Orchestrating an interoperable sovereign federated Multi-vector Energy data space built on open standards and ready for GAia-X

D3.5 KPIs applicable in OMEGA-X

Document Identification	
Contractual delivery date:	30/06/2023
Actual delivery date:	30/06/2023
Responsible beneficiary:	EDP
Contributing beneficiaries:	ATOS IT, Tecnalia, EyPESA, ELIA, 50Hz, UPC, Odit-e, RINA-C, REVOLT, AU, PUPIN, ASTEA, EW, METEO
Dissemination level:	PU
Version:	1.0
Status:	Final

Keywords:
KPI, Use Case, Reference Architecture, Validation, Evaluation

This document is issued within the frame and for the purpose of the OMEGA-X project. This project has received funding from the European Union's Horizon Europe Framework Programme under Grant Agreement No. 101069287. The opinions expressed and arguments employed herein do not necessarily reflect the official views of the European Commission.

Document Information

Document Identification			
Related WP	WP3	**Related Deliverables(s):**	
Document reference:	OMEGA-X_D3.5	**Total number of pages:**	161

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Document History			
Version	**Date**	**Change editors**	**Change**
0.1	06/02/2023	EDP	Table of Contents and structure alignment of the document.
0.2	03/03/2023	EDP	Table of Contents update and definition of contents respective leaders. Included EWF inputs.
0.2.1	30/03/2023	EDP	Included EDP inputs.
0.3	24/04/2023	EDP	Annex 2 and inputs in other sections

Document History			
Version	**Date**	**Change editors**	**Change**
0.3.1	04/05/2023	EDP and Tecnalia	Annexes update and Tecnalia contribution on section 5
0.3.2	11/05/2023	EDP	Updated and included contents in all sections.
0.4	24/05/2023	All T3.5 partners	Reviewed document and contributed in sections 3, 4 and annex 2.
0.5	02/06/2023	EDP	New consolidated version including partners inputs.
0.6	09/06/2023	ATOS and IMPULSA	Peer Technical review
0.7	21/06/2023	EDP	Reviewed version
0.8	23/06/2023	ATOS	Quality review
0.9	23/06/2023	EDP	Reviewed version
1.0	30/06/2023	ATOS	FINAL VERSION TO BE SUBMITTED

Quality Control		
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Table of Contents

List of Tables

List of Figures

List of Acronyms

Abbreviation / acronym	Description
BIPV	Building Integrated Photovoltaics
BOS	Balance of System
BUC	Business Use Case
CAPEX	Investment costs or Capital Expenditures
CDR	Charge Detail Record
CPO	Charging Points Operators
DER	Distributed Energy Resources
DoA	Description of Action
DSO	Distribution System Operator
DSSC	Data Space Support Centre
Dx.y	Deliverable number y belonging to WP x
DP	Data Provider
EA	Energy-based availability
EC	European Commission
EMSP (or eMSP)	E-Mobility Service Provider
EM UCF	Electromobility Use Case Family
EO	Expected Outcomes
ETL	Extract, Transform, Load
EU	European Union
EV	Electric Vehicle
FLEX UCF	Flexibility Use Case Family
FSP	Flexibility Service Provider
GCO	Granular Certificates
GDPR	General Data Protection Regulation
ICT	Information and Communication Technology
IDS	Industrial Data Space
IEC	International Electrotechnical Commission

Abbreviation / acronym	Description
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
KWh	Kilowatt-hour
KWp	Kilowatt peak
KPI	Key Performance Indicator
LEC UCF	Energy Communities Use Case Family
LCOE	Levelized Cost of Energy
MW	Megawatt
MWh	Megawatt-hour
N/A	Not Applicable
Nb	Number
O&M	Operations and Maintenance
OPEX	Reduction of operational expenditures
PV	Photovoltaic
R&D	Research and Development
REN	Renewable Energy Network
RES	Renewable Energy Sources
REN UCF	Renewables Use Case Family
ROI	Return on Investment
SD	Service Developer
SME	Electrical Mobility Company
SUC	System Use Case
TBD	To Be Decided
UC	Use Case
UCF	Use Case Family
WACC	Weighted Average Cost of Capital
WP	Work Package

Executive Summary

The present deliverable lies under the scope of OMEGA-X design activities, as a direct result of those related to KPI elicitation for use case validation.

The main objective of this deliverable is to identify and define the OMEGA-X Use Case and Reference Architecture Key Performance Indicators (KPIs) which will support the monitoring and assessment procedure of the demonstrators and project activities. This document describes the metrics (technical, functional, impact-oriented) against which the realization of the use cases identified in OMEGA-X in the various pilot sites will be validated.

Therefore, this work on KPI elicitation, as presented in this deliverable, is closely linked to OMEGA-X activities for Use case (UC) identification and Full system architecture and building blocks design. Furthermore, the work conducted regarding the implementation of OMEGA-X demonstrators, related to the 4 Use Case Families (UCF) Renewables (REN), Local Energy Communities (LEC), Electromobility (EM) and Flexibility (FLEX), are also key for the development and understanding of this deliverable, as the pilots serve to demonstrate and validate the services and architecture defined in the project.

The methodology followed to achieve the objective above is detailed in the next figure and at Section 2.

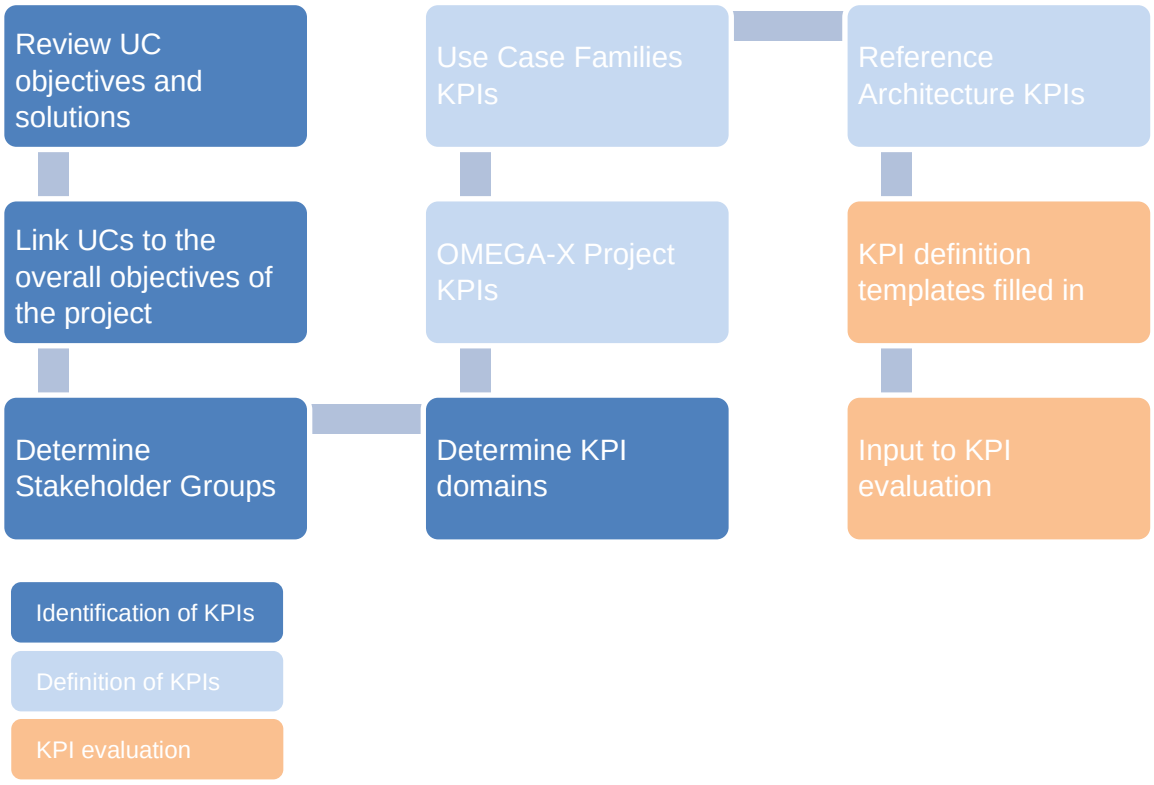

Figure 1 Methodology followed to achieve T3.5 objective.

The KPI domain mapping of the Reference Architecture KPIs, common KPIs (more than 1 UCF), and the specific KPIs for each UCF is shown in next table.

Table 1 KPIs mapping.

KPI Domain	Reference Architecture KPIs	Common KPIs	UC specific KPIs			
			REN UCF	LEC UCF	EM UCF	FLEX UCF
Scientific	7	2				
Economic		4	5	9		1
Societal		5		2		1
Economic/ Societal	2	1	9	11	1	6
Economic/ Scientific			1		3	
Scientific/ Societal		3				1
Total	9	65				

74 KPIs total, 65 Use Case Family KPIs and 9 OMEGA-X data space/Architecture KPIs.

To calculate these KPIs, the data included in the KPI definition templates, detailed in Annexes 1 and 2 must be collected and used following the calculation methodologies described in such templates. The results and evaluation obtained through the monitoring of the KPIs, UCFs and project activities will be subject of future work under KPI evaluation activities.

1 Introduction

1.1 Purpose of the document and relation to another project work

In this task, the project will define a series of metrics (technical, functional, impact-oriented) against which the realization of the use cases and the implementation of the reference architecture in the various pilot sites will be validated. The assessment of these metrics, to be done in the validation phase of the project, will provide interesting insights for a diverse set of stakeholders.

The outcome of this task is documented in this D3.5 “KPIs applicable in OMEGA-X”, which main objective is to identify and define the OMEGA-X Use Case Key Performance Indicators (KPIs) which will support the monitoring and assessment procedure of the demonstrators and project activities.

1.2 Structure of the document

This document is structured in 6 major sections:

Section 1 presents the introduction to D3.5 document, purpose of the document, relation to another project work and structure of the document.

Section 2 describes the methodology followed to fulfil OMEGA-X project objectives and details the template adopted to define each KPI.

Section 3 objective is to identify the KPIs. It covers the description of OMEGA-X Use Cases, considering a brief general introduction addressing its scope, objectives, BUCs, SUCs and Services. Then, it establishes the link between UCs and Expected Outcomes (EO) of the project, defines the Stakeholders groups and KPIs domains

Section 4 objective is to define the KPIs. It describes the Use Case Families KPIs and the Reference Architecture KPIs, following the identification already performed at Section 3 and ending in the detail and specification of all the KPIs, that can be consulted at Annex 2.

Section 5 presents the expected link of the work performed in this task to the evaluation of project KPIs.

Section 6 presents the conclusions of this document D3.5 “KPIs applicable in OMEGA-X”.

2 Methodology

This section describes the methodology followed to fulfil the OMEGA-X project objectives [1] and Expected Outcomes (EO) as well as the methodology followed to identify and define the OMEGA-X KPIs which will support the monitoring and assessment procedure of the demonstrators and project activities.

- EO1 – Higher degree of interoperability between data platforms
- EO2 – Energy data made available and re-usable
- EO3 – Enable new market roles, market participants and energy communities
- EO4 – Demonstrated implementations of Energy Data Spaces, exploiting open standards related to data packages, interfaces, protocols, platforms, and procedures
- EO5 – Enabling new digital solutions and services supporting the energy transition
- EO6 – Increased acceptance of and participation of consumers in data sharing for energy services

The KPIs have been selected as the means to validate and evaluate the effectiveness of the solutions proposed to achieve OMEGA-X project objectives. To promote the development and evaluation of the project, the UCs and project solutions should be analysed in a structured and reproducible manner. This way, a systematic approach, described next, was followed to suit the needs of the OMEGA-X project.

The following steps, already presented at

Figure 1, show the methodological framework followed for the identification and definition of the Key Performance Indicator, Use Case Families and OMEGA-X objectives:

- Identification of KPIs (Section 3)
  - UCs, BUCs, objectives and solutions
  - Link UCs to the overall objectives of the project
  - Stakeholder Groups
  - KPI Domains
- Definition of KPIs (Section 4)
  - OMEGA-X Project KPIs
  - Use Case Families KPIs
  - Reference Architecture KPIs
- KPI evaluation, to be carried out in future evaluation activities in OMEGA-X (Section 5)

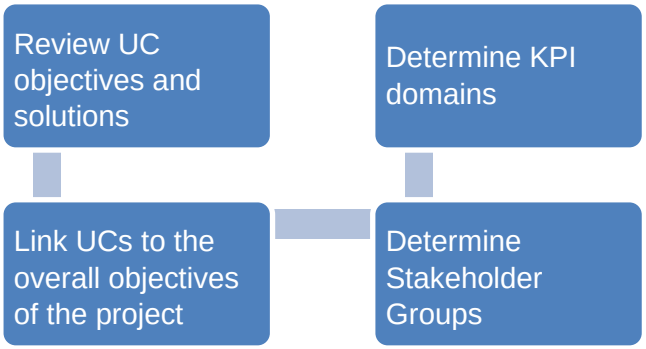

Figure 2 Methodology followed to achieve the KPI elicitation objective – Identification of KPIs part.

The steps established to systematically analyse the Use Cases (UCs) and OMEGA-X objectives for the identification of KPIs, as illustrated in Figure 2, will be described in detail in Section 3. This section will not only explain how these steps are interconnected but also explore the relationships between stakeholder groups and KPI domains, laying the groundwork for the subsequent definition of KPIs.

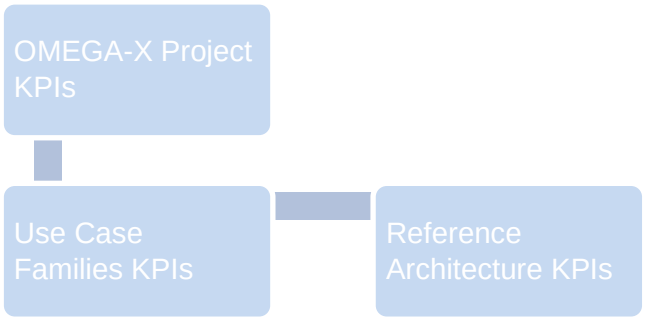

Figure 3 Methodology followed to achieve the KPI elicitation objective – Definition of KPIs part.

To achieve the KPI elicitation objective, a structured and replicable methodology for defining and calculating Key Performance Indicators (KPIs) is described in Section 4, as illustrated in Figure 3.

About ICT standards being followed, this is a dependent task from the previous OMEGA-X activities in architecture [2] and requirements for interoperability, security and privacy [3], so it will therefore follow the same methodologies, even though indirectly:

- From Use cases [2]:
  - IEC 62559-2 [4] (Use case methodology - Part 2: Definition of the templates for use cases, actor list and requirements list).
  - IEC 62913-1 [4] (Specific application of the Use Case methodology for defining generic smart grid requirements according to the IEC systems approach).
  - This approach allows the production of consensual descriptions of what is expected in each service carried by the OMEGA-X project. It is used by many actors in the energy world.
- From Architecture [3]:
  - ISO/IEC/IEEE 42010:2011 [6] “Systems and software engineering - Architecture description”.

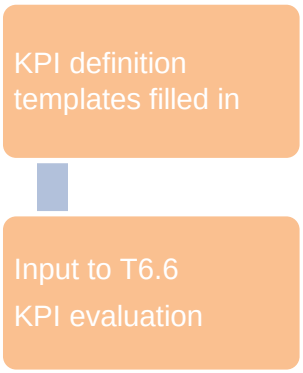

Figure 4 Methodology followed to achieve KPI elicitation objective – KPI evaluation part.

Finally, the results obtained by conducting these steps (Figure 4) can be found in Section 5 and Annex 2.

For the detailed definition of each KPI, presented at Annex 2, a previously designed template was used from Integrid EU project [7], at Annex 1, that was adjusted to the needs of OMEGA-X.

The information contained in this KPI template is the following:

- GENERAL INFORMATION:
  - KPI ID and Name
  - Business Use Case (BUC) and its corresponding System Use Case (SUC) to which it is linked
  - Use Case where KPI applies, if any: If it is related to a specific UC or if it is a KPI identified outside the UCs
  - KPI description: Description of KPI and rationale for including in project
  - KPI formula: Precise mathematical formula for calculating KPI, and explanation of the defined formula
  - Monitoring, the rules to apply the previous formula
  - Units of measurements: (i.e., % percentage basis, MW, MWh, etc.)
  - Parent KPI, if another KPI is necessary to support this KPI, its Name and ID should be indicated
  - Reporting:
    - Data upload rate indicates how often this indicator must be reported (weekly, monthly, yearly) or “Other” upload rate
    - Information to be displayed, if it is a cumulated value, a trend or n/a
  - KPI calculation trigger (target value): When should the calculation be triggered, periodically and the KPI final target value
- Calculation/Extraction Methodology:
  - KPI Methodology Step ID,
  - Step by step methodology description on how to calculate the defined KPI
  - Responsible Partner for a specific step in KPI calculation methodology
  - Data ID, for all data needed to calculate/perform each step

- Data Collection
  - Data ID: Identification of data requiring collection, it is used as well in formulas for calculating KPI
  - Data description: Description of the data to collect
  - Data source responsible: Partner(s) responsible for the databases/sources where the data to be collected comes from
  - Data sink responsible: Partner(s) responsible for collecting/aquiring data
  - Data collection method: Describes the method how data is collected
  - Data collection update rate: Indicates how often and when data is collected
  - Data collection time range: Indicates for how long data is collected
- Baseline
  - Baseline Source: Literature values / Partner historical values / Values measured during the project / Values collected from simulations / Other
  - Partner(s) responsible for Baseline
  - Description of the Baseline

3 Identification of KPIs

3.1 UCs, BUCs, objectives and solutions

This section covers the description of OMEGA-X Use Cases, considering a brief general introduction addressing its scope, objectives, BUCs, SUCs and Services.

The OMEGA-X project has organized its energy-related business offerings into four distinct use case families, each highlighting the benefits of a shared Data Space in addressing specific issues identified by energy stakeholders. These use case families are Renewables, Local Energy Communities, Electro-Mobility and Flexibility. The services that will be created and showcased through various pilot projects within each use case family have been thoroughly examined and documented in D3.4 [3].

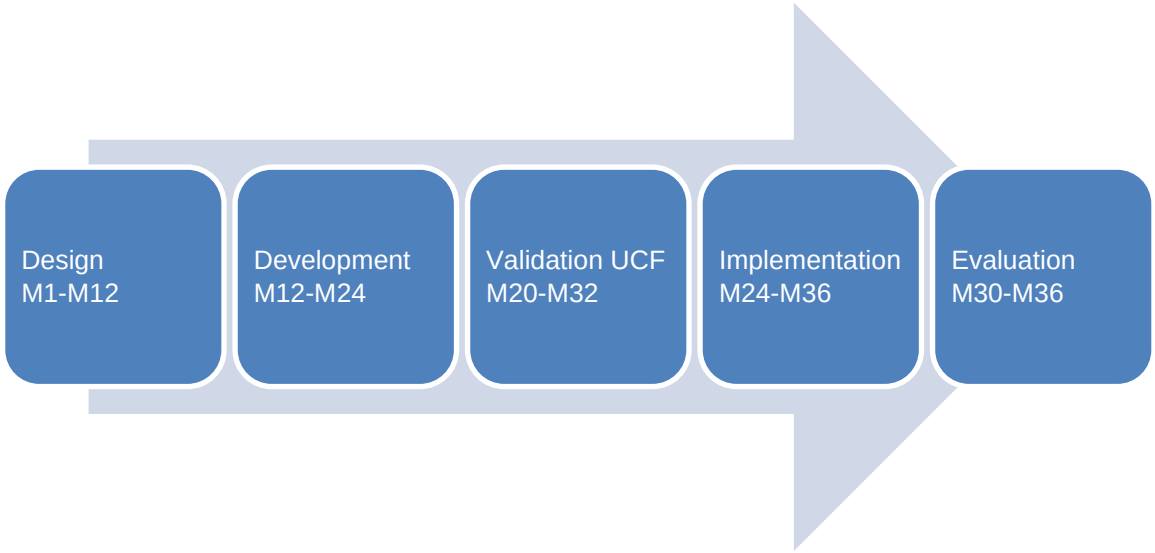

Figure 5 Plan for the implementation of services.

The figure shows the plan for the implementation of the services. Here, the validation and evaluation phases are connected to the KPIs, further described at Section 5.

3.1.1 Renewables Use case family

The main challenges of renewable energies in general, and Photovoltaics (PV) in particular, for getting larger deployment are cost competitiveness and smart grid integration.

On the one hand, regarding cost competitiveness, an optimized Operation and Maintenance (O&M) of large PV plants along their own lifetime is key to reducing Levelized Cost of Energy (LCOE) by increasing Performance Ratio (PR) and reducing O&M costs and Weighted Average Cost of Capital (WACC). Thus, the aim is to provide PV Asset Managers with services helping them to optimize O&M activity.

On the other hand, in relation to smart grid integration, high penetration rates of distributed PV systems in distribution grids requires special measures by the Distribution System Operator (DSO) to ensure the Quality and Security of Service. Consequently, the goal is to provide DSOs with services helping them to plan grid reinforcement when needed and anticipate potential issues during operation to implement the required corrective measurements.

By using data spaces for O&M BUC, this UC family gains access to a wider range of information than the one related to one single portfolio, enhances the learning of real

performance of new PV technologies under different operating conditions and progressively improves data analytic services. In the business cases of planning and operating PV smart grid integration, the main advantage of using data spaces is the integration of all the required data sources to get the whole picture and make the right decision.

In this use case family, the following partners will participate:

- EDF will be the PV Asset Manager
- EyPESA will be the DSO and the PV Asset Manager
- SENER ING, UPC, METEO and TECNALIA will be service providers.

Additional actors outside of the project consortium are the following:

- PV Asset Owner from EDF portfolio
- Prosumers from EyPESA distribution grid

Thanks to the Data Space in OMEGA-X, it will be possible to develop the services described at Table 2.

The use cases (BUCs and SUCs) that will support the services are the following, including how each is connected to the services:

- BUC Ren 1.0 PV O&M Optimization
- BUC Ren 2.0 Operating PV Smart Grid Integration
- BUC Ren 3.0 Planning PV Smart Grid Integration
- SUC Ren 1.0 Actual versus expected production comparison (BUC Ren 1.0)
- SUC Ren 2.0 PV module degradation monitoring (BUC Ren 1.0)
- SUC Ren 3.0 Tracking system monitoring (BUC Ren 1.0)
- SUC Ren 4.0 Recurrent shading problem detection (BUC Ren 1.0)
- SUC Ren 5.0 Cleaning recommendations (BUC Ren 1.0)
- SUC Ren 6.0 Predictive Maintenance of PV generator (BUC Ren 1.0)
- SUC Ren 7.0 Predictive Maintenance of BOS (BUC Ren 1.0)
- SUC Ren 8.0 Benchmarking analysis (BUC Ren 1.0)
- SUC Ren 9.0 PV Generation Forecasting (BUC Ren 2.0)
- SUC Ren 10.0 BIPV Generation Forecasting (BUC Ren 2.0)
- SUC Ren 11.0 Detect and correct measurement errors (BUC Ren 2.0)
- SUC Ren 12.0 Detect non-technical losses (BUC Ren 2.0)
- SUC Ren 13.0 Congestion detection (BUC Ren 2.0)
- SUC Ren 14.0 Voltage volatility detection (BUC Ren 2.0)
- SUC Ren 15.0 Planning grid reinforcement (BUC Ren 3.0)

The Renewable Family is split into three business cases: PV O&M Optimization (BUC Ren 1.0), Operating PV Smart Grid Integration (BUC Ren 2.0), and Planning PV Smart Grid Integration (BUC Ren 3.0). The BUCs planned for the Renewable Use Case Family, describes new potential businesses, with the objectives, sequence of actions, and all the actors involved, further described next at the following sub-sections. A set of advanced data analytics services

will be developed by SENER ING, METEO, UPC and Tecnalia, on top of the data gathered, and linked with the use cases (BUCs and SUCs) according to the following table.

