2019

Data communication analysis and requirements

DREM – DSO ROLE IN ELECTRICITY MARKET

D6.1 REPORT

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Document no.:	DREM-D6.1 Data analysis and requirements
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Last revision date:	2020-04-02

Contents

Introduction and scope

The DREM project is a R&D project partly funded by the partners and the EUDP program.

DREM stands for – **D**istributed system operators **R**ole in the **E**nergy **M**arket

Partners in the project are: Radius Elnet (project leader), HOFOR, DTU, Markedskraft and EURISCO

The objective of the DREM project is to investigate specific problems faced by DSOs in a future energy system where power system balancing services are provided by flexibility assets, connected at the distribution level.

Large scale use of flexibility assets may cause congestion problems as well as market conflicts between operators, and the overall socio-economic objectives may be hampered by private financial objectives.

DREM will investigate how the DSO could provide a service in a form of a *Trade Permission System* (TPS) to secure that trade on electricity markets is not causing congesting problems in the distribution system.

The communication scheme that forms the basic instrument in TPS is expected to utilize and further develop the communication protocol developed and tested in another R&D project called CHPCOM (Combined Heat and Power Communication www.chpcom.dk) where congestion issues from the DSO point of view, was not investigated completely.

CHPCOM developed and tested a standardized communication platform[1] primary for the CHP, which is facilitating easy and safe communication between energy assets in general. The perspective of the CHPCOM project was precisely to enable such communication used further in a smart energy future and in this way, facilitate marked models and smooth competition.

The scope of this document

- ✓ This document will focus on the ICT requirements for the data communication platform, based on the main concept and findings from other deliverables in DREM – especially WP2/WP3 and WP5.
- ✓ Analysis on regulatory requirements and concepts of information hubs will be made and documented.
- ✓ Basic ICT architecture model will be developed based on input from the other work packages, both from a logical and physical point of view.
- ✓ ICT use cases will be documented, to explain the information exchange between the actors involved.
- ✓ All references to material used for the analysis and requirements specification, will be listed in the annex.

[1] CHPCOM used IEC 61850, which is generally agreed to be the international standard. Energinet.dk has in Regulations since 2007 recommended this standard.

Statements

The European electricity sector is undergoing radical changes in every segment of the power industry, from generation to supply. Ambitious policy goals set at European level to enhance the competitiveness, security and sustainability of the EU's energy system have called for major changes in the regulatory, technological, and market structure fields.

The distribution sector is particularly affected by these changes. The increasing penetration of local renewable generation and the emergence of demand response enabling solutions are placing new requirements on the distribution networks, posing challenges to the reliability and efficiency of system operation. At the same time, however, these new applications can also create opportunities to manage the distribution grids in a more flexible and efficient way, paving the way to new services to end consumers.

JRC Technical Reports 'Distribution system operators observatory'

Basic architecture

From the very beginning of the DREM application and project start, the figure 1 has been the basic ICT architecture that has been in scope.

The red lines are ICT information exchange between the **actors** (grey boxes) and the **systems** (blue boxes).

The **TPS platform** (green box) listed under the DSO domain, is the focus for this requirements specification.

