UseCases

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

Use Cases U2Demo

Business Use Cases

NL: Full operation of the Energy Community

Description of the use case

Name of use case

|  |  |  |
| --- | --- | --- |
| ***Use case identification*** | | |
| ***ID*** | ***Area(s)/Domain(s)/Zone(s)*** | ***Name of use case*** |
|  | Use Cases U2Demo | NL: Full operation of the Energy Community |

Version management

Scope and objectives of use case

|  |  |
| --- | --- |
| ***Scope and objectives of use case*** | |
| ***Scope*** | This BUC shows the operation of the EC in the Netherlands.  In this EC, the members are connected to each other through a microgrid with only one connection point to the distribution grid. The EC receives a bill as a whole, the bill is then divided between the members by the EC manager.  The members of the EC have individual flexible assets such as batteries, electric vehicles (EVs), charging stations (CS), PV panels and heat pumps (HP). The community owns a collective battery.  The EC participates in the day-ahead flexibility market through the platform GOPACS through a CSP. They plan to participate in the intraday flexibility market in the future. |
| ***Objective(s)*** | Lower the energy bill for each member: Through sharing energy, the energy bill of the EC members shall be lowered. Facilitate the participation in flexibility services to help reduce net congestion Increase use of renewable energy : Through the coordinated behavior of the EC members, more locally generated renewable energy shall be used.  Increase use of locally generated energy: Through the scheduling process of the EC, more locally generated energy shall be used. Generate revenue through participation in flexibility services Increase energy literacy: Through the monitoring interface, the EC members gain a more profound understanding of the PV production, their energy usage and the market prices. This aims at increasing energy literacy and understanding for the use of renewable energy and the benefits of ECs. Increase the amount of shared energy: Through coordination of the energy usage of the EC members, the amount of shared energy shall be increased. Increase revenue generated through the DERs |
| ***Related business case(s)*** | Current Operation of the EC Operation of the EC with flexibility/ ancillary services |

Narrative of Use Case

|  |
| --- |
| ***Narrative of use case*** |
| ***Short description*** |
| This business use case shows the information flow between the roles in the pilot in the Netherlands. In this pilot site, the members are connected through a microgrid and have one collective connection to the grid. The EC engages in the day-ahead flexibility market through GOPACS. Thus BUC additionally shows the participation in the intraday flexibility market, which is envisioned in the future. |
| ***Complete description*** |
| This BUC shows the information flow between the roles in the pilot in the Netherlands.  The EC participates in the day-ahead flexibility market on the platform GOPACS through a CSP and will engage in the intraday flexibility market on GOPACS in the future.  First, the PV production, consumption and market prices are forecasted by the EC manager and a schedule for the flexible assets of the community is created. This schedule is calculated considering different objectives such as collective self-consumption maximization, minimization of the electricity bill, etc.  In this pilot site, the members of the EC are connected through a microgrid and have only one access point to the main grid. The whole EC has one supplier and receives one collective bill.  Summary of use case   * [**01 Day-ahead scheduling and profile of the EC**](#{5A39C7C6-3403-4464-B8AD-444719B91C4D}) Description: In this scenario, the EC manager creates forecasts for the PV production, the consumption of each EC member and the market prices of the energy of the grid. Based on these forecasts, the EC manager schedules all community flexible assets and sets the internal price for energy.   + 01Request numerical weather prediction data Description: The GEMS requests numerical weather prediction data through a specific API.   + 02PV production and consumption forecast Description: The GEMS computes a forecast for the PV production and the consumption of each EC member. This forecast is based on the numerical weather prediction data, on historical consumption and production data of the EC members and possibly additional a-priori information such as: car calendar, festival agenda, etc.   + 02PV production and consumption forecast Description: The GEMS computes a forecast for the PV production and the consumption of each EC member. This forecast is based on the numerical weather prediction data, on historical consumption and production data of the EC members and possibly additional a-priori information such as: car calendar, festival agenda, etc.   + 03Request energy prices Description: The GEMS requests the energy prices in the day-ahead (DA) energy market.   + 04Define EC internal price Description: With knowledge on the PV production and energy consumption forecasts, and the current prices for energy, the GEMS defines an EC internal energy price.   + 05Individual look-ahead energy resources scheduling Description: The HEMS of each household optimizes its own flexible assets. In this step, different objective functions may be considered such as:     - Minimization of monetary cost     - Maximization of self-consumption     - Maximization of the opportunity cost     - others   In this pilot site, the flexible assets are mainly storage systems, heat pumps, PV and electric vehicles.   * + 06EC look-ahead energy resources scheduling Description: With the information of the schedule of each HEMS, the GEMS optimizes the community resources and sets new setpoints for import and export of each HEMS.   + 07Update EC internal energy price Description: If the convergence criterion is not fulfilled, the EC internal energy prices are updated.   + 08Organize information about possible flexibility and the schedule Description: In this step, the solution of the optimization problem is stored.  The schedules for import and export of each HEMS are stored in order to be sent to the HEMS of the EC members.  The consumption and injection forecasts of the whole EC are stored, to be sent to the DSO.  Information on the possible flexibility is extracted in order to participate in the flexibility market.   + 09Acknowledge the schedule Description: Each HEMS acknowledges the schedule for its import and export values. * [**02 Day-ahead profile communication and flexibility market (GOPACS)**](#{FD3E755C-D48F-42e3-906C-B3D80BFF7F21}) Description: This scenario consists of two parts,  1) communication of the expected profile of the EC 2) participation of the EC in the day-ahead flexibility market through the platform GOPACS For the day-ahead flexibility market, the EC agreed to a contract with a certain flexibility. The EC is contractually obliged to deliver up to this flexibility upon request of the DSO.  Additionally, it is planned to participate in the intraday flexibility market. In this case, after the participation in the day-ahead flexibility market, possible additional flexibility is estimated and communicated to the CSP to trade on the intraday flexibility market.   + 01Put together the available flexibility Description: From the previous scenario "01 Day-ahead scheduling and profile of the EC", the EC extracts the available flexibility and sends this flexibility to the CSP.   + 02Organize day-ahead profile of the EC Description: The profile of consumption and injection of the EC, generated in the activity "01 Day-ahead scheduling and profile of the EC" is stored in the form of a day-ahead (DA) profile to be sent to the DSO.   + 03Evaluate grid load Description: The DSO evaluates the grid load on the basis of all DA profiles they receive. The grid load is assessed in order to identify locations and times in which congestion might occur and the amount of flexibility to be requested.   + 04Generate flexibility request if needed to manage congestion Description: In case of congestion, the DSO publishes a flexibility request on the day-ahead GOPACS platform.   + 05Acknowledge the available flexibility of the EC Description: The CSP receives the available flexibility of the EC and places this flexibility on the platform GOPACS.   + 06Read the flexibility request and activate flexibility of the EC Description: The CSP reads the flexibility request of the DSO and matches it with the available flexibility of the EC.   + 06Read the flexibility request and activate flexibility of the EC Description: The CSP reads the flexibility request of the DSO and matches it with the available flexibility of the EC.   + 07Acknowledge the response of the EC Description: The DSO acknowledges the response of the EC through the CSP.   + 08Acknowledge the flexibility request Description: The EC receives the flexibility request. In the day-ahead flexibility request procedure, the EC is contractually obliged to accept flexibility requests within their contractually agreed limit. The EC cannot deny the flexibility request at this step.   + [**09Reschedule with updated market prices and flexibility request**](#{6585F062-85D6-46e0-920A-E60C3E55C628}) Description: On the basis of the requested flexibility and the updated market prices, the flexible assets of the EC are rescheduled.     - 01Collect known production and consumption forecast Description: The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling.     - 01Collect known production and consumption forecast Description: The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling.     - 02Collect agreed flexibility Description: The EC already agreed to deliver a certain amount of flexibility at a certain time. This information has to be taken into consideration when creating a new schedule for the EC assets.     - 03Request updated energy prices Description: The GEMS requests the current energy prices in the market.     - 04Define EC internal price Description: With knowledge on the PV production and consumption forecasts, the current energy prices and the flexibility the EC agreed to deliver, the GEMS defines an internal price for the energy inside the EC.     - 05Individual look-ahead energy scheduling Description: The HEMS of each household optimizes its own flexible assets. In this step, different objective functions may be considered such as:       * Minimization of monetary cost       * Maximization of self-consumption       * Maximization of the opportunity cost       * others   In this pilot site, the flexible assets are mainly storage systems, heat pumps, PV and electric vehicles.   * + - 06EC look-ahead energy scheduling Description: With the information of the schedule of each HEMS, the GEMS optimizes the community resources and the import and export setpoints for each HEMS.     - 07Update EC internal energy price Description: If the convergence criterion is not fulfilled, the EC internal energy prices are updated.     - 08Organize information about possible flexibility and the schedule Description: In this step, the solution of the optimization problem is stored.  The schedules of import and export of each HEMS are stored in order to be sent to the HEMS of the EC members.  The consumption and injection forecast of the whole EC are stored, to be sent to the BRP.  Information on the possible flexibility is extracted in order to participate in the flexibility market through a BRP.     - 09Acknowledge the schedule Description: Each HEMS acknowledges the schedule for its import and export values.   + 10Put together additional possible flexibility  Description: This activity is planned in the future and is not yet implemented in the operation of the EC.  The EC might be able to deliver more flexibility than was requested by the DSO on the DA GOPACS platform. This additional flexibility information is organized and sent to the CSP, to be traded in the Intraday flexibility market.   + 11Acknowledge possible flexibility of the EC Description: This activity is planned in the future and is not yet implemented in the operation of the EC.  The CSP acknowledges the additional flexibility information of the EC.   + 12Generate the updated profile of the EC Description: The updated consumption and injection profile of the EC is put together in form of a DA profile and sent to the supplier.   + 13Acknowledge the profile Description: The supplier acknowledges the updated DA profile of the EC.   + 14Place bids for the profile on the day-ahead market Description: On the basis of the DA profile of the EC, the supplier places bids on the DA energy market. These bids are a time series with 15 min intervals of:  - amount of energy to be bought/sold  - price for this energy   + 15Receive the results from the day-ahead market closing  Description: The DA energy procurement market closes and the prices for the DA spot market are cleared.   + 16Generate T-prognosis Description: The supplier puts together the T-prognosis of the EC based on the result of the market closing.   + 17Acknowledge the T-prognosis Description: The DSO acknowledges the T-prognosis. * [**03-0 Intraday flexibility market (GOPACS)**](#{13984F26-85C1-4ac2-A5DF-F5DCE9ADFFA6}) Description: In addition to the day-ahead flexibility market, an intraday GOPACS market will be established in the Netherlands in the future. The EC can participate in this intraday market through a Congestion Service Provider (CSP). This scenario shows the information flow for participating in the intraday flexibility market.   + 01Evaluate grid load Description: The DSO evaluates the grid load.   + 02Place flexibility requests on ID GOPACS Description: In case of needing flexibility, the DSO places a flexibility request on the intraday GOPACS platform.   + 03Place bids and respond to requests on ID GOPACS Description: The CSP places bids for flexibility and responds to the flexibility request of the DSO.   + 04Make flexibility requests to EC Description: The CSP makes a flexibility request to the EC.   + 05Process flexibility request Description: The GEMS receives the flexibility request of the CSP and processes this flexibility request.   + [**06Generate new schedule to meet the flexibility request**](#{E3DDCFFC-9D99-4ea3-AE67-148624371B52})  Description: The GEMS generates a new schedule to meet the flexibility request.     - 01Collect known production and consumption forecast Description: The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling.     - 02Collect agreed flexibility Description: The EC already agreed to deliver a certain amount of flexibility at a certain time, both in the DA GOPACS, as well as in the intraday GOPACS. This information has to be taken into consideration when creating a new schedule for the EC assets.     - 03Request updated energy prices Description: The GEMS requests the current energy prices in the market.     - 04Define EC internal price Description: With knowledge on the PV production and consumption forecasts, the current prices for energy and information on the flexibility the EC agreed to deliver, the GEMS defines an EC internal energy price.     - 05Individual look-ahead energy scheduling Description: The HEMS of each household optimizes its own flexible assets. In this step, different objective functions may be considered such as:       * Minimization of monetary cost       * Maximization of self-consumption       * Maximization of the opportunity cost   In this pilot site, the flexible assets are mainly storage systems, heat pumps, PV and electric vehicles.   * + - 06EC look-ahead energy scheduling Description: With the information of the schedule of each HEMS, the GEMS optimizes the community resources.     - 07Update EC internal energy price Description: If the convergence criterion is not fulfilled, the EC internal energy prices are updated.     - 08Organize information about possible flexibility and the schedule Description: In this step, the solution of the optimization problem is stored.  The schedules of import and export of each HEMS are stored in order to be sent to the HEMS of the EC members.  The consumption and injection forecast of the whole EC are stored, to be sent to the BRP.  Information on the possible flexibility is extracted in order to participate in the flexibility market through a BRP.     - 09Acknowledge the schedule Description: Each HEMS acknowledges the schedule for its import and export values. * [**03-1 RT operation**](#{99928A9A-2822-47a6-AC32-3021A6CE9973}) Description: This scenario shows the real-time (RT) operation of the EC. The flexible loads are controlled through setpoints communicated from the GEMS to the HEMS.   + 01Set incentives and setpoints Description: The GEMS sends the setpoints for import/export to each HEMS, along with an incentive to meet these setpoints.   + 02Controls the flexible assets Description: The setpoints for import/export and the incentives to meet these are processed by the HEMS. The HEMS the computes control signals for the flexible assets based on local goal optimization and the incentives set by the GEMS.   + 03Control of community assets Description: The GEMS controls the community assets. * [**03-2 RT performance evaluation**](#{0CE19382-A2C7-4cca-A47D-6E7A30E0991F})  Description: In this scenario, the difference between the RT measurements and the current schedule is evaluated. If the deviation is larger than a certain threshold, the flexible assets are rescheduled.   + 01Organize house measurements  Description: Each HEMS measures the states of the house and stores these to be sent to the GEMS.   + 02Receive house measurements Description: The GEMS receives the house measurements of each HEMS.   + 03Compare RT measurements with schedule Description: The GEMS compares the real-time measurements of import and export of each HEMS with the schedule.   + [**04Reschedule**](#{629E0A76-8CAD-4149-9FDD-BFEE5D4CB6EE}) Description: In case that the difference between the RT measurements and the schedule is larger than the threshold, the GEMS requests a new schedule for the EC.     - 01Collect known production and consumption forecast Description: The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling.     - 01Collect known production and consumption forecast Description: The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling.     - 02Collect agreed flexibility Description: The EC already agreed to deliver a certain amount of flexibility at a certain time. This information has to be taken into consideration when creating a new schedule for the EC assets.     - 03Collect states of the flexible assets of each HEMS Description: In the previous step, the GEMS received the states of the flexible assets of each HEMS.     - 04Request updated energy prices Description: The GEMS requests the current energy prices in the market.     - 05Define EC internal price Description: With knowledge on the PV production and consumption forecasts, the current prices for energy and information on the flexibility the EC agreed to deliver, the GEMS defines an EC internal energy price.     - 06Individual look-ahead energy scheduling Description: The HEMS of each household optimizes its own flexible assets. In this step, different objective functions may be considered such as:       * Minimization of monetary cost       * Maximization of self-consumption       * Maximization of the opportunity cost       * others   In this pilot site, the flexible assets are mainly storage systems, heat pumps, PV and electric vehicles.   * + - 07EC look-ahead energy scheduling Description: With the information of the schedule of each HEMS, the GEMS optimizes the community resources.     - 08Update EC internal energy price Description: If the convergence criterion is not fulfilled, the EC internal energy prices are updated.     - 09Organize information about possible flexibility and the schedule Description: The schedule of each HEMS, the GEMS and the consumption and injection data of the whole community are stored. Additionally, information on possible flexibility is stored.     - 10Acknowledge the schedule Description: Each HEMS acknowledges the schedule of its flexible resources. * [**03-3 RT monitoring**](#{BDB425C3-BF1C-42cc-9406-E6FA596D3AE0}) Description: The EC manager collects measurements and sends them to the EC members to inform them about their energy usage behavior.   + 01Organize EC data Description: The GEMS collects and organizes the data of the community level. This data set consists of the injection and consumption data at the connection point to the grid and the state of community assets. Data from the other EC members is only collected on the HEMS level, in order to ensure privacy.   + 02Organize individual data Description: In this step, the HEMS collects all data from the house. This includes the information on the consumption, production and injection, as well as data from the flexible loads and storage systems.  The data is stored in an appropriate way, in order to be sent to a dashboard for visualization.   + 03Receive the data Description: The EC member receives the data.   + 04Visualize the data Description: The data is visualized on the EC member level. The EC member interacts with an interface to access and see the data. * [**04 Settlement and billing**](#{17C616F3-7D60-48e2-96C9-FF3A8ABC1D7A}) Description: This scenario shows the billing and settlement process of the EC. The EC receives one bill from the retailer, which is settled by the EC manager. The EC manager then drafts a bill for each EC member.   + 01Consolidation of consumption & injection data of the EC Description: Once a month, the measurement company (Kenter in this case) collects the consumption and injection data of the EC through the meter at the connection point. This data is stored and then sent to the DSO and to the Supplier.   + 02Set up an invoice for the EC (MOP) Description: The measurement company sets up an invoice for the EC for the service.   + 03Set up an invoice for the EC (DSO) Description: With the meter data from the measurement company, the DSO calculates a bill for the EC for the connection to the grid. This bill is then sent to the EC manager.   + 04Set up an invoice for the EC (Supplier) Description: Based on the measurements provided by the measurement company, the supplier computes a bill for the whole community. Depending on the market prices and the volume traded, the bill may be such that the EC manager has to pay to the retailer or that the EC manager receives a payment from the supplier.   + 05Consolidate the meter data of each EC member Description: The EC manager has access to the meters of each EC member and reads the consumption and injection measurements.   + 06Acknowledge the invoices & payment  Description: The EC manager acknowledges and settles the bills.   + 07Set up invoice for each EC member Description: With the bill for the whole EC and the measurements of the meter of each EC member collected by the EC manager, the EC manager computes a bill for each EC member.   + 08Acknowledge the invoice & payment  Description: Each EC member acknowledges the bill sent by the EC manager and the bill is being settled. |