Table 2 Services connection to service developers and use cases – REN Family.

Service	Category	Service Developers (SDs)	Data Providers (DPs)	BUC	SUC
Actual versus expected production comparison	Descriptive services	SENER ING	EDF, EyPESA	BUC Ren 1.0	SUC Ren 1.0
PV module degradation monitoring	Descriptive services	SENER ING	EDF, EyPESA	BUC Ren 1.0	SUC Ren 2.0
Tracking system monitoring	Descriptive services	SENER ING	EDF, EyPESA	BUC Ren 1.0	SUC Ren 3.0
Recurrent shading problem detection	Descriptive services	SENER ING	EDF, EyPESA	BUC Ren 1.0	SUC Ren 4.0
Cleaning recommendations	Prescriptive services	SENER ING	EDF, EyPESA	BUC Ren 1.0	SUC Ren 5.0
Predictive Maintenance of PV generator	Prescriptive services	SENER ING	EDF, EyPESA	BUC Ren 1.0	SUC Ren 6.0
Predictive Maintenance of BOS	Prescriptive services	SENER ING	EDF, EyPESA	BUC Ren 1.0	SUC Ren 7.0
Benchmarking analysis	Descriptive services	Tecnalia	EDF, EyPESA	BUC Ren 1.0	SUC Ren 8.0
PV Generation Forecasting	Predictive services	METEO	EyPESA	BUC Ren 2.0	SUC Ren 9.0
BIPV Generation Forecasting	Predictive services	Tecnalia	EyPESA	BUC Ren 2.0	SUC Ren 10.0
Detect and correct measurement errors	Data quality assessment services	UPC	EyPESA	BUC Ren 2.0	SUC Ren 11.0
Detect non-technical losses	Descriptive services	UPC	EyPESA	BUC Ren 2.0	SUC Ren 12.0
Congestion detection	Predictive Services	UPC	EyPESA	BUC Ren 2.0	SUC Ren 13.0
Voltage volatility detection	Predictive Services	UPC	EyPESA	BUC Ren 2.0	SUC Ren 14.0
Planning grid reinforcement	Prescriptive services	UPC	EyPESA	BUC Ren 3.0	SUC Ren 15.0

3.1.2 Energy communities and sector integration Use case family

Local energy communities (LECs) can have a significant impact on multi-vector energy markets by introducing different players in the market: prosumers, associations and cooperatives. The increase in distributed generation, through the higher use of renewable energies, has led to the decentralization of the value chain. Therefore, LECs, with their novel business model, represent nowadays an excellent tool to involve citizens and local economic actors. The main challenges that LECs must face include the lack of coordination between different actors and prosumer involvement. Services are needed that allow to exploit the potential of LECs for the benefit of the community, covering the full value chain, reducing costs and optimizing the LEC's operation.

The advantages which can be derived from the use of a data space concern the possibility of bringing together information from different actors in the community and exploiting data coming from external sources. This information would allow to have a better understanding of the current state of the LEC asset, to make more accurate forecasts and on top of that take proper decisions and, finally, develop services to inform and involve prosumers at different stages from formation to management of LECs.

This use case family will be led by RINA-C and will have four pilot sites located in different parts of Europe: Two in Spain, one in Italy and one in Serbia.

- EDP as LEC operator will act as data provider and data user, providing data from the two solar neighbourhoods located in Zaragoza, Spain
- ASTEA as LEC operator will act as data provider and data user, providing data from multi vector municipal LEC in Osimo in Italy
- PUPIN as LEC operator will be a data provider and data user and data user, providing data from their R&D campus in Belgrade, Serbia
- IMPULSA as LEC operator will be a data provider and data user providing data from its headquarters located in Granollers, Spain

Additionally, there will be these other partners that will participate:

- REVOLT, Tecnalia and UPC will be service providers and data users
- EDF will be in charge of supervising the compliance of proposed services with existing regulatory framework in Europe.
- Thanks to the Data Space in OMEGA-X, it will be possible to develop the services described at Table 3.
- The use cases (BUCs and SUCs) that will support the services are the following, including how each is connected to the services:
- BUC LEC 1.0 O&M Optimisation
- BUC LEC 2.0 Energy Consumption Optimisation Through Prosumer Engagement
- BUC LEC 3.0 LEC Planning Services
- SUC LEC 1.0 Smart meter data ingestion and management (BUC LEC 1.0)
- SUC LEC 2.0 Manage authentication (BUC LEC 1.0, BUC LEC 2.0)
- SUC LEC 3.0 AI algorithm training (BUC LEC 1.0, BUC LEC 2.0)
- SUC LEC 4.0 Benchmarking (BUC LEC 1.0, BUC LEC 2.0)
- SUC LEC 5.0 Losses detection (BUC LEC 1.0)

- SUC LEC 6.0 Provide data analytics and KPI (BUC LEC 1.0, BUC LEC 2.0)
- SUC LEC 7.0 Manage PV & Electric Storage (BUC LEC 1.0)
- SUC LEC 8.0 ETL of smart meter data (BUC LEC 2.0)
- SUC LEC 9.0 Consumer suggestion (BUC LEC 2.0)
- SUC LEC 10.0 Promote notification (BUC LEC 3.0)
- SUC LEC 11.0 Establishing energy demand profiles (BUC LEC 3.0)
- SUC LEC 12.0 Calculating energy baseline (BUC LEC 3.0)
- SUC LEC 13.0 Holistic energy dispatch optimization (BUC LEC 3.0)
- SUC LEC 14.0 Self-consumption digital control (BUC LEC 3.0)
- SUC LEC 15.0 Forecasting services (BUC LEC 3.0)
- SUC LEC 16.0 Implementation of integration solutions (BUC LEC 3.0)

The BUCs identified for this family focus on Local Energy Communities (LEC) from three different aspects: LEC O&M Optimization, LEC Energy Consumption Optimisation through Prosumer Engagement, and LEC Planning Services.

Table 3 Services connection to service developers and use cases – LEC Family.

Service	Category	Service Developers (SDs)	Data Providers (DPs)	BUC	SUC
Gamification for electrical energy savings	LEC Energy consumption optimization services	REVOLT	EDP/ ASTEA	BUC LEC 2.0	SUC 8.0, SUC 2.0, SUC 3.0, SUC 4.0, SUC 9.0, SUC 6.0, SUC 10.0
Local Energy Communities Designer	LEC Energy consumption optimization services	REVOLT	EDP/ IMPULSA/ ASTEA	BUC LEC 2.0	SUC 8.0, SUC 2.0, SUC 3.0, SUC 4.0, SUC 9.0, SUC 6.0, SUC 10.0
Thermal Losses Detection and Benchmarking at LEC level	O&M services	REVOLT	ASTEA	BUC LEC 1.0	SUC 1.0, SUC 2.0, SUC 3.0, SUC 4.0, SUC 5.0, SUC 6.0, SUC 7.0
Water Losses Detection and Benchmarking at LEC level	O&M services	REVOLT	ASTEA	BUC LEC 1.0	SUC 1.0, SUC 2.0, SUC 3.0, SUC 4.0, SUC 5.0, SUC 6.0, SUC 7.0

Service	Category	Service Developers (SDs)	Data Providers (DPs)	BUC	SUC
Optimizing sharing coefficients in collective self-consumption	LEC Energy consumption optimization services	Tecnalia	EDP	BUC LEC 2.0	SUC 8.0, SUC 2.0, SUC 3.0, SUC 4.0, SUC 9.0, SUC 6.0, SUC 10.0
Optimizing self-consumption of renewable energy at LEC level	LEC Energy consumption optimization services	Tecnalia	IMPULSA	BUC LEC 2.0	SUC 8.0, SUC 2.0, SUC 3.0, SUC 4.0, SUC 9.0, SUC 6.0, SUC 10.0
Planning Services	LEC Planning services	Tecnalia	PUPIN	BUC LEC 3.0	SUC 11.0, SUC 12.0, SUC 13.0, SUC 14.0, SUC 15.0, SUC 16.0
Electrical Losses Detection and Benchmarking at LEC level	O&M services	UPC	EDP/ IMPULSA/ ASTEA	BUC LEC 1.0	SUC 1.0, SUC 2.0, SUC 3.0, SUC 4.0, SUC 5.0, SUC 6.0, SUC 7.0
Reinforcement Plan of Local Energy Communities for Future Renewable Integration	LEC Planning services	UPC	IMPULSA/ ASTEA/ PUPIN*	BUC LEC 3.0	SUC 11.0, SUC 12.0, SUC 13.0, SUC 14.0, SUC 15.0, SUC 16.0
Estimate the probability of congestions	O&M services	UPC	IMPULSA	BUC LEC 1.0	SUC 1.0, SUC 2.0, SUC 3.0, SUC 4.0, SUC 5.0, SUC 6.0, SUC 7.0

* PUPIN to use synthetic data since real data will not be available to test this service.

3.1.3 Collaboration among Electromobility actors Use Case Family

Electric Vehicles are a main component of the European strategy to decarbonize the economy and tackle climate change. Anything that can make life easier for vehicle users (economically or from a practical point of view) is worth developing.

Reservation of charging points and availability of information about their availability and tariffs is critical for EV users as it helps them to plan their journeys confidently without the fear of running out of battery charge. With the increasing adoption of electric vehicles, charging points could become more crowded and EV users would want to avoid the inconvenience, stress, or

frustration to look for a charging point at destination or on their itinerary. Additionally, information in advance about the tariffs can help them to better plan the journey and its cost.

One of the use cases of this family is thus centred on the data exchanges to be implemented to offer this service to electric vehicle users and concerns the Roaming of booking services (developed by GIREVE, ATOS and EDF). The main challenge in this use case lies in the ability to homogenize exchanges between various e-Mobility Service Providers (EMSP) and charging points operators (CPOs). Although booking for all time horizons is the target, the use case will first focus on booking for near-term use. The user is then the next to be able to use the charge point. OMEGA-X will extend the use case to more distant reservations if there is sufficient time and resources.

Another aspect studied in this family is the possibility of using, virtually, the energy locally produced by EV users at home to recharge their battery while they and their vehicle are in another location; with a certification mechanism that ensures that this production exists when needed.

This mechanism would have the double virtue of encouraging recharging in synchronization with renewable energy production and would open the possibility of offering services to network operators. The second use case of the electro-mobility family is focused on Roaming of self-consumption. The challenges of this use case are related to the ability to certify the different energy flows, and to the coordination of the multiple actors involved in the exchanges (network operators, energy suppliers, charging infrastructure operators, etc.).

In this use case family, the following partners will participate:

- EDF will be a data provider and data user
- GIREVE will be a data provider
- ELIA will be a data provider, data user and service provider
- EW and ATOS will act as service providers

Thanks to the Data Space in OMEGA-X, it will be possible to develop the services described at Table 4.

The use cases (BUCs and SUCs) that will support the services are the following, including how each is connected to the services:

- BUC EM 1.0 Roaming of booking services
- BUC EM 2.0 Roaming of self-consumption
- SUC EM 1.0 Authenticate to EMSP Application
- SUC EM 2.0 Manage Authorizations
- SUC EM 3.0 Manage consumer Meter Data
- SUC EM 4.0 Manage Reservation Ask
- SUC EM 5.0 Manage Reservation Bid
- SUC EM 6.0 Provide a list of Available Charging Stations
- SUC EM 7.0 Transfer consumption Energy Data
- SUC EM 8.0 Verify and Settle Activated Reservations
- SUC EM 9.0 Erase and Rectify Data
- SUC EM 10.0 Manage producer metering data

- SUC EM 11.0 Authentication of asset
- SUC EM 12.0 Generation of certificates
- SUC EM 13.0 Match certificates

The use case family contains two BUCs: Roaming of booking services and roaming of self-consumption. In both cases, the aim is to simplify the life of the EV user by facilitating charging services anywhere in Europe, enabling in a simple and fair manner to select the source of electricity (in particular, its own production). The Electro-mobility family has identified a set of 13 System Use Cases on which the Business Use Case Roaming of reservation relies.

The use cases (BUCs and SUCs) that will support the services are the following, including how each is connected to the services:

Table 4 Services connection to service developers and use cases – EM Family.

Service	Category	Service Developers (SDs)	Data Providers (DPs)	BUC	SUC
Mobility services with regards to the selection of charging offers meeting specific user criteria (static & dynamic information exchange about charging points and offers)	E-mobility services	(TBD)	GIREVE	BUC 1.0 - 2.0	SUC EM 4.0, 5.0, 6.0
Mobility services with regards to charging services price information (price calculation, price comparison)	E-mobility services	(TBD)	GIREVE	BUC 1.0 - 2.0	SUC EM 4.0, 5.0, 6.0
Mobility services with regards to the booking of a charging service	E-mobility services	(TBD)	GIREVE	BUC 1.0 - 2.0	SUC EM 4.0, 5.0, 6.0
EMSP Referral/reselling to a CPO allowing to purchase a charging service at CP	Referral/reselling services	(TBD)	GIREVE	BUC 2.0	SUC EM 7.0
API development and data exchanges	Technical intermediation services	ISP		BUC 1.0-2.0	SUC EM 2.0, 3.0

Service	Category	Service Developers (SDs)	Data Providers (DPs)	BUC	SUC
Authentication of behind the meter assets (PV, Charging point, EV, …)	Authentication services	EW	ELIA, OEM	BUC 2.0	SUC EM 11.0
Marketplace for GCO certificate exchange	Marketplace services	ELIA	GIREVE, Data Access providers	BUC 2.0	SUC 12.0, 13.0

3.1.4 Flexibility Use Case Family

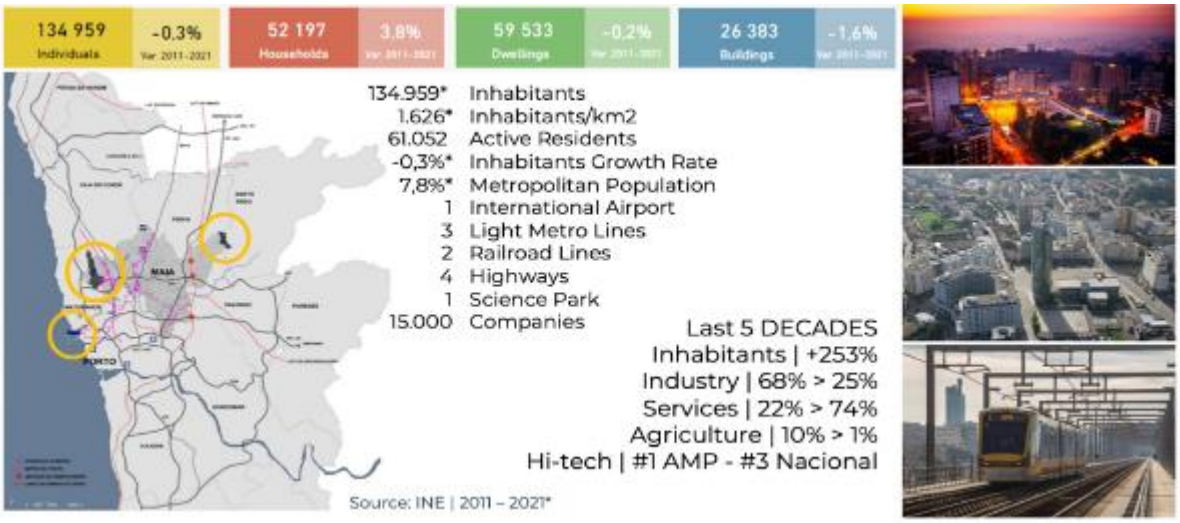

Figure 6 Flexibility pilot site. Maia Municipality.

In energy systems, flexibility is linked to the ability a power system has in adjusting its consumption and production to a varying electricity demand both anticipated and unanticipated. Currently electricity produced from renewables cannot be stored efficiently, therefore it is impossible, for instance, to shave peak hours and smoothen the energy demand by moving some of the consumption to off-peak hours. The end goal is therefore to provide flexibility while optimizing some cost function, such as by minimizing the cost of production through renewable usage.

Flexibility benefits requires a high-level of information integration between different partners, which will be highly accelerated through a common data space simplifying and reducing the burden of many managerial, bureaucratic, and technological aspects of the data exchange. Examples of information exchanged include consumption and production of all network nodes periodically, information from weather stations, information from advanced analytics and predictive services, models already trained, energy consumption/production profiles, information on how to activate and deactivate consumption and production remotely of specific resources, among others.

This Use Case Family will be led by EDP and will have one pilot site located in Portugal, in the municipality of Maia, in Porto region. The University of Maia, ISMAI, will be helping Maia

throughout the project. Tecnalia and Odit-e will be the service developers and most of the data with be provided either by the municipality of Maia or E-Redes (EDP).

Maia municipality is within the metropolitan area of Porto and has 135.000 inhabitants. Maia is one of the most industrialized municipalities of Portugal and an important transportation hub. Maia began seriously paving the way to be a sustainable city in 2012, first by tackling energy issues and in 2014 by creating the Sustainable Energy Action Plan addressing the RES penetration, energy efficiency, CO2 emissions, mobility, citizen's engagement, among others. In Maia municipality there are a few production and consumption endpoints that can be used as a source of flexibility that will be the basis for our pilot. These are briefly listed next:

Production sources:

- PV generator of municipal pool

Consumption sources:

- Maia Forum (public building): HVAC, pumps, and rest of consumption appliances
- Municipality EVs (Electric Vehicles) car fleet
- Other public buildings

In terms of partners and their interactions, the roles will be:

- Maia will be the prosumer, providing and using data
- ISMAI (University/RTO) will be a facilitator and a data provider
- EDP will be the energy supplier, a facilitator, and is also the owner of E-REDES
- E-REDES is the DSO and the flexibility market operator, providing and using data
- Tecnalia will be the flexibility service provider
- Odit-e will be the analytic service provider

Thanks to the Data Space in OMEGA-X, it will be possible to develop the services described at Table 5.

The use cases (BUCs and SUCs) that will support the services are the following, including how each is connected to the services:

- BUC Flex 1.0 Flexibility for internal optimization
- BUC Flex 2.0 Flexibility for congestion management with bilateral contracts
- BUC Flex 3.0 Flexibility for capacity management with market structures
- SUC Flex 1.0 Define the context of flexibility management (all BUCs)
- SUC Flex 2.0 Optimize the baseline of resources (all BUCs)
- SUC Flex 3.0 Manage flexibility needs (BUC Flex 2.0 and 3.0)
- SUC Flex 4.0 Optimize flexibility offers (BUC Flex 3.0)
- SUC Flex 5.0 Manage flexibility offers (BUC Flex 3.0)
- SUC Flex 6.0 Activate flexibility orders (BUC Flex 2.0 and 3.0)

The services to be developed are identified in the following Table, including how the use cases (BUCs and SUCs) are connected to the services:

Table 5 Services connection to service developers and use cases – FLEX Family.

Service	Category	Service Developers (SDs)	Data Providers (DPs)	BUC	SUC
Grid observability and network analysis	Predictive services	Odit-e	MAIA / DSO	BUC Flex 1.0 BUC Flex 2.0 BUC Flex 3.0	SUC Flex 1.0 SUC Flex 3.0
Grid validation platform, real-time	Flexibility management services	Odit-e	MAIA / DSO	BUC Flex 2.0 BUC Flex 3.0	SUC Flex 3.0 SUC Flex 5.0
Flexibility platform for DER connection, planning	Flexibility management services	Odit-e	MAIA / DSO	BUC Flex 1.0 BUC Flex 2.0 BUC Flex 3.0	SUC Flex 1.0 SUC Flex 3.0
Passive consumption baseline prediction service	Predictive services	Tecnalia	MAIA / DSO	BUC Flex 1.0 BUC Flex 2.0 BUC Flex 3.0	SUC Flex 1.0 SUC Flex 2.0
Active consumption resource prediction service	Predictive services	Tecnalia	MAIA	BUC Flex 1.0 BUC Flex 2.0 BUC Flex 3.0	SUC Flex 2.0
Intermittent DER generation resource baseline prediction service	Predictive services	Tecnalia	MAIA / DSO	BUC Flex 1.0 BUC Flex 2.0 BUC Flex 3.0	SUC Flex 1.0 SUC Flex 2.0
Prosumer EMS internal optimization service	Flexibility management services	Tecnalia	MAIA	BUC Flex 1.0 BUC Flex 2.0 BUC Flex 3.0	SUC Flex 2.0
Flexibility order disaggregation service	Flexibility management services	Tecnalia	MAIA	BUC Flex 2.0 BUC Flex 3.0	SUC Flex 6.0
Aggregated flexibility offers optimization service	Flexibility management services	Tecnalia	MAIA	BUC Flex 3.0	SUC Flex 4.0

3.2 Link UCs to the expected outcomes of the project

The next step in the methodology involves indicating which specific UCs will contribute to accomplish each OMEGA-X Expected Outcomes (EOs). This will allow to assess at a later stage in the project if, and to what extent, the OMEGA-X project objectives have been fulfilled.

Next table shows the list of the OMEGA-X project EOs, which combined, tackle the main goal of the project: to implement a data space (based on European common standards), including federated infrastructure, data marketplace and service marketplace, involving data sharing between different stakeholders and demonstrating its value for real and concrete Energy use cases and needs, while guaranteeing scalability and interoperability with other data space initiatives, not just for energy but also cross-sector.

In addition, the table indicates the UCs that will allow to achieve each of these EOs.

Table 6 OMEGA-X project EOs and the corresponding UCs.

EO number	EO description	UC
EO1	Higher degree of interoperability between data platforms	LEC UCF FLEX UCF EM UCF REN UCF OMEGA-X data space/Architecture
EO2	Energy data made available and re-usable	REN UCF FLEX UCF EM UCF OMEGA-X data space/Architecture
EO3	Enable new market roles, market participants and energy communities	LEC UCF FLEX UCF REN UCF EM UCF
EO4	Demonstrated implementations of Energy Data Spaces, exploiting open standards related to data packages, interfaces, protocols, platforms, and procedures	LEC UCF REN UCF FLEX UCF EM UCF OMEGA-X data space/Architecture
EO5	Enabling new digital solutions and services supporting the energy transition	LEC UCF FLEX UCF REN UCF EM UCF

EO number	EO description	UC
EO6	Increased acceptance of and participation of consumers in data sharing for energy services	LEC UCF FLEX UCF EM UCF

The Domains proposed for OMEGA-X project have been selected to cover the Expected Outcomes, without limiting the scope to technical solutions. Then, the domain's relation to the Use Cases is shown in next table.

Table 7 Domain's relation to UC.

	Domain	UC
1	Scientific: innovation, data and research outputs measurements	All UCF
2	Economic: analysis of consumer needs, expectations and concerns that can lead to new business models and innovations and how energy sector regulation can be improved to accommodate innovations for smart energy systems	All UCF
3	Societal: user engagement, trust, privacy and life quality measurements	All UCF

3.3 Target Stakeholders Groups

To maximise the impact of OMEGA-X, the stakeholder engagement is considered essential. It focuses on sharing results with pre-defined target groups and to engage these for the replication of pilots and to ensure sustainability of OMEGA-X outputs long after the project has ended.

Consequently, the next step in the methodology involves indicating the target Stakeholders group that will contribute to accomplish the OMEGA-X Expected Outcomes (EOs) relating it with the specific Domains and the respective relative objective and impact, as shown in next table. That will later allow the assessment of OMEGA-X project objectives fulfilment.

Table 8 Target Stakeholders Groups related to EO and Domains.