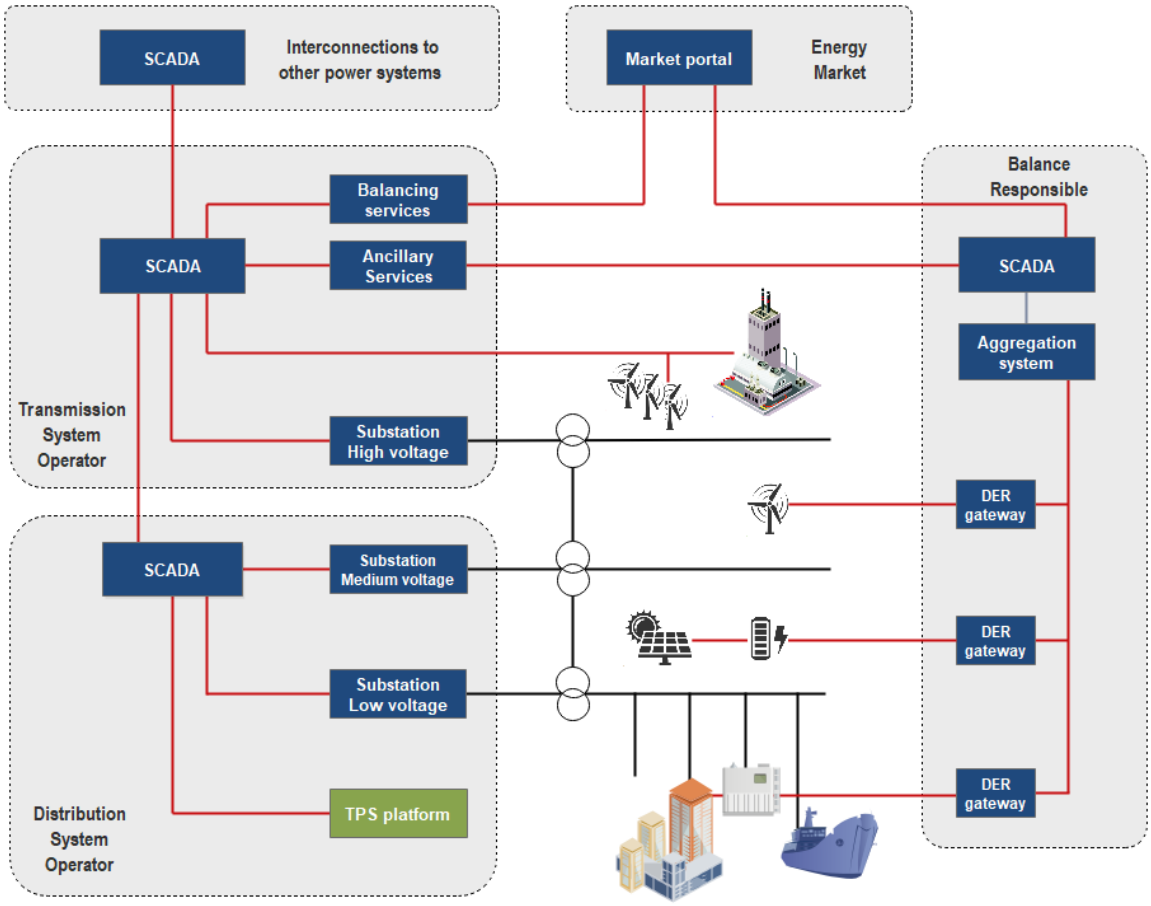

Figure 1 Basic ICT architecture

International standards used in DREM

International standards are an important part of a future power system, based on digital infrastructure with data exchange between national and international partners.

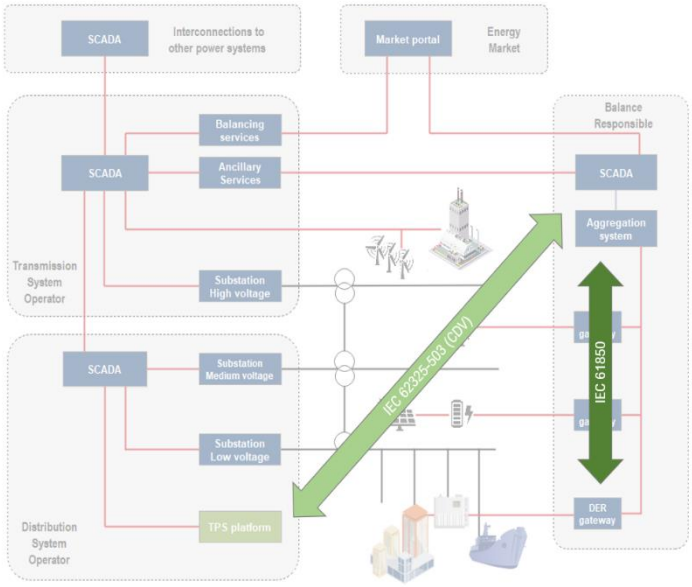

Figure 2 ICT architecture with international standards

The DREM project will generally be focusing on two standard series for data exchange, which are:

IEC 61850 for **real-time** data exchange

IEC 62325 for **market-based** data exchange

It is a very important requirement for the DREM project, that international standards are used – which can be referenced by regulators in the current harmonization process for grid codes.

Why is DREM based on international standards?

The integration of renewable energy sources (RES), which is a major target of the EU's energy and climate policy objectives for 2020 and beyond, will affect existing electricity grid infrastructure, operations and the functioning of the electricity market itself. The integration of renewables into the power system requires for their intermittency to be balanced.

This can be tackled by electricity grids operating smartly and cost-efficiently. To do this, a seamless and efficient information exchange is necessary at various stages, between an increasing number of companies – TSOs, DSOs, generators, etc.

