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Appendix 1 Documentation

Energy storage facility categories c and d

Technical regulation 3.3.1 for electrical energy storage facilities

EFFECTIVE FROM 18 December 2019

Please note: This is a translation. In case of inconsistencies, the Danish version applies.

# Appendix 1 Documentation

Appendix 1 specifies the documentation requirements for the five facility categories, see section 1.1.4 in the regulation:

A. Energy storage facilities up to 125 kW

B. Energy storage facilities from and including 125 kW up to 3 MW

C. Energy storage facilities from and including 3 MW up to 25 MW

D. Energy storage facilities from and including 25 MW or connected at voltages above 100 kV

SX. Category A or B energy storage facilities

T. Temporarily connected energy storage facilities

Documentation, see specifications in section 9 of the regulation, must be sent electronically to the electricity supply undertaking.

The technical documentation must include configuration parameters and configuration data applicable to the energy storage facility at the time of commissioning.

All appendix subsections must be filled in for the facility in question.

If information changes after the time of commissioning, updated documentation must be submitted as required in section 2.2.

Templates for Appendix 1 for the various facility categories are available on Energinet's website [www.energinet.dk](http://www.energinet.dk). It is thus possible to print only the appendix to be filled in.

Documentation – categories C and D

* 1. Documentation for category C and D energy storage facilities (part 1)

Please fill in the documentation form with data for the facility, valid before commissioning, and submit it to the electricity supply undertaking.

* + 1. Identification

|  |  |
| --- | --- |
| Facility | Description of the facility |
| Facility owner name and address |  |
| Facility owner telephone no. |  |
| Facility owner e-mail |  |
| Inverter – manufacture |  |
| Inverter – model |  |
| Inverter – rated power |  |
| Storage medium – manufacture |  |
| Storage medium – model no. |  |
| Storage medium – usable energy storage capacity [kWh] |  |

* + 1. Normal operating conditions

|  |  |
| --- | --- |
| Can the energy storage facility be started and operate continuously within the normal operation range, restricted only by grid protection settings, c.f. requirements in Figure 6-Figure 10? | Yes  No |

* + 1. Tolerance of frequency deviations

|  |  |
| --- | --- |
| Will the energy storage facility remain connected to the public electricity supply grid during frequency deviations as specified in section 4 for categories C and D? | Yes  No |
| Will the facility remain connected in the event of frequency changes of 2.0 Hz/s in the POC? | Yes  No |

* + 1. Tolerance of voltage deviations (FRT)

|  |  |
| --- | --- |
| Will the energy storage facility remain connected to the public electricity supply grid at the voltage dips, as specified in 4.4.4 and 4.4.5 for categories C and D, respectively? | Yes  No |
| After a voltage dip, the energy storage facility is able to return to normal operation no later than 5 s after operating conditions have returned to the normal operating range. | Yes  No |

* + - 1. Additional reactive current

|  |  |
| --- | --- |
| Does the energy storage facility deliver additional reactive current as specified in sections 4.4.4 or 4.4.5 for categories C and D, respectively? | Yes  No |

* + 1. Connection and synchronisation

|  |  |
| --- | --- |
| Do connection and synchronisation occur as specified in section 4.3.1 for categories C and D? | Yes  No |

* + 1. Active power control
       1. Active power control at overfrequency

|  |  |
| --- | --- |
| Is the energy storage facility equipped with a frequency response function for overfrequency as specified in section 6.2.2.1 for categories C and D? | Yes  No |

* + - 1. Active power control at underfrequency

|  |  |
| --- | --- |
| Is the energy storage facility equipped with a frequency response function for underfrequency as specified in section 6.2.2.3 for categories C and D?  If Yes, reference to documentation: | Yes  No |

* + - 1. Frequency control

|  |  |
| --- | --- |
| Is the energy storage facility equipped with a frequency control function as specified in section 6.2.3.2 for categories C and D?  If Yes, reference to documentation: | Yes  No |

* + - 1. System protection

|  |  |
| --- | --- |
| Is the energy storage facility equipped with a system protection function as specified in section 6.4.2?  If Yes, reference to documentation: | Yes  No |

* + - 1. Absolute power constraint function

|  |  |
| --- | --- |
| Is the energy storage facility equipped with an absolute power constraint function as specified in section 6.2.4.1.1 for categories C and D?  If Yes, reference to documentation: | Yes  No |

* + - 1. Ramp rate constraint function

|  |  |
| --- | --- |
| Is the energy storage facility equipped with a ramp power constraint function as specified in section 6.2.4.2.1 for categories C and D?  If Yes, reference to documentation: | Yes  No |

