Empowering local renewable energy communities for the decarbonisation of the energy systems

D4.3 – Field Implementation and Data Monitoring Report I

09 June 2023

This project has received funding from the European Union's Horizon 2020 Programme under the Grant Agreement no. 957819

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15/02/2023	V1.4	Inputs from Andrea Gabaldón (CARTIF)	5th draft
17/02/2023	V1.5	Format editing and deliverable consolidation. Hanna and Edvard Nordlund (FLEXENS)	Final version for peer-review
27/04/2023	V1.6	Hanna Nordlund (FLEXENS), Demo teams, Alberto Belda (CARTIF)	Update according to latest progress and status in the demos until March 2023 (M23). Final consolidation (first submitted version)
09/06/2023	V1.7	CARTIF	Revised version

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Executive summary

The LocalRES project aims to demonstrate innovative renewable energy solutions at a local level. This deliverable document serves as the first of three reports on the progress of field implementation and data monitoring concerning the demonstration actions in the LocalRES project. In the introductory part of the report, the background and purpose of the report are described. In addition, the relation between T4.3 and D4.3 with other tasks and deliverables is elaborated, and the contribution by each partner is specified.

The document includes a general overview of the global and project's internal developments that have affected task 4.3, which is responsible for producing the reports. Furthermore, both the field implementation and data monitoring statuses are reviewed by demo, specifically action-by-action, including information on the progress completed until the end of month 23 (i.e. March 2023). The level of completion of each action is indicated as a percentage, and a traffic light symbol illustrates the status regarding the future implementation outlook. Ergo, this document aims to provide the reader with a clear understanding of the developments in the reference period and how they potentially might affect the project and its schedule. Between the submissions of the different monitoring reports and during task 4.3, this document is frequently updated and elaborated. This is to capture the chronological order of events and ensure that the provided information is up to date at the time of submission. It is important to note that this document includes the actual progress and situation in the demos until M23 of the project (March 2023).

Significant progress has been made in the demos during the first period of the project, especially in Ollersdorf and Ispaster. Ispaster has finished their action on E-mobility (*Action 3.4*), purchasing an electric vehicle for the municipality and installing two charging points. The citizen engagement activities (*Action 3.1*) have progressed very favourable, and the official constitution of the REC and legal register is expected by June 2023. The civil works associated to the extension of the district heating network (DHN; *Action 3.2*) was completed by December 2022, including the preparation of the connection to three public facilities and eight flats above the, and the effective connection of the three public buildings is expected soon. The update and upgrade of the monitoring and management system (*Action 3.7*) is on track, and the installation of new PV systems (*Action 3.3*) is planned to start by the end of summer 2023, and the first activities regarding policy recommendation (*Action 3.8*) and business models (*Action 3.9*) have taken place during this period, too. In Ollersdorf, the REC has been registered as a legal entity, being one of the first RECs officially constituted in Austria, and the citizen engagement activities have been regularly organized with very positive results (*Action 4.1*). The future energy scenarios have been finished and shared with local actors (*Action 6*), and the installation of the smart ICT infrastructure is done, and only the commissioning is pending (*Action 4.2*). The implementation of control algorithms and blackout strategies (*Action 4.3*) and the new community information system (*Action 4.4*) are also progressing as planned. Berchidda has had an active community engagement with good results (*Action 2.1*) and have done technical surveys in potential households for the heat pumps that are waiting for quotations (*Action 2.4*). Positions for the installation of EV infrastructure (*Action 2.3*) have been decided, quotations have been received and other paperwork is currently being done. In Kökar, the

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contributions to Åland sustainability Agenda (*Action 1.1*) have included the assessment of long-term decarbonisation scenarios and the definition of a REC-based use case, potentially replicable in the region. The prefeasibility studies and pre-engineering plans have been performed (*Actions 1.3-1.8*) and the community has been engaged through workshops and informative sessions (*Action 1.2*). Finally, SEMS for residential house have arrived recently (*Action 1.6*).

However, several deviations have occurred, with significant impact on the development of the actions in some cases. The major deviations have been a legal process in Kökar, which has caused the effective pause of the implementation on municipal grounds and the subsequent ongoing revision of the way forward of the demo (*Actions 1.3-1.8*), a new regulation in Austria that makes the P2P activities in Ollersdorf unfeasible as initially planned (*Action 4.5*), and, in general, the global context during this period, that has implied an energy crisis, shortage of components or limited availability of materials, which have affected the original plans of the demonstration actions and consequently their effective development during this initial phase of the project. In consequence, some of the actions in the demos have been significantly delayed. In several cases, these delays have been already solved by applying effective mitigation actions. In others, additional mitigation measures and contingency plans have been defined in the document, including the exploration of commercial alternatives with higher availability and lower prices, searching additional funds to cover extra costs, or making progress in the preparation of the actions so that the implementations can be faster and with shorter times.

In summary, the Consortium of LocalRES project needs to maintain the close monitoring and active management that has been carrying out so far to steer the demos over the perceived issues. Mitigation actions need to be taken promptly to address the identified risks, and frequent communication must be upheld to stay on top of the task and react swiftly when situations arise, as done during this first period. The document's findings highlight the importance of proactive risk management and contingency planning in complex projects such as LocalRES.

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List of acronyms and abbreviations

BESS	Battery Energy Storage System
CHP	Combined Heat and Power
CP	Contingency Plan
DSO	Distribution System Operator
EV	Electric Vehicle
GA	Grant Agreement
HP	Heat Pump
ICT	Information and Communications Technology
LPG	Liquid Petroleum Gas
MA	Mitigation Action
MEVPP	Multi-Energy Virtual Power Plant
N/A	Not Applicaple
P2H	Power to Heat
P2P	Peer-to-Peer
PV	Photovoltaic
REC	Renewable Energy Community
RES	Renewable Energy Source
SEMS	Smart Energy Management System
STO	Scientific and Technical Objective
TESS	Thermal Energy Storage System
°C	Degrees Celsius

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1/ Introduction

The LocalRES project will deploy innovative local energy systems driven by Renewable Energy Communities (RECs) for a socially fair energy transition that puts renewable energy into the hands of communities and people.

LocalRES includes four demonstration cases in remote communities across Europe (in Kökar, Finland; Berchidda, Italy; Ispaster, Spain; and Ollersdorf, Austria), where the LocalRES concept will be deployed, and innovative local energy systems will be demonstrated promoting a sector-coupling approach. The systems are expected to be able to interconnect and optimise the joint operation of different energy vectors (e.g. electricity, heating), maximising the contribution of Renewable Energy Sources (RES) and enhancing the energy system flexibility and security of supply. This document belongs to Work Package (WP) 4 of the project, which is responsible for implementing the project's pilot demonstration actions.

Figure 1: LocalRES demo sites

The first task in WP4 (T4.1) produced the deliverable D4.1, *KPI-driven evaluation framework and baseline*, which included the creation of an evaluation framework, definition of Key Performance Indicators (KPIs), and calculation of the baseline scenario. Task 4.2 produced D4.2: *Detailed demonstration plans*, which included an initial version of the actions' schedule, installation plan, training plan, safety measures, and responsibilities and roles. The present document (D4.3: *Field Implementation and Data Monitoring Report I*) belongs to T4.3 and constitutes the first out of three deliverables dedicated to monitoring and reporting the implementation progress of the demonstration plans from D4.2, including ongoing and completed tasks, deviations and mitigation measures.

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Task 4.3 is responsible for implementing the different actions in the demonstration sites, including the acquisition, installation and commissioning of all components and functionalities according to the deployment plan, as well as the follow-up of progress and monitoring of the activities. The demonstration actions proposed to be implemented in this project, and which will be followed-up on in this deliverable, are summarized in the following table (Table 1):

Table 1: List of demonstration actions

1	**Kökar demonstration site actions**
1.1	Contribution to the development and sustainability agenda for Åland (by reducing CO2 emissions and increasing the RES share).
1.2	Community engagement.
1.3	Renovation of the school's heating system, from an oil-based system to a hybrid heating system including thermal storage, HPs and micro-wind.
1.4	Solar PV panels for the school.
1.5	Micro-wind system for the school.
1.6	Smart Energy Management System (SEMS) for the school and demo households.
1.7	Public charging station for Electric Vehicles (EVs).
1.8	Solar PV system, battery storage and smart EMS in the Elderly (nursing) home.
2	**Berchidda demonstration site actions**
2.1	Community engagement.
2.2	Energy storage with optimised community logic.
2.3	E-mobility, by installing EV infrastructure with Vehicle-To-Grid (V2G) capabilities.
2.4	Uptake of RES: potential installation of PV, wind turbine, HPs.
2.5	Smart management of the distributed energy sources.
3	**Ispaster demonstration site actions**
3.1	Community engagement.
3.2	Upgrade of the DHN and connection of new customers.
3.3	Expansion of the micro-grid through the installation of new PV.
3.4	E-mobility through the installation of EV-charging infrastructure and the purchase of an EV.
3.5	Power to heat in residential buildings, replacing existing fuel-based systems.
3.6	Electric storage.
3.7	Smart control, monitoring and management.
3.8	Policy recommendations, in social acceptance, financial or regulatory issues.
3.9	Business model innovation.

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4	Ollersdorf demonstration site actions
4.1	Community engagement.
4.2	Implementation of smart ICT infrastructure for the smart operation of the local energy system.
4.3	Implementation of control algorithms and blackout strategies.
4.4	Community information system.
4.5	Blockchain-based P2P trading / accounting.
4.6	Future energy scenario and impact of scaling up.

The progress of all milestones (steps in demonstration planning listed in D4.2) and demonstration actions (listed in Table 1) are followed up using the indicators presented below:

Table 2: Legend for action monitoring

Legend of actions' progress:	
	smoothly running
	aspects to be monitored
	significant issues to be faced

An action will be considered *smoothly running* when progressing on time and there are no obstacles hindering the implementation. *Aspects to be monitored* indicate that a task or an action is not progressing as planned. In addition, there can be an obstacle that needs to be monitored closely (but does not hinder the implementation). Finally, the indicator *significant issues to be faced* will be included whenever relevant aspects such as budget issues, lack of communication, significant uncertainty of the future of an action, etc. will be affecting the implementation or activity of a demo site's "Demonstration Plan". The status indicators will be represented by an intuitive colour code to visually show the status, as shown in Table 2. Whenever the status is yellow or red (i.e. *aspects to be monitored*, or *significant issues to be faced*), a mitigation plan will be proposed by the System Integrator and/or demo site leader. It is to be noted that, for simplicity, throughout the document only the coloured symbols have been used, while the associated meaning has been omitted

Active information exchange between demonstration sites and challenges are solved in collaboration through bi-weekly meetings. This task is also responsible for monitoring the deployment of the demonstrations. The monitoring campaign, expected when all components have been installed around M32, will last at least one year, during which the system's operation will be monitored, and data needed for impact evaluation is gathered. For that reason, digitisation activities within the demonstration actions are also part of this task, and included in the planning avoid delays in the collection of the required data. Also, the preparation of the necessary user interfaces is also part of the task. The current status of the actions is continuously compared against the planning, and measures are proposed in case any deviation is identified.

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1.1. Background/purpose of the report

As part of the LocalRES project, demonstration actions in four sites in Finland, Italy, Spain, and Austria will be implemented, and generated data will be monitored to create a Renewable Energy Community (REC) via the Multi Energy Virtual Power Plant (MEVPP) approach. Following figure shows the demo teams in each demo site (Figure 2). For **Kökar (Finland)**, the demo team consists of Flexens (demo responsible), Kökar municipality and VTT. In **Berchidda (Italy)**, the demo team is formed by R2M (demo responsible), AEC (Municipality of Berchidda), and GridAbility. In **Ispaster (Spain)**, the demo team is constituted by Barrizar (demo responsible), Ispaster municipality, Aiguasol and Tecnalia. Lastly, in **Ollersdorf (Austria)**, the demo team consists of AIT (demo responsible), Ollersdorf municipality, Energie Kompass and University of Passau.

Figure 2: Demo teams in LocalRES project

This document constitutes the first *Field Implementation and Data Monitoring report* for the four LocalRES demonstration sites. The purpose is to provide the reader with tools for understanding the status and progress regarding the demonstration actions and the reasoning for how it has played out. This deliverable document is the first of three *Field Implementation and Data Monitoring* reports submitted in M18, M32, and M46.

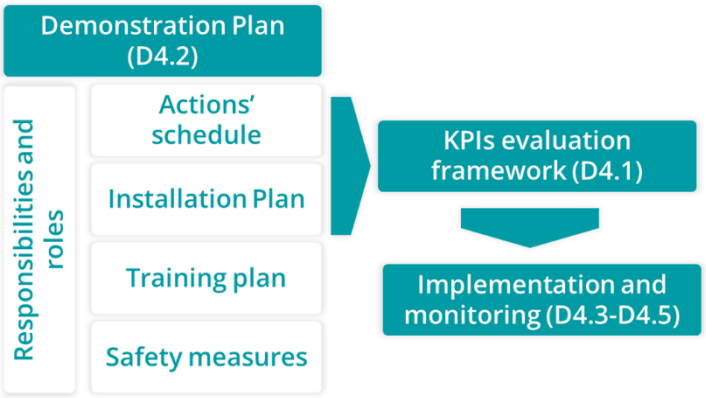

Figure 3: Overview of links among Tasks 4.1, 4.2 and T4.3

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1.2. Relation to other activities of the project

WP4 plans, implements, and monitors the demonstration actions in the four project demo sites in Finland, Italy, Spain, and Austria. The demonstrations aim to address technical and non-technical challenges in different community contexts and locations, contributing to the 4th Scientific and Technical Objective of the project (STO4): *to demonstrate solutions for the decarbonisation of the local energy system in 4 different EU contexts*. The target is to: *i) reduce 50% the energy grid exchange; ii) meet a RES contribution of 60%; iii) save 20% of the end-user's energy bill, and iv) deliver energy and CO_2 emission savings of 25%.*

This deliverable is responsible for following up and assessing the demonstration activities described in Task 4.2. The current status will be compared against the planning, and measures will be proposed if any deviation is identified. The planning was done by considering the data architecture, software design, and ICT platform testing defined in WP3. In Table 4, the relation between Task 4.3 and other tasks in the project is listed. Moreover, in Table 4, the connection between D4.3 and other project deliverables can be obtained.

Table 3: Relation of Task 4.3 to other tasks

Tasks	Relation
Task 3.1.2.- User Interfaces Definition	In Task 4.3, graphical user interfaces for the REC members will be defined as stated in Task 3.1.2, including the recommendations and examples on UX design, wireframes, personas and required data and functional analysis.
Task 4.1.- Demonstration actions KPIs definition and baseline studies	The baseline situations described in Task 4.1 constitute the starting point in the demo sites, which will be changed according to the demonstration plan presented in Task 4.2, and implemented in Task 4.3. Its implications for the project objectives will be evaluated using the framework and KPIs defined in the scope of Task 4.1.
Task 4.2.- Detailed demonstration planning	The detailed demonstration Plans to be implemented in the scope of Task 4.3 were initially defined in Task 4.2, including specifications of equipment, communication interfaces, needed changes to existing installations, etc. Also, adaptations and further details on equipment and activities at each demonstration site will be made as part of Task 4.3, including the revision of schedules and the reporting of the progress compared to the plan of Task 4.2.
Task 4.4.- Technical validation of the MEVPP and demonstration actions	Once all the demonstration actions will be implemented in Task 4.3, the operation of the new assets will be validated, ensuring that they fulfil the technical objectives in remote operation. The validation of the MEVPP operation in the demos is one of the critical points of this task.

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Table 4: Relation of D4.3 to other deliverables

Deliverables	Relation
D3.1.- Monitoring, standard data model, and interfaces report	The Demonstration Plans were created based on D3.1 requirements, which will be integrated into the different demonstration actions. Additional aspects regarding digitalisation requirements are also contained, including data architecture, data storage or communication interfaces.
D4.1. - KPI-driven evaluation framework and baseline	The demo actions and functionalities described in this deliverable will be assessed using the KPIs and evaluation framework contained in D4.1.
D4.2. – Detailed demonstration plans	The field implementation reports D4.3-4.5 will assess how well the Demonstration Plan in D4.2 was followed, and include any required adaptation or modification, reporting progress and deviations, and proposing mitigation measures.
D4.4 – Field implementation and data monitoring report II	D4.4 will constitute the update of D4.3, including the following up and assessment of the demonstration activities during the intermediate phase of the project compared to the planning.
D4.5– Field implementation and data monitoring report III	D5.5 will be the last version of D4.3 and continuation of D4.4, reporting the progress of demonstration activities during the last phase of the project.

1.3. Contribution of partners

The contribution of each partner to this deliverable is outlined in Table 5.

