Energinet
Tonne Kjærsvej 65
DK-7000 Fredericia

+45 7010 2244
info@energinet.dk
CVR/VAT no. 28 98

IMPLEMENTATION GUIDE

# EXCHANGE OF OPERATIONAL SCHEDULES – REV. 13 MAY 2025

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## Revision history

| SECTION | CHANGE | DATE/REV |
|---|---|---|
| 4, 7 | Corrections to table 1, Planned resource schedule | October 2022 |
| 1-4<br><br>3.4.3<br><br><br><br><br><br><br>3.4.4 | General explanations added to sections 1-4C11 – solar cells added; A97 added.<br>Corrections to table 2, Time series: explanatory and GLN code for Energinet moved to receiver field.<br>All example dates in tables have been "standardised".<br>Mutual interdependence between registere-dResource.mRID and mktPSRType.psrType<br>ObjectAggregation changed to mandatory.<br>Time series has been added to table 2: A97.<br>In Table 7, sender and receiver have been corrected | December 2022 |
| 2. and 3.4 | Time series for mFRR activated, A97, has sign (+/-) | 19 December 2022 |
| -<br>3.3<br><br><br>3.4.4 | Clarifications and additional guidance.<br>Updated figure 2, last step is a technical acknowledgement; this has now been omitted from the process.<br>Deleted as a result of the removal of the Con-firmedResourceSchedule_marketDocument | 2 March 2023 |
| 3.4.3 | In message types, use hyphen | 30 March 2023 |
| 3.4.3 | In createdDateTime, indication of seconds was added | 30 May 2023 |
| 3<br>3.3.2<br>App. 1 | Special regulation not included in mFRR time series.<br>Merging of schedules – changed “dead time”.<br>Guidance for shutdown schedules in appendix 1. | 13 May 2025 |

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# 1. Scope

This document aims to clarify and describe the business processes for submitting operational schedules for balance-responsible parties (BRPs) operating in the Danish electricity market.

# 2. Definitions

**mFRR:** Manual Frequency Restoration Reserve is a system service activated/ordered based on submitted bids depending on the system's needs and it is initiated by balance-responsible parties and plant owners subsequently. Previously known as regulating power.

**ENTSO-E:** European Network of Transmission System Operators for Electricity; publishes, among other things, standards for data exchange about the electricity system.

# 3. Business process for operational schedule

## 3.1 Overview

Requirements for the operational schedule process are stated in market regulation C3. Fundamentally, schedule data is used to support operations, and the submitted values must always represent the operation of the plants as expected with the known assumptions at the time. A 'use case' is linked to the operational schedule process. The process for exchanging data, and the way in which this is done, is described below.

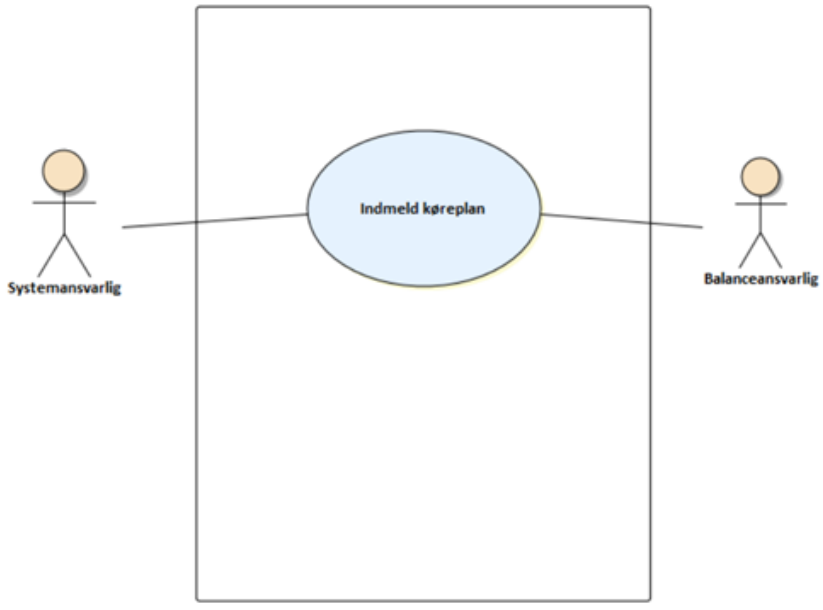


*Figure 1 Use case Submit operational schedule*

## 3.2 General outline

An operational schedule contains a balance-responsible party's aggregated set of time series for production, demand, and reduction of weather-dependent RE facilities for a 24-hour period. Operational schedules are submitted for western Denmark (DK1) and eastern Denmark (DK2), respectively.

