Market Offering

Based on IEC 62559-2 edition 1
Generated from UML Use Case Repository with Modsarus® (EDF R&D Tool)

1. Description of the use case

1.1. Name of use case

Use case identification		
ID	***Area(s)/Domain(s)/Zone(s)***	***Name of use case***
	Distribution Management, Energy Markets, Transmission System, Distribution System, Users, Operational planning, Real-Time Operation	Market Offering

1.2. Version management

Version management				
Version No.	***Date***	***Name of author(s)***	***Changes***	***Approval status***
1	2018-08-20	Nermin Suljanovic & Hugo Morais		Approved Version

1.3. Scope and objectives of use case

Scope and objectives of use case	
Scope	- Demonstrate activities and information exchange during market offering procedure in which TSO (Transmission System Operator) procures different services like the balancing capacity. The offering process includes a technical validation of the DSO for the offers did by market participants with SGU (Significant Grid User) connected in the distribution system. - Validation of TSO/DSO coordination mechanism to distributed flexibility resources procurement avoiding double or counter activation of the same flexibility resource by TSO and DSO (Distribution System Operator). - Prevent the negative impact of blind offers activation in the networks - Definition of the data that should exchange between the TSO, the DSO and the market operator.
Objective(s)	In the Slovenian Scenario, DSO provides balancing service to TSO using demand response mechanism. Take advantage of increasing amount of flexibility resources connected in the distribution grid for providing services for the benefits of the overall power. Improve the system security. Evaluate the impact of the DSO technical validation of the offers
Related business case(s)	

1.4. Narrative of Use Case

Narrative of use case
Short description
This system use case defines the information exchange between the market operator, the system operators and the market participants. Two scenarios are described, namely, a scenario that will be tested in Slovenian demonstrator considering the active participation of the DSO in the balancing market and a scenario that will be tested in French demonstrator considering a generic approach to

validate different market services. In order to provide balancing service, DSO must pass pre-qualification procedure run by TSO.

Complete description

The System Use Case defines the information exchange for the market offering. Two different scenarios are proposed. The scenario 1 intends to describe the specific field test that will be implemented in Slovenia and the scenario 2 the demonstrator that will be tested in France in the TDX-ASSIST project. Both scenarios may not be applicable in other geographies or in networks with other types of constraints.

Scenario 1: Offering balancing service at the balancing market - Slovenian Scenario

This scenario describes the information exchange between the market participants and the market operator during the balancing services procurement.

In the present scenario the role of market operator is responsibility of the TSO. The DSO have two different roles in the present scenario: 1. can have the role of market participant; 2. can have the role of pre-operational planning validating the merit-order list of the market.

Exclusions: The offering process of other market participants is not described in the present scenario; the validation process provided by the DSO is not described.

TSO collects offers made by pre-qualified market participants in its control area using market platform, in order to create merit order list (MOL). The offering is done in two stages. In the first step, market participants send offers for the balancing capacity. If an offer is selected, the market participant signs the contract to provide balancing capacity in the limited time period (e.g. 1 year). During contracted period, the market participant is obliged to send offers for the balancing energy (mandatory offers). TSO creates MOL using mandatory offers with the lowest prices. All offers are further validated in the sense that activation of the balancing capacity is in line with overall safe grid operation. When balancing asset is connected to the distribution grid, conformity validation is done by DSO and information is exchanged with TSO prior MOL creation.
This scenario uses an assumption that DSO is eligible to make an offer for the balancing capacity utilizing demand response mechanism, such as conservation voltage reduction (CVR). DSO must be pre-qualified to make an offer for the balancing capacity. Offered balancing power (consumption reduction) is determined in refer to the baseline forecast, which is a prediction of energy consumption that does not take into account the likely effects of conservation actions. Prior balancing service provision, DSO should ensure that such action will not have negative impact on the voltage profile and loads in the distribution grid. The offered consumption reduction (power) is determined using analysis and calculations with restrictions that demand response actions will not cause voltage violations of more than 5%.

Scenario 2: Offering flexibilities at the national market - French Scenario

The French scenario intends to describe the scenario that will be tested in the French demonstrator. In the proposed architecture, each market actor should do the offers mentioning the location of the offer. If the offers were provided by SGU connected to distribution system, the location should be provided at least at HV/MV level. The scenario can be applied for different services requiring a technical validation of the DSO.

This scenario is composed by three different scenario.
1. The first one describes a generic process to send an offer to the market and to acknowledge the results of the market. The internal process to define the offer is not described in the present scenario.
2. The second scenario describes the process lo lead with the market offers. The market clearing mechanism is not described in the scenario.
3. Finally, the third scenario describes the process to validate the offers of the market participants with the SGU connected to distribution system.

1.5. Key performance indicators (KPI)

Key performance indicators			
ID	***Name***	***Description***	***Reference to mentioned use case objectives***
1	Number of successful offers, provided by DSO, in a time period (week, month)	Measure the impact of DSO offers in the Slovenian balancing market.	In the Slovenian Scenario, DSO provides balancing service to TSO using demand response mechanism.
2	Number of offers in the market	Evaluate the number of offers did by the DSO in the Slovenian balancing market.	In the Slovenian Scenario, DSO provides balancing service to TSO using demand response mechanism.
3	Number of procured offers did by market participants with resources connected to distribution system	Evaluate the impact of technical validation in the number of procured offers did by SGU connected in the distribution system. This impact can be evaluated considering the number of offers or the power of the offers.	Take advantage of increasing amount of flexibility resources connected in the distribution grid for providing services for the benefits of the overall power. Improve the system security. Evaluate the impact of the DSO technical validation of the offers
4	Number of constraints in the distribution system		Improve the system security.
5	Cost of the procured services	Evaluate the impact of the validation process in the services procurement.	Evaluate the impact of the DSO technical validation of the offers