Target Groups	Expected Outcomes	Domain
RES Producers, DSOs, TSOs	REN Use Case Family: Enhancing RES usage and grid management by optimising RES asset management, estimating probability of congestions in the grid and total harmonic distortion caused by RES. [EO 2, 4 and 5]	Scientific/Societal: 20% increased performance in grid control algorithms and 10% increased cross border stability due to roaming services.
Municipalities, LEC, DSO, Electrical mobility company (SME), Industries	Flexibility Use Case Family: Improving grid performance through provision of flexibility services to DSO based on aggregation of multiple distributed infrastructures operated by a single owner (Maia municipality). [EO 3, 5 and 6]	Societal/Economic: Bilateral business model developed to provide economic remuneration for unlocking the value of flexibility sources.
LECs, DSOs, Gas, District Heating providers, ESCOs, etc.	LEC Use Case Family: leverage data from different actors to develop, implement and validate services to optimise LEC operation by taking into account in an integrated and synchronised manner multiple energy vectors including electricity, heating and cooling and hydrogen. [EO 1, 3 ,4, 5 and 6]	Societal/Economic: 40% increased autonomy in LECs, 10% decarbonization increase, 5 energy carriers considered.
Producers, local communities and network managers	Flexibility Use Case Family: DER collaborative connection platform will provide a multitude of relevant benefits a) maximizing deployment of new RES which otherwise would not get the connection permission by DSO, if grid is not reinforced; b) increased ROI of DER projects and c) proposing an alternative to the current "first come, first served, first payer" process of grid connection for DERs by collaborative technical offer allowing optimal integration of the community. [EO 1, 2, 3, 4 and 6]	Economic/Societal: 80% increase in prosumer flexibility with 15% energy bill reduction for them.
Local Energy Communities	LEC Use Case Family: Digital tools for increasing efficiency and RES self-consumption. In long-term, this leads to significant socio-economic impact, as it enables fair/constant energy access with low price fluctuation. [EO3 and 6]	Economic/Societal: 20% end user increased engagement in LEC initiatives, with 10% increased consumer satisfaction.

Target Groups	Expected Outcomes	Domain
Mobility service provider, EV charging booking service providers, Self-consumption service providers, Energy Supplier, Charging Point Operator, Roaming and clearing services providers	Electromobility Use Case Family: Reduce cost, data non-quality/non-consistency, risks and cybersecurity breaches (including personal data) in Electromobility. Provide trust, transparency, and traceability (complying with GDPR). Create of trust/security across power/mobility sectors via robust identification/authorization processes. Large-scale deployment of value-added charging & customer centric services with real-time data exchange, thanks to industry standards. Facilitate competition, reduce lock-in effects via open/interoperable ecosystems. Integrate small scale, DER in scalable way. [EO 1, 2, 4 and 6]	Societal: Enhance consumer satisfaction with consumer centric value-added services. Green tracking process. Empower end users to produce and consume own green electricity Technological/Economic: Enable new kind of Energy Block exchanges allowing energy services and business models peer-to-peer trades.
Data/Service Providers/Consumers (Energy companies including SMES, ICT companies, public sector, RTOs and Academia)	OMEGA-X Data Space: definition of a federated soft infrastructure and building blocks by developing new and reusing and extending existing technologies from previous projects and leveraging existing open reference standards. Marketplace to allow exchange and monetisation of data and services. [EO 1, 2 and 4]	Scientific: interoperability with other similar data spaces towards a common European data space. Economic: Direct impact on EU data economy by EUR 7.2 -10.9 billion in 2028.
Flexibility providers, large generators, consumers/prosumers, Flexibility users: utilities/DSO RES producers	REN Use Case Family: Identifying potential inefficiencies by benchmarking different plants from different companies in similar conditions. Flexibility Use Case Family: Flexibility services to the DSO which are only possible using data from multiple entities (flexibility providers, DSOs, public data, CPOs, prosumers…). [EO 3 and 5]	Economic: Lower exploitation costs of energy assets by. The savings can be forwarded either to fund Energy efficiency or flexibility, i.e., to improving ROI, or be redirected to investment, even in other areas besides Energy.
RES producers Market participants and LECs leveraged by the stakeholder's participation.	REN Use Case Family: benchmarking different plants from different technologies to help in the decision-making process to select the best investment alternative.	Economic/Societal: Enabling grid reinforcement planning for future renewable scenarios.

Target Groups	Expected Outcomes	Domain
Self-consumption service providers, Energy Supplier, Charging Point Operator, Balance responsible, TSO, DSO	Flexibility Use Case Family: DER collaborative connection platform will maximize deployment of new RES generators, which otherwise would not get the connection permission and avoid renewable energy curtailment of DER generators. Electromobility Use Case Family: Enable new kind of Energy Block exchanges allowing energy services and business models involving peer to peer energy trades. [EO 1, 2, 3 and 5]	

3.4 KPI Domains

The KPIs are linked to project outcomes and KPI domains were defined per type of project outcome (Scientific, Economic, Societal), to support the KPI identification. These categories also allow to classify the KPIs into groups and facilitates filtering and finding the KPIs of particular interest for the reader. The KPIs categorised by domain can be found in section 4.2.

The domains used in OMEGA-X project are the following:

- Scientific Domain is related to the KPIs measuring the technological performance and scientific development.
- Economic Domain is related with the KPIs are measuring the economic and regulatory performance.
- Societal Domain is related to the KPIs measuring the users' degree of satisfaction.

Not limiting the scope to KPIs in the Scientific domain, and including economic and societal domains, will allow for a better overview and assessment of the impact of the UCs and the project.

About the KPIs definition, they were defined accordingly with the types of metrics (technical, functional, impact-oriented) against which the realization of the use cases as identified in [2] and the implementation of the reference architecture also described in [2] in the various pilot sites will be validated during the evaluation phase of OMEGA-X.

4 Definition of KPIs

4.1 OMEGA-X Project KPIs

This section provides a comprehensive and detailed definition of the project KPIs, building upon the identification process already conducted in Section 3. The outcome of this section will encompass the precise specifications of all the 74 identified KPIs, which can be referred to in Annex 2. This documentation will serve as a valuable resource for evaluating the project KPIs, as elaborated upon in Section 5.

The definition of these KPIs is based on the establishment of a set of metrics, encompassing technical, functional, and impact-oriented aspects. These metrics will be used to validate the realization of the use cases outlined in [2] and the implementation of the reference architecture introduced also in [2] across the various pilot sites within the implementation activities of OMEGA-X.

Out of the total 74 KPIs, 65 pertain to the Use Case Family, while the remaining 9 relate to OMEGA-X data space/Architecture KPIs. The specific details and breakdown of the SSH KPIs can be found in D7.1 [8].

Furthermore, to assess the effectiveness of the communication and dissemination plan, the communication team will employ an evaluation strategy that encompasses both quantitative and qualitative KPIs [8]. This strategy aims to measure the impact of the communication efforts and gauge their success in reaching the intended target audience.

4.2 Use Case Families KPIs

The use case description method proposed by the IEC includes in its templates the possibility of defining KPIs at business use case (and later at system use case) level. The addition of KPIs is even recommended.

These KPIs mainly concern metrics linked to the business success or proper functioning of the use case described. For example: number of users overall or over time slots, volumes traded or degree of liquidity of a market, satisfaction of a category of players, among others.

For system use cases, the KPIs will focus more on metrics linked to the successful execution of exchanges or data processing for the use case: calculation time, exchange latency, volume of data processed, among others.

Below is a list of KPIs derived from the projects use case families.

Table 9 UC KPIs detail.

Expected Outcome	Domain	KPI id & description	UCF & where to be verified	Type of metrics
EO2	Scientific	**KPI 2.3** Number of datasets made available through the marketplace with the developed data governance schema and data privacy, security and sovereignty.	All UCF (T5.3)	technical

Expected Outcome	Domain	KPI id & description	UCF & where to be verified	Type of metrics
E02	Scientific	**KPI 2.4** Increased usage of datasets	All UCF (T5.6)	technical
	Economic/ Societal	**KPI 2.5** Increased number of prosumers that share data for energy monitoring and sustainable energy actions definition.	LEC UCF (T6.3)	impact-oriented
		KPI 2.6 New energy services developed for smart consumers.	All UCF (WP5)	impact-oriented
		KPI 2.7 Increased consumer satisfaction.	LEC UCF (T6.3)	impact-oriented
	Economic	**KPI 2.8** Data driven business models defined	All UCF (T7.2)	impact-oriented
EO3	Economic	**KPI 3.1** Flexibility offer optimisation by aggregators and LECs.	FLEX UCF (T6.5)	functional
		KPI 3.2 Increased revenues by the LEC coming from ancillary services provided to the TSO/DSO.	LEC UCF (T6.3)	functional
		KPI 3.3 Increased RES production in the community until 2026.	REN UCF (T6.2)	functional
	Scientific/ Societal	**KPI 3.4** Number of services provided by new market participants.	All UCF (T5.3)	impact-oriented
		KPI 3.5 Revenue increase from the provision of flexibility into the grid.	FLEX UCF (T6.5)	impact-oriented
		KPI 3.6 New business models for new market roles/participants.	All UCF (T7.2)	impact-oriented
	Economic/ Scientific	**KPI 3.7** Discovering of CPO/eMSP offers	EM UCF (T6.4)	functional
		KPI 3.8 Charging points open for GCO claims	EM UCF (T6.4)	functional
		KPI 3.9 Cross border exchange of GCO.	EM UCF (T6.4)	functional

Expected Outcome	Domain	KPI id & description	UCF & where to be verified	Type of metrics
EO3	Economic/ Societal	**KPI 3.10** Increased revenue from SMEs that participate in the project.	LEC UCF (T6.3)	impact-oriented
		KPI 3.11 Percentage of utilisation of public data is increased.	LEC UCF (T6.3)	impact-oriented
		KPI 3.12 Households connected	EM UCF (T6.4)	functional
EO4	Economic	**KPI 4.4** Number of datasets shared between pilots	LEC UCF (T6.3)	impact-oriented
	Scientific/ Societal	**KPI 4.5** Complete toolbox validated in large-scale pilots.	All UCF (T6.1)	technical
EO5	Economic	**KPI 5.1** Data analytics services are developed or enhanced.	All UCF (T5.1)	technical
	Economic/ Scientific	**KPI 5.2** Data analytics services for RES developed, implemented and validated.	REN UCF (T6.2)	impact-oriented
	Economic/ Societal	**KPI 5.3** RES availability increase.	REN UCF (T6.2)	functional
		KPI 5.4 Economic benefit increase for RES producers.	REN UCF (T6.2)	impact-oriented
		KPI 5.5 Economic benefit increase for DSOs and TSOs.	REN UCF (T6.2)	impact-oriented
		KPI 5.6 Energy bill decrease for prosumers.	REN UCF (T6.2)	impact-oriented
		KPI 5.7 CO2 emissions reduction.	REN UCF (T6.2)	impact-oriented
		KPI 5.8 Enabling flexibility service provision for the DSO.	FLEX UCF (T6.5)	impact-oriented
	Economic	**KPI 5.9** Services supported by new datasets.	All UCF (T5.3)	functional
		KPI 5.10 Open data sets available for third parties as a result of the project.	All UCF (T6.1)	functional
	Economic/ Societal	**KPI 5.11** Energy loss characterization error.	REN UCF (T6.2)	impact-oriented

Expected Outcome	Domain	KPI id & description	UCF & where to be verified	Type of metrics
EO5	Economic/ Societal	**KPI 5.12** Fault detection time.	REN UCF (T6.2)	functional
	Economic	**KPI 5.13** PV Asset OPEX reduction.	REN UCF (T6.2)	functional
	Economic/ Societal	**KPI 5.14** Electric Power Quality.	REN UCF (T6.2)	functional
		KPI 5.15 Continuity of Service.	REN UCF (T6.2)	functional
	Economic	**KPI 5.16** CAPEX.	REN UCF (T6.2)	functional
		KPI 5.17 OPEX.	REN UCF (T6.2)	functional
		KPI 5.18 Asset improvements.	REN UCF (T6.2)	functional
EO6	Economic/ Societal	**KPI 6.1** Prosumer flexibility offer increase.	FLEX UCF (T6.5)	impact-oriented
		KPI 6.2 Energy bill reduction.	FLEX UCF (T6.5)	impact-oriented
		KPI 6.3 Revenue increase for flexibility providers.	FLEX UCF (T6.5)	impact-oriented
		KPI 6.4 Incentives towards end users that support sharing/trading of data.	FLEX UCF (T6.5)	functional
		KPI 6.5 Increased sharing of data from consumers.	FLEX UCF (T6.5)	functional
	Societal	**KPI 6.6** RES usage increase.	LEC UCF (T6.3)	impact-oriented
		KPI 6.7 CO2 emissions reduction.	LEC UCF (T6.3)	impact-oriented
	Economic/ Societal	**KPI 6.8** Energy autonomy increase for single user.	LEC UCF (T6.3)	functional
		KPI 6.9 Imported energy/ Total energy consumption.	LEC UCF (T6.3)	functional

Expected Outcome	Domain	KPI id & description	UCF & where to be verified	Type of metrics
EO6	Societal	**KPI 6.10** Number of users involved in the pilots.	All UCF (T7.6)	impact-oriented
		KPI 6.11 Gender representation, Number of men, women, non-binary involved in the pilots.	All UCF (T7.6)	impact-oriented
		KPI 6.12 Awareness impact, percentage of people in the target group that have been reached and/or are activated by the project.	All UCF (T7.6)	impact-oriented
		KPI 6.13 Perceived value from the citizens (Surveys based in Likert scale (% of surveys with average to good results).	All UCF (T7.6)	impact-oriented
		KPI 6.14 Technical requirements, Number of requirements identified through end user engagement.	All UCF (T7.6)	impact-oriented
		KPI 6.15 Percentage of citizens that support municipality in integrating more RES in the energy mix, as flexible sources.	FLEX UCF (T6.5)	impact-oriented
	Economic/ Societal	**KPI 6.16** Water losses detection	LEC UCF (T6.3)	functional
		KPI 6.17 Thermal losses detection	LEC UCF (T6.3)	functional
		KPI 6.18 Electrical losses detection	LEC UCF (T6.3)	functional
		KPI 6.19 Coverage smart meters	LEC UCF (T6.3)	impact-oriented
		KPI 6.20 Increase decarbonisation of Local Energy Communities	LEC UCF (T6.3)	impact-oriented
	Economic	**KPI 6.21** OPEX Reduction	LEC UCF (T6.3)	functional
		KPI 6.22 CO2 compensated	LEC UCF (T6.3)	impact-oriented

Expected Outcome	Domain	KPI id & description	UCF & where to be verified	Type of metrics
EO6	Economic	**KPI 6.23** Euros saved	LEC UCF (T6.3)	impact-oriented
		KPI 6.24 Energy ranking	LEC UCF (T6.3)	impact-oriented
		KPI 6.25 Energy costs	LEC UCF (T6.3)	functional
		KPI 6.26 Production forecasting	LEC UCF (T6.3)	functional
		KPI 6.27 Demand forecast	LEC UCF (T6.3)	functional

KPI 4.4 was changed from: "Variation of stakeholders that have difficulties in using data from other organizations received from market sampling survey" (at the Grant Agreement) to: "Number of datasets shared between pilots" which makes more sense in the work being performed.

KPI 6.8 was changed from: "Energy autonomy increase" (at the Grant Agreement) to: "Energy autonomy increase for single user" which makes more sense in the work being performed.

There are 21 new KPIs (in addition to the 53 previously identified from the Grant Agreement), that were identified under D3.1 [2] works:

- REN UCF: 8 new KPIs (5.11 To 5.18), totalizing now 15 KPIs for this UCF
- LEC UCF: 12 new KPIs (6.16 to 6.27), totalizing now 22 KPIs for this UCF
- EM UCF: 1 new KPI (3.12), totalizing now 4 KPIs for this UCF
- FLEX UCF: no new KPIs, totalizing now 9 KPIs for this UCF

Table 10 UC KPIs summary.

UCF & where to verify KPI	Lead Partner	Nº of KPIs
All UCF (WP5)	Tecnalia	1
All UCF (T5.1)	UPC	1
All UCF (T5.3)	ICOM	3
All UCF (T5.6)	Tecnalia	1
All UCF (T6.1)	EDF	2
REN UCF (T6.2)	Tecnalia	15
LEC UCF (T6.3)	RINA-C	22
EM UCF (T6.4)	EDF	4
FLEX UCF (T6.5)	EDP	9

UCF & where to verify KPI	Lead Partner	Nº of KPIs
All UCF (T7.2)	UCP	2
All UCF (T7.6)	AU	5

In total, 65 Use Case Family KPIs.

4.3 Reference Architecture KPIs

This section outlines those OMEGA-X KPIs that are closely related to the definition of the architecture and alignment with data space principles. Therefore, most of them are cross-cutting and non-functional requirements, affecting all OMEGA-X business and system use cases.

The project will make sure those KPIs, which mostly emanate from the Architectural description (D3.1 report [2]), are, first, understood by all stakeholders (being module developers or deployment responsibles) and then, incorporated in all relevant outputs.

While the process of conveying the message across the multiple participants in the ideation-development-deployment process is a challenging task, measuring those KPIs should not be very difficult, as they are usually just evaluated with a Boolean question (Yes/No) or fulfilled by identifying a list/number of technologies/choices made.

Table 11 Reference Architecture KPIs detail.

Expected Outcome	Domain	KPI id & description	UCF & where to be verified	Type of metrics
EO1	Scientific	**KPI 1.1** Interoperability test with other projects in the same call, ensuring that different types of stakeholders' exchange data and services, use it to improve current services to their customers and enable new innovative products/services.	OMEGA-X data space/Architecture (T2.4)	functional
		KPI 1.2 Alliances with relevant European Dataspace initiatives.	OMEGA-X data space/Architecture (WP2)	impact-oriented
	Economic/ Societal	**KPI 1.3** Number of Data Spaces identified from other domains, i.e., electromobility and Smart Manufacturing/Industry 4.0, to share experience related to energy-based service improvements and innovation, thus creating alliances with other national or Horizon Europe projects.	OMEGA-X data space/Architecture (WP2)	impact-oriented

Expected Outcome	Domain	KPI id & description	UCF & where to be verified	Type of metrics
EO1	Economic/ Societal	**KPI 1.4** Number of other projects identified to share best practices with about service improvement.	OMEGA-X data space/Architecture (WP2)	functional
EO2	Scientific	**KPI 2.1** Governance models developed, implemented and validated in large scale pilots.	OMEGA-X data space/Architecture (WP4)	technical
		KPI 2.2 Open-source components to allow secure, private and sovereign exchange of data and services implemented and validated in large scale pilots.	OMEGA-X data space/Architecture (WP4)	technical
EO4	Scientific	**KPI 4.1** New/extended Open-source components published on IDS/GitHub.	OMEGA-X data space/Architecture (WP4)	technical
		KPI 4.2 Standard connectors/APIs for vertical interoperability.	OMEGA-X data space/Architecture (WP4)	technical
		KPI 4.3 API for inter-Data Spaces technical interoperability.	OMEGA-X data space/Architecture (WP4)	technical

Table 12 Reference Architecture KPIs summary.

Task	Lead Partner	Nº of KPIs
OMEGA-X data space / Architecture (WP2)	AU	3
OMEGA-X data space / Architecture (T2.4)	RINA-C	1
OMEGA-X data space / Architecture (WP4)	ATOS IT	4
OMEGA-X data space / Architecture (WP4)	TECNALIA/ATOS IT/ICOM	1

In total, 9 OMEGA-X data space / Architecture KPIs.

5 KPI evaluation

Based on the templates defined in this deliverable the future OMEGA-X evaluation activities will conduct the formal evaluation of the KPIs using real data from large scale pilots. These KPIs will be compared with the defined targets and the different stakeholders will be consulted for acceptance. The results will be documented as part of deliverable “D6.3 OMEGA-X use case family evaluation”.

The KPI evaluation will be done from M30-M36 (October 2024, April 2025), however, it is likely that during the development phase of technical development activities of the project and/or pilot implementation phase some changes might happen that could impact the defined KPIs. Therefore, following the iterative methodology defined in OMEGA-X, the KPIs defined in this deliverable will be reviewed and updated, if necessary, as part of deliverable “D3.2 Use Cases and Architecture living report-Second release” in month M24 (April 2024) before the formal evaluation in deliverable D6.3 “OMEGA-X use case family evaluation”.

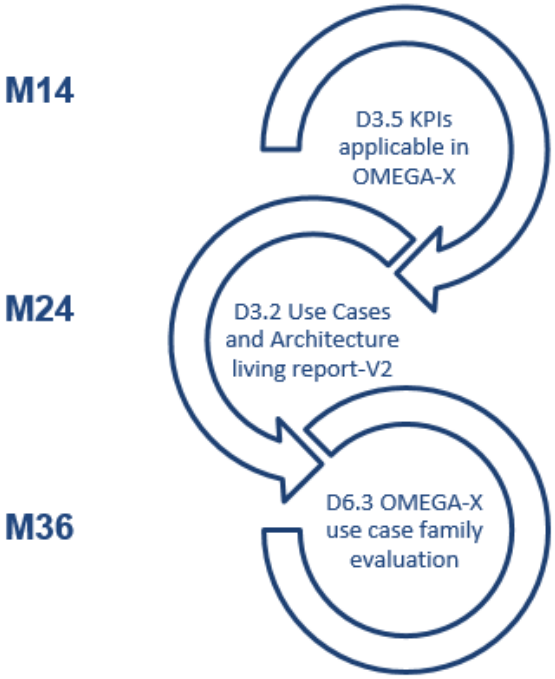

Figure 7 KPI Definition and evaluation process.

Finally, the output from the KPI evaluation performed in the future evaluation activities will be fed to the different tasks for exploitation and business. In particular, the results of the KPI evaluation will impact the feasibility of the business models and the scalability and replicability of solutions conducted inside the impact group of activities for OMEGA-X.

6 Conclusions

The present deliverable, within the scope of OMEGA-X Design activities and, among those, especially for the KPI elicitation for use case validation task, plays a crucial role in the OMEGA-X project. It aims to identify and define Key Performance Indicators (KPIs) for the OMEGA-X Use Cases. The main objective is to facilitate the monitoring and assessment of project activities and demonstrators, so that they can be precisely evaluated with respect to the specific demonstrator objectives together with the overall OMEGA-X architectural and framework related goals.

The deliverable is closely linked to the Use case identification Full system architecture and building blocks activities, also grouped within the same set of Design activities for OMEGA-X. Additionally, the work to be conducted as part of OMEGA-X demonstration implementation activities, specifically the four Use Case Families (UCF) of Renewables (REN), Local Energy Communities (LEC), Electromobility (EM), and Flexibility (FLEX), is crucial for the development and understanding of this deliverable. The pilots in these UCFs serve to demonstrate and validate the services and architecture defined in the project.

This document is structured into six major sections, each addressing specific aspects of the KPI identification and definition process. It begins with an introduction, presenting the purpose of the document and its relation to other project works.

The methodology section describes a comprehensive methodology followed to achieve the objective of identifying and defining the KPIs. The methodology involves a systematic approach, including the identification of UCs, BUCs, objectives, and solutions, as well as the linkage between UCs and the overall objectives of the project.

The identification of KPIs section establishes the link between UCs, objectives, stakeholder groups, and KPI domains. As a result of the methodology, a total of 74 KPIs have been identified for the OMEGA-X project, classified into three domains: Scientific Domain, Economic Domain, and Societal Domain:

- Scientific Domain is related to the KPIs measuring the technological performance and scientific development.
- Economic Domain is related with the KPIs measuring the economic and regulatory performance.
- Societal Domain is related to the KPIs measuring the users' degree of satisfaction.

Stakeholder groups and KPI domains were also considered in setting the foundations for the KPI definition.

