



**Business Requirements
for
Settlement of
flexibility services**

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A. About this document

This Business Requirement Specification (BRS) describes the processes and the exchange of information related to settlement of flexibility services.

Based on determined flexibility volumes and a reference line (also called baseline), the Flexibility Settlement Responsible settles the delivered volumes of the flexibility services between the Flexibility Service Provider and the Buyer of Flexibility, determines and distributes non-delivered supply volumes and handles the compensation of imbalances and supply volumes.

The BRS is made in an ebIX® project with members and representatives of TSOs (related to ENTSO-E) and of DSOs. The reason for ebIX® to start modelling flexibility services was induced by the quickly growing interest in flexibility energy services and the increasing number of flexibility implementations, all be it most of them still experimentally. We tried to use as much experience as possible in the project in setting up this BRS by using the work of the “ebIX® Overview of energy flexibility services” [7] and the good work already done by other groups, such as USEF and Horizon 2020 projects, and using the experience from the project members.

One of the challenges of the project was, while discussing all details of different kinds of flexibility services, keeping the document at such an abstract level that in principle it covers all kind of different flexibility services and applications, ranging from balancing services, congestion services to services for portfolio optimisation.

As a general introduction ebIX® has published a separate document “Introduction to ebIX® Business Requirements and Business Information Models” [3]. The introduction also includes the generic model elements that are not specific for a particular business process.

In line with UN/CEFACT Modelling Methodology version 2 (UMM-2) ebIX® defines the business requirements as the first step in modelling energy market processes and data exchange. This document specifies an UMM Business Requirements View, which consist of the three sub views: Business Domain View, Business Partner View and Business Entity View.

The Business Information Model is in turn the basis for the creation of XML schema’s and is the basis for the specification of web services.

Since the ebIX® model is open for national customisation, some attributes are added as optional for usage for regional/national customisation. If used, these attributes must be specified nationally.

A.1. References

A.1.1. Standards

- [1] UML Profile for UN/CEFACT’s Modelling Methodology (UMM), Base Module 2.0, (http://www.unece.org/cefact/umm/umm_index.html)
- [2] The Harmonized Role Model (for the Electricity Market) by ebIX®, ENTSO-E, and EFET (www.ebix.org)

A.1.2. ebIX® Documents

- [3] Introduction to ebIX® Business Requirements and Business Information Models (www.ebix.org)
- [4] Recommended Identification Schemes for the European Energy Market (www.ebix.org)
- [5] ebIX® code lists (www.ebix.org)
- [6] ebIX® Business Requirements Specifications (www.ebix.org)
- [7] ebIX® Overview of energy flexibility services (www.ebix.org)

A.1.3. Energy flexibility services work by other groups

- [8] USEF (<https://www.usef.energy/>)
- [9] Horizon 2020 projects (EU-SysFlex, INTERFACE and OneNet) (<https://ec.europa.eu/programmes/horizon2020/en/home>)
- [10] Equigy project (<https://equigy.com/>)
- [11] CEDEC, E.DSO for Smart Grids, Eurelectric, GEODE and ENTSO-E; [A toolbox for TSOs and DSOs to make use of new system and grid services](#)

A.2. Participants in the project

These Business Requirements, as part of the ebIX® Model for the European Energy Market (*see [3]*), are prepared by the ebIX Flexibility project phase II, consisting of representatives from ebIX (and their countries), ENTSO-E, DSO’s and TSO’s.

A.3. Main changes since last version

Old	New	Clarification	Date
Version 1.0			
	v1r0A	First version approved by ebIX® Forum.	20231115

1. Business Requirements View: Settlement of flexibility services

1.1. Definitions

An **activation window** is a period of time agreed between the Buyer of Flexibility and the Flexibility Service Provider to activate the flexibility service in question. The activation window begins when the Buyer of Flexibility requires the activation and includes the time for ramping up and down, as opposite to a “delivery period” that only includes the period of time where the Resource or Pool of Resources delivers the full effect.