1.6. Use case conditions

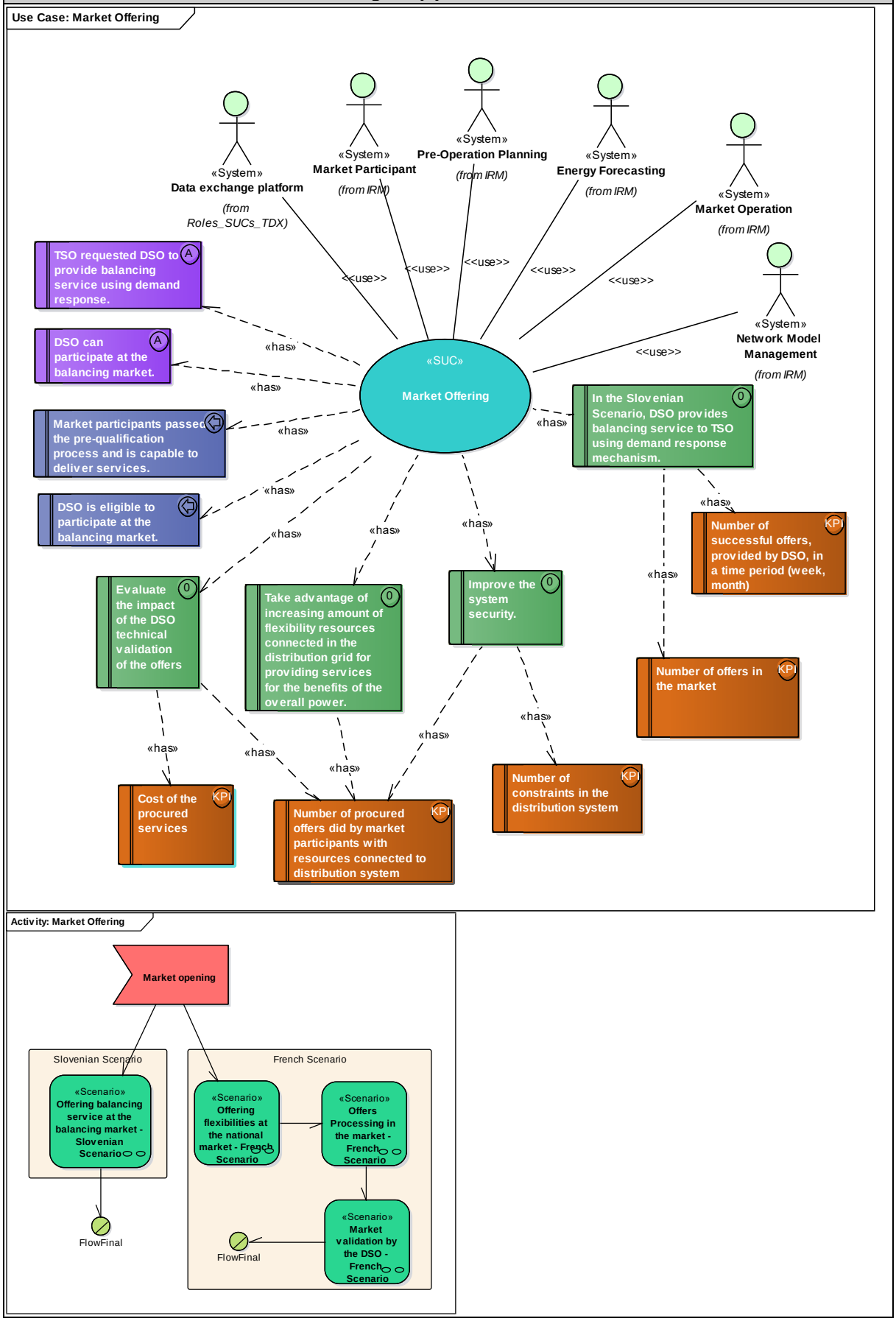
Use case conditions	
Assumptions	
1	DSO can participate at the balancing market.
2	TSO requested DSO to provide balancing service using demand response.
Prerequisites	
1	Market participants passed the pre-qualification process and is capable to deliver services.
2	DSO is eligible to participate at the balancing market.

1.7. Further information to the use case for classification/mapping

Classification information
Relation to other use cases
<<BUC>> Coordination of distributed flexibility resources in a marketplace <<BUC>> Activation of DSO-connected resources for balancing purposes in market environment <<SUC>> Information exchange using a collaborative platform <<SUC>> Market Pre-qualification <<SUC>> Market Services Activation
Level of depth
Prioritisation
High
Generic, regional or national relation
Specific use-case to be used in TDX-ASSIST project.
Nature of the use case
SUC
Further keywords for classification
Energy Markets; Offering

