/RI, SVC, STATCOM, series capacitor at HVDC station
	AC-E.SW - Other AC Switchyard Equipment	E.g. switches, surge arresters, busbars, insulators
	AC-E.CP - AC Control and Protection	AC C&P incl. CTs, VTs, also for aux. power and valve cooling
	AC-E.TX - Converter Transformer	Incl. interface transformers
	AC-E.SC - Synchronous Compensator	Incl. SC cooling system and exciter
	AC-E.AX - Auxiliary Equipment and Auxiliary Power	E.g. aux. transformers, pumps, battery chargers, heat exchangers, cooling system instrumentation, LV switchgear, motor control centers, fire protection, civil works
DC converter and yard	V.E - Valve Electrical	
	V.VC - Valve Cooling	
	V.C - Valve Capacitor	
	DC-E.F - DC Filters	

	DC-E.SR - DC Smoothing Reactor	
	DC-E.SW - DC Switching Equipment	
	DC-E.ME - DC Measuring Equipment	
	DC-E.O - Other DC Yard and Valve Hall Equipment	
DC Electrodes	DC-E.GE - DC Ground Electrode	
	DC-E.EL - DC Ground Electrode Line	
DC Overhead line	TL-OH - DC Overhead Transmission Line	
DC Cable	TL-C - DC Underground / submarine Cable	
Other or unknown origin	O - Other	

\*) There is no direct compatible 1:1 between DISTAC and CIGRE for these definitions.

## 6.5 Equipment restoration (optional, by asset management)

Each event (where applicable) should preferably be classified according to the needed actions to restore the power transmission of the HVDC system, according to the drop-down list given below:

- **No equipment failure:** if the outage was not caused by any failed equipment;
- **Equipment causing outage is repaired or adjusted:** if the HVDC-link operation was restored after the repair or adjustment of the failed equipment;
- **Failed equipment is replaced with spare:** if the HVDC-link operation was restored after the replacement of the failed equipment with a spare;
- **Equipment failure, but HVDC-link operated with reduced capacity:** if there was an equipment failure, but the HVDC-link could still be running with reduced power transfer;
- **Equipment limitation, and HVDC-link operated with reduced capacity:** if there was a limitation in the equipment, and the HVDC-link could still be running with reduced power transfer;
- **Equipment failure, but normal operation:** if there was an equipment failure, but the HVDC-link could still be running with full power transfer.

## 6.6 Descriptions and comments (optional, e.g. by asset management)

Each event can be submitted with a free text field containing any additional information or clarifications.

## 6.7 Consequences of event: Incident classification scale (ICS) (Optional)

Consequences of disturbances shall be reported according to ENTSO-E Incident classification scale (ICS) reporting principles. This is optional in DISTAC and the data can be used in ICS report.

Categories used in ICS:

- No pre-incident
- (T) Transmission system element
- (L) Load
- (G) Generation
- (F) Frequency degradation
- (ON) N or N-1 violation
- (RS) Separation from grid
- (OV) Voltage violation
- (RRC) Reduction of reserve capacity
- (LT) Loss of tools and facilities

Scales used in ICS:

- Below Scale : For anomalies, local event; the system remains in normal state
- 0 : For noteworthy local incident, the system remains in normal state
- 1 : For significant incident; violation of operational security limit; the system is in alert state
- 2 : For extensive incident; probability of wide area incident; the system is in emergency state
- 3 : For major incident in the control area of one transmission system operator; the system is in blackout state

**Pre incident;** Drop-down list of ICS Categories:

- No pre-incident / (T) Transmission system element / (L) Load / (G) Generation / (F) Frequency degradation / (ON) N or N-1 violation / (RS) Separation from grid / (OV) Voltage violation / (RRC) Reduction of reserve capacity / (LT) Loss of tools and facilities