The definition of KPIs section further elaborates on the KPIs related to the OMEGA-X Project, Use Case Families, and Reference Architecture. To calculate the KPIs, the KPI definition templates provided in the annexes were used, and the data collection methodologies described within those templates. The monitoring of the KPIs, UCFs, and project activities will be subject to future work under KPI evaluation and is discussed in a dedicated section.

Finally, the document concludes with a summary of the findings presented in the deliverable.

Overall, this deliverable contributes to the project's evaluation by establishing a comprehensive set of KPIs that will be used to assess the technological performance, economic and regulatory performance, and users' degree of satisfaction in the OMEGA-X project.

7 References

[1] OMEGA-X, OMEGA-X Grant Agreement 101069287, 2022.

[2] OMEGA-X, D3.1 Use Cases and Architecture living report. First release., 2023.

[3] OMEGA-X, D3.4 Data analytic services and requirements related to interoperability, security, privacy and data sovereignty, 2022.

[4] IEC 62559-2:2015 “Use case methodology - Part 2: Definition of the templates for use cases, actor list and requirements list”.

[5] IEC 62351:2022 SER - Power systems management and associated information exchange - Data and communications security, 2022.

[6] ISO/IEC/IEEE, ISO/IEC/IEEE 42010:2011, Systems and software engineering - Architecture description, 2011.

[7] Demonstration of INTElligent grid technologies for renewables INTEgration and INTEractive consumer participation enabling INTEroperable market solutions and INTErconnected stakeholders, 2020.

[8] OMEGA-X, D7.1 Plan for the dissemination and exploitation including communication activities and online presence, 2022.

[9] OMEGA-X, D2.1 Foundations for a holistic iterative methodology, 2022.

Annex 1 KPI Template

Table 13 KPIs definition template.

GENERAL INFORMATION					
ID		**Name**			
Business UC/ System UC					
Use Case	Renewables ☐	Energy communities☐	Electromobility ☐	Flexibility☐	N/A☐
Description					
Formula					
Monitoring					
Units		**Parent KPI**			
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A☐	
KPI calculation trigger (target value)					

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1			

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1						

BASELINE					
Baseline source	Literature☐	Historical data☐	Measurements ☐	Simulations ☐	Other ☐
	"Other" baseline source				
Responsible					
Description					

Annex 2 KPI filled in templates

74 filled in KPI templates.

The KPIs detailed in this section can be updated or adapted, until the end of the project, to better fit the reality of the use cases and needs of OMEGA-X project.

Table 14 KPI 1.1 definition.

GENERAL INFORMATION					
ID	KPI 1.1		**Name**	Interoperability with sister project	
Business UC/ System UC	All BUCs/SUCs				
Use Case	Renewables ☒	Energy communities☒	Electromobility☒	Flexibility☒	N/A☐
Description	Number of projects in the same call with whom testing interoperability. Interoperability is intended as the exchange of data between projects or the testing of services between projects.				
Formula	$\sum_{i=1}^{N} Project_i$				
Monitoring	Monitoring will start in T2.4 (M13) and will continue for the entire duration of the project (M36)				
Units	N/A		**Parent KPI**	N/A	
Reporting [to DWH]	**Data upload rate**		Other	**"Other" upload rate**	End of the project
	Information display		Cumulated value☐	Trend☐	N/A☒
KPI calculation trigger (target value)	3 projects				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Compute the number of sister projects whose use case has been tested	UCF Leaders	$Project_i$
2	Compute the number of sister projects that tested Omega-x use cases	UCF Leaders	$Project_i$
3	Compute the number of sister projects with whom data has been shared		$Project_i$
4	Report the total number of projects reached	RINA-C	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$Project_i$	UCF Leader	Rina-C	Notification	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☐	Simulations ☐	Other ☒
	"Other" BASELINE source	N/A			
Responsible	N/A				
Description	N/A				

Table 15 KPI 1.2 definition.

GENERAL INFORMATION					
ID	KPI 1.2		**Name**	Alliances with relevant European Dataspace initiatives.	
Business UC/ System UC	All BUCs/SUCs				
Use Case	Renewables☐	Energy communities☐	Electromobility☐	Flexibility☐	N/A☒
Description	Strategic and technical alignment with European Dataspace initiatives regarding Omega-X 5 points of actuation				
Formula					
Monitoring	Monitoring will continue for the entire duration of the project (M36)				
Units	N/A		**Parent KPI**	N/A	
Reporting	**Data upload rate**		Other	**"Other" upload rate**	End of the project
	Information display		Cumulated value☒	Trend☐	N/A☐
KPI calculation trigger (target value)	2 alliances				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Liaising with GAIA-X and other Dataspace initiatives' experts, participate in meetings to align and share findings, contribute to strategic and technical documents.	EDF, ATOS	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
N/A						

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☐	Simulations ☐	Other ☒
	"Other" BASELINE source	No baseline needed			
Responsible	N/A				
Description	N/A				

Table 16 KPI 1.3 definition.

GENERAL INFORMATION					
ID	KPI 1.3	**Name**	Number of Data Spaces identified from other domains		
Business UC/ System UC	All BUCs/SUCs				
Use Case	Renewables☐	Energy communities☐	Electromobility☐	Flexibility☐	N/A☒
Description	Number of Data Spaces identified from other domains, i.e., electromobility and Smart Manufacturing/Industry 4.0, to share experience related to energy-based service improvements and innovation, thus creating alliances with other national or Horizon Europe projects.				
Formula	N/A				
Monitoring	Active monitoring of other dataspace initiatives and sister projects Identification Strategic Agendas and reference architecture				
Units	N/A	**Parent KPI**	N/A		
Reporting	**Data upload rate**	Other	**"Other" upload rate**	End of the project	
	Information display	Cumulated value☒	Trend☐	N/A☐	
KPI calculation trigger (target value)	2 alliances				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Map and identify Data spaces from other domains.	EDF, ATOS	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
N/A						

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations ☐	Other ☒
	"Other" BASELINE source		No baseline needed		
Responsible	EDF				
Description	The result will be benchmarked with respect to the reference Architectures of Gaia-X, IDSA and the sister projects.				

Table 17 KPI 1.4 definition.

GENERAL INFORMATION					
ID	KPI 1.4		**Name**	Number of other projects identified to share best practices with about service improvement.	
Business UC/ System UC	All BUCs/SUCs				
Use Case	Renewables☒	Energy communities☒	Electromobility☒	Flexibility☒	N/A☐
Description	Number of other projects identified to share best practices about service improvement, with the aim to increase degree of interoperability				
Formula	N/A				
Monitoring	Active monitoring of relevant projects.				
Units	#		**Parent KPI**	N/A	
Reporting	**Data upload rate**		Other	**"Other" upload rate**	End of the project
	Information display		Cumulated value☐	Trend☒	N/A☐
KPI calculation trigger (target value)	4				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Monitoring and identification of relevant projects	EDF	
2	Engage with project in sharing of best practices	EDF	
3.	Analyse and report	EDF	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
N/A						

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations ☐	Other ☒
	"Other" BASELINE source	No baseline needed			
Responsible	N/A				
Description	N/A				

Table 18 KPI 2.1 definition.

GENERAL INFORMATION					
ID	KPI 2.1		**Name**	Governance models developed, implemented and validated in large scale pilots.	
Business UC/ System UC	Applicable to all BUCs				
Use Case	Renewables☐	Energy communities☐	Electromobility☐	Flexibility☐	N/A☒
Description	In the DoA a specific objective (objective 4) was defined to design, develop and validate 2 different data governance models: 1. Community model in which the governance model is shared between data space participants with main responsible rotated periodically; 2. Unique organization responsible for the data governance. However, since then the Data Space Support Centre (DSSC) Coordination and Support Action was created so different Data Spaces Solutions (IDSA, GAIA-X, FIWARE…) can converge into a common definition of a Data Space which is applicable not only to energy but also to other sectors. As part of this convergence, DSSC is currently working on the definition a Data Space Governance Model. It seems reasonable that OMEGA-X adopts the Data Governance model defined in DSSC. Therefore, this KPI will validate that the Governance model defined in DSSC is correctly implemented in all the use case families which include the different large-scale pilots.				
Formula	N/A				
Monitoring	N/A				
Units	N/A		**Parent KPI**	N/A	
Reporting	**Data upload rate**		N/A	**"Other" upload rate**	
	Information display		Cumulated value☐	Trend☐	N/A☒
KPI calculation trigger (target value)	Data Space Governance Model defined by the DSSC is correctly implemented and validated in all large-scale pilots is OMEGA-X. 2 Governance Models.				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Monitor the deliverables of DSSC and attend different forums of DSSC (Thematic Groups, Expert Groups) and Energy Interoperability task force to understand the definition of the Data Space Governance Model defined by the DSSC.	ATOS/TECNALIA/ICOM	N/A
2	Implement the defined Data Governance Model into the OMEGA-X federated data space	ATOS/TECNALIA/ICOM	N/A
3	Validate the defined Data Governance Model into all the use case families which include the different large-scale pilots.	UCF leaders (TECNALIA/EDF/RINA-C/EDP)	N/A

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
N/A						

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☐	Simulations☐	Other ☒
	"Other" BASELINE source	N/A			
Responsible	N/A				
Description	N/A				

Table 19 KPI 2.2 definition.

GENERAL INFORMATION					
ID	KPI 2.2		**Name**	Total Open-Source Components	
Business UC/ System UC	All				
Use Case	Renewables☒	Energy communities☒	Electromobility☒	Flexibility ☒	N/A☐
Description	Open-source components to allow secure, private and sovereign exchange of data and services implemented and validated in large scale pilots.				
Formula	$\sum_{i=1}^{N} Component_i$				
Monitoring	Active monitoring starting at WP3 architecture definition and continuing on WP4/WP5 development activities so that open-source modules are used always as first option, especially those listed/used in IDSA and/or Gaia-X reference implementations.				
Units	No units		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger	6 components				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Flag Open-Source components on development phase	Module developers	$Component_i$
2	Aggregate number of open-source components	ATOS	Total Components

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$Component_i$	Component developers	Coordinator	Notification	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations☐	Other☒
	"Other" BASELINE source	Data Space Reference Architectures			
Responsible	ATOS				
Description	The result will be benchmarked with respect to the reference Architectures of Gaia-X, IDSA and the sister projects. The number of Open-Source modules used will be compared with those in OMEGA-X				

Table 20 KPI 2.3 definition.

GENERAL INFORMATION				
ID	KPI 2.3	**Name**	Total number of available datasets	
Business UC/ System UC	All BUCs are relevant			
Use Case	Renewables☒	Energy communities☒	Electromobility☒	Flexibility☒	N/A☐
Description	Number of datasets made available through the marketplace with the developed data governance schema and data privacy, security and sovereignty.			
Formula	$\sum_{i=1}^{N} Dataset_i$			
Monitoring	• Monitoring through Data Governance – updating every time a provider adds or deletes a data source • Counting self-descriptions from catalogue			
Units	No unit	**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**	
	Information display	Cumulated value☐	Trend☐	N/A☐
KPI calculation trigger	Upon request			
Target Value	10 datasets			

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Search all available datasets in catalogue	ICOM	Search data
2	Count self-descriptions from catalogue	ICOM	Add data
3	Make report of the responses of all participants	ICOM	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Dataset nr	ICOM	ICOM	Metadata	Upon modification of catalogue	After implementation of marketplace and data set registration

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source		No baseline needed.		
Responsible	NA				
Description	NA				

Table 21 KPI 2.4 definition.

GENERAL INFORMATION					
ID	KPI 2.4	**Name**	Increased usage of datasets		
Business UC/ System UC	All BUCs/SUCs				
Use Case	Renewables☒	Energy communities☒	Electromobility ☒	Flexibility ☒	N/A ☐
Description	Currently most of the existing data analytics servicers use a data source from one single data provider to train and validate the services. OMEGA-X will extend/develop, implement and validate a set of open-source components to allow secure, private and sovereign exchange of data and services. This will allow to leverage multiple datasets from multiple data providers to train and validate the models achieving a higher robustness.				
Formula	$\frac{(\text{number of datasets used by existing services after T5.1 – T5.2} - \text{number of datasets used by existing services before T5.1 – T5.2})}{\text{number of datasets used by existing services before T5.1 – T5.2}} * 100$				
Monitoring	T5.1, T5.2 and T6.6				
Units	N/A	**Parent KPI**	N/A		
Reporting [to DWH]	**Data upload rate**	N/A	**"Other" upload rate**	N/A	
	Information display	Cumulated value☐	Trend☐	N/AX	
KPI calculation trigger	T6.6				
Target Value	20%				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Evaluate the number of datasets used by existing services before T5.1-T5.2	Tecnalia	N/A
2	Evaluate the number of datasets used by new/improved services after T5.1-T5.2	Tecnalia	N/A
3	Calculate the ration between obtained results from step 1 and 2	Tecnalia	N/A

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
N/A						

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements☐	Simulations☐	Other☐
	"Other" BASELINE source	N/A			
Responsible	Tecnalia/ UCF leaders				
Description	Number of datasets used by existing services before T5.1-T5.2.				

Table 22 KPI 2.5 definition.

GENERAL INFORMATION				
ID	KPI 2.5	**Name**	Prosumer involvement	
Business UC/ System UC	BUC LEC 2.0 ECO SUC LEC 4.0 Benchmarking SUC LEC 5.0 Provide Data Analytics and KPI SUC LEC 6.0 Prosumer behaviours			
Use Case	Renewables ☐	Energy communities☒	Electromobility ☐	Flexibility ☐	N/A☐
Description	Increased number of prosumers that share data for energy monitoring and sustainable energy actions definition.			
Formula	$$Prosumers_{increase} = \frac{Prosumers_{M32} - Prosumers_{M20}}{Prosumers_{M20}} \cdot 100$$ $Prosumers_{M20}$ = the total number of prosumers involved at M20 before the pilot implementation $Prosumers_{M32}$ = the total number of prosumers involved at M32 after the pilot implementation			
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed			
Units	%	**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot
	Information display	Cumulated value☐	Trend☒	N/A☐
KPI calculation trigger (target value)	10% increase			

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Number of prosumers involved for each pilot before implementing OMEGA-X solutions	Pilot owner	$Prosumers_{M20}$
2	Number of prosumers involved for each pilot after the implementation of OMEGA-X solutions	Pilot owner	$Prosumers_{M32}$
3	Collect input from pilot owners and report the increment	RINA-C	$Prosumers_{increase}$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Number of prosumers	Pilot owners	RINA-C	Database	Twice: before and after pilots' implementation	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☐	Simulations ☐	Other ☒
	"Other" BASELINE source	Compute number of prosumers			
Responsible	Pilot owners				
Description	Number of prosumers that are involved				

Table 23 KPI 2.6 definition.

GENERAL INFORMATION						
ID	KPI 2.6		**Name**	New energy services developed for smart consumers.		
Business UC/ System UC	BUC					
Use Case	Renewables☐	Energy communities☒	Electromobility☐	Flexibility☐	N/A ☐	
Description	New energy services developed for smart consumers.					
Formula	Number of services energy services for smart consumers after T5.1-T5.2 - Number of existing services energy services for smart consumers before T5.1-T5.2					
Monitoring	T5.1, T5.2 and T6.6					
Units	N/A		**Parent KPI**	N/A		
Reporting [to DWH]	**Data upload rate**	N/A	**"Other" upload rate**	N/A		
	Information display	Cumulated value☐	Trend☐	N/AX		
KPI calculation trigger	T6.6					
Target Value	2					

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Evaluate the number of existing services energy services for smart consumers before T5.1-T5.2	Tecnalia	N/A
2	Evaluate the number of services energy services for smart consumers after T5.1-T5.2	Tecnalia	N/A
3	Calculate the difference between obtained results from step 1 and 2	Tecnalia	N/A

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
N/A						

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements☐	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	TECNALIA/ UCF leaders				
Description	Number of numbers of existing services energy services for smart consumers before T5.1-T5.2.				

Table 24 KPI 2.7 definition.

GENERAL INFORMATION					
ID	KPI 2.7		**Name**	Increased consumer satisfaction	
Business UC/ System UC	All BUCs/SUCs				
Use Case	Renewables ☒	Energy communities☒	Electromobility ☒	Flexibility☒	N/A☐
Description	Better use of data in energy sector can lead to more efficient and relevant public service and thus increased quality of life, as well as more efficient services in relation to data management, and efficiency to support the energy transition to achieve affordable and clean energy goals (i.e., real time operation of networks and data sharing for decision making).				
Formula	Survey based in Likert scale to be filled in by at least 40 consumers				
Monitoring	• Start monitoring at WP6 before implementation of services at LEC Use Case Family • Continuing on WP6 T6.3 after implementation of services at LEC Use Case Family for the verification of the KPI target • Reporting on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger (target value)	10% increase in satisfaction				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identification of target group and engagement	Pilot owner	
2	Conduct first survey before service implementation to collect baseline	RINA-C	
3	Conduct a second survey after service implementation	RINA-C	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	% of increment	Pilot owners	RINA-C	Survey	Twice: before and after pilots' implementation	A week

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☐	Simulations ☐	Other ☒
	"Other" BASELINE source	Results from first survey			
Responsible	N/A				
Description	N/A				

Table 25 KPI 2.8 definition.

GENERAL INFORMATION					
ID	KPI 2.8		**Name**	Data-driven business model defined	
Business UC/ System UC	All Business use cases				
Use Case	Renewables☒	Energy communities☒	Electromobility☒	Flexibility☒	N/A☐
Description	Identification of potential data-driven business models associated to each use case family				
Formula	N/A				
Monitoring	N/A				
Units	N/A		**Parent KPI**	N/A	
Reporting [to DWH]	**Data upload rate**			**"Other" upload rate**	N/A
	Information display		Cumulated value☐	Trend☐	N/A☒
KPI calculation trigger (target value)	At least 2 data-driven business models				

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1.1	Interviews	Use case families	UCP	Interviews	Done	Mar-May 23

BASELINE					
BASELINE source	Literature☒	Historical data☐	Measurements☐	Simulations ☐	Other ☒
	"Other" BASELINE source		Interviews/surveys with use case family leaders and pilots		
Responsible	UCP				
Description	The expected results will be compiled in a white paper for project's dissemination.				

Table 26 KPI 3.1 definition.

GENERAL INFORMATION					
ID	KPI 3.1	**Name**	Flexibility offer optimisation		
Business UC/ System UC	BUC Flex3.0 Flexibility for capacity management with market structures SUC Flex4.0 Optimize flexibility offers SUC Flex6.0 Activate flexibility orders				
Use Case	Renewables☐	Energy communities☐	Electromobility☐	Flexibility☒	N/A☐
Description	Flexibility offer optimisation by aggregators and LECs. From Aggregated flexibility offer optimization service (Tecnalia) and Flexibility order disaggregation service (Tecnalia)				
Formula	$\frac{\sum_{i=1}^{N} Flexibility\ offers\ M32_i - \sum_{i=1}^{N} Flexibility\ offers\ M20_i}{\sum_{i=1}^{N} Flexibility\ offers\ M20_i}$ M20 – Month 20 of the project: Before the pilot implementation M32 – Month 32 of the project: After the pilot implementation				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing WP6 T6.5 implementation of services at Flexibility Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	In the end of the pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (& target value)	10% increase				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and sum the number of flexibilities offers by aggregators and LECs before implementing the pilot.	MAIA	*Flex of fers M20*
2	Identify and sum the number of flexibilities offers by aggregators and LECs after implementing the pilot.	EDP	*Flex of fers M32*

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	*Flex of fers M2*	MAIA	EDP	Databases available	N/A	N/A
2	*Flex of fers M3*	MAIA	EDP	Databases available	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements☐	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Maia Municipality & Service developers				
Description	The result will be benchmarked with respect to the information collected by Maia Municipality. The flexibility offer optimisation will be compared with that in OMEGA-X T6.5, to verify the objective outcome of Enabling new market roles, market participants and energy communities.				

Table 27 KPI 3.2 definition.

GENERAL INFORMATION					
ID	KPI 3.2	**Name**	Increased revenues by the LEC		
Business UC/ System UC	BUC LEC 1.0 O&M BUC LEC 2.0 ECO				
Use Case	Renewables ☐	Energy communities☒	Electromobility ☐	Flexibility☐	N/A☐
Description	Increased economic profits LEC managers				
Formula	$Revenues_{increase} = \frac{Revenues_{M32} - Revenues_{M20}}{Revenues_{M20}} \cdot 100$ $Revenues_{M20}$ = the total revenues for LEC managers at M20 before the pilot implementation $Revenues_{M32}$ = the total revenues for LEC managers at M32 after the pilot implementation				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of the pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	10% increase				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and quantify the revenues by LECs before implementing the pilot (M8 to M20)	Pilot owner	$Revenues_{M20}$
2	Quantify the revenues by LECs after implementing the pilot (M20 to M32)	Pilot owner	$Revenues_{M32}$
3	Report the increment	RINA-C	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$Revenues_{M1}$	Pilot owner	Pilot owner	Database	N/A	N/A
2	$Revenues_{M1}$	Pilot owner	Pilot owner	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Pilot owners				
Description	Revenues by LEC the year before implementing the pilot, from M8 to M20.				

Table 28 KPI 3.3 definition.

GENERAL INFORMATION					
ID	KPI 3.3	**Name**	Increased community RES production		
Business UC/ System UC	BUC Flex1.0 Flexibility for internal prosumer portfolio optimization BUC Flex2.0 Flexibility for congestion management with bilateral contracts BUC Flex3.0 Flexibility for capacity management with market structures BUC LEC-ECO ProsumerEngagement: Local Energy Communities Energy Consumption Optimisation through prosumer engagement BUC LEC-O&M: LEC Operation and Maintenance Optimization				
Use Case	Renewables☐	Energy communities☒	Electromobility ☐	Flexibility☒	N/A☐
Description	Increased RES production (energy yield) in the community until 2026, as compared to the whole community production (it is not a KPI to reflect the share of renewable self-consumption). Applicable to all pilots where the production of the different resources is monitored and activities for the promotion of RES production/optimizations are delivered. To be calculated in these pilots: • Maia (T6.5) • Zaragoza (T6.3) • Granollers (T6.3) • Osimo (T6.3) Data to be provided by the Data Provider in each pilot: ISMAI, EyPESA, EDP and Astea, respectively and calculation to be done by each pilot owner: Maia Municipality, EyPESA, EDP and Astea				
Formula	$\sum_{i=1}^{N} RES\ production_i \Big/ \sum_{i=1}^{N} Total\ production_i$ Average value during the validation of each pilot implementation From M20 – Month 20 of the project: Before the pilot implementation To M32 – Month 32 of the project: After the pilot implementation				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6, T6.3 implementation of services at Energy Communities Use Case Family and T6.5 implementation of services at Flexibility Use Case Family, for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	In the end of the pilots	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	Up to 60%				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and sum both the total and RES production during the pilot execution	Pilot owner	RES production, Total production

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	RES production	Prosumer(s) in each pilot	Data provider for each prosumer in each pilot	Database	N/A	N/A
2	Total production	Prosumer(s) in each pilot	Data provider for each prosumer in each pilot	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations☐	Other ☒
	"Other" BASELINE source	N/A			
Responsible	N/A				
Description	N/A				

Table 29 KPI 3.4 definition.

GENERAL INFORMATION					
ID	KPI 3.4	**Name**	Total number of new services		
Business UC/ System UC	All BUCs are relevant				
Use Case	Renewables☒	Energy communities☒	Electromobility ☒	Flexibility☒	N/A☐
Description	Number of services provided by new market participants.				
Formula	$\sum_{i=1}^{N} Service_i$, for each new market participant "i"				
Monitoring	• Monitoring through Data Governance – updating every time a provider adds or deletes a service • Counting self-descriptions from catalogue				
Units	No unit	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A☐	
KPI calculation trigger	Marketplace launch				
Target Value	4 services				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Define if new market participant of not	Service Provider	
2	Count self-descriptions from catalogue for specific market participants	ICOM	
3	Make report of the responses of all participants	ICOM	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Report	All Service Providers	ICOM	Metadata	Upon modification of catalogue	After implementation of marketplace and services

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations☐	Other ☒
	"Other" BASELINE source	No baseline needed.			
Responsible	NA				
Description	NA				

Table 30 KPI 3.5 definition.