2. Diagrams of use case

Diagram(s) of use case



3. Technical details

3.1. Actors

Actors			
Grouping (e.g. domains, zones)		***Group description***	
Actor name	***Actor type***	***Actor description***	***Further information specific to this use case***
Market Participant	System	Party that describes an entity who participates in one or more markets through buying, selling, transmission, or distribution of energy, capacity or ancillary services into, out of, or through one or more areas of the power grid.	
Energy Forecasting	System	The Energy Forecasting business (EF) function involves the forecasting of one or more of the items consumption (load), production (primarily intermittent or price inelastic production), direct current and area inter-exchange. This also include energy forecast for intermittent or price inelastic production that is part of Distributed Energy Resources (DER).	
Data exchange platform	System	Platform used by several entities to exchange information for different proposes. The 3 types of data (Real-time; scheduled and structural data) can be exchanged in this platform. The operational/control data are not included in the real-time type. The exchange of information related with markets is included in the scheduled data. The data-agnostic ICT infrastructure enables a secure and reliable information exchange for different purposes and within different time scales.	
Pre-Operation Planning	System	The Predictive Operation Planning (POP) business function involved in forecasting future operation situation with an acceptable level of reliability, the inclusion of what-if scenarios and risk assessment. This include the management of adequate that requires system operators and planners to take into account scheduled and reasonably expected unscheduled availability of equipment, while maintaining a constant balance between supply and demand.	
Network Model Management	System	The Network Model Management (NMM) manages information for establishing and maintenance of the functional description of the network grid that is provided by current installed asset (as-built model), planned installed asset (future model) or potential installation (what-if/ hypothetical model). The focus is to provide a mathematical model of the network grid that can be used in different analysis of the grid, including but not limited to steady state power flow, state estimation, contingency analysis as part of security assessment and stability analysis. It maintains master representations of the power system for network analysis functions, so that all analysis shares the same source information. Network Model Management (NMM) handles both internal enterprise element and cross entity both in the horizontal and vertical domain, e.g. TSOs-TSOs and TSOs-DSOs coordination.	

Market Operation	System	The Market Operation (MO) business function involves the provision of a market based allocation of energy, capacity and ancillary services based on bid-based market clearing. Market Operations produce schedules and balancing dispatch instructions that are feasible considering market and grid constraints.	

3.2. References

4. Step by step analysis of use case

4.1. Overview of scenarios

Scenario conditions						
No.	***Scenario name***	***Scenario description***	***Primary actor***	***Triggering event***	***Pre-condition***	***Post-condition***
1	Offering balancing service at the balancing market - Slovenian Scenario	This scenario describes the specific offering process that will be tested in the Slovenian demonstrator. This process is very aligned with the Slovenian TSO/DSO needs. This case is particular due to the TSO profits of DSO demand response mechanisms to balancing purposes. In the presented scenario, is described the process of the DSO (with the role of market participant) to provide an offer to the balancing market. Other market participants like the BSPs can also participate in the market. However, the process to elaborate the offers is not the focus of the presented scenario. The process to validate the offers did by other market participants connected in the DSO side is not described in the presented scenario.		Market opening	DSO passed pre-qualification and is capable to deliver balancing services using a demand response mechanism managed by the DSO.	
2	Offering flexibilities at the national market - French Scenario	The French scenario intends to describe the scenario that will be tested in the French demonstrator. In the proposed architecture, each market actor should do the offers mentioning the location of the offer. If the offers were provided by SGU connected to distribution system, the location should be provided at least at HV/MV level.		Market opening		

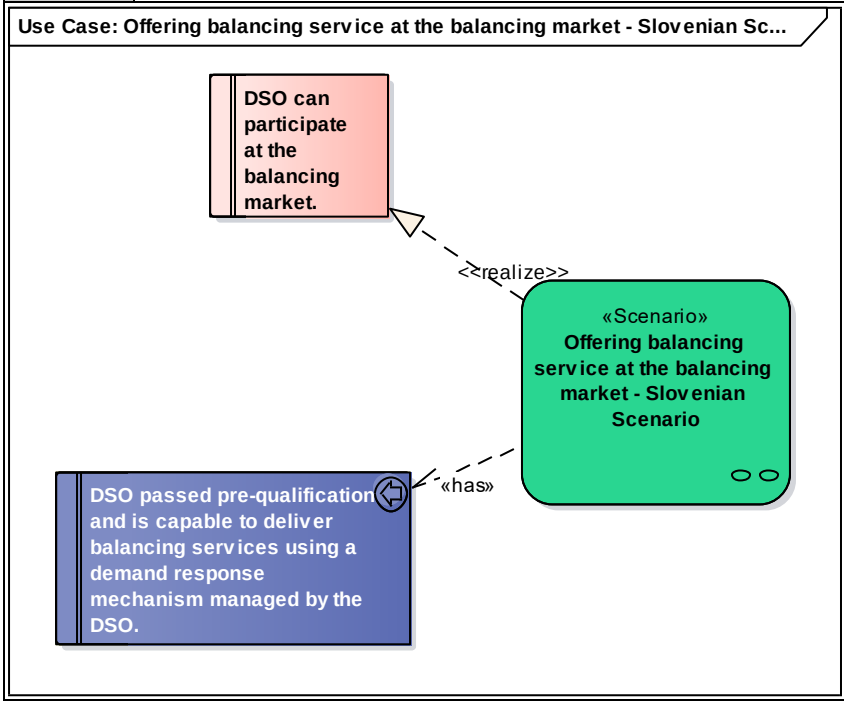
		The presented scenario describes the process to send the offers to the market through the data information platform.				
3	Offers Processing in the market - French Scenario	In this scenario the offers processing in the market are described.				
4	Market validation by the DSO - French Scenario	In the presented scenario is described the validation process of the offers od SGU connected to distribution system.				