**Pre Scale;** Drop-down list of ICS Scales:

- Below Scale / 0 / 1 / 2 / 3

**Pre Fault Category;** Drop-down list:

- No Fault
- Technical Fault
- Operational Fault
- Latent Fault
- System Fault

**HVDC incident;**

- (T) Transmission system element

**HVDC Scale (ICS);** Drop-down list of ICS Scales:

- Below Scale / 0 / 1 / 2 / 3

**Post incident (ICS);** Drop-down list of ICS Categories:

- No pre-incident / (T) Transmission system element / (L) Load / (G) Generation / (F) Frequency degradation / (ON) N or N-1 violation / (RS) Separation from grid / (OV) Voltage violation / (RRC) Reduction of reserve capacity / (LT) Loss of tools and facilities

**Post Scale (ICS);** Drop-down list of ICS Scales:

- Below Scale / 0 / 1 / 2 / 3

**Post Fault Category;** Drop-down list:

- No Fault / Technical Fault / Operational Fault / Latent Fault / System Fault

## 6.8 Maintenance outage

A maintenance outage is when the HVDC system is not in service because of planned or unplanned maintenance, either on the HVDC link or in the surrounding AC grid which totally prevent transmission of energy via the HVDC link. If the HVDC system is partially in service, the event is categorised as a limitation.

The following outage data shall/should be filled in for each maintenance outage event:

- **Type of maintenance:** to be selected from drop-down list:
  - o **Planned;** when the HVDC system is manually disconnected for any reason that has been planned beforehand and it the reason thereof is not of emergency or extremely urgent character. See further definitions and examples in chapter 3.2.3.
  - o **Unplanned;** when the HVDC system is manually disconnected for emergency or extremely urgent repair (i.e. it cannot wait to be re-scheduled). See further definitions in chapter 3.2.2.
- **Maintenance Cause (Pri.):** primary or main reason for the maintenance outage to be selected from drop-down list (by asset management, if needed):
  - o **Annual maintenance:** if annually or biennially performed maintenance is the primary cause to the outage;
  - o **Commissioning:** if the primary cause of the maintenance outage is due to commissioning work (as part of a construction, extension or modification project);
  - o **Corrective maintenance:** if repair or replacement of components is the main reason to the maintenance outage;
  - o **Modification or refurbishment work:** if the main cause of the maintenance outage is due to modification, extension, renewal or refurbishment work;
  - o **Testing:** if the maintenance outage is taken because of the need to test or verify the behaviour of (part of) the HVDC system;
  - o **Warranty work:** if the maintenance work requiring outage is due to warranty inspections, corrections, repair or improvements (after a project).
- **Maintenance Cause (Sec.):** second main reason or any other (significant) secondary reason for the maintenance outage, to be selected by asset management from drop-down list:
  - o **Annual maintenance:** if the original cause of the maintenance outage is due to corrective maintenance or a modification projects and other planned actions of the annual maintenance are performed during the same outage;

- **Commissioning:** if commissioning work is undertaken during same outage as other work;
- **Corrective maintenance:** if any significant component repairs or replacements are done during another (e.g. annual) maintenance;
- **Modification or refurbishment work:** if some modifications or upgrades are done especially during annual maintenance outage;
- **Testing:** if testing is done in context with other main reasons for the outage, e.g. commissioning, warranty or modification or refurbishment work;
- **Warranty work:** if the main reason to the outage is e.g. repair (corrective maintenance) of a broken device in a running system or verification testing of the behaviour that still is under warranty;
- **No secondary cause:** if the outage is due to one reason only.