Such information exchanges have become indispensable in network planning (outage- and congestion management, etc), distribution system operation (real-time information from the sub-stations and feeder equipment etc.), market (generation schedules, trades, balancing resource management, etc.).

Data exchange involving so many different actors and systems, require international standards and harmonized regulation.

European grid codes for generation and load

EU-wide rules have become increasingly necessary to effectively manage electricity flows. These rules, known as network codes or guidelines, are legally binding European Commission implementing Regulations. They govern all cross-border electricity market transactions and system operations alongside the EU Regulation 714/2009 on conditions for accessing the network for cross-border electricity exchanges.

Some of the relevant grid codes and regulations used as background material for the DREM requirement specification, is listed here:

System Operation

The Regulation establishing a guideline on electricity transmission system operation (SO) entered into force on 14 September 2017. The provisions of SO establish a framework for the maintenance of the secure operation of the interconnected transmission system in real time.

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017R1485

Requirements for Generators

The Regulation establishing a network code on requirement for grid connection of generators (RfG) entered into force on 17 May 2016. The provisions of RfG set out detailed rules relating to the connection of, principally, new power generating installations to national electricity networks.

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:JOL_2016_112_R_0001

Electricity network codes and guidelines

The Regulation establishing a network code on demand connection (DCC) entered into force on 7 September 2016. The provisions of DCC set out detailed rules relating to the connection of, principally, new demand facilities to national electricity networks.

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1388&from=EN

Emergency and Restoration

The Regulation establishing a network code on emergency and restoration entered into force on 18 December 2017. The Emergency and Restoration network code will set down rules relating to the management of the electricity transmission system in the emergency, blackout and restoration states. The main objective of the relevant rules is to bring the system back to the normal state. The below is the provisional final version of the text, which will be shortly placed on the comitology register, with updates to numbering and referencing where required

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017R2196

Capacity Allocation and Congestion Management

The Regulation establishing a guideline on Capacity Allocation and Congestion Management (CACM) entered into force on 15 August 2015. The provisions of CACM govern the establishment of cross-border EU electricity markets in the day-ahead and intraday timeframes, as well as methods for the calculation of interconnection capacity.

DREM data communication-based use cases

The WP2 report (D2.2 Workshop Report Final) concludes that using a Trade Permission System to communicate between AGR/BRP and DSO is a good solution. The report also concludes that the different described scenarios is fully covered by one of two main use cases:

- Foreseen Capacity Issues, where the DSO communicates ahead of time when capacity issues may arise, due to scheduled maintenance of the power grid lines and connected equipment.
- Unforeseen Capacity Issues, where the DSO communicates an abnormality in the power grid, that results in limitation of the available capacity in the grid.

The following communication diagrams involves five different systems / functions:

- AGR/BRP : Aggregators and Balance Responsible Parties, responsible for operating flexibility assets connected to the power grid.
- DSO : Distribution System Operator – an entity that operates a sub section of the national power grid on the distribution level.
- Static Information : a catalogue of information about flexibility assets connected to grid, their capabilities, and the AGR/BRP that operates the flexibility asset.
- Dynamic Information Broker : facilitates communication between AGR/BRP and DSO using standardised protocols. The broker will forward messages between the two sides, without disclosing information that is not relevant for the processes to work as intended.
- Fairness Filter : a feature that fairly distribute capacity limitations between AGR/BRPs operating affected flexibility assets. While the feature is recognised as necessary for a fully operational TPS platform, the specification and design of such a feature is not in scope in the DREM project.