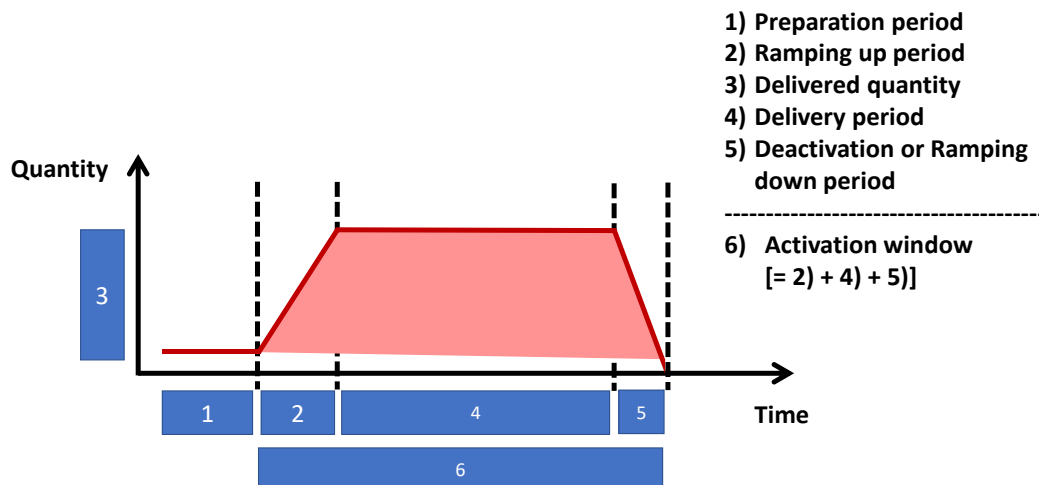


Figure 1 What is an activation window?

Flexibility is defined as the capability to modify generation injection and/or consumption patterns in the energy system¹ (like electricity or gas) - on an individual Resource, Accounting Point or aggregated level - on external request.

The **flexibility volume** is the quantity of energy or capacity delivered as a flexibility service.

Flexibility services are energy services offered, where flexibility is used to meet the needs of energy market participants or System Operators on existing or new energy or capacity markets. Examples are defined as balancing services, non-frequency ancillary services, congestion management services, etc.

Flexibility Service Provider is a party that offers flexibility services to the energy and/or capacity market(s) based on acquired (aggregated) capabilities².

The new role **Flexibility Settlement Responsible (FSR)**³ is introduced in this document, defined as a party that is responsible for the quantification and settlement of the energy volume and of the volume

¹ An energy system is a system primarily designed to supply energy-services to end-users, see [Energy system \(Wikipedia\)](#).

² The “Aggregator” (including the “Independent aggregator”) often corresponds to the Flexibility Service Provider role.

³ The term Flexibility Settlement Responsible is an intermediate term that may be changed in the future.

compensation (positive or negative) of the supplied energy or capacity for the delivered flexibility service by a Flexibility Service Provider.

Grid constraints are technical requirements, such as thermal limit of a network element and/or voltage limits for a grid section, part of operational security limits of an operational grid that need to be observed to meet security requirements defined in Article 18 of the EU System Operation Guideline⁴.”

A **pool** is a collection of one or more Resources that is used by a Flexibility Service Provider to offer certain flexibility services to the market.

A **reference line** (also called baseline) is the best approximation of the normal load or generation curve for an Accounting Point or Resource (group) without flexibility services being invoked. In this way the flexibility services that are delivered can be quantified (as the difference between reference line and measurements of operation) and non-delivered supply volumes can be determined. The reference line can be estimated based on schedules or based on actual production/consumption measurements. The method of calculating the reference line is agreed between the Buyer of Flexibility and the Flexibility Service Provider, or defined in the product specification, governed by national rules or regulations.