* + 1. Reactive power control functions
       1. Requirements for reactive power control area

|  |  |
| --- | --- |
| Can the facility supply reactive power at Pn and varying operating voltages, as specified in sections 6.3.5.3, 6.3.5.4 and 6.3.5.5 for categories C, D and D\*, respectively? | Yes  No |
| Can the energy storage facility supply reactive power at varying active power as specified in sections 6.3.5.3, 6.3.5.4 and 6.3.5.5 for categories C, D and D, respectively? | Yes  No |

* + - 1. Q control

|  |  |
| --- | --- |
| Is the energy storage facility equipped with a Q control function as specified in section 6.3.1.1 for categories C and D? | Yes  No |

* + - 1. Power factor control

|  |  |
| --- | --- |
| Is the energy storage facility equipped with a power factor control function as specified in section 6.3.2.1 for categories C and D? | Yes  No |

* + - 1. Voltage control

|  |  |
| --- | --- |
| Is the energy storage facility equipped with a voltage control function as specified in section 6.3.3.2 for categories C and D? | Yes  No |
| Where is the voltage reference point located? |  |

* + 1. Power quality

|  |  |
| --- | --- |
| Are stated emission values calculated values? | Yes  No |
| Are stated emission values measured values? | Yes  No |
| Is a report enclosed, documenting that calculations or measurements comply with emission requirements? | Yes  No |

* + - 1. Rapid voltage changes

|  |  |
| --- | --- |
| Does the energy storage facility comply with the rapid voltage changes thresholds specified in sections 5.2.1.3 and 5.3 for categories C and D distribution connections and category D\* transmission connections, respectively? | Yes  No |

* + - 1. DC content

|  |  |
| --- | --- |
| Does DC content at normal operation exceed the thresholds set out in sections 5.2.1.1 and 5.3 for categories C and D distribution connections and category D\* transmission connections, respectively? | Yes  No |

* + - 1. Voltage unbalance

|  |  |
| --- | --- |
| Is the facility three-phase balanced? | Yes  No |

* + - 1. Flicker

|  |  |
| --- | --- |
| Is flicker contribution for the energy storage facility below the thresholds set out in sections 5.2.1.4 and 5.3 for categories C and D distribution connections and category D\* transmission connections, respectively? | Yes  No |

* + - 1. Harmonics

|  |  |
| --- | --- |
| Are all harmonic distortions for the energy storage facility below the thresholds set out in sections 5.2.1.5 and 5.3 for categories C and D distribution connections and category D\* transmission connections, respectively? | Yes  No |

* + - 1. Interharmonics

|  |  |
| --- | --- |
| Are all interharmonics for the energy storage facility below the thresholds set out in sections 5.2.1.6 and 5.3 for categories C and D distribution connections and category D\* transmission connections, respectively? | Yes  No |

* + - 1. Disturbances in the 2-9 kHz range

|  |  |
| --- | --- |
| Emission of distortions with frequencies in the 2-9 kHz range is determined by the electricity supply undertaking. Is the requirement met? | Yes  No |

* + 1. Protection

|  |  |
| --- | --- |
| Is the facility protected with the functions required in sections 7.2.3 and 7.2.4 for categories C and D, respectively? | Yes  No |

* + - 1. Island operation detection

|  |  |
| --- | --- |
| Is the facility protected with the functions required in section 6.2.3.2 for categories C and D? | Yes  No |

* + 1. Information exchange
       1. Data communication

|  |  |
| --- | --- |
| Have data communication protocols and data security factors been implemented as specified in section 8.2? | Yes  No |
| Are signals as specified in section 8.2 available in the PCOM interface? | Yes  No |

* + - 1. Fault incident recording

**Only for category D facilities**

|  |  |
| --- | --- |
| Have logging equipment been installed in the POC as specified in section 8.3 for category D? | Yes  No |
| Has it been agreed with the transmission system operator which incidents should be logged?  If 'Yes', which? | Yes  No |

* + 1. Simulation model requirements

**Only for facilities with power output above 10 MW**

|  |  |
| --- | --- |
| Has a simulation model been prepared as specified in section 10.1 for categories C and D?  If Yes, reference to documentation and model: | Yes  No |

* + 1. Conformity testing

|  |  |
| --- | --- |
| Has a conformity testing plan been prepared as specified in section 9.2.11 for categories C and D?  If Yes, reference to documentation: | Yes  No |

* + 1. Signature

|  |  |
| --- | --- |
| Date |  |
| Installation contractor |  |
| Person responsible for  commissioning |  |
| Signature  (person responsible for  commissioning) |  |
| Facility owner |  |
| Signature (facility owner) |  |

* 1. Documentation for category C and D energy storage facilities (part 2)

Please fill in the documentation form with data for the facility, valid before final commissioning, and submit it to the electricity supply undertaking.