Regulation C3, section 5, lists the production and demand units that operational schedules must be submitted for.

For generation facilities, operational schedules must be broken down, depending on the size of the individual unit and the main fuel type used. If the generation facility is ≥ 10 MW, one operational schedule per generator type must be submitted for the generation facility (see C3 guideline, if relevant). If the generation facility is < 10 MW, a total schedule must be submitted, containing all units < 10 MW with the same main fuel type.

The operational schedule for balance-responsible parties for production must include the following time series for each of the units' generator type and the sum of units with the same main fuel type, respectively, including wind and solar power connected at transmission level:

- Production schedule in MW
- Current minimum capacity in MW
- Current maximum capacity MW
- Current schedule for activated mFRR energy in MW.

Examples of minimum capacity:

- Solar and wind power units – 0
- Thermal units – minimum electricity load limit on generator

Examples of maximum capacity:

- Solar and wind power units – forecast for a unit with full utilisation of wind and solar resources.
- Thermal units – the maximum production of a unit with the configuration of the specific day (incl. fuel).

The time series for activated mFRR energy applies only to balancing activations (Balancing B49) and must not include special regulation used for constraint management (System Regulation B22).

The operational schedule for balance-responsible parties for demand must include the following time series for each of the units' demand site/sum of demand sites:

- A demand schedule in MW
- Current minimum capacity schedule in MW
- Current maximum capacity schedule in MW
- Current schedule for activated mFRR energy in MW.

The time series for activated mFRR energy applies only to balancing activations (Balancing B49) and must not include special regulation (System Regulation B22).

For all solar and wind power connected to the distribution network, a special exception applies. For these generation facilities, shutdown schedules must be submitted.

For plants > 10 MW, the schedules must be shown by plant, otherwise they must be included in sum schedules divided by solar and wind (solar, B16 or wind, B19):

- Shutdown time series for the volume of installed power which has been shut down (MW)
- Current schedule for activated mFRR energy in MW.

When submitting a shutdown time series (C11), the volume of installed power regulated downwards must be specified.

By downward regulation, it is important that the schedule shows the actual change at the submitted time, as the forecast is formed based on which plants are producing, combined with the actual weather conditions.

Examples of shutdown schedules may be found in appendix 1.

For all schedule types, a time series for activated mFRR energy, A97 time series, is included. It indicates which actual power is downwards or upwards regulated when it is submitted and activated as an mFRR bid. Upward regulation is indicated with a positive sign and downward regulation is indicated with a negative sign; if no mFRR is delivered, 0 is indicated.

The time series for activated mFRR energy applies only to balancing activations (Balancing B49) and must not include special regulation (System Regulation B22).

Example of using signs for regulation:

- Production plants that increase production upon activation deliver a time series with a positive sign.
- Demand plants that decrease demand upon activation deliver a time series with a positive sign.

### 3.3 Business process

*Figure 2 Schedule submission process for operational schedules (DK1 and DK2)*

and the following description explain the process of submitting operational schedules.