Key performance indicators (KPI)

|  |  |  |  |
| --- | --- | --- | --- |
| ***Key performance indicators*** | | | |
| ***ID*** | ***Name*** | ***Description*** | ***Reference to mentioned use case objectives*** |
| 1 | Energy bill of the EC members | As stated in the Grant Agreement, the energy bill shall be lowered by >= 10% and by >= 15% for vulnerable customers in comparison to the beginning of the project. | [Lower the energy bill for each member](#{C3343683-81D0-4993-B291-0B52D1DCCC15}) |
| 2 | Willingness of the EC to participate in flexibility services | As stated in the Grant Agreement, the willingness to participate in flexibility services shall be increased by >= 40% compared to the results of a first survey conducted in T1.2. | [Facilitate the participation in flexibility services to help reduce net congestion](#{BF8D0F57-4AC0-4370-92EA-2BED51B0586E}) |
| 3 | Amount of flexibility agreed on with the DSO | To evaluate the effectiveness of the response of the EC to requests from the DSO, the amount of flexibility agreed on with the DSO can be measured. | [Facilitate the participation in flexibility services to help reduce net congestion](#{BF8D0F57-4AC0-4370-92EA-2BED51B0586E}) |
| 4 | Amount of available flexibility | The flexibility potential shall be increased by >=25% according to the Grant Agreement. | [Facilitate the participation in flexibility services to help reduce net congestion](#{BF8D0F57-4AC0-4370-92EA-2BED51B0586E}) |
| 5 | Collective self-consumption | The self-consumption on the community level shall be increased by >=15% as stated in the Grant Agreement. | [Increase use of renewable energy](#{2802C8DF-89A3-45ce-9316-B66ECB05483D}) [Increase use of locally generated energy](#{200D8D84-9382-4dbe-B93D-CFE79687E3A9}) |
| 6 | Use of DER | The use of distributed energy resources by active consumers shall be increased by >=30% as stated in the Grant Agreement. | [Increase use of locally generated energy](#{200D8D84-9382-4dbe-B93D-CFE79687E3A9}) |
| 7 | Revenue from the flexibility services |  | [Generate revenue through participation in flexibility services](#{D31A813C-AFD3-4cbb-A22E-A071B1A5C612}) |
| 8 | Energy literacy of the EC members | As stated in the Grant Agreement, the energy literacy of the EC members shall be increased by >= 50% with respect to the baseline based on computations at the start of the project (D1.2, D2.3). | [Increase energy literacy](#{5ED17661-E8D4-445a-B1EF-5F04760C60D9}) |
| 9 | Amount of shared energy | The amount of shared energy shall be increased by >=30%, as stated in the Grant Agreement. | [Increase the amount of shared energy](#{B16F25A2-F8BA-4d66-9BA4-5581767DAE95}) |
| 10 | Revenue | As described in the Grant Agreement, the revenue generated through the DERs shall be increased by >=25%. | [Increase revenue generated through the DERs](#{AE48CF12-C2D6-4ef9-B3BA-9A0CB6336B6F}) |