Foreseen Capacity Issues

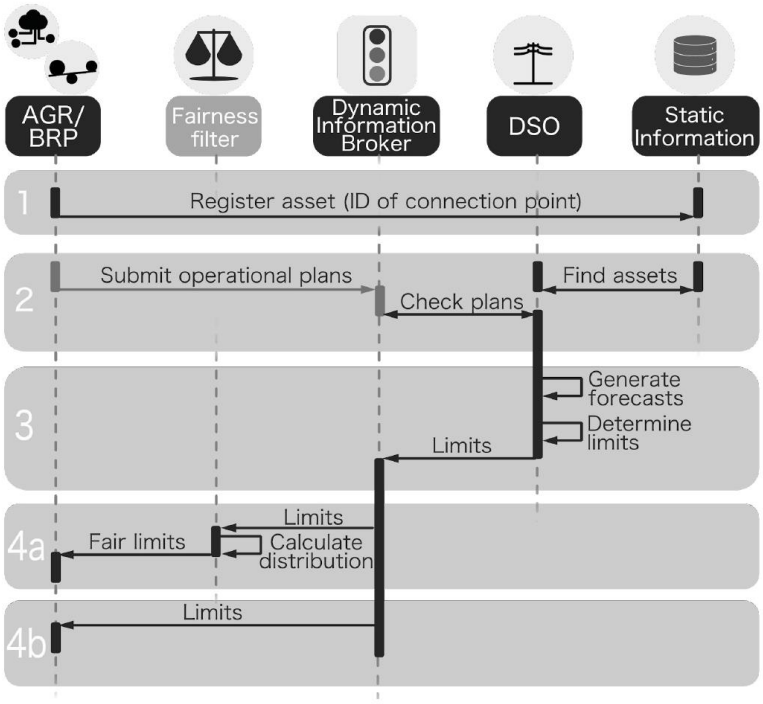

Figure 3 Communication of Foreseen Capacity Issues

As seen in 'Figure 3 Communication of Foreseen Capacity Issues', the communication of foreseen capacity issues involves several communication sequences.

1) The AGR or BRP updates the Static Information system with information about the flexibility assets that they operate. The data will reflect which AGR/BRP operates the flexibility asset, where the flexibility asset is electrically connected in the power grid and the capabilities of the flexibility assets.
   This update should happen whenever flexibility assets are connected to or disconnected from the power grid, or if flexibility assets gets reassigned to a different operator.

2) On a regularly basic (e.g. daily), the DSO will retrieve a list of flexibility assets connected to their power grid. The list will not disclose details on who operates the flexibility assets.
   Also, the DSO checks for operational plans for the flexibility assets, submitted by the AGRs/BRPs to the Dynamic Information Broker. These plans reflect the production and/or consumption planned for the flexibility assets.
   While submitting operation plans is not mandatory, it will greatly help the DSO when determining capacity issues. Without any operational plans, the estimations must include a greater safety margin, hence will allow less operational flexibility compared to if operational plans are provided.

3) Based on knowledge about scheduled maintenance of the power grid that the DSO operates, historical power flow in the grid and flexibility asset operational plans, the DSO estimates expected power production and consumption in the grid and determines limits in the available capacity. Information about the limits and which flexibility assets are affected by these limits and sent to the Dynamic Information Broker.

4) The Dynamic Information Broker communicates the capacity limits to the AGR/BRPs that operates the flexibility assets involved. The TPS shall distribute the limits between the AGR/BRPs, so that they get a fair share of the total limit. As determining the meaning of "fair" is a complex matter, it is deemed out of scope of DREM. In the proof-of-concept implementation, the sharing is based on a 'percentage of total' that each AGR/BRPs operates in the affected section of the grid.

Unforeseen Capacity Issues

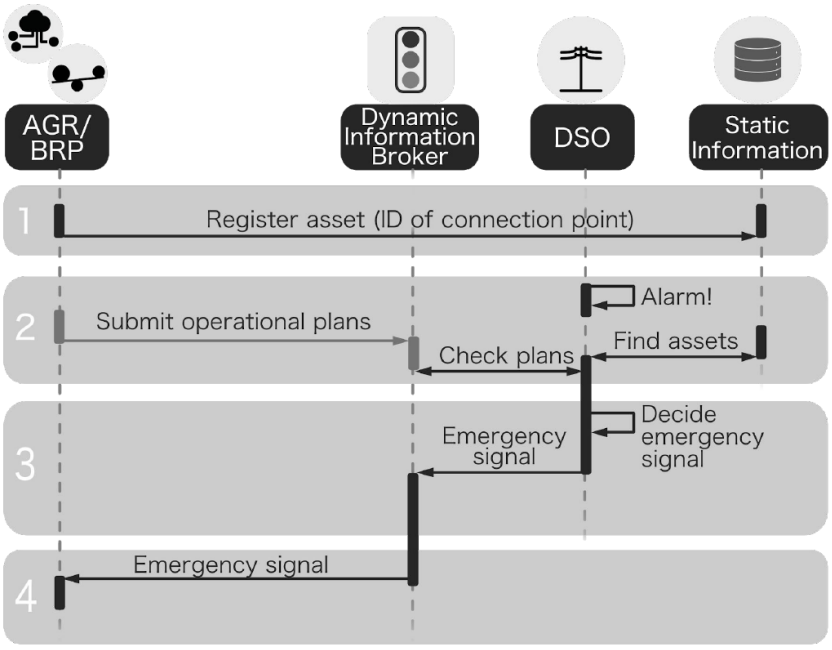

Figure 4 Communication of Unforeseen Capacity Issues

As seen in 'Figure 4 Communication of Unforeseen Capacity Issues', the communication sequences that takes place in the unforeseen capacity issues scenario, are as follows:

1) Just like in the foreseen scenario, the AGR or BRP updates the Static Information system with information about the flexibility assets that they operate. The data will reflect which AGR/BRP operates the flexibility asset, where the flexibility asset is electrically connected in the power grid and the capabilities of the flexibility assets.
   This update should happen whenever flexibility assets are connected to or disconnected from the power grid, or if flexibility assets gets reassigned to a different operator.

2) The DSO detects an abnormality in their power grid, that could result in a severe situation, if not dealt with on short notice.
   The DSO requests a list of flexibility assets connected to the power grid section affected by the abnormality. For the sake of speediness, this information could have been previously fetched and cached by the DSO on a regularly basis (e.g. hourly), so that the list would already be available in a system local to the DSO.
   Then the DSO checks for submitted plans for the listed flexibility assets. This could also be a regularly updated and cached version of the plans available from the Dynamic Information Broker.

3) Based on the operational plans and type of affected flexibility assets, the DSO then determines whether the flexibility assets should stop or continue producing or consuming power or start production or consumption. This information is sent to the Dynamic Information Broker.

4) The Dynamic Information Broker distributes the emergency signal to the AGR/BRPs that operates the flexibility assets.

Requirements for DREM data communication

The DREM data communication use cases are being tested and validated using a proof-of-concept (PoC) implementation of a communication platform.

The requirements to the platform are collected in two groups: functional and non-functional.

Functional requirements are the main features that users would expect from the system, i.e. what the system should do. For example, if the system is an online to-do list application, it should be possible to create a new list, add an item to a list, remove an item from a list, etc.

Non-functional requirements are not straight forward requirement of the system. In some way they are related to the usability of the system. With the example of an online application a major non-functional requirement would be availability, e.g. the application should be available 24/7 with no down time.

The requirements reflect the solutions proposed by the "D2.2 Workshop Report Final" document:

Solution acronym	Solution name
R-1	Registration of flexibility units on the Datahub
R-2	Redefining the DSOs installed capacity obligation
R-3	Aggregators must be attached to a BRP
R-4	DSOs are not required to reimburse for trade interruptions
R-5	DSOs are not responsible for redispatch impact
M-1	Use of flexibility markets for DSO services
M-2	Redefinition of services to include rebound
C-1	Establishing a dynamic information broker for allowing the DSO to communicate limits to BRP/AGR
C-2	AGR/BRPs submit operational schedules

Functional requirements

F1 - Standardised communication

Communication within the platform SHALL be according to the international standard IEC 62351-503 (MADES MArket Data Exchange Standard).

The platform SHALL provide an ECP Component Directory, an ECP Broker and three ECP Endpoints (one per backend as specified in requirement 'NF1 - Grouping of functionality').

The messages communicated SHALL be using XML documents as specified in 'IEC 62325-451 Framework for energy market communications. As the documents have been designed to exchange power grid related information between Transmission System Operators (TSO), it MAY be necessary to extend the documents with additional information. If such extensions are necessary, they SHALL follow the rules of extensions as specified in the IEC 62325 documents.

Messages SHALL only be communicated indirectly between AGR/BRP and DSO modules (i.e. with the platform as mediator; communication SHALL NOT take place between the AGR/BRP and DSO modules directly.

F2 - Web service interfaces

The AGR/BRP and DSO backend implementation SHALL provide a REST/HTTP based interface that simplifies the sending and receiving of the standardised messages. The interfaces SHALL be specified using the RESTful API Modelling Language (RAML).

The AGR/BRP interface SHALL include the following functionality:

- ping : for checking if the interface is available, SHALL respond with pong
- set, update, get and delete the configuration of a flexibility asset (ref. 'F4 - Registration of flexibility assets' for details)
- set, update and cancel operational plans for a flexibility asset (ref.: 'F8 – Sending operational schedules' for details)
- get relevant capacity limit plans (ref.: 'F7 – Retrieving capacity limits' for details)

The DSO interface SHALL include the following functionality:

- ping : for checking if the interface is available, SHALL respond with pong
- get list of flexibility assets (ref.: 'F5 – List available flexibility assets' for details)
- set, update and cancel capacity limits (ref.: 'F6 – Sending capacity limit' for details)
- get operational plans (ref.: 'F9 – Receiving operational schedules' for details)

F3 - Web based graphical user interface

The DREM-TPS backend SHALL provide a graphical web interface that can be used for demonstration purposes.