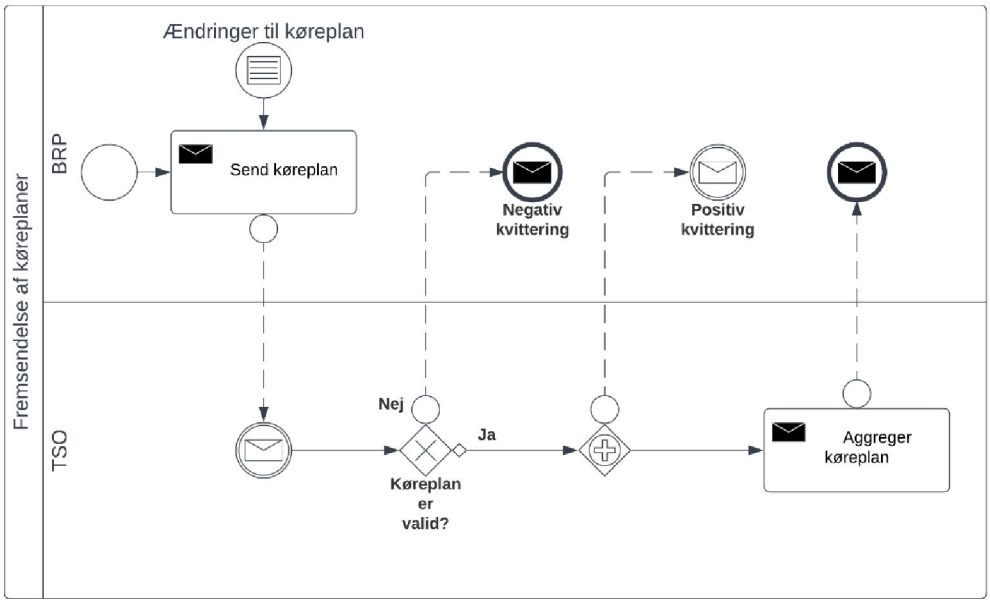


*Figure 2 Schedule submission process for operational schedules (DK1 and DK2)*

#### 3.3.1 Initial status before submission of operational schedules

Prior to submitting an operational schedule, a balance-responsible party has planned production and/or demand for the next day of operation.

### 3.3.2 Operational schedule submission process

**Submit operational schedule**

All balance-responsible parties for production and balance-responsible parties for demand with adjustable demand submit individual operational schedules for the next day of operation. The schedule must always describe how operation is expected to be conducted for all generators/units that the respective parties are responsible for. An operational schedule must always cover a full day of operation.

However, the first operational schedule submitted must reach Energinet before the deadline, but after "gate open": D-1 at 00:10.

**Changes to operational schedules**

If a balance-responsible party (BRP) makes operational changes or receives an order for mFRR activation (regulating power order), which is accepted, the balance-responsible party must submit a revised operational schedule to Energinet as described in "Submit operational schedule"; thus, the operational schedule must also include the part of the time series submitted previously. If a special regulation is activated, the operational schedule must be updated, but the regulation is not to be incorporated into the A97 time series.

Energinet "merges" the party's revised operational schedule with the most recently approved operational schedule. When a party revises and submits an operational schedule to Energinet, changes from the previous schedule compared to the revised schedule will take place using values from up till 5 minutes before the time of merging. Energinet will merge the two operational schedules to create a new schedule, which will be the sum of the previous schedule adjusted to match the revised schedule.

Figure 3 below illustrates how two operational schedules are merged.

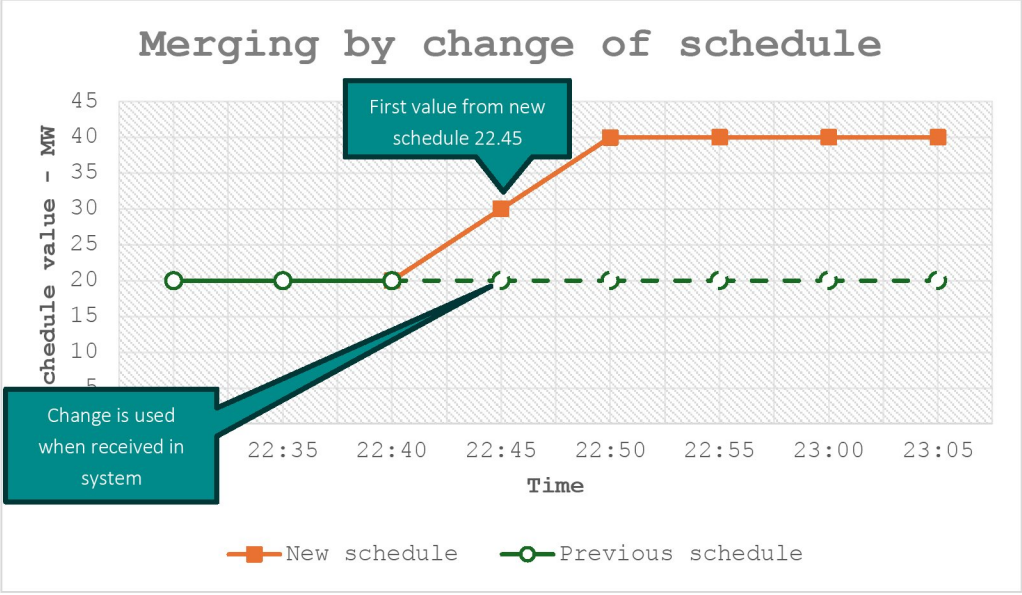


*Figure 3 Merging to create new operational schedule.*

Changes may be submitted until 5 minutes before end of the day.

### Validate operational schedule

On receipt of an operational schedule, Energinet will check the content for general errors in relation to the ENSTSO-E schema, check whether the codes used are correct and whether the necessary message elements are present. The identification of the individual parties is verified, and it is checked whether the schedule covers a 24-hour period with time indicated in CET with regard to summer/wintertime.