* + 1. Identification

|  |  |
| --- | --- |
| Facility | Description of the facility |
| GSRN no. |  |
| Facility owner name and address |  |
| Facility owner telephone no. |  |
| Facility owner e-mail |  |
| Inverter – manufacture |  |
| Inverter – model |  |
| Inverter – rated power |  |
| Storage medium – manufacture |  |
| Storage medium – model no. |  |
| Storage medium –  usable energy storage capacity [kWh] |  |

* + 1. Active power control
       1. Active power control at overfrequency

|  |  |
| --- | --- |
| Is the frequency response function for overfrequency as specified in section 6.2.2.1 for categories C and D activated?  If Yes, with which settings?  Frequency threshold:  Droop:  Time for island operation detection (minimum response time): | Yes  No  \_\_\_\_\_\_\_\_ Hz  \_\_\_\_\_\_\_\_ %  \_\_\_\_\_\_\_\_ ms |

* + - 1. Active power control at underfrequency

|  |  |
| --- | --- |
| Is the frequency response function for underfrequency as specified in section 6.2.2.3 for categories C and D activated?  If Yes, with which settings?  Frequency threshold:  Droop:  Time for island operation detection (minimum response time): | Yes  No  \_\_\_\_\_\_\_\_ Hz  \_\_\_\_\_\_\_\_ %  \_\_\_\_\_\_\_\_ ms |

* + - 1. Frequency control

|  |  |
| --- | --- |
| Is the frequency control function specified in section 6.2.3.2 for categories C and D activated?  If Yes, with which settings?  Frequency threshold - Low (fRU):  Frequency threshold - High (fRO):  Droop:  Desired frequency:  ΔP: | Yes  No  Online control  \_\_\_\_\_\_\_\_ Hz  \_\_\_\_\_\_\_\_ Hz  \_\_\_\_\_\_\_\_ %  \_\_\_\_\_\_\_\_ Hz  \_\_\_\_\_\_\_ kW |

* + - 1. Absolute power constraint function

|  |  |
| --- | --- |
| Is the absolute power constraint function as specified in section 6.2.4.1.1 for categories C and D activated?  If Yes, with which value? | Yes  No  Online control  \_\_\_\_\_\_\_\_ kW |

* + - 1. Ramp rate constraint function

|  |  |
| --- | --- |
| Is the energy storage facility's ramp rate constraint function as specified in section 6.2.4.2.1 for categories C and D activated?  If Yes, with which value? | Yes  No  Online control  \_\_\_\_\_\_\_%Pn/min |

* + 1. Reactive power control
       1. Q control

|  |  |
| --- | --- |
| Is the Q control function as specified in section 6.3.1.1 for categories C and D activated?  If Yes, with which set point?  (Value differing from 0 kVAr must be agreed with the electricity supply undertaking.) | Yes  No  Online control  \_\_\_\_\_\_\_\_ kVAr |

* + - 1. Power factor control

|  |  |
| --- | --- |
| Is the power factor control function as specified in section 6.3.2.1 for categories C and D activated?  If Yes, with which set point?  (Value differing from cosφ 1.0 must be agreed with the electricity supply undertaking.) | Yes  No  Online control  \_\_\_\_\_\_\_\_ cosφ  Inductive  Capacitive |

* + - 1. Voltage control

|  |  |
| --- | --- |
| Is the voltage control function as specified in section 6.3.3.2 for categories C and D activated?  (Not to be activated without agreement with the electricity supply undertaking.)  If Yes, with which set point? | Yes  No  Online control  \_\_\_\_\_\_\_\_ kV |

* + 1. Protection

|  |  |
| --- | --- |
| Has a list of protective functions and settings at the time of commissioning been enclosed?  If Yes, reference to documentation: | Yes  No |

* + 1. Conformity testing

|  |  |
| --- | --- |
| Is documentation of compliance testing enclosed? | Yes  No |

* + 1. Verification of simulation model

**Only for facilities with power output above 10 MW**

|  |  |
| --- | --- |
| Is the verification report for the simulation model enclosed? | Yes  No |

* + 1. Signature

|  |  |
| --- | --- |
| Date |  |
| Installation contractor: |  |
| Person responsible for  commissioning |  |
| Signature  (person responsible for commissioning) |  |
| Facility owner |  |
| Signature (facility owner) |  |