It SHALL provide a display of:

- operational plans sent by a selected AGR/BRP
- capacity restrictions sent by a selected DSO
- possible implications between operational plans and capacity restrictions

F4 - Registration of flexibility assets

This requirement is described in the D2.2 Workshop Report as" R-1 Registration of flexibility units on the Datahub"

The DSOs has to know which flexibility assets are connected to the power grid and where in the grid the flexibility assets are connected. This information is provided by the AGR/BRPs which operate the flexibility assets.

For the DSOs to be able to only receive information about flexibility assets connected to the power grid that the DSO operates, the DSO needs to provide information about the electrical connection points in their respective grid.

Flexibility asset registration message

The message communicated SHALL include the following information:

- the ID of the flexibility asset
- who operates the flexibility asset
- the ID of the electrical connection point of the flexibility asset
- the capabilities of the flexibility asset; whether the flexibility asset is producing and/or consuming, and the maximum power it can produce or consume

The content and structure of the message SHALL be as specified in IEC 62325-451-N Ref_MarketDocument.

The message SHALL be communicated as specified in requirement'F1 - Standardised communication'.

Electrical Connection Point registration message

In order to allow a DSO to get a list of flexibility assets connected to their power grid, the DSOs need to register electrical connection points with the platform. Such a message SHALL include the following information:

- the ID of the DSO
- the IDs of electrical connection points in their grid

The content and structure of the message SHALL be as specified in IEC 62325-451-N Ref_MarketDocument.

The message SHALL be communicated as specified in requirement'F1 - Standardised communication'.

F4a – DREM-TPS backend

The DREM-TPS backend SHALL be able to receive and process the messages specified in requirement'F4 - Registration of flexibility assets'.

F4b – AGR/BRP backend

The AGR/BRP backend SHALL provide a REST interface for sending flexibility asset information messages to the DREM-TPS backend, as specified in the requirement 'F4 - Registration of flexibility assets - Flexibility asset registration message'.

The REST interface SHALL implement endpoints to provide the following functionality:

- set the information about a flexibility asset
  - SHALL allow setting one or more flexibility assets in a single endpoint call
- get information about a flexibility asset
  - SHALL allow listing one or more flexibility assets in a single endpoint call
- update the information about a flexibility asset
  - SHALL allow setting one or more flexibility assets in a single endpoint call
- remove information about a flexibility asset
  - SHALL allow removing one or more flexibility assets in a single endpoint call

F4c – DSO backend

The DSO backend SHALL provide a REST interface for sending electrical connection point registration messages to the DREM-TPS backend, as specified in the requirement 'F4 - Registration of flexibility assets - Electrical Connection Point registration message'.

The REST interface SHALL implement endpoints to provide the following functionality:

- set the information about a connection point
  - SHALL allow setting one or more connection points in a single endpoint call
- get information about a connection point
  - SHALL allow listing one or more connection points in a single endpoint call
- update the information about a connection point
  - SHALL allow setting one or more connection points in a single endpoint call
- remove information about a connection point
  - SHALL allow removing one or more connection points in a single endpoint call

F5 – List available flexibility assets

This requirement is described in the D2.2 Workshop Report as" C-1 Establishing a dynamic information broker for allowing the DSO to communicate limits to BRP/AGR"

In order for the DSO to communicate limits to the AGR/BRP, the DSO need knowledge about flexibility assets connected to the power grid.

Get flexibility asset list message

The message for requesting a list of available flexibility assets SHALL include the following information:

- the ID of the DSO

The structure of this message is specified in IEC 62325-451-5 StatusRequest_MarketDocument.

Flexibility asset list message

The message that provides a list of available flexibility assets SHALL include the following information:

- the ID of the DSO that operates the power grid that the listed flexibility assets are electrically connected to
- a list of flexibility assets, where each flexibility asset SHALL be described by
    - the ID of the flexibility asset
    - the ID of the electrical connection point

The message SHALL NOT include details on the operator of the flexibility asset.

The structure of this message is specified in IEC 62351-451-N Ref_MarketDocument.

The messages SHALL be communicated as specified in requirement'F1 - Standardised communication'.