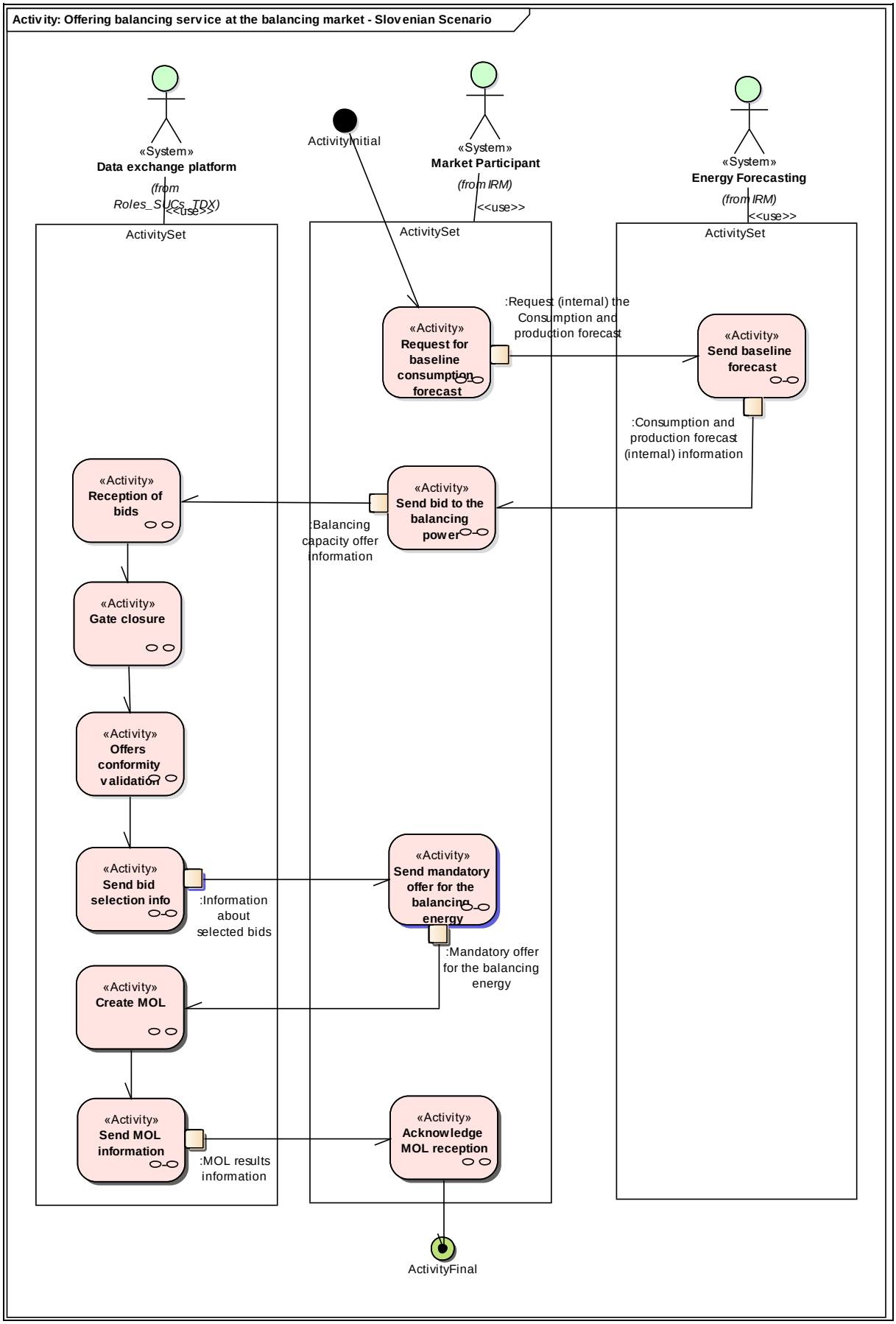
4.2. Steps - Scenarios

4.2.1. Offering balancing service at the balancing market - Slovenian Scenario

Scenario step by step analysis

Scenario	
Scenario name	Offering balancing service at the balancing market - Slovenian Scenario





Based on IEC 62559-2 edition 1
Generated from UML Use Case Repository with Modsarus® (EDF R&D Tool)

Step No	Event	Name of process/activity	Description of process/activity	Service	Information producer (actor)	Information receiver (actor)	Information exchanged (IDs)	Requirement, R-IDs
1.1		Request for baseline consumption forecast			Market Participant	Energy Forecasting	Info1-Request (internal) the Consumption and production forecast	
1.2		Send baseline forecast	In the presented case, only the consumption is required.		Energy Forecasting	Market Participant	Info2-Consumption and production forecast (internal) information	
1.3		Send bid to the balancing power	DSO sends the bid for the balancing service (capacity power) using the data exchange platform (market platform). Balancing service is based on the demand response mechanism, such as the conservation voltage reduction (CVR). The amount of the offered consumption reduction (P [MW]) is determined in refer to the baseline forecast and with restrictions that conservation action will not cause negative effects on voltage profile in the distribution grid.		Market Participant	Data exchange platform	Info3-Balancing capacity offer information	