If a unit larger than 10 MW submits an operational schedule with values below 10 MW, this schedule will, however, be accepted. Depending on whether or not errors are found, a positive or negative receipt acknowledgement will be generated and is then sent to the party.

### Send acknowledgement

Depending on whether or not errors are found, a positive or negative acknowledgement will be generated, which is then sent to the party. The acknowledgement uses “reason-codes” as specified in ENTSO-E’s StandardReasonCodeTypeList in urn-entsoe-eu-wgedi-codelists.xsd.

### Send aggregated operational schedule

If a schedule is approved, Energinet will send the confirmed operational schedule in a separate message, and the balance-responsible party acknowledges receipt hereof.

## 3.4 Business rules

All values are marked with a positive sign, except downward regulation in the A97 time series, for activated mFRR.

### 3.4.1 Adjustment of schedules

If adjustments are made to an operational schedule, the entire schedule must be re-submitted, including any changes.

### 3.4.2 Description of parties

Each participant in the electricity market is responsible for its balance between generation and demand of electricity as well as trade in electricity. A participant is identified by a unique ID, regardless of the number of roles the participant may have. An approved balance-responsible party (BRP) is a participant approved to handle balance responsibility for a given production facility, demand, or trade towards Energinet. In this document, a balance-responsible party is a balance-responsible party for demand or production who is responsible for the submission of operational schedules based on physical trades for one or more electricity-consuming or electricity-generating units.

### 3.4.3 Businesstypes and registeredRessource.mRID

The choice of business types is based on the Planned Resource Schedule IEC 62325-451-7 and Filename: iec62325-451-7-plannedresourceschedule_v6_2.xsd, which can be downloaded from Energinet's website about schedules.

### The following business types are used in this operational schedule document:

**A01 (Production):** Indicates production for a generation facility including any activations.

**A04 (Demand):** Indicates demand of a demand facility including any activations.

**A60 (Minimum):** Indicates minimum capacity per unit.

A61 (Maximum): Indicates maximum capacity per unit.

A97 (mFRR): Indicates the amount of activated mFRR energy per facility/sum of fuel type with sign, upward regulation being indicated by a positive sign and downward regulation by a negative sign. This time series must always be supplied. If ancillary services are not provided, the time series must be 0.

C11 (ProductionStopped): Weather-dependent RE facilities (wind turbines and solar cells connected to the DSO grid) participating in the day-ahead, intraday, or mFRR energy activation markets, must submit the volume of withheld installed capacity in a shutdown time series.

The following registeredResource.mRID are used in the operational schedule document:

GSRN for generation/demand units ≥ 10 MW: For all units with a capacity larger than or equal to 10MW, a separate time series must be submitted with the expected generation of the unit.

A10: Indicates Global Location Number (GLN 13) or Global Service Relation Number (GSRN 18), maintained by GS1 (gs1.dk).

The following mktPSRType.psrType is used in the operational schedule document:

For sum-submission of production/demand units < 10MW, mktPSRType.psrType must be filled in with the main fuel type. For larger units, the main fuel type is registered in master data and therefore does not need to be submitted. For solar and wind power facilities, C11 (shutdown time series) must be submitted with main fuel type Solar or Onshore Wind.

A03 (Mix production and demand unit): Indicates a unit that can both store and consume energy, e.g. a battery.

A05 (Decentral Consumption): Indicates the sum of decentralized demand.

B01 (Biomass): Indicates sum production for units using straw, rapeseed oil, woodchips, or wood waste.

B04 (Fossil Gas): Indicates sum production for units using refinery gas, natural gas, or LPG.

B05 (Fossil Hard coal): Indicates sum production for units using hard coal, furnace coke, or coke.

B06 (Fossil Oil): Indicates sum production for units using diesel, fuel oil, or gas oil.

B11 (Hydro Run-of-river and poundage): Indicates sum production for units using hydropower.

B15 (Other renewables): Indicates sum production for other renewable energy types such as biogas waste gasification, biogas landfill gas, biogas liquid manure, biogas water treatment plant, or wave power.

B16 (Solar): Indicates sum shutdown for solar energy.

B17 (Waste): Indicates sum production for waste.

B19 (Onshore wind): Indicates sum shutdown of wind energy.

### 3.4.4 Dependencies with PlannedRessourceSchedule_MarketDocument

The Planned Resource Schedule market document is used to submit operational schedules.
The table below describes the values in the fields.