Table 5: Partners involved in Task 4.3, and their respective contributions

Partners	Contributions
Flexens	Main responsible for overall deliverable writing and the procurer of SEMS for the Kökar demo.
N/A (prev. Kökar mun.)	System Integrator and leading procurer for Kökar demo.
R2M	Demo leader and primary deliverable author for the Berchidda demo.
Barrizar	Demo leader and primary deliverable author for the Ispaster demo.
AIT	Demo leader and primary deliverable author for the Ollersdorf demo.
Demo team Kökar	Demo team supports the collection of data and information necessary for writing the deliverable and implementing the actions.
Demo team Berchidda	
Demo team Ispaster	
Demo team Ollersdorf	
CARTIF	Overall review of the document and progress of the demos. Support on coordination of the tasks.

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1.4. Progress overview

Despite the present document was prepared and updated during 2022 and the first months of 2023, the final consolidation was completed at M24 of LocalRES project (see Figure 4), including the progress performed until M23. At this point, most of the preparatory work has been done in all demos, and the implementation of the demonstration actions for each site should be well underway. However, there have been very relevant obstacles which have significantly affected the initial plans and expected progress regarding the implementation of the activities in the demo sites.

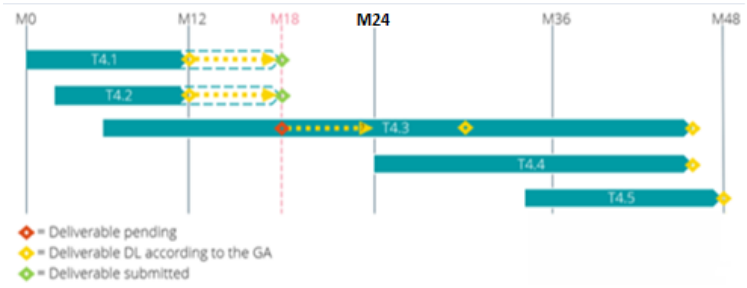

Figure 4: LocalRES WP4 timeline

The project started amidst the COVID-19 crisis, which heavily impacted global logistics and supply chains, making raw materials and feedstocks scarce and reducing regular day-to-day interactions to a minimum. The consequences have been shortages in stock, long delivery times and raised prices for essential technologies, such as electrical components, that are needed in all demo sites. Furthermore, the initial onsite activities, both technical and social (e.g. recruitment and engagement of local actors), were very limited and had to be postponed and/or adapted due to the COVID restrictions, as part as the continuous follow-up and assessment performed both at demo and work package level.

Additionally, the global energy crisis in Europe derived from the armed conflict in Ukraine has drastically affected stocks, production, prices and worries about sufficiency, contributing to a steeply rising inflation. Moreover, the crisis has led to a high demand for energy efficiency services and self-production equipment, increasing the cost of installation work and hardware, and reducing their availability. As a result, in-budget procurement for LocalRES demo sites has been even more complex, and required different mitigation actions to avoid or minimize the impacts.

Risks are identified per demo site to address these issues, and mitigation actions are proposed. The most relevant aspects related to data monitoring plan for each demo regarding the period under evaluation is included in section 3/. It is to be noted that, considering that monitoring strongly depends on the completion of the demonstration actions the information is limited due to the early stage of development during this first phase. Additional aspects related to monitoring including digitization, user interfaces or actual data records will be further developed in next deliverables (i.e. D4.4, D4.5).

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2/ Field implementation

This chapter presents, by demo site, the status of the planned field implementation activities and explains the main issues related to the progress. The completion of each demo action is estimated on a scale from 0 to 100%, and explanatory comments are provided respectively.

2.1. Field implementation in Kökar

Disclaimer: As already stated above, please, note that this deliverable contains demo updates until M23 of LocalRES project. Due to a legal process the way forward for the demo site is under revision.

During the months being reported, the critical roles in the demo team required to ensure successful deployment and agreed operation quality were as follows, as defined in D4.2:

Table 6: Roles & Responsibilities in Kökar Demo

Role	Name	Responsibility
Project Manager	Kökar Energy Group	Responsible for communication, schedules, resourcing, etc.
System Integrator	Kökar Municipality	Responsible for the documentation procurement, licenses, permissions, etc.
Installation Manager	Kökar Service	Responsible for the fluent execution of the installation work for many of the demo hardware.
Demo Leader/Advisor	Flexens	Responsible for overseeing the project's progression and providing additional expertise on the project execution. Additionally, the responsible for the SEMS procurement for private households.

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The planned timetable for Kökar is presented in Table 7. As can be seen, it is generally delayed and a further delay is expected until the ongoing legal process regarding Kökar's involvement in LocalRES is solved (see section 2.1.3 for further information). The progress towards all relevant milestones is either on hold or not started (pending), therefore the expected dates are still to be determined (TBD).

Table 7: Timetable for the Kökar demo as presented in D4.2 compared to current time

Milestones	Deliverable	Responsible	End Date	Status & Actual/ Expected Date	Mitigation action	Contingency plan	Monitoring
Permitting	Building permit (Environmental permit)	Project Manager	27/6/2022	On hold (delayed 1+ year) / TBD	Provide the authorities with a sufficient amount and high-quality materials.	Keep in close contact with the authorities and provide them with sufficient support.	
EIA	EIA document	Project Manager	27/6/2022	On hold (delayed 1+ year) / TBD	Put effort into proving that it is not needed.	Continue with everything else, and try to speed up the process when possible.	
Procurement	Tender review	Project Manager	27/6/2022	On hold (delayed 1+ year) / TBD	Publish the tender material early and with high quality.	Add a new deadline with sufficient time for proper tendering.	
Installation	Receipt of installation	Installation Manager	31/10/2022	Pending (delayed 1+ year) / TBD	Make sure the installer has enough resources.	Have a secondary contractor sourced if the primary has problems.	
Transfer to operation	Notification of transfer	System Integrator	1/1/2024	Pending (delayed) / TBD	Commence enough tests before.	Add a new deadline with sufficient time for tests.	
Monitoring	Monitoring reports	Demo Leader	28/2/2025	Pending (delayed) / TBD	Start drafting the reports early on and keep them up to date.	Request for new deadline early ahead.	
Handover	Signed contract	Demo Leader	30/4/2025	Pending (delayed) / TBD	Ensure sufficient training for end-user.	Agree on new DL after the training is finished.	

The progress of the timetable will be monitored along the development of the document and task 4.3. Once the court administration has a resolution for Kökar the timetable will be updated.

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2.1.1. Implementation status summary – Kökar

The implementation status in Kökar is summarized in Table 8.

Table 8: Summary of the implementation status of the demonstration actions in Kökar

ID	Demonstration action	Status (0-100%)	Comments	Monitoring
1.1	Contribution to Åland sustainability Agenda by reducing CO_2 emissions and increasing the RES share	30%	Assessment of long-term decarbonisation scenarios and definition of a REC-based use case for Kökar potentially replicable in Åland. Additional progress once other activities are done.	
1.2	Community engagement	30%	Many information-sharing sessions have been held, and several task-specific workshops as well. Yet, active engagement will continue throughout the project.	
1.3	Renovation of the school's heating system, from an oil-based system to a hybrid heating system including thermal storage, heat pumps and micro-wind	10%	Pre-engineering plans are under development, and some offers for heat pumps and the micro wind turbine have been received, but the feasibility of the thermal storage is uncertain (more details in section 3.1.2).	
1.4	Solar panels for the school	10%	Pre-engineering plans are under development, but the panels and inverters have received no offers.	
1.5	Micro-wind system for the school	10%	Pre-engineering plans are under development, but no offers for the turbine have been received.	
1.6	SEMS for the school and demo households	50%	After a long wait, the devices were just received (M23), and the installers tendered. Installation in private households on hold.	
1.7	Public charging station for EVs	10%	Pre-engineering plans are under development, but no offers for the charger have been received.	
1.8	Solar PV system, battery storage and smart EMS in the Elderly (nursing) home	10%	Pre-engineering plans are under development, but no offers for the equipment, other than EMS, have been received.	

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2.1.2. Description of activities performed until M23 - Kökar

Although the implementation of technology-based actions of the demo site have not started, the following activities have been performed in the period M1 to M23 to ensure a successful implementation of the technologies: pre-feasibility studies of alternative options, legal and administrative documents, negotiations with the suppliers, and business model studies. The details are the following:

Action 1.1.- Contribution to Åland sustainability Agenda by reducing CO_2 emissions and increasing the RES share

Any demonstration action that will be implemented on Kökar will contribute to fulfilling the goal of making progress on the sustainability agenda as the goals of the agenda are in line with the overall outcomes of LocalRES actions: reducing emissions of greenhouse gases and increasing the share of RES. As no actions have been implemented this far, there is no tangible progress on this action yet. Nevertheless, different studies contributing to achieving the agenda have been carried out, including organizing workshops and information sharing to align the agenda with the community needs, co-creation sessions of community goals and scenarios, assessment of long-term decarbonisation scenarios in the island, or the co-design of a REC-based use case with local stakeholders which could be replicated in similar contexts in the region, both from a methodological perspective to promote the REC-based systems, and in terms of the specific configuration of energy assets, services and interactions between local actors.

Action 1.2.- Community engagement

In order to engage the community of Kökar, the goal is to have frequent two-way communication and workshops that allows the locals to take part of information and keep them engaged. So far, different informative sessions and open discussions with citizens regarding the project took place, and one workshop for WP1 regarding REC-based business models and another one for the co-design of the Planning Tool (WP2) have been held (additional information about the citizen engagement strategy can be found in .2.1.5). Thus, engaging the locals has been done in time and all workshop arrangements have been successful. Furthermore, the delays in project implementation due to the complaints towards the project has increased citizen participation within the held events, with very active and positive participation from many participants.

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Figure 5: Participatory session for the co-design of the Planning Tool in Kökar, Karlby school.

Action 1.3.- Renovation of the school's heating system, from an oil-based system to a hybrid heating system including thermal storage, heat pumps and micro-wind

Despite the court process is still ongoing, negotiations with the technology providers have been conducted, as well as prefeasibility studies and a detailed engineering design to install and integrate the technologies. Mainly due to inflation, and other factors, the price of the thermal storage was greatly increased, and negotiations for a better price have taken place. Nevertheless, as the court process affects this action, the implementation is on-hold. Due to the delays and the cascading impact on grant budget, the heat storage will face very significant challenges with the implementation from an economic perspective, and at the time of writing the feasibility of this solution was seriously jeopardized. Nonetheless, sophisticated modelling to prove the business case of the storage has been carried out by Flexens. In the figure below, the foreseen operation of the optimized heat storage can be visualized. On the left, it can be seen that PV and wind generation is used to charge the storage to a certain extent, which is later discharged once the heat demand increases. On the right, the SE3 spot price is seen in light blue, and that the storage is being charged during cheap hours and vice versa.

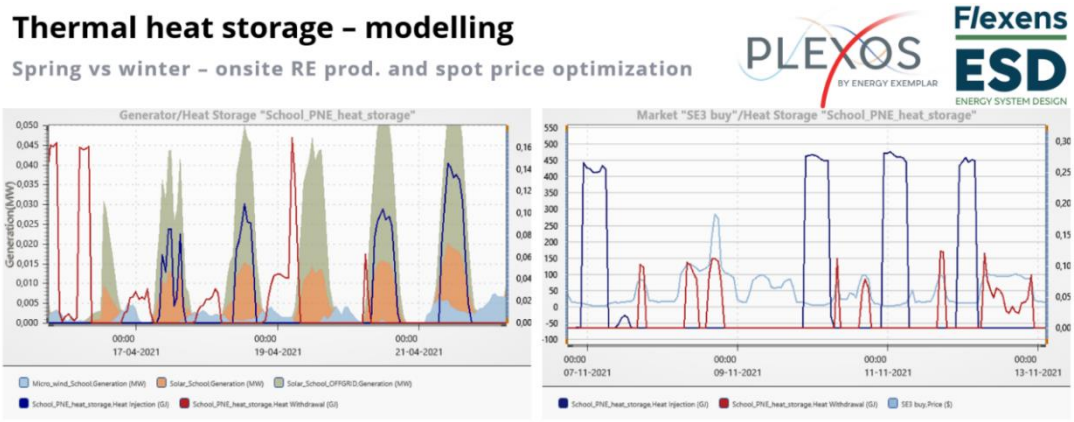

Figure 6: Thermal heat storage modelling for Kökar

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Action 1.4.- Solar PV panels for the school

This action is on-hold due to the court process, but negotiations with the technology providers have been conducted, as well as prefeasibility studies and a detailed engineering design to install the technology.

Action 1.5.- Micro-wind system for the school

An analysis of the design of the wind turbines (horizontal versus vertical axis) has been conducted. The feasibility studies were performed as well as detailed engineering design for installing the technology. Nevertheless, as the court process affects this action, the implementation is on hold.

Action 1.6.- SEMS for the school and demo households

The devices for the demo households have been selected and ordered, and recently arrived to Flexens premises (M23, March 2023) with a substantial delay in delivery times (original expected arrival on order date was November 2022). The installer has been selected and the installation was expected in Q1 2023 for private households, while the installation for municipal buildings has been put on-hold due to the court process. Nevertheless, after the periodic review, it has been decided that the installation should wait until there is confirmation on the next steps for the Kökar demo site in the project.

Action 1.7.- Public charging station for EVs

This action is on-hold due to the court process, but detailed engineering design and feasibility studies have been performed (2 EV chargers at designated locations at the school).

Action 1.8.- Solar PV system, battery storage and smart EMS in the Elderly (nursing) home

This action is on-hold due to the court process, but detailed engineering design and feasibility studies have been performed.

In general – Overview of activities and events

Despite the ongoing court process, and although municipal procurement actions are not possible, other activities related to technical planning can be conducted, and tendering for the equipment can be opened. The progress made for Kökar within the project has been the following:

Q1-2021, Kökar energy group is formed on behalf of the municipality to review and implement the proposed energy project. All the planning and inventory of technical installations to ensure that existing installations work with the intended solution is done. Furthermore, an investigation of how the project will affect society and the environment is done, as well as preparation of the project budget.

Q2-2021, the agreement is signed by Kökar Municipality. Applications for economic grants for the project from Åland's regional government are made. Budget presentations with attached quotations to Åland's regional government, budget, schedule, and planning are put together. Lastly,

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preparation of the basis for hiring internal/external staff for the project is done. In Q1 2021, the project was appealed.

Q3-2021, pre-planning work for new technical installations that needs to replace old installations to function with the technical and environmental limitations on the island is made. The production budget and project time schedule is put together and adjusted to the new technical solution (as reflected in the first project amendment, approved by Q4-2021.

Q4-2021, the information meetings with power grid owner Ålands El Andelslag "ÅEA" about the project are held. Also, technical data and documents for the registration are prepared. The registration to grid owner Ålands El Andelslag "ÅEA" to get a permit for the planned installations is made, and the advance notice is answered and approved with restricted power levels.

Q1-2022, the production and compilation of building permit basis and the environmental inventory report is done, as well as preparation of request documents for public procurement contracts and materials in "Ålands portalen", "HILMA Finland" and "TED".

Q2-2022, several meetings are held to request documentation and review the building permit applications and environmental inventory report in order to gain legal force after a court decision. All request documents to "Ålands portalen", "HILMA Finland" and "TED" are downloaded.

In Q3-2022, while waiting for the court's decision, with FLEXENS Energy Design using PLEXOS energy system modelling software with certified specialists, a model over the planned installations is done, containing relevant energy prices, grid tariffs, technical operation and constraints of e.g. heat storage, and CAPEX and OPEX costs. This is translated to an economic analysis provided to the Kökar municipality to help understand the economic aspects of a delay in the process, changes in price, as well as the project's IRR dependence on the available grants. This material, combined with additional material from Kökar municipality, is also used to provide background to the court in their decision-making process. The energy modelling contains both the school, including heat storage (100 kW, 9 MWh), micro wind turbines (15 kW) and solar PV (50 kW), as well as the nursing home with battery storage (40 kW, 120 kWh) and solar PV (70 kW). The EV chargers are not modelled due to lack of local EV consumption profiles.

2.1.3. Issues affecting implementation - Kökar

The demonstration in Kökar has been severely stalled from its original schedule, as already summarized in previous sections.

The demonstration actions were planned to be implemented and prepared (permissions, EIA, and procurement) during June of 2022 and installed by the end of October 2022. After the installations, the data monitoring would start. By the time of writing this deliverable, the planned timetable is delayed and will be delayed further, as the procurement has not been completed yet. Consequently, the installation actions cannot begin as of now. Moreover, the data monitoring will also be delayed from the original schedule.

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The leading cause has been a series of implementation bans that have been in force for most of the project's lifetime. The local administrative court has enforced the ban as there have been some unclarities about the correctness of the municipality's decision-making process to participate in the LocalRES project. The appeal leading to the ban has been submitted by an individual belonging to the municipal council in Kökar. While the ban is in place and the administrative court has not officially resolved the issue, the municipality cannot make any investment decisions relating to the project. However, although municipal procurement actions are forbidden, elementary technical planning can be conducted and tendering for the equipment can be opened.

