MASTERPIECE -
Multidisciplinary Approaches and Software Technologies for Engagement, Recruitment and Participation in Innovative Energy Communities in Europe

Deliverable 5.7

Evaluation of social, environmental, technical and economic impact – interim update

Title	Evaluation of social, environmental, technical and economic impact – interim update
Document description	Deliverable 5.7 is an updated version of D5.6, incorporating the progress made in T5.6. It reflects the overall progress made in the context of evaluating and monitoring the proposed solutions.
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Version 0.1	ODINS	07/11/2024	ToC
Version 0.2	ODINS	05/12/2024	Incorporated KPI-related contributions based on the feedback obtained from pilots and component developers
Version 0.3	ODINS	12/12/2024	Incorporated test cases
Version 0.4	SUST, NGENIC	19/12/2024	Review
Version 1.0	ODINS	20/12/2024	Final version

Disclaimer:

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1. EXECUTIVE SUMMARY

This document continues a series of deliverables aimed at comprehensively reporting all activities and progress made in the evaluation of the MASTERPIECE solution from various perspectives. Specifically, this deliverable is an update of document D5.6, focusing on the KPIs methodologies improvements and adjustments made throughout the project.

The different evaluation approaches have been structured using global KPIs covering the main objectives of the project, as well as specific KPIs for each use case of the pilots. This deliverable details the refinements made to the methodologies for evaluating these KPIs as the project progressed, highlighting the impact of coordination between different work packages, such as WP2, WP3 and WP4, which is fundamental to align the objectives of each KPI with the tools developed throughout the project, ensuring that they are consistent.

In addition, this deliverable includes a section dedicated to Test Cases, which provides a detailed reference format for defining and validating the various components included in the solution. For clarity and organisation, the components have been divided into two main groups: the MASTERPIECE Tools and the DLT Secure Platform Components. This division makes it easier to understand the interactions between the different elements of the solution and their individual assessment.

2. INTRODUCTION

2.1. Background and context

This product represents an evolution of deliverable D5.6, including extensions, refinements and updates to some general project KPIs and specific KPIs for each use case in the pilots.

These improvements were made in synergy with the ongoing development of the tools by the component developers and pilot partners, ensuring greater alignment with the project objectives and greater process efficiency.

The main focus of this phase was to analyse the interactions between the tools used - whether digital or empirical, such as physical forms/questionnaires - and the expected results, both at the level of each pilot and in the overall scope of the MASTERPIECE solution. In addition, the Test Cases were designed on the basis of the market needs and social requirements previously identified in T2.1 "Multilevel regulatory frameworks, administrative/operational barriers, market and financial requirements", T2.2 "Assessment of energy communities maturity and aspirations in the pilot cases" and T2.3 "Pilot surveys, validation scenarios analysis and deployment definition".

The lessons learnt from this process will be essential for furthering the activities in WP3 and WP4. At the same time, the KPI results will play a key role in evaluating and comparing critical performance factors of the MASTERPIECE solution.

2.2. Relationship with other WPs, Deliverables, and Tasks

2.2.1. Rationale for relationship with WP2, WP3 and WP4

The work carried out in WP2 was crucial in establishing the foundation for the entire evaluation process, including the definition of the strategy, methodology, and tools to be used. This information was documented as part of the results generated by T2.4 "Evaluation planning and KPIs definition", reported in D2.3 "Functionalities' needs and performance measurement planning", and will be updated in D2.4 "Functionalities' needs and performance measurement planning – update", which will be delivered in the same month as this deliverable, in M24. D2.4 will focus on defining pilot use cases and evaluation planning to assess the performance of the MASTERPIECE solution in accordance with T2.4.

Building on the historical data presented in D5.6, further updates will be made as the social innovations and digital tools developed in WP3 and WP4 begin to yield results. Moreover, the activities developed in WP4 play a key role, as by defining the data models and outputs generated by each component, it is possible to know which functionalities are available to be used in each KPI, contributing to the calculation methodology of each one, the object of this deliverable.

This process will allow the scope of the evaluation to be expanded, not only to cover the period when the project is fully operational but also to include the earlier phase when the MASTERPIECE solution was still under development.

2.2.2. Alignment with other WP5 Deliverables

This deliverable is based on D5.6, where this deliverable presents an update focused on the methodology for calculating pilot KPIs and test cases for each available tool.

In addition, this deliverable is closely linked to D5.3 "Intervention Program: All pilots implementation", where the use cases and KPIs for the different pilots were introduced for the first time.

2.3. Document Structure Overview

This document is organised into five sections. The first section is the Executive Summary, which provides an overview of the key points addressed.

The second section is the Introduction, explaining the background and context of the deliverable and its connection to Work Packages 2, 3 and 4.

The third section focuses on the methodology, tools and baseline parameters used to calculate the KPIs, both at the global project level and for each use case within the pilots. Section 4 presents the test cases, including an analysis of the Masterpiece tools in subsection 4.3 and a discussion of the components of the DLT Secure Platform in subsection 4.4. Finally, the fifth section offers the conclusions, summarising the findings and outcomes of the document, as well as some next action points.

3. METHODOLOGY, TOOLS AND BASELINES FOR CALCULATING THE KPIS

This section presents the updates to what was described in D5.6 about the global KPIs that were adjusted and refined until they reached their definitive version. The global KPIs that remain unchanged have not been updated or included in this deliverable to avoid redundancy, as they were already detailed in D5.6.

The same refinement process was applied to the specific KPIs of each pilot's use cases.

Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference:

- *KPIs related to cases of achieving absolute values*
- *KPIs related to the publication of deliverables*
- *KPIs calculated by comparing reference periods*
- *KPIs related to the beta version of the platform*

3.3. Global KPIs

KPI 1: Adherence to the ECs after the Intervention Program	
Description	The evaluation of the four energy community centres will explore innovative methods to boost citizen engagement, using qualitative insights to develop tools for participation, literacy, and social entrepreneurship. These tools will be applied through an Intervention Programme, aiming to increase energy community membership by 30%.
How to measure	AEC represents the initial adherence to energy communities (ECs) at the start of the Pilot Monitoring Phase, determined by the number of people who used the MASTERPIECE solution during the first two months, later

	compared with post-Intervention Programme data to evaluate incentive impacts. $$KPI1 = ((AAIP - AEC) / AEC) * 100$$ Where: AEC = Initial Adherence to the ECs during the pilot monitoring phase. AAIP = Adherence alter the Intervention Program in the pilot scenarios.		
Baseline			
Month available	**Not Available**	**Comments**	Due to the legal complexities involved in setting up an EC, the necessary information to properly define the baseline for this KPI is not available at the current stage of the project. Therefore, it has been decided to postpone the calculation of the baseline to ensure that it is more representative in line with the calculation methodology presented in document D2.3. In this regard, this KPI will be calculated two months after the launch of the first version of the platform. This approach will offer a more accurate result, more in line with the reality of the use of the platform (see *KPIs related to the beta version of the platform*). **This baseline is conditional on the beta version of the platform being deployed by M27.**
Calculated Value	**Not Available**		

KPI 3: Increase of federated services	
Description	Multi-dimensional incentive models will equip consumers with tools to support investments and lifestyle changes for becoming prosumers in energy communities. Federated services are autonomous, interoperable systems that work collaboratively, using outputs from one as inputs to another. Furthermore, from a user perspective, federated identity allows you to navigate between tools transparently (without authentication or redundant configurations).

	The goal is to expand federated services by 20%, simplifying clean energy transactions and sharing through automation and incentives.
How to measure	**KPI3 = ((FFSN - IFSN) / IFSN) * 100** Where: IFSN = Initial Number of Federated Services measured at the beginning of the pilot monitoring phase. FFSN = Final Number of Federated Services at the End of the Intervention Program.

Baseline			
Month available	M01	**Comments**	The baseline is measured from the start of the project. As the tools and components were initially isolated, the baseline reflects zero federated services within the context of MASTERPIECE.
Calculated Value	0		

KPI 4: Secure data management	
Description	Together with an improved access control system that allows policy-based authentication and authorization evaluation for data exchange and access while maintaining privacy, privacy-preserving identity management techniques will be expanded and integrated, enabling secure exchange between the different components within the platform. The project must guarantee **100% secure data management** of private information.
How to measure	**KPI4 = (IDC - FNSD) / IDC) * 100** Where: IDC = Initial number of (kind of) Data Collected at the beginning of the pilot monitoring phase. FNSDC = Final Number of No Secured Data collected at the end of the Intervention Program.

Baseline			
Month available	M21	**Comments**	This baseline is equal to zero, and once all the components of the platform are deployed, all values will go from 0 to 100 immediately.
Calculated Value	0		

3.4. Pilot use cases KPIs

3.4.1. PoC: Spain - UMU: Universidad de Murcia

As an update and development of what was presented in D5.6, this section presents the KPIs of each pilot with its updated methodology and baseline. The PoC is highlighted first, as it has a specific role in the project as a reference pilot to generate knowledge and experience that will be applied to the other pilots.

3.2.1.1. Use case 1: Fostering a Socially Responsible Energy Community

KPI 1: Number of people who have interacted with the tool.			
Description	This KPI seeks to reflect the number of participants who, through the app, have managed to capture and, in some cases, enhance community involvement and commitment to sustainability.		
How to measure	The methodology for calculating this KPI is to determine the number of users who have interacted with the application through the number of people registered and number of quizzes filled provided by the MEET APP tool. This KPI is considered to have been achieved when **50 people** interact with the tool.		
Baseline			
Month available	**Not Applicable**	**Comments**	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values.*
Calculated Value	**Not Applicable**		

3.2.1.2. Use case 2: Promoting Collaboration and Self-Consumption from PV

KPI 1: Number of people reached and percentage that attained the collaborative behaviour.	
Description	This use case focuses on directing solar power generation (solar power flows will be simulated based on actual photovoltaic generation available on campus) to power air conditioning systems in specific study rooms, designated as "climate shelters".