## 6.9 Disturbance outage

The following outage data shall/should be filled in for each disturbance outage event:

- **Type of fault;** to be selected from drop-down list:
  - **Temporary**, which means that the fault can be cleared with either a reset or something else that do not require repairing or physical replacing of any component(s);
  - **Permanent**, which means that either repair or replacement of a component is required to get the system back in operation. (Examples: damaged/faulty cable or station device, like transformer, switch, measuring transducer or C&P computer, etc.).
- **Fault Category;** to be selected from drop-down list:
  - **Technical Fault**, where the cause of the fault is in technical equipment, like an internal failure due to bad quality or wear, lack of maintenance, installation error, etc.;
  - **Operational Fault**, where the fault occurred as a result of erroneous actions or operations by a human;
  - **Latent Fault**, where the cause of the event could not have been foreseen earlier by testing or maintenance;
  - **System Fault**, where the fault occurred due to a system issue (e.g. commutation failure in nearby AC grid faults, HVDC disturbance due to energization of a nearby transformer, interaction problems with another AC grid incident, excessive harmonics levels, etc.).

**Technical Fault Cause (Pri.);** to be selected from drop-down list:

- **Environmental Cause**, when (exceptional) environmental stress or conditions have been the main cause to the fault;
- **External Influences**, when external reasons (submarine cable damaged by e.g. trawler, underground cable damaged by e.g. digging, OHL pole damaged by e.g. tractor and similar) are the primary cause to the fault;
- **Maintenance**, when a maintenance error or lack of maintenance is the primary cause to the fault;
- **Technical Equipment**, when the main cause to the fault is due to equipment failure that may occur due to bad quality, wear, age, (sub-)component failure, technical inability to perform its duties, etc.;
- **Other**, when none of the above selections are suited to describe the known main cause for the fault;
- **Unknown**, when the root-cause to the fault was not found.

**Technical Fault Cause (Sec.);** to be selected from same drop-down list as for Primary Cause above. This is given only, if there is a secondary cause for the disturbance outage.



**Operational Fault Cause;** to be selected from drop-down list:

- **Operation**, if the fault has occurred due human mistakes by operation personnel;
- **Other**, if the fault is due to other than operation personnel;
- **Unknown**, if there seems to be a wrong operation that cannot be explained otherwise (and if it was also not possible to prove that any technical failure occurred).

**Latent Fault Cause;** to be selected from drop-down list:

- **Loss of tools**, if the fault is due to loss of tools;
- **N-violation**, if the fault is due to violation of the N-1 criteria leading to the necessity to urgently take the HVDC system down.

**System Fault Cause (Pri.);** to be selected from drop-down list:

- **High/Low Voltage**, if the system fault is due to either too high or too low HV AC grid voltage;
- **Overload**, if the system fault is due to an overload situation in the AC-grid;
- **High/Low Frequency**, if the system fault is due to too high or too low frequency in the AC grid;
- **Rate of Change of Frequency**, if the system fault is due to too high rate of change of frequency in the AC grid;
- **High Harmonic**, if the system fault is due to too high level of harmonics in the AC grid;
- **Voltage dip/swell**, if the system fault is due to voltage dips or swells in the AC grid;
- **Power Oscillations**, if the system fault is due to too high levels of power oscillations in the AC grid;
- **Separation from Grid**, if the system fault is due to the fact that the HVDC system has been separated from the AC grid;

**System Fault Cause (Sec.);** to be selected from same drop-down list as for Primary Cause above. This is given only, if there are multiple system based causes for the disturbance outage.

## 6.10 Other outage

Other outage is to be selected only, if no available option from disturbance, maintenance or limitation categories fit to it. Examples of other outages could be:

- A market situation where the intraday is closed because of IT-problems;
- Test of some sort which requires zero available capacity on the HVDC link (and is not due to commissioning or maintenance work);
- Black start or other HVDC-AC grid interaction tests, not belonging to commissioning or maintenance work;
- Unusual events like preparedness of a solar eclipse.

The following outage data shall/should be filled in for each other outage event:

- **Type of outage:** to be selected from drop-down list:
  - **Planned;** when the HVDC system is manually disconnected for other reason than maintenance or commissioning/modification work, which has been planned beforehand and if the reason thereof is not of emergency or extremely urgent character. See further definitions and examples in chapter 3.2.3.