The current energy crisis and inflation are also negatively affecting the implementation actions as many planned technologies have gotten remarkably costlier than they were at the kick-off time. The inflated prices are seen in all demo actions, but the sand-based thermal energy storage system (TESS) from Polar Night Energy took the most significant toll. As of now, the TESS does not fit in the allocated budget, but negotiations with the technology suppliers are ongoing and substituting alternatives are being sought.

Despite there is a positive acceptance of the project and the actions towards the decarbonisation of systems among the vast majority of the inhabitants in the community (around 200 inhabitants), this process has been extended for months due to the overload of work in the court, and the subsequent actions from the plaintiff to keep extending the process, therefore avoiding the possibility of making any progress. To overcome this situation, first the whole administrative process was proposed to be repeated. However, additional complaints were immediately made, which resulted in a longer process and eventually an injunction from the court which effectively stopped the activities of Kökar in the project. During the first iterations, the process was expected to be solved in a couple of months. In October 2022, the court informed that the final decision would be released by the end of the year. However, in January 2023, the court again postponed the final decision, with the earliest expected date for a resolution being March 2023.

This unfortunate situation has resulted in very valuable lessons about how to handle an appeal and how it can affect similar projects like LocalRES. Therefore, key learnings on how to avoid similar issues in future projects is an important outcome of the Kökar demo site so far, which was not foreseen in the start of the project.

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2.1.4. Mitigation plan - Kökar

Table 9: Risks and plans to solve them for Kökar demo site.

Risk	Probability to happen	Impact of the risk	Mitigation action (MA)/ Contingency plan (CP)	Deadline to foresee the MA or CP
TESS cannot be foreseen as an action	Medium	Demo action 1.3 cannot be completed.	Negotiate with the supplier and source an alternative solution.	If by M24 (04/05/2023), the issue has not been solved, the alternative will need to be considered.
Unfavourable court decision	Low	Kökar needs to remake the decision to take part.	Re-vote to participate in LocalRES to replace the faulty one.	The re-vote has already occurred before the court decision.
Severely delayed court decision-making process	High	Kökar demo becomes unfeasible.	Create a plan for Kökar to exit the project smoothly.	If by MS7 in M24 (04/05/2023), the issue has not been solved, the CP will need to be considered.
Subsequent complaints	High	Further delay of the project implementations.	Informing the public and preparing answers to the most probable issues.	30 days from the moment when the complaint is submitted.
Lack of work force	Low	Delays in installation works.	Secure contractors early on and ensure sufficient resilience to common misfortunes.	By the time contracts are signed for the contractors.

Note: As previously stated, due to the legal process affecting the demo, the way forward for the Kökar site is under revision.

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2.1.5. Citizen engagement strategy - Kökar

Throughout the project, frequent two-way communication is expected to be upheld. Furthermore, the community engagement in Kökar will contribute to promoting people-powered renewables to other locations, which are in the abundance in the archipelago province of Åland. Engaging the locals has been done in time and all workshop arrangements have been successful.

Communication channels:

There is a "Kökar forum" Facebook group with 1,7k members with people either living on, or interested in, Kökar. This forum has been used in multiple occasions to share information regarding the project. For example, on March 2022 an informational video was posted regarding the energy survey (D4.1) which was physically mailed to each household on Kökar. In May 2022, FLEXENS posted about being present at Karlby school with open invitation to all citizens regarding an update on the project combined with the planned workshop. In addition to this, there was a news article on Smart Energy Åland regarding LocalRES linking to an 11-minute informational video about the project.

Activities/workshops:

Different informative sessions and open discussions with citizens regarding the project took place, which were especially intensified since the appeal in the court to provide clarity and allow for questions from citizens and local actors. Furthermore, one participatory workshop focused on the assessment of REC-based business models in the island (WP1) and another one for the co-design of the Planning Tool (WP2) have been held on site. Other workshops and co-design sessions were organized online with local actors, for instance for the preliminary definition of community goals and future community-based scenarios of interest for the local community. Additional workshops are planned to be arranged for locals to keep them informed and engaged.

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2.2. Field implementation in Berchidda

During the months being reported, the roles and responsibilities of the Italian demo team are summarised in Table 10 below, as defined in D4.2:

Table 10: Roles & Responsibilities - Berchidda

Role	Name	Responsibility
Project manager (PM)	GridAbility – R2M Energy	Responsible for communication, schedules, resourcing, etc.
System Integrator (SI)	GridAbility - R2M Energy – AEC	Responsible for the documentation, licenses, permissions, etc.
Installation manager (IM)	To be defined. Subcontracted by GridAbility/ R2M Energy/AEC	Responsible for the fluent execution of the installation work
Community manager	To be defined with the community	Formalisation of Berchidda REC
Energy Manager (EM)	R2M Energy	Provides additional expertise on the smart grid energy management

The demonstration actions in Berchidda demo site were planned to be implemented and finalised between February 2022 and mid-April 2023 as shown in Table 11. The traffic-light code on the last right column of Table 11 gives a quick overview of the progress of the main activities planned to meet the demonstration actions in Berchidda. As Table 11 shows, the engagement process is going as planned and proceeding well. However, some activities have been delayed due to changes in part of the demonstration actions that will be elaborated more in detail in the next sub chapters 0, 2.2.2, 2.2.3.

At the time of writing, the Berchidda pilot's coordinator just concluded the onsite surveys for the heat pumps design, and selected together with Berchidda Municipality the main strategic points of the town for the installation of the EV charging stations.

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Table 11: Timetable for Berchidda demo as presented in the D4.2 compared to current time

Phase	Deliverable	Responsibility	End Date	Status & Actual/ Expected Date	Mitigation Action	Contingency plan	Monitoring
Community engagement	Definition of engagement activities	PM / SI	14/02/2022	Done / 14/02/2022	N/A	N/A	
	Engagement sessions	PM / SI	13/04/2022	Done / 13/04/2022	N/A	N/A	
	Engagement document signature	PM / SI	15/11/2022	Done / 15/09/2022	N/A	N/A	
	REC creation	Energy4Com	15/12/2022	Pending / 09/2023	Intensify informative and engagement activities with citizens using relevant channels	Work closely with residents directly involved in the project, as a community	
Optimised community logic for the energy storage	Preliminary work and design	Berchidda municipality	15/03/2022	Pending / 07/2023	Work closely with the Municipality to help them with the design	Intensify communication with the municipality to make sure they stay on track.	
	Deployment of optimised logic	PM / SI	15/09/2022	Pending / 10/2023	Make as much progress as possible before the installation	Use pre-existing local private batteries	
Heat Pumps deployment	Households agreements	PM / SI	15/08/2022	In progress / 07/2023	Make residents sign during the onsite survey	Make a new round of on-site visits to make sure they sign it	
	Design and installation project	PM / SI	15/10/2022	Ongoing / 07/2023	Prepare preliminary design before onsite survey	Make the design based on documentation received	
	Financial paperwork	PM / SI	15/11/2022	Pending / 07/2023	Prepare request after obtaining quotation for HPs and installations	Find alternatives to the leasing options	

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Heat Pumps deployment	Submission of permits	PM / SI	15/11/2022	Pending / 07/2023	Talk to the municipality to be sure of the required documents	Work closely with the municipality to make sure that support and answers are provided	
	Heat pumps installation	PM / SI	15/03/2023	Pending / 09/2023	Choose a producer with immediate availability of the equipment		
E-Mobility	Preliminary work (analysis of EV chargers, capacity, etc.)	PM / EM	15/09/2022	Ongoing (on track) / 05/2023	Work closely with the Municipality (and DSO) to receive all necessary information	Contact other relevant actors to receive the required data	
	Financial paperwork	PM / EM	15/11/2022	Pending / 07/2023	Prepare the documentation in advance	Find alternative solutions to the leasing options	
	Submission of permits	PM / SI	15/12/2023	Pending / 07/2023	Talk to the municipality to support the process	Work closely with the municipality to make sure that support and answers are provided	
	Order and installation of EV chargers	PM / EM	15/03/2023	Pending / 09/2023	Choose an available product for the installation	Find two different suppliers	
Smart metering	Purchase and installation	PM / SI	15/11/2022	Pending / 09/2023	Linked to the HP installation	Install the smart meters independently of the heat pumps	

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2.2.1. Implementation status – Berchidda

The implementation status in Berchidda is summarised in Table 12 below.

Table 12: Summary of the implementation status of the demonstration actions in Berchidda

ID	Demonstration action	Status (0-100%)	Comments	Monitoring
2.1	Community engagement	40%	The project was promoted on different social media channels, and two public events and several targeted workshops have been organised. Communication and dissemination material have been prepared with ENC. More than 70 inhabitants have been contacted by telephone during summer 2022. One-to-one meetings with 35 potential participants were conducted in 12/2022.	
2.2	Energy storage with optimised community logic	5%	Considerably delayed due to Municipality's change of plans for the installation, and lack of additional funds. The option of using part of the budget for other actions was explored but was dismissed. Since M22, alternative funds are being explored to be able to complete this action.	
2.3	E-mobility, by installing EV infrastructure with V2G capabilities	30%	Positions for their installation have been decided and quotations have been received. R2M and AEC are working on the administrative urban permits and alternatives to leasing option.	
2.4	Uptake of RES: potential installation of PV, wind turbine, heat pumps	15%	The project will directly install heat pump systems that, in many cases, will be coupled with private investment into PV. Surveys have been conducted in December 2022 and quotations have been asked end of January 2023. Delays are also taking place due to the difficulties encountered to proceed with the leasing option initially foreseen for the installation of equipment. Thus, this option is not possible for R2M, and as a mitigation measure the budget available is proposed to be transferred to Berchidda Municipality, which would be in charge of purchasing the equipment Additionally, the municipality of Berchidda also planned initially installing other RES-based system outside of the project (e.g. centralised photovoltaic), but these actions may eventually be postponed due to the changes of priorities in the village associated to their local situation.	
2.5	Smart management of the distributed energy sources	0%	This demo action is linked to 2.4. The installation of the smart meters will be done at the same time of the heat pumps installation.	

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2.2.2. Description of activities performed until M23 – Berchidda

Action 2.1.- Community engagement

The first activities performed in Berchidda at the beginning of the LocalRES project were mainly focused on the citizen engagement to promote the project within the town, to let citizens know what the project will bring to the community and to recruit active participants willing to let us test the demonstration actions by installing heat pumps in their houses. Indeed, even though there is already a strong engaged community in Berchidda Municipality derived from a channel of trust led by GridAbility with the HESTIA project, R2M Energy, GridAbility, and AEC conducted a recruitment campaign specific for the LocalRES project to get consumers and prosumers on board for the demo actions. From February 2022, R2M Energy, with the help of GridAbility and support from AEC, discussed and planned its citizen engagement strategy. In March 2022 the project was promoted on different social media channels, such as the Municipality's telegram chat and official Facebook page, and a form for "Expression of interest" was disseminated through the municipality website, and several people applied.

Then, different workshops and events have been held in April 2022. A general presentation of the LocalRES project have been made during a public event addressed to the whole population in collaboration with MTU and the support of the Municipality's board members. An overview of the project's objectives, the specific activities that will be carried out in Berchidda and the benefits that the project can bring to the participants and the community have been explained during the meeting (see Figure 7). Furthermore, a participatory session to contribute to the co-design of the Planning Tool took place, allowing receiving relevant inputs and feedback. After the event, R2M Energy and GridAbility dedicated some time to answer to questions, doubts or give more specifications, and collected the signatures of the participants interested in actively joining the project and for the installation of heat pumps in their houses. The recruitment campaign continued by telephone during June-July-August 2022 where more than 70 citizens were contacted to promote the project. Out of the workshops and the phone calls, ~35 potential participants have been identified.

To raise awareness among young people on the issues of consumption, production, and better energy management, a workshop in the town's middle school was also organised in April 2022 to involve them and make them feel part of and protagonists in the energy transition (see Figure 8). The children were encouraged to share their own small daily habits for spending less or saving energy through questions and interactive games, and with great satisfaction and interest in the topic they participated actively. Finally, also in April 2022, a workshop dedicated and focused on women, that play an important role in the demand response mechanisms as they are, from Berchidda's statistics, the ones that spend more time in the houses, was also organised in collaboration with Hestia project.

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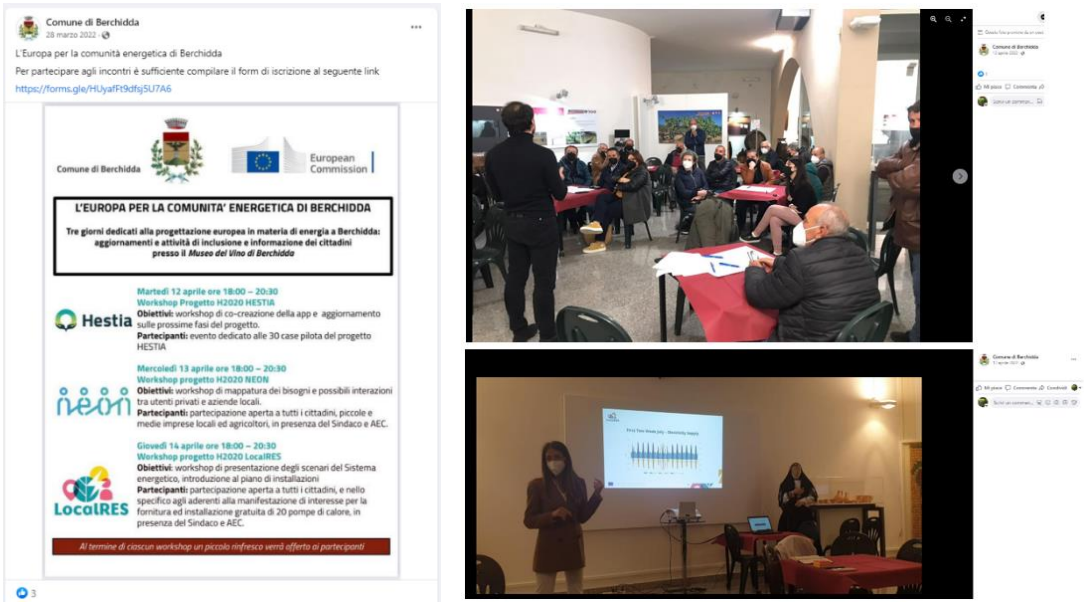

Figure 7: Posts to promote event (left) and photos of the event (right) posted on the Municipality's Facebook page

Figure 8: Posts of the workshops held in the town's middle school posted on the Municipality's Facebook page

Other parallel communication activities to support the community engagement campaign have been carried out, such as the preparation of a LocalRES Facebook page dedicated to the Berchidda pilot through the Municipality to get more visibility, and a local poster promoting the LocalRES project to be hanged in the municipality's hall and main square was designed with the support of ENC (see Figure 9) and is expected to be distributed in following months.

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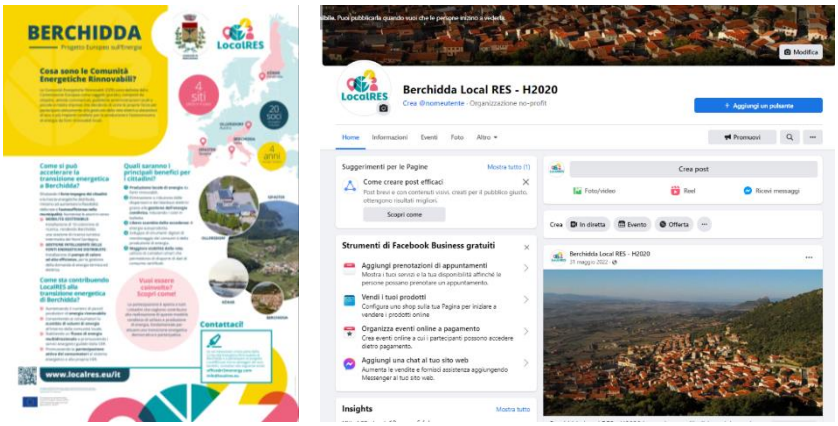

Figure 9: Local Poster (left) and Facebook page (right) of LocalRES for Berchidda

In October 2022, a workshop with the main business stakeholders and the board members of the municipality was organised and conducted in collaboration with AIT in the municipality's offices. Discussions and debates were carried out to assess the impacts and interests of stakeholders for the development of business models targeted specifically for Berchidda using a REC-centred approach (see Figure 10).