	This KPI consists of to make effective use of renewable energy and encourage community behaviour change.
How to measure	Thanks to the counting cameras installed, it will be possible to know in real time the occupancy of the study rooms, which are considered to be "climate shelters".
	The % that achieved the collaborative behaviour is obtained by comparing before and after, how many people there were before and how many after the system was activated. DR-FLEX is used in this Use Case for the optimisation phase based on the generation forecast, with the results being planned when the weather shelters are called (in the most optimised way).
	This KPI will then be calculated by comparing the values obtained in two periods: a reference period in which the system is inactive and another in which the system is active.
	This KPI is considered achieved when **15 people more** has gone to the climate shelter when the system is active.
Baseline			
Month available	Not Available	**Comments**	• See *KPIs calculated by comparing reference periods.*
Calculated Value	Not Available		

3.2.1.3. Use case 3: Management of Demand and Fair Pricing

KPI 1: 10% Energy savings			
Description	This KPI consists of modifying the demand for energy consumption based on incentivising consumption during periods of renewable generation by shifting demand to periods of high photovoltaic generation in order to reduce energy consumption from the grid.		
How to measure	This KPI will be calculated by the value extracted directly from the energy saving functionality provided by the DR-FLEX tool.		
	This KPI will be achieved when **10% of energy** has been saved.		
Baseline			
Month available	Not Available	**Comments**	• See *KPIs calculated by comparing reference periods*.
Calculated Value	Not Available		

KPI 2: 10 % cost energy savings		
Description	This KPI adjusts the energy consumption demand in accordance with electricity tariff rates and energy cost savings in order to reduce energy cost.	
How to measure	This KPI will be calculated by the value extracted directly from the energy cost savings functionality provided by the DR-FLEX tool. This KPI will be achieved when **10% of energy cost** has been saved.	
Baseline		
Month available	**Not Available** **Comments**	• See *KPIs calculated by comparing reference periods.*
Calculated Value	**Not Available**	

3.2.1.4. Use case 4: Achieving Sustainable Energy Transition and Equitable Access

KPI 1: % Increase in grid energy independence (community level).		
Description	The objective of this KPI is to try to reduce the inequality between buildings with higher energy-saving potential (altruistic buildings) and buildings with lower potential (energy poor buildings) This KPI aims to demonstrate the targeting of solar energy (renewable energy in simulated form) based on the energy-saving resources of the different faculties, with the intention of reducing the environmental impact on all faculties.	
How to measure	This KPI will be calculated by the value extracted directly from the Grid energy independence of the network (%) functionality provided by the DR-FLEX tool. This KPI will be achieved when a **10% increase in grid energy independence** has been achieved (community level)	
Baseline		
Month available	**Not Available** **Comments**	• See *KPIs calculated by comparing reference periods.*
Calculated Value	**Not Available**	

3.4.2. Italy - BER: Municipality of Berchidda

3.2.2.1. Use case 1: Promoting the transition from consumer to prosumer in an informed and conscious manner among citizens.

KPI 1: Number of individuals informed.			
Description	This KPI aims to inform individuals about what the Energy Community is all about, the incentives, restrictions and other aspects, in order to improve their understanding of what it means to participate in an Energy Community and what they need to do to play an active role in it.		
How to measure	The methodology of this KPI is based on the collection of empirical data through various feedback from face-to-face workshops. A survey will be conducted at the events to understand what a Renewable Energy Community (REC) is. Feedback from users on the training and information material available will also be collected, as well as feedback from users on the usability of the application. This KPI is considered achieved when at least **60 people** (represents around 2% of inhabitants of Berchidda, which is about 2900 people) have been informed and filled a short questionnaire on REC and on App usage.		
Baseline			
Month available	M18	Comments	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values.*
Calculated Value	0		

3.2.2.2. Use case 2: Achieving Active Participation and Sensibilisation in Sustainable Energy Usage

KPI 1: More than fifty citizens have collaborated and expressed interest in creating the official energy community.	
Description	In order for all individuals to comprehend the potential socio-economic advantages of an EC, this KPI seeks to provide a clear and concise explanation of the business case supporting its formation.
How to measure	The methodology for calculating this KPI is based on the number of people who have agreed to create an EC. The indicator will therefore be measured by the total number of registrations on the ECOOP platform. The tool will

	continue to be promoted face-to-face during planned events in Berchidda, providing an opportunity to explain in detail how it works and allowing direct interaction with citizens, encouraging greater engagement and clarifying doubts.		
Baseline			
Month available	M18	**Comments**	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values*.
Calculated Value	0		

3.4.3. Turkey - UEDAS: Aşağıçavuş Forest Village

As already described in D5.6, the methodology of the KPIs for each use case was adapted due to the lack of connectivity in the Aşağıçavuş Forest Village and the profile of its members.

3.2.3.1. Use case 1: Understanding ECs and engagement of citizens.

KPI 1: Nº Interaction within the learning process	
Description	This KPI aims to encourage the use of the tools available, with the constant support of the EC manager, so that citizens can familiarise themselves and learn more about the subject.
How to measure	In order to calculate this first KPI, in this phase of presenting and informing about the concept of the Energy Community with the aim of involving the inhabitants of the pilot site in the creation of an EC, information will be obtained through feedback from the physical workshops and data from different tools. All tools will be used by the EC Manager based on the answers given by each individual. The EC Manager, an intermediary between the tools and the citizens, will use the RECOMME tool to create a profile of each interested individual and will also be assisted in making decisions.
	Based on the information collected by the EC Manager, the latter will also comment on the tool's usability, user interface, availability, etc.
	Interactions will also take place through the MEET APP tool, where users (via the EC Manager) can participate in discussions, create a new discussion or comment on an existing discussion, as well as show interest in an event organised in the app. In addition, the MEET APP tool has another feature

that allows users to provide feedback on the training and informative material available in the application.

1. The EC Manager is expected to perform at least **50 interactions overall**, with **a minimum of 3 actions per participant**, such as profile creation, feedback submission, and discussion initiation.
2. Information from participants will be gathered through physical meetings or phone calls. The EC Manager will input this information into the RECOMME tool. The target is to collect and upload information for all participants, with **at least 10 data entries completed**.
3. The EC Manager will provide training materials to participants, explain the content in person and collect feedback. This feedback will then be submitted into the MEET APP. **At least 80% of participants should receive the training**, and **a minimum of 8 feedback entries should be collected and uploaded**.
4. The EC Manager will organize and facilitate **at least 3 physical meetings or events** for participants. Feedback from these events will be collected and uploaded into the system, with **at least 8 feedback entries recorded after each event**.
5. The EC Manager will submit regular reports on the usability, interface, and availability of the tools based on their experience and participant feedback. **At least 1 report per month** must be prepared to address challenges and propose improvements.

Baseline			
Month available	M18	**Comments**	See _Due to the heterogeneous nature of the KPIs_, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: _KPIs related to cases of achieving absolute values_.
Calculated Value	0		

KPI 2: Rate of understanding of the EC environment	
Description	This KPI plans to increase citizens' knowledge and awareness by providing energy, climate, sustainability and some technical training to a total of 13 households, creating the concept of an Energy Community.
How to measure	This KPI will be measured empirically through surveys of workshop participants conducted before and after these trainings, and also through the results of quizzes on the training/information material provided by the MEET APP tool.

Given the lack of connectivity and low digital literacy among users, it has been agreed that these quizzes will be used in printed form so that they can be completed by each individual without the need for the internet, and then the Ec-manager can enter the answers given into the MEET APP tool and obtain the final results.

This KPI is considered achieved when the **understanding rate reaches 75%.**

Baseline			
Month available	Not Applicable	**Comments**	See *Due to the heterogeneous nature of the KPIs*, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values.*
Calculated Value	**Not Applicable**		

KPI 3: Rate of acceptance to create an Energy Community.			
Description	As a final step in the process of introducing and learning about EC concepts and accessing the tools (via the EC-manager), this KPI consists of identifying the number of families who have agreed to join a EC.		
How to measure	The methodology for calculating this KPI consists of the number of people who have agreed to create a CE. The ECOOP tool, which offers this functionality, will therefore be used. The rate will be calculated according to the following formula: Rate of acceptance to create an Energy Community = [(N° of households entered the system of ECOOP for the EC / Total number of households) *100]. This KPI is considered achieved when the rate of **acceptance to create an Energy Community reaches 60%**.		
Baseline			
Month available	M18	**Comments**	See *Due to the heterogeneous nature of the KPIs*, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference:

			KPIs related to cases of achieving absolute values.
Calculated Value	0		

3.2.3.2. Use case 2: Achieving Active Participation and Sensibilisation in Sustainable Energy Usage

KPI 1: Energy shifted to solar generation periods - from the Community point of view (kWh).			
Description	This KPI will encourage users by giving them recommendations on how to adjust their energy consumption when there is community solar production, as well as showing them the community's consumption and solar production.		
How to measure	This KPI will be measured using the DR-FLEX tool, which provides the Energy transfer for solar generation periods (kWh) functionality. This KPI is considered achieved when: • **At least 50% of users adjust their energy consumption** during periods of community solar production based on the recommendations provided. • **Energy consumption during solar generation periods is increased by 20%**, indicating alignment with solar production peaks.		
Baseline			
Month available	**Not Available**	**Comments**	See *KPIs calculated by comparing reference periods.*
Calculated Value	**Not Available**		

KPI 2: Community participation rate (%).	
Description	This KPI aims to increase community participation by organising workshops with households to teach them how to interpret the data displayed (consumption, photovoltaic generation on an individual/community basis), how to act on the recommendations, show the results of the changes they have made (if applicable), etc.
How to measure	According to the specificities of this pilot project, the moderator will be the only and exclusive user registered in DR-FLEX. He or she will have access to the information of all households (consumption and production) and the corresponding recommendations. Based on this information, the moderator will rate the recommendations from 1 to 5 and record whether people have followed the recommendations or not (in Boolean format), will be responsible

	for collecting these ratings and Boolean information (whether they were followed or not) and entering them into DR-FLEX for each household. In this way, the KPI will be calculated automatically on a monthly basis using the DR-FLEX tool. KPI2 = sum of people who say "Yes, I follow the recommendation" / total number of recommendations. This KPI is considered achieved when **at least 60% of households consistently follow the recommendations** provided by the moderator, as recorded in the DR-FLEX tool.
Baseline	

Month available	M18	Comments	See _Due to the heterogeneous nature of the KPIs_, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: _KPIs related to cases of achieving absolute values_.
Calculated Value	0		

3.4.4. France - SEIN: Poissy and Magnanville

This use case aims to establish a joint ownership model for the collective investment in PV installations. The objective is to create a collaborative framework where participants contribute collectively to develop and co-consume energy generated by the PV installations.