- **Unplanned;** when the HVDC system is manually disconnected for emergency or extremely urgent reason not related to maintenance/commissioning/modification (i.e. it cannot wait to be re-scheduled). See further definitions in chapter 3.2.2.
- **Cause of outage:** to be selected from drop-down list:
  - **Testing;** system interaction testing without maintenance, commissioning or modification work (e.g. black start tests).
  - **Market situation;** Outage due to electricity market reasons (e.g. closed intraday market, IT-problems, etc.).
  - **Unusual event;** E.g. preparedness for solar eclipse or other extreme condition.
  - **Other;** Other known reason.
  - **Unknown;** The cause is not known.

Any additional information, like for the examples above, should be submitted via the free text field "Descriptions and comments" as per chapter 6.6.

## 6.11 Limitation

Nordic and Baltic countries can find limitations from UMMs published on the regional energy marketplace. (i.e. Nord Pool Spot)

<https://umm.nordpoolgroup.com/#/messages?publicationDate=lastweek&eventDate=nextyear> or from NUCS which is developed specific for the Nordic TSO's

Other TSO's might find limitations from either internal data or markets in their area.

The following data shall/should be filled in for each other type of limitation event:

- **Type of Limitation;** either planned or unplanned, to be selected from drop-down list:
  - **Planned:** when the power limitation can be foreseen and planned or re-scheduled relatively freely (CIGRE Scheduled partial outage);
  - **Unplanned:** when the limitation is due to challenges or faults of urgent matter that cannot wait for re-scheduling (CIGRE Forced partial outage).
  - **Transient:** temporary commutation error situations that do not lead to disturbance outage, *very seldom used;*
- **Origin of Limitation;** either due to external AC grid or to HVDC system itself, to be selected from drop-down list:
  - **AC limiting condition:** the power is limited by a condition in external AC grid, e.g.
    - Overload in the distribution grid;
    - High infeed of renewable energy;
    - Maintenance in AC grid;
    - Disturbance in AC grid.
  - **DC limiting condition:** the power is limited by a condition in the HVDC system, e.g.
    - Maintenance which doesn't require total outage;
    - Reduced capacity to avoid cable damage, e.g. during investigation of the technical conditions;
    - Cooling problems, caused by high ambient temperature;
    - Limitations during commissioning of the HVDC system (incl. modifications);
    - AC equipment that is part of the HVDC system like AC filters, transformers, busbar etc.

- **Direction:** The power direction(s), for which the limitation in active power was valid
  - o **North / South / East / West** or **Both ways**
- **Limitation Cause;** describes whether the limitation is caused by a disturbance (CIGRE: forced partial outage), maintenance (CIGRE: Scheduled partial outage) or other reason (CIGRE: forced or scheduled), to be selected from drop-down list:
  - o **Disturbance:** faults in AC grid or at the HVDC station, which limit the available transfer capacity;
  - o **Maintenance:** maintenance work on either AC grid or the HVDC system which require a power limitation;
  - o **Seasonal limitation:** re-occurring or expected power limitations due to exceeding risk limits e.g. cooling inadequacy because of high ambient temperature during summer, or contamination like dirt and salt together with humidity;
  - o **Permanent condition:** if the technical condition of the HVDC system is changed permanently (by owner's decision) to avoid exceeding risks due to component degradation (e.g. voltage or current limitation to reduce risk of HVDC cable damage);
  - o **Technical:** if the cause of power limitation is in the technical equipment;
  - o **Commutation error:** if commutation errors have led to limitations in power transfer
  - o **Loss of tools:** if the power limitation is due to that the operator has lost a control tool;
  - o **Reduction of reserve capacity:** if the reason to limit HVDC power is based on a reduction of reserve capacity;
  - o **N-violation:** the HVDC link would – without the limitation – violate the N-1 stability criteria
  - o **Other:** any other reason to limit power transfer. It could be testing, commissioning or similar, i.e. if it does not fit in any other category;
  - o **Unknown:** if the reason is unknown.