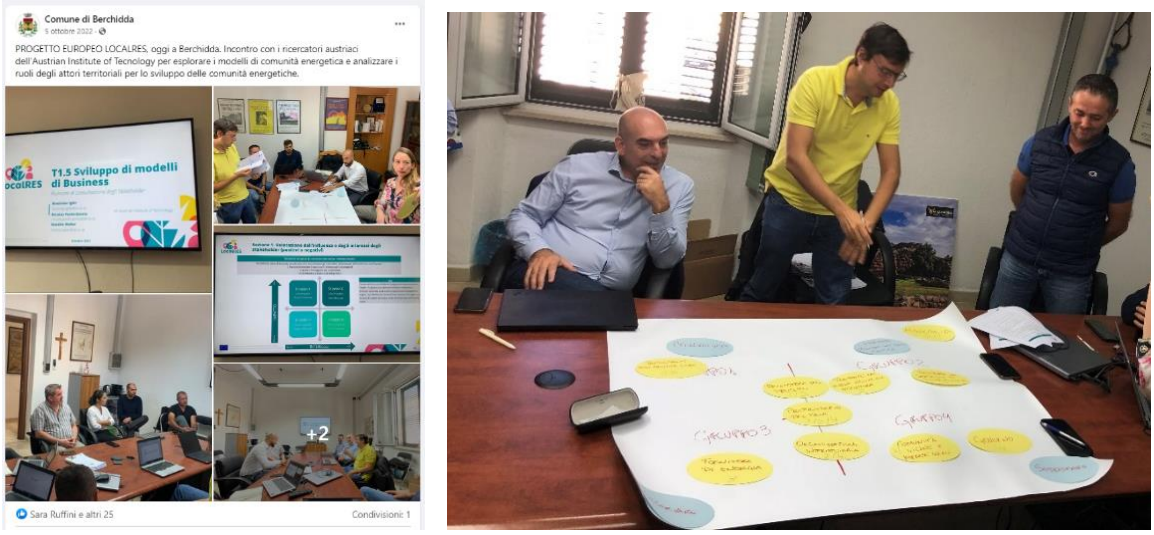

Figure 10: Post of the workshop posted on the Municipality's Facebook page

The last action performed within citizen engagement in this first period was the one-to-one meetings conducted in December 2022 with the inhabitants that expressed their interest in participating in the project. R2M Energy went directly to their houses to give them more details on the requirements and process to follow to participate, on the different steps of the project, and to perform technical surveys for the preliminary design and installation of the heat pumps.

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Action 2.2.- Energy storage with optimised community logic

Action 2.2 has suffered from major delays. Initially, as stated in the GA, Berchidda Municipality was planning to use their own funds to install four battery electrical storage systems of 50 kWh capacity each to optimise the energy fluxes of the community. However, for various reasons (i.e. war in Ukraine, energy crisis, decrease in equipment availability, and consequent increase of costs due to COVID-19, together with the Italian incentive "SuperEcoBonus" being removed which resulted in a change of priorities in the local interests), the city administration decided to postpone their installation in favour of more urgent grid maintenance and other public works. Therefore, in the upcoming months, R2M Energy, GridAbility and AEC worked on finding alternative solutions. At first, as mitigation action, some budget shifts between demonstration actions were being explored, while remaining within the total project budget dedicated to Berchidda for the acquisition of all equipment. This would affect the demonstration actions 2.3 and 2.4 and the pilot's predicted impacts, as the budget shifts would mean less installations of EV chargers and heat pumps, but this would have also potentially caused long delays in actions 2.3 and 2.4. As an alternative mitigation action, R2M and AEC will support the Municipality to explore other sources of funding, e.g. from national or regional incentives.

Action 2.3.- E-mobility, by installing EV infrastructure with Vehicle-To-Grid (V2G) capabilities

R2M Energy collected some quotations for EV chargers, and AEC discussed and decided with Berchidda Municipality in October 2022 which are the most strategic positions for electric vehicles to be recharged in the town to serve its inhabitants and make Berchidda an attractive recharging spot for tourists that travel from the eastern to the western side of the northern part of Sardinia. At the time of writing, delays have been encountered due to the difficulties to proceed with the leasing option initially foreseen for the installation of the EV chargers. Thus, this option is not possible for R2M, and as a mitigation measure the budget available is proposed to be transferred to Berchidda Municipality, which would be in charge of purchasing the EV Chargers.

Action 2.4.- Uptake of RES: potential installation of PV, wind turbine, heat pumps

R2M Energy worked on the steps towards the installation of heat pumps in different private houses to uptake RES in Berchidda. So far, the actions have been mainly concentrated in recruiting private households to install the heat pumps in their houses. Thanks to the intense community engagement and recruitment campaign started in March 2022 with the circulation of the form of "Expression of interest" on the Municipality's official website and reinforced by telephone specifically for the heat pumps in June-July-August 2022, R2M Energy collected approximately 35 potential participants among the 70 inhabitants contacted. During the next months, R2M Energy contacted different potential heat pump suppliers and in December 2022 conducted on-site technical surveys at 35 participant's houses to check if their characteristics, status, and documentation meet the regulation and the project's requirements with the installer of one of the potential suppliers. At the time of writing, R2M Energy is waiting for the quotations to understand how many final participants can be selected within the available budget and starting to prepare the necessary urban authorizations and leasing paperwork. The final collection and verification of the documents will

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determine the final ~9 -15 participants according to budget. In parallel, R2M Energy and AEC are collecting quotations from different suppliers to find better prices.

Regarding the financial aspects, it was recently found out that the leasing option initially foreseen for the installation of equipment was not possible for R2M, so, as a mitigation measure the budget available is proposed to be transferred to Berchidda Municipality, which would be in charge of purchasing the equipment. These difficulties on the leasing paperwork combined with the low availability of heat pumps (due to the high demand caused by the high number of renovations works triggered by the Italian incentive "SuperEcoBonus") and the long time of delivery of the engines may further delay their installation.

Additionally, as external actions outside of the project to complement the installation of heat pumps, AEC initially planned installing more centralised RES-based solutions such as a centralised PV system and potentially a wind turbine in the Municipality. These actions are still being evaluated, but considering the changes in the local context mentioned above, it is not clear whether they will be completed during the activity of the project or after LocalRES. In parallel, R2M Energy is also encouraging the population to install private PV systems, and to LocalRES participants to pair the heat pumps with private investment in PV systems to further deployment of RES.

Action 2.5.- Smart management of the distributed energy sources

Action 2.5 tackles the objective of covering the heating and cooling demand of the Municipality through the installation of heat pumps and the community batteries. As it is linked to the installation of the community batteries within the demonstration action 2.2, also this demonstration action will be partially affected in terms of smart management of the energy fluxes. Whereas for the installation of the smart metering and monitoring systems, this will be done at the same time as the installation of the heat pumps so it will follow the slight delay of the heat pump's installation, but other than that there are no other relevant issues that should affect this demonstration action.

2.2.3. Issues affecting implementation - Berchidda

As previously mentioned, the implementation of the actions in Berchidda within the LocalRES project has suffered significant delays compared to the initial planned timeline presented in D4.2 due to the events mentioned above (e.g. Covid-19, war in Ukraine and the consequent rise in energy prices) that forced the municipality of Berchidda to revise their priorities in the urban and energy plan, thus postponing some of the investments that should have complement the actions of LocalRES project for more urgent works. As previously stated and mentioned in D4.2, Berchidda Municipality decided to postpone the installation of the centralised PV system and the four 50 kWh storage systems at various locations in the municipality, in favour of more urgent grid maintenance and other public works. The centralised batteries are a key part of the demonstration actions as they affect directly the demo actions 2.2, 2.3, 2.4 and 2.5. As a mitigation action, R2M Energy, GridAbility and AEC initially discussed the option of redistributing the total budget in the demo to have all actions 2.2, 2.3, 2.4 and 2.5 with a reduced scope, but this would have potentially caused further delays in the rest of actions. Thus, an alternative contingency plan, negotiations with

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technology suppliers for BESS are ongoing, asking for a quotation that might be within the administration's budget. Furthermore, more funds are being sought from regional or national funds.

Additionally, in small towns of Italy like Berchidda, lots of dwellings do not have the documentation needed to be submitted for the urban permits requests to the municipality when major renovation works are performed like the substitution of the entire heating and cooling system of the house. Specifically in Berchidda, for the installation of air-to-water heat pumps or air-to-air heat pumps with a capacity higher than 12 kWp, the municipality asks for documents that most of Berchidda's houses do not have because they were not mandatory when the houses were constructed and/or they would require money to be produced now, which the inhabitants are not willing to pay as it would be more expensive than the heat pumps. So, it is most likely that among the participants recruited, lots of them might not have the documentation needed for the permits, causing delays in their submission and installation of the heat pumps. The documentation needed for the permits have started to be asked for in the recruitment phase, prior to inspections, to limit the possible risk that the houses being considered have no documents and can delay the process (see Table 13).

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2.2.4. Mitigation plan - Berchidda

Table 13: Risks and plans to address them for Berchidda demo.

Risk	Probability to happen	Impact of the risk	Mitigation action (MA) or Contingency plan (CP)	Deadline to foresee the MA
Municipality cannot install storage system with public funds (Action 2.2)	High	Action 2.2 cannot be demonstrated. KPI on Cumulative ESS will not be calculated.	AEC collected quotations from different suppliers and R2M is discussing the possibility to find alternative funds (e.g. from regional or national initiatives) to install the BESS.	As of October 2022, the Municipality declared that it would not be able to install the storage systems within the project timeframe, so R2M initiated the contingency plan.
Leasing paperwork delayed due to bureaucratic issues (Action 2.3 and 2.4)	High	EV charging and HP purchase and installation will be delayed.	Find alternative solutions to leasing.	As of February 2023, for R2M was not possible to pursue this option. As a mitigation measure, the budget available is proposed to be transferred to Berchidda Municipality, which would be in charge of purchasing the equipment.
Dwellings not up to standard	High	Longer timeline for submission of permits. Thus, delay in HP leasing request and installation.	Recruit and survey more participants than the project's target to have more choice in the selection phase. Install systems that need lighter documentation.	If by June 2023, after the second survey inspections, participants surveyed do not meet the project's requirements further surveys will be conducted in July 2023.
Long time of equipment's delivery	High	Delay in HP installation	Select a different supplier that has a short-term availability of the product.	If by July 2023 the equipment are not available, they will be requested to different suppliers
Energy monitoring System	Medium	Delay in EMS installation from the Municipality plan	R2M will install the EMS in the selected households	If by July 2023 the Municipality have not installed the EMSs, R2M will install them within HP installation

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2.2.5. Citizen engagement strategy - Berchidda

The citizen engagement strategy in Berchidda has been approached from different sides:

Communication channels:

- Telegram chat managed by the municipality to send all info related to the community, along with info and updates of the project;
- Facebook page specific to the project LocalRES for Berchidda prepared in May 2022 and will be launched during next months;
- Local poster prepared with ENC to promote the LocalRES project with its main activities, objectives, and benefits for Berchidda, to be distributed in following months;
- official form for participation published in the Municipality's website.

Working sessions:

- Participatory session in April 2022 with the population and the municipality's board members for WP2 to present an overview of the LocalRES project with its general objectives, activities, and benefits to the community, and to present the mockup of the planning tool developed within the project to carry out co-design activities with local citizens;
- Collaborative session in October 2022 for WP1 with the pilot's main stakeholders and the municipality's board members to analyze the possible business model development specific for Berchidda, prioritizing a REC-centered approach.

Workshops:

- Workshop in April 2022 conducted in collaboration with HESTIA project dedicated and focused on women that play an important role in the demand response mechanisms as they are, from Berchidda's statistics, the ones that spend more time in the houses;
- Workshop in the town's middle school, with an active interest and participation of the children, to interact with them on subjects such as renewable energies and buildings' consumption, understand which is their level of knowledge, and teach them the daily habits to consume less energy. A further aim of this workshop was to reach parents through their children.

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2.3. Field implementation in Ispaster

As stated in D4.2, The roles and responsibilities of the Spanish demo site are summarised in Table 14 below:

Table 14: Roles & Responsibilities - Ispaster

Role	Name	Responsibility
Project Manager (PM)	BARRIZAR	Responsible for communication, schedules, resourcing, etc.
System Integrator (SI)	BARRIZAR, ISPASTER	Responsible for the documentation, licenses, permissions, etc.
Data integrator (DI)	AIGUASOL	Responsible for integrating data from the monitoring systems with the pilot's database and with the platforms that require those data.
Installation manager (IM)	BARRIZAR	Responsible for the fluent execution of the installation work
Citizen engagement & social dynamization (CE&SD)	TECNALIA, AIGUASOL	Support on the social and technical aspects related to the establishment of the REC. Organization of sessions and preparation of material
Consultant on energy management and blackout Strategies	AIGUASOL	Provision of expertise on energy management

The technological actions in Ispaster were planned to be implemented between April 2022 and July 2023, but due to external factors such as the unavailability of equipment, increased prices, limited or delayed provision of material and devices, social distrust in new technologies due to the energy crisis or lack of additional funds, the initial plans actions were affected, resulting in delays of up to 6 months, approximately. Nevertheless, relevant progress has been made. The EV charging points were installed in August 2022, the public EV is available since July 2022, or the civil works for the DHN extension were completed in December 2022. Furthermore, the citizen engagement is progressing very favourably, and there has been agreement about the creation of the REC, expected to be legally formalized soon. Linked to this agreement, the locations to install about 100 kWp of PV have been selected among the new REC-members, and it is expected to start installation works by September 2023. Because of high prices for P2H systems, volunteers for the installation of the heat pump-based solution have not yet made up their minds but promotional and information activities are carried out with local residents committed with the REC or just with sustainability. Monitoring (definition of needed parameters) and communication are done for the current Scada system, and we will continue working as the rest of the actions are implemented. Finally, the initially proposed CHP system is not available commercially, and an alternative using woodchips is being searched. More details about the progress of the actions are provided in following sections.

The following Table 15 presents, in short, the timetable for the Ispaster demo as presented in D4.2:

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Table 15: Timetable for the Ispaster demo as presented in the D4.2 compared to current time

Milestone /action	Deliverable	Responsibility	End Date	Status & Actual/	Mitigation action	Contingency plan	Monitoring
Implementation plan definition	Demonstration Planning meeting	PM	23/12/22	Ongoing / End of actions	N/A	Continuous review and update of the plan.	
E-mobility	Distribute Project Plan	PM / SI	25/04/22	Done	N/A	N/A	
	The EV is purchased and the chargers installed	PM / IM	06/07/22	Done	N/A	N/A	
Enlargement of the DHN	Review Project Schedule	PM	03/05/22	Done	N/A	N/A	
	Civil works	PM / SI / IM	28/11/22	Done	N/A	N/A	
	Connection	SI / IM	05/05/22	Ongoing / 05/23	Meetings with the municipality to find the best design to minimize affecting private garages	Connection prepared for private dwellings above the public facilities	
Creation of the energy community	Develop matrix of resources/skills	CE&SD / PM	05/05/22	Done	N/A	N/A	
	Engagement sessions	CE&SD	09/12/22	Done / Last session with future REC members: 30/03/23	Continuous adaptation of the sessions to the local conditions and social acceptance. Set of fluent communication channels. Active contribution of members of promoter group in the preparation of sessions.	Organization of additional engagement sessions, including communication actions focused revised based on the results of the first round of sessions.	

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Creation of the energy community	Document signature	CE&SD / PM	02/02/23	Pending / 06/23	Biweekly meetings with promoter group since 09/02/22.	Creation of a WhatsApp group. Minutes of each meeting.	
	REC creation	CE&SD / PM	25/04/23	In progress / 06/23	N/A	N/A	
Smart control, monitoring and management	Identify pre-deployment activities	PM / SI / DI	18/04/22	Done	N/A	N/A	
	Monitoring Strategy´s definition	PM / SI / DI	13/07/22	Done	N/A	N/A	
	Smart control, data capture & expound, website	DI / IM / SI	23/12/22	In progress / 06/23	N/A	N/A	
Installation of new PV system	Stakeholders, budgets, funds	PM	08/04/22	Ongoing / 09/23	Prioritize new PV as the first action of the REC, including funds from members.	Search and apply for additional funding sources and local actors to be involved.	
	Permits for location(s) of the new PV systems	PM	01/12/22	In progress/ 04/23	Identify in advance all requirements for permits. Actively involve all relevant stakeholders to accelerate the process.	Evaluate the permits for additional locations among those already identified. Explore new locations and their permits	
	Installation & Connections	PM	19/06/23	Pending / 10/23	Complete all preliminary work in advance to accelerate the installation and commissioning.	Search for alternatives which can be completed in a shorter period.	