The assembly of the two energy communities (Poissy and Magnanville) is underway and the energy community of Poissy is more advanced than the EC of Magnanville.

3.2.4.1. Use case 1: Evaluation of Joint Ownership Model for collective PV installation Investment

KPI 1: Up to 60 engaged members | Establishing 3 categories of members: Residential, Small and Medium businesses, Large Groups or Consumers.	
Description	This KPI aims to engage more than 60 members by establishing 3 categories of members for a joint ownership model of collective investment in photovoltaic installations.

How to measure	This KPI will be measured using a combination of empirically collected data and data from available tools. The empirically collected data will be contract documents and monthly reports from the two energy communities, which provide insights into the benefits allocated to each member, such as energy savings, financial returns, and their share of renewable energy production.
	The data from the available tools will be the number of user registrations/accounts provided by the ECOOP tool and the technical-economic analysis provided by the SIT tool.
	Together, these data will be used to calculate and track the KPI, ensuring the target of **60 engaged participants** is met for the joint ownership model of the collective PV installation investment.

Baseline			
Month available	M18	Comments	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values*
Calculated Value	0		

KPI 2: CAPEX per kW installed < 2500 EURkW	Yearly OPEX per kW PV installed < 50 EUR.		
Description	The PART'Ener project proposes a tailored Joint Ownership Model wherein members co-invest for collective PV installation, creating a sense of shared ownership and shared benefits.
	A lot of technical and economic data has been collected in the previous stages and will be used in this KPI to test the tools and validate the results obtained.
How to measure	To calculate this KPI, it will be necessary to collect information on CAPEX per kW installed and annual OPEX per kW PV installed, both of which are provided by SIT tool.

Baseline			
Month available	M18	Comments	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference:

			KPIs related to cases of achieving absolute values.
Calculated Value	0		

3.2.4.2. Use case 2: Promoting Inclusivity, fair governance, and Equity, in Collaborative Self-Consumption ECs

KPI 1: At least 3 actor profiles represented in EC: public and private economic actors, academic actors, households.			
Description	The aim of this KPI is to encourage the involvement of different stakeholder profiles in order to promote representativeness and fair governance.		
How to measure	This KPI will be measured by the output data from the RECOMME tool used to identify the member's behavioural profile.		
Baseline			
Month available	M18	**Comments**	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values*
Calculated Value	0		

KPI 2: Balanced governance - at least 3 votes per category of stakeholders during decision-making.			
Description	This KPI seeks to increase their long-term engagement and promote fair governance and collective decision-making.		
How to measure	This KPI will be measured using output data from the ECOOP tool used to tracking the number of votes during decision making within an energy community. The different stakeholder profiles have already been identified through the use of the RECOMME tool in KPI1 and this information will also be used to calculate this KPI, where it is necessary to know the votes according to stakeholder category.		
Baseline			
Month available	M18	**Comments**	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the

			nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference:
			KPIs related to cases of achieving absolute values.
Calculated Value	0		

3.4.5. France - RDIUP: Les Mureaux

3.2.5.1. Use case 1: Empowering Citizens' Access to Solar-Powered Energy Community Ownership

KPI 1: Eagerness to learn more about ECs.			
Description	This KPI focuses on facilitating the early discovery of EC and informing citizens about sustainable energy practices, while promoting solar energy and self-consumption.		
How to measure	This KPI will be calculated using the MEET APP and the ECOOP tools.		
	The MEET APP tool will provide informative content on what an Energy Community ecosystem consists of, its characteristics, benefits and barriers, as well as quizzes on the presented material to measure the knowledge acquired after accessing these materials. The data from the MEET APP will be used to track user engagement with educational content, the features include: "Feedback from users on the training and informative material available in the application" and "Results of quizzes on training/informative material". The results from the quizzes will indicate the level of knowledge gained, and user feedback will help assess their interest in learning more.		
	While ECOOP will track additional engagement by measuring "Time to acceptance and time spent on Tool " + "Social discussions and comments added by Members" + "Organized events and members interested in attending". These metrics will help assess how engaged users are with the concept of ECs and their eagerness to learn more.		
	The KPI will be considered achieved when at least **60 users show interest in learning more about ECs**: This will be measured through quiz results, user feedback in the MEET APP, and participation data from ECOOP (described above). These combined metrics will determine the number of users eager to learn more about ECs.		
Baseline			
Month available	M18	**Comments**	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in

			more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values.*
Calculated Value	0		

KPI 2: Acceptance to join a Solar-powered ECs (%).			
Description	This KPI is to provide an accessible framework for eligibility and proximity analysis for all potential EC members to enable them to explore the possibility of EC membership.		
How to measure	This KPI will be measured using output data from the ECOOP tool used to tracking the percentage of participants who join and participate in Solar-powered ECs. The acceptance rate will be calculated by dividing the number of participants who accepted to join the EC by the total number of users who accessed the tool for membership exploration. KPI1 will be considered achieved when the **acceptance rate to participate in solar-powered ECs reaches 20%**.		
Baseline			
Month available	M18	**Comments**	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values.*
Calculated Value	0		

3.4.6. France - ALEC: Solévent

3.2.6.1. Use case 1: Management of the EC and participation of the members in the activities.

KPI 1: Number of logins and Time spent on ECOOP.	
Description	This KPI is designed to measure the interest and participation of EC members.
How to measure	This KPI will be measured using output data from ECOOP tool: Number of logins total or individual and Time dedicated on the tool.

EU's Grant Agreement 101096836.

	This KPI will be considered achieved when there is a total of 10 logins per month, when **5 registered members spend at least 5 minutes per month on the tool** and when **the EC manager (if identifiable) spends 20 minutes per month on the tool**.		
Baseline			
Month available	M18	**Comments**	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values.*
Calculated Value	0		

KPI 2: Number of interactions between participants (participation frequency in private chat rooms and discussions and number of meetings organised within the EC).			
Description	This KPI tracks how EC members participate and communicate with one another, fostering an informed and involved community and assisting in the planning of community events as well as the sharing of knowledge and social contact.		
How to measure	This KPI will be measured using output data from ECOOP tool: Frequency of participation in private chat rooms and discussions/ Number of meetings organized within the EC. This KPI will be considered achieved when there are a total of **5 participations in private chat rooms/month and 1 meeting organised through the app**.		
Baseline			
Month available	M18	**Comments**	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values.*
Calculated Value	0		

3.2.6.2. Use case 2: Enrolment and on-boarding on the EC

KPI 1: Number of new members interested in joining the EC.			
Description	This KPI measures the number of new members who are interested in joining an EC using tools that facilitate their involvement.		
How to measure	To calculate this KPI, the number of user registrations/accounts provided by the ECOOP tool and the number of registered users engaged in discussions (i.e. creating a new discussion or commenting on an existing discussion) provided by the MEET APP tool will be used.		
Baseline			
Month available	M18	**Comments**	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values.*
Calculated Value	0		

KPI 2: Qualitative feedback of RECOMME (online questionnaire).			
Description	This KPI performs a qualitative analysis through the feedback given by the EC manager on the use of the tool to a panel of selected members.		
How to measure	This KPI will be measured using output data from the RECOMME tool, which is planned to provide a rating scale for the use of the tool.		
Baseline			
Month available	M18	**Comments**	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values.*
Calculated Value	0		

3.2.6.3. Use case 3: Achieving Active Participation and Sensibilisation in Sustainable Energy Usage

KPI 1: In the recommendation of DR-FLEX there will be the option for the person using it, to indicate if it has acted based on the recommendations. [User Action Confirmation Rate (%)].		
Description	The purpose of this KPI is to determine whether or not the user acted on the recommendation given by DR-FLEX.	
How to measure	This KPI will be measured using output data from DR-FLEX tool: User action confirmation rate based on the recommendation received. Rate of user action confirmation = [(Nº user action confirmation based on the recommendation received / Total number of recommendations received) *100]. This KPI will be considered achieved when the **rate of user action confirmation reaches 10%**.	
Baseline		
Month available	**Not Available**	**Comments**	• See *KPIs calculated by comparing reference periods.*
Calculated Value	**Not Available**	