PlannedResourceSchedule_MarketDocument is message type ENDK-A14
The acknowledgement is message type ENDK-ACK-A14
ECP service endpoint: SERVICE-ENDK-RESOURCESCHEDULE

| | XSD require-ments | |
|---|---|---|
| **PlannedResourceSchedule_MarketDocument** | | |
| mRID | Mandatory | Senders Unique Identification, preferably UUID |
| revisionNumber | Mandatory | The revision number of the document |
| type | Mandatory | A14 = Resource Provider Resource Schedule |
| process.processType | Mandatory | A17 = Schedule day |
| sender_MarketParticipant.mRID | Mandatory | The coding scheme is the Energy Identification Coding Scheme (EIC), maintained by ENTSO-E.<br><br>GLN/EIC for BRP<br>A01=EIC<br>A10 = EAN/GLN |
| sender_MarketParticipant.marketRole.type | Mandatory | A06 = Production responsible party |
| receiver_MarketParticipant.mRID | Mandatory | The coding scheme is the Energy Identification Coding Scheme (EIC), maintained by ENTSO-E.<br><br>EIC for Energinet = 10X1001A1001A248<br>GLN for Energinet = 5790000432752<br>A01=EIC<br>A10 = EAN/GLN |
| receiver_MarketParticipant.marketRole.type | Mandatory | A04 = System operator |
| createdDateTime | Mandatory | Creation date/time of the document (in ISO 8601 UTC format)<br>YYYY-MM-DDTHH:MM:SSZ |
| schedule_Period.timeInterval | Mandatory | Period covered (in ISO 8601 UTC format)<br><br><period.timeInterval><br><start>2013-07-31T22:00Z</start><br><end>2013-08-01T22:00Z</end><br></period.timeInterval><br><br>This should cover the complete period<br>In relation to a CET time zone:<br>In winter the time spread is from 23:00 UTC to 23:00 UTC<br>The change from winter to summer time spread is from 23:00 UTC to 22:00 UTC<br>The summer time spread is from 22:00 UTC to 22:00 UTC<br>The change from summer to winter time spread is from 22:00 UTC to 23:00 UTC |
| domain.mRID | Conditional | Not used |
| subject_MarketParticipant.mRID | Conditional | Not used |
| subject_MarketParticipant.marketRole.type | Conditional | Not used |

*Table 1 PlannedResourceSchedule_MarketDocument*

| PlannedResource_TimeSeries | | |
|---|---|---|
| mRID | Mandatory | Unique identification of time series within the document |
| businessType | Mandatory | A01 = Production dispatchable |
| | | A04 = Consumption dispatchable |
| | | A60 = Minimum possible. The time series provides a schedule of minimum possible values for a Resource Object. |
| | | A61 = Maximum available. The time series provides a schedule of maximum available values for a Resource Object. |
| | | A97 = Manual frequency restoration reserve activated |
| | | C11 = A time series providing the volume of production units reduced by an energy provider / producer / supplier. |
| flowDirection.direction | Conditional | Not used |
| Product | Mandatory | 8716867000016 = Active power |
| connecting_Domain.mRID | Mandatory | DK1 = 10YDK-1--------W (EIC) |
| | | DK2 = 10YDK-2--------M (EIC) |
| registeredResource.mRID | Conditional (Mandatory this or the next) | GSRN for production/consumption unit >= 10 MW<br><br>A10 = GS1, the coding scheme for the preceding attribute.<br><br>Mutually exclusive with mktPSRType.psrType |
| mktPSRType.psrType | Conditional (Mandatory this or the previous) | Main fuel type when submitting sum for production/consumption units < 10MW.<br><br>Mutually exclusive with registeredResource.mRID<br><br>A03 = Mixed production and consumption unit. Used for e.g. batteries. |
| | | A05 = Load (Decentral Consumption: decentralised consumption) |
| | | B01 = Biomass A production unit using biomass |
| | | B04 = Fossil Gas: A production unit using refinery gas, natural gas, LPG |
| | | B05 = Fossil Hard coal: A production unit using hard coal, furnace coal, coke |
| | | B06 = Fossil Oil: A production unit using diesel, fuel oil, gas oil |
| | | B11 = Hydro Run-of-river and poundage: A production unit using hydropower |
| | | B15 = Other renewables: Other renewable energy types such as biogas waste gasification, biogas landfill gas, biogas liquid manure, biogas water treatment plant, wave power |
| | | B16 = (Solar): A production unit based on solar energy, |
| | | B17 = Waste: A production unit using waste |
| | | B19 (Onshore wind): A production unit based on wind power. |
| resourceProvider_MarketParticipant.mRID | Mandatory | A01=EIC |
| | | The coding scheme is the Energy Identification Coding Scheme (EIC), maintained by ENTSO-E.<br>In this context we expect balance-responsible party, same as GLN/EIC for BRP in sender_MarketParticipant.mRID, table 1 |
| | | A10 = EAN/GLN |
| Acquiring_Domain.mRID | Conditional | Not used |
| marketAgreement.type | Conditional | Not used |
| marketAgreement.mRID | Conditional | Not used |
| measurement_Unit.name | Mandatory | MAW = Megawatt |
| objectAggregation | Mandatory | A06 = Resource Object. Production/consumption unit >= 10 MW<br>A08 = Resource type. Production/consumption < 10MW<br><br>Defines if either registeredResource.mRID – GSRN or mktPSRType.psrType – main fuel type is used in the time series |