Use case conditions

|  |  |
| --- | --- |
| ***Use case conditions*** | |
| ***Assumptions*** | |
| ***Prerequisites*** | |
| 1 | Preconditions: For this BUC, the following assumptions have to be fulfilled:  - The EC signed a contract with the DSO to provide flexibility. With this contract, the EC is obliged to deliver a certain amount of flexibility upon request of the DSO. The contract specifies time intervals for the flexibility, the amount of flexibility and a renumeration. - The EC members established the EC agreeing on sharing mechanisms, optimization methods, internal pricing methods and the use of shared assets. - The EC uses a platform to control the flexible assets. In this pilot OpenRemote is used.  - The EC members have an agreement with the EC manager such that the EC manager can access their meters. This information is needed to gather historical data for the forecasts and real-time data for rescheduling purposes.  - The EC members inform the EC manager about their flexible assets and their preferences for using these. This information is necessary for the scheduling process. |

Further information to the use case for classification/mapping

|  |
| --- |
| ***Classification information*** |
| ***Relation to other use cases*** |
|  |
| ***Level of depth*** |
|  |
| ***Prioritisation*** |
|  |
| ***Generic, regional or national relation*** |
|  |
| ***Nature of the use case*** |
| BUC |
| ***Further keywords for classification*** |
| Single grid connection point, Dutch regulations, Flexibility services through GOPACS, Flexible assets (batteries; heat pumps; electric vehicles) |

General remarks

Diagrams of use case

|  |
| --- |
| ***Diagram(s) of use case*** |
| BusinessUseCase1 - overview  BusinessUseCase1 - scenarios flowchart |

Technical details

Actors

|  |  |  |  |
| --- | --- | --- | --- |
| ***Actors*** | | | |
| ***Grouping (e.g. domains, zones)*** | | ***Group description*** | |
|  | |  | |
| ***Actor name*** | ***Actor type*** | ***Actor description*** | ***Further information specific to this use case*** |
| HEMS | Business | The HEMS is a role used in the pilot site in the Netherlands.  The HEMS is the House Energy Management System, which is installed at each node of the Energy Community. The HEMS controls the flexible assets of this node and collects measurements from the node. The HEMS acts according to setpoints and incentives received from the GEMS and according to its own optimization towards the local goal, defined by the node owner. It may ignore commands from GEMS. |  |
| GEMS | Business | The GEMS is a role used in the pilot site in the Netherlands. The GEMS is the Grid Energy Management System. The GEMS schedules all flexible community assets and the import and export values of each HEMS. Additionally, the GEMS sets the EC internal energy price.  The GEMS optimizes towards the collective goal of the EC, while respecting the individual goals of the EC members. |  |
| BRP | Business | A Balance Responsible Party (BRP) is responsible for balancing generation and consumption.  The pilot site in the Netherlands participates in the ID flexibility market through a BRP. The EC sends available flexibility to the BRP and the BRP asks the EC to activate this flexibility when needed. |  |
| DSO | Business | Distribution System Operators (DSO) are responsible for distribution and management of energy, starting at the TSO substations to the points of consumption.  The DSO plays an integral role in the management of energy communities. In the pilots in Italy, Belgium and Portugal, the DSO provides the official measurements of the consumption and injection data of EC members. Depending on country specific regulations and the configuration of the EC, the measurements are used in an internal billing process or for the billing process through a supplier.  In the Dutch pilot, the DSO does not provide the official measurements, but they are collected by a measurement company. The DSO then receives the data and drafts a bill for the grid usage of the EC. In the Italian pilot, the meter data is sent to the GSE, to compute the incentive for the shared energy, and to the suppliers of each EC Member, for the individual billing process.  In the Belgian pilot, the DSO computes the credit points for shared energy and shares the measurements with the suppliers and with Klimaan for the internal billing process.   Apart from consolidating the consumption and injection data, the DSO plays an important role in the flexibility market in the Netherlands, Italy and Portugal. The DSO evaluates the grid load and places flexibility requests, both on the DA flexibility market and on the ID flexibility market. In the Netherlands the flexibility market is managed through the platform GOPACS, in Italy and Portugal through Piclo Flex. |  |
| EC Manager | Business | The EC manager has a versatile role in the ECs.  In the case of the Italian and Belgian pilot, the EC manager collects the data needed for forecasting algorithms and calculates the forecast. Additionally, the EC manager creates a schedule for the flexible assets and gives advice to the EC members to guide their energy consumption behavior.  In the Italian pilot, the flexible assets are under the governance of each EC member. In this case, the EC manager schedules these assets and gives the result as an advice to the members.  In the Belgian pilot, the EC manager has control over the flexible assets, creates the schedule and controls the assets.  In both governance models, the EC manager monitors the operation, decides on possible rescheduling and sends the measurements to the EC members for monitoring purpose.  In the Italian pilot, the EC manager has control over the bank account of the community and acknowledges the incentives received for sharing energy.  In the Dutch pilot, the EC manager is responsible for settling the bill with the supplier and for the internal billing process. Additionally, the EC manager is active in the communication of the load profile of the EC to the DSO and in the process of offering flexibility services to the DSO. In the Portuguese pilot, the EC manager can take a more passive or more active role in the EC, depending on which entity makes the scheduling for the batteries. If the EC manager optimizes the scheduling of the batteries, then it is an active entity which considers community goals and participation in flexibility or in mFRR in the optimization. Otherwise, it plays a passive role, collecting and processes data only. This role is also responsible, in the Portuguese pilot, for exchanging money from energy sharing for Municipality vouchers to be distributed among EC members. |  |
| Supplier | Business | The supplier is the intermediate party between the wholesale electricity market and the consumer. The supplier receives the official measurements of consumption and production and drafts a bill accordingly.  In the Dutch pilot, the supplier has a relation to a wholeseller who is a Balance Responsible Party (BRP). The daily profile of the EC is thus sent to the supplier and deviations from this profile are bought/sold against the unbalance market price. |  |
| EC Member | Business | The EC member is an entity in the community which can act as a prosumer or a consumer. Depending on the governance model of the EC, the EC member has an active role and can control the own assets or has a passive role in which the EC member does not control these assets. |  |
| Measurement company | Business | The measurement company is a role solely used in the pilot in the Netherlands. This company measures the consumption and injection data on a monthly basis and sends these results to the DSO and to the Supplier. |  |
| CSP | Business | The congestion service provider (CSP) is a role used exclusively in the Dutch pilot. Through the CSP, the EC can participate in the flexibility market on GOPACS. The CSP offers the available flexibility on behalf of the EC in the flexibility market. |  |

References

Step by step analysis of use case

Overview of scenarios

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Scenario conditions*** | | | | | | |
| ***No.*** | ***Scenario name*** | ***Scenario description*** | ***Primary actor*** | ***Triggering event*** | ***Pre-condition*** | ***Post-condition*** |
| 1 | 01 Day-ahead scheduling and profile of the EC | In this scenario, the EC manager creates forecasts for the PV production, the consumption of each EC member and the market prices of the energy of the grid. Based on these forecasts, the EC manager schedules all community flexible assets and sets the internal price for energy. |  |  |  |  |
| 2 | 02 Day-ahead profile communication and flexibility market (GOPACS) | This scenario consists of two parts,  1) communication of the expected profile of the EC 2) participation of the EC in the day-ahead flexibility market through the platform GOPACS For the day-ahead flexibility market, the EC agreed to a contract with a certain flexibility. The EC is contractually obliged to deliver up to this flexibility upon request of the DSO.  Additionally, it is planned to participate in the intraday flexibility market. In this case, after the participation in the day-ahead flexibility market, possible additional flexibility is estimated and communicated to the CSP to trade on the intraday flexibility market. |  |  |  |  |
| 3 | 03-0 Intraday flexibility market (GOPACS) | In addition to the day-ahead flexibility market, an intraday GOPACS market will be established in the Netherlands in the future. The EC can participate in this intraday market through a Congestion Service Provider (CSP). This scenario shows the information flow for participating in the intraday flexibility market. |  |  |  |  |
| 4 | 03-1 RT operation | This scenario shows the real-time (RT) operation of the EC. The flexible loads are controlled through setpoints communicated from the GEMS to the HEMS. |  |  |  |  |
| 5 | 03-2 RT performance evaluation | In this scenario, the difference between the RT measurements and the current schedule is evaluated. If the deviation is larger than a certain threshold, the flexible assets are rescheduled. |  |  |  |  |
| 6 | 03-3 RT monitoring | The EC manager collects measurements and sends them to the EC members to inform them about their energy usage behavior. |  |  |  |  |
| 7 | 04 Settlement and billing | This scenario shows the billing and settlement process of the EC. The EC receives one bill from the retailer, which is settled by the EC manager. The EC manager then drafts a bill for each EC member. |  |  |  |  |

Steps - Scenarios

01 Day-ahead scheduling and profile of the EC

In this scenario, the EC manager creates forecasts for the PV production, the consumption of each EC member and the market prices of the energy of the grid. Based on these forecasts, the EC manager schedules all community flexible assets and sets the internal price for energy.

|  |
| --- |
| Scenario 01 - activities flowchart |

Scenario step by step analysis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Scenario*** | | | | | | | | |
| ***Scenario name*** | | 01 Day-ahead scheduling and profile of the EC | | | | | | |
| ***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 |  | 01Request numerical weather prediction data | The GEMS requests numerical weather prediction data through a specific API. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 1.2 |  | 02PV production and consumption forecast | The GEMS computes a forecast for the PV production and the consumption of each EC member. This forecast is based on the numerical weather prediction data, on historical consumption and production data of the EC members and possibly additional a-priori information such as: car calendar, festival agenda, etc. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info1-Forecast information for one HEMS](#{3D6CAD7D-C412-401a-999E-E9B70FC77512}) |  |
| 1.3 |  | 02PV production and consumption forecast | The GEMS computes a forecast for the PV production and the consumption of each EC member. This forecast is based on the numerical weather prediction data, on historical consumption and production data of the EC members and possibly additional a-priori information such as: car calendar, festival agenda, etc. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [Info2-Forecast information for the GEMS](#{207DD5F9-7943-4cd7-9B8C-886C15E25549}) |  |
| 1.4 |  | 03Request energy prices | The GEMS requests the energy prices in the day-ahead (DA) energy market. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 1.5 |  | 04Define EC internal price | With knowledge on the PV production and energy consumption forecasts, and the current prices for energy, the GEMS defines an EC internal energy price. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info3-EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |
| 1.6 |  | 05Individual look-ahead energy resources scheduling | The HEMS of each household optimizes its own flexible assets. In this step, different objective functions may be considered such as:   * Minimization of monetary cost * Maximization of self-consumption * Maximization of the opportunity cost * others   In this pilot site, the flexible assets are mainly storage systems, heat pumps, PV and electric vehicles. |  | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [Info4-Scheduling information of a HEMS](#{B0B0B2D0-0104-490e-B4E7-C99CDB15A28D}) |  |
| 1.7 |  | 06EC look-ahead energy resources scheduling | With the information of the schedule of each HEMS, the GEMS optimizes the community resources and sets new setpoints for import and export of each HEMS. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 1.8 |  | 07Update EC internal energy price | If the convergence criterion is not fulfilled, the EC internal energy prices are updated. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info3-EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |
| 1.9 |  | 08Organize information about possible flexibility and the schedule | In this step, the solution of the optimization problem is stored.  The schedules for import and export of each HEMS are stored in order to be sent to the HEMS of the EC members.  The consumption and injection forecasts of the whole EC are stored, to be sent to the DSO.  Information on the possible flexibility is extracted in order to participate in the flexibility market. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info5-EC member Imp/Exp Scheduling](#{12B895F7-3168-4eee-B90D-D87052B41B9E}) |  |
| 1.10 |  | 09Acknowledge the schedule | Each HEMS acknowledges the schedule for its import and export values. |  | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) |  |  |  |