GENERAL INFORMATION					
ID	KPI 3.5	**Name**	Provision of flexibility to grid		
Business UC/ System UC	BUC Flex2.0 Flexibility for congestion management with bilateral contracts SUC Flex1.0 Define the context of flexibility management SUC Flex3.0 Manage flexibility needs				
Use Case	Renewables☐	Energy communities☐	Electromobility ☐	Flexibility☒	N/A☐
Description	Revenue increase from the provision of flexibility into the grid (avoided cost). In the calculations, the possible changes in the energy price (M20 vs M32) should be considered. From Flexibility platform for DER connection planning service (Odit-E)				
Formula	$\frac{\sum_{i=1}^{N} Revenue\ from\ flexibility\ M32_i - \sum_{i=1}^{N} Revenue\ from\ flexibility\ M20_i}{\sum_{i=1}^{N} Revenue\ from\ flexibility\ M20_i}$ M20 – Month 20 of the project: Before the pilot implementation M32 – Month 32 of the project: After the pilot implementation				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.5 implementation of services at Flexibility Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	In the end of the pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (& target value)	>10%				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and sum the revenue from the provision of flexibility into the grid before implementing the pilot.	DSO	*Flex rev M20*
2	Identify and sum the revenue from the provision of flexibility into the grid after implementing the pilot.	EDP	*Flex rev M32*

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	*Flex rev M20*	DSO	EDP	Databases available	N/A	N/A
2	*Flex rev M32*	DSO	EDP	Databases available	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Maia Municipality & DSO				
Description	The result will be benchmarked with respect to the information collected by Maia Municipality. The provision of flexibility to grid will be compared with that in OMEGA-X T6.5, to verify the objective outcome of Enabling new market roles, market participants and energy communities.				

Table 31 KPI 3.6 definition.

GENERAL INFORMATION					
ID	KPI 3.6	**Name**	New Business Models		
Business UC/ System UC	All Business use cases				
Use Case	Renewables☒	Energy communities☒	Electromobility☒	Flexibility☒	N/A☐
Description	Identification and development of potential new business models				
Formula	N/A				
Monitoring	N/A				
Units	N/A	**Parent KPI**	N/A		
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**	N/A	
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger (target value)	4				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Online course on business modelling with pilots	UCP	1.1
2	Onsite workshop for the development of business models	UCP	1.2

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
N/A	N/A	N/A	N/A	N/A	N/A	N/A

BASELINE					
BASELINE source	Literature☒	Historical data☒	Measurements ☐	Simulations ☐	Other ☒
	"Other" BASELINE source	Online course and workshop			
Responsible	UCP				
Description	The expected results are a business model developed for each pilot.				

Table 32 KPI 3.7 definition.

GENERAL INFORMATION					
ID	KPI 3.7	**Name**	Discovering of CPO/eMSP offers		
Business UC/ System UC	BUC_1.1: [Booking] - eMSP receives B2B CPO charging services offers descriptions BUC_1.2: [Booking] - MSP receives B2C eMSP charging services offers descriptions BUC_2.1: [Self Consumption] - an EV user asks to store a charge consumption certificate in the GCO Registry				
Use Case	Renewables ☐	Energy communities ☐	Electromobility ☒	Flexibility☐	N/A☐
Description	Data describing charging services offers are available on OMEGA-X data spaces. It could be either B2B roaming offers (Owned by CPOs) or B2C offers (owned by eMSP). It supposes that CPO and/ or eMSP has agreed to expose their charging services data description on OMEGA-X data space, either directly or via an EV interoperability Service provider.				
Formula	Number of CPO or eMSP directly connected or via an EV interoperability Service provider				
Monitoring	N/A				
Units	Company	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	N/A	**"Other" upload rate**	N/A	
	Information display	Cumulated value☐	Trend☐	N/A ☒	
KPI calculation trigger (target value)	At least 2 operations (CPO or eMSP)				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Flag the number of CPO and eMSP that agree to sign OMEGA-X data provision contracts	Coordinator (EDF)	CPO/eMSP data provision contracts
2	Aggregates the number signatures	Coordinator (EDF)	Total CPO/eMSP

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
CPO/eMSP data provision contracts	Signatures	Coordinator (EDF)		N/A	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☐	Simulations ☐	Other ☒
	"Other" BASELINE source		No active operators yet		
Responsible	EDF				
Description	Service doesn't exist yet; the use case is here to show that having multiple operators in a reservation process in feasible				

Table 33 KPI 3.8 definition.

GENERAL INFORMATION					
ID	KPI 3.8	**Name**	Charging points open for GCO claims		
Business UC/ System UC	BUC_2.1: [Self Consumption] - an EV user asks to store a charge consumption certificate in the GCO Registery				
Use Case	Renewables ☐	Energy communities ☐	Electromobility ☒	Flexibility☐	N/A☐
Description	Number of charging points available on OMEGA-X Data spaces at which an EV User can claim a GCO when charging his EV. It supposes that: • An EV user is able to give consent to his eMSP, and eMSP connected parties, to make his own EV User Charge Detail Record (CDR) available on the OMEGA-X Data Space in order to be registered on the appropriate GCO registery by the Granular Certificates (GCO) Registery Operator. • eMSP has agreed to expose CDR of its consenting customers directly, or indirectly, to Granular certificates (GCO) registry operator via OMEGA-X Data space				
Formula	Number of charging points open for GCO				
Monitoring	N/A				
Units	Charging Point	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A ☒	
KPI calculation trigger (target value)	At least 2 charging points				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Flag the eMSP that agrees to expose CDR of their consenting customers to Granular certificates (GCO) registry operator via OMEGA-X Data space	ELIA	eMSP open to GCO
2	Flag the number of charging points available through these eMSP charging services Offer	ELIA	eMSP charging point coverage
3	Aggregates the number of charging points	ELIA	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
eMSP open to GCO	List of eMSP	eMSP or EV Interperablity service provider	GCO Registry	List	N/A	N/A
eMSP charging point coverage	Nb of charge point	eMSP	GCO Registry	Declarative	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations ☐	Other ☒
	"Other" BASELINE source	Currently no baseline for this metric for a similar service			
Responsible	ELIA				
Description	Objective to reach multiple charging points				

Table 34 KPI 3.9 definition.

GENERAL INFORMATION					
ID	KPI 3.9	**Name**	Cross border exchange of GCO		
Business UC/ System UC	BUC_2.1: [Self Consumption] - an EV user asks to store a charge consumption certificate in the GCO Registery				
Use Case	Renewables ☐	Energy communities☐	Electromobility ☒	Flexibility☐	N/A☐
Description	• The demonstrator will cover cross border exchange of GCO in the sense of • The EV user charges his EV in Country A and claims for a match of this GCO consumption with a GCO -Production made on a country B. • The marketplace on which this exchange will happen will guarantee temporal matching, meaning the certificate exchange between the countries must be based in the same time-period and owned by the same user.				
Formula	Number of cross border exchanges				
Monitoring	n/a				
Units	cross border exchanges	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A ☒	
KPI calculation trigger (target value)	2 EU countries				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Flag the eMSP that agreed to expose CDR of their consenting customers to Granular certificates (GCO) registry operator via OMEGA-X Data space	ELIA	eMSP open to GCO
2	Flag the number of countries available through these eSMP charging services Offers	ELIA	eMSP country coverage
3	Flag the GCO production Registries	ELIA	Number of GCO production registry
4	Flag the number of countries covered by these GCO production Registries	ELIA	GCO production registry country coverage
5	Flag the number of common countries between (2) & (4)	ELIA	Common countries
6	Calculates the number of cross border situation [(1)*(2)*(3)*(4)] - 5	ELIA	Number of cross border situations

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
eMSP open to GCO	Nb of eMSP	eMSP or EV Interperablity service provider		List	N/A	N/A
eMSP country coverage	Nb of country	eMSP		Declarative	N/A	N/A
Number of GCO production registry	Nb of registery	GCO registery		list		
GCO production registry country coverage	Nb of country	GCO registery		Declarative		
Common countries	Nb of country			Comparison		

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☒	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	ELIA				
Description	Database of CDR´s (which would have to be exchanged with consumption certificates)				

Table 35 KPI 3.10 definition.

GENERAL INFORMATION					
ID	KPI 3.10	**Name**	Increased revenue from SMEs		
Business UC/ System UC	BUC LEC 1.0 O&M BUC LEC 2.0 ECO				
Use Case	Renewables ☐	Energy communities☒	Electromobility☐	Flexibility☐	N/A☐
Description	Increased economic profit from SME that participate in the project.				
Formula	$SME\ Revenues_{increase} = \frac{SME\ Revenues_{M32} - SME\ Revenues_{M20}}{SME\ Revenues_{M20}} \cdot 100$ SME $Revenues_{M20}$ = the total revenues at M20 before the pilot implementation SME $Revenues_{M32}$ = the total revenues at M32 after the pilot implementation				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of the pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	15% increase				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and quantify the revenues by SME involved before implementing the pilot (M8 to M20)	SME	$SME\ Revenues_M$
2	Quantify the revenues by SME involved after implementing the pilot (M20 to M32)	SME	$SME\ Revenues_M$
3	Report the increment	RINA-C	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$Revenues_M$	SME	SME	Database	N/A	N/A
2	$Revenues_M$	SME	SME	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	SME				
Description	Revenues by SME the year before implementing the pilot, from M8 to M20.				

Table 36 KPI 3.11 definition.

GENERAL INFORMATION					
ID	KPI 3.11	**Name**	Percentage of utilisation of public data is increased.		
Business UC/ System UC	BUC LEC 1.0 O&M BUC LEC 2.0 ECO BUC LEC 3.0 Service Planning				
Use Case	Renewables ☐	Energy communities☒	Electromobility ☐	Flexibility☐	N/A☐
Description	Increased usage of public data				
Formula	$Public\ Data\ usage_{increase} = \frac{Public\ Data\ usage_{M32} - Public\ Data\ usage_{M20}}{Public\ Data\ usage_{M20}} \cdot 100$ Public data usage$_{M20}$ = the total use of public data at M20 before the pilot implementation Public data usage$_{M32}$ = the total use of public data at M32 after the pilot implementation				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	25% increase				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and quantify the use of public data before implementing the pilot (M8 to M20)	Pilot owner	$Public\ Data\ usage_{M20}$
2	Quantify the use of public data after implementing the pilot (M20 to M32)	Pilot owner	$Public\ Data\ usage_{M32}$
3	Report the increment	RINA-C	

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and quantify the use of public data before implementing the pilot (M8 to M20)	Pilot owner	$Public\ Data\ usage_{M20}$
2	Quantify the use of public data after implementing the pilot (M20 to M32)	Pilot owner	$Public\ Data\ usage_{M32}$
3	Report the increment	RINA-C	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$Public\ Data\ usage_{M}$	Pilot owner	Pilot owner	Database	N/A	N/A
2	$Public\ Data\ usage_{M}$	Pilot owner	Pilot owner	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Pilot owners				
Description	Public data use in the pilot the year before implementing the pilot, from M8 to M20.				

Table 37 KPI 3.12 definition.

GENERAL INFORMATION					
ID	KPI 3.12	**Name**	Households connected		
Business UC/ System UC	BUC_2.2: [Prosumption] – a prosumer asks to store a production certification in the GCO Registery				
Use Case	Renewables ☐	Energy communities☐	Electromobility ☒	Flexibility☐	N/A☐
Description	The demonstrator shows that: • A household (producer) can be connected behind the meter and production certificates can be issued, carrying the prosumers unique ID and metadata about the origin of the production. • Through the Omega-X dataspace, the households can connect with the GCO registry which will store the production certificates.				
Formula	Number of households issuing production certificates				
Monitoring	n/a				
Units	Households	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value ☐	Trend☐	N/A ☒	
KPI calculation trigger (target value)	Count number of households				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Households providing injection data to the metered data collector (MDC)	MDC	Injection data
2	Data hub operator (DHO) receiving access to data from MDC	DHO	DHO access
3	GCO registry receives data from DHO and households	DHO/Producer	Producer data

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
Injection data	Metering data	Producer meter	MDC	List	N/A	N/A
Producer data	Metadeta	Producer	GCO Registry	List	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☐	Simulations ☐	Other ☒
	"Other" BASELINE source	No baseline today			
Responsible	ELIA				
Description	New service				

Table 38 KPI 4.1 definition.

GENERAL INFORMATION					
ID	KPI 4.1		**Name**	New Open Source Components	
Business UC/ System UC	All				
Use Case	Renewables ☒	Energy communities☒	Electromobility ☒	Flexibility ☒	N/A☐
Description	New/extended Open-source components published on IDS/GitHub				
Formula	$\sum_{i=1}^{N} NEW\_Component_i$				
Monitoring	Active monitoring starting at WP3 architecture definition and continuing on WP4/WP5 development activities so that NEW open-source modules or extensions of previous open source modules are produced by the project, specially aiming at contributing to listed/used in IDSA and/or Gaia-X reference implementations.				
Units	No units		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**			**"Other" upload rate**	
	Information display		Cumulated value☐	Trend☐	N/A☒
KPI calculation trigger	2 components				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Flag NEW Open-Source components on development phase	Module developers	$NEW\_Component_i$
2	Aggregate number of NEWopen source components	ATOS	Total Components

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$NEW\_Component_i$	Component developers	Coordinator	Notification	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations☐	Other☒
	"Other" BASELINE source		Data Space Reference Architectures		
Responsible	ATOS				
Description	The result will be benchmarked with respect to the reference Architectures of sister projects. The number of NEW Open-Source modules used will be compared with those in OMEGA-X				

Table 39 KPI 4.2 definition.

GENERAL INFORMATION					
ID	KPI 4.2	**Name**	Connector		
Business UC/ System UC	All				
Use Case	Renewables ☒	Energy communities☒	Electromobility ☒	Flexibility☒	N/A☐
Description	Standard connectors for vertical interoperability				
Formula	$\sum_{i=1}^{N} Connector_i$				
Monitoring	Usage of open source and IDSA/Gaia-X compliant connector. Monitor the proper reuse of the connector along the OMEGA-X use case families. Promote the extension of the connector as part of the project outcomes				
Units	No units	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger	1 opens source connector used in all 4 OMEGA-X use case families				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Present Connector to Use Case developers	ATOS	Connector
2	Implement the connector in use cases	Use case developers	Connector_implemented
3	Count instances of the connector	ATOS	Total_connector

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☐	Simulations ☐	Other☒
	"Other" BASELINE source		Data Space Reference Architectures		
Responsible	ATOS				
Description	The connector should be compliant with both IDSA and Gaia-X specifications.				

Table 40 KPI 4.3 definition.

GENERAL INFORMATION					
ID	KPI 4.3		**Name**	Open APIs for interoperability	
Business UC/ System UC	All				
Use Case	Renewables☒	Energy communities☒	Electromobility☒	Flexibility ☒	N/A ☐
Description	API for inter-Data Spaces technical interoperability, allowing other data spaces to discover data/services from OMEGA-X and the other way around				
Formula	$\sum_{i=1}^{N} API_i$				
Monitoring	Active monitoring starting at WP3 architecture definition and continuing on WP4/WP5 development activities so that an API is provided on top of the horizontal services and allowing external data spaces to interact the same way the OMEGA-X Marketplace does inside the project.				
Units	No units		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**			**"Other" upload rate**	
	Information display		Cumulated value☐	Trend☐	N/A☒
KPI calculation trigger	1 Open API				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Flag API on development phase	API developers	API_i
2	Aggregate number of APIs	ATOS	Total APIs

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	API_i	API developer	Coordinator	Notification	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations ☐	Other ☒
	"Other" BASELINE source	Data Space Reference Architectures			
Responsible	ATOS				
Description	The result will be benchmarked with respect to the reference Architectures of the sister projects. The open APIs used will be compared with those in OMEGA-X				

Table 41 KPI 4.4 definition.

GENERAL INFORMATION					
ID	KPI 4.4		**Name**	Number of datasets shared between pilots	
Business UC/ System UC	BUC LEC 1.0 O&M BUC LEC 2.0 ECO SUC LEC 3.0 AI algorithm training SUC LEC 4.0 Benchmarking SUC LEC 6.0 Provide data analytics and KPI				
Use Case	Renewables☐	Energy communities☒	Electromobility ☐	Flexibility☐	N/A☒
Description	Number of datasets				
Formula	$Shared\ datasets\ Month\ over\ Month\ Growth = \left(\frac{Nr\ of\ shared\ datasets_M}{Nr\ of\ shared\ datasets_{M-1}} - 1\right) \cdot 100$ M = Currents months shared datasets M-1 = Prior months shared datasets				
Monitoring	• Upon identification and availability of all datasets every month see the change in number of shared datasets • Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**		Monthly	**"Other" upload rate**	
	Information display		Cumulated value☐	Trend☒	N/A☐
KPI calculation trigger (target value)	20% increase				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify the number of shared data sets starting from a specific moment in time every month.	Pilot owner	M
2	Divide the current months total number of shared datasets with the prior months total	Pilot owner	M-1

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$Nr\ of\ shared\ datasets$	Pilot owner	Pilot owner	Database	monthly	monthly
2	$Nr\ of\ shared\ datasets$	Pilot owner	Pilot owner	Database	monthly	monthly
3	$Public\ Data\ usage_{M20}$	Pilot owner	Pilot owner	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data ☐	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source	N/A			
Responsible	N/A				
Description	N/A				

Table 42 KPI 4.5 definition.

GENERAL INFORMATION					
ID	KPI 4.5		**Name**	Complete toolbox validated in large-scale pilots	
Business UC/ System UC	All				
Use Case	Renewables☒	Energy communities☒	Electromobility ☒	Flexibility☒	N/A ☐
Description	OMEGA-X will produce a toolbox composed of a common infrastructure for the Data Space (developed in WP4) and data and service marketplaces (developed in WP5). This complete toolbox will be implemented in large-scale pilots in WP6 in order to demonstrate its robustness and scalability in real life scenarios. These components are implemented and validated in pre-commercial real-life scenarios scale involving all the energy value chain.				
Formula	$\sum_{i=1}^{N} Component_i$				
Monitoring					
Units	No units		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**			**"Other" upload rate**	
	Information display		Cumulated value☐	Trend☐	N/A☒
KPI calculation trigger (& target value)	2 components				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Present components of the common infrastructure for the Data Space to UC leaders	ATOS	
2	Present components of data and service marketplaces to UC leaders	Tecnalia	
3	Validate components of the toolbox in UC	UCF leaders	
4	Aggregate number of validated toolboxes	EDF	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	IDS/Github	Service Developers	UCF leaders	Notification	N/A	M17-M36

BASELINE					
BASELINE source	Literature ☐	Historical data☐	Measurements☐	Simulations☐	Other ☐
	"Other" BASELINE source	Similar project			
Responsible	EDF				
Description	The result will be benchmarked with respect to the sister projects.				

Table 43 KPI 5.1 definition.

GENERAL INFORMATION					
ID	KPI 5.1	**Name**	Analytic services		
Business UC/ System UC	All BUCs and SUCs.				
Use Case	Renewables ☒	Energy communities☒	Electromobility☒	Flexibility☒	N/A☐
Description	Deploy 10+ data analytic energy services in the scope of use case families.				
Formula	$$\sum_{i=1}^{N} DeployedService_i$$ $$DeployedService_i = \begin{cases} 1 & if\ Service_i\ has\ been\ deployed \\ 0 & otherwise \end{cases}$$				
Monitoring	Monitoring within WP5, specially within T5.1 and T5.2, which are focused on services development.				
Units	N/A	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Monthly	**"Other" upload rate**		
	Information display	Cumulated value☒	Trend☐	N/A☐	
KPI calculation trigger	10 Analytic services deployed				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Report on services deployed once they are being integrated into the Use Case Family.	Use Case Family Leader	$DeployedServi$
2	Aggregate the total number of services deployed in the different use case families.	UPC	Total

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$Deployed\ Service_i$	Service Developers	UC Family leader	Notification	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations ☐	Other☒
	"Other" BASELINE source	Similar projects			
Responsible	UPC				
Description	The result will be benchmarked with respect to the sister projects.				

Table 44 KPI 5.2 definition.

GENERAL INFORMATION					
ID	KPI 5.2	**Name**	Data analytics services for RES		
Business UC/ System UC	BUC Ren PV O&M Optimization BUC Ren PV Smart Grid Integration Energy Generation Forecast service would also be tested in: • BUC Flex1.0 Flexibility for internal prosumer portfolio optimization • BUC Flex2.0 Flexibility for congestion management with bilateral contracts • BUC Flex3.0 Flexibility for capacity management with market structures • BUC LEC-ECO ProsumerEngagement: Local Energy Communities Energy Consumption Optimisation through prosumer engagement • BUC LEC-O&M: LEC Operation and Maintenance Optimization				
Use Case	Renewables☒	Energy communities☒	Electromobility ☐	Flexibility☒	N/A☐
Description	The KPI counts the new data analytics services for RES developed, implemented, and validated in the pilots. By the moment these 13 are proposed: • Predictive Maintenance for large PV plants • Benchmarking • Digital Twin BIPV Self Consumption Systems in Buildings • Detect t measurement errors • Detect non-technical losses • Congestion detection • Detection of the volatility of voltage in grids with high renewable penetration • Plan grid reinforcements for future renewable scenarios • Energy Generation Forecast • Compare actual production versus expected • PV Cleaning Advisor • Shading Analysis. • Tracking algorithm check				
Formula	$\sum_{i=1}^{N} Service_i$				

GENERAL INFORMATION				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing WP6, T6.2 implementation of services at Renewables Use Case Family, T6.3 implementation of services at Energy Communities Use Case Family and T6.5 implementation of services at Flexibility Use Case Family, for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed			
Units	N/A	**Parent KPI**	5.1/Analytic services	
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	At the end of the pilot activities (M32)
	Information display	Cumulated value☒	Trend☐	N/A☐
KPI calculation trigger (target value)	15 services			

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Report on services deployed once they are being integrated into the Use Case Family.	Service developer	*DeployedServ*
2	Aggregate the total number of services deployed in the renewable use case family.	Use Case Family Leader	Total

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	*Deploye Service*	Service Developers	UC Family leader	Notification	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☐	Simulations ☐	Other☒
	"Other" BASELINE source	Similar projects			
Responsible	Use Case Family Leader				
Description	The result will be benchmarked with respect to the sister projects.				

Table 45 KPI 5.3 definition.