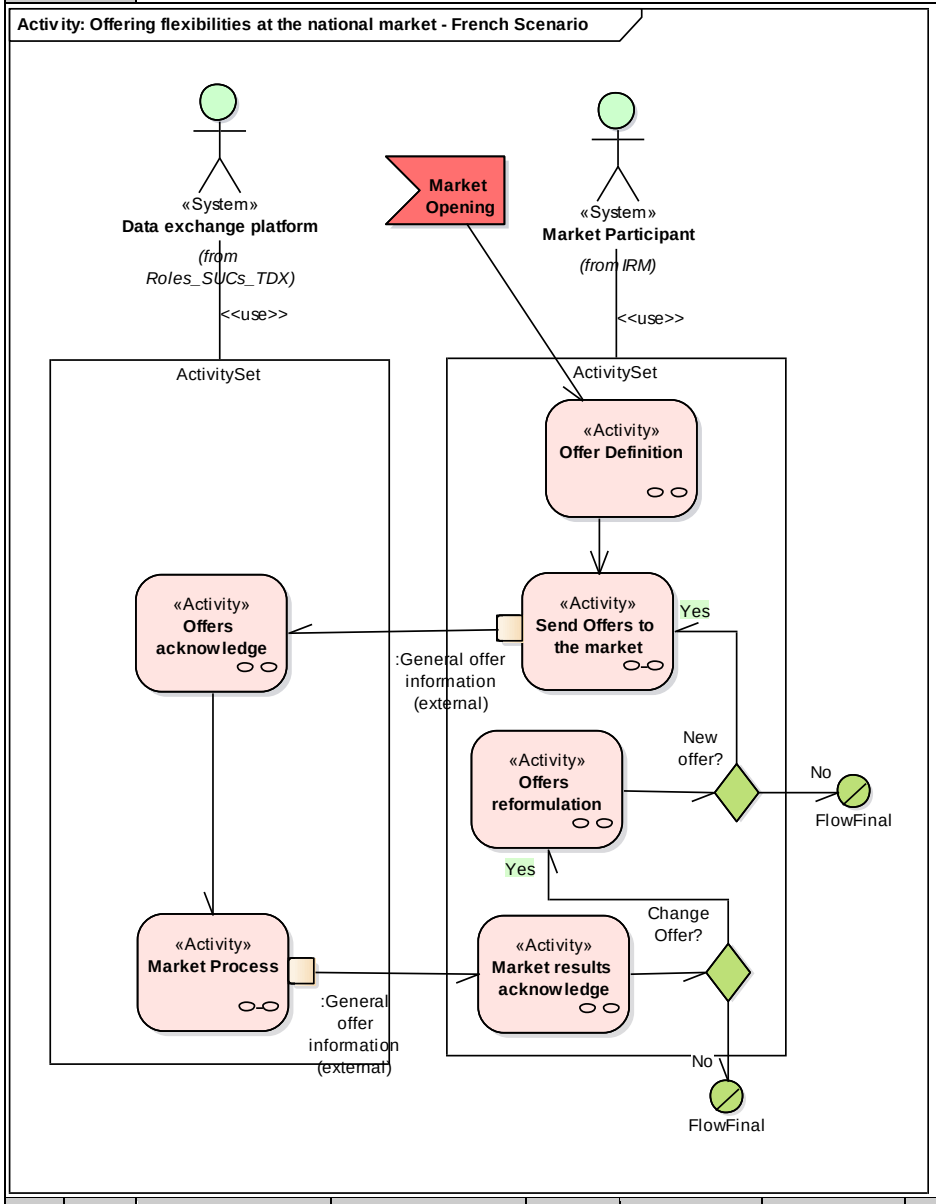
1.4		Reception of bids			Data exchange platform			
1.5		Gate closure			Data exchange platform			
1.6		Offers conformity validation	The market operator (TSO in the presented case) should validate the conformity of the bids. If balancing asset is connected to the distribution grid, conformity validation should be requested to DSO.		Data exchange platform			
1.7		Send bid selection info	TSO collects offers for the balancing capacity* (power) and makes a selection according the offered price. In such way, market participants (BSP and DSO) agrees to hold a volume of capacity and submit bids for a corresponding volume of balancing energy. After selection, market participants (BSP and DSO) signs a contract for the balancing capacity with limited duration (e.g. 1 year). * 'Balancing capacity' means a volume of reserve		Data exchange platform	Market Participant	Info4-Information about selected bids	

			capacity that a balancing service provider has agreed to hold and in respect to which the balancing service provider has agreed to submit bids for a corresponding volume of balancing energy to the TSO for the duration of the contract.					
1.8		Send mandatory offer for the balancing energy	It is mandatory for selected market participants (BSPs and DSOs) to provide balancing capacity aFRR/mFRR to send offer for the balancing energy. 'Balancing energy' means energy used by TSO to perform balancing.		Market Participant	Data exchange platform	Info5-Mandatory offer for the balancing energy	
1.9		Create MOL			Data exchange platform			
1.10		Send MOL information			Data exchange platform	Market Participant	Info6-MOL results information	
1.11		Acknowledge MOL reception			Market Participant			

4.2.2. Offering flexibilities at the national market - French Scenario

Scenario step by step analysis

Scenario	
Scenario name	Offering flexibilities at the national market - French Scenario