3.4.7. Sweden - UPP: Dansmästaren

3.2.7.1. Use case 1: Understanding ECs and engagement of citizens.

KPI 1: Ten or more citizens have been informed about the possibility to start and/or participate in an energy community.	
Description	Inform residents about energy communities and identify if there is an interest to form an energy community.
How to measure	This KPI will be evaluated with the RECOMME and the MEET APP tools. The KPI is calculated by the number of residents who have been informed/interviewed using the MEET APP tool, data collected through the number of users registered in the tool. In addition, the use of the RECOMME tool will be aimed at engaging residents. UPP will manage the tool and inform/interview residents. The KPI is considered achieved when **10 or more residents are informed** about energy communities and the possibility of starting energy communities.
Baseline	

Month available	M18	Comments	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values*
Calculated Value	0		

3.2.7.2. Use case 2: Empowering Citizens in Renewable Energy Community

KPI 1: The success ratio in residents taking further steps to start an energy community is ten or more percentage points.			
Description	To nudge residents to take a more active role in learning more and/or starting or participating in an energy community.		
How to measure	This KPI will be evaluated with the tools MEET APP and/or ECOOP (for users starting or participating in ECs). The KPI is calculated by numbers of accounts created in either tool. A successful count is determined by an account created within Uppsala municipality. The KPI will be calculated by: [(Number registered accounts / number of informed residents from KPI1)*100]. The KPI is considered achieved when **10 or more percentage points of the results of KPI have registered an account in either app**.		
Baseline			
Month available	M18	Comments	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values*
Calculated Value	0		

3.2.7.3. Use case 3: Registering an official EC.

KPI 1: UPP is an official energy community.

Description	Registration of an energy community in the name of UPP so that everyone can contribute and learn.
How to measure	The official UPP document will serve as proof of achievement of this KPI.

Baseline			
Month available	Not Applicable	Comments	The official UPP document will serve as proof of achievement of this Boolean KPI.
Calculated Value	Not Applicable		

3.4.8. Sweden - NGENIC: BRF Väppeby Backe & BRF Venus

3.2.8.1. Use case 1: Strengthening social bonds and energy literacy.

KPI 1: Five or more residents have been informed about the possibility to start and/or participate in an energy community.	
Description	Encourage the development of energy communities in Sweden where citizens are involved and educated in the field of energy by informing them about the possibilities.
How to measure	This KPI will be evaluated with the RECOMME and the MEET APP tools. The KPI is calculated by the number of residents who have been informed/interviewed using the MEET APP tool, data collected through the number of users registered in the tool. In addition, the use of the RECOMME tool will be aimed at engaging residents. NGENIC will manage the tool and inform/interview residents. The KPI is considered achieved when **5 or more residents are informed about energy communities** and the possibility of starting energy communities.

Baseline			
Month available	M18	Comments	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values*
Calculated Value	0		

KPI 2: The success ratio in residents taking further steps to start an energy community is ten or more percentage points.

EU's Grant Agreement 101096836.

Description	To nudge residents to take a more active role in learning more and/or starting or participating in an energy community by offering the tools.
How to measure	This KPI will be evaluated with the tools MEET APP and/or ECOOP (for users starting or participating in ECs).
	The KPI is calculated by numbers of accounts created in either tool. A successful count is determined by an account created within Uppsala municipality.
	The KPI will be calculated by:
	[(Number registered accounts / number of informed residents from KPI1)*100].
	The KPI is considered achieved when **10 or more percentage points of the results of KPI have registered an account in either app**.

Baseline			
Month available	M18	Comments	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference: *KPIs related to cases of achieving absolute values*
Calculated Value	0		

3.4.9. Sweden - NGENIC: Austerland

3.2.9.1. Use case 1: Empowering citizens in PV community energy ownership showing the return on investment.

KPI 1: % Average return investment for at least 5 people from Group 2

Description	Enable users in Austerland to collectively own and use a new photovoltaic park, demonstrating the average return on investment in %.
How to measure	This KPI will be calculated using the output data from the SIT tool, so that **at least 5 CEC users have monitored their ROI, the number of Austerland users who have optimised their demand for the photovoltaic production site and the improved ROI of the photovoltaic plant**.
	The target users will be those who belong to group 2, users who use the platform to show their ROI on the cooperative PV investment. This group doesn't have their DSO meters connected.

Baseline

Month available	M18	Comments	See Due to the heterogeneous nature of the KPIs, some relevant questions regarding the nature of the baselines were described in more detail in D5.6, where this deliverable is highlighted below for reference:
			KPIs related to cases of achieving absolute values.
Calculated Value	0		

4. TEST CASES

As already presented in D2.3, one of the methods to establish evaluation mechanisms is the development of Test Cases. In the previous deliverable, a template for the definition of Test Cases was introduced. This format is used in the following sections for describing the testing activities of the different components present in the solution, as part of the evaluation process.

For a better organization of the Test Cases, the components are divided in two groups:

- MASTERPIECE tools.
- DLT Secure Platform Components.

4.3. MASTERPIECE tools

4.3.1. SIT

1. Test Case	SIT-001
Actor & MASTERPIECE tools involved	SIT
Goal	Test and verify that the configuration of an EC is user-friendly
Brief description	In the configuration section, the SIT allows users to specify the EC to be analyzed and assessed. Users have to define the generators and loads. If an EC has storage systems, so users can add ESSs. Also, location and starting have to be provided. This test case intends to assess usability and the facility to configure an EC.
Precondition	The user has to set up the economic and the environmental parameters for analysis.
Postcondition	-
Involved Work Packages	WP4
Execution	1. Signup then signin 2. Open "settings" and enter EC's parameters

EU's Grant Agreement 101096836.

	3. Navigate to "configuration" menu
	4. Add name, location and starting date of the configuration
	5. Add energy assets
	6. Understand the difference between predefined profiles and "custom"
	7. Click on "Configure"
	8. Visualize the results and historical configurations
Expected results	Display success message of configuration creation and visualize the configuration in the "Config list"
Successful criteria	- Successful access to the different services - Success adding of custom csv file - The EC configuration is created successfully - The new configuration can be visualized by the user
Fail criteria	- Failure signup or signin - Missing inputs or bad requests - Misunderstanding of the required information - Wrong settings of parameters - Failure import of CSV consumption data

1. Test Case	SIT-002
Actor & MASTERPIECE tools involved	SIT
Goal	Test that users can generate the sustainability planning after optimization
Brief description	To generate a replication and sustainable planning, users have to simulate and optimize the configuration while including best practices, lessons learnt and actions.
Precondition	The user has to specify the scenarios to be analyzed.
Postcondition	The user has to make trade-off (cast savings or decarbonization) based on the results
Involved Work Packages	WP4
Execution	1. Open simulation or optimization and select the configuration ID 2. choose the plots and usage 3. Run the simulation or optimization 4. Wheel starts spinning 5. Display the 8 KPIs 6. Visualization of pre-choosen plots 7. Navigate to "Planning" 8. Select the configuration and 9. Generate the planning

Expected results	The sustainability planning is generated and can be downloaded in PDF format.
Successful criteria	- The successful generation of KPIs and plots - Simulation and or optimization results created - Any results can be included in the planning
Fail criteria	- The wheel keeps spinning without results - Failure message for PDF creation - Missing inputs for simulation or optimization - Users can't access to different functionalities

4.3.2. COMPASS TOOL

1. Test Case	COMPASS-001
Actor & MASTERPIECE tools involved	COMPASS tool
Goal	Verify that users can search for incentives using keywords combined with initial filters (e.g., type of incentive, location) on the first page, and that the returned results match the specified criteria.
Brief description	In the resources page, the COMPASS allows users to enter keywords and initial filters to obtain tailored incentive results. This test will check if, when keywords and filters are entered, the website returns results that match both the search term and the selected filter criteria.
Precondition	-
Postcondition	-
Involved Work Packages	WP3, WP4

Execution	1. Open the COMPASS website and navigate to the resources tab
	2. Enter a relevant keyword (e.g., «EU Funds»)
	3. Select initial filters, such as:
	   a. Type: financial
	   b. EC phase: development
	   c. Location: EU-wide
	4. Press "search" to submit
	5. Observe the results displayed

Expected results	COMPASS displays incentives that match both the keyword and the selected filters

Successful criteria	- The displayed incentives match the entered keyword and the selected initial filters. - No unrelated incentives appear in the results.
Fail criteria	- No results are displayed, even though there should be relevant incentives for the keyword and initial filters. - Irrelevant incentives appear in the results list. - Search results take an unreasonable amount of time to load or lead to errors.

2. Test Case	COMPASS-002
Actor & MASTERPIECE tools involved	COMPASS tool
Goal	Verify that users can refine incentive search results with additional sub-filters.
Brief description	In the resources page of the COMPASS, after an initial search using keywords and filters, users can further refine results using sub-filters (e.g., type of funding, status). This test will verify that the sub-filters correctly narrow down the search results.
Precondition	-
Postcondition	-
Involved Work Packages	WP3, WP4

Execution	1. Open the compass website and navigate to the resources tab
	2. Enter a relevant keyword (e.g., « EU Funds»)
	3. Select initial filters, such as:
	    a. Type: financial
	    b. EC phase: development
	    c. Location: EU-wide
	4. Press "search" to view the results
	5. Apply sub-filters, such as: Grants (type of funding) and Ongoing (Status)
	6. Observe the refined results.

Expected results	The COMPASS website displays incentives that match all criteria from the initial keyword and filter search, further narrowed down by the selected sub-filters.
Successful criteria	- The refined results align with both the initial filters and the sub-filter criteria.