The reference line can be ex-ante (equals the schedules) and ex-post (based on actual production/consumption measurements), dependent on the product specification:

1. Ex-ante: the predicted and confirmed (but not necessarily validated) energy consumption/production measurements, latest just before operational time, per time interval, normally on an aggregated level, but may depending on the service be “drilled down” to an individual Accounting Point or Resource.
2. Ex-post: a reference line can be calculated based on actual production/consumption measurements.

We introduce the **Reference Line Responsible** role for the party that is responsible for establishing and distributing the reference line for the flexibility services for a (set of) Resource(s). The reference line is determined either by calculation or by using measured data. The role may be performed by the Flexibility Service Provider, the Buyer of Flexibility or a third-party.

A **Resource** delivers the capability to modify generation injection and/or consumption patterns in the energy system (like electricity or gas). It is a market representation of an asset, or a group of assets having this capability. A Resource represents for example grid assets, energy generating units, energy consuming units, energy storing units or a virtual power plant.

1.2. Basic principles and assumptions

- When defining the UseCases in this Business Requirement Specifications (BRS), the electricity sector has been the focus area. However, it should be possible to also use the UseCases as a basis for other energy sources, such as gas or heat/cold.

⁴ Article 18 COMMISSION REGULATION (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation.

- “The happy flow principle” is used in the UseCase descriptions, i.e., the focus is the expected outcome of a process and exceptions on this outcome (rejections, etc.) are described in the “exception row”.
- It is not differentiated between flexibility (trades) used by a System Operator (DSO or TSO) and other market parties. The model should be applicable for all kinds of applications of flexibility and all kind or parties that can buy flexibility services, i.e. the Buyer of Flexibility.
- We realise that not all market rules and regulations, roles, domains and processes are finally defined in the energy and/or capacity market(s) yet.
- It is assumed that (near) real-time measured data are non-validated. These measured data are directly sent by the Metered Data Collector⁵.
- All non-real-time measured data are assumed to be validated by the Metered Data Responsible and to be distributed by the Metered Data Administrator⁶.
- In this BRS it is assumed that parties that are involved in the process are implicitly consented, i.e. consented by law or regulation, to receive relevant data. Other parties who are interested in receiving these data may get them under the condition that they are explicitly consented by the Customer. These parties are called Consented Parties.
- Settlement can be done for both activation and availability of both energy and capacity. In this BRS we split into settlement of the availability of flexibility and settlement of the consequences of activation of flexibility.
- For activated energy and capacity for flexibility services, a determined reference line and actual energy- or capacity-measurements are needed.
- Both (near) real-time measured data and validated measured data may be used for the determining the reference line and for the settlement of flexibility services.
- The Flexibility Settlement Responsible receives the reference line from the Reference Line Responsible and validated measurements from the Metered Data Administrator or non-validated real-time measured data directly from the Metered Data Collector as basis for the settlement. We assume that the Flexibility Settlement Responsible only settles the volume, hence doesn't calculate any prices nor amounts of money.
- There can only be one Flexibility Service Provider (FSP) responsible for a Resource for a delivery period, but a Flexibility Service Provider may have many Resources at the same time.
- We use Accounting Point as the object where energy (transfer) is measured for market purposes and where market players assume certain responsibilities in well-defined roles. An Accounting Point is a type of Metering Point. The administration of the characteristics for the Accounting Points, including the different responsible roles, is the Metering Point administration, performed by the Metering Point Administrator.
- Each Accounting Point is associated with a physical connection to the grid (sometimes referred to as connection point or similar). This Grid connection is identified with the “Grid connection ID” (*Definition*: “The unique identification of the grid connection the Accounting Point is

⁵ We assume it is the Metered Data Collector that provides (near) real-time measured data to the Flexibility Settlement Responsible. The Metered Data Collector can for instance be the same organisation that also has the role of Flexibility Service Provider, Resource Provider or an Energy Service Company.