* 1.2. 02PV production and consumption forecast

Business section: 01 Day-ahead scheduling and profile of the EC/02PV production and consumption forecast  
The GEMS computes a forecast for the PV production and the consumption of each EC member. This forecast is based on the numerical weather prediction data, on historical consumption and production data of the EC members and possibly additional a-priori information such as: car calendar, festival agenda, etc.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Forecast information for one HEMS](#{3D6CAD7D-C412-401a-999E-E9B70FC77512}) |  |  |

* 1.3. 02PV production and consumption forecast

Business section: 01 Day-ahead scheduling and profile of the EC/02PV production and consumption forecast  
The GEMS computes a forecast for the PV production and the consumption of each EC member. This forecast is based on the numerical weather prediction data, on historical consumption and production data of the EC members and possibly additional a-priori information such as: car calendar, festival agenda, etc.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Forecast information for the GEMS](#{207DD5F9-7943-4cd7-9B8C-886C15E25549}) |  |  |

* 1.5. 04Define EC internal price

Business section: 01 Day-ahead scheduling and profile of the EC/04Define EC internal price  
With knowledge on the PV production and energy consumption forecasts, and the current prices for energy, the GEMS defines an EC internal energy price.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |  |

* 1.6. 05Individual look-ahead energy resources scheduling

Business section: 01 Day-ahead scheduling and profile of the EC/05Individual look-ahead energy resources scheduling  
The HEMS of each household optimizes its own flexible assets. In this step, different objective functions may be considered such as:

* + Minimization of monetary cost
  + Maximization of self-consumption
  + Maximization of the opportunity cost
  + others

In this pilot site, the flexible assets are mainly storage systems, heat pumps, PV and electric vehicles.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Scheduling information of a HEMS](#{B0B0B2D0-0104-490e-B4E7-C99CDB15A28D}) |  |  |

* 1.8. 07Update EC internal energy price

Business section: 01 Day-ahead scheduling and profile of the EC/07Update EC internal energy price  
If the convergence criterion is not fulfilled, the EC internal energy prices are updated.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |  |

* 1.9. 08Organize information about possible flexibility and the schedule

Business section: 01 Day-ahead scheduling and profile of the EC/08Organize information about possible flexibility and the schedule  
In this step, the solution of the optimization problem is stored.   
The schedules for import and export of each HEMS are stored in order to be sent to the HEMS of the EC members.   
The consumption and injection forecasts of the whole EC are stored, to be sent to the DSO.   
Information on the possible flexibility is extracted in order to participate in the flexibility market.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [EC member Imp/Exp Scheduling](#{12B895F7-3168-4eee-B90D-D87052B41B9E}) |  |  |

02 Day-ahead profile communication and flexibility market (GOPACS)

This scenario consists of two parts,   
1) communication of the expected profile of the EC  
2) participation of the EC in the day-ahead flexibility market through the platform GOPACS  
For the day-ahead flexibility market, the EC agreed to a contract with a certain flexibility. The EC is contractually obliged to deliver up to this flexibility upon request of the DSO.   
Additionally, it is planned to participate in the intraday flexibility market. In this case, after the participation in the day-ahead flexibility market, possible additional flexibility is estimated and communicated to the CSP to trade on the intraday flexibility market.

|  |
| --- |
| Scenario 02 - activities flowchart |

Scenario step by step analysis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Scenario*** | | | | | | | | |
| ***Scenario name*** | | 02 Day-ahead profile communication and flexibility market (GOPACS) | | | | | | |
| ***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 |  | 01Put together the available flexibility | From the previous scenario "01 Day-ahead scheduling and profile of the EC", the EC extracts the available flexibility and sends this flexibility to the CSP. |  | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) | [CSP](#{E1AA62D9-5BFC-4247-AAF8-72D0E7B79C74}) | [Info6-Flexibility profile](#{FA60CBBB-4467-497d-BFAA-64094500EB17}) |  |
| 2.2 |  | 02Organize day-ahead profile of the EC | The profile of consumption and injection of the EC, generated in the activity "01 Day-ahead scheduling and profile of the EC" is stored in the form of a day-ahead (DA) profile to be sent to the DSO. |  | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) | [DSO](#{B9728693-DE6D-4ab7-B4C4-B0B1C1CF0779}) | [Info7-DA profile](#{D0D381B3-49B7-4814-B8BE-B7FA8FDA264B}) |  |
| 2.3 |  | 03Evaluate grid load | The DSO evaluates the grid load on the basis of all DA profiles they receive. The grid load is assessed in order to identify locations and times in which congestion might occur and the amount of flexibility to be requested. |  | [DSO](#{B9728693-DE6D-4ab7-B4C4-B0B1C1CF0779}) |  |  |  |
| 2.4 |  | 04Generate flexibility request if needed to manage congestion | In case of congestion, the DSO publishes a flexibility request on the day-ahead GOPACS platform. |  | [DSO](#{B9728693-DE6D-4ab7-B4C4-B0B1C1CF0779}) | [CSP](#{E1AA62D9-5BFC-4247-AAF8-72D0E7B79C74}) | [Info8-Flexibility request](#{672897FF-FD6B-4c9b-9E95-2358FFB099D2}) |  |
| 2.5 |  | 05Acknowledge the available flexibility of the EC | The CSP receives the available flexibility of the EC and places this flexibility on the platform GOPACS. |  | [CSP](#{E1AA62D9-5BFC-4247-AAF8-72D0E7B79C74}) |  |  |  |
| 2.6 |  | 06Read the flexibility request and activate flexibility of the EC | The CSP reads the flexibility request of the DSO and matches it with the available flexibility of the EC. |  | [CSP](#{E1AA62D9-5BFC-4247-AAF8-72D0E7B79C74}) | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) | [Info8-Flexibility request](#{672897FF-FD6B-4c9b-9E95-2358FFB099D2}) |  |
| 2.7 |  | 06Read the flexibility request and activate flexibility of the EC | The CSP reads the flexibility request of the DSO and matches it with the available flexibility of the EC. |  | [CSP](#{E1AA62D9-5BFC-4247-AAF8-72D0E7B79C74}) | [DSO](#{B9728693-DE6D-4ab7-B4C4-B0B1C1CF0779}) | [Info9-Response to flex request in DA market](#{FD81571A-2B24-4767-862A-CF5A3C8A0982}) |  |
| 2.8 |  | 07Acknowledge the response of the EC | The DSO acknowledges the response of the EC through the CSP. |  | [DSO](#{B9728693-DE6D-4ab7-B4C4-B0B1C1CF0779}) | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) | [Info10-Acknowledgement of response](#{949B11C5-200C-4892-9156-1B1DB5A02AC9}) |  |
| 2.9 |  | 08Acknowledge the flexibility request | The EC receives the flexibility request. In the day-ahead flexibility request procedure, the EC is contractually obliged to accept flexibility requests within their contractually agreed limit. The EC cannot deny the flexibility request at this step. |  | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) | [DSO](#{B9728693-DE6D-4ab7-B4C4-B0B1C1CF0779}) | [Info9-Response to flex request in DA market](#{FD81571A-2B24-4767-862A-CF5A3C8A0982}) |  |
| 2.10 |  | 09Reschedule with updated market prices and flexibility request | On the basis of the requested flexibility and the updated market prices, the flexible assets of the EC are rescheduled. |  | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) |  |  |  |
| 2.11 |  | 10Put together additional possible flexibility | This activity is planned in the future and is not yet implemented in the operation of the EC.  The EC might be able to deliver more flexibility than was requested by the DSO on the DA GOPACS platform. This additional flexibility information is organized and sent to the CSP, to be traded in the Intraday flexibility market. |  | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) | [CSP](#{E1AA62D9-5BFC-4247-AAF8-72D0E7B79C74}) | [Info6-Flexibility profile](#{FA60CBBB-4467-497d-BFAA-64094500EB17}) |  |
| 2.12 |  | 11Acknowledge possible flexibility of the EC | This activity is planned in the future and is not yet implemented in the operation of the EC.  The CSP acknowledges the additional flexibility information of the EC. |  | [CSP](#{E1AA62D9-5BFC-4247-AAF8-72D0E7B79C74}) |  |  |  |
| 2.13 |  | 12Generate the updated profile of the EC | The updated consumption and injection profile of the EC is put together in form of a DA profile and sent to the supplier. |  | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) | [BRP](#{13636E3E-1809-4122-839A-BD4385E13860}), [Supplier](#{34C5B059-CA4B-46ba-AAB9-51DBA945F605}) | [Info7-DA profile](#{D0D381B3-49B7-4814-B8BE-B7FA8FDA264B}) |  |
| 2.14 |  | 13Acknowledge the profile | The supplier acknowledges the updated DA profile of the EC. |  | [BRP](#{13636E3E-1809-4122-839A-BD4385E13860}), [Supplier](#{34C5B059-CA4B-46ba-AAB9-51DBA945F605}) |  |  |  |
| 2.15 |  | 14Place bids for the profile on the day-ahead market | On the basis of the DA profile of the EC, the supplier places bids on the DA energy market. These bids are a time series with 15 min intervals of:  - amount of energy to be bought/sold  - price for this energy |  | [BRP](#{13636E3E-1809-4122-839A-BD4385E13860}), [Supplier](#{34C5B059-CA4B-46ba-AAB9-51DBA945F605}) |  |  |  |
| 2.16 |  | 15Receive the results from the day-ahead market closing | The DA energy procurement market closes and the prices for the DA spot market are cleared. |  | [BRP](#{13636E3E-1809-4122-839A-BD4385E13860}), [Supplier](#{34C5B059-CA4B-46ba-AAB9-51DBA945F605}) |  |  |  |
| 2.17 |  | 16Generate T-prognosis | The supplier puts together the T-prognosis of the EC based on the result of the market closing. |  | [BRP](#{13636E3E-1809-4122-839A-BD4385E13860}), [Supplier](#{34C5B059-CA4B-46ba-AAB9-51DBA945F605}) | [DSO](#{B9728693-DE6D-4ab7-B4C4-B0B1C1CF0779}) | [Info12-T-prognosis](#{3D808402-0F53-4904-80F2-2703A0B4AA92}) |  |
| 2.18 |  | 17Acknowledge the T-prognosis | The DSO acknowledges the T-prognosis. |  | [DSO](#{B9728693-DE6D-4ab7-B4C4-B0B1C1CF0779}) |  |  |  |