*Table 2 PlannedResource_TimeSeries*

| UnavailableReserve_TimeSeries (associated with Original_MarketDocument) | Conditional | Not used |
|---|---|---|

*Table 3 UnavailableReserve_TimeSeries (associated with Original_MarketDocument)*

| Series_Period | | |
|---|---|---|
| timeinterval | Mandatory | The start and end time of the period.<br><period.timeInterval><br><start>2013-07-31T22:00Z</start><br><end>2013-08-01T22:00Z</end><br></period.timeInterval> |
| resolution | Mandatory | PT05M = 5 minutes |

*Table 4 Series_Period*

| Point | | |
|---|---|---|
| Position<br>Position_Integer | Mandatory | Position within the time interval<br><br>Between 1- 289 (+/- 12 on DTS days) |
| Quantity<br>Decimal | Mandatory | The principal quantity identified for a point<br>(only zero/positive values are reported, except for timeseries A97)<br>Precision is 0.1 |

*Table 5 Point*

| Reason | Conditional | Not used |
|---|---|---|

*Table 6 Reason*

# 4. Assembly Model's references

IEC 62325-451-7 – Planned Resource Schedule
iec62325-451-1 – Acknowledgement_v8_1.xsd

## APPENDIX 1 Examples with Shutdown Schedules

As an example of a mFRR downward regulation where Energinet has ordered 5 MW downward regulation, a wind turbine with an installed capacity of 6 MW, which is expected to generate 5 MW based on the wind on that day, would have to submit 6 MW in C11 and 5 MW in A97.

Moreover, regulation may take place without the supply of mFRR/regulating power, for example in the event of outages, negative prices, or downward regulation of the unit 'in advance' to be able to supply upward regulation later. In this case, C11 must show the installed capacity regulated downwards, while A97 must be 0.

Below is an example of the time series to be submitted for solar and wind power.

| Type | Grid level connection | Size in MW | Time series |
|---|---|---|---|
| Solar | Transmission | 150 | A01, A60, A61, and A97 |
| Solar | Transmission | 100 | A01, A60, A61, and A97 |
| Wind | Transmission | 200 | A01, A60, A61, and A97 |
| Solar | Distribution | 50 | C11 and A97 |
| Wind | Distribution | 60 | C11 and A97 |
| Wind | Distribution | 40 | C11 and A97 |
| Wind | Distribution | 5 | C11 and A97 (total) |
| Wind | Distribution | 4 | |
| Solar | Distribution | 1 | C11 and A97 (total) |
| Solar | Distribution | 0.3 | |
| Solar | Distribution | 0.2 | |
| Solar | Distribution | 0.01 | |
| Solar | Distribution | 0.01 | |
| Solar | Distribution | 0.01 | |

Tabel 7 Example of time series for solar and wind

Further examples of shutdown schedules:

**Example of normal shutdown schedule, in which the unit operates without shutdown**

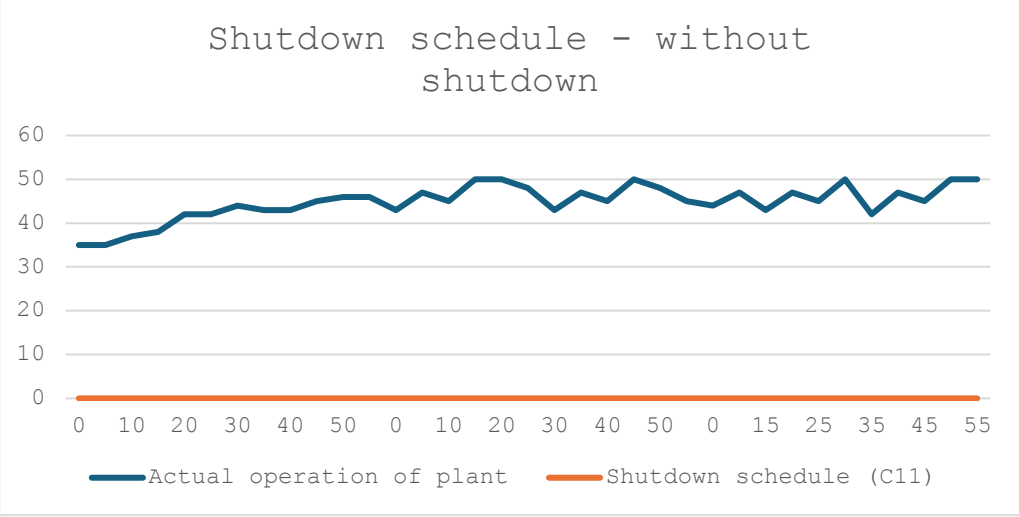


*Figure 4 Example of shutdown schedule without shutdown*

In this case, only 0 is indicated in the shutdown time series and in the mFRR activation time series.

### Example of shutdown schedule with full shutdown for about 1 hour

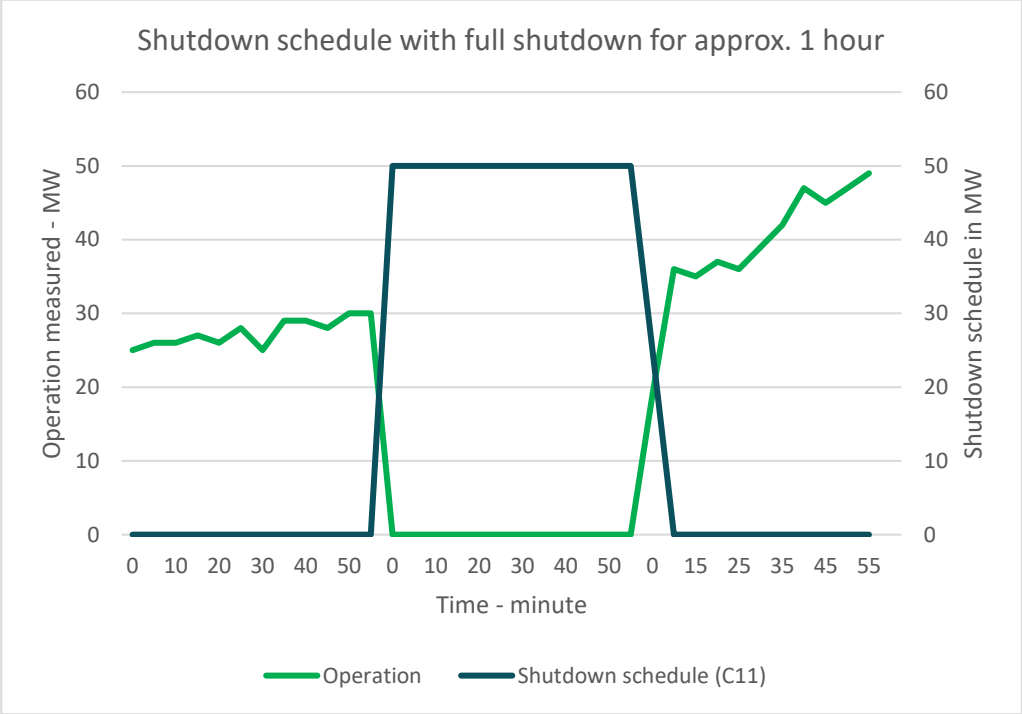


*Figure 5 Example of shutdown schedule with full shutdown for about 1 hour*

In this case, the shutdown values are 0 until minute 0 in the 2nd hour, where there is a 50 MW shutdown. This value continues until minute 55 and ramps down via 25 MW at minute 0 to 0 shutdown at minute 05. The total connected capacity of the unit is 50 MW.