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New electrical storage	Permits for location in public basement	PM	15/04/22	Done	N/A	N/A	
	Installation & connections	PM	19/06/23	Pending / 12/23	Complete all preliminary work in advance to accelerate the installation and commissioning.	N/A	
P2H systems in residential buildings	Household´s agreement	PM	09/12/22	In progress / 07/23	Organizing meetings with the community and individuals (house owners) and giving support to any questions from citizens.	Identification of new solution packages or financing models	
	Design, Project & Permits	PM	17/03/23	Ongoing / 10/23	The initial designs were carried out with low and high temperature, but a new high temperature system is also valued, which will reduce investment costs.	Identification of new solutions or financing models: proposals including PV & batteries + new financing models for installation in dwellings.	
	Heat pumps installation	PM	27/06/23	Pending / 12/23	Proposal for 3 different locations	N/A	
CHP boiler is installation	Identify best option & location	PM	01/12/22	Ongoing / 09/23	Due to the difficulties to find suitable equipment and costs, alternatives are being sought (biomass-based within an acceptable budget.	Search for a business model with a bigger CHP system using woodchips	
	Purchase & Installation	PM	25/06/23	Pending / 02/24	N/A	N/A	

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2.3.1. Implementation status – Ispaster

In this chapter the summary of the implementation status of each one of the nine demonstration actions ongoing in Ispaster is explained:

Table 16: Summary of the implementation status of the demonstration actions in Ispaster

ID	Demonstration action	Status (0-100%)	Comments	Monitoring
3.1	Community engagement	70%	Since the beginning of the project, the demo team has had open communication with citizens. Several actions have been carried out: presentation of the project, workings session, etc. Currently, and after the creation of a "promoter group for the creation of the REC" of citizens, the demo team is defining and creating the REC of Ispaster. Between January and the end of March 5 working sessions have been held with this group and key decisions have been made for the creation of a local REC: mission and values of the REC, juridical form of the entity, type of members, organizational structure, decision making process, rights and obligations of REC members, etc. The official creation of the REC as a cooperative is the next step, expected by June 2023.	
3.2	Upgrade of the DHN and connection of new customers	40%	Civil works finished in December 2022, connection of 3 new public consumers to be finished in May 2023. Delay since Oköfen has stopped manufacturing of CHP biomass boiler. Searching for alternatives (Hargassner, Glock) but the size is much bigger and not feasible with the actual budget. Same for more connections due to high prices.	
3.3	Expansion of the micro-grid through the installation of new PV	35%	Several meetings have been held with different stakeholders and locations with high potentiality for installing PV panels were initially identified (church, semi-detached houses). Due to the difficulties to get a final commitment with the affected actors and to avoid long delays, local citizens working as the "promoter group of the creation of the REC" (see "citizens engagement" action) have identified around 20 new locations, with an expected total capacity of around 200 kWp. During 2023 and beginning 2024, 100 kWp are planned to be installed.	

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3.4	E-mobility through the installation of EV-charging infrastructure and the purchase of an EV	100%	One single and one double EV- charging points installed, and the EV purchased and in operation.	
3.5	Power to heat in residential buildings, replacing existing fuel-based systems	20%	Relevant barriers to be highlighted, mainly: (1) no social acceptance of heat pumps, in general, in the Basque Country, and (2) increasing costs of electricity in Spain. Meetings were held with stakeholders and detailed feasibility studies were carried out to show the benefits of the solution, with no major success. Currently, the option of installing PV-fed HPs and electrical storage for 6 households that nowadays are using LPG for heating is being explored and proposed to relevant actors. This activity can be fostered also within the REC, once officially created.	
3.6	Electric storage	20%	Permissions for the location in the public area was obtained in January 2022 and installation works are planned for December 2023. Lithium technology is being explored instead of lead acid, which implies less energy with the same budget, but greater DOD and better performance. Potential grants at regional level.	
3.7	Smart control, monitoring and management	45%	After a complete review of the existing hardware and software, new components were installed and connected to the updated SCADA. A Data Map and RTU were developed and deployed which are allowing communication between SCADA and a database developed to read and save key parameters. The latter can be visualized on a new web monitoring platform. A control module API is now under development while communication between the database and CENTRICA is in process. The first phase of the action is expected to be finished by June 2023, and a second phase will take place once new installations are complete.	
3.8	Policy recommendations in social acceptance, financial or regulatory issues	50%	Based on previous and project experiences, some of the first recommendations are: • reduction in taxes and increase of public investment. 5% VAT)accepted in 2023) • simplification of procedure to get the connection point for new PV installations Several meetings were held with the Basque Government to discuss about them.	
3.9	Business model innovation	30%	A working session have been held with citizens, BARRIZAR and the City Council. The more suitable business model identified was the “cooperative” formula including both citizens and the City Council.	

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2.3.2. Description of activities performed until M23 – Ispaster

In this chapter the implementation status until month 23 of the project of each one of the nine demonstration actions ongoing in Ispaster is explained in detail, with clarity purpose.

Action 3.1.- Community engagement

Since the beginning of the project, BARRIZAR and Ispaster Municipality, as demo partners located in the town, together with the support and collaboration of TECNALIA and AIGUASOL, have had open communication with citizens.

During 2021, BARRIZAR held different meetings with citizens and the municipality, to explain and discuss the main ideas of the project. It must be underlined at this point that the restrictions due to the COVID pandemic caused difficulties and it was not possible to work adequately to achieve the ambitious objectives of the project. This is clearly one of the reasons behind the different delays in the whole project.

One official presentation of the LocalRES project took place in January 2022 to local citizens and stakeholders together with a participatory session to contribute to the co-design of the planning tool. Different working sessions were held in total during 2022, with significant participation of citizens. The municipality made dissemination by mail, posters and website. In addition, a workshop about the business model was also held on the 6th of October together with AIT and BARRIZAR. Some questionnaires were completed with the comments from the participants of the sessions.

After three working sessions, the need to create a "promoter group" of citizens was identified, to push the initiative in the town. With this purpose, an application form was put in place in December 2022 to create this "promoter group" of citizens that will work together in the definition and creation of the REC in Ispaster. 28 people signed up to be part of the promoter group with the aim of advancing on the definition of the REC on Ispaster.

This promoter group of citizens have participated in 5 working sessions and made key decisions in regard to the local REC to be created. A series of workshops together were held with the promoter group lead TECNALIA and AIGUASOL, and participated also by BARRIZAR and the Ispaster City Council:

- 1st session – launching of the promoter group and 1st decision [26/01/2023]
- 2nd session – Technical and economic foundations of the Ispaster REC [09/02/2023]
- 3rd session – Philosophy and strategy of the REC [23/02/2023]
- 4th session – Operation of the REC [09/03/2023]
- 5th session – last decisions pending from previous session in regard to the statutes of the REC [30/03/2023]

Further details about citizen engagement strategy are explained in section 2.3.5.

The key milestone of the Consolidation of the REC is planned by the end of June 2023.

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Figure 11: Community engagement meeting in Ispaster

Action 3.2.- Upgrade of the DHN and connection of new customers

The extension of the DHN is ongoing, after overcoming some administrative aspects and issues with permissions. The civil works to prepare the connection system for the integration of 3 public facilities (medical centre, pharmacy and Egiluz cultural centre) and 8 flats above the public facilities started in November 2022 and finished in December 2022.

Currently, some aspects are pending to be solved regarding the accessibility to the equipment. To avoid future potential problems for maintenance or any other activity related to the equipment, it must be ensured that the installation and equipment in public areas are accessible without actively involving individuals from the buildings. This last step is still ongoing. The connection of the new public consumers is expected to be finished in May 2023. There is a delay since Oköfen has stopped the manufacturing of the biomass CHP. Alternatives are being sought (Hargassner, Glock), but the size of the CHP systems found so far are too big and not feasible with the actual budget, so new business models are under study.

Figure 12: DH ampliation works in December 2022

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Action 3.3.- Expansion of the micro grid through the installation of new PV

Installing photovoltaics on the roof is becoming more and more common and frequent and therefore, it is one of the actions that more easily can reach to the people´s interest and commitment.

Since the beginning of the project and with more intensity during the year of 2022, different actions have been carried out to advance in this demonstration action. On the one hand, several meetings have been held with stakeholders to analyse the possibilities and their interest of installing PV on their roofs. In total, 5 multifamily residential buildings (or blocks of flats) and 1 semidetached house were visited. On the other hand, locations with high potentiality for the installation of PV panels are identified. More specifically, in the Elexalde area, two main roofs were identified as interesting:

- The church:
  - Conversations with the church have already been initiated, asking the permission for the installation of around 36kWp of PV panels on the roof. In return, the connection to the DH substituting the current oil-fired boiler is offered for the heating of the church on Sundays.
- Semi-detached single-family homes behind the school
  - Some of the neighbors in these houses have shown their interest for the REC in Ispaster and for the installation of PV panels.

In the next Figure 13 the identified interesting location for PV in Elexalde area is shown:

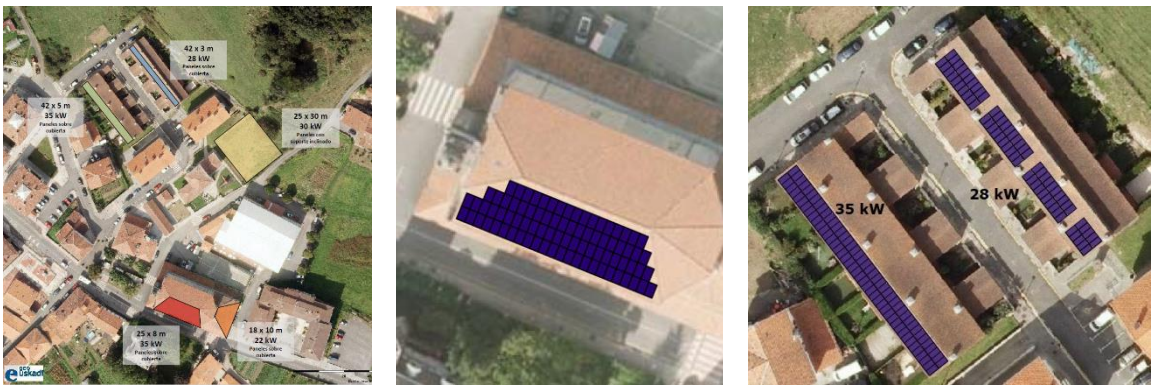

Figure 13: Different photovoltaic proposals in Elexalde, Ispaster

Due to the difficulties to get a final commitment with these stakeholders, i.e., the church and the inhabitants in the semi-detached single-family homes behind the school, the promoter group of the future REC of Ispaster took the leadership of the promotion of this demonstration action.

In this way, the promoter group (see “citizens engagement” action) worked in the identification of potential locations for the installation of PV panels. Many of the member in the promoter group offered their own roof for the installation of PV panels and in addition, many of them talked to their neighbours to explain the LocalRES project and the initiative of the creation of a local REC, and as a result of all this commitment and work, around 20 locations have been identified and committed

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for the installation of PV panels, with an expected total capacity of around 200 kWp (Figure 14). In the next link, all the locations which have been accepted can be seen as placed in the map: https://goo.gl/maps/VczGE8myXMW8FbQ7A.

Figure 14: identified locations for the installation of new PV systems

From summer 2023 until beginning 2024, 100 kWp are planned to be installed. Currently, discussions are starting to agree on in the order of the installation works in the different locations.

Action 3.4.- E-mobility through the installation of EV-charging infrastructure and the purchase of an EV

After various meetings to advice the municipality about different options in charging points and EV, the final decision was made and the first EV-charging infrastructure for municipal EVs was installed by May 2022 in the municipal pavilion. This point is partially powered by PV and batteries installed in the municipality in 2021.

The second charging point, installed in August 2022, is a double point with a Place to Plug app. It permits to know status, prices and to make bookings. The municipality has 10 cards for the use of the municipal-workers and with this, the City Council aims at fostering the use of EV in the town. This second point is partially powered by PV and batteries installed in the municipality in 2016. It includes a MID certified meter for each power socket, a RFID card reader and communication protocol om OCCP 1.6 JSON.

The EV was purchased by July 2022.

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Figure 15: EV charging points in the municipal pavilion and on the sports centre

Action 3.5.- Power to heat in residential buildings, replacing existing fuel-based systems

Heat pumps technology is not new but in the Basque Country it is not common to install this kind of technology. In the south of Spain, for example, where the climate is much hotter, people are used to the heat pumps, but in the Basque Country people are not familiarized with the technology of heat pumps. Due to this lack of knowledge (and distrust, in some measure) on the technology, there is no social acceptance of heat pumps in the region. In addition, the increasing and unstable costs of electricity in Spain also represents a barrier for the successful implementation of the heat pumps.

In the beginning of the project, in January 2022, the power-to-heat option was presented to the community as one of the actions of the project in the town. Several citizens have been contacted to propose to participate in this action, or those citizens that have asked for a more sustainable heating system for their homes have been advised to opt for the heat pump technology.

During 2022, different meetings were held with stakeholders and the municipality to analyse the possibilities and their interest to install heat pumps. In total, 2 blocks of flats and 1 semidetached home have been visited. Additionally, detailed studies of costs and benefits of heat pumps have been carried out to show and explain how interesting the solution may be to those potentially interested in the solution. Even though the solution is overall interesting, the initial investment is very high (in comparison to the conventional gas boiler). No volunteers have been recruited yet.

Efforts have been focused on advancing with this implementation and currently, 6 households have been identified as “of interest” for this implementation. These 6 households are nowadays using LPG for heating and a proposal of substituting these old systems with heat pumps fed with renewable electricity and combined with electric storage has been presented. The agreement on the acceptance of the solution proposed and the final design are ongoing.

This activity can be fostered also within the REC Cooperative, once it is officially created.

Action 3.6.- Electric storage

Several meetings have been held with local residents in semi-detached buildings and two blocks of apartments, where there is space available for PV and storage and currently the heating system is powered by LPG. Thus, they have been identified as optimal candidates to combine the use of renewable energy (PV) with electrical storage systems and substitute the heating systems by heat

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pumps (action 3.5), therefore promoting the decoupling of energy production and consumption, and in this way to maximize the self-consumption rate of locally generated renewable energy. Field visits and both formal and informal meetings were held to explain the benefits of this solution.

Finally, the best location for the electric storage was found in a public basement and then, BARRIZAR started the process for permissions with the council to carry out this action in this location. The positive answer about the permission for the location was obtained in January 2022. Proposal has been made with lead acid batteries (30.000 €/200 kWh) in 2020 when the LocalRES project was first elaborated. Lithium batteries are to be installed in September 2023 with the same budget.

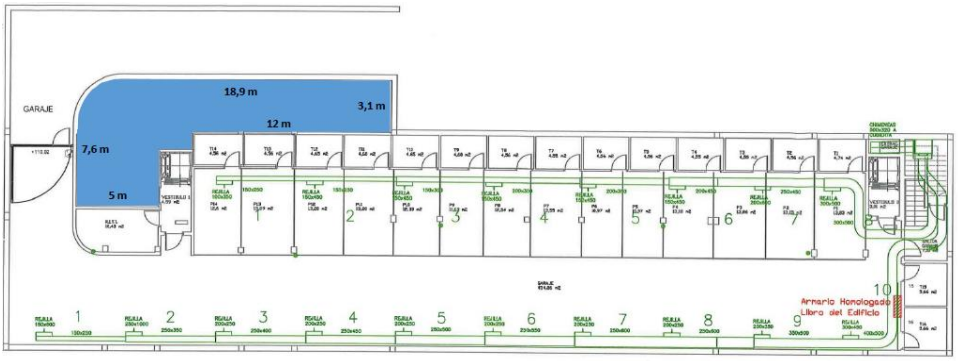

Figure 16: Space available to install batteries to power heat pumps

Action 3.7.- Smart control, monitoring and management

The existing monitoring and management system were outdated and some of the hardware was not fully functioning. Following an identification and verification of the existing system, the PV combox was replaced, Modbus communication was established, new sensors were installed, and a new industrial PC was acquired to manage all the information.

Once the hardware was ready, the local demo team worked on the reprogramming and connection with existing SCADA. Parallelly, Aiguasol developed a specific module that allows the reading of electricity consumption of residential users, accessing the data through the DSO meters, via the Datadis platform. At this stage, a data map and RTU was developed and deployed. This hardware component makes it possible to send the recorded variables to the new motorisation platform and to receive (and update) the new control signals setpoints.

In October 2022, the first connectivity tests have started with positive results; data is being collected and saved. In the same period, an API/ middleware of the control module has been defined and is still under development. A new web monitoring platform has been developed and deployed in December 2023 to receive and send all selected variables and control parameters. A temporary database (opentsb) and a web data viewer (Grafana) have also been deployed for further data analysis and KPI calculation. In February 2023, the confirmation on writing over key parameters is pending. The control over these parameters will enable optimization on EV charging points and DH demands without affecting on final users' requirements. Once the parameters will be confirmed,

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the final development of the control module will be executed, and tests will be run. The communication process between CENTRICA and RTU has started. The action is expected to be finished by June 2023.

Figure 17: New SCADA data-communication platform

Action 3.8.- Policy recommendations in social acceptance, financial or regulatory issues

Financial aids in Spain for private owners are not getting the needs of citizens interested in the acting towards a more sustainable future. Renewable installations, with 21% VAT and 25% Aid, grow too slow. The process for application to public funds is complicated and takes a very long time. That is why, based also in the learning of the project, the first recommendation is to reduce taxes to promote new installations, for example, 5% VAT instead of the current 21%, and to increase public investment in renewable and / or sustainable projects and initiatives.