⁶ The company assuming the role of Flexibility Service Provider may, based on national rules, also act in the role(s) as Metered Data Responsible and/or Metered Data Administrator.

connected to”). Each Accounting Point is connected to one Grid connection (ID), although there are rare cases where an Accounting Point can have more than one physical Grid connection to the grid. A Grid connection ID has one or more Accounting Points linked to it, as is the case for sub–Accounting Points (see below).

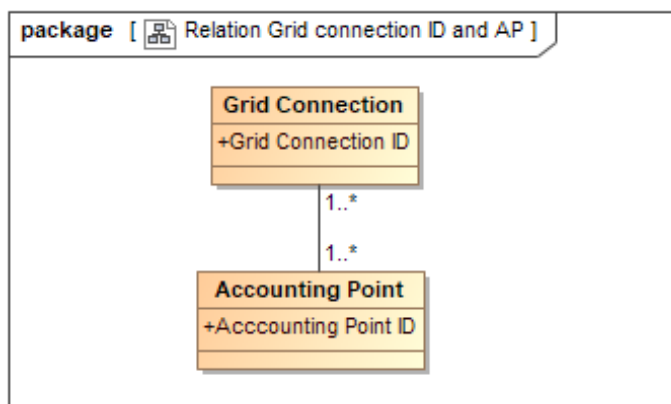


Figure 2 Relation between Grid connection ID and Accounting Point

- An Accounting Point consists of one or more Installation(s), which contains one or more Assets that consume or produce energy. At the connection of an Installation to the grid, the energy transfer usually is measured with one or more Meter(s).

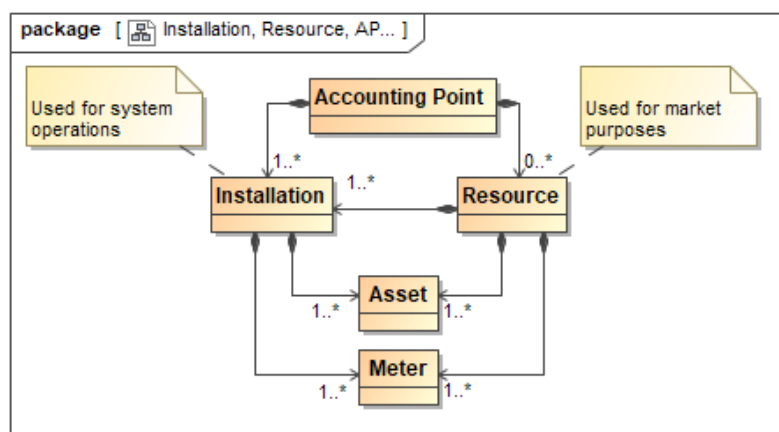


Figure 3 What is an Accounting Point?

Further, an Accounting Point can have zero or more Resources. A Resource is built up of one or more Assets of one or more Installations at the Accounting Point, but not all Assets from an Installation nor all Installations at an Accounting Point need to be part of a Resource. The Resource may be used for offering a certain energy and/or capacity (service) to the market. A Resource can be measured separately or using the meter(s) of the installation(s) of the Accounting Point. The Resource is through the Accounting Point also linked to the same Grid connection and has the same Grid connection ID as the Accounting Point it is part of.

Since this BRS concerns (flexibility) market processes, we use the Resource. The Installation is not used in the rest of the BRS.

- From each Accounting Point it may be split off one or more sub–Accounting Point(s) (linked to the same Grid connection ID), which is measured. A sub–Accounting Point can have zero or more Resources. Sometimes a Resource can for market reasons be split off into a sub–Accounting Point.
- The sub–Accounting Points (SAPs) must be treated as normal Accounting Points (APs) in the market processes. For the flexibility processes, measurements can come from Accounting

Point-, sub–Accounting Point- or Resource level. Where we write in this document Accounting Point it applies as well for a sub–Accounting Point; we do not (need to) distinguish between main and sub–Accounting Points.