Limitation Cause	Planned	Unplanned	Note:
Disturbance		X	Always unplanned
Maintenance	X	X	Can be either or
Seasonal limitation	X	X	Can be either or
Permanent condition	X		Only planned
Technical	X	X	Can be either or
Commutation error		X	Always unplanned
Loss of tools		X	Always unplanned
Reduction of reserve capacity	?	X	Only unplanned?
N-violation		?	Always unplanned?
Other	X	X	Can be either or
Unknown		X	Always unplanned

## 7 Examples

### 7.1 Disturbance Example C&P Fault

Data field	Entered data
Internal ref. nr.	EL2-2019-2
Date of event	17.4.2019
Time of event	19:01
End date of event	18.4.2019
End time of event	5:30
Reporting company	Fingrid
HVDC link	EstLink 2
Station	Anttila
Type of event	Disturbance
Rated capacity MW	650
Available capacity MW	0
Pre-event MW	
P direction	
Pre-event MVar	
Q direction	
Pre-event Condition	Normal operation
Origin of Event	Control, protection and communication
Subcategory	C-P.L - Local HVDC Control & Protection
Type of Fault	Permanent fault
Fault category	Technical fault (Note: XXX selection is dependent on this one)
XXX Fault cause (Pri.)	Technical equipment
XXX Fault cause (Sec.)	
Descriptions and comments	The optical measurement system signal from output2 at the ICH-board of PC3 (D12) on the CPU551 board of TDC Simatic DC Control & Protection System 1 was strongly weakened. Start up with one measurement system for both pole control systems. Fault seeking continued next day and following week (optical signal meters were purchased --> needed to be able to find the faulty signal location)
Equipment restoration	
Pre incident (ICS)	Normal operation
Pre Scale (ICS)	
Pre Fault Category	No fault
HVDC incident (ICS)	Incidents on transmission network elements (T)
HVDC Scale (ICS)	Scale 0
Post incident (ICS)	Normal operation
Post Scale (ICS)	No incident
Post Fault Category	No fault
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## 7.2 Disturbance Example C&P Fault

Data field	Entered data
Internal ref. nr.	EL1-2019-6
Date of event	15.5.2019
Time of event	16:03
End date of event	0:00
End time of event	0,775694444
Reporting company	Fingrid
HVDC link	EstLink 1
Station	Espoo
Type of event	Disturbance
Rated capacity MW	350
Available capacity MW	0
Pre-event MW	
P direction	
Pre-event MVar	
Q direction	
Pre-event Condition	Normal operation
Origin of Event	AC busbar, feeder, filters and transformer
Subcategory	AC-E.AX - Auxiliary Equipment & Auxiliary Power
Type of Fault	Permanent fault
Fault category	Technical fault (Note: XXX selection is dependent on this one)
XXX Fault cause (Pri.)	Technical equipment
XXX Fault cause (Sec.)	
Descriptions and comments	UMD trip because of current peak during auxiliary power change-over. Due to this both cooling pumps stopped and external trip was initiated due to low flow in main cooling circuit. Repair by change of sin-filter in the UMD system.
Equipment restoration	
Pre incident (ICS)	Normal operation
Pre Scale (ICS)	
Pre Fault Category	No fault
HVDC incident (ICS)	Incidents on transmission network elements (T)
HVDC Scale (ICS)	Scale 0
Post incident (ICS)	Normal operation
Post Scale (ICS)	No incident
Post Fault Category	No fault
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### 7.3 Maintenance Example Repair of Valve Cooling System Components