F5a – DREM-TPS backend

The DREM-TPS backend SHALL be able to receive and process the message specified in requirement'F5 – List available flexibility assets - Get flexibility asset list message'.

The DREM-TPS backend SHALL be able to generate and send the message specified in requirement'F5 – List available flexibility assets - Flexibility asset list message'.

F5b – DSO backend

The DSO backend SHALL provide a REST interface for listing available flexibility assets, as specified in the requirement'F5 – List available flexibility assets'.

The REST interface SHALL implement endpoints to provide the following functionality:

- get the current list of flexibility assets
    - SHALL return all flexibility assets connected to power grid that the DSO operates
- get changes when the list is updated
    - SHALL return with an empty list after a while if the list has not changed since the request was made
    - SHALL return with a list only including new or changed flexibility assets, when the list has been changed

F6 – Sending capacity limit

This requirement is described in the D2.2 Workshop Report as" C-1 Establishing a dynamic information broker for allowing the DSO to communicate limits to BRP/AGR"

It allows a DSO to indirectly notify an AGR/BRP about limitation in available capacity in the power grid.

This requirement deals with two scenarios:

1) Foreseen: scheduled maintenance of a substation will result in the station being disconnected from the grid, hence limiting the available capacity in a section of the power grid
2) Unforeseen: an unscheduled event, e.g. an internal component of a substation forces a power line disconnect

The foreseen message SHALL include the following details:

- flexibility assets affected by the incident
- the capacity available for use by these flexibility assets
- the time period when the capacity is limited

The unforeseen message SHALL include the following details:

- flexibility assets affected by the incident
- the action required by these flexibility assets; the action SHALL indicate either start, stop or hold
- date/time when the incident is expected to be dealt with, hence the power grid returning to normal operation

The structure of the message is specified in IEC 62325-451-6 Unavailablity_MarketDocument

The messages SHALL be communicated as specified in requirement'F1 - Standardised communication'.

F6a – DREM-TPS backend

The DREM-TPS backend SHALL be able to receive and process the messages described in requirement'F6 – Sending capacity limit'.

Based on the listed flexibility assets in the message sent by the DSO, the DREM-TPS backend SHALL forward the message to any AGR/BRP that controls one or more of these flexibility assets. Capacity limits SHALL be fairly divided between flexibility assets.

F6b – DSO backend

The DSO backend SHALL be able to generate and send the messages described in requirement' F6 – Sending capacity limit'

The DSO backend SHALL provide a REST interface for sending foreseen and unforeseen capacity limit plans to the DREM-TPS backend, as specified in the requirement'F6 – Sending capacity limit'

The REST interface SHALL implement endpoints that provides the following functionality:

- sending a foreseen capacity limit message
- sending an unforeseen capacity limit message
- sending an update to a foreseen capacity limit message
- sending an update to an unforeseen capacity limit message
- cancelling/deleting a foreseen capacity limit message

- cancelling/deleting an unforeseen capacity limit message

Parameters for the messages to be send are described in requirement'F6 – Sending capacity limit'.

F7 – Retrieving capacity limits

This requirement is described in the D2.2 Workshop Report as" C-1 Establishing a dynamic information broker for allowing the DSO to communicate limits to BRP/AGR"

It provides an AGR/BRP with knowledge about limitations in the power grid that may affect the operation of connected flexibility assets.

The content and structure of the messages SHALL be as defined by requirement'F6 – Sending capacity limit'

The message SHALL be communicated as specified in requirement'F1 - Standardised communication'.

F7a – AGR/BRP backend

The AGR/BRP backend SHALL be able to receive and parse the messages described in requirement'F7 – Retrieving capacity limits'

The AGR/BRP backend SHALL provide a REST interface for requesting foreseen and unforeseen capacity limit plans, as specified in the requirement'F7 – Retrieving capacity limits'

The AGR/BRP backend SHALL implement REST endpoints for the following functionality:

- get capacity limit schedules limited by time
  - SHALL return all schedules received by the platform within a specified period of time
  - SHALL only return schedules relevant for the AGR/BRP
- get capacity limit schedules that are currently active
  - SHALL return all non-expired schedules
  - SHALL only return schedules relevant for the AGR/BRP
- wait for new capacity limit schedules that are currently active
  - SHALL block until timeout or a new schedule is available
  - SHALL return all non-expired schedules that has been received by the AGR/BRP backend since the last time this endpoint was addressed
  - SHALL only return schedules relevant for the AGR/BRP

F8 – Sending operational schedules

This requirement is described in the D2.2 Workshop Report as" C-2 AGR/BRPs submit operational schedules"

It allows an AGR/BRP to inform DSOs about planned energy production and consumption, which can help the DSO to more precisely estimate if capacity issues will arise in their power grid.