- The reference line is at the same level as the measured data, i.e. on Accounting Point level, Resource level or both.
- The effect of a Resource for a flexibility service is determined based on actual measured data or calculated/profiled data. This can be done on Accounting Point or Resource level. Based on national rules these measured data are made available to the Flexibility Settlement Responsible and to other entitled roles, however these individual data, based on measured or calculated data at Resource level, are not necessarily made available via a Metered Data Responsible and/or Metered Data Administrator.

2. Business Domain View: Settle flexibility services

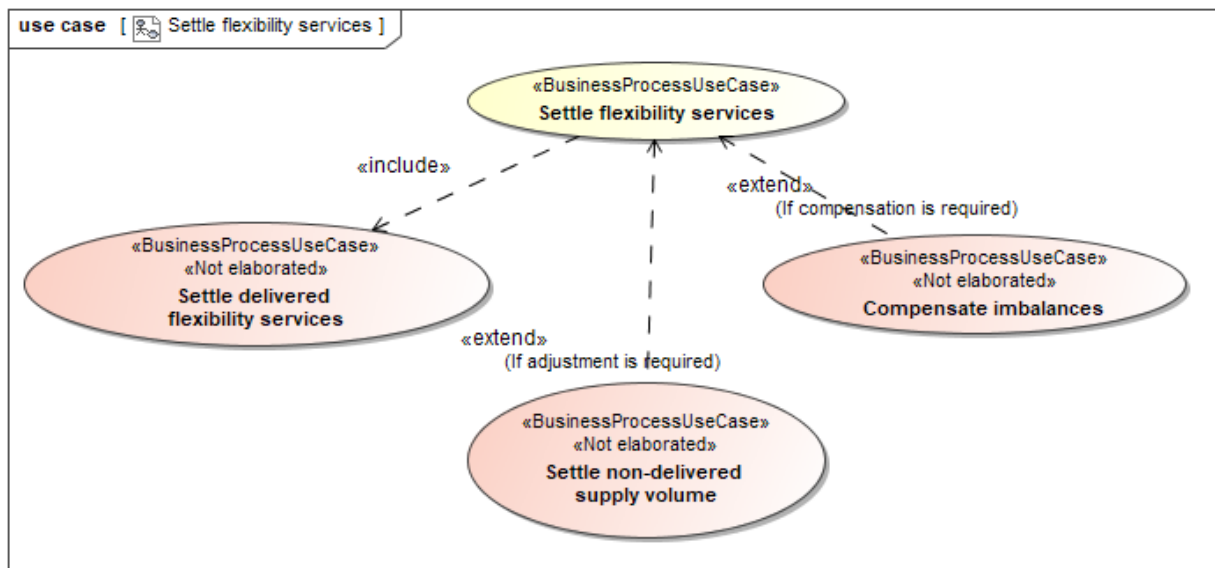


Figure 4 Business Process UseCase: Settle flexibility services

2.1. Description

UseCase description: Settle flexibility services	
definition	<p><i>This is an overview use case.</i></p> <p>In this process the Flexibility Settlement Responsible settles the agreed flexibility services (delivered services and, if applicable, contractual conditions) between the Flexibility Service Provider and the Buyer of Flexibility for the activation window. If needed (dependent on market rules and the used services) the Flexibility Settlement Responsible will settle the compensation of the Energy Supplier for the energy volume and/or compensation of the imbalances for the activation window between the Balance Responsible Parties involved.</p>
beginsWhen	<p>When the flexibility volumes for the flexibility services for the activation window have been determined and distributed or, in case of availability services, the activation window has expired.</p>
preCondition	<p>The Resources that contributed to the energy or capacity of the flexibility service for the activation window, are identified.</p> <p>Delivered (and non-delivered) quantities for the flexibility services for the activation window have been quantified and have been sent from the Flexibility Settlement Responsible to the Flexibility Service Provider and other involved roles.</p> <p>If applicable, all relevant roles have received the compensation volume.</p>