	- No incentives appear in the results that do not meet both the initial and sub-filter requirements. - Refining the search does not reset or alter the initial keyword and filter selections.
Fail criteria	- Results include incentives that do not meet the sub-filter criteria. - Sub-filters do not narrow down results as expected, or irrelevant incentives remain in the list. - Applying sub-filters causes the initial keyword or filter settings to be cleared or reset. - Results take an excessive time to load, or errors occur when applying sub-filters.

4.3.3. MEET APP

1. Test Case	MEETAPP-001
Actor & MASTERPIECE tools involved	Meet App
Goal	Verify that users can create a social discussion/event in the app
Brief description	In the Discover section, the Meet App provides a collaborative environment to share knowledge and organizing community initiatives. This test case aims to prove that the user can use the app to create a social discussion/event.
Precondition	The user has entered their personal information in the Profile section.
Postcondition	-
Involved Work Packages	WP4
Execution	6. Open the app and complete identification (add initial personal information to access) 7. Navigate to the Discover section 8. Use the "+" button to create a new discussion/event 9. Enter the required information and submit it 10. Verify that the discussion/event was created and can be correctly visualized
Expected results	The discussion/event is correctly created and can be visualized in the app.
Successful criteria	- The user is able to access the app and provides necessary identity information - The discussion/event is created successfully - The new discussion/event can be visualized in the app
Fail criteria	- The user can't access the app and/or the discover section - The creation of the discussion/event fails or take an unreasonable amount of time

	- The new discussion/event cannot be correctly visualized and/or accessed

2. Test Case	MEETAPP-002
Actor & MASTERPIECE tools involved	Meet App
Goal	Verify that users can successfully complete a quiz in the app.
Brief description	In the Understand section, the Meet App provides a quiz feature to engage users and allow them to assess their knowledge acquisition
Precondition	The user has entered their personal information in the Profile section (not mandatory).
Postcondition	-
Involved Work Packages	WP4
Execution	1. Open the app (and complete identification by adding initial personal information to access – not mandatory for this test) 2. Navigate to the Understand section 3. Select the quiz 4. Answer each question in the quiz, then submit it 5. Verify that the quiz was submitted and the visualize the score
Expected results	The user can complete the quiz, submit it, and view their score immediately after submission.
Successful criteria	- The user can access the Understand section and locate the quiz. - The quiz loads without issues, and all questions are visible and answerable. - Upon submission, the quiz result is displayed clearly to the user.
Fail criteria	- The user cannot access the Understand section or locate the quiz. - The quiz fails to load or experiences significant delays. - The submission process fails, or the score is not displayed after completion. - Errors or discrepancies are found in the scoring (e.g., incorrect score calculation).

4.3.4. RECOMME

1. Test Case	RCM-001: Community Members Profiling
Actor & MASTERPIECE tools involved	EC (potential) member/RECOMME
Goal	Characterize and profile the users based on their inputs in the tool

Brief description	The Community Members Profiling is responsible for profiling the users producing meaningful results about their interests and behaviours towards Energy Communities. The profile will be chosen from a predefined list of archetypes (i.e. all potential profiles). The inputs of the users will help us understand which archetype is the best suited for them
Precondition	EC members must fill in their answers in RECOMME
Postcondition	A response with the user's category will be saved
Involved Work Packages	WP3
Execution	1. Login 2. Interact with the tool and give as many information as possible 3. Users reach a page with all of our generated results for their case
Expected results	The archetype of the user
Successful criteria	The user is able to see all available information for her profile
Fail criteria	If the component is not running, user won't be able to see information about their profile

2. Test Case	RCM-002: Profile Clustering
Actor & MASTERPIECE tools involved	EC (potential) member /RECOMME
Goal	Cluster the users based on their profile
Brief description	The Profile Clustering clusters the users of an EC based on the generated profiles or sociodemographic features. This is crucial in order to have an overview how the members of an EC are distributed and potentially identify potential members that would benefit specific ECs.
Precondition	EC members must fill in their answers in RECOMME
Postcondition	
Involved Work Packages	WP3
Execution	1. Login 2. Interact with the tool and give as many information as possible 3. Users reach a page with all of our generated results for their case
Expected results	The cluster of the user

Successful criteria	The user is able to see all available information for her specific cluster
Fail criteria	If the component is not running, user won't be able to see information about their cluster

3. Test Case	**RCM-003: EC Active Competition framework**
Actor & MASTERPIECE tools involved	EC member/RECOMME
Goal	Encourage users to adopt eco-friendly behaviors with a gamified approach
Brief description	The EC Active Competition framework aims to guide the EC members towards more considerate behaviors for the environment. Similar users (either based on their sociodemographics or their profiles) will be compared to find the best one in terms of energy consumption. The rest of the users in the same category will be nudged to follow the example of the "best"
Precondition	EC members must fill in their answers in RECOMME There must be energy data of the specific user
Postcondition	A response with the relevant recommendations for that user
Involved Work Packages	WP3
Execution	1. Login 2. Interact with the tool and give as many information as possible 3. Users reach a page with all of our generated results for their case
Expected results	Recommendations to follow the lead example
Successful criteria	The user is able to see all available recommendations and suggestions for an eco-friendlier behavior
Fail criteria	If the component is not running, user won't be able to see information about their cluster

4.3.5. ECOOP

1. Test Case	**ECOOP-001**
Actor & MASTERPIECE tools involved	ECOOP
Goal	Test and verify that the creation of an EC and or portfolio in a user-friendly manner.

Brief description	In the "creation" section, the users can create an EC or a portfolio to join ECs. The users will fill forms to define the criteria of eligibility (e.g. in specific cases) and acceptance.
Precondition	The user has to set up the parameters of joining and participation.
Postcondition	-
Involved Work Packages	WP4
Execution	1. Signup then signin 2. Open "creation" EC or portfolio 3. Fill the form 4. Click on "Create" 5. Receive success message 6. Navigate to Explore to verify the creation 7. EC Managers navigate to "My cooperatives" to visualize ECs created
Expected results	Display success message of creation and visualize the EC or portfolio information on the popups
Successful criteria	- Successful access to the different creation features - Success adding of portfolio or EC to the Explore space - The EC is created successfully and can be visualized by the user
Fail criteria	- Failure signup or signin - Missing inputs or bad requests - Misunderstanding of the required information - Wrong settings of parameters

2. Test Case	ECOOP-002
Actor & MASTERPIECE tools involved	ECOOP
Goal	Test and verify that the configuration of metering device in an automated way
Brief description	In the "configuration" Sidebar menu, the users can select their portfolio among the list. They select a zone/ asset to be connected to an e-meter. Then, they choose one e-meter type (e.g. linky, shelly or SMA). A device_uid will be created to link them together.
Precondition	The user has to provide the device_id and validate the consent form.
Postcondition	-
Involved Work Packages	WP4
Execution	1. Navigate to "configration" 2. Select the portolio

	3. Select the zone/Asset 4. Select an emeter type 5. Set up the parameters of emeter 6. Validate the consent form 7. Navigate to dashboard 8. Select the EC and filter the emeter to display data
Expected results	Display success message of emeter configuration
Successful criteria	- Successful access to the emeter types - Fetching data from configured emeter - creation of device_uid to be linked to the portfolio zone
Fail criteria	- Failure during data fetching - Failure during the consent form redirection - Wrong settings of parameters

3. Test Case	**ECOOP-003**
Actor & MASTER-PIECE tools involved	ECOOP
Goal	Test and verify that the joining process between EC Manager and Members (portfolios)
Brief description	In the Explore space, EC manager can send to potential members invitation to join the EC and EC members can send requests to be a member.
Precondition	The user has to match with goals and all criteria required by the EC or the local regulations (e.g. eligibility).
Postcondition	-
Involved Work Packages	WP4
Execution	EC Manager: 1. Navigate to Explore 2. On the Map, click on the EC member portfolio 3. Invite the potential member 4. Potential Member will receive notification 5. Members can accept or reject the invitation 6. If accepted, the member will access to all private features of the EC Potential EC members 7. Navigate to Explore 8. Access the list of Eligible ECs 9. Select an Eligible EC 10. Click on "Join" EC 11. EC Manager will receive request 12. EC Manager can accept or no the request 13. If accepted, EC member will access all private features

Expected results	The participation status will become "True" and EC Members will access EC features (e.g. private chatting, vote, etc.)
Successful criteria	- Successful access to the different services - Successful joining to the EC - The new EC Member can be visualized publicly among the list of members
Fail criteria	- Missing inputs or bad requests - Misunderstanding of the required information - Not receiving notifications - Users can access to the private features