The message SHALL include the following information:

- the ID of the AGR/BRP
- list of flexibility assets; for each flexibility asset, the following information SHALL be provided:
  - ID of the flexibility asset
  - a schedule, where positive values is 'production' and negative values is 'consumption'

The content and structure of the message SHALL be as specified in IEC 62325-451-6 GL_MarketDocument.

The message SHALL be communicated as specified in requirement'F1 - Standardised communication'.

F8a – DREM-TPS backend

The DREM-TPS backend SHALL be able to receive and process the messages described in requirement'F8 – Sending operational schedules'.

Based on the listed flexibility assets in the message sent by the AGR/BRP, the DREM-TPS backend SHALL reorganize the message into a message per DSO and send these messages to the respective DSO.

F8b – AGR/BRP backend

The AGR/BRP backend SHALL be able to generate and send the message described in requirement'F8 – Sending operational schedules'

The AGR/BRP backend SHALL provide a REST interface for sending operational plans messages, as specified in the requirement'F8 – Sending operational schedules'

The AGR/BRP backend SHALL implement REST endpoints for the following functionality:

- sending an operational schedules message for one or more flexibility assets
- sending an update to an operational schedules message for one or more flexibility assets
- cancelling/deleting an operational schedules message for one or more flexibility assets

F9 – Receiving operational schedules

This requirement is described in the D2.2 Workshop Report as" C-2 AGR/BRPs submit operational schedules"

It provides a DSO with knowledge about planned energy flows, that will help the DSO in estimating if issues could arise in their power grid.

The DSO can get the the schedules using two methods:

1. by sending a request to the platform
2. by waiting for an AGR/BRP to send new schedules

Message request

The message for requesting operational plans from the platform, SHALL include the following information:

- the ID of the DSO

The content and structure of the message SHALL be as specified by IEC 62325-451-5 StatusRequest_MarketDocument.

The message SHALL be communicated as specified in requirement'F1 - Standardised communication'.

Schedules message

The message for receiving operational plans, SHALL include the following information:

- the ID of the DSO
- a list of flexibility assets; for each flexibility asset, the following information SHALL be provided
    - the ID of the flexibility asset
    - a schedule, where positive values indicates feeding energy to the grid and negative values indicates removing energy from the grid

The message SHALL NOT include information about who operate the flexibility assets

The content and structure of the message SHALL be as specified by IEC 62325-451-6 GL_MarketDocument.

The message SHALL be communicated as specified in requirement'F1 - Standardised communication'.

F9a – DREM-TPS backend

The DREM-TPS backend SHALL be able to receive and parse the message described in requirement'F9 – Receiving operational schedules : Message request'.

It SHALL respond with a message as described in requirement'F9 – Receiving operational schedules : Schedules message'.

F9b – DSO backend

The DSO backend SHALL be able to receive and parse the message described in requirement'F9 – Receiving operational schedules : Schedules message'.

The DSO backend SHALL provide a REST interface for requesting and waiting for operational plans, as specified in the requirement 'F9 – Receiving operational schedules : Message request'.

The DSO backend SHALL implement REST endpoints for the following functionality:

- get operational schedules for one or more flexibility assets
  - SHALL only return schedules for flexibility assets connected to the DSOs grid
- Waits for new operation schedules
  - SHALL block until timeout or a new schedule is available
  - SHALL return all schedules that has been received by the DSO backend since the last time this endpoint was addressed
  - SHALL only return schedules for flexibility assets connected to the DSOs grid

Non-functional requirements

NF1 - Grouping of functionality

The PoC SHALL consist of three main groups of functionalities:

- An AGR/BRP backend, that an AGR or BRP can use to communicate with the platform
- A DSO backend, that a DSO can use to communicate with the platform
- A DREM-TPS backend, that implements the Static Information and Dynamic Information Broker functionality.

NF2 - Platform architecture

All modules of the platform SHALL be deployed in Docker or Kubernetes.

NF3 – Platform privacy

The platform SHALL prevent an actor from getting information that belongs to another actor. E.g. AGR#1 SHALL NOT be allowed to retrieve information provided by AGR#2.