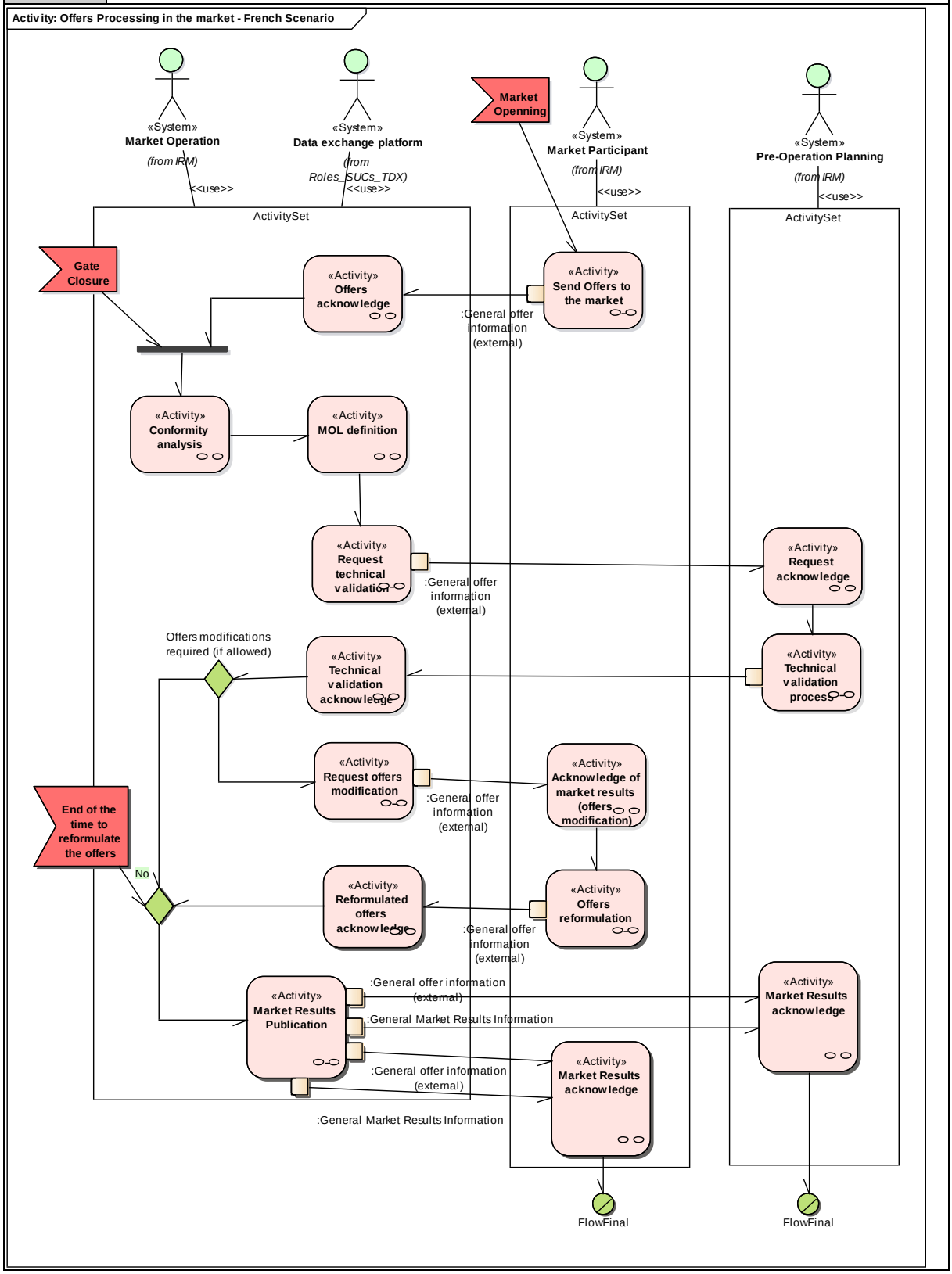
Step No	Event	Name of process/activity	Description of process/activity	Service	Information producer (actor)	Information receiver (actor)	Information exchanged (IDs)	Requirement, R-IDs
2.1		Offer Definition	The definition of market offer is an internal process of the market actors. This process can be described in a specific SUC.		Market Participant			

2.2		Send Offers to the market	The offers should be sent before the market gate closure.		Market Participant	Data exchange platform	Info7-General offer information (external)	
2.3		Offers acknowledge			Data exchange platform			
2.4		Market Process	The market process is described in the scenario 'Offers Processing in the market - French Scenario' of the presented SUC.		Data exchange platform	Market Participant	Info7-General offer information (external)	
2.5		Market results acknowledge	In the presented market architecture is assumed that the market can propose the change of some offers. The changes can be of three types: - Change the active power of the offer - Change the time of the offer if multiple-periods have been proposed - Change the location of the offer (only for the aggregators) This process can be different in each system.		Market Participant			
2.6		Offers reformulation	The market participant can propose some changes in the offers or not. If no changes were provided, the offer is rejected.		Market Participant			

4.2.3. Offers Processing in the market - French Scenario

Scenario step by step analysis

Scenario	
Scenario name	Offers Processing in the market - French Scenario



Step No	Event	Name of process/activity	Description of process/activity	Service	Information producer (actor)	Information receiver (actor)	Information exchanged (IDs)	Requirement, R-IDs
3.1		Send Offers to the market	The market participants can send the offers to the markets before the gate closure. This process is described in the scenario 'Offers Processing in the market - French Scenario' of the presented SUC.		Market Participant	Data exchange platform, Market Operation	Info7-General offer information (external)	
3.2		Offers acknowledge			Data exchange platform, Market Operation			
3.3		Conformity analysis	After the gate closure, the market responsible should validate the conformity of each offer.		Data exchange platform, Market Operation			
3.4		MOL definition	The market operator should define the MOL of the offers. The rules to establish the MOL is not the focus of the presented SUC.		Data exchange platform, Market Operation			
3.5		Request technical validation	The market operator should request a technical validation of the offers to the concerned SOs (TSO and/or DSO).		Data exchange platform, Market Operation	Pre-Operation Planning	Info7-General offer information (external)	
3.6		Request acknowledge			Pre-Operation Planning			
3.7		Technical validation process	The technical validation process of the offers provided by the SGU connected to distribution system and		Pre-Operation Planning	Data exchange platform, Market Operation		