4.3.6. DR-FLEX

1. Test Case	DRFLEX-001
Actor & MASTERPIECE tools involved	DR-FLEX tool
Goal	Validate the proper execution of DR-FLEX for demand optimisation in an EC. DR-FLEX involves a workflow consisting of several stages, each of which will be validated in different steps in this case.
Brief description	The operation of DR-FLEX primarily occurs in the background. At the end of each day, the demand optimisation task for the following day in the EC is periodically carried out. This involves a series of stages that make up the DR-FLEX workflow, which consists of several components: • Stage 1: Set-up of the environment. In this stage, an information and analytics environment is prepared to provide input for the subsequent optimisation stages. This includes electricity prices, PV forecasting, DSO signals, and thermal demand assessment. In the context broker, there will be entities dedicated to each of these elements, allowing their results to be obtained with just a single query. • Stage 2: EC - DR Scheme Optimisation: In this stage, the responsible component uses the information from the previous stage to calculate the optimal curve at the EC level. This optimal curve is updated daily in its corresponding entity in the Context Broker. • Stage 3: EC-Member Scheme Disaggregation: In this stage, the optimized curve for the EC is disaggregated among its EC members. This process involves breaking down the overall optimized demand curve into individual curves for each member of the EC. The goal is to determine the optimal demand curves for each EC member, ensuring that the overall demand optimisation is achieved collectively. Each EC member's optimal curve is then

	updated in their corresponding entity within the Context Broker, allowing for precise tracking and adjustment based on individual contributions to the community's demand profile
Precondition	The testing process should be initiated at the end of the day, coinciding with the time when demand optimisation is performed. This ensures that the most recent data is being verified.
Postcondition	
Involved Work Packages	WP4
Execution	• Step 1 This step is related to the Stage 1-> read entities related to electricity prices, PV forecasting, DSO signals, and thermal demand assessment in the Real-Time Context Broker. Check that these entities are updated with current day's data and validate their consistency and expected ranges. • Step 2 This step is related to the Stage 2-> read the optimal curve entity at the EC level in the Real-Time Context Broker. Ensure it has been recently calculated and focused on the next day's optimisation. • Step 3 This step is related to the Stage 3 -> read the optimal curves for each EC member in the Real-Time Context Broker (after disaggregation). Verify that these individual curves are updated with disaggregation results and ensure they match the overall EC optimal curve and reflect an equitable demand distribution.
Expected results	Optimal demand curve for each EC member
Successful criteria	Correct calculation of optimized curves for the next day for each EC member, which reflects the proper functioning of the demand optimisation task by DR-FLEX. Since this test is executed considering various steps, following are the criteria for each step: **Criteria for step 1:** - **DailyPrices**: The *DailyPrices* entities retrieved contain an array with 24 entries with non-null values. 1 value per hour -> 24 values in total reflecting the prices for the day-ahead. Also, the timestamps of these values must point to the next-day. - **PV Generation**: The *PVGenerationForecast* entities retrieved contains an array with 36 entries with non-null values. 1 value per hour -> 36 values in total reflecting the forecasted values, starting from 00:00h of the next day and to 36 hours later. - **DSO signals**: The "*DSOFlexibilityRequest*" entities retrieved during the test execution contains reduction requests for the next

	day. The "period start" and "period end" attributes must be a valid range for the next-day. Also, the attributes regarding the amount of power to reduce must be valid numbers (specified accordingly in the test configuration, for example: 0 W < X >= 40000W) - **ExpectedThermalDemand** : The *ExpectedThermalDemand* entities retrieved contains three valid timeseries (baseline, UpFlex, DownFlex) with 24 values each. These values must be non-null values and pointing to each hour of the nex day. **Criteria for step 2:** - **ECAggregatedDemandOptimisation:** the *ECAggregatedDemandOptimisation* entities must contain a timeseries with 24 values. These values must be non-null values and pointing to each hour of the next day. **Criteria for step 3:** - **OptimalLoadCurve:** the *OptimalLoadCurve* entities must contain a timeseries with 24 values. These values must be non-null values and pointing to each hour of the next day.
Fail criteria	- *DailyPrices* entities containing an array of invalid values (null/NaN values, etc.), timestamps not pointing to the next day hours (outdated) or not including exactly 24 values as expected. - *PVGenerationForecast* entities containing an array of invalid values (null/NaN values), timestamps not pointing to the next day hours (outdated) or not including exactly 36 values as expected. - *DSOFlexibilityRequest* entities containing an invalid amount of power (negative/NaN values) or period not pointing to the next day hours (outdated). - *ExpectedThermalDemand* entities containing timeseries of invalid values (null/NaN values), timestamps not pointing to the next day hours (outdated) or not including exactly 24 values as expected. - **ECAggregatedDemandOptimisation** entities containing a timeseries of invalid values (null/NaN values), timestamps not pointing to the next day hours (outdated) or not including exactly 24 values as expected. - *OptimalLoadCurve* entities containing a timeseries of invalid values (null/NaN values), timestamps not pointing to the next day hours (outdated) or not including exactly 24 values as expected.

2. Test Case	DRFLEX-002
Actor & MASTERPIECE tools involved	DR-FLEX - Expected Thermal Demand and Flexibility
Goal	This component aims to proactively assess and forecast demand side flexibility levels.
Brief description	This component aims to assess and predict demand-side flexibility in ECs. By integrating historical energy profiles, baseline consumption forecasts and PV generation forecasts, it provides accurate overall flexibility estimations. Daily updates from historical data and real-time data repositories ensure accurate forecasting and provide support for optimized energy consumption, renewable energy utilization, and strategic decision-making. The continuous data flow and extended collection periods improve to its reliability and functionality. This contributes to more effective energy management and increased energy efficiency, the management of DR events and the long-term sustainability of the EC.
Precondition	Availability of all required inputs: 1) Historical energy profiles of the EC members; 2) Baseline consumption (energy consumption profile forecasts per EC member); 3) PV Generation Forecasting;
Postcondition	The tool outcomes the aggregated demand-side flexibility bounds.
Involved Work Packages	WP4
Execution	This tool receives daily data from the historical data repository to perform training procedures. It also gets data from the real-time data repository every night to obtain the latest data stream from the required inputs to be able to infer the forecasted demand flexibility bounds back to the platform.
Expected results	The expected outcomes of the tool are to provide accurate forecasts and estimates of demand flexibility, contributing to optimizing energy management and energy efficiency, improving the efficiency of renewable energy sources and supporting strategic decision making for demand management.
Successful criteria	A continuous flow of data from all required inputs is vital for effective training of the tool and the production of reliable results. In addition, extending the data collection period will allow for the incorporation

	of additional functionalities, providing a more integrated evaluation of the tool's performance under different conditions.
Fail criteria	Potential issues such as insufficient or interrupted data, low performance, and inaccurate results will be addressed through appropriate strategies to prevent them.

3. Test Case	**DRFLEX-003**
Actor & MASTERPIECE tools involved	DR-FLEX - Optimized EC Energy and Flexibility Management
Goal	This component aims to reduce costs sustaining thermal comfort to end-users and at the same time meet as much as possible the DSO demand requests.
Brief description	This component aims to address demand response (DR) events, modifying expected demand profiles to minimize impact on end-users while maximizing benefits such as peak reduction and cost savings. A considerable emphasis is placed on the efficient management of HVAC appliances, aiming to conserve as much energy or flexibility as possible. This conservation aligns with demand requests from the Distribution System Operator (DSO) and the energy tariffs, thus maximizing turnovers or minimizing energy costs. The tool employs a Reinforcement Learning (RL) strategy for DR at the Energy Community (EC) level, taking into account tariffs, EC thermal demand profiles, flexibility signals from DSO and forecasted PV produced energy. It acts as a critical resource for EC operators/managers by utilizing a variety of inputs enabling dynamic adjustments based on real-time grid conditions and market signals.
Precondition	Availability of all required inputs: 1) Baseline consumption per EC member; 2) Flexibility graphs per EC member; 3) DSO demand requests and incentives; 4) PV energy produced; 5) Market prices
Postcondition	The tool outcomes the aggregated demand at EC level, while also the disaggregated demands per EC member to feed the Demand Response Management Engine which will subsequently produce the recommendations to users.
Involved Work Packages	WP4
Execution	This component gets data from historical data repository daily to perform training procedures for the optimizer. Also, get data from the real-time data repository every night to get the last stream of data from the required inputs in order to be able to inference the

	aggregated optimized demand and the disaggregated ones back to the platform.
Expected results	Optimized demand in terms of cost reduction sustaining thermal comfort for users, while also to reduce peaks.
Successful criteria	It is critical to have an uninterrupted stream of data from all required inputs for adequate time prior to start producing results. This means that there will be an adequate pool of data for training. However, our approaches are plug-and-play which means that the tool can produce results with only a few days of data. Nevertheless, adequate data will lead to incorporate more functionalities, while also to test the tool under different exogenous conditions. Thus, in order to meet the desired objectives, the aforementioned conditions should be met. This will lead to a period that we can evaluate and test the methods outputs regarding a set of metrics/KPIs like, cost reduction, energy reduction, percentage of DSO demand requests meet, penalization scores regarding sustaining thermal comfort etc.
Fail criteria	Insufficient data availability (interrupted or incomplete data), Failure to meet sufficient performance, Inaccurate outputs (if the produced disaggregated profiles will not be actionable for the Demand Response Management Engine). In any case, mitigation actions regarding the retraining strategies will be incorporated to avoid these cases.

4.4. DLT Secure Platform Components

4.4.1. Real-Time Data Repository

1. Test Case	RTDR-001
Actor & MASTERPIECE tools involved	Real-Time Data Repository
Goal	Validate the availability of the component by making requests to the REST API it offers.
Brief description	The Real-Time Data Repository is responsible for managing the current information of the entities stored in the platform. It offers a REST API that allows writing and reading data and, in this sense, it is necessary to test the component to ensure that it is always available.
Precondition	-
Postcondition	A response will be obtained from the component's API validating that it is accessible.

Involved Work Packages	WP4
Execution	A request must be launched with the following format: GET /version HTTP/1.1 Host: {{ContextBroker-Host}}:1026
Expected results	Receive the response from the API accessed. The response contains the context broker version information in JSON format.

Successful criteria	Get a response with a 200-Ok code.
	
	The response body should contain information about the deployed context broker instance.
	
	{
	  "orionld version": "1.3.0",
	  "orion version": "1.15.0-next",
	  "uptime": "107 d, 0 h, 21 m, 45 s",
	  "git_hash": "nogitversion",
	  "compile_time": "Mon Jul 17 15:50:04 UTC 2023",
	  "compiled_by": "root",
	  "compiled_in": "",
	  "release_date": "Mon Jul 17 15:50:04 UTC 2023",
	  "doc": "https://fiware-orion.readthedocs.org/en/master/"
	}

Fail criteria	If the component is not running, the API will not be accessible and you will receive the following error message: Error: connect ECONNREFUSED

4.4.2. Historical Data Repository

1. Test Case	HDR-001
Actor & MASTERPIECE tools involved	Historical Data Repository
Goal	Validate the availability of the component by making requests to the REST API it offers.