* 2.1. 01Put together the available flexibility

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/01Put together the available flexibility  
From the previous scenario "01 Day-ahead scheduling and profile of the EC", the EC extracts the available flexibility and sends this flexibility to the CSP.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Flexibility profile](#{FA60CBBB-4467-497d-BFAA-64094500EB17}) |  |  |

* 2.2. 02Organize day-ahead profile of the EC

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/02Organize day-ahead profile of the EC  
The profile of consumption and injection of the EC, generated in the activity "01 Day-ahead scheduling and profile of the EC" is stored in the form of a day-ahead (DA) profile to be sent to the DSO.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [DA profile](#{D0D381B3-49B7-4814-B8BE-B7FA8FDA264B}) |  |  |

* 2.4. 04Generate flexibility request if needed to manage congestion

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/04Generate flexibility request if needed to manage congestion  
In case of congestion, the DSO publishes a flexibility request on the day-ahead GOPACS platform.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Flexibility request](#{672897FF-FD6B-4c9b-9E95-2358FFB099D2}) |  |  |

* 2.6. 06Read the flexibility request and activate flexibility of the EC

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/06Read the flexibility request and activate flexibility of the EC  
The CSP reads the flexibility request of the DSO and matches it with the available flexibility of the EC.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Flexibility request](#{672897FF-FD6B-4c9b-9E95-2358FFB099D2}) |  |  |

* 2.7. 06Read the flexibility request and activate flexibility of the EC

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/06Read the flexibility request and activate flexibility of the EC  
The CSP reads the flexibility request of the DSO and matches it with the available flexibility of the EC.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Response to flex request in DA market](#{FD81571A-2B24-4767-862A-CF5A3C8A0982}) |  |  |

* 2.8. 07Acknowledge the response of the EC

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/07Acknowledge the response of the EC  
The DSO acknowledges the response of the EC through the CSP.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Acknowledgement of response](#{949B11C5-200C-4892-9156-1B1DB5A02AC9}) |  |  |

* 2.9. 08Acknowledge the flexibility request

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/08Acknowledge the flexibility request  
The EC receives the flexibility request. In the day-ahead flexibility request procedure, the EC is contractually obliged to accept flexibility requests within their contractually agreed limit. The EC cannot deny the flexibility request at this step.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Response to flex request in DA market](#{FD81571A-2B24-4767-862A-CF5A3C8A0982}) |  |  |

* 2.10. 09Reschedule with updated market prices and flexibility request

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/09Reschedule with updated market prices and flexibility request  
On the basis of the requested flexibility and the updated market prices, the flexible assets of the EC are rescheduled.

|  |
| --- |
| Activity 02.1 - activities flowchart |

Activity step by step analysis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Scenario*** | | | | | | | | |
| ***Scenario name*** | | 02 Day-ahead profile communication and flexibility market (GOPACS) | | | | | | |
| ***Step No*** | ***Event*** | ***Name of process/activity*** | ***Description of process/activity*** | ***Service*** | ***Information producer (actor)*** | ***Information receiver (actor)*** | ***Information exchanged (IDs)*** | ***Requirement, R-IDs*** |
| 2.10.1 |  | 01Collect known production and consumption forecast | The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info1-Forecast information for one HEMS](#{3D6CAD7D-C412-401a-999E-E9B70FC77512}) |  |
| 2.10.2 |  | 01Collect known production and consumption forecast | The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [Info2-Forecast information for the GEMS](#{207DD5F9-7943-4cd7-9B8C-886C15E25549}) |  |
| 2.10.3 |  | 02Collect agreed flexibility | The EC already agreed to deliver a certain amount of flexibility at a certain time. This information has to be taken into consideration when creating a new schedule for the EC assets. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}), [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [Info11-Information about participation in flexibility request](#{0486F593-517F-4123-8D52-57ADAA687411}) |  |
| 2.10.4 |  | 03Request updated energy prices | The GEMS requests the current energy prices in the market. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 2.10.5 |  | 04Define EC internal price | With knowledge on the PV production and consumption forecasts, the current energy prices and the flexibility the EC agreed to deliver, the GEMS defines an internal price for the energy inside the EC. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info3-EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |
| 2.10.6 |  | 05Individual look-ahead energy scheduling | The HEMS of each household optimizes its own flexible assets. In this step, different objective functions may be considered such as:   * + Minimization of monetary cost   + Maximization of self-consumption   + Maximization of the opportunity cost   + others   In this pilot site, the flexible assets are mainly storage systems, heat pumps, PV and electric vehicles. |  | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [Info4-Scheduling information of a HEMS](#{B0B0B2D0-0104-490e-B4E7-C99CDB15A28D}) |  |
| 2.10.7 |  | 06EC look-ahead energy scheduling | With the information of the schedule of each HEMS, the GEMS optimizes the community resources and the import and export setpoints for each HEMS. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 2.10.8 |  | 07Update EC internal energy price | If the convergence criterion is not fulfilled, the EC internal energy prices are updated. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info3-EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |
| 2.10.9 |  | 08Organize information about possible flexibility and the schedule | In this step, the solution of the optimization problem is stored.  The schedules of import and export of each HEMS are stored in order to be sent to the HEMS of the EC members.  The consumption and injection forecast of the whole EC are stored, to be sent to the BRP.  Information on the possible flexibility is extracted in order to participate in the flexibility market through a BRP. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info5-EC member Imp/Exp Scheduling](#{12B895F7-3168-4eee-B90D-D87052B41B9E}) |  |
| 2.10.10 |  | 09Acknowledge the schedule | Each HEMS acknowledges the schedule for its import and export values. |  | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) |  |  |  |

* + 2.10.1. 01Collect known production and consumption forecast

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/09Reschedule with updated market prices and flexibility request/01Collect known production and consumption forecast  
The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Forecast information for one HEMS](#{3D6CAD7D-C412-401a-999E-E9B70FC77512}) |  |  |

* + 2.10.2. 01Collect known production and consumption forecast

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/09Reschedule with updated market prices and flexibility request/01Collect known production and consumption forecast  
The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Forecast information for the GEMS](#{207DD5F9-7943-4cd7-9B8C-886C15E25549}) |  |  |

* + 2.10.3. 02Collect agreed flexibility

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/09Reschedule with updated market prices and flexibility request/02Collect agreed flexibility  
The EC already agreed to deliver a certain amount of flexibility at a certain time. This information has to be taken into consideration when creating a new schedule for the EC assets.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Information about participation in flexibility request](#{0486F593-517F-4123-8D52-57ADAA687411}) |  |  |

* + 2.10.5. 04Define EC internal price

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/09Reschedule with updated market prices and flexibility request/04Define EC internal price  
With knowledge on the PV production and consumption forecasts, the current energy prices and the flexibility the EC agreed to deliver, the GEMS defines an internal price for the energy inside the EC.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |  |

* + 2.10.6. 05Individual look-ahead energy scheduling

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/09Reschedule with updated market prices and flexibility request/05Individual look-ahead energy scheduling  
The HEMS of each household optimizes its own flexible assets. In this step, different objective functions may be considered such as:

* + - Minimization of monetary cost
    - Maximization of self-consumption
    - Maximization of the opportunity cost
    - others

In this pilot site, the flexible assets are mainly storage systems, heat pumps, PV and electric vehicles.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Scheduling information of a HEMS](#{B0B0B2D0-0104-490e-B4E7-C99CDB15A28D}) |  |  |

* + 2.10.8. 07Update EC internal energy price

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/09Reschedule with updated market prices and flexibility request/07Update EC internal energy price  
If the convergence criterion is not fulfilled, the EC internal energy prices are updated.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |  |

* + 2.10.9. 08Organize information about possible flexibility and the schedule

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/09Reschedule with updated market prices and flexibility request/08Organize information about possible flexibility and the schedule  
In this step, the solution of the optimization problem is stored.   
The schedules of import and export of each HEMS are stored in order to be sent to the HEMS of the EC members.   
The consumption and injection forecast of the whole EC are stored, to be sent to the BRP.   
Information on the possible flexibility is extracted in order to participate in the flexibility market through a BRP.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [EC member Imp/Exp Scheduling](#{12B895F7-3168-4eee-B90D-D87052B41B9E}) |  |  |

* 2.11. 10Put together additional possible flexibility

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/10Put together additional possible flexibility   
This activity is planned in the future and is not yet implemented in the operation of the EC.   
The EC might be able to deliver more flexibility than was requested by the DSO on the DA GOPACS platform. This additional flexibility information is organized and sent to the CSP, to be traded in the Intraday flexibility market.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Flexibility profile](#{FA60CBBB-4467-497d-BFAA-64094500EB17}) |  |  |

* 2.13. 12Generate the updated profile of the EC

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/12Generate the updated profile of the EC  
The updated consumption and injection profile of the EC is put together in form of a DA profile and sent to the supplier.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [DA profile](#{D0D381B3-49B7-4814-B8BE-B7FA8FDA264B}) |  | This is an updated DA profile. Based on knowledge of the requested flexibility and the current DA energy prices. |

* 2.17. 16Generate T-prognosis

Business section: 02 Day-ahead profile communication and flexibility market (GOPACS)/16Generate T-prognosis  
The supplier puts together the T-prognosis of the EC based on the result of the market closing.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [T-prognosis](#{3D808402-0F53-4904-80F2-2703A0B4AA92}) |  |  |

03-0 Intraday flexibility market (GOPACS)

In addition to the day-ahead flexibility market, an intraday GOPACS market will be established in the Netherlands in the future. The EC can participate in this intraday market through a Congestion Service Provider (CSP). This scenario shows the information flow for participating in the intraday flexibility market.