In addition, the connection point for new PV installations must be done with the energy distributor and this procedure generates delays and problems to get these connections in a reasonable time frame. Due to this, the second recommendation is to simplify the procedure to get the connection point for new PV installations.

A meeting was held with the Basque Government to share these two recommendations, i.e., to ask for a reduction in taxes for RES and RECs and for more investment to boost private installations as well as the simplification of connection procedures. In the beginning of 2023, the reduction of the VAT tax was accepted for energy bills, with 5% VAT instead of 21%.

Action 3.9.- Business model innovation

The business model is a key aspect to guarantee the future sustainability of the implementation, and also to foster maximum replicability and scalability of the interventions. A meeting or working session, led by AIT, was held on the 6th of October with the participation of different stakeholders: 10 citizens, the municipality and BARRIZAR. A survey was presented during the meeting, and it was distributed among attendees to collect different information. First, participants in the working session were asked about the following topics:

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- 1st analysis the interest of everyone
- who can influence in the REC
- benefits and detriments
- who can promote or block up the development of a REC
- 2nd Impact & Influence Matrix for each different stakeholder

Then, the citizens, the municipality and BARRIZAR were asked to identify, analyse, and consider some economic aspects:

- investment preferences for the REC
- economic incomes preferences
- business models
- different financial internal & external sources: loans, bonus, etc.

Finally, attendees were asked to identify local resources and benefits, possible partners, and distribution of benefits. Most of the participants in the working session opted for a "cooperative" or "association" formula as the more suitable business model for the REC in Ispaster, including both citizens and the City Council.

Once the REC creation process is finalized officially and the REC Cooperative of Ispaster in operation, business model actions will be explored together with them.

2.3.3. Issues affecting implementation - Ispaster

The implementations of the actions in Ispaster are rescheduled compared to the initial plan in the LocalRES project because of the recent events, such as the Covid-19 crisis, the war in Ukraine, and the consequences of these events such as the rise in energy prices and the shortage of raw materials and key components, among others. It must be highlighted that the demo team and the municipality of Ispaster have planned again the implementation and investments of the actions committed in LocalRES, and currently no major deviation is foreseen.

These are the main aspects or issues affecting the implementation of the actions in the Ispaster demo case:

- Issues related to the equipment and installation components
    - First, concerning the P2H solution, i.e., the heat pumps for residential users, difficulties arose due to the price increases of this equipment. P2H solution were already expensive, as the needed equipment for the households (change of emitters, and type of heat pumps) using LPG requires a significant investment for households (around 50% bigger investment compared to a conventional gas boiler, for example).
      In addition, the power-to-heat option was presented to the community in January 2022, and apart from the high prices of the units themselves, we also realized that there is no social acceptance of heat pumps in the area mainly due to (1) the increasing costs of electricity in Spain and (2) the lack of knowledge (and distrust, in some measure) on the technology.

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In this context, and with the aim of unblocking the situation, detailed studies of costs and benefits of heat pumps have been carried out, in order to show and explain how interesting the solution may be to those potentially interested in the solution, although the initial investment may be very high (in comparison to the conventional gas boiler) and the electricity prices are increasing in Spain.

- Second, regarding CHP to reinforce the district heating network, we found that the initially proposed unit is not available for Spain. Currently, we are searching for an alternative equipment, carrying out analysis for alternative solutions, trying to find the optimum balance among the technical needs, the budget, and the expected impact of the project. In the moment of the elaboration of this deliverable, different options are being explored.

- Citizen engagement

  Social aspects are always complex, and there is not a single formula to overcome this challenge. Issues related to social aspects or citizen engagement are always crucial and need to be considered carefully in projects with such ambitious objectives as the LocalRES project. The citizen engagement strategy to afford the challenge is explained in the section "*2.3.5 Citizen engagement strategy - Ispaster*".

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2.3.4. Mitigation plan – Ispaster

To ensure that the implementation plan of the demonstration actions in Ispaster are kept on the track, a risks analysis is carried out and some mitigation measures are proposed. In the following Table 17, this information is shown:

Table 17: Risks and plans to solve them for the Ispaster demo.

Risk	Probability to happen	Impact of the risk	Mitigation action (MA) or Contingency plan (CP)	Deadline to foresee the MA
No CHP available with current budget	Medium	Less renewable electric energy in winter	MA (already ongoing): try to find additional funds and a financing plan CP: definition of new business models for the action, supported by funds	If by 25/05/2023 the issue has not been solved, the CP will take place
No residential users willing to install P2H	Medium-High	Less reduction in the use of gas	Analysis of different alternatives to reduce investment costs for residents, at technology level and also at financial level	July 2023
Lack of funds	High	Potential reduced scope of demonstration actions	MA: identification and analysis of new business models and financing schemes, including the application to alternative funds.	July 2023
Delay in the Monitoring implementation	Low	Delay verifying communication with the MEVPP	CP: start with the data gathering process at least locally and in parallel, verify / adjust the communication, although missing all the data.	May 2023
No constitution of the REC	Very low	Lack of access to residential users' meter data	Register the Municipality's infrastructure users and promote the user interface to the citizens already involved	June 2023

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2.3.5. Citizen engagement strategy - Ispaster

As stated previously, social aspects are always complex, and the challenge related to social aspects or citizen engagement is handled with the following strategy. In Ispaster demo, the final goal of this action is the creation of the local REC, i.e., to constitute and to define the key rules of functioning for the community. In the beginning of the project, in January 2022, a presentation session was held to present the overall LocalRES project to the town and to the citizens.

Working sessions:

Several working sessions have already been carried out within this task:

- Work Session 1 - 15th September 2022: Quick update of Ispaster and LocalRES presentation. Presentation of what a REC is, followed by a dynamization session to identify benefits, difficulties, and requirements that citizens find regarding the REC idea.
- Work Session 2 - 6th October 2022: Business models' session.
- Work Session 3 - 1st December 2022: presentation of the current energy & environment context, what a REC is, some first ideas of the juridical and organizational structure of a REC, dynamic exercises to understand the awareness of citizens and their potential commitment, etc.

Activities and workshops for the establishment of the REC:

After the three work sessions, the need to create a "promoter group" of citizens was identified, to push the initiative in the town. With this purpose, an application form was put in place in December 2022 to create this "promoter group" of citizens that will work together in the definition and creation of the REC in Ispaster. 21 people have signed up to be part of the promoter group.

The promoter group is working in several sessions or workshops to advance on the definition of the REC on Ispaster from January to March 2023, and to reach the key milestone of the Consolidation of the REC and legal constitution, expected by June 2023. This is the schedule or structure of the workshops of the promoter group:

- 1st session – launching of the promoter group and 1st decision [26/01/2023]
    - Functioning of the promoter group (voting process)
    - Decision on types of partners in the REC
- 2nd session – Technical and economic foundations of the Ispaster REC [09/02/2023]
    - Technological project – PV
    - Fees (initial and annual) by type of REC member
- 3rd session – Philosophy and strategy of the REC [23/02/2023]
    - REC name
    - Profit: with or without
    - Benefits: what are they used for?
    - Strategy and vision in the medium / long term

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- 4th session – Operation of the REC [09/03/2023]
    - Identification of Founding Partners
    - Governing Council and Roles
    - Assemblies and decision-making
    - Ordinary management
- 5th session – last decisions pending from previous session in regard to the statutes of the REC [30/03/2023]

Around 15 to 20 people, members of the promoter group, participated in each of the workshops. Each of these sessions was organized by TECNALIA, with the support of Aiguasol and also of volunteers of the promoter group.

In general, all the sessions were structured as follows:

- Presentation of the topic
- Teamwork; time to discuss in small groups and to present to all the participants the conclusions agreed in these small groups
- Voting and decision making

In this way, it is ensured that participants have the required information to discuss about the key topics, then that they have the opportunity to express their opinions and discuss with others about different views, and finally, that the decisions made by the promoter group follow democratic principles.

Communication channels and continuous efforts:

To promote the involvement of the citizens, the connection between the mayoress and so-called "local heroes" has been used for the first three working sessions, as well as the local communications of Barrizar and the Municipality (town council). In addition, leaflets are distributed in bars of the town and in the mailboxes. The communication with the "promoter group" is structured as follows:

- A mailing list managed by the Municipality is used for official communications with the promoter group
- A WhatsApp group is used for informal communication among members
- Some volunteers of the promoter group are participating in the organization and preparation of the workshops together with TECNALIA and AIGUASOL

Finally, to strengthen the awareness (information, commitments, etc.) of citizens regarding sustainability and energy, a person is hired to join the municipality for coordinating the energy actions and community engagement in the municipality.

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2.4. Field implementation in Ollersdorf

As stated in D4.2, the roles and responsibilities of the Austrian demo site which have been defined in the scope of LocalRES are summarised in Table 18 below.

Table 18: Roles & Responsibilities in Ollersdorf Demo

Role	Name	Responsibility
Project manager (PM)	Austrian Institute of Technology	Responsible for communication, schedules, resourcing, etc.
Community Manager (CM)	Energie Kompass	Responsible for interaction with local municipality and installation/integration
System Integrator (SI)	Energie Kompass	Responsible for the documentation, licenses, permissions, etc.
Installation manager	Energie Kompass	Responsible for the fluent execution of the installation work
Consultant: Energy management	Austrian Institute of Technology	Provides additional expertise on power flow management
Consultant: Site monitoring	Austrian Institute of Technology	Provides additional expertise on metrology and site monitoring
Consultant: Blackout strategies	University of Passau	Provides additional expertise on black-out strategies

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Table 19: Timetable for the Ollersdorf demo as presented in the D4.2 compared to current time

Phase	Deliverable	Responsibility	End Date	Status & Actual/ Expected Date	Mitigation Actions (MA)	Contingency plan	Monitoring
Preliminary works	Determine training needs	System Integrator	11/21	Done / 11/21	N/A	N/A	
	Interest to participate from residents	Community Manager/ SI	11/21	Done / 11/21	N/A	N/A	
	[Blackout] Specification document for implementation	PM / Consultants	05/22	Done / 05/22	N/A	N/A	
Pre-deployment	Demonstration Planning meeting	Project Manager	11/21	Done / 11/21	N/A	N/A	
	Determine roles & responsibilities	Project Manager	09/21	Done / 09/21	N/A	N/A	
	Review Project Schedule	Project Manager	01/22	Done / 01/22	N/A	N/A	
	Develop matrix of resources/skills	PM / SI	01/22	Done / 01/22	N/A	N/A	
	Identify pre-deployment activities	Project Manager	01/22	Done / 01/22	N/A	N/A	
	Assign staff	PM / SI	02/22	Done / 02/22	N/A	N/A	
	Residents sign up to participate	CM / SI	12/21	Done / 12/21	N/A	N/A	
	Helpline set up	System Integrator	12/21	Done / 12/21	N/A	N/A	
	[Alg development] Finished grid Topology model	PM / Consultants	06/22	Done / 06/22	N/A	N/A	
	[Blackout] Approved Concept of implementation	PM / Consultants	06/22	Done / 06/22	N/A	N/A	
	[Blackout] Approved Concept of implementation	PM / Consultants	05/22	Done / 05/22	N/A	N/A	

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Deployment Phase	ICT HW ready to be used on site	SI /Installation Manager	12/21	Done / 12/21	N/A	N/A	
	teams4energy deployed and ready to integrate	SI / Installation Manager	01/22	Done / 08/22	N/A	N/A	
	Monitoring equipment installed according to regulation	SI/ Installation Manager	11/22	Done / 11/22	N/A	N/A	
	Demo location integrated into teams4energy	SI/ Installation Manager	12/22	Done / 12/22	N/A	N/A	
	Deployment to participants done	SI/ Installation Manager	01/23	Done / 01/23	None->Single-dependency process	N/A	
	All participants are integrated into teams4energy	SI /Installation Manager	03/23	Ongoing / 05/23	N/A	N/A	
	[Optimisation] alg. Integrated into local ICT	Project Manager/ System Integrator/ Consultants	10/22	Pending / 4/23	Optimiser done, unforeseen additional implementation	No alternative in the demo/ MA started	
	[Blackout] flexibility reserve integrated into local ICT	Project Manager/ System Integrator/ Consultants	11/22	Test pending/ 06/23	Same as with Optimisation	No alternative in the demo / MA started	
	[Blackout] KPIs visualised in local ICT	Project Manager/ System Integrator/ Consultants	12/22	Pending / 6/23	N/A	N/A	
EOP	[MEVPP/ASGC] Field validation complete	Project Manager/ Consultants	05/25	Pending / 05/25	N/A	N/A	

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2.4.1. Implementation status – Ollersdorf

The implementation status in Ollersdorf is summarised in Table 20 below.

Table 20: Summary of the implementation status of the demonstration actions in Ollersdorf

ID	Demonstration action	Status (0-100%)	Comments	Monitoring
4.1	Community engagement	60%	The interest of participants in the LocalRES project was launched with a first information event in August 2021 about Energy Communities. From that onwards, several workshops have been held. Information conversations happen between the community regularly. All planned community workshops have been held in time so far. The constitution of the community as a legal entity has been done.	
4.2	Implementation of smart ICT infrastructure for the smart operation of the local energy system	90%	Hardware installations are ongoing during the first reporting period and have been mostly finalized. The installation works have been completed by the end of 2022, but the commissioning is still pending, and is expected by 05/2023.	
4.3	Implementation of control algorithms and black-out strategies	90%	The task and models are progressing well and smoothly. Communication protocols are defined. Preparation for deployment, i.e., the development of an orchestration concept and API definition is ongoing.	
4.4	Community information system	20%	Design and deployment of visualization (information) system to be installed are being defined. The implementation has not initiated yet as it depends on Action 4.2. It is planned to be done during summer 2023 and finalized by 10/2023.	
4.5	Blockchain based P2P trading / accounting	0%	After legislation changes in Austria, P2P as stated in the GA cannot be deployed. Different options are being evaluated. Mitigations considering the local communication for GCM and Blackout also consider P2P data requirements.	
4.6	Future energy scenario and impact of scaling up	100%	Scenarios for future investments and optimal generation mix to reduce the dependence of Ollersdorf from the main transmission line have been developed in WP1 and finished (with D1.3), and have been discussed with local citizens and stakeholders.	

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2.4.2. Description of activities performed until M23 – Ollersdorf

Action 4.1.- Community engagement

The interest of participants in the LocalRES project was launched with a first information event in August 2021 about Energy Communities in general that was followed by an information event in November 2021 about the LocalRES project. Residents were invited to participate as pilot households in the Ollersdorf demo actions and 34 interested parties signed up to participate in December 2021. During a wave of fearmongering about Blackout in Austria, a questionnaire on the topic was related to address fears and issues more accurately. This helped Task 3.6 to adjust its demonstration actions to ensure that these fears were addressed. It also showed the participants that the project team cares about their concerns, promoting the channel of trust between them. With the citizens having formally agreed to participate, the set-up procedure for the legal entity for the Energy Community could be started and the REC Ollersdorf officially went operative in February 2022.

After the first information events, a community participatory workshop was held in April 2022 to collect community and user feedback to ultimately co-design the development of the Community Tools. After this, a workshop presenting the results from WP1 concerning the energy scenario simulation and development towards decarbonisation was held in July 2022. A new participatory workshop that took place in the first reporting period was held in September 2022 where user and community feedback was collected on the business model development. All planned community workshops have been held in time so far. The constitution of the community as legal entity has been done.

Action 4.2.- Implementation of smart ICT infrastructure for the smart operation of the local energy system

The ICT infrastructure will operate in a smart way the local energy system, optimizing the use of PV panels, heat pumps, electric boilers, EVs and energy storage (batteries). Hardware installations are ongoing during the first reporting period and have been finalized by 02/2023. Commissioning of the whole ICT system is ongoing and expected to be finalized in May 2023. As installations are to be done in the power supply cabinets of the participating households, authorized registered electric installation companies have been selected to carry out the needed work.

The installations have been prepared in cooperation with the participating households to make sure there would be no interference with electric supply and the daily needs of the respective households. In most cases, the measuring and ICT equipment could fit into the already existing cabinets. In case of space constraints, separate boxes to hold the ICT equipment have been manufactured and connected to the main power supply cabinets.

The installation works were finished by February 2023. APIs have been created. Only the data connections to the control algorithm API need to be connected, which will be done during the commissioning in May 2023.

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Figure 18: Installation of the smart ICT in Ollersdorf

Action 4.3.- Implementation of control algorithms and blackout strategies

Grid topology and participants are digitally modelled and were provided to all partners requiring it. Optimisation/GCM algorithm is done. Training model for GCM is currently ongoing. Flexibility reserve optimization for blackout strategies is done in Task 3.6. The models are completed, and mitigation actions concerning the connection point to the local ICT are done during commissioning. An OpenAPI-based interface definition is available and needs to be distributed to the local operator during the commissioning.