Brief description	The Historical Data Repository is responsible for managing the current information of the historical entities stored in the platform. It offers a REST API that allows registering and reading data and, in this sense, it is necessary to test the component to ensure that it is always available.
Precondition	-
Postcondition	A response will be obtained from the component's API validating that it is accessible.
Involved Work Packages	WP4
Execution	A request must be launched with the following format: GET /_cluster/stats HTTP/1.1 Host: {{historicalRepository-Host}}:9200
Expected results	Receive the response from the accessed API. The response contains the statistics of the historical data repository cluster instance in JSON format.
Successful criteria	Get a response with a 200-Ok code. The response body should contain information about the cluster as nodes, created indices, shards, documents, store size, etc…)
Fail criteria	If the component is not running, the API will not be accessible and you will receive the following error message: Error: connect ECONNREFUSED

4.4.3. Data Healing

1. Test Case	DH-001
Actor & MASTERPIECE tools involved	Data Healing
Goal	Uphold high data quality standards across the DLT platform to enable accurate, reliable, and consistent data insights.
Brief description	The data healing module is responsible to detect anomalies and erroneous measurements—such as outliers, duplicates, and data

	gaps—and applies robust imputation methods to address these issues. Its purpose is to preserve data integrity, ensuring high-quality and accurate information for downstream tasks like feature extraction, citizen clustering, and metric representation. This enhances decision-making, information extraction, and analytical capabilities across data-driven applications.
Precondition	Raw data requiring healing is available in the data repository.
Postcondition	The module outputs healed data, which is then integrated back into the DLT platform for further use.
Involved Work Packages	WP4
Execution	The data healing component continuously polls the data repository, aiming for near real-time processing to identify and heal all candidate entities promptly. Upon retrieval, the component applies healing mechanisms to detect and address potential errors or anomalies. When anomalies are identified, imputation algorithms replace or correct faulty data. Finally, the transformed, healed data is returned to the DLT platform in real time, making it available for MASTERPIECE applications.
Expected results	Identify and correct anomalies and erroneous measurements in the data.
Successful criteria	Since ground-truth data is not available for real-time data streams, the component's success will be evaluated in relation to benchmarks from similar applications in existing literature, acknowledging an intrinsic and abstract measurement of accuracy.
Fail criteria	Since ground-truth data is not available for real-time data streams, the module's success will be evaluated in relation to benchmarks from similar applications in existing literature, acknowledging an intrinsic and abstract measurement of accuracy.

4.4.4. Secure Energy Flow Monitoring

1. Test Case	SEFM-001
Actor & MASTERPIECE tools involved	Secure Energy Flow Monitoring
Goal	Validate that the aggregation script correctly iterates over the entities, checks the aggregation type, and performs the daily, weekly, and monthly aggregations according to the entity aggregation type on the

	defined time, resulting in successful updates to the blockchain and context broker.
Brief description	The aggregation script is designed to: • Wake up every hour • Iterate through each entity defined in the configuration. • Check if current time = Aggregation time • Check the aggregation Type for each entity (daily, weekly, or monthly). • Get the entity last update date • Perform the aggregation based on the type form (Last update date + 1) to the current date. • Prepare and send the aggregated data to the blockchain API. • Update the context broker with the new aggregated data. In this test case: • The date is set to **November 21, 2024**.

Precondition	• **Data Availability:**
	    ○ The data repository contains data up to **November 14, 2024**.
	• **Configuration:**
	    ○ The config.json file is properly configured with the correct entities, devices, time zones, and aggregation types.
	
	`{`
	`"hostContextBroker": "https://masterpiece.odins.es",`
	`"hostDataRepository": "https://masterpiece.odins.es",`
	`"hostBlockchainGet": "https://masterpiece-blockchain.odins.es/masterpiece/get",`
	`"hostBlockchainPost": "https://masterpiece-blockchain.odins.es/masterpiece",`
	`"entities": [`
	`{`
	`"id": "urn:ngsi-ld:AggregatedEnergySeries:UEDAS-TR-B1-DailyConsumption-activeEnergyImport",`
	`"aggregationType": "daily",`
	`"hourToCheck": 4,`
	`"timezone": "Europe/Istanbul",`
	`"entities": [`
	`{`
	`"id": "urn:ngsi-ld:DeviceMeasurement:UEDAS-TR-B1-Main-floor-GlobalMeter-activeEnergyImport",`
	`"ownershipPercent": 100`

```
          }
        ]
      },
      {
        "id": "urn:ngsi-ld:AggregatedEnergySeries:UEDAS-TR-B1-Week-
lyConsumption-activeEnergyImport",
        "aggregationType": "weekly",
        "hourToCheck": 4,
        "timezone": "Europe/Istanbul",
        "entities": [
          {
            "id": "urn:ngsi-ld:DeviceMeasurement:UEDAS-TR-B1-Main-
floor-GlobalMeter-activeEnergyImport",
            "ownershipPercent": 100
          }
        ]
      },
      {
            "id":  "urn:ngsi-ld:AggregatedEnergySeries:UEDAS-TR-B1-
MonthlyConsumption-activeEnergyImport",
        "aggregationType": "monthly",
        "hourToCheck": 4,
        "timezone": "Europe/Istanbul",
        "entities": [
          {
            "id": "urn:ngsi-ld:DeviceMeasurement:UEDAS-TR-B1-Main-
floor-GlobalMeter-activeEnergyImport",
            "ownershipPercent": 100
          }
        ]
      }
    ]
}
```

- **Context Broker:**
  - The last updated date for each entity in the context broker is **November 18, 2024**.
- **Operational Systems:**
  - The blockchain API and context broker are operational and accessible.

Postcondition	• Aggregated data is sent to the blockchain API and receives a **200 OK** response.

	- The context broker is updated with the new aggregated data and receives a **204 No Content** response. - The script completes execution without errors, having performed the aggregations according to the entities' aggregation types.
Involved Work Packages	WP4

Execution	**Execution Steps**
	1. **Initialization**
	   o The script sets the current UTC time (now_utc) to a fixed datetime for testing purposes: 2024-11-23 01:00:00 UTC.
	   o Loads configurations from config.json, including entities, devices (Measurements), aggregation types, time zones, and check hours.
	   o Sets global variables HOST_DATA_REPOSITORY and BLOCKCHAIN_API_URL from the configuration.
	2. **Iterate Over Entities**
	   o For each entity in the config.json:
	      ▪ **Retrieve Entity Configuration:**
	         ▪ **Entity ID:** e.g., urn:ngsi-ld:AggregatedEnergySeries:UEDAS-TR-B1-DailyConsumption-activeEnergyImport
	         ▪ **Aggregation Type:** daily, weekly, or monthly
	         ▪ **Hour to Check:** e.g., 4 (4 AM)
	         ▪ **Time Zone:** e.g., Europe/Istanbul
	         ▪ **Devices:** List of device IDs to aggregate
	      ▪ **Time Zone Adjustment:**
	         ▪ Converts now_utc to the entity's local time (now_local) using the specified time zone.
	      ▪ **Check Hour Verification:**
	         ▪ Compares now_local.hour with hourToCheck.
	         ▪ If they match, proceeds with aggregation; otherwise, skips the entity.
	3. **Aggregation Process**
	   o **Retrieve Last Updated Date:**
	      ▪ Calls get_last_updated_date_from_context_broker(entity_id) to get the last dateObserved.

- If not available, defaults to yesterday's date.
  - o **Calculate Dates to Process:**
    - Calculates delta_days as the difference between today's date and the last updated date.
    - If delta_days is less than or equal to 0, no new data needs processing.
  - o **Process Each Date:**
    - For each day from last_updated_date + 1 to today:
      - **Aggregation Based on Type:**
        - **Daily Aggregation:**
          - Calls perform_daily_aggregation(aggregation_date, devices, entity_id, entity_timezone).
        - **Weekly Aggregation:**
          - Calls perform_weekly_aggregation(aggregation_date, devices, entity_id, entity_timezone).
        - **Monthly Aggregation:**
          - Calls perform_monthly_aggregation(aggregation_date, devices, entity_id, entity_timezone).

4. **Aggregation Functions**
   - o **Fetching Device Data:**
     - fetch_device_data(device_id, aggregation_date, entity_timezone) fetches data for a single device and date.
     - Converts dates to UTC and constructs the request URL.
     - Sends a GET request to the data repository.
     - Parses the response and sums the numValue attributes.
   - o **Fetching Data for All Devices:**
     - fetch_data(devices, aggregation_date, entity_timezone) sums data from all devices for a specific date.
   - o **Daily Aggregation:**

- Calculates the total for the target day.
- Prepares the request body for the blockchain API.
- Prints the aggregation result.
  - **Weekly Aggregation:**
    - Determines the week range (Monday to target day).
    - Sums data for each day in the week.
    - Prepares the request body for the blockchain API.
    - Prints the aggregation result.
  - **Monthly Aggregation:**
    - Determines the month range (from the first day to the target day).
    - Sums data for each day in the month.
    - Prepares the request body for the blockchain API.
    - Prints the aggregation result.
5. **Updating Blockchain API and Context Broker**
   - **Blockchain API Interaction:**
     - Sends a POST request to the blockchain API with the aggregated data.
     - (In the provided code, the actual POST request is commented out for testing purposes.)
   - **Context Broker Update:**
     - Calls update_context_broker(entity_id, aggregated_values, date_observed_str) to update the entity's attributes.
     - Sends a PATCH request to the context broker.
     - Handles responses and exceptions.
6. **Completion**
   - After processing all entities and dates, the script ends.