GENERAL INFORMATION					
ID	KPI 5.3	**Name**	RES availability increase		
Business UC/ System UC	BUC Ren PV O&M Optimization BUC Ren PV Smart Grid Integration				
Use Case	Renewables☒	Energy communities☐	Electromobility☐	Flexibility☐	N/A☐
Description	• Energy-based availability (EA) takes into consideration that an hour in a period with high irradiance is more valuable than in a period with low irradiance. Therefore, it uses as base for calculation not time but energy (and lost energy): $$EA\ [\%] = \left(1 - \frac{\sum_i E_{loss}^{(i)}}{E_{total} + \sum_i E_{loss}^{(i)}}\right) x100$$ EA [%]=(1−Σ$Eloss(i)$i$Etotal$+Σ$Eloss(i)i$)×100 where: Eloss(i) [kWh] = calculated lost yield per event (i) Etotal [kWh] = absolute yield in the period under review according to feed-in meters • The challenge of this method is to accurately determine the lost yield. The following cases can be distinguished: Failure of the whole system, where lost yield can be calculated via performance ratio (PR) and irradiation according to the formula below: $$E\ [kWh]=PR\times H\times P$$ where: PR = performance ratio. The PR is determined from the average PR over the last ten days during which the PV system fed into the grid without faults. H [kWh/m²] = irradiation measured in module plane P [kWp] = the nominal power of the system. • Failure of an inverter or module string, where the expected yield of the failed inverter/module string for the period of the failure is ascertained by comparing the specific yields in kWh/kWp of the other inverters or module strings with the same alignment/inclination/configuration. • The periods for which the Contractor cannot accept any responsibility and that are not included in the calculation of technical system availability are listed below: • Force majeure • Snow and ice on PV modules • Damage to the PV plant (including the cables up to the feed-in point) by the customer or third parties who are not sub-contractors of O&M Contractor, including but not limited to vandalism;				

Description	• Ambient conditions (for example, air quality, temperature, humidity) outside permissible value ranges of inverters and transformers; • Disconnection or reduction of energy generation by the customer or as a result of an order issued to the customer by a court or public authority; • Operational disruption by grid disconnections or disruptions in the grid of the grid operator; • Disconnections or power regulation by the grid operator or his control devices. • Downtimes resulting from failures of the inverter or MV voltage components (for example, transformer, switchgear), if this requires • Technical support of the manufacturer and/or • Logistical support (for example supply of spare parts) by the manufacturer. • Downtimes due to scheduled maintenance measured per year and component. • Outages of the communication system. • Delays of approval by the customer to conduct necessary works. • Downtimes for implementation of measures to improve the PV plant, if this is agreed between the parties. • Downtimes caused by the fact that the customer has commissioned third parties with the implementation of technical work on the PV plant.
Formula	$$EA\ [\%] = \left(1 - \frac{\sum_i E_{loss}^{(i)}}{E_{total} + \sum_i E_{loss}^{(i)}}\right) x100$$
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing WP6 T6.2 implementation of services at Renewable Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed

Units	%	**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**	In the end of the pilot
	Information display	Cumulated value☒	Trend☐	N/A☐
KPI calculation trigger (target value)	1%			

CALCULATION/EXTRACTION METHODOLOGY

Step ID	Step description	Responsible	Data ID
1	Quantify the EA production the last year before implementing the pilot, from M8 to M20.	ENGIE, EDF, EyPESA	Res production M20
2	Quantify the EA production during the pilot, from M20 to M32, in case of following recommended predictive maintenance.	ENGIE, EDF, EyPESA	Res production M32

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Energy availability M20	ENGIE, EDF, EyPESA	ENGIE, EDF, EyPESA	Database	N/A	N/A
2	Energy availability M32	ENGIE, EDF, EyPESA	ENGIE, EDF, EyPESA	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements☐	Simulations☐	Other☐
	"Other" BASELINE source				
Responsible	Each pilot owner (ENGIE, EDF, EyPESA)				
Description	RES production the last year before implementing the pilot, from M8 to M20.				

Table 46 KPI 5.4 definition.

GENERAL INFORMATION					
ID	KPI 5.4		**Name**	Economic benefit increase for RES producers	
Business UC/ System UC	BUC Ren PV O&M Optimization BUC Ren PV Smart Grid Integration				
Use Case	Renewables☒	Energy communities☐	Electromobility ☐	Flexibility☐	N/A☐
Description	Economic earning increase for RES producers. Depending on the pilot the increase in earning can come from an increase in the revenues, a decrease on the costs, or both.				
Formula	$\left(\sum_{i=1}^{N} RES\ earning\ M32_i - \sum_{i=1}^{N} RES\ earning\ M20_i\right) \Big/ \sum_{i=1}^{N} RES\ earning\ M20_i$				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing WP6 T6.2 implementation of services at Renewable Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**			**"Other" upload rate**	In the end of the pilot
	Information display		Cumulated value☐	Trend☒	N/A☐
KPI calculation trigger (target value)	15% increase				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Quantify the earnings the last year before implementing the pilot, from M8 to M20.	ENGIE, EDF, EyPESA	Res earning M20
2	Quantify the earnings during the pilot, from M20 to M32.	ENGIE, EDF, EyPESA	Res earning M32

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	RES earning M20	ENGIE, EDF, EyPESA	ENGIE, EDF, EyPESA	Database	N/A	N/A
2	RES earning M32	ENGIE, EDF, EyPESA	ENGIE, EDF, EyPESA	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements☐	Simulations☐	Other ☐
	"Other" BASELINE source				
Responsible	Each pilot owner (ENGIE, EDF, EyPESA)				
Description	Earning for the RES producer the last year before implementing the pilot, from M8 to M20.				

Table 47 KPI 5.5 definition.

GENERAL INFORMATION					
ID	KPI 5.5	**Name**	Economic benefit increase for DSOs and TSOs		
Business UC/ System UC	BUC Flex1.0 Flexibility for internal prosumer portfolio optimization BUC Flex2.0 Flexibility for congestion management with bilateral contracts BUC Flex3.0 Flexibility for capacity management with market structures BUC LEC-ECO ProsumerEngagement: Local Energy Communities Energy Consumption Optimisation through prosumer engagement BUC LEC-O&M: LEC Operation and Maintenance Optimization				
Use Case	Renewables☐	Energy communities☒	Electromobility☐	Flexibility☒	N/A☐
Description	Economic benefit increase for DSOs and TSOs due to the cut of costs due to the avoidance of grid reinforcement, a reduction of the compensation associated to RES curtailment, or both, and taking into account the increment of costs due to flexibility purchase. Thus, in each pilot the calculation of the earning would be different and would be done by the DSO implied at the pilot site, due to the need of business related info.				
Formula	$\left(\sum_{i=1}^{N} SO\ earning\ M32_i - \sum_{i=1}^{N} SO\ earning\ M20_i\right) \Big/ \sum_{i=1}^{N} SO\ earning\ M20_i$				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6, T6.3 implementation of services at Energy Communities Use Case Family and T6.5 implementation of services at Flexibility Use Case Family, for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**	In the end of the pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	10% increase				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Quantify the earnings the last year before implementing the pilot, from M8 to M20.	EDP, other DSO/TSOs of the pilot sites	SO earning M20
2	Quantify the earnings during the pilot, from M20 to M32.	EDP, other DSO/TSOs of the pilot sites	SO earning M32

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Earning M20	EDP, other DSO/TSOs of the pilot sites	EDP, other DSO/TSOs of the pilot sites	Database	N/A	N/A
2	Earning M32	EDP, other DSO/TSOs of the pilot sites	EDP, other DSO/TSOs of the pilot sites	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	DSO/TSOs of each pilot site				
Description	Earning for the DSO/TSO the last year before implementing the pilot, from M8 to M20.				

Table 48 KPI 5.6 definition.

GENERAL INFORMATION					
ID	KPI 5.6		**Name**	Energy bill decrease for prosumers	
Business UC/ System UC	BUC Flex1.0 Flexibility for internal prosumer portfolio optimization BUC Flex2.0 Flexibility for congestion management with bilateral contracts BUC Flex3.0 Flexibility for capacity management with market structures BUC LEC-ECO ProsumerEngagement: Local Energy Communities Energy Consumption Optimisation through prosumer engagement BUC LEC-O&M: LEC Operation and Maintenance Optimization				
Use Case	Renewables☐	Energy communities☒	Electromobility☐	Flexibility☒	N/A☐
Description	For each pilot site, the average yearly energy bill decreases of all prosumers involved. To be calculated in these pilots: • Maia (T6.5) • Zaragoza (T6.3) • Granollers (T6.3) • Osimo (T6.3) Data to be provided by the Data Provider in each pilot: ISMAI, EyPESA, EDP and Astea, respectively and calculation to be done by each pilot owner: Maia Municipality, EyPESA, EDP and Astea				
Formula	$\left(\sum_{i=1,j=1}^{i=N,j=12} Energy\ bill\ M32_i - \sum_{i=1,j=1}^{i=N,j=12} Energy\ bill\ M20_i\right) \Big/ \sum_{i=1,j=1}^{i=N,j=12} Energy\ bill\ M20_i$ Average value for all Prosumer i during the validation of each pilot implementation From M20 – Month 20 of the project: Before the pilot implementation To M32 – Month 32 of the project: After the pilot implementation				
Monitoring	n/a				
Units	%		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**			**"Other" upload rate**	In the end of the pilots
	Information display		Cumulated value☐	Trend☒	N/A☐
KPI calculation trigger (target value)	20% reduction				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Quantify the average energy bill the last year before implementing the pilot, from M8 to M20.	Pilot owner	Energy bill M20
2	Quantify the average energy bill during the pilot, from M20 to M32.	Pilot owner	Energy bill M32

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Energy bill M20	Pilot owner	Pilot owner	Database	N/A	N/A
2	Energy bill M32	Pilot owner	Pilot owner	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Each pilot owner				
Description	Energy bill the last year before implementing the pilot, from M8 to M20.				

Table 49 KPI 5.7 definition.

GENERAL INFORMATION					
ID	KPI 5.7		**Name**	CO2 emissions reduction	
Business UC/ System UC	All BUCs				
Use Case	Renewables☒	Energy communities☒	Electromobility ☒	Flexibility ☒	N/A☐
Description	Reduction in the CO2 emissions after the OMEGA-X services have been implemented in each pilot side. Depending on the different business logic in each BUC, the calculation can be done differently (for instance substituting each country's average market mix production by RES production)				
Formula	$(\sum_{i=1}^{N} Emissions\ M32_i - \sum_{i=1}^{N} Emissions\ M20_i) \Big/ \sum_{i=1}^{N} Emissions\ M20_i$				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing WP6 for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**			**"Other" upload rate**	In the end of the pilot
	Information display		Cumulated value☐	Trend☐	N/A☐
KPI calculation trigger (target value)	20% reduction				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Quantify the CO2 emissions the last year before implementing the pilot, from M8 to M20.	Pilot owner	Emissions M20
2	Quantify the CO2 emissions during the pilot, from M20 to M32.	Pilot owner	Emissions M32

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Emissions M20	Pilot owner	Pilot owner	Database	N/A	N/A
2	Emissions M32	Pilot owner	Pilot owner	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements☐	Simulations☐	Other☐
	"Other" BASELINE source				
Responsible	Each pilot owner				
Description	CO2 emissions the last year before implementing the pilot, from M8 to M20				

Table 50 KPI 5.8 definition.

GENERAL INFORMATION					
ID	KPI 5.8	**Name**	Flexibility service provision		
Business UC/ System UC	BUC Flex3.0 Flexibility for capacity management with market structures SUC Flex3.0 Manage flexibility needs SUC Flex5.0 Manage flexibility offers				
Use Case	Renewables☐	Energy communities☐	Electromobility ☐	Flexibility ☒	N/A☐
Description	Enabling flexibility service provision for the DSO. From Grid validation platform real-time service (Odit-E) and Grid observability and network analysis service (Odit-E)				
Formula	$\sum_{i=1}^{N} Service_i$				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.5 implementation of services at Flexibility Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	No units	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	In the end of the pilot	
	Information display	Cumulated value☒	Trend☐	N/A☐	
KPI calculation trigger (target value)	1 service				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Report on flexibility services provided once they are starting to be implemented in the Flexibility Use Case Family.	EDP	$Service_i$
2	Aggregate the total number of services deployed.	EDP	Total

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$Service_i$	Service developers	EDP	Notification	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements☐	Simulations ☐	Other☐
	"Other" BASELINE source				
Responsible	Maia Municipality & DSO				
Description	The result will be benchmarked with respect to the information collected by Maia Municipality. The flexibility service provision will be compared with those in OMEGA-X T6.5, to verify the objective outcome of Enabling new digital solutions and services supporting the energy transition.				

Table 51 KPI 5.9 definition.

GENERAL INFORMATION					
ID	KPI 5.9	**Name**	Use of new dataset		
Business UC/ System UC	Data Management				
Use Case	Renewables☒	Energy communities☒	Electromobility☒	Flexibility ☒	N/A☐
Description	All OMEGA-X services supported by at least 1 dataset they did not have access to before				
Formula Monitoring	Yes/no				
	• Static form to be filled in by partners when the project is mature asking if they are using dataset(s) they did not have access to before				
Units	No unit	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A☐	
KPI calculation trigger	1 new data set. Marketplace launch				
Target Value	1 new data set per service.				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	For each service provided define if at least 1 new dataset is used	Service Provider	
2	Make report of the responses of all participants	ICOM	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Report	ICOM	ICOM	questionnaire	once	A week

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations☐	Other☐
	"Other" BASELINE source	No baseline needed.			
Responsible	NA				
Description	NA				

Table 52 KPI 5.10 definition.

GENERAL INFORMATION					
ID	KPI 5.10		**Name**	Open data sets available	
Business UC/ System UC	Data Management				
Use Case	Renewables☒	Energy communities☒	Electromobility ☒	Flexibility ☒	N/A☐
Description	The goal of this KPI is to measure the number of data sets that can be made available for third parties as a result of the project				
Formula	$\sum_{i=1}^{N} Data\ set_i$				
Monitoring	Active monitoring begins at WP6 starting phase and continues till the end of the project				
Units	No units		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**			**"Other" upload rate**	
	Information display		Cumulated value☐	Trend☐	N/A☒
KPI calculation trigger (& target value)	2 open data sets				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Flag potential data sets that can be opened by partners in demonstration phase	UC leaders	$Data\ set_i$
2	Aggregate number of open data sets	EDF	Total data sets

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	potential open datasets	UC leaders	UCF leaders	notification	N/A	M17-M36

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations☐	Other☐
	"Other" BASELINE source	other similar projets			
Responsible	EDF				
Description	Benchmark with other sister project				

Table 53 KPI 5.11 definition.

GENERAL INFORMATION					
ID	KPI 5.11	**Name**	Energy loss characterization error		
Business UC/ System UC	BUC Ren PV O&M Optimization				
Use Case	Renewables☒	Energy communities☐	Electromobility☐	Flexibility ☐	N/A☐
Description	Relative error of the estimation of energy loss for a certain period related to detected failure mode through data analytics in PV systems. This error is computed as the difference between the estimated energy loss estimated by the failure detection and diagnosis tool and the energy loss measured by means of the corresponding in-field inspection technique, like IV curve measurement for failure modes related to PV generator.				
Formula	$estimationerror[\%] = \frac{(Eloss_{estimated} - Eloss_{measured})}{Eloss_{measured}} x100$ where $Eloss_{estimated}$ is the energy loss estimated by the failure detection and diagnosis tool, $Eloss_{measured}$ is the energy loss measured by means of in-field technique				
Monitoring	WP6 T6.2 implementation of services at Renewable Use Case Family				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger (& target value)	10%				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Estimation of energy loss related to detected failure mode and notification	Service provider	
2	In-field measurement of energy loss through IV curve measurement	Pilot owner	
3	Computation of averaged estimation error	Service Provider	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Estimated energy loss	Service provider	Pilot owner	Database	Every fault detection	Validation period
2	Measured energy loss	Pilot owner	Service provider	Database	Every fault detection	Validation period

BASELINE					
BASELINE source	Literature☒	Historical data☐	Measurements ☐	Simulations☐	Other☐
	"Other" BASELINE source				
Responsible	Service provider				
Description	Published results of other similar services				

Table 54 KPI 5.12 definition.

GENERAL INFORMATION					
ID	KPI 5.12	**Name**	Fault detection time		
Business UC/ System UC	BUC Ren PV O&M Optimization				
Use Case	Renewables☒	Energy communities☐	Electromobility☐	Flexibility ☐	N/A☐
Description	This is the time since a fault happens until is noticed by failure detection and diagnosis tools. For this purpose, it is necessary to generate ad-hoc failure modes in some section of the PV generator to precisely know the starting time and measure the time to detection. This should be carried out for different failure modes and with different severity degrees.				
Formula	$Faultdetectiontime\ [minutes] = T_{detection} - T_{startingfault}$				
Monitoring	WP6 T6.2 implementation of services at Renewable Use Case Family				
Units	minute	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger (& target value)	Depending on failure mode				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Generation of ad-hoc failure mode	Pilot owner	
2	Notification of failure detection	Service provider	
3	Measurement and registration of time interval between steps 1 and 2	Pilot owner	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Starting time of fault generation	Pilot owner	Pilot owner	Logbook	Every failure mode generation	
2	Fault Alarm	Service Provider	Pilot Owner	Database	Every failure mode detection	
3	Fault detection time	Pilot owner	Service Provider	Logbook	Every failure mode detection	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☒	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Pilot owner				
Description	Measurement of fault detection time with the precedent supervising system				

Table 55 KPI 5.13 definition.

GENERAL INFORMATION					
ID	KPI 5.13		**Name**	PV Asset OPEX reduction	
Business UC/ System UC	BUC Ren PV O&M Optimization				
Use Case	Renewables☒	Energy communities☐	Electromobility☐	Flexibility ☐	N/A☐
Description	Reduction of operational expenditures (OPEX) of PV asset thanks to reduction of required inspection techniques, avoidance of unnecessary preventative activities, anticipation of corrective interventions.				
Formula	$OPEXreduction\ [\%] = \frac{OPEX_{before} - OPEX_{after}}{OPEX_{before}} x100$ where $OPEX_{before}$ is the OPEX in €/MWp yearly before following the recommendations of the predictive maintenance services and $OPEX_{after}$ the estimated OPEX in case of following these recommendations.				
Monitoring	WP6 T6.2 implementation of services at Renewable Use Case Family				
Units	%		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger (& target value)	20%				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Measurement of OPEX before the predictive maintenance implementation	Pilot owner	
2	Measurement of OPEX after the predictive maintenance implementation	Pilot owner	
3	Computation of OPEX reduction	Pilot owner	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
	OPEX	Pilot owner	Pilot owner	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements☐	Simulations☐	Other☐
	"Other" BASELINE source				
Responsible	Pilot owner				
Description	Comparison to OPEX evolution in the precedent years				

Table 56 KPI 5.14 definition.

GENERAL INFORMATION					
ID	KPI 5.14	**Name**	Electric power quality		
Business UC/ System UC	Operating PV Smart Grid Integration				
Use Case	Renewables☒	Energy communities☐	Electromobility ☐	Flexibility☐	N/A☐
Description	Total number of times there have been significant frequency or voltage deviations due to events such as congestion or unexpected high penetration of renewables.				
Formula	$\sum (V_{dev_i} + f_{dev_i})$				
Monitoring	The pilot owner is responsible of counting the times with significant voltage or frequency deviation.				
Units		**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Monthly	**"Other" upload rate**		
	Information display	Cumulated value☒	Trend☐	N/A☐	
KPI calculation trigger (& target value)	1				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	After executing the services of this BUC, the pilot owner should take actions to improve power quality. It is its responsibility to record the times voltage or frequency deviates significantly.	Pilot Owner	V_{dev_i} f_{dev_i}

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	V_{dev_i}	Significant voltage deviation occurrence ($\pm 10\%$)	Pilot Owner	Database	Monthly	
2	f_{dev_i}	Significant frequency deviation occurrence ($\pm 0.2\ Hz$)	Pilot Owner	Database	Monthly	

BASELINE					
BASELINE source	Literature☒	Historical data☐	Measurements ☒	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Pilot Owner				
Description	Based in standards				

Table 57 KPI 5.15 definition.

GENERAL INFORMATION					
ID	KPI 5.15	**Name**	Continuity of service		
Business UC/ System UC	Operating PV Smart Grid Integration				
Use Case	Renewables☒	Energy communities☐	Electromobility ☐	Flexibility☐	N/A☐
Description	Equivalent outage time of the installed power at low voltage				
Formula	$\frac{\sum_{i=1}^{k} PI_i \times H_i}{\sum PI}$ Being $\sum PI$ the sum of power installed in the grid and *k* the number of interruptions during the considered period.				
Monitoring	Monitor the outages occurring in the grid in terms of power (PI_i, in kVA), and time (H_i, in h)				
Units	h	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Monthly	**"Other" upload rate**		
	Information display	Cumulated value☒	Trend☐	N/A☐	
KPI calculation trigger (& target value)	1 h. Target value: 0 h.				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Calculate power and time of every outage occurring in a grid.	Pilot Owner	PI_i H_i
2	Add them and calculate the KPI		

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
PI_i	Power installed affected by the interruption	Pilot owner	Pilot owner	Outage evaluation	When occurring	Monthly
H_i	Duration of the interruption	Pilot owner	Pilot owner	Outage evaluation	When occurring	Monthly

BASELINE					
BASELINE source	Literature☒	Historical data☐	Measurements☒	Simulations☐	Other ☐
	"Other" BASELINE source				
Responsible	Pilot Owner				
Description	N/A				

Table 58 KPI 5.16 definition.

GENERAL INFORMATION					
ID	KPI 5.16	**Name**	CAPEX		
Business UC/ System UC	Planning PV Smart Grid Integration				
Use Case	Renewables☒	Energy communities☐	Electromobility☐	Flexibility☒	N/A☐
Description	Investment costs or Capital Expenditures (CAPEX) for Long Term Scenarios by minimizing the number of elements to be replaced using an optimal planning strategy.				
Formula	$IC = IC_{Trafos} + IC_{Lines} + IC_{Batteries}$ $IC = Asset\ Investment\ Costs$ [€] $IC_{Trafos} = Investment\ cost\ of\ transformers$ [€] $IC_{Lines} = Investment\ cost\ of\ lines\ or\ cables$ [€] $IC_{Batteries} = Investment\ cost\ of\ Batteries$ [€]				
Monitoring	When the service is executed in a specific grid.				
Units	Euro [€]	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	On demand	**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger (& target value)	Near 0.00 €				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Model Distribution grid Network using real data	Developer - UPC	
2	Stress the Network with Future PV production Scenarios	Developer - UPC	
3	Plan future asset investments using passive and flexible planning strategies.	Developer - UPC	
4	Obtain the investment cost of new assets.	Developer - UPC	IC_{Trafos} IC_{Lines} $IC_{Batteries}$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	IC_{Trafos}	Pilot owner	Pilot owner	Database	When service is executed	N/A
2	IC_{Lines}	Pilot owner	Pilot owner	Database	When service is executed	N/A
3	$IC_{Batteries}$	Pilot owner	Pilot owner	Database	When service is executed	N/A

BASELINE					
BASELINE source	Literature☒	Historical data☒	Measurements☐	Simulations☒	Other ☐
	"Other" BASELINE source				
Responsible	Pilot owners and Service Provider				
Description	Asset Costs, Secondary Substation historic data, Network parameters, etc.				

Table 59 KPI 5.17 definition.

GENERAL INFORMATION					
ID	KPI 5.17	**Name**	OPEX		
Business UC/ System UC	Planning PV Smart Grid Integration				
Use Case	Renewables☒	Energy communities☐	Electromobility ☐	Flexibility☒	N/A☐
Description	Operational expenditures (OPEX) for Long Term Scenarios by minimizing the number of elements to be replaced using an optimal planning strategy.				
Formula	$OC = OC_{Tnfos} + OC_{Lines} + OC_{Batteries}$ $OC = Operational\ Costs\ of\ Assets\ [€]$ $OC_{Trafos} = Operational\ cost\ of\ transformers\ [€]$ $OC_{Lines} = Operational\ cost\ of\ lines\ or\ cables\ [€]$ $OC_{Batteries} = Operational\ cost\ of\ Batteries\ [€]$				
Monitoring	When the service is executed in a specific grid.				
Units	Euro [€]	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	On demand	**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger (& target value)	Near 0.00 €				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Model Distribution grid Network using real data	Developer - UPC	
2	Stress the Network with Future PV production Scenarios	Developer - UPC	
3	Plan future asset investments using passive and flexible planning strategies.	Developer - UPC	
4	Obtain the operational cost (installation, transportation, etc.) of each new asset based on the analysis.	Developer - UPC	OC_{Trafos} OC_{Lines} $OC_{Batteries}$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	OC_{Trafos}	Pilot owner	Pilot owner	Database	When service is executed	N/A
2	OC_{Lines}	Pilot owner	Pilot owner	Database	When service is executed	N/A
3	$OC_{Batteries}$	Pilot owner	Pilot owner	Database	When service is executed	N/A

BASELINE					
BASELINE source	Literature☒	Historical data☒	Measurements☐	Simulations☒	Other ☐
	"Other" BASELINE source				
Responsible	DSOs				
Description	Asset Costs, Secondary Substation historic data, Network parameters, etc.				