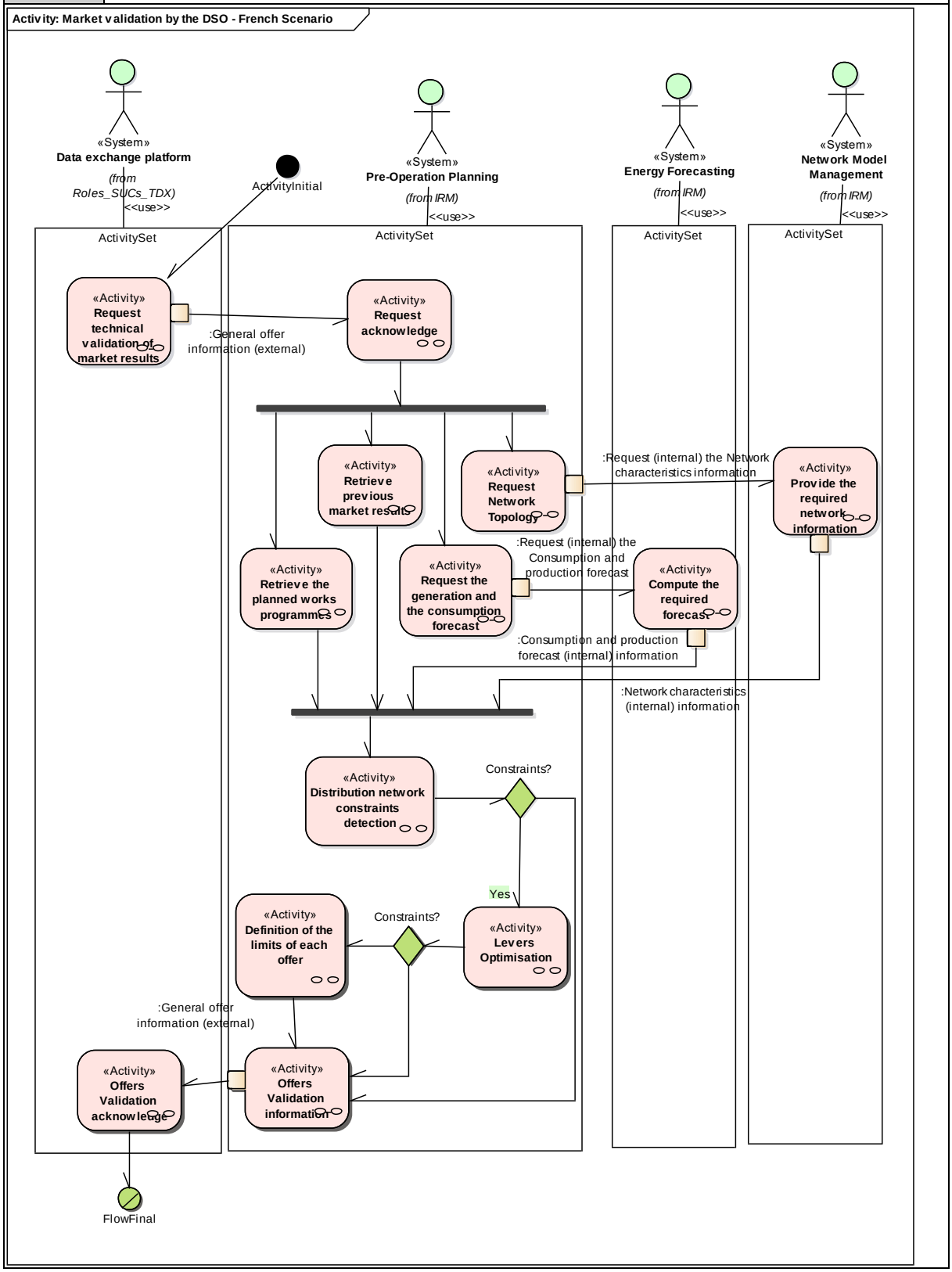
			validated by the DSO are described in the scenario 'Market validation by the DSO - French Scenario' of the presented SUC.					
3.8		Technical validation acknowledge			Data exchange platform, Market Operation			
3.9		Acknowledge of market results (offers modification)			Market Participant			
3.10		Request offers modification	If possible, and requested by the system operators, the market operator can ask the market participants to change their offers.		Data exchange platform, Market Operation	Market Participant	Info7-General offer information (external)	
3.11		Offers reformulation	The market participants can change their offers to avoid constraints in the networks. These changes are not mandatory. This process is described in the scenario 'Offering flexibilities at the national market - French Scenario' in the presented SUC. The market participant should send an offer with a new ID but identifying the previous related offers.		Market Participant	Data exchange platform, Market Operation	Info7-General offer information (external)	
3.12		Reformulated offers acknowledge			Data exchange platform, Market Operation			

3.13		Market Results Publication	The market operator should publish the market results and inform the market actors concerning the accepted/rejected offers.		Data exchange platform, Market Operation	Pre-Operation Planning	Info7-General offer information (external)	
3.14		Market Results Publication	The market operator should publish the market results and inform the market actors concerning the accepted/rejected offers.		Data exchange platform, Market Operation	Market Participant	Info7-General offer information (external), Info8-General Market Results Information	
3.15		Market Results Publication	The market operator should publish the market results and inform the market actors concerning the accepted/rejected offers.		Data exchange platform, Market Operation	Pre-Operation Planning	Info8-General Market Results Information	
3.16		Market Results acknowledge			Pre-Operation Planning			
3.17		Market Results acknowledge			Market Participant			

4.2.4. Market validation by the DSO - French Scenario

Scenario step by step analysis

Scenario	
Scenario name	Market validation by the DSO - French Scenario



Step No	Event	Name of process/activity	Description of process/activity	Service	Information producer (actor)	Information receiver (actor)	Information exchanged (IDs)	Requirement, R-IDs
4.1		Request technical validation of market results	The market operator should request the technical validation of the initial market results. If the offers were provided by the SGU connected to the distribution system, the validation should be made by the DSO.		Data exchange platform	Pre-Operation Planning	Info7-General offer information (external)	
4.2		Request acknowledge			Pre-Operation Planning			
4.3		Retrieve the planned works programmes	To validate the market offers, the DSO should take into consideration the works planned. These works are the ones in the distribution system but also the works of TSO with impact in the DSO network and in the SGUs.		Pre-Operation Planning			
4.4		Retrieve previous market results	If the SGU participate in more than one markets, the market (other markets) results should be take into account in the presented offers validation.		Pre-Operation Planning			
4.5		Request Network Topology	The system should request the network information to define the		Pre-Operation Planning	Network Model Management	Info9-Request (internal) the Network characteristi	

			aggregation of information				cs information	
4.6		Provide the required network information			Network Model Manageme nt	Pre-Operation Planning, Pre-Operation Planning, Pre-Operation Planning	Info10-Network characteristi cs (internal) information	
4.7		Request the generation and the consumption forecast	The forecast of the generation should be done by producer. The forecast of the consumption should be done by substation HV/MV. The forecast can disaggregate by type of consumption (Residential, Industrial, Services)		Pre-Operation Planning		Info1-Request (internal) the Consumptio n and production forecast	
4.8		Compute the required forecast	The forecast should be done for the next 72 hours in intervals of 15 minutes. The forecast process is not the main focus of the presented SUC.			Pre-Operation Planning, Pre-Operation Planning, Pre-Operation Planning	Info2-Consumptio n and production forecast (internal) information	
4.9		Distribution network constraints detection	Considering the consumption and production forecast, the previous markets and the planned works, the DSO should evaluate if some constraints can exist in distribution system.		Pre-Operation Planning			