### Example of shutdown schedule with error in reporting

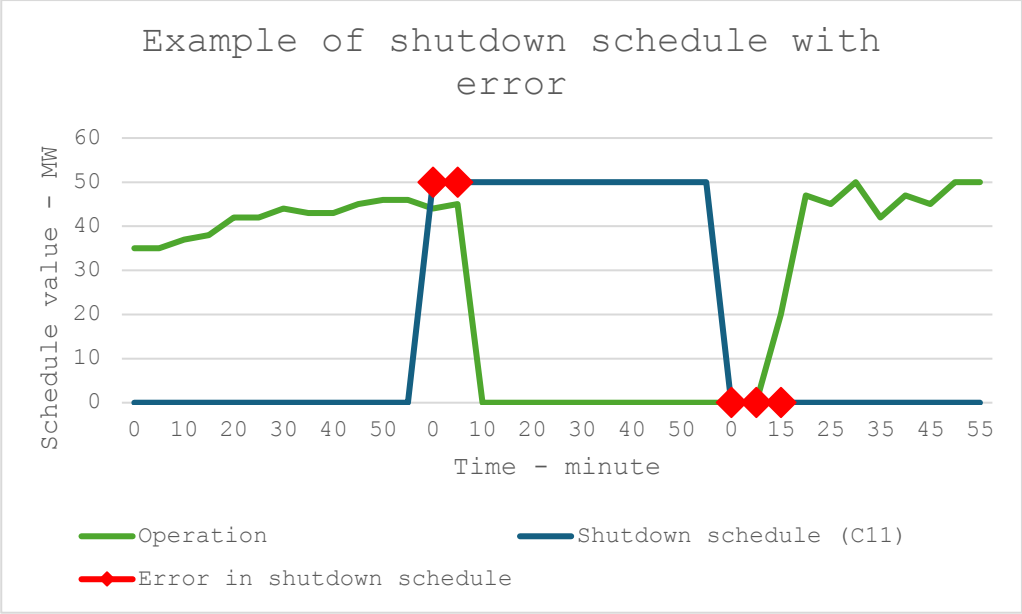


*Figure 6 Example of shutdown schedule with error*

In this case, shutdown is reported at 00 and 05 in the 2nd hour, but the unit only shuts down between minutes 05 and 10. When the unit is put back into operation, shutdown is indicated until minute 55, while the unit is only back in operation between minutes 10 and 20 in a gradual ramp-up.

Shutdown due to activation of mFRR

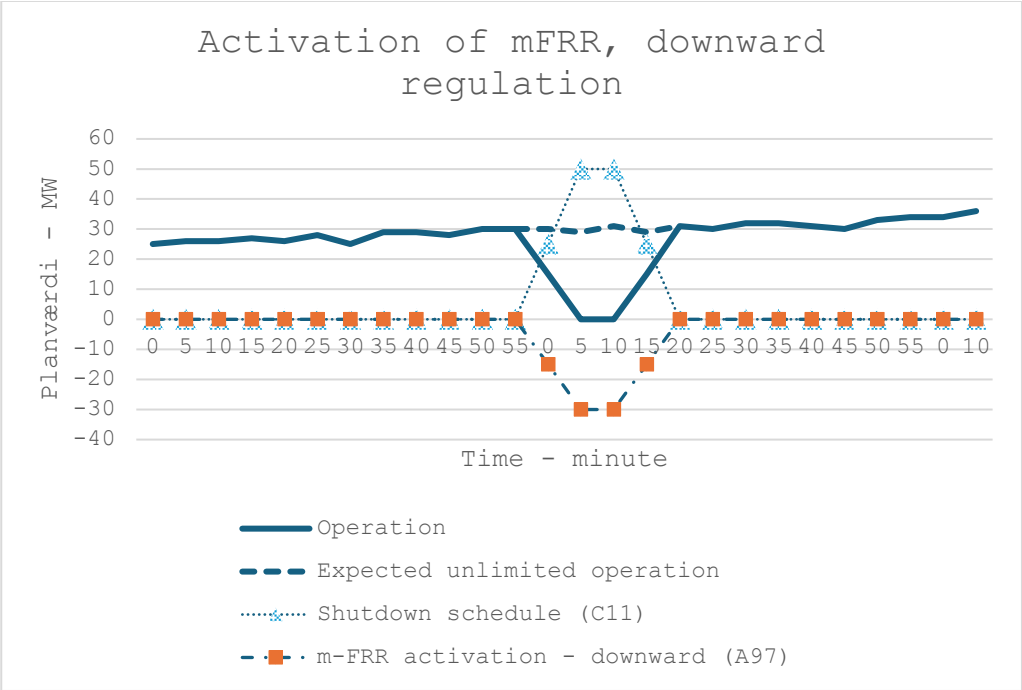


*Figure 7 Example of shutdown due to activation of mFRR*

In this case, a shutdown of a unit is activated; the unit is 50 MW, but the actual operation is about 30 MW. The shutdown schedule must show that the unit is shut down with the full capacity (i.e., 50 MW), while the activation schedule (A97) must show the actual contribution, in this case about 30 MW. The shutdown occurs over minute 0 and the restart occurs over minute 15, with ramp-down and ramp-up parallel over each of the two times. Thus, there is full delivery of mFRR from minute 05 to minute 10.