Table 60 KPI 5.18 definition.

GENERAL INFORMATION					
ID	KPI 5.18		**Name**	Asset improvements	
Business UC/ System UC	Planning PV Smart Grid Integration				
Use Case	Renewables☒	Energy communities☐	Electromobility☐	Flexibility☒	N/A☐
Description	Improvement of Lines Loadings, Transformer Loadings and Bus Voltages.				
Formula	$L_R = \frac{L_{BS} - L_{Pla}}{L_{Bs}}$ $L_R = Loading\ Reduction\ [\%]$ $L_{BS} = Loading\ in\ Base\ Scenario\ [\%]$ $L_{Pla} = Loading\ after\ Planning\ Actions\ [\%]$				
Monitoring	Introduce loading in base scenario. The service calculates the loading after planning actions when executed.				
Units	Percent [%]		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**		On demand	**"Other" upload rate**	
	Information display		Cumulated value☐	Trend☐	N/A☒
KPI calculation trigger (& target value)	More than 20 %				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Model Distribution grid Network using real data and obtain loading in base scenario	Developer	L_{BS}
2	Stress the Network with Future PV production Scenarios	Developer	
3	Plan future asset investments using passive and flexible planning strategies.	Developer	
4	Obtain the loading after planning actions.	Developer	L_{Pla}

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	L_{BS}	Pilot owner	Pilot owner	Database	As a service parameter	N/A
2	L_{Pla}	Pilot owner	Pilot owner	Database	When service is executed	N/A

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	L_{BS}	Pilot owner	Pilot owner	Database	As a service parameter	N/A
2	L_{Pla}	Pilot owner	Pilot owner	Database	When service is executed	N/A

BASELINE					
BASELINE source	Literature☒	Historical data☐	Measurements ☐	Simulations ☒	Other ☐
	"Other" BASELINE source				
Responsible	Service Developer				
Description	The Service Provider will obtain the reduction of asset congestions and voltage deviations from simulations of the stress scenarios.				

Table 61 KPI 6.1 definition.

GENERAL INFORMATION					
ID	KPI 6.1	**Name**	Flexibility offer increase		
Business UC/ System UC	BUC Flex1.0 Flexibility for internal optimization SUC Flex2.0 Optimize the baseline of resources				
Use Case	Renewables ☐	Energy communities☐	Electromobility ☐	Flexibility☒	N/A☐
Description	Prosumer flexibility offer increase. From Prosumer EMS internal optimization service (Tecnalia)				
Formula	$\frac{\sum_{i=1}^{N} Prosumer\ Flexibility\ offers\ M32_i - \sum_{i=1}^{N} Prosumer\ Flexibility\ offers\ M20_i}{\sum_{i=1}^{N} Prosumer\ Flexibility\ offers\ M20_i}$ M20 – Month 20 of the project: Before the pilot implementation M32 – Month 32 of the project: After the pilot implementation				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.5 implementation of services at Flexibility Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	In the end of the pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (& target value)	By 80%				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and sum the number of flexibility offers by prosumers before implementing the pilot.	MAIA	$P\ Flex\ offers\ M20$
2	Identify and sum the number of flexibility offers by prosumers after implementing the pilot.	EDP	$P\ Flex\ offers\ M32$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$P\ Flex\ offers\ M20$	MAIA	EDP	Databases available	N/A	N/A
2	$P\ Flex\ offers\ M32$	MAIA	EDP	Databases available	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☐	Simulations ☐	Other☐
	"Other" BASELINE source				
Responsible	Maia Municipality & Service providers				
Description	The result will be benchmarked with respect to the information collected by Maia Municipality. The flexibility offer increase will be compared with that in OMEGA-X T6.5, to verify the objective outcome of Increased acceptance of and participation of consumers in data sharing for energy services.				

Table 62 KPI 6.2 definition.

GENERAL INFORMATION					
ID	KPI 6.2	**Name**	Energy bill reduction		
Business UC/ System UC	BUC Flex1.0 Flexibility for internal optimization SUC Flex1.0 Define the context of flexibility management SUC Flex2.0 Optimize the baseline of resources				
Use Case	Renewables☐	Energy communities☐	Electromobility☐	Flexibility☒	N/A☐
Description	Energy bill reduction (saving in €). In the calculations, the possible changes in the energy price (M20 vs M32) should be considered. From Passive consumption baseline prediction service (Tecnalia) and Active consumption resource prediction service (Tecnalia)				
Formula	$\frac{\sum_{i=1}^{N} Energy\ Bill\ M20_i - \sum_{i=1}^{N} Energy\ Bill\ M32_i}{\sum_{i=1}^{N} Energy\ Bill\ M32_i}$ M20 – Month 20 of the project: Before the pilot implementation M32 – Month 32 of the project: After the pilot implementation				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.5 implementation of services at Flexibility Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Yearly	**"Other" upload rate**		
	Information display	Cumulated value☒	Trend☐	N/A☐	
KPI calculation trigger (& target value)	By 15%				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and sum the Energy Bill 12 month before implementing the pilot.	MAIA	$Energy\ Bill\ M20$
2	Identify and sum the Energy Bill 12 month after implementing the pilot.	MAIA	$Energy\ Bill\ M32$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	*Energy Bill M2*	MAIA	EDP	Databases available	N/A	N/A
2	*Energy Bill M3*	MAIA	EDP	Databases available	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements☒	Simulations☐	Other ☐
	"Other" BASELINE source				
Responsible	Maia Municipality				
Description	The result will be benchmarked with respect to the information collected by Maia Municipality. The historical energy bill will be compared with that after the implementation of OMEGA-X T6.5, to verify the objective outcome of Increased acceptance of and participation of consumers in data sharing for energy services.				

Table 63 KPI 6.3 definition.

GENERAL INFORMATION					
ID	KPI 6.3	**Name**	Revenue increase		
Business UC/ System UC Use Case	BUC Flex1.0 Flexibility for internal optimization SUC Flex2.0 Optimize the baseline of resources				
	Renewables☐	Energy communities☐	Electromobility☐	Flexibility☒	N/A☐
Description	Revenue increase for flexibility providers (increase in €). In the calculations, the possible changes in the energy price (M20 vs M32) should be considered. From Passive consumption baseline prediction service (Tecnalia) and Prosumer EMS internal optimization service (Tecnalia)				
Formula	$\frac{\sum_{i=1}^{N} Revenue\ for\ flexibility\ P\ M32_i - \sum_{i=1}^{N} Revenue\ for\ flexibility\ P\ M20_i}{\sum_{i=1}^{N} Revenue\ for\ flexibility\ P\ M20_i}$ M20 – Month 20 of the project: Before the pilot implementation M32 – Month 32 of the project: After the pilot implementation				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.5 implementation of services at Flexibility Use Case Family for the verification of the KPI target • Finalizing on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analyzed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	In the end of the pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (& target value)	By 10%				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and sum the revenue for flexibility providers before implementing the pilot.	MAIA	$Flex\ P\ rev\ M20$
2	Identify and sum the revenue for flexibility providers after implementing the pilot.	EDP	$Flex\ P\ rev\ M32$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	*Flex P rev M2*	MAIA	EDP	Databases available	N/A	N/A
2	*Flex P rev M3*	MAIA	EDP	Databases available	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements☒	Simulations☐	Other ☐
	"Other" BASELINE source				
Responsible	Maia Municipality & DSO & Service providers				
Description	The result will be benchmarked with respect to the information collected by Maia Municipality. The revenue increase will be compared with that in OMEGA-X T6.5, to verify the objective outcome of Increased acceptance of and participation of consumers in data sharing for energy services.				

Table 64 KPI 6.4 definition.

GENERAL INFORMATION					
ID	KPI 6.4	**Name**	Incentives for data sharing		
Business UC/ System UC	N/A				
Use Case	Renewables☐	Energy communities☐	Electromobility☐	Flexibility☒	N/A☐
Description	Incentives towards end users that support sharing/trading of data.				
Formula	$\sum_{i=1}^{N} Incentives_i$				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.5 implementation of services at Flexibility Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	No units	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	In the beginning of the pilot (M20)	
	Information display	Cumulated value☒	Trend☐	N/A☐	
KPI calculation trigger (& target value)	1 list of incentives proposed, backed up with the findings on use case families (6 incentives, 2 technical, 2 functional, 2 impact oriented)				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	List the incentives towards end users that support sharing/trading of data, along their definition, during the implementation of the Flexibility Use Case Family.	EDP	$Incentive_i$
2	List the total number of incentives defined and implemented.	EDP	Total

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$Incentives_i$	MAIA & service developers	EDP	N/A	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements☐	Simulations☐	Other ☐
	"Other" BASELINE source				
Responsible	Maia Municipality				
Description	The result will be benchmarked with respect to the information collected by Maia Municipality. The existent incentives in data sharing will be compared with those in OMEGA-X T6.5, to verify the objective outcome of Increased acceptance of and participation of consumers in data sharing for energy services.				

Table 65 KPI 6.5 definition.

GENERAL INFORMATION					
ID	KPI 6.5	**Name**	Increase data sharing		
Business UC/ System UC	N/A				
Use Case	Renewables ☐	Energy communities☐	Electromobility☐	Flexibility☒	N/A☐
Description	Increased sharing of data from consumers.				
Formula	$\frac{\sum_{i=1}^{N} kB\ of\ data\ shared\ M32_i - \sum_{i=1}^{N} kB\ of\ data\ shared\ M20_i}{\sum_{i=1}^{N} kB\ of\ data\ shared\ M20_i}$ M20 – Month 20 of the project: Before the pilot implementation M32 – Month 32 of the project: After the pilot implementation				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.5 implementation of services at Flexibility Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	In the end of the pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (& target value)	20% increased sharing				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and sum the respective kB per month of data shared from consumers before implementing the pilot.	MAIA	*data shared M20*
2	Identify and sum the respective kB per month of data shared from consumers after implementing the pilot.	EDP	*data shared M32*

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	*data shared M*	MAIA	EDP	Databases available	N/A	N/A
2	*data shared M*	MAIA	EDP	Databases available	N/A	N/A

BASELINE

BASELINE source	Literature☐	Historical data☐	Measurements☒	Simulations ☐	Other☐
	"Other" BASELINE source				
Responsible	Maia Municipality				
Description	The result will be benchmarked with respect to the information collected by Maia Municipality. The increase in data sharing will be compared with those in OMEGA-X T6.5, to verify the objective outcome of Increased acceptance of and participation of consumers in data sharing for energy services.				

Table 66 KPI 6.6 definition.

GENERAL INFORMATION					
ID	KPI 6.6	**Name**	RES usage increase		
Business UC/ System UC	BUC LEC 2.0 ECO BUC LEC 3.0 Service Planning				
Use Case	Renewables☐	Energy communities☒	Electromobility ☐	Flexibility ☐	N/A☐
Description	Indicates the increase in usage from Renewable Energy Sources (RES) computed as the total amount of energy generated by a renewable energy system used over a given period of time				
Formula	$$RES\ usage_{increase} = \frac{RES\ usage_{M32} - RES\ usage_{M20}}{RES\ usage_{M20}} \cdot 100$$ RES $usage_{M20}$ = sum of RES usage at M20 before the pilot implementation RES $usage_{M32}$= sum of RES usage at M32 after the pilot implementation				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	10% increase				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify the revenues by LECs before implementing the pilot (M8 to M20)	Pilot owner	$RES\ usage_M$
2	Identify the revenues by LECs after implementing the pilot (M20 to M32)	Pilot owner	$RES\ usage_M$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$RES\ usage_M$	Pilot owner	Pilot owner	Database	N/A	N/A
2	$RES\ usage_M$	Pilot owner	Pilot owner	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Pilot owners				
Description	Total amount of RES used the year before implementing the pilot, from M8 to M20.				

Table 67 KPI 6.7 definition.

GENERAL INFORMATION					
ID	KPI 6.7	**Name**	CO_2 emissions reduction		
Business UC/ System UC	BUC LEC 1.0 O&M BUC LEC 3.0 Service Planning				
Use Case	Renewables ☐	Energy communities☒	Electromobility☐	Flexibility☐	N/A☐
Description	Equivalent CO_2 emissions savings measured in tCO_2				
Formula	$\frac{CO_{2_{M32}} - CO_{2_{M20}}}{t_{CO2_{M20}}} * 100$ $CO_{2_{M32}}$= CO_2 emissions before the project $CO_{2_{M20}}$= CO_2 emissions after the project				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	10% reduction				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Quantify the CO_2 emissions the last year before implementing the pilot, from M8 to M20.	Pilot owner	$CO_{2_{M20}}$
2	Quantify the CO_2 emissions during the pilot, from M20 to M32.	Pilot owner	$CO_{2_{M32}}$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$CO_{2_{M20}}$	Pilot owner	Pilot owner	Database	N/A	N/A
2	$CO_{2_{M32}}$	Pilot owner	Pilot owner	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Pilot owners				
Description	CO_2 emissions the year before implementing the pilot, from M8 to M20.				

Table 68 KPI 6.8 definition.

GENERAL INFORMATION				
ID	KPI 6.8	**Name**	Energy autonomy increase for single user	
Business UC/ System UC	BUC LEC 2.0 SUC LEC 10.0			
Use Case	Renewables ☐	Energy communities☒	Electromobility☐	Flexibility☐	N/A☐
Description	Increased energy autonomy computed as the ratio of the imported energy over the total consumed energy for single user			
Formula	$$Energy\ autonomy = \frac{\sum_{t=1}^{N} E_t^{imported}}{\sum_{t=1}^{N} E_t^{consumed}} * 100$$ Average value during the pilot implementation From M20 – Month 20 of the project: Before the pilot implementation To M32 – Month 32 of the project: After the pilot implementation $E_t^{imported}$ = Energy that is imported from the grid $E_t^{produced,local}$= Total Energy consumption			
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed			
Units	%	**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot
	Information display	Cumulated value☐	Trend☒	N/A☐
KPI calculation trigger (target value)	10%			

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify the prosumers by LECs before implementing the pilot (M8 to M20)	Pilot owner	$Prosumers_M$
2	Identify the prosumers by LECs after implementing the pilot (M20 to M32)	Pilot owner	$Prosumers_M$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$E_t^{imported}$	Pilot owner	Pilot owner	Database	N/A	N/A
2	$E_t^{consume}$	Pilot owner	Pilot owner	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Pilot owner or the DSO				
Description	Energy autonomy the year before implementing the pilot, from M8 to M20				

Table 69 KPI 6.9 definition.

GENERAL INFORMATION					
ID	KPI 6.9		**Name**	Imported energy/ Total energy consumption	
Business UC/ System UC	BUC LEC 2.0 SUC LEC 7.0 SUC LEC 11.0				
Use Case	Renewables ☐	Energy communities☒	Electromobility☐	Flexibility☐	N/A☐
Description	Increased energy autonomy computed as the ratio of the imported energy over the total consumed energy.				
Formula	$Energy\ autonomy = \frac{\sum_{t=1}^{N} E_t^{imported}}{\sum_{t=1}^{N} E_t^{consumed}} * 100$ Average value during the pilot implementation From M20 of the project: Before the pilot implementation To M32 of the project: After the pilot implementation $E_t^{imported}$ = Energy that is imported from the grid $E_t^{produced,local}$= Total Energy consumption				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%		**Parent KPI**	[KPI Name/ID]	
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	40% minimum energy autonomy for LEC				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and quantify the energy imported from the grid during the pilot execution	Pilot owner	$E_t^{imported}$
2	Identify and quantify the energy consumed from the grid during the pilot execution	Pilot owner	$E_t^{consumed}$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$E_t^{imported}$	Pilot owner	Pilot owner	Database	N/A	N/A
2	$E_t^{consume}$	Pilot owner	Pilot owner	Database	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Pilot owners				
Description	Energy autonomy the year before implementing the pilot, from M8 to M20				

Table 70 KPI 6.10 definition.

GENERAL INFORMATION					
ID	KPI 6.10	**Name**	Number of (end) users involved in OMEGA-X.		
Business UC/ System UC	All BUCs/SUCs				
Use Case	Renewables☒	Energy communities☒	Electromobility☒	Flexibility☒	N/A☐
Description	Number of (end) users involved in OMEGA-X pilots				
Formula	N/A				
Monitoring	Registration of (end) users in OMEGA-X pilots				
Units	#	**Parent KPI**	N/A		
Reporting	**Data upload rate**	Other	**"Other" upload rate**	End of project	
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger (target value)	2000 users				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Registration users in the pilot activities	Pilot Owner	
2	Engagement activities	Pilot Owner	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Pilot owner	Pilot owner	Database	N/A	N/A	

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations☐	Other ☒
	"Other" BASELINE source	No baseline needed			
Responsible	N/A				
Description	N/A				

Table 71 KPI 6.11 definition.

GENERAL INFORMATION					
ID	KPI 6.11		**Name**	Balanced representation in engaged end users	
Business UC/ System UC	All BUCs/SUCs				
Use Case	Renewables☒	Energy communities☒	Electromobility ☒	Flexibility☒	N/A☐
Description	Balanced representation amongst end users				
Formula	N/A				
Monitoring	N/A				
Units	#		**Parent KPI**	N/A	
Reporting	**Data upload rate**		N/A	**"Other" upload rate**	N/A
	Information display		Cumulated value☒	Trend☐	N/A☐
KPI calculation trigger (target value)	Balanced representation				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Registration of end users in OMEGA-X pilots	Pilot owner	
2	Reporting on end users in OMEGA-X pilots	Pilot owner	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1		Pilot owner	Pilot owner	survey	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations☐	Other ☒
	"Other" BASELINE source	No baseline needed			
Responsible	N/A				
Description	N/A				

Table 72 KPI 6.12 definition.

GENERAL INFORMATION					
ID	KPI 6.12		**Name**	End users informed and activated	
Business UC/ System UC	All BUCs/SUCs				
Use Case	Renewables☒	Energy communities☒	Electromobility☒	Flexibility☒	N/A☐
Description	Awareness impact, Percentage of people in the target group that have been reached and/or are activated by the project.				
Formula	N/A				
Monitoring	Active engagement monitoring by pilot leads and engagement activities				
Units	% and qualitative		**Parent KPI**	N/A	
Reporting	**Data upload rate**		N/A	**"Other" upload rate**	N/A
	Information display		Cumulated value☒	Trend☐	N/A☐
KPI calculation trigger (target value)	70% and qualitative				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identification target groups	Pilot owner	
2	Communication and engagement target groups	Pilot owner	
3	Analysis and reporting of target groups activities and output	Pilot owner	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1		Pilot owner	Pilot owner	Survey, monitoring, qualitative feedback		

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations☐	Other☒
	"Other" BASELINE source	No baseline needed			
Responsible	N/A				
Description	N/A				

Table 73 KPI 6.13 definition.

GENERAL INFORMATION					
ID	KPI 6.13		**Name**	Perceived value from the citizens	
Business UC/ System UC	All BUCs/SUCs				
Use Case	Renewables☒	Energy communities☒	Electromobility☒	Flexibility☒	N/A☐
Description	Perceived value from the citizens of OMEGA-X pilot activities (short term – long term)				
Formula	N/A				
Monitoring	Active monitoring by pilot leads, surveys, workshops, interviews, focus groups				
Units	%		**Parent KPI**	[KPI Name/ID]	
Reporting	**Data upload rate**		N/A	**"Other" upload rate**	N/A
	Information display		Cumulated value☒	Trend☐	N/A☐
KPI calculation trigger (target value)	>=70% Surveys based in Likert scale (% of surveys with average to good results).				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identification target groups	Pilot owners, AU, Norce	
2	Communication and engagement target groups	OASC & Pilot owner	
3	Workshops, focus groups, surveys	Pilot owners	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Value	Pilot owner	Pilot owner	Survey, registration	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations☐	Other ☒
	"Other" BASELINE source	No baseline needed			
Responsible	N/A				
Description	N/A				

Table 74 KPI 6.14 definition.

GENERAL INFORMATION					
ID	KPI 6.14		**Name**	Technical requirements, Number of requirements identified through end user engagement.	
Business UC/ System UC	All BUCs/SUCs				
Use Case	Renewables☒	Energy communities☒	Electromobility ☒	Flexibility☒	N/A☐
Description	Number of requirements identified through end user engagement.				
Formula	N/A				
Monitoring	End user experience monitoring, interviews, surveys				
Units	#		**Parent KPI**	N/A	
Reporting	**Data upload rate**		N/A	**"Other" upload rate**	N/A
	Information display		Cumulated value☒	Trend☐	N/A☐
KPI calculation trigger (target value)	#, at least 10 technical requirements				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identification target groups	Pilot owner	
2	Identification relevant experience monitoring tools	Pilot owner	
3	Identification technical requirements	Pilot owner, EDF	

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1		pilot owner	Pilot owner			

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements☐	Simulations☐	Other ☒
	"Other" BASELINE source	No baseline needed			
Responsible	N/A				
Description	N/A				

Table 75 KPI 6.15 definition.

GENERAL INFORMATION					
ID	KPI 6.15	**Name**	Integrating RES as flexible sources		
Business UC/ System UC	BUC Flex1.0 Flexibility for internal optimization SUC Flex1.0 Define the context of flexibility management SUC Flex2.0 Optimize the baseline of resources				
Use Case	Renewables☐	Energy communities☐	Electromobility☐	Flexibility☒	N/A☐
Description	Percentage of citizens that support municipality in integrating more renewables in the energy mix (RES already existing in the beginning of the pilot), as flexible sources and applying energy efficiency measures as a way to reduce its internal costs (Surveys based in Likert scale, % of surveys with average to good results). From Intermittent DER generation resource baseline prediction service (Tecnalia)				
Formula	$\frac{\sum_{i=1}^{N} Citizens\ integrating\ RES\ M32_i - \sum_{i=1}^{N} Citizens\ integrating\ RES\ M20_i}{\sum_{i=1}^{N} Citizens\ integrating\ RES\ M20_i}$ M20 – Month 20 of the project: Before the pilot implementation M32 – Month 32 of the project: After the pilot implementation				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.5 implementation of services at Flexibility Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	In the end of the pilot	
	Information display	Cumulated value☐	Trend☒	N/A☒	
KPI calculation trigger (&target value)	90%				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Identify and sum the number of citizens that support municipality in integrating more renewables in the energy mix before implementing the pilot.	MAIA	*Cit RES M20*
2	Identify and sum the number of citizens that support municipality in integrating more renewables in the energy mix after implementing the pilot.	EDP	*Cit RES M32*

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	*Cit RES M2(*	MAIA	EDP	Databases available	N/A	N/A
2	*Cit RES M3*	MAIA	EDP	Databases available	N/A	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☒	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Maia Municipality				
Description	The result will be benchmarked with respect to the information collected by Maia Municipality. The integration of RES as flexibility sources will be compared with those in OMEGA-X T6.5, to verify the objective outcome of Increased acceptance of and participation of consumers in data sharing for energy services.				

Table 76 KPI 6.16 definition.