Data field	Entered data
Internal ref. nr.	EL1-2019-3
Date of event	31.1.2019
Time of event	14:09
End date of event	31.1.2019
End time of event	18:34
Reporting company	Fingrid
HVDC link	EstLink 1
Station	Espoo
Type of event	Maintenance
Rated capacity MW	350
Available capacity MW	0
Pre-event MW	
P direction	
Pre-event MVar	
Q direction	
Pre-event Condition	
Origin of Event	AC busbar, feeder, filters and transformer
Subcategory	AC-E.AX - Auxiliary Equipment & Auxiliary Power
Type of maintenance	Planned maintenance
Descriptions and comments	
Equipment restoration	Valve cooling system failure repair. PCP1.MC1 systems was in Off-mode due to faulty Beckhoff modules in VCCP system. Replaced Beckhoff modules BK5120 and KL9190 and re-start of VCCP B system.
Maintenance Cause (Pri.)	Corrective maintenance
Maintenance Cause (Sec.)	
Pre incident (ICS)	
Pre Scale (ICS)	
Pre Fault Category	
HVDC incident (ICS)	
HVDC Scale (ICS)	
Post incident (ICS)	
Post Scale (ICS)	
Post Fault Category	
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### 7.4 Maintenance Example Repair of DC-CT

Data field	Entered data
Internal ref. nr.	
Date of event	26.1.2019
Time of event	7:48
End date of event	26.1.2019
End time of event	11:50
Reporting company	Fingrid
HVDC link	Fenno-Skan 1
Station	Dannebo, Rauma
Type of event	Maintenance
Rated capacity MW	400
Available capacity MW	0
Pre-event MW	400
P direction	East (import)
Pre-event MVar	
Q direction	
Pre-event Condition	
Origin of Event	DC converter and yard
Subcategory	DC-E.ME - DC Measuring Equipment
Type of maintenance	Planned maintenance
Descriptions and comments	
Equipment restoration	Repair works in Dannebo for an overheated DC-CT at Fenno-Skan 1 DC yard neutral area. Also works in Rauma for improving some wirings for valve cooling system flow measurement.
Maintenance Cause (Pri.)	Corrective maintenance
Maintenance Cause (Sec.)	
Pre incident (ICS)	
Pre Scale (ICS)	
Pre Fault Category	
HVDC incident (ICS)	
HVDC Scale (ICS)	
Post incident (ICS)	
Post Scale (ICS)	
Post Fault Category	
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## 7.5 Limitation due to External Cause

Data field	Entered data
Internal ref. nr.	
Date of event	26.5.2019
Time of event	0:00
End date of event	6.6.2019
End time of event	17:00
Reporting company	Fingrid
HVDC link	Fenno-Skan 2
Station	Rauma
Type of event	Limitation
Rated capacity MW	800
Available capacity MW	200
Pre-event MW	
P direction	
Pre-event MVar	
Q direction	
Pre-event Condition	
Origin of Event	AC External Grid
Subcategory	EXT - External AC System
Origin of Limitation	AC limiting condition
Type of Limitation	Planned
Direction	East (previously import)
Limitation Cause	Other
Descriptions and comments	Reconstruction work and commissioning of a new switchyard at Olkiluoto substation.
Equipment restoration	
Pre incident (ICS)	
Pre Scale (ICS)	
Pre Fault Category	
HVDC incident (ICS)	
HVDC Scale (ICS)	
Post incident (ICS)	
Post Scale (ICS)	
Post Fault Category	
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## 7.6 Limitation due to Environmental Stress

Data field	Entered data
Internal ref. nr.	
Date of event	28.7.2019
Time of event	14:32
End date of event	28.7.2019
End time of event	14:56
Reporting company	Fingrid
HVDC link	Fenno-Skan 1
Station	Rauma
Type of event	Limitation
Rated capacity MW	400
Available capacity MW	300
Pre-event MW	400
P direction	East
Pre-event MVar	
Q direction	
Pre-event Condition	Normal operation
Origin of Event	Other or unknown origin
Subcategory	O - Other
Origin of Limitation	DC limiting condition
Type of Limitation	Unplanned
Direction	Both ways
Limitation Cause	Environmental cause
Descriptions and comments	High inlet temperature of valve cooling liquid at Rauma due to high ambient temperature, transmitted power decreased. 1st stage alarm level 44° was exceeded. CC reacted acc. to pre-defined instructions.
Equipment restoration	
Pre incident (ICS)	Normal operation
Pre Scale (ICS)	
Pre Fault Category	No Fault
HVDC incident (ICS)	Incidents on transmission network elements (T)
HVDC Scale (ICS)	
Post incident (ICS)	Normal operation
Post Scale (ICS)	
Post Fault Category	No Fault
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## 7.7 Other Outage due to Testing