endsWhen	All relevant roles have agreed the settlement and if applicable the compensation for the flexibility services for the activation window.
postCondition	<p>The effects of the flexibility services for the activation window as agreed between the Flexibility Service Provider, the Buyer of Flexibility and other involved roles, as well as potential compensations are determined and exchanged, and the settlement is agreed and ready to be billed between the respective parties.</p> <p>The influence of the flexibility services transaction(s) on the portfolios (offerings)/positions of all other involved roles, is known/assigned for compensation and ready to be billed.</p>
exceptions	None.
actions	Not applicable at this level.

2.1.1. Settle delivered flexibility services

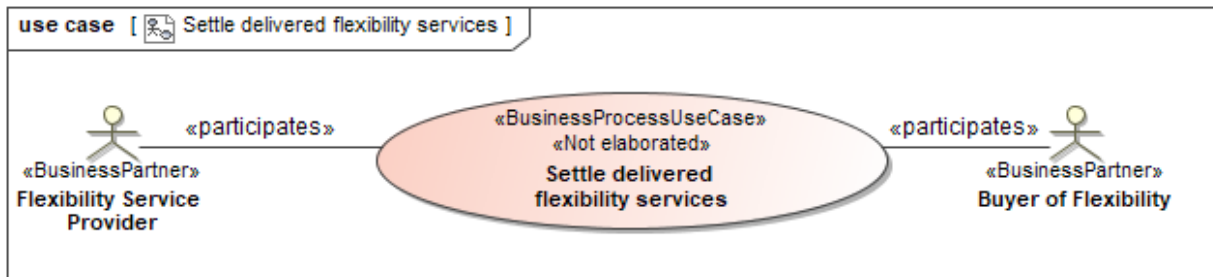


Figure 5 Business Process UseCase: Settle delivered flexibility services

2.1.1.1. Description

UseCase description: Settle delivered flexibility services	
definition	In this process the delivered flexibilities (activated services and/or availability services for the activation window) are settled between the Flexibility Service Provider and the Buyer of Flexibility.
beginsWhen	The activation window has expired and, in case of activated services, when the flexibility volume for the flexibility services for the activation window has been determined and distributed.
preCondition	In case of activated services, the Flexibility Service Provider and the Buyer of Flexibility have received the determined delivered flexibility volume for the flexibility services for the activation window.
endsWhen	Delivered flexibility services for the activation window have been agreed between the Flexibility Service Provider and the Buyer of Flexibility.
postCondition	The delivered flexibility services for the activation window as agreed between the Flexibility Service Provider and the Buyer of Flexibility are settled and are ready for billing and payment.
exceptions	None.
actions	This is not further elaborated, as it is for the time being expected to be a bilateral, diverse process.