|  |
| --- |
| Scenario 03 - activities flowchart |

Scenario step by step analysis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Scenario*** | | | | | | | | |
| ***Scenario name*** | | 03-0 Intraday flexibility market (GOPACS) | | | | | | |
| ***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 |  | 01Evaluate grid load | The DSO evaluates the grid load. |  | [DSO](#{B9728693-DE6D-4ab7-B4C4-B0B1C1CF0779}) |  |  |  |
| 3.2 |  | 02Place flexibility requests on ID GOPACS | In case of needing flexibility, the DSO places a flexibility request on the intraday GOPACS platform. |  | [DSO](#{B9728693-DE6D-4ab7-B4C4-B0B1C1CF0779}) | [BRP](#{13636E3E-1809-4122-839A-BD4385E13860}), [Supplier](#{34C5B059-CA4B-46ba-AAB9-51DBA945F605}), [CSP](#{E1AA62D9-5BFC-4247-AAF8-72D0E7B79C74}) | [Info8-Flexibility request](#{672897FF-FD6B-4c9b-9E95-2358FFB099D2}) |  |
| 3.3 |  | 03Place bids and respond to requests on ID GOPACS | The CSP places bids for flexibility and responds to the flexibility request of the DSO. |  | [BRP](#{13636E3E-1809-4122-839A-BD4385E13860}), [Supplier](#{34C5B059-CA4B-46ba-AAB9-51DBA945F605}), [CSP](#{E1AA62D9-5BFC-4247-AAF8-72D0E7B79C74}) |  |  |  |
| 3.4 |  | 04Make flexibility requests to EC | The CSP makes a flexibility request to the EC. |  | [BRP](#{13636E3E-1809-4122-839A-BD4385E13860}), [Supplier](#{34C5B059-CA4B-46ba-AAB9-51DBA945F605}), [CSP](#{E1AA62D9-5BFC-4247-AAF8-72D0E7B79C74}) | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [Info8-Flexibility request](#{672897FF-FD6B-4c9b-9E95-2358FFB099D2}) |  |
| 3.5 |  | 05Process flexibility request | The GEMS receives the flexibility request of the CSP and processes this flexibility request. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 3.6 |  | 06Generate new schedule to meet the flexibility request | The GEMS generates a new schedule to meet the flexibility request. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |

* 3.2. 02Place flexibility requests on ID GOPACS

Business section: 03-0 Intraday flexibility market (GOPACS)/02Place flexibility requests on ID GOPACS  
In case of needing flexibility, the DSO places a flexibility request on the intraday GOPACS platform.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Flexibility request](#{672897FF-FD6B-4c9b-9E95-2358FFB099D2}) |  |  |

* 3.4. 04Make flexibility requests to EC

Business section: 03-0 Intraday flexibility market (GOPACS)/04Make flexibility requests to EC  
The CSP makes a flexibility request to the EC.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Flexibility request](#{672897FF-FD6B-4c9b-9E95-2358FFB099D2}) |  |  |

* 3.6. 06Generate new schedule to meet the flexibility request

Business section: 03-0 Intraday flexibility market (GOPACS)/06Generate new schedule to meet the flexibility request   
The GEMS generates a new schedule to meet the flexibility request.

|  |
| --- |
| Activity 03.1 - activities flowchart |

Activity step by step analysis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Scenario*** | | | | | | | | |
| ***Scenario name*** | | 03-0 Intraday flexibility market (GOPACS) | | | | | | |
| ***Step No*** | ***Event*** | ***Name of process/activity*** | ***Description of process/activity*** | ***Service*** | ***Information producer (actor)*** | ***Information receiver (actor)*** | ***Information exchanged (IDs)*** | ***Requirement, R-IDs*** |
| 3.6.1 |  | 01Collect known production and consumption forecast | The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info1-Forecast information for one HEMS](#{3D6CAD7D-C412-401a-999E-E9B70FC77512}) |  |
| 3.6.2 |  | 02Collect agreed flexibility | The EC already agreed to deliver a certain amount of flexibility at a certain time, both in the DA GOPACS, as well as in the intraday GOPACS. This information has to be taken into consideration when creating a new schedule for the EC assets. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}), [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [Info11-Information about participation in flexibility request](#{0486F593-517F-4123-8D52-57ADAA687411}) |  |
| 3.6.3 |  | 03Request updated energy prices | The GEMS requests the current energy prices in the market. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 3.6.4 |  | 04Define EC internal price | With knowledge on the PV production and consumption forecasts, the current prices for energy and information on the flexibility the EC agreed to deliver, the GEMS defines an EC internal energy price. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info3-EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |
| 3.6.5 |  | 05Individual look-ahead energy scheduling | The HEMS of each household optimizes its own flexible assets. In this step, different objective functions may be considered such as:   * + Minimization of monetary cost   + Maximization of self-consumption   + Maximization of the opportunity cost   In this pilot site, the flexible assets are mainly storage systems, heat pumps, PV and electric vehicles. |  | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [Info4-Scheduling information of a HEMS](#{B0B0B2D0-0104-490e-B4E7-C99CDB15A28D}) |  |
| 3.6.6 |  | 06EC look-ahead energy scheduling | With the information of the schedule of each HEMS, the GEMS optimizes the community resources. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 3.6.7 |  | 07Update EC internal energy price | If the convergence criterion is not fulfilled, the EC internal energy prices are updated. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info3-EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |
| 3.6.8 |  | 08Organize information about possible flexibility and the schedule | In this step, the solution of the optimization problem is stored.  The schedules of import and export of each HEMS are stored in order to be sent to the HEMS of the EC members.  The consumption and injection forecast of the whole EC are stored, to be sent to the BRP.  Information on the possible flexibility is extracted in order to participate in the flexibility market through a BRP. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info5-EC member Imp/Exp Scheduling](#{12B895F7-3168-4eee-B90D-D87052B41B9E}) |  |
| 3.6.9 |  | 09Acknowledge the schedule | Each HEMS acknowledges the schedule for its import and export values. |  | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) |  |  |  |

* + 3.6.1. 01Collect known production and consumption forecast

Business section: 03-0 Intraday flexibility market (GOPACS)/06Generate new schedule to meet the flexibility request /01Collect known production and consumption forecast  
The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Forecast information for one HEMS](#{3D6CAD7D-C412-401a-999E-E9B70FC77512}) |  |  |

* + 3.6.2. 02Collect agreed flexibility

Business section: 03-0 Intraday flexibility market (GOPACS)/06Generate new schedule to meet the flexibility request /02Collect agreed flexibility  
The EC already agreed to deliver a certain amount of flexibility at a certain time, both in the DA GOPACS, as well as in the intraday GOPACS. This information has to be taken into consideration when creating a new schedule for the EC assets.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Information about participation in flexibility request](#{0486F593-517F-4123-8D52-57ADAA687411}) |  |  |

* + 3.6.4. 04Define EC internal price

Business section: 03-0 Intraday flexibility market (GOPACS)/06Generate new schedule to meet the flexibility request /04Define EC internal price  
With knowledge on the PV production and consumption forecasts, the current prices for energy and information on the flexibility the EC agreed to deliver, the GEMS defines an EC internal energy price.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |  |

* + 3.6.5. 05Individual look-ahead energy scheduling

Business section: 03-0 Intraday flexibility market (GOPACS)/06Generate new schedule to meet the flexibility request /05Individual look-ahead energy scheduling  
The HEMS of each household optimizes its own flexible assets. In this step, different objective functions may be considered such as:

* + - Minimization of monetary cost
    - Maximization of self-consumption
    - Maximization of the opportunity cost

In this pilot site, the flexible assets are mainly storage systems, heat pumps, PV and electric vehicles.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Scheduling information of a HEMS](#{B0B0B2D0-0104-490e-B4E7-C99CDB15A28D}) |  |  |

* + 3.6.7. 07Update EC internal energy price

Business section: 03-0 Intraday flexibility market (GOPACS)/06Generate new schedule to meet the flexibility request /07Update EC internal energy price  
If the convergence criterion is not fulfilled, the EC internal energy prices are updated.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |  |

* + 3.6.8. 08Organize information about possible flexibility and the schedule

Business section: 03-0 Intraday flexibility market (GOPACS)/06Generate new schedule to meet the flexibility request /08Organize information about possible flexibility and the schedule  
In this step, the solution of the optimization problem is stored.   
The schedules of import and export of each HEMS are stored in order to be sent to the HEMS of the EC members.   
The consumption and injection forecast of the whole EC are stored, to be sent to the BRP.   
Information on the possible flexibility is extracted in order to participate in the flexibility market through a BRP.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [EC member Imp/Exp Scheduling](#{12B895F7-3168-4eee-B90D-D87052B41B9E}) |  |  |

03-1 RT operation

This scenario shows the real-time (RT) operation of the EC. The flexible loads are controlled through setpoints communicated from the GEMS to the HEMS.

|  |
| --- |
| Scenario1 - activities flowchart |

Scenario step by step analysis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Scenario*** | | | | | | | | |
| ***Scenario name*** | | 03-1 RT operation | | | | | | |
| ***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 |  | 01Set incentives and setpoints | The GEMS sends the setpoints for import/export to each HEMS, along with an incentive to meet these setpoints. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info13-Setpoints and incentives](#{AE04F1FE-151A-4f62-94E3-BF761F2E9AB4}) |  |
| 4.2 |  | 02Controls the flexible assets | The setpoints for import/export and the incentives to meet these are processed by the HEMS. The HEMS the computes control signals for the flexible assets based on local goal optimization and the incentives set by the GEMS. |  | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) |  |  |  |
| 4.3 |  | 03Control of community assets | The GEMS controls the community assets. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |

* 4.1. 01Set incentives and setpoints

Business section: 03-1 RT operation/01Set incentives and setpoints  
The GEMS sends the setpoints for import/export to each HEMS, along with an incentive to meet these setpoints.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Setpoints and incentives](#{AE04F1FE-151A-4f62-94E3-BF761F2E9AB4}) |  |  |

03-2 RT performance evaluation

In this scenario, the difference between the RT measurements and the current schedule is evaluated. If the deviation is larger than a certain threshold, the flexible assets are rescheduled.

|  |
| --- |
| Scenario1 - activities flowchart |

Scenario step by step analysis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Scenario*** | | | | | | | | |
| ***Scenario name*** | | 03-2 RT performance evaluation | | | | | | |
| ***Step No*** | ***Event*** | ***Name of process/activity*** | ***Description of process/activity*** | ***Service*** | ***Information producer (actor)*** | ***Information receiver (actor)*** | ***Information exchanged (IDs)*** | ***Requirement, R-IDs*** |
| 5.1 |  | 01Organize house measurements | Each HEMS measures the states of the house and stores these to be sent to the GEMS. |  | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [Info14-House measurements](#{8FA44315-6F53-45f8-9189-DF32CC20E430}) |  |
| 5.2 |  | 02Receive house measurements | The GEMS receives the house measurements of each HEMS. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 5.3 |  | 03Compare RT measurements with schedule | The GEMS compares the real-time measurements of import and export of each HEMS with the schedule. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 5.4 |  | 04Reschedule | In case that the difference between the RT measurements and the schedule is larger than the threshold, the GEMS requests a new schedule for the EC. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |

* 5.1. 01Organize house measurements

Business section: 03-2 RT performance evaluation /01Organize house measurements   
Each HEMS measures the states of the house and stores these to be sent to the GEMS.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [House measurements](#{8FA44315-6F53-45f8-9189-DF32CC20E430}) |  |  |

* 5.4. 04Reschedule

Business section: 03-2 RT performance evaluation /04Reschedule  
In case that the difference between the RT measurements and the schedule is larger than the threshold, the GEMS requests a new schedule for the EC.