Data field	Entered data
Internal ref. nr.	EL1-2019-8
Date of event	16.6.2019
Time of event	16:52
End date of event	16.6.2019
End time of event	19:05
Reporting company	Fingrid
HVDC link	EstLink 1
Station	Harku
Type of event	Other outage
Rated capacity MW	400
Available capacity MW	0
Pre-event MW	
P direction	
Pre-event MVar	
Q direction	
Pre-event Condition	
Origin of Event	Other or unknown origin (Note: reason for this selection is "System" interaction testing without maintenance or modification work)
Subcategory	O - Other
Type of Other Outage	Planned
Descriptions and comments	Harku black-start functionality test
Equipment restoration	
Pre incident (ICS)	
Pre Scale (ICS)	
Pre Fault Category	
HVDC incident (ICS)	
HVDC Scale (ICS)	
Post incident (ICS)	
Post Scale (ICS)	
Post Fault Category	
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## 8 DISTAC/CIGRE

This chapter shows the similarities and differences between DISTAC and CIGRE, which can be used to classify events so it fits both reports.

### 8.1 Origin of Event, Subcategories vs. outage code

DISTAC’s “Origin of event” now incorporates the Subcategories that match the CIGRE Outage Codes. This is explained in detail in chapter 6.

### 8.2 Type of event

There is a small difference between DISTAC and CIGRE concerning classifying the Type of Events which can be seen in the Table below. CIGRE uses two types of events: Forced Outages and Scheduled Outages, while DISTAC uses three types of events: Disturbances, Maintenance and Limitations.

CIGRE	DISTAC	Comments
Forced Outage	Disturbance	
	Unplanned maintenance	
	Limitations (DC)	
	Other	
Scheduled Outage	Planned maintenance	
	Limitations (DC)	
	Other	
Commutations failure	NA	Not relevant for DISTAC
Thyristor failure	NA	Not relevant for DISTAC
External AC System	Limitations (AC)	CIGRE: Not included in unavailability, and therefore only relevant in DISTAC

### 8.3 Restoration code

DISTAC’s “Equipment restoration” partly matches the CIGRE Restoration Codes. This is explained in detail in the Table below:

CIGRE	DISTAC	Comments
M: No equipment failure, only manual restart	No equipment failure	CIGRE = DISTAC
R: Equipment causing outage is repaired or adjusted	Equipment causing outage is repaired or adjusted	CIGRE = DISTAC
S: Failed equipment is replaced by spare	Failed equipment is replaced with spare	CIGRE = DISTAC
N.A.	Equipment failure, but HVDC-link operated with reduced capacity	Limitation
N.A.	Equipment limitation, and HVDC-link operated with reduced capacity	Limitation
N.A.	Equipment failure, but normal operation	No outage

### 8.4 Other

Otherwise, DISTAC and CIGRE are collecting different additional outage related data that is not collected by the other party. This is mainly due to the different angles taken:

- CIGRE asset management perspective;
- DISTAC system operations perspective.

## 9 References

- How to report the data. Educational tool - <http://distac.info/>
- ENTSO-E HVDC utilization and unavailability statistics (Subgroup DISTAC reports) - <https://www.entsoe.eu/publications/system-operations-reports/#fault-statistics>
- CIGRE Technical Brochure TB 590 - Protocol for Reporting the Operational Performance of HVDC Transmission Systems (AG B4-04, 2014) (no direct link)
- ICS Methodology - [https://www.entsoe.eu/network\\_codes/sys-ops/annual-reports/](https://www.entsoe.eu/network_codes/sys-ops/annual-reports/)