2.1.2. Settle non-delivered supply volume

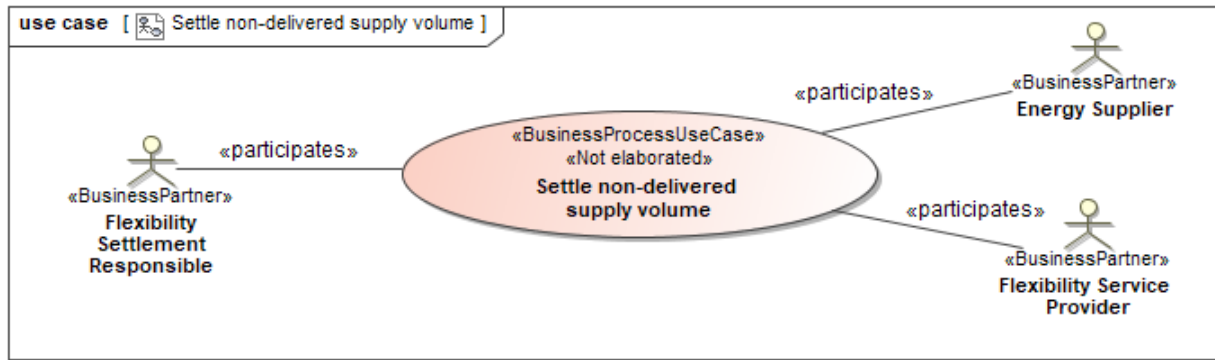


Figure 6 Business Process UseCase: Settle non-delivered supply volume

2.1.2.1.1. Description

UseCase description: Settle non-delivered supply volume	
definition	In this process the non-delivered supply volume is settled between the Flexibility Service Provider and the affected Energy Supplier(s). However, since these processes are not mature, the determination of the non-delivered supply volume is not specified.
beginsWhen	When the settlement process has started, and compensation of the non-delivered supply volume is agreed.
preCondition	The Flexibility Service Provider and the affected Energy Supplier(s) have agreed to determine and settle the non-delivered supply volume or the settlement is based on national or market rules.
endsWhen	The non-delivered supply volume per Energy Supplier for the activation window has been agreed.
postCondition	The non-delivered supply volume(s) for the flexibility services for the activation window for the affected Energy Supplier(s) is/are determined and settled and are ready for billing and payment.
exceptions	None.
actions	This is not further elaborated, as it is for the time being expected to be a bilateral, diverse process.

2.1.3. Compensate imbalances

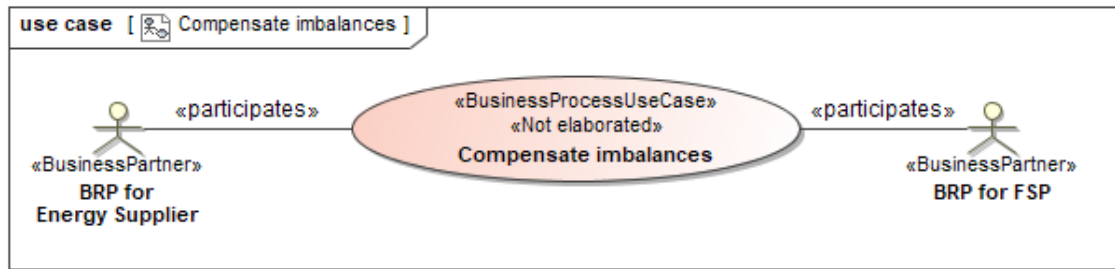


Figure 7 Business Process UseCase: Compensate imbalances

2.1.3.1.1. Description

UseCase description: Compensate imbalances	
definition	In this process the imbalances caused by activation of the flexibility service(s) in the activation window by the Flexibility Service Provider are compensated between the involved Balance Responsible Parties. Since these processes are not mature, the determination of the imbalance consequences between the involved Balance Responsible Parties is not specified.
beginsWhen	When there is a need for compensation between the involved Balance Responsible Parties.
preCondition	The two involved Balance Responsible Parties have received the determined flexibility volume. The imbalance settlement process has started.
endsWhen	The imbalance is compensated.
postCondition	The imbalance consequences of activation of the flexibility services for the activation window have been determined and agreed between the involved Balance Responsible Parties and are ready for billing and payment.
exceptions	None.
actions	This is not further elaborated, as it is for the time being expected to be a bilateral, diverse process.