Expected results	The user will receive the response from the API accessed. The response obtained will depend on the data storage component they accessed (real-time or historical), as well as the method and resource used. In the case of readings, a JSON in NGSI-LD format with the requested information will appear in the body of the response.
Successful criteria	• **Data Aggregation Accuracy:**

- The `value` arrays in the request bodies match the expected sums of device data.

- **Correct API Requests:**

  - The script constructs the correct URLs and headers for the data repository, blockchain API and context broker.

- **Proper Time Handling:**

  - The script correctly handles time zone conversions and date calculations.

- **Error Handling:**

  - The script gracefully handles HTTP errors and exceptions, logging appropriate messages.

- **Script Execution:**

  - The script processes all entities and performs aggregations as per their `aggregationType`.
  - Sample of outpout eg:

    Current UTC time: 2024-11-23 01:00:00

    Current time in timezone Europe/Istanbul: 2024-11-23 04:00:00

    Starting aggregation for entity urn:ngsi-ld:AggregatedEnergySeries:UEDAS-TR-B1-DailyConsumption-activeEnergyImport at 2024-11-23 04:00:00 Europe/Istanbul

    Last updated date from Context Broker for entity urn:ngsi-ld:AggregatedEnergySeries:UEDAS-TR-B1-DailyConsumption-activeEnergyImport: 2024-11-20

    Processing up to date: 2024-11-23

    Delta days: 3

    Processing date 2024-11-21 for entity urn:ngsi-ld:AggregatedEnergySeries:UEDAS-TR-B1-DailyConsumption-activeEnergyImport

	Daily aggregation for 2024-11-21: 0
	Processing date 2024-11-22 for entity urn:ngsi-ld:AggregatedEnergySeries:UEDAS-TR-B1-DailyConsumption-activeEnergyImport
	Daily aggregation for 2024-11-22: 0
	Processing date 2024-11-23 for entity urn:ngsi-ld:AggregatedEnergySeries:UEDAS-TR-B1-DailyConsumption-activeEnergyImport
	Daily aggregation for 2024-11-23: 0
	Aggregation complete for entity urn:ngsi-ld:AggregatedEnergySeries:UEDAS-TR-B1-DailyConsumption-activeEnergyImport.
Fail criteria	Incorrect Aggregated Data: Aggregation results do not match expected values based on input data. Malformed Requests: The script constructs incorrect URLs or request bodies, causing API requests to fail. Time Calculation Errors: Incorrect handling of time zones or date calculations leading to wrong data being fetched or aggregated. Unhandled Exceptions: The script crashes due to unhandled exceptions or errors. API Failures: The script fails to interact with the data repository, blockchain API, or context broker due to code issues.

4.4.5. Security and Privacy Engine

1. Test Case	S&PE-001

Actor & MASTERPIECE tools involved	SECURITY AND PRIVACY ENGINE
Goal	Validate the correct execution of Security and Privacy Engine for data access. This engine involves a workflow consisting of several stages, each of which will be validated at different steps in this case.
Brief description	The security and privacy engine controls access to real-time and historical data. The flow that applications/components must follow to access data involves the following three steps: • <u>Authentication:</u> where applications/components must prove that they are registered in the system (as Keycloak users). • <u>Authorization:</u> where applications/components, once authenticated, will be allowed or denied access to data based on the configuration of access control policies. • <u>Access to the resource</u>: where applications/components, once authorized, will access the corresponding resource for storing, updating or reading purposes.
Precondition	Applications/components are registered and configured on the platform and have valid credentials (Keycloak's user). Applications/components are considered/configured in access control policies.
Postcondition	Applications/components can access API resources (endpoints) offered by components that manage data (real-time/historical data repositories).
Involved Work Packages	WP4

Execution	• Authentication
	
	In this step the user will access the authentication endpoint, to do so a request must be launched with the following format:
	
	POST /authN HTTP/1.1
	Host: masterpiece.odins.es:443
	Content-Type: application/json
	{
	    "name": "{{user}}",
	    "password": "{{userpass}}"
	}
	
	Where:

- {{user}} is the user name.
- {{userpass}} is the password.

- Authorization

In this step the user will access the authorization endpoint, to do so a request must be launched with the following format:

```
POST /authZ HTTP/1.1
Host: masterpiece.odins.es:443
Content-Type: application/json
domain: masterpiece

{"token":  "{{authN}} ", "ac": "{{method}}", "de":
"https://masterpiece.odins.es", "re": "{{resource}}"}
```

Where:

- {{authN}} is the authentication token obtained previously.

- {{method}} is the HTTP request method that the user will use to access the data (GET, POST, UPDATE, DELETE,...).

- {{resource}} is the API endpoint that the user will use to access the data. For instance: "/ngsi-ld/v1/entities/urn:ngsi-ld:DeviceMeasurement:identifier001"

- Access to the resource

In this step, the user will access the stored data (real-time or historical) by sending a HTTP request.

The format of the request depends on the API of the component that is protected by the Security and Privacy Engine. As an example, we show two accesses to obtain data, one for real-time and one for historical:

```
GET /ngsi-ld/v1/entities/{{entityID}} HTTP/1.1
Host: masterpiece.odins.es:443
fiware-service: masterpiece
fiware-servicepath: /
x-auth-token: {{authZ}}
```

	``
GET /temporal/entities/{{entityID}}/type/{{type}}/
time/{{time}}/endTime/{{endTime}}/attrs/{{property}}
HTTP/1.1
fiware-service: masterpiece
Accept: application/json
x-auth-token: {{authZ}}
```

Where:

- {{authZ}} is the authorization token obtained previously.
- {{entityID}} is the identifier of the entity.
- {{type}} is the type of the entity.
- {{time}} and {{endTime}} are values to define the period time range (historical accesses).
- {{property}} is the property of the entity to recover |
| **Expected results** | The user will receive the response from the API accessed. The response obtained will depend on the data storage component they accessed (real-time or historical), as well as the method and resource used.

In the case of readings, a JSON in NGSI-LD format with the requested information will appear in the body of the response. |
| **Successful criteria** | **Criteria for Authentication:**

Get a response with a 200-Ok code.

The response body should contain information about the authentication token obtained following the next format:

```
{
    "token": {
        "methods": [
            "password"
        ],
        "expires_at": "2024-11-04T10:48:34.251Z"
    },
    "idm_authorization_config": {
        "level": "basic",
        "authzforce": false
    }
``` |

```
}
```

Where "expires_at" shows the token's expiration date and time.

The authentication token is obtained in the "X-Subject-Token" response header.

Criteria for Authorization:

Get a response with a 200-Ok code.

An example of body response (authorization token) is:

```
{"id": "619915f84e5872c99f9ca59b7c9f9af8", "ii":
1730714924, "is": "capabilitymanager@odins.es", "su":
"urn:ietf:params:scim:schemas:core:2.0:id|13a48914-85cf-
4d1b-ba24-cd937061e970", "de":
"https://masterpiece.odins.es", "si":
"MEYCIQDgp0TAHQ8Iidw33V0zAF26KhNAeZLeue/5Vmceynn
r8QIhAPMRlhMlKcVZeNnLISYUmgbwL2kq3y3H+zoN7LRWxgY
A", "ar": [{"ac": "GET", "re": "/ngsi-ld/v1/entities/urn:ngsi-
ld:DeviceMeasurement:identifier001"}], "nb": 1730714924,
"na": 1730724924}
```

Criteria for Access to the resource:

The user will receive the response from the API they accessed. The response depends on the method and resource used in the request. The security and privacy engine validates the authorization token (included in the user's request in the "x-auth-token" header).

Fail criteria

Criteria for Authentication:

Get a response with a 401-Unauthorized code.

The response body should contain information about the authentication token obtained following the next format:

```
{
    "error": "invalid_grant",
    "error_description": "Invalid user credentials"
}
```

Criteria for Authorization:

Get a response with a 401-Unauthorized code.

Two possible request bodies depending on whether the access attempt is explicitly denied or there is no defined access control policy to validate it.

```
"Can't generate capability token (Deny)"
```

```
"Can't generate capability token (NotApplicable)"
```

Criteria for Access to the resource:

If the authorization token is not included in the request or its validity time has expired get a response with a 401-Unauthorized code with the following body containing:

```
{
    "code": 401,
    "error": "Unauthorized",
    "details": "The token is missing or invalid."
}
```

5. CONCLUSIONS

This deliverable has reported the progress of the work done in the context of evaluation after Deliverable D5.6, paying special attention to have a clear definition of how each KPI is going to be evaluated in the last part of the project.

In parallel with the work done for D2.4, also to be submitted in M24, analysis on methodologies and tools for KPI calculations have been carried out to obtain a clear view of what needs to be done to properly evaluate the different parts of the solution, both KPIs and components. This includes a more detailed definition of the target values of each KPI as well as detailed descriptions of how components are going to be tested.

After the adjustments done in the consortium, with some partners leaving the project and some of them being responsible of certain components, adjustments needed to be done to fill the missing gaps. As a result, some extra time will be required to close the evaluation definition, especially after the appearance of a new partner (MAPS) with a new component taking the place of another from ALWA. Part of the information related to this component will be included in future deliverables once it has been integrated.

On the other hand, due to the scheduling of the activities of WP3 and the submit month of this deliverable, the results of the *Experimental Plan*, which is part of T3.5, will be reported in future deliverables too, either from WP3 or from WP5.

And regarding the current line of deliverables, D5.8 will be the last one, including the results of the evaluation of the entire project, to be submitted in M42.