|  |
| --- |
| Activity2 - activities flowchart |

Activity step by step analysis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Scenario*** | | | | | | | | |
| ***Scenario name*** | | 03-2 RT performance evaluation | | | | | | |
| ***Step No*** | ***Event*** | ***Name of process/activity*** | ***Description of process/activity*** | ***Service*** | ***Information producer (actor)*** | ***Information receiver (actor)*** | ***Information exchanged (IDs)*** | ***Requirement, R-IDs*** |
| 5.4.1 |  | 01Collect known production and consumption forecast | The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info1-Forecast information for one HEMS](#{3D6CAD7D-C412-401a-999E-E9B70FC77512}) |  |
| 5.4.2 |  | 01Collect known production and consumption forecast | The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [Info2-Forecast information for the GEMS](#{207DD5F9-7943-4cd7-9B8C-886C15E25549}) |  |
| 5.4.3 |  | 02Collect agreed flexibility | The EC already agreed to deliver a certain amount of flexibility at a certain time. This information has to be taken into consideration when creating a new schedule for the EC assets. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}), [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [Info11-Information about participation in flexibility request](#{0486F593-517F-4123-8D52-57ADAA687411}) |  |
| 5.4.4 |  | 03Collect states of the flexible assets of each HEMS | In the previous step, the GEMS received the states of the flexible assets of each HEMS. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 5.4.5 |  | 04Request updated energy prices | The GEMS requests the current energy prices in the market. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 5.4.6 |  | 05Define EC internal price | With knowledge on the PV production and consumption forecasts, the current prices for energy and information on the flexibility the EC agreed to deliver, the GEMS defines an EC internal energy price. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info3-EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |
| 5.4.7 |  | 06Individual look-ahead energy scheduling | The HEMS of each household optimizes its own flexible assets. In this step, different objective functions may be considered such as:   * + Minimization of monetary cost   + Maximization of self-consumption   + Maximization of the opportunity cost   + others   In this pilot site, the flexible assets are mainly storage systems, heat pumps, PV and electric vehicles. |  | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [Info4-Scheduling information of a HEMS](#{B0B0B2D0-0104-490e-B4E7-C99CDB15A28D}) |  |
| 5.4.8 |  | 07EC look-ahead energy scheduling | With the information of the schedule of each HEMS, the GEMS optimizes the community resources. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) |  |  |  |
| 5.4.9 |  | 08Update EC internal energy price | If the convergence criterion is not fulfilled, the EC internal energy prices are updated. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info3-EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |
| 5.4.10 |  | 09Organize information about possible flexibility and the schedule | The schedule of each HEMS, the GEMS and the consumption and injection data of the whole community are stored. Additionally, information on possible flexibility is stored. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [Info5-EC member Imp/Exp Scheduling](#{12B895F7-3168-4eee-B90D-D87052B41B9E}) |  |
| 5.4.11 |  | 10Acknowledge the schedule | Each HEMS acknowledges the schedule of its flexible resources. |  | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) |  |  |  |

* + 5.4.1. 01Collect known production and consumption forecast

Business section: 03-2 RT performance evaluation /04Reschedule/01Collect known production and consumption forecast  
The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Forecast information for one HEMS](#{3D6CAD7D-C412-401a-999E-E9B70FC77512}) |  |  |

* + 5.4.2. 01Collect known production and consumption forecast

Business section: 03-2 RT performance evaluation /04Reschedule/01Collect known production and consumption forecast  
The GEMS fetches the consumption and production forecast which was computed for the day-ahead scheduling.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Forecast information for the GEMS](#{207DD5F9-7943-4cd7-9B8C-886C15E25549}) |  |  |

* + 5.4.3. 02Collect agreed flexibility

Business section: 03-2 RT performance evaluation /04Reschedule/02Collect agreed flexibility  
The EC already agreed to deliver a certain amount of flexibility at a certain time. This information has to be taken into consideration when creating a new schedule for the EC assets.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Information about participation in flexibility request](#{0486F593-517F-4123-8D52-57ADAA687411}) |  |  |

* + 5.4.6. 05Define EC internal price

Business section: 03-2 RT performance evaluation /04Reschedule/05Define EC internal price  
With knowledge on the PV production and consumption forecasts, the current prices for energy and information on the flexibility the EC agreed to deliver, the GEMS defines an EC internal energy price.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |  |

* + 5.4.7. 06Individual look-ahead energy scheduling

Business section: 03-2 RT performance evaluation /04Reschedule/06Individual look-ahead energy scheduling  
The HEMS of each household optimizes its own flexible assets. In this step, different objective functions may be considered such as:

* + - Minimization of monetary cost
    - Maximization of self-consumption
    - Maximization of the opportunity cost
    - others

In this pilot site, the flexible assets are mainly storage systems, heat pumps, PV and electric vehicles.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Scheduling information of a HEMS](#{B0B0B2D0-0104-490e-B4E7-C99CDB15A28D}) |  |  |

* + 5.4.9. 08Update EC internal energy price

Business section: 03-2 RT performance evaluation /04Reschedule/08Update EC internal energy price  
If the convergence criterion is not fulfilled, the EC internal energy prices are updated.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [EC internal energy prices](#{F6D5ABF6-2D0E-40a4-8660-A71F97DF4D85}) |  |  |

* + 5.4.10. 09Organize information about possible flexibility and the schedule

Business section: 03-2 RT performance evaluation /04Reschedule/09Organize information about possible flexibility and the schedule  
The schedule of each HEMS, the GEMS and the consumption and injection data of the whole community are stored. Additionally, information on possible flexibility is stored.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [EC member Imp/Exp Scheduling](#{12B895F7-3168-4eee-B90D-D87052B41B9E}) |  |  |

03-3 RT monitoring

The EC manager collects measurements and sends them to the EC members to inform them about their energy usage behavior.

|  |
| --- |
| Scenario 04.3 - activities flowchart |

Scenario step by step analysis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Scenario*** | | | | | | | | |
| ***Scenario name*** | | 03-3 RT monitoring | | | | | | |
| ***Step No*** | ***Event*** | ***Name of process/activity*** | ***Description of process/activity*** | ***Service*** | ***Information producer (actor)*** | ***Information receiver (actor)*** | ***Information exchanged (IDs)*** | ***Requirement, R-IDs*** |
| 6.1 |  | 01Organize EC data | The GEMS collects and organizes the data of the community level. This data set consists of the injection and consumption data at the connection point to the grid and the state of community assets. Data from the other EC members is only collected on the HEMS level, in order to ensure privacy. |  | [GEMS](#{30AC1091-1194-4d22-AE45-B7B00CF615B4}) | [EC Member](#{D236E56F-8F7A-436e-917A-37A096594B02}) | [Info15-Community measurements](#{9A3ECE75-AA13-42ba-9F76-CC73626F0CB8}) |  |
| 6.2 |  | 02Organize individual data | In this step, the HEMS collects all data from the house. This includes the information on the consumption, production and injection, as well as data from the flexible loads and storage systems.  The data is stored in an appropriate way, in order to be sent to a dashboard for visualization. |  | [HEMS](#{524900AB-BC85-4dec-BAAD-2CAAFCA3928B}) | [EC Member](#{D236E56F-8F7A-436e-917A-37A096594B02}) | [Info14-House measurements](#{8FA44315-6F53-45f8-9189-DF32CC20E430}) |  |
| 6.3 |  | 03Receive the data | The EC member receives the data. |  | [EC Member](#{D236E56F-8F7A-436e-917A-37A096594B02}) |  |  |  |
| 6.4 |  | 04Visualize the data | The data is visualized on the EC member level. The EC member interacts with an interface to access and see the data. |  | [EC Member](#{D236E56F-8F7A-436e-917A-37A096594B02}) |  |  |  |

* 6.1. 01Organize EC data

Business section: 03-3 RT monitoring/01Organize EC data  
The GEMS collects and organizes the data of the community level.  
This data set consists of the injection and consumption data at the connection point to the grid and the state of community assets.  
Data from the other EC members is only collected on the HEMS level, in order to ensure privacy.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Community measurements](#{9A3ECE75-AA13-42ba-9F76-CC73626F0CB8}) |  |  |

* 6.2. 02Organize individual data

Business section: 03-3 RT monitoring/02Organize individual data  
In this step, the HEMS collects all data from the house. This includes the information on the consumption, production and injection, as well as data from the flexible loads and storage systems.   
The data is stored in an appropriate way, in order to be sent to a dashboard for visualization.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [House measurements](#{8FA44315-6F53-45f8-9189-DF32CC20E430}) |  |  |

04 Settlement and billing

This scenario shows the billing and settlement process of the EC. The EC receives one bill from the retailer, which is settled by the EC manager. The EC manager then drafts a bill for each EC member.

|  |
| --- |
| Scenario1 - activities flowchart |

Scenario step by step analysis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Scenario*** | | | | | | | | |
| ***Scenario name*** | | 04 Settlement and billing | | | | | | |
| ***Step No*** | ***Event*** | ***Name of process/activity*** | ***Description of process/activity*** | ***Service*** | ***Information producer (actor)*** | ***Information receiver (actor)*** | ***Information exchanged (IDs)*** | ***Requirement, R-IDs*** |
| 7.1 |  | 01Consolidation of consumption & injection data of the EC | Once a month, the measurement company (Kenter in this case) collects the consumption and injection data of the EC through the meter at the connection point. This data is stored and then sent to the DSO and to the Supplier. |  | [Measurement company](#{0A898594-86F8-4efa-80CD-D0FF39483DD5}) | [Supplier](#{34C5B059-CA4B-46ba-AAB9-51DBA945F605}), [DSO](#{B9728693-DE6D-4ab7-B4C4-B0B1C1CF0779}) | [Info16-Invoice preliminary information](#{D91DB229-BCF8-41dc-A346-FD3676E47B78}) |  |
| 7.2 |  | 02Set up an invoice for the EC (MOP) | The measurement company sets up an invoice for the EC for the service. |  | [Measurement company](#{0A898594-86F8-4efa-80CD-D0FF39483DD5}) | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) | [Info17-Invoice from the measurement company](#{A1D92E75-8037-485d-8979-4FB1AFF75DB1}) |  |
| 7.3 |  | 03Set up an invoice for the EC (DSO) | With the meter data from the measurement company, the DSO calculates a bill for the EC for the connection to the grid. This bill is then sent to the EC manager. |  | [DSO](#{B9728693-DE6D-4ab7-B4C4-B0B1C1CF0779}) | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) | [Info18-Invoice from DSO](#{8F051984-A265-4024-A0C8-CC7418657721}) |  |
| 7.4 |  | 04Set up an invoice for the EC (Supplier) | Based on the measurements provided by the measurement company, the supplier computes a bill for the whole community. Depending on the market prices and the volume traded, the bill may be such that the EC manager has to pay to the retailer or that the EC manager receives a payment from the supplier. |  | [Supplier](#{34C5B059-CA4B-46ba-AAB9-51DBA945F605}) | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) | [Info19-Invoice from the supplier](#{52F4416B-30F1-4f56-844B-F090469868DB}) |  |
| 7.5 |  | 05Consolidate the meter data of each EC member | The EC manager has access to the meters of each EC member and reads the consumption and injection measurements. |  | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) |  |  |  |
| 7.6 |  | 06Acknowledge the invoices & payment | The EC manager acknowledges and settles the bills. |  | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) |  |  |  |
| 7.7 |  | 07Set up invoice for each EC member | With the bill for the whole EC and the measurements of the meter of each EC member collected by the EC manager, the EC manager computes a bill for each EC member. |  | [EC Manager](#{BF6EE37F-C53B-469a-B171-2699A1A42E7F}) | [EC Member](#{D236E56F-8F7A-436e-917A-37A096594B02}) | [Info20-Invoice for EC member](#{432E7FFE-0E2A-4892-B13C-90EC9B47C716}) |  |
| 7.8 |  | 08Acknowledge the invoice & payment | Each EC member acknowledges the bill sent by the EC manager and the bill is being settled. |  | [EC Member](#{D236E56F-8F7A-436e-917A-37A096594B02}) |  |  |  |