Preparation for deployment, i.e., the development of an orchestration concept and API definition is ongoing and expected to be finalized by 06/2023.

Action 4.4.- Community information system

Design and deployment of visualization (information) system to be installed in the current public facilities of the smart street showcase in Ollersdorf to inform the citizens about the important events and to present community-rated information: blackout events, generated energy within the community, number of electric vehicles charged in a dedicated period and used energy, amount of traded energy within the community, the announcement of project-related events, are examples of the contents that will be displayed in this system. The demo action 4.4 contributes to STO4 and NTO2. The implementation has not initiated yet as it depends on Action 4.2 and is expected to be finalized by 10/2023.

Action 4.5.- Blockchain based P2P trading / accounting

The demo action 5, blockchain based P2P trading, is not feasible in the Austrian demo as initially planned according to the new Austrian regulation due to the requirement for allocation of shared energy being done by DSO. As a contingency plan, options to transfer this action to a different pilot are being assessed.

Action 4.6.- Future energy scenario and impact of scaling up

Scenarios for future investments and optimal generation mix to reduce the dependence of Ollersdorf from the main transmission line have been developed in the scope of WP1. This action

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included benchmarking, comparison of different assumptions, data sources, scenario building, estimating the probability of blackouts, and modelling suites to explore the pathways to long-term climate-energy policies. Furthermore, it included identifying the measures and strategies to update the local electric grid to allow these changes. The demo action 4.6 contributes to STO1, STO2, NTO1, and NTO2 as it developed future scenario and assessed its impact so that they could be utilized in other locations or used to scale up the current one in Ollersdorf. The scenarios were presented in workshops to citizens, and open to discussions involving the municipality about possible strategies for future actions.

2.4.3. Issues affecting implementation – Ollersdorf

One of the main delays Ollersdorf demo has faced was the lack of contractors that are qualified to install the gateway hardware. This moved implementation and deployment back. At the time of writing this report, this issue has been solved and devices have been deployed at all participants.

A recent issue was discovered during a meeting on integration: the local ICT infrastructure needs more adaptation than that initially expected. Mainly, all algorithm implementation and interfacing were assumed as a single entity that will interact with the low-level MQTT layer. This however is not possible as there is a cluster controller present that: 1) does not have the ability to proxy commands to single entities and 2) would overwrite any setpoint the Optimizer, Blackout would set. This issue does affect implementation actions related to WP3, and requires a type of *middleware* or *interface* that allows interaction between the cluster controller and the orchestrated service container. Mitigation actions have been implemented as soon as the problem was found, and are in the process of working on the *connector*. An interface defined by an OpenAPI schema has been designed for container internal communication, as well as standardised external communication. This approach now also allows the container to be introduced somewhere else with ease.

Finally, the most relevant issue affecting the implementation actions in Ollersdorf is constituted by the legal context in Austria derived from a new regulation (*Gesamte Rechtsvorschrift für Elektrizitätswirtschafts- und - organisationsgesetz 2010, Fassung vom 23.03.2022*). Thus, while the Austrian law does not explicitly prohibit P2P trading, following the current regulation enforced makes it impossible to do any true P2P energy trading, as the measuring and allocation of energy surplus of individual participants have to be done by the grid operator, and there is no process in place to inform the grid operator of any agreements between participants. Consequently, the action as initially proposed is not feasible in Ollersdorf demo, and as a contingency plan alternatives are under study to potentially transfer this action to a different demo.

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2.4.4. Mitigation plan - Ollersdorf

Table 21: Risks and plans to solve them for Ollersdorf demo.

Risk	Probability to happen	Impact of the risk	Mitigation action (MA) or Contingency Plan (CP)	Deadline to foresee the MA
Deployment delay	Low	Very limited	Overall project schedule has sufficient contingency to catch up.	Mitigation already in action since 10/22. No alternative.
ICT Connector	Low	Limited	OpenAPI interface definition, all-in-one container	Design finalization: 02/23 Development & deployment: 05/23
Unfeasibility of P2P	High	High	Find another demo site to demonstrate	May-June 2023

2.4.5. Citizen engagement strategy - Ollersdorf

Communication channels:

The municipality plays a very active role in the project and communication is done utilizing the official municipal channels, such as the municipality newsletter, the municipality website and direct communication between the mayor, the municipality project team and citizens.

Working sessions:

Working sessions take place approximately bi-monthly in the municipality premises between the project team and participating citizens. During these the project progress is discussed; open questions and issues are being answered and feedback from citizens is considered for the project.

Figure 19: First community event in August 2021

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Activities:

The main activity accomplished so far has been the establishment of the Renewable Energy Community within the Austrian legal and regulatory framework. The REC is operative since February 2022 and has been onboarding new members since the initial establishment.

Workshops:

So far, a number of workshops have been taken place. An initial information workshop on the LocalRES project in general has been conducted in November 2021. A citizen engagement workshop on the development of energy scenarios (from WP1) has been done in April 2022. Another two workshops on economic opportunities and potential business models have been done in July 2022 and September 2022 respectively.

Continuous efforts:

Communication and Information between the project team and Ollersdorf citizens is a continuous effort. Citizens have always direct access to the project team, either in person, by phone or via email and many questions and concerns are dealt with on a day-to-day basis.

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3/ Data monitoring

This chapter assesses the status and issues relating to data monitoring, which is an essential part of the project to validate the different solutions. The situation and the problems are described to give the reader a clear image of the progress and solid reasoning behind it.

For each demo, a diagram summarizing the monitoring sensors is indicated. Figure 20 shows the legend of the elements used in the monitoring diagrams of next sections.

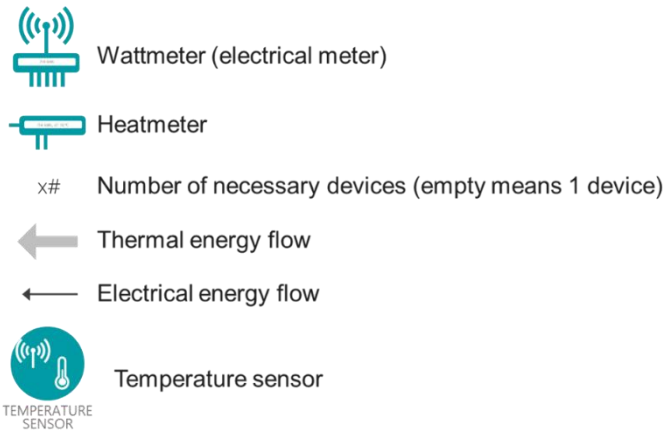

Figure 20: Legend of the monitoring diagrams

3.1. Data monitoring in Kökar

3.1.1. Data monitoring status – Kökar

Currently, no data is being monitored on the Kökar demo site due to the general delay affecting the demo, as detailed in section 2.1. In particular, the SEMS are not yet installed in private households or municipal buildings (school and nursing home). The devices for the private households just arrived by the time this report was being consolidated (M23), and a recruitment campaign is planned to take place after their delivery. During this campaign, around 20 households with heat pumps and other controllable loads will be recruited to get the SEMS installed. After the households' agreement to participate, it will be possible for the installation to start immediately and it should not take more than a few weeks, as the devices are very easy to install. Only identifiable bottleneck is the availability of the installers (limited in the island), as the work will be done by the local contractor, Kökar Service. Nevertheless, and despite the Municipality is not directly involved in the installation of SEMS in private households, the general situation of uncertainty in the demo due to the extended resolution time about the ongoing legal process may eventually indirectly affect this process.

The software and IT infrastructure planned for Kökar consist of the system optimisation platform included in the SEMS and the operative control from the MEVPP.

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The use cases of this platform include:

- Collective peak-shaving via connected and controllable loads
- Automatic energy optimisation
- Collective self-consumption optimisation
- EV-charger optimisation
- Energy storage management, including BESS and TESS
- Demand response capabilities
- Anomalies detection at the REC level

In addition, building heating optimisation is provided using a SEMS. The optimisation will be done at a level of individual buildings participating in the REC. To save energy, the SEMS considers solar radiation and other heating sources, i.e., fireplace, to optimise heat generation from electric heating to meet the desired indoor temperature, increasing comfort and saving energy. The management system can also be used to minimise the operational cost of the electric heating system by considering the day-ahead spot price on the relevant Nord Pool market for Kökar, SE3. The desired indoor temperature will always override spot price signals to ensure comfort, but the temperature can fluctuate, e.g., between 21-23 °C (degrees Celsius). That way, the house can be pre-heated slightly during low price hours when knowing in the day-ahead market that a price peak is approaching to decrease consumption during those hours. The SEMS working principle is illustrated in Figure 21 below.

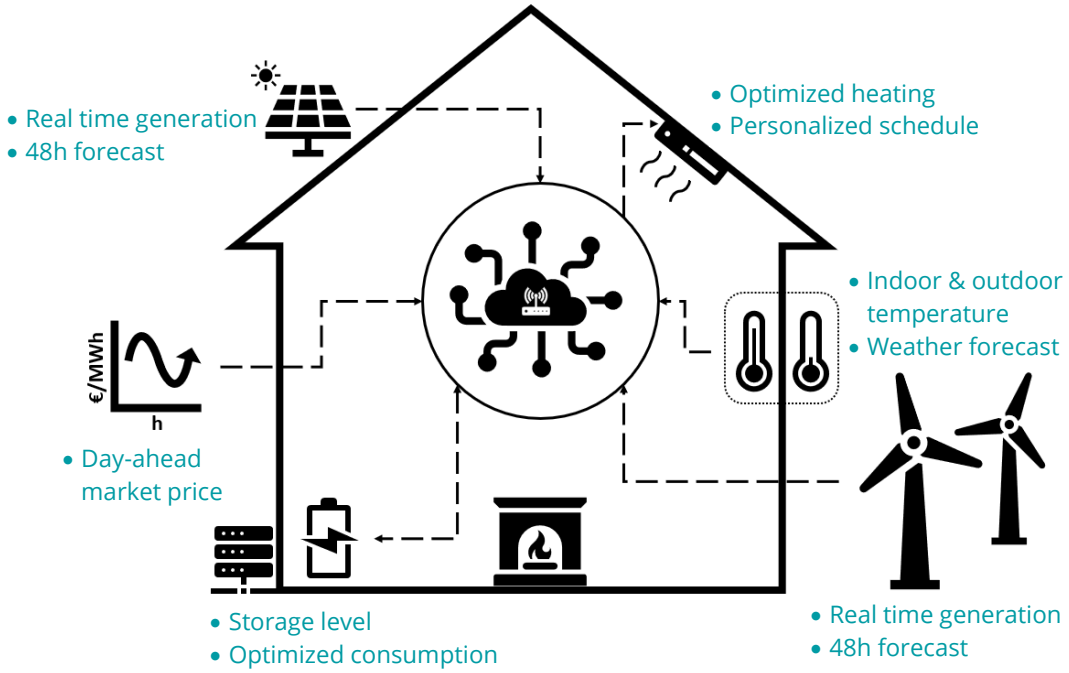

Figure 21: An illustrative schematic of a household equipped with a SEMS, including the decision-making parameters.

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Furthermore, several households can be aggregated and used by the DSO to shave peaks, for example, in local congestions on the importing line to Kökar. Twenty households should, on average, have 40 kW of aggregated flexibility available that can be utilised in the MEVPP and combined with the other planned flexibility resources to be demonstrated in the Kökar demo. The SEMS can easily be installed onto water-carried electric heating such as immersion heaters, air-to-water heat pumps, water-to-water heat pumps and ground-source heat pumps.

Thus, the data variables to be collected in general are:

- Indoor temperature in the houses (degree C)
- Consumption and production of assets (kWh)
- Aggregated demand response when activated – correlated against spot price (kWh/h)
- Energy prices (Hourly SE3 Nord Pool)
- EV charging (kWh)
- Storage flexibility – charging vs discharging (kWh)
- Grid import (kWh)
- Grid export (kWh)

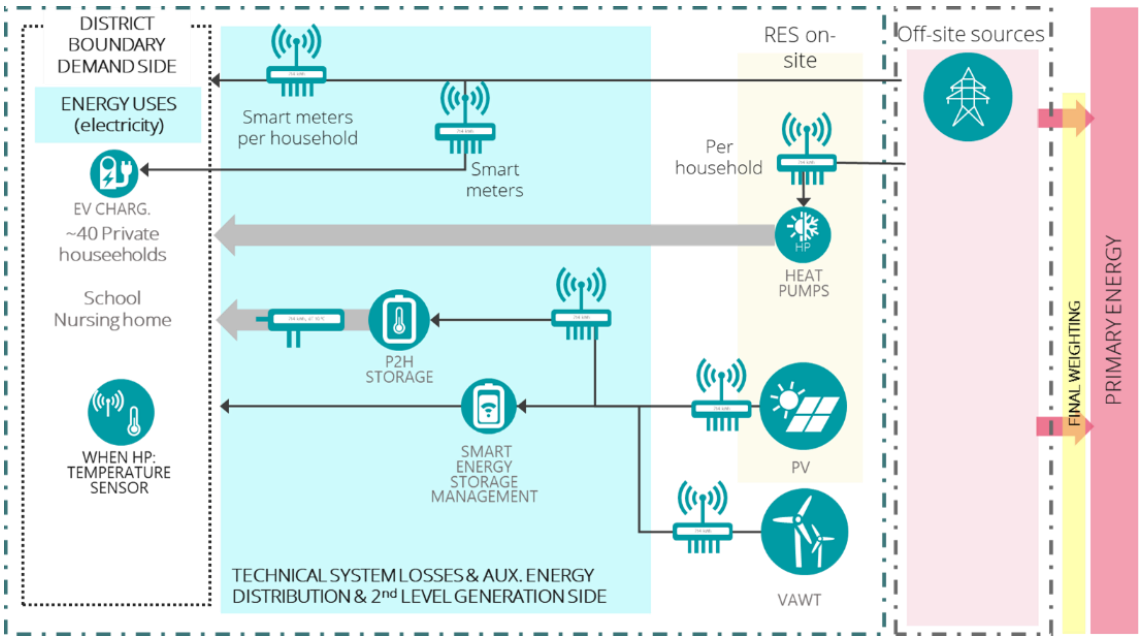

Figure 22: Kökar monitoring sensors (numbers to be confirmed).

For the other Kökar demo sites, the school and the nursing home, plus the kindergarten, the SEMS will be used to optimise the self-generation use behind the meter for direct consumption and for storing in relevant energy storage. The day-ahead spot price will also be used to optimise, e.g., charging during night-time with lower cost considering efficiencies and self-generation to reach the lowest cost for heating and electricity possible within the buildings.

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3.1.2. Issues in data monitoring - Kökar

The main and only issue with data monitoring is that there are no monitoring devices in place yet, although the ones meant for the private households just arrived by the time this document was being consolidated (M23). The devices for the municipal buildings, i.e., the school and nursing home have not been procured yet primarily due to the issues mentioned in chapter 2.1.3 earlier in the document.

3.2. Data monitoring in Berchidda

3.2.1. Data monitoring status – Berchidda

Currently, no data is being monitored on the Berchidda demo site due to the fact that no Smart management systems of the distributed energy sources are currently installed in the Berchidda Municipality as anticipated in the Grant Agreement (see more details in section 2.2). Energy Hub will be installed in the buildings within heat pumps installation, foreseen around September 2023. Both GridAbility and R2M Energy are in charge of this installation, while the access and control of meters is managed within GridAbility, and data are stored remotely on a secured cloud platform.

For the Berchidda demo, a measuring and data communication infrastructure will be deployed and connected to already existing assets such as PV installations, heat pumps, battery storages and EV chargers and it will communicate with the MEVPP. Berchidda use case, as already presented in D2.1, integrates a series of services which would be of interest for the Municipality to be provided in a medium and long-term, partly within the scope of the progress and also beyond LocalRES, including:

- Collective peak shaving
- REC/Collective self-consumption
- Optimization of energy flows within REC
- Demand response
- V2G services
- P2P energy trading
- Aggregated (REC level) energy trading
- Public EV charging station
- Smart storage Management system
- P2H

Thus, the data to be collected in general is:

- Active Power
- Reactive Power
- Active Energy
- Reactive Energy
- Voltage
- Frequency
- Current
- Power Factor

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Those data have maximum sampling frequency of 15 minutes.