3. Business Partner View: Settlement of flexibility services

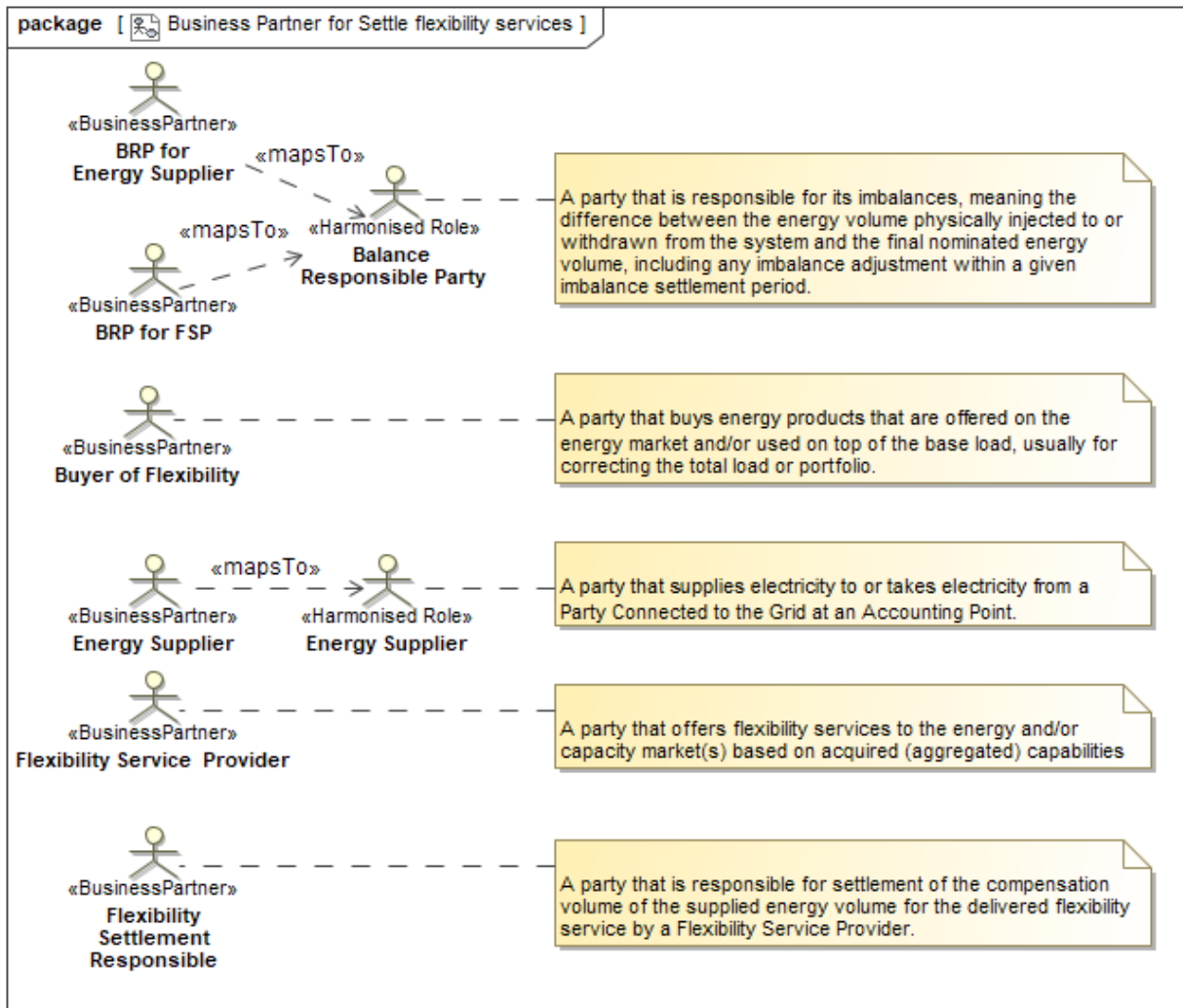


Figure 8 Business Partners related to Settlement of flexibility services

4. Business Entity View

Since, for the time being, the processes described in this BRS are expected to be a bilaterally agreed, the business entity view has not been elaborated.

A general introduction to the Business Entity View can be found in the Introduction to ebIX® Business Requirements and Business Information Models (www.ebix.org) [3].