4.10		Levers Optimisation	To avoid the forecasted constraints in operational planning in consequence to market offers, the DSO can activate some levers. The levers available to solve the constraints can be different in each system.		Pre-Operation Planning			
4.11		Definition of the limits of each offer	Based in the remaining constraints, the DSO can define some limits for the offers (eg. change the power) to avoid the network constraints.		Pre-Operation Planning			
4.12		Offers Validation information	The information concerning the market offers validation should be provided to market operator.		Pre-Operation Planning	Data exchange platform	Info7-General offer information (external)	
4.13		Offers Validation acknowledge			Data exchange platform			

5. Information exchanged

Information exchanged			
Information exchanged, ID	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
Info1	Request (internal) the Consumption and production forecast	Consumption and generation forecast (scheduled information) request. Internal Request ID Type of Request Substation Transformer Feeder Start Time (day; hour; minute) End Time (day; hour; minute)	

		The time should be done in intervals of 15 minutes.	
Info2	Consumption and production forecast (internal) information	The consumption and generation forecast (scheduled information). Internal Request ID Type of Request Substation Quantile Pconso_Substation Pprod_Substation Qconso_Substation Qprod_Substation Transformer Quantile Pconso_Transformer Pprod_Transformer Qconso_Transformer Qprod_Transformer Feeder Quantile Pconso_Feeder Pprod_Feeder Qconso_Feeder Qprod_Feeder Start Time (day; hour; minute) End Time (day; hour; minute) The time should be done in intervals of 15 minutes. If necessary, several quantiles (the number of quantiles depends of the request and the process needs) can be included in the forecast. With this information, more advanced algorithms leading with uncertainties can be adopted.	
Info3	Balancing capacity offer information	Power (Regulation up) Power (Regulation Down) Maximum offered power Defined minimal power (e.g. 5 MW) Resolution 1 MW Power:annual/monthly/weekly products Time	
Info4	Information about selected bids	Acknowledgment that balancing service bid is selected. The bid is not mandatory and it is expected that BSP sends mandatory offer for the balancing energy. Information that balancing capacity offer was successful.	
Info5	Mandatory offer for the balancing energy	This is mandatory offer for the balancing energy, after the bid is selected. It is used to create Merit Order List (MOL). In the case that DSO provides balancing service, this information also contains baseline forecast. Type of product (15 min, 60 min...)	

		Validity period Restrictions Offered volumes (MW) Offered price (EUR)	
Info6	MOL results information	The list of selected offers for balancing energy, in accordance with the offered prices. This list is used for activation. Merit order list for each period (1 hour, 30 minutes or 15 minutes). The merit order list should include the active power and the activation point.	
Info7	General offer information (external)	The definition of the offer can be different for each service and for each market considering different market rules: Offer ID Market ID Session ID (useful if the market have more than one session) Market Participant ID Status [in Validation, Conformity validated, Technical validated, Changes Requirement**, Selected, Rejected] Iteration / Offer ID related Service* Currency Measure Unit Type [Production/Consumption] or [selling/Buying] or [Regulation Up / Regulation Down] Service Parameter 1 Service Parameter 2 Service Parameter 3 Time (Begin) Time (End) Time (Minimum duration) Time (Maximum duration) Point(s) of activation (Substation; Transformer,BUS) Divisible [Possible/Not Possible] Price * Several services can be proposed in different markets: - Energy - Primary reserve - Secondary reserve - Tertiary reserve - Capacity - Fast Frequency Response - Voltage control - Other 1 - Other 2 - Other 3 For each service the service parameter can be different. As example, for the energy market, the service parameter 1 is the amount of energy of the offer in [€/MWh], the service parameter 2 can be the ramp between two consecutive periods and the service parameter 3 can be the total energy in all	

		periods of the offer. ** If the status of the offer was 'Changes Requirement' the SO should change the parameters of the offer to the limit and give a new offer ID. As example if the market participant offered 6MW and the maximum allow by the SO was 5MW the SO should create a new offer (new offer ID but related with previous one) with the service parameter 1 equal to 5MW.	
Info8	General Market Results Information	The definition of the offer can be different for each service and for each market considering different market rules: Market ID Session ID (useful if the market have more than one session) Market price Market Service Offer ID Market Participant ID Status [Selected, Rejected] Offer type/service Offer price Order (in merit order list)	
Info9	Request (internal) the Network characteristics information	The structural information of the network characteristics are required to the computation process. This information is exchanged between different systems roles in the SOs. A structural network information request consists of: Internal Request ID Type of request Substation (All the information in downstream of substation) Transformer (All the information in downstream of transformer) Feeder (All the information in downstream of feeder)	
Info10	Network characteristics (internal) information	The structural information of the network characteristics are required to the computation process. This information is exchanged between different systems roles in the SOs. Structural network information request: Internal Request ID Substation Power Transformer Resistance Reactance Feeder Line Resistance Reactance Capacitance	

6. Requirements (optional)

Requirements (optional)		
Categories ID	***Category name for requirements***	***Category description***
Requirement R-ID	***Requirement name***	***Requirement description***
Req1	DSO can participate at the balancing market.	

7. Common terms and definitions

8. Custom information (optional)