GENERAL INFORMATION					
ID	KPI 6.16	**Name**	Water losses detection		
Business UC/ System UC	BUC LEC 1.0 LEC O&M optimization SUC LEC 1.0 ETL of smart meter data SUC LEC 2.0 Manage authentication SUC LEC 3.0 AI algorithm training SUC LEC 5.0 Provide Data Analytics and KPI				
Use Case	Renewables ☐	Energy communities☒	Electromobility ☐	Flexibility ☐	N/A☐
Description	Evaluate and detect water losses of the LEC. Reduction of water losses on an annual basis in %				
Formula	$WaterLosses_{decrease} = WaterLosses_{baseline} - WaterLosses_{pilot}$ WaterLosses_{baseline} = the average of estimated water losses in the last x years in % WaterLosses_{pilot} = the estimated water losses after the pilot implementation in %				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot ☒	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	5% decrease				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Define the average of estimated water losses in the last x years in %	ASTEA	1
2	Define the estimated water losses after the pilot implementation in %	REVOLT	2
3	Collect data from pilot and implement water losses detection and report the KPI	REVOLT	3

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Water losses in the last x years in %	ASTEA	REVOLT	Database	Daily: water consumption of LEC;	At least 2 years
2,3	Estimated water losses after the pilot implementation in % and KPI calculation	ASTEA	REVOLT	Database	Half yearly: KPI evaluation	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☒	Simulations ☒	Other ☐
	"Other" BASELINE source	Water consumption of LEC in the last x years			
Responsible	ASTEA				
Description	Water consumption of users in the last x years. Data collected by water meters.				

Table 77 KPI 6.17 definition.

GENERAL INFORMATION					
ID	KPI 6.17	**Name**	Thermal losses detection		
Business UC/ System UC	BUC LEC 1.0 LEC O&M optimization SUC LEC 1.0 ETL of smart meter data SUC LEC 2.0 Manage authentication SUC LEC 3.0 AI algorithm training SUC LEC 5.0 Provide Data Analytics and KPI				
Use Case	Renewables☐	Energy communities☒	Electromobility☐	Flexibility☐	N/A☐
Description	Evaluate and detect thermal losses of the LEC. Thermal energy reduction compared to the last 5 years.				
Formula	$ThermalLosses_{decrease} = ThermalLosses_{baseline} - ThermalLosses_{pilot}$ ThermalLosses_{baseline} = the average of estimated thermal losses in the last x years in % ThermalLosses_{pilot} = the estimated thermal losses after the pilot implementation in %				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot ☒	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	2% decrease				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Define the average of estimated thermal losses in the last x years in %	ASTEA	1
2	Define the estimated thermal losses after the pilot implementation in %	REVOLT	2
3	Collect data from pilot and implement thermal losses detection and report the KPI	REVOLT	3

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Average of estimated thermal losses in the last x years in %	ASTEA	REVOLT	Database	monthly: thermal consumption of LEC	At least 1 year
2,3	Estimated thermal losses after the pilot implementation in % and KPI calculation	ASTEA	REVOLT	Database	Yearly: KPI evaluation	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☒	Simulations ☐	Other ☐
	"Other" BASELINE source	Thermal consumption of LEC in the last x years			
Responsible	ASTEA				
Description	Thermal consumption of users in the last x years. Data collected by smart meters.				

Table 78 KPI 6.18 definition.

GENERAL INFORMATION					
ID	KPI 6.18	**Name**	Electrical losses detection		
Business UC/ System UC	LEC Operation and Maintenance Optimization				
Use Case	Renewables ☐	Energy communities☒	Electromobility ☐	Flexibility ☐	N/A☐
Description	Reduction of electrical losses at a LEC level (in percentage)				
Formula	$\frac{Initial\ losses\ -\ Actual\ losses}{Initial\ losses} \times 100$				
Monitoring	Initial losses calculated the first time the service is executed in a specific grid. Actual losses calculated monthly.				
Units	%	**Parent KPI**	-		
Reporting [to DWH]	**Data upload rate**		**"Other" upload rate**		
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger	50 %				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Calculated initial power losses in a specific grid (in kW)	Pilot Owner	$Losses_0$
2	Every time the service is executed (recommendation: monthly), it reports the actual losses. The KPI can be then updated.	Pilot Owner	$Losses_t$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	$Losses_0$	Pilot owner	Pilot owner	Database	Once	N/A
2	$Losses_t$	Pilot owner	Pilot owner	Database	Monthly	Monthly

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☐	Simulations ☐	Other ☐
	"Other" BASELINE source	N/A			
Responsible	Pilot owners				
Description	Losses existing in the grid before applying the service				

Table 79 KPI 6.19 definition.

GENERAL INFORMATION					
ID	KPI 6.19	**Name**	Coverage smart meters		
Business UC/ System UC	BUC LEC 1.0 LEC O&M optimization SUC LEC 1.0 ETL of smart meter data SUC LEC 2.0 Manage authentication SUC LEC 4.0 Benchmarking SUC LEC 5.0 Provide Data Analytics and KPI				
Use Case	Renewables ☐	Energy communities☒	Electromobility ☐	Flexibility ☐	N/A☐
Description	Minimum weekly % coverage of smart meters				
Formula	$coverage_{increase=} \frac{coverage_{sm}}{coverage_{manual}}$ coverage_{increase}= increase of the readings coverage _{sm}= Minimum weekly/monthly readings by smart meters coverage _{manual}= Minimum weekly/monthly readings by human operator (normally once a month)				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	n/a	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot ☒	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	3 times increase				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Collect data from pilot and estimate coverage	REVOLT	1
2	Calculate the KPI	REVOLT	2

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Coverage	ASTEA	REVOLT	Database	Minimum monthly walk-by readings	At least 1 year
2	KPI	REVOLT	REVOLT	Database	Monthly	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☒	Simulations ☐	Other ☐
	"Other" BASELINE source	Manually readings by human operator			
Responsible	ASTEA				
Description	Manually readings by human operator				

Table 80 KPI 6.20 definition.

GENERAL INFORMATION					
ID	KPI 6.20	**Name**	Increase decarbonisation of Local Energy Communities		
Business UC/ System UC	BUC LEC 1.0 LEC O&M optimisation SUC LEC 1.0 ETL of smart meter data SUC LEC 4.0 Benchmarking SUC LEC 5.0 Provide Data Analytics and KPI				
Use Case	Renewables☐	Energy communities☒	Electromobility ☐	Flexibility ☐	N/A☐
Description	Evaluate total CO2 emissions based on local conversion factors energy				
Formula	*For Water/Thermal* $C02_{Tot}$ = C02 emission of water/thermal energy in a time period $\Delta C02_{TL}$ = *CO2 emission avoided by reducing baseline Thermal losses* $\Delta C02_{WL}$= *CO2 emission avoided by reducing baseline Water losses* $C02_{O\&M}$ = *CO2 emission avoided after the pilot implementation* $\Delta C02_{O\&M} = \frac{\Delta C02_{TL} + \Delta C02_{WL}}{C02_{Tot}}.100$				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot ☒	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	<1% decrease				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Collect data from pilot and estimate C02 emissions/saved	ASTEA/REVOLT	1
2	Calculate the KPI	ASTEA/REVOLT	2

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Evaluate total CO2 emissions/ saved based on local conversion factors energy	ASTEA	REVOLT	Database	After pilots' implementation	N/A
2	KPI	ASTEA	REVOLT	Database	After pilots' implementatio	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☒	Simulations ☒	Other ☐
	"Other" BASELINE source	• % of water losses • average of thermal energy losses			
Responsible	ASTEA				
Description	CO2 emission of the last x years (without O&M optimization)				

Table 81 KPI 6.21 definition.

GENERAL INFORMATION					
ID	KPI 6.21	**Name**	OPEX Reduction		
Business UC/ System UC	BUC LEC 1.0 LEC O&M optimisation SUC LEC 1.0 ETL of smart meter data SUC LEC 4.0 Benchmarking SUC LEC 5.0 Provide Data Analytics and KPI				
Use Case	Renewables ☐	Energy communities☒	Electromobility ☐	Flexibility☐	N/A☐
Description	Reduction of operational expenses				
Formula	*For Water/Thermal* *Example, for water* $Cost = m3\ loss * Energy\ to\ m3 * EnergyCost$ *Cost = cost of water losses in a time period* *CostO&M = cost of water losses after the pilot implementation (water losses detection)* $\frac{Cost - Cost_{O\&M}}{Cost} \cdot 100$				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot ☒	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	<1% decrease				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Collect data from pilot and estimate costs	REVOLT/ ASTEA	1
2	Calculate the KPI	REVOLT/ ASTEA	2

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Estimated water and thermal losses	ASTEA	REVOLT	Database	Monthly	N/A
2	KPI	REVOLT/ ASTEA	REVOLT	Database	After pilots' implementation	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☒	Simulations ☒	Other ☐
	"Other" BASELINE source	Water and thermal losses of the last x years			
Responsible	ASTEA				
Description	Water and thermal losses of the last x years				

Table 82 KPI 6.22 definition.

GENERAL INFORMATION					
ID	KPI 6.22	**Name**	C02 compensated		
Business UC/ System UC	BUC LEC 2.0 Local Energy Communities Energy Consumption Optimization through prosumer engagement SUC LEC 4.0 Benchmarking SUC LEC 5.0 Provide Data Analytics and KPI SUC LEC 6.0 Prosumer behaviors SUC LEC 1.0 ETL of smart meter data				
Use Case	Renewables☐	Energy communities☒	Electromobility☐	Flexibility☐	N/A☐
Description	Quantity of carbon emission reduced due to challenge faced by consumers after joining the LEC				
Formula	$CO_{2reduced} = \frac{E_{selfconsumed} \cdot K_{emission}}{E_{consumed} \cdot K_{emission}} \cdot 100$ $K_{emission}$: C0$_2$ factor emission $\left[\frac{kg_{CO_2}}{kWh}\right]$ $E_{selfconsumed} = \sum_t \min\left(E_{produced}(t), E_{consumed}(t)\right)$				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	15%				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Compute minimum between energy consumed and produced in the LEC for each time interval	Pilot owner	$E_{selfconsume}$
2	Obtain the CO2 factor emission for a specific time instant	REVOLT	$K_{emission}$
3	Collect input from pilot owners and compute emission percentage reduced	REVOLT	$CO_{2reduced}$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Energy Consumption	Pilot owners	REVOLT	API and Database	Monthly or weekly	Year, Month
2	Energy Production	Pilot owners	REVOLT	API and Database	Monthly or weekly	Year, Month

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☒	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Pilot owners				
Description	Energy consumption and production in the LEC				

Table 83 KPI 6.23 definition.

GENERAL INFORMATION					
ID	KPI 6.23	**Name**	Euros saved		
Business UC/ System UC	BUC LEC 2.0 Local Energy Communities Energy Consumption Optimization through prosumer engagement SUC LEC 4.0 Benchmarking SUC LEC 5.0 Provide Data Analytics and KPI SUC LEC 6.0 Prosumer behaviors SUC LEC 1.0 ETL of smart meter data				
Use Case	Renewables ☐	Energy communities☒	Electromobility☐	Flexibility☐	N/A☐
Description	Quantity of euros that the consumers have saved due to action taken by them.				
Formula	$$€_{saved} = \frac{\sum_t \min\left(E_{produced}(t),\ E_{consumed}(t)\right) \cdot E_€(t)}{\sum_t E_{consumed}(t) \cdot E_€(t)}$$ $E_€(t)$: energy costs at specific time interval t				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	%	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	15%				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Compute minimum between energy consumed and produced in the LEC for each time interval	REVOLT	Eselfconsumed
2	Obtain the energy cost for a specific time instant	REVOLT	$E_€(t)$
3	Collect input from pilot owners and compute energy cost percentage reduced	REVOLT	$€_{saved}$

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Energy Consumption	Pilot owners	REVOLT	API and Database	Monthly or weekly	Year, Month
2	Energy Production	Pilot owners	REVOLT	API and Database	Monthly or weekly	Year, Month

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☒	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Pilot owners				
Description	Energy consumption and production in the LEC				

Table 84 KPI 6.24 definition.

GENERAL INFORMATION					
ID	KPI 6.24	**Name**	Energy ranking		
Business UC/ System UC	BUC LEC 2.0 ECO SUC LEC 4.0 Benchmarking SUC LEC 5.0 Provide Data Analytics and KPI SUC LEC 6.0 Prosumer behaviours				
Use Case	Renewables☐	Energy communities☒	Electromobility ☐	Flexibility☐	N/A☐
Description	Position of single consumer with respect to other LEC participants in terms of both energies saved and consumed and related habits.				
Formula	Ranking position based on E_{score} $$E_{score} = E_{\%selfconsumed} + E_{\%saved}$$ $$E_{\%selfconsumed} = \frac{\sum_t \min\left(E_{LECproduced}(t), E_{LECconsumed}(t)\right)\cdot\frac{E_{consumed}(t,i)}{E_{LECconsumed}(t)}}{E_{consumed}(t)}$$ where i is the i^{th} consumer $E_{\%saved} = \frac{E_{actual}}{E_{previous}}$ Where E_{actual} is the actual energy consumed and $E_{previous}$ is the historical data of energy consumed				
Monitoring	• Start monitoring at WP3 Use Cases and Services definition • Continuing on WP6 T6.3 implementation of services at LEC Use Case Family for the verification of the KPI target • Finalising on WP6 T6.6 KPI elicitation, where the resulting values will be collected and analysed				
Units	#	**Parent KPI**	[KPI Name/ID]		
Reporting [to DWH]	**Data upload rate**	Other	**"Other" upload rate**	End of pilot	
	Information display	Cumulated value☐	Trend☒	N/A☐	
KPI calculation trigger (target value)	N/A				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Collect consumption data	Pilot owner	$E_{consumed}$
2	Compute the amount of self-consumption energy by consumer over his overall consumption	REVOLT	$E_{\%selfconsu}$
3	Compute the amount of saved energy by consumer	REVOLT	$E_{\%saved}$
4	Compute the energy score	REVOLT	E_{score}

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
1	Energy consumption	Pilot owner	REVOLT	API and Database	Monthly or weekly	Year, Month, Week
2	Energy production	Pilot owner	REVOLT	API and Database	Monthly or weekly	Year, Month, Week

BASELINE					
BASELINE source	Literature☐	Historical data☐	Measurements ☒	Simulations ☐	Other ☐
	"Other" BASELINE source				
Responsible	Pilot owners				
Description	Energy consumption and production in the LEC				

Table 85 KPI 6.25 definition.

GENERAL INFORMATION					
ID	KPI 6.25	**Name**	Energy costs		
Business UC/ System UC	BUC LEC 3.0 LEC Planning Services				
Use Case	Renewables ☐	Energy communities☒	Electromobility ☐	Flexibility☐	N/A☐
Description	Total energy costs per year, including all the different energy sources. Projections of these costs under the different demand and supply scenarios (KPI 6.26 & KPI 6.27)				
Formula	$\sum \text{Energy source (kWh/year)} * \text{Costs (€/kWh)}$				
Monitoring	No monitoring - Calculation of costs for different scenarios				
Units	€/year for each scenario	**Parent KPI**	N/A		
Reporting [to DWH]	**Data upload rate**	N/A	**"Other" upload rate**	N/A	
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger (& target value)	N/A				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Define scenarios for energy system in 2030	TECNALIA	1
2	Calculation of energy costs for each scenario	TECNALIA	2

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
Current electricity cost	Cost of the electricity in the current situation	Pupin		Bills	Monthly	Historical since 2016
Future electricity cost	Cost of the electricity in the future	Pupin	TEC	Monitoring	Hourly	Hourly
Mazut consumption	Mazut tank level	Pupin		Monitoring	Hourly	
Mazut cost €/Kg	Cost of the fuel used. Current and expected in the future	Pupin		-		

BASELINE					
BASELINE source	Literature ☐	Historical data☒	Measurements ☒	Simulations ☒	Other ☐
	"Other" BASELINE source				
Responsible	PUPIN, TECNALIA				
Description	Historical energy use and costs for different energy sources. Description of overall system, including equipment and buildings.				

Table 86 KPI 6.26 definition.

GENERAL INFORMATION					
ID	KPI 6.26		**Name**	Production Scenarios	
Business UC/ System UC	BUC LEC 3.0 LEC Planning Services				
Use Case	Renewables☐	Energy communities☒	Electromobility☐	Flexibility☐	N/A☐
Description	Local energy production to supply different energy demand scenarios for 2030 (as per KPI 6.27)				
Formula	$\sum$ Local energy production systems (kWh/year)				
Monitoring	No monitoring - Calculation of energy production for different scenarios				
Units	kWh		**Parent KPI**	N/A	
Reporting [to DWH]	**Data upload rate**		N/A	**"Other" upload rate**	N/A
	Information display		Cumulated value☐	Trend☐	N/A☒
KPI calculation trigger (& target value)	N/A				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Define scenarios for energy system in 2030	TECNALIA	1
2	Calculation of local energy production for each scenario	TECNALIA	2

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
PV production	Electricity production from the PV panels	Pupin	TEC	Monitoring		Hourly from 2021
Electricity cost	Cost of the electricity in the future	Pupin	TEC	Monitoring	Hourly	Hourly
Mazut cost €/Kg	Cost of the fuel used	Pupin	TEC	Bills		Month or year
Energy system data	Characteristics of the energy system, like efficienty	Pupin	TEC	N/A	None	N/A
Building energy needs	Hourly energy consption profile of the buildings	Pupin	TEC	Monitoring		Hourly

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements☒	Simulations☒	Other ☐
	"Other" BASELINE source				
Responsible	PUPIN, Tecnalia				
Description	Historical energy use and costs for different energy sources. Description of overall system, including equipment and buildings.				

Table 87 KPI 6.27 definition.

GENERAL INFORMATION					
ID	KPI 6.27		**Name**	Demand scenarios	
Business UC/ System UC	BUC LEC 3.0 LEC Planning Services				
Use Case	Renewables☐	Energy communities☐	Electromobility☐	Flexibility☐	N/A☐
Description	Energy demand scenarios for 2030.				
Formula	$\sum$ Energy demand of diffierent systems , by energy source (kWh/year)				
Monitoring	No monitoring - Calculation of energy demand for different scenarios				
Units			**Parent KPI**	N/A	
Reporting [to DWH]	**Data upload rate**	N/A	**"Other" upload rate**	N/A	
	Information display	Cumulated value☐	Trend☐	N/A☒	
KPI calculation trigger (& target value)	N/A				

CALCULATION/EXTRACTION METHODOLOGY			
Step ID	**Step description**	**Responsible**	**Data ID**
1	Define scenarios for energy system in 2030	TECNALIA	1
2	Calculation of energy demand for each scenario	TECNALIA	2

DATA COLLECTION						
Data ID	**Data description**	**Data source (entity/responsible)**	**Data sink (entity/responsible)**	**Data collection method**	**Data collection update rate**	**Data collection time range**
Hourly energy demand	Hourly energy demand (electricity and thermal)	Pupin	TEC	Monitoring		Hourly
PV production	Electricity production from the PV panels	Pupin	TEC	Monitoring		Hourly from 2021
Fuel cost	Cost of the fuel used (Mazut)	Pupin	TEC	Monitoring		Monthly or year
Electricity cost	Cost of the electricity in the future	Pupin	TEC	Monitoring	Hourly	Hourly
Energy system data	Characteristics of the energy system, like efficienty	Pupin	TEC	N/A	None	N/A

BASELINE					
BASELINE source	Literature☐	Historical data☒	Measurements ☒	Simulations☒	Other ☐
	"Other" BASELINE source				
Responsible	PUPIN, TECNALIA				
Description	Historical energy use and costs for different energy sources. Description of overall system, including equipment and buildings.				

Annex 3 Communication and dissemination KPIs

Quantitative KPIs

To capture the results of different tactics deployed during the project lifecycle, several measurements and indicators are set for each of the activities (as stated in the OMEGA-X DoA [1]). The earlier in the project these tactics are implemented the better. The table below outlines quantitative targets for tracking and measuring progress.

Table 88 Communication and dissemination quantitative KPIs.

Communication & Dissemination Support and Channels		KPI target (cumulative)		
		M12	M24	M36
Project documentation	Leaflets	1	4	8
	Posters	1	2	3
	Reference project presentations	1	3	5
Publications	Newsletter	4	8	12
	Scientific articles and conference proceedings	2	5	10
		Impact factor > 1,5		
	Videos	1	1	3
	OMEGA-X Academy	Setup	10 courses	
Web and social media	Project website (visitors/month)	300	800	1.500
	LinkedIn (monthly interactions)	1.000	2.000	5.000
	Twitter prints (monthly interactions)	5.000	10.00	20.000
Events	Fairs (booth), workshops and/or conferences attended	15 (5/year, energy related and/or ICT related)		
	Organized workshops	3 (attendance of > 150 people to each)		

Qualitative KPIs

While quantitative targets are important, they are not enough to understand whether something is performing to the desired standard. For that reason, qualitative feedback is needed to paint a more complete picture.

Table 89 Communication and dissemination qualitative KPIs.

Indicator	Objective	Means of verification
Relevance	Communication and dissemination messages should be relevant to stakeholders being targeted.	• Contact form. • Time lag between results creation and announcement. • Number of downloads. • Click through rate. • Follow-ups, e.g. email exchanges, on/offline meetings. • Unsubscribe button.
Clarity	Communication and dissemination messages should be clear enough to be easily recognised.	
Timeliness	Communication and dissemination tactics should follow the principle “strike while the iron is hot”.	
Efficiency	The outcome of communication and dissemination tactics should be proportional to the amount of invested effort, time and resources.	
Openness	Outreach efforts should include an option for target audience to provide feedback, complain, make suggestions or unsubscribe.	

Annex 4 SSH KPIs

From the handbook on user engagement at D2.1 [9].

Human-centered solutions and pathways for societal impact

OMEGA-X Objective 9 [1] aims at integrating a user-centric and collaborative approach throughout the project's lifetime. This integration is targeted at three different levels in the project: At the pilot level, at the collaboration level, and at the impact level, as described in deliverable D2.1 [9]. As the findings of BRIDGE show [9], many EU funded projects addressing energy systems add a SSH approach and user engagement activities only in the final phase of the project. OMEGA-X strives for an early integration to ensure that the necessary activities and engagements are built in the pilots and the project and that not only a technological, but also societal impact can be achieved.

In the preparation phase of the pilots, SSH related activities will focus on four areas:

- Stakeholder and user engagement
- Ecosystem level
- Policy level
- Project level (internal)

Table 90 Preliminary overview of possible KPIs for societal impact.

OMEGA-X KPIs for Societal impact (DoA)	OMEGA-X Use Case Families			
	Renewables	Flexibility	Energy Communities	Mobility
Number of stakeholders sharing data/services involved	>7	>7	>7	>7
Number of locations involved	>2	>2	>2	>2
Number of Energy Communities involved	#	#	#	#
Collaboration with use cases in sister projects	#	#	#	#
Services that increase quality of life in pilot site	#	#	#	#
Incentives for communities & companies to adopt a collaborative approach	#	#	#	#
Increased acceptance and participation of consumers on data sharing for energy services	>%	>%	>%	>%
Trust in data sharing increased amongst stakeholders	>%	>%	>%	>%
Energy affordability for citizens	>%	>%	>%	>%

OMEGA-X KPIs for Societal impact (DoA)	OMEGA-X Use Case Families			
	Renewables	Flexibility	Energy Communities	Mobility
Decrease of energy poverty	<%	<%	<%	<%
Citizens' access to energy services	>%	>%	>%	>%
Diversity amongst stakeholders (including gender balance)	>%	>%	>%	>%
Increased consumer satisfaction.	>%	>%	>%	>%
New energy services developed in collaboration with consumers and citizens.	#	#	#	#
Policy recommendations delivered that have the potential to increase citizens quality of life.	#	#	#	#