* 7.1. 01Consolidation of consumption & injection data of the EC

Business section: 04 Settlement and billing/01Consolidation of consumption & injection data of the EC  
Once a month, the measurement company (Kenter in this case) collects the consumption and injection data of the EC through the meter at the connection point. This data is stored and then sent to the DSO and to the Supplier.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Invoice preliminary information](#{D91DB229-BCF8-41dc-A346-FD3676E47B78}) |  |  |

* 7.2. 02Set up an invoice for the EC (MOP)

Business section: 04 Settlement and billing/02Set up an invoice for the EC (MOP)  
The measurement company sets up an invoice for the EC for the service.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Invoice from the measurement company](#{A1D92E75-8037-485d-8979-4FB1AFF75DB1}) |  |  |

* 7.3. 03Set up an invoice for the EC (DSO)

Business section: 04 Settlement and billing/03Set up an invoice for the EC (DSO)  
With the meter data from the measurement company, the DSO calculates a bill for the EC for the connection to the grid. This bill is then sent to the EC manager.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Invoice from DSO](#{8F051984-A265-4024-A0C8-CC7418657721}) |  |  |

* 7.4. 04Set up an invoice for the EC (Supplier)

Business section: 04 Settlement and billing/04Set up an invoice for the EC (Supplier)  
Based on the measurements provided by the measurement company, the supplier computes a bill for the whole community. Depending on the market prices and the volume traded, the bill may be such that the EC manager has to pay to the retailer or that the EC manager receives a payment from the supplier.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Invoice from the supplier](#{52F4416B-30F1-4f56-844B-F090469868DB}) |  |  |

* 7.7. 07Set up invoice for each EC member

Business section: 04 Settlement and billing/07Set up invoice for each EC member  
With the bill for the whole EC and the measurements of the meter of each EC member collected by the EC manager, the EC manager computes a bill for each EC member.   
Information sent:

|  |  |  |
| --- | --- | --- |
| ***Business object*** | ***Instance name*** | ***Instance description*** |
| [Invoice for EC member](#{432E7FFE-0E2A-4892-B13C-90EC9B47C716}) |  |  |

Information exchanged

|  |  |  |  |
| --- | --- | --- | --- |
| ***Information exchanged*** | | | |
| ***Information exchanged, ID*** | ***Name of information*** | ***Description of information exchanged*** | ***Requirement, R-IDs*** |
| Info1 | Forecast information for one HEMS | * ID of the HEMS * Time stamp * Time series for the day in 15 min intervals:   - PV production forecast  - Consumption forecast |  |
| Info2 | Forecast information for the GEMS | * Time stamp * Time series for the day in 15 min intervals:   - PV production forecast of the whole EC  - Consumption forecast of the whole EC |  |
| Info3 | EC internal energy prices | * Time stamp * Time series for the day in 15 min intervals:   - Grid buy price (including transmission fees and taxes)  - Grid sell price (including transmission fees and taxes) - Internal price of the energy community |  |
| Info4 | Scheduling information of a HEMS | * ID of the HEMS * Time stamp * Time series for the day in 15 min intervals:   - Import of this EC member  - Export of this EC member   * Available flexibility (up/down, amount, time interval) |  |
| Info5 | EC member Imp/Exp Scheduling | * ID of the HEMS * Time stamp * Time series for the day in 15 min intervals:   - Power imported to this EC member - Power exported from this EC member |  |
| Info6 | Flexibility profile | * ID of the EC * Time stamp * Flex offers:   - Possible flexibility (start time, duration, amount, up/down)  - Requested price for this flexibility |  |
| Info7 | DA profile | * ID of the EC * Time Stamp * Time series for the day in 15 min intervals:   - Consumption of the EC  - Injection of the EC |  |
| Info8 | Flexibility request | The flexibility request includes:   * Amount and direction (up/down) of requested flexibility * Starting time of this flexibility * Duration of the flexibility * Price of the flexibility (only NL) |  |
| Info9 | Response to flex request in DA market | The EC is contractually obliged to accept the flexibility request. When the CSP matches the request of the DSO with the available flexibility of the EC, this response is "Yes". |  |
| Info10 | Acknowledgement of response | The DSO acknowledges that the EC accepted the DA flexibility request. |  |
| Info11 | Information about participation in flexibility request | Information about the requested flexibility:  - Time stamp  - Member ID (IT)/ EC ID (NL) - Start time of the flexibility request  - Duration of the flexibility request  - Amount of the flexibility request |  |
| Info12 | T-prognosis | * ID of the EC * Time Stamp * Time series for the day in 15 min intervals:   - Consumption of the EC  - Injection of the EC |  |
| Info13 | Setpoints and incentives | * ID of the HEMS * Time stamp * Setpoint for import/export value of this HEMS * Incentive for the HEMS to meet these setpoints |  |
| Info14 | House measurements | * Member ID * Time stamp * PV data (only for members with PV):   S\_AC (VA) S\_AC\_L1 (VA) S\_AC\_L2 (VA) S\_AC\_L3 (VA) P\_AC (W) P\_AC\_L1 (W) P\_AC\_L2 (W) P\_AC\_L3 (W) Q\_AC (VAr) Q\_AC\_L1 (VAr) Q\_AC\_L2 (VAr) Q\_AC\_L3 (VAr) PF\_L1 (Real) PF\_L2 (Real) PF\_L3 (Real) U\_AC\_L1 (V) U\_AC\_L2 (V) U\_AC\_L3 (V) I\_AC\_L1 (A) I\_AC\_L2 (A) I\_AC\_L3 (A) Ump\_DC\_St1 (V) Imp\_DC\_St1 (A) P\_DC\_St1 (W) Ump\_DC\_St2 (V) Imp\_DC\_St2 (A) P\_DC\_St2 (W) P\_DC (W) f (Hz) Temperature (ºC) Inverter State (Integer)   * House data:   S\_Imp (VA) S\_Imp\_L1 (VA) S\_Imp\_L2 (VA) S\_Imp\_L3 (VA) S\_Exp (VA) S\_Exp\_L1 (VA) S\_Exp\_L2 (VA) S\_Exp\_L3 (VA) P\_Imp (W) P\_Imp\_L1 (W) P\_Imp\_L2 (W) P\_Imp\_L3 (W) P\_Exp (W) P\_Exp\_L1 (W) P\_Exp\_L2 (W) P\_Exp\_L3 (W) Q\_Imp (VAr) Q\_Imp\_L1 (VAr) Q\_Imp\_L2 (VAr) Q\_Imp\_L3 (VAr) Q\_Exp (VAr) Q\_Exp\_L1 (VAr) Q\_Exp\_L2 (VAr) Q\_Exp\_L3 (VAr) PF\_L1 (Real) PF\_L2 (Real) PF\_L3 (Real) U\_L1 (V) U\_L2 (V) U\_L3 (V) I\_L1 (A) I\_L2 (A) I\_L3 (A) f (Hz)   * Storage data per battery (if applicable):   SOC (%) Temperature (ºC)  S\_Imp (VA) S\_Imp\_L1 (VA) S\_Imp\_L2 (VA) S\_Imp\_L3 (VA) S\_Exp (VA) S\_Exp\_L1 (VA) S\_Exp\_L2 (VA) S\_Exp\_L3 (VA) P\_Imp (W) P\_Imp\_L1 (W) P\_Imp\_L2 (W) P\_Imp\_L3 (W) P\_Exp (W) P\_Exp\_L1 (W) P\_Exp\_L2 (W) P\_Exp\_L3 (W) Q\_Imp (VAr) Q\_Imp\_L1 (VAr) Q\_Imp\_L2 (VAr) Q\_Imp\_L3 (VAr) Q\_Exp (VAr) Q\_Exp\_L1 (VAr) Q\_Exp\_L2 (VAr) Q\_Exp\_L3 (VAr) PF\_L1 (Real) PF\_L2 (Real) PF\_L3 (Real) U\_L1 (V) U\_L2 (V) U\_L3 (V) I\_L1 (A) I\_L2 (A) I\_L3 (A) f (Hz)  - Possibly additional states of flexible assets |  |
| Info15 | Community measurements | * ID of the EC * Time stamp * Data of:   - Consumption of the whole EC  - Production of the whole EC  - Injection of the whole EC  - Price inside the community  - Grid energy price |  |
| Info16 | Invoice preliminary information | * ID of the EC member (IT, BE)/ ID of the EC (NL) * Time stamp * Time series for 15 min intervals of the whole month:   - Consumption  - Injection |  |
| Info17 | Invoice from the measurement company | - ID of the EC  - Time stamp  - Bill for the EC |  |
| Info18 | Invoice from DSO | - ID of the EC  - time stamp  - fixed cost for the whole month for the connection to the grid  - cost for the whole month for the contracted capacity  - cost for the whole month for the amount of kWhs used in the respective month - cost for the whole month for the maximum power (15 min average) in that month  - total amount to pay |  |
| Info19 | Invoice from the supplier | * ID of the EC * Time stamp * Time series of:   - Consumption data (kWh) - Injection data (kWh) - Price for consumption (€/kWh) - Renumeration for injection (€/kWh)   * Total amount to pay/amount of renumeration (€) |  |
| Info20 | Invoice for EC member | * ID of the EC member * Time stamp * Information on the invoice of the retailer * Time series of the data of this EC member:   - Consumption data  - Injection data   * Time series of the EC internal energy price * Total amount to pay/of renumeration |  |

Requirements (optional)

Common terms and definitions

Custom information (optional)