Figure 23 summarizes the monitoring sensors in Berchidda demo (units to be confirmed):

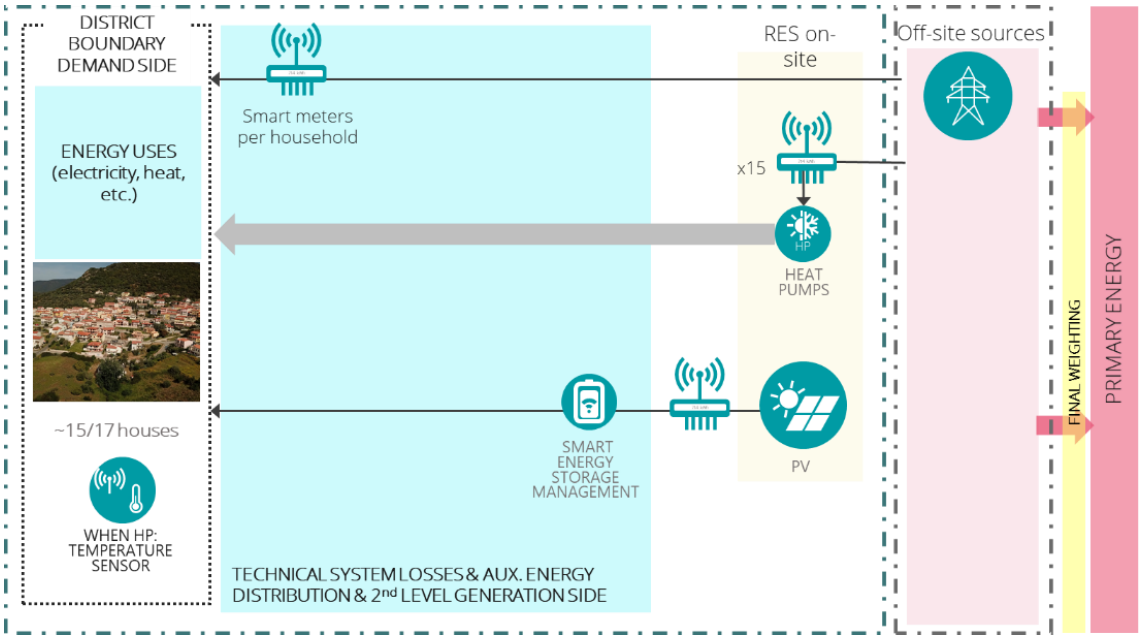

Figure 23: Berchidda monitoring sensors.

3.2.2. Issues in data monitoring - Berchidda

At the time being, there are no monitoring devices in place yet in Berchidda, primarily due to the issues mentioned earlier in the document, i.e. in chapter 0.

3.3. Data monitoring in Ispaster

3.3.1. Data monitoring status – Ispaster

Aiguasol has raised the Web infrastructure with its six (6) modules parallelly, while Barrizar has verified the installations hardware and adjusted the SCADA. Currently, all the systems installed are communicating with the platform with Dset company support. Since the DH expansion is still under construction, the communication with this system is limited. All data is saved in the data storage module DATUMA. The system data architecture is depicted in Figure 24 below.

The integration module which enables the collection from external providers is communicated with the Meteoblue and DATADIS to collect information regarding the weather and obtain consumption curves from the users' meters. Together with the forecasting module, the platform gives information to the used over the forecast data.

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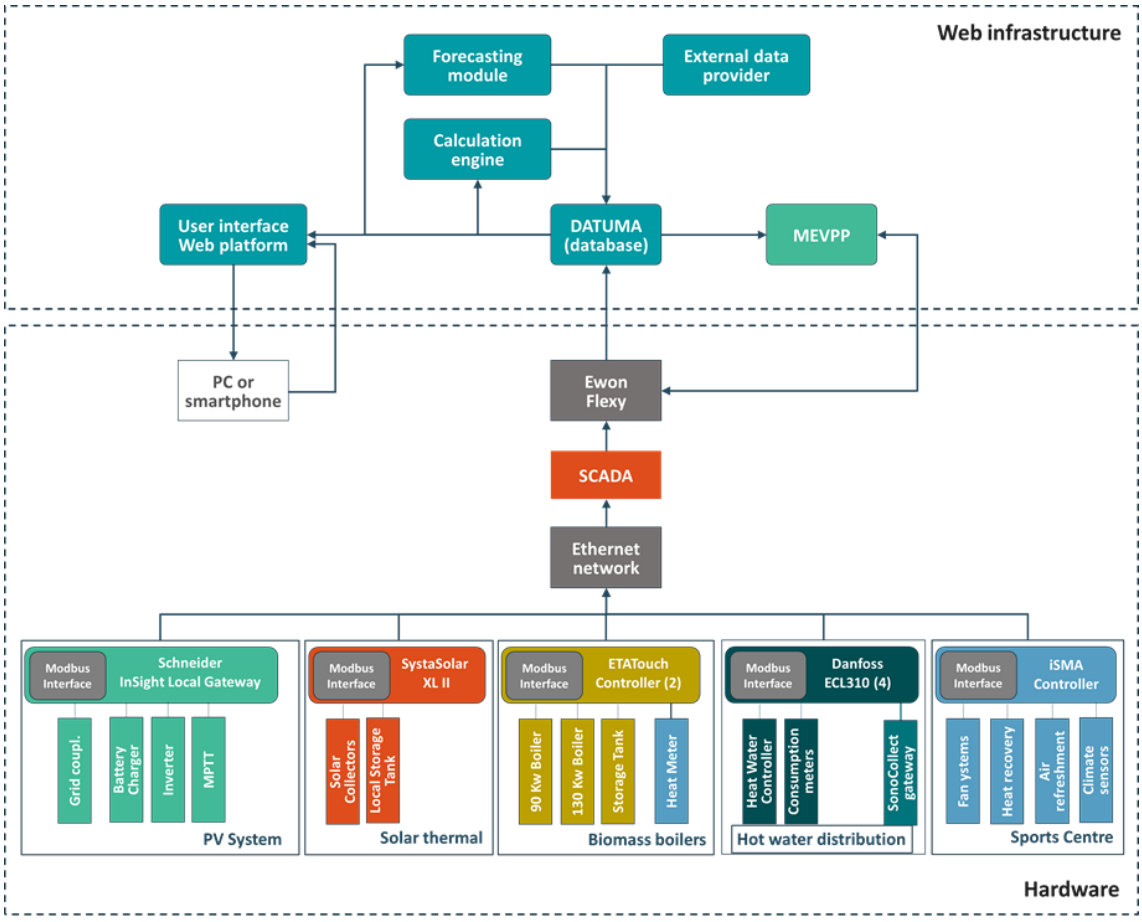

Figure 24: Diagram of the IT infrastructure (software) in Ispaster demo

The calculation engine, which takes data from DATUMA, is already developed and provides indicators for later analysis.

User Interface Visualization structure is set up with most features working properly. The interface registers the users and gets authorization from them to access to the electricity consumption curve of their meter through API with DATADIS. It uses this data to calculate and optimize the coefficient of distribution for each user linked to a self-consumption with RE generators Figure 25. With the sharing coefficient (β), the energy production is divided per household and, by comparing the allocated production with the consumption, the excess of energy per household is obtained. This way the savings ("estalvi" in Figure 25) is gathered per household and a simplified electric bill is provided. This data is given to the energy distributor for energy bills compensations.

The platform shows key indicators to the user, that allows them to understand how much energy is generated and self-consumed, as well as providing data over their payback time and value. The users can see both their individual consumption and economical values as the one of the communities (Figure 26). The interface includes a space for communication with other members and with contact with technical services providers. The construction of the interface APP is ongoing and will allow the user to get the information easily as well as obtain alerts on tips to improve self-

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consumption, as can be seen in Figure 27 (in the Figure, the tip message "Today is better to user your appliances from 3pm to 6pm" is displayed).

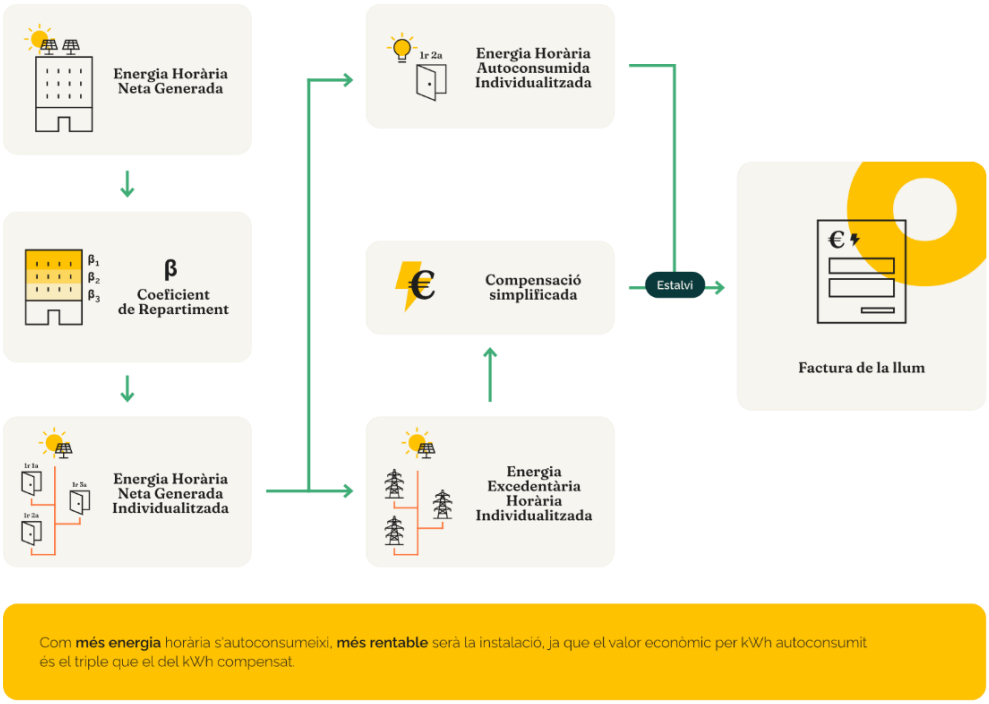

Figure 25: Diagram of self-consumption with surplus energy compensation in Spain

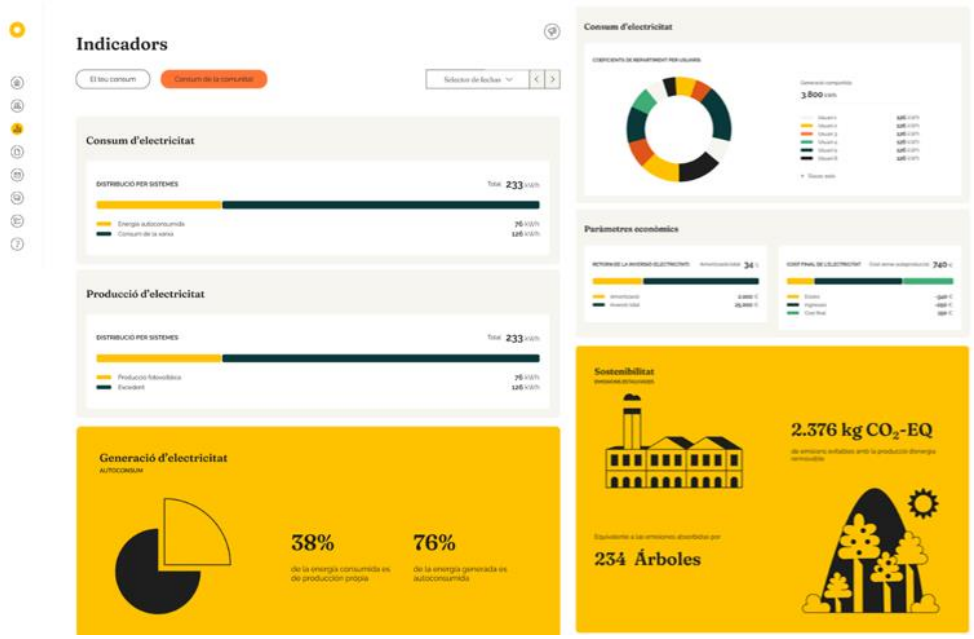

Figure 26: Community key indicators visualization (energy consumption, energy production

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Figure 27: APP Visualization on energy generation prediction (over a 24h period.

Finally, the execution module which verifies the proper operation of modules and detects anomalies is in an advance development stage.

Thus, the data that is being collected in general is (Table 22):

- Smart meter data: Power, Voltage (U), Current (I), Apparent power (S), cosphi, frequency (f), on all phases
- PV production at the PV inverter: frequency and power factor
- Thermal energy production, temperatures (inlet, return, and at the water buffer in the boiler room), flowrates at the boiler room and solar thermal production (production, temperature, flowrates)
- At each substation (8 substations in total): heat consumed, temperatures and flowrate. At each dwelling of building A there is individual heat meters too.
- Electricity consumption of the 8 buildings (1 to 8 in figure below), electricity consumption of the boiler room and solar thermal installation.

Table 22: Datapoints units and frequency of Ispaster demo site

Datapoint	Unit	Frequency
Battery - Power -hourly IN (Charge)	kWh	15 min
Battery - Power -hourly OUT (Inverting)	kWh	15 min
Battery - Voltage	V	15 min
Electricity consumption from the grid -*llifetime*	kWh	15 min
Energy export - *lifetime*	kWh	15 min
Energy import - *lifetime*	kWh	15 min
Frequency measurement - *"GRID Frequency"*	Hz	15 min
PV - Generation profile (PV Total Active) - This Hour	kWh	15 min
Biomass boiler - generated heat -*lifetime*	kWh	15 min
Building heat usage *(Ayuntamiento)*	kWh	15 min
Building heat usage *(Frontón)*	kWh	15 min

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Building heat usage *(Bloque A)*	kWh	15 min
Building heat usage *(Bloque B)*	kWh	15 min
Outdoor temperature *(Sensor Bloque B)*	ºC	15 min
Solar thermal - generated heat - *lifetime*	kWh	15 min
Supply temperature for heating *(Ayuntamiento)*	ºC	15 min
Supply temperature for heating *(Frontón)*	ºC	15 min
Supply temperature for heating *(Bloque A)*	ºC	15 min
Supply temperature for heating *(Bloque B)*	ºC	15 min

Figure 28 summarizes the monitoring sensors in Ispaster demo:

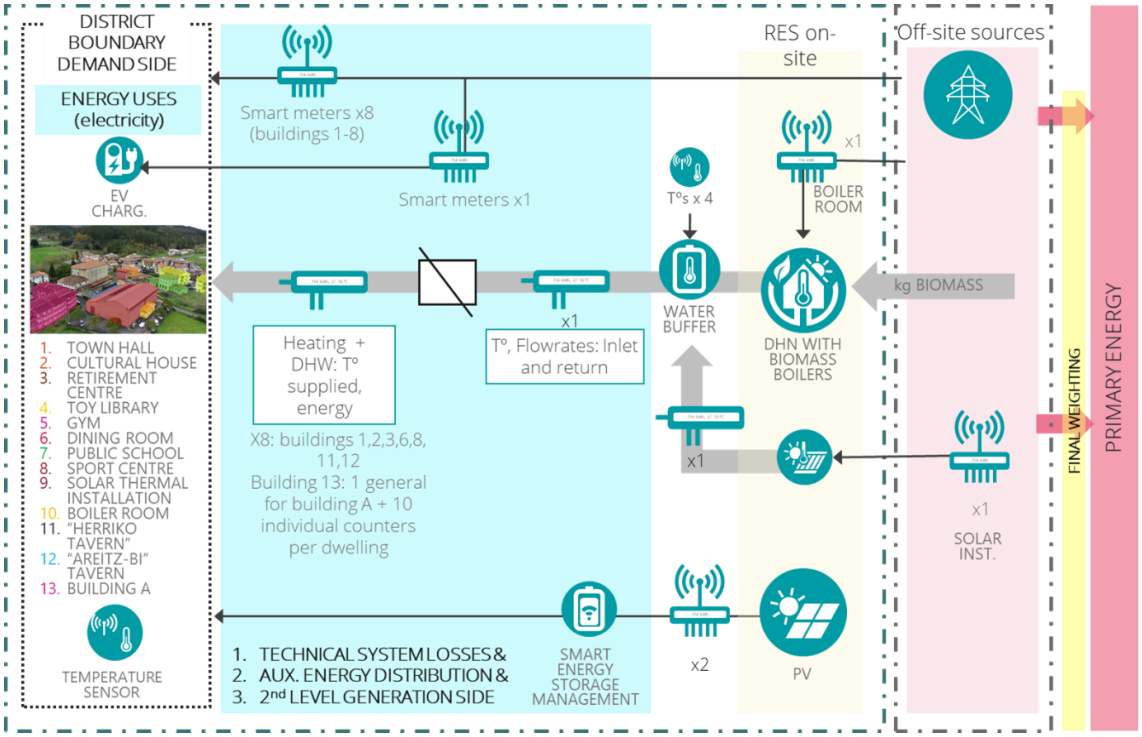

Figure 28: Monitoring sensors in Ispaster

3.3.2. Issues in data monitoring – Ispaster

There have been some delays in the arrival of key components for the SCADA setup and improvement of the equipment hardware, which have affected the development of the monitoring.

The parameter preferences are still being reviewed and adjusted to the requirement for the monitoring and control system and for the MEVPP. Some issues on the control of the parameter have been risen regarding privacy and comfort. A meeting with key partners will be necessary to solve these questions.

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3.4. Data monitoring in Ollersdorf

3.4.1. Data monitoring status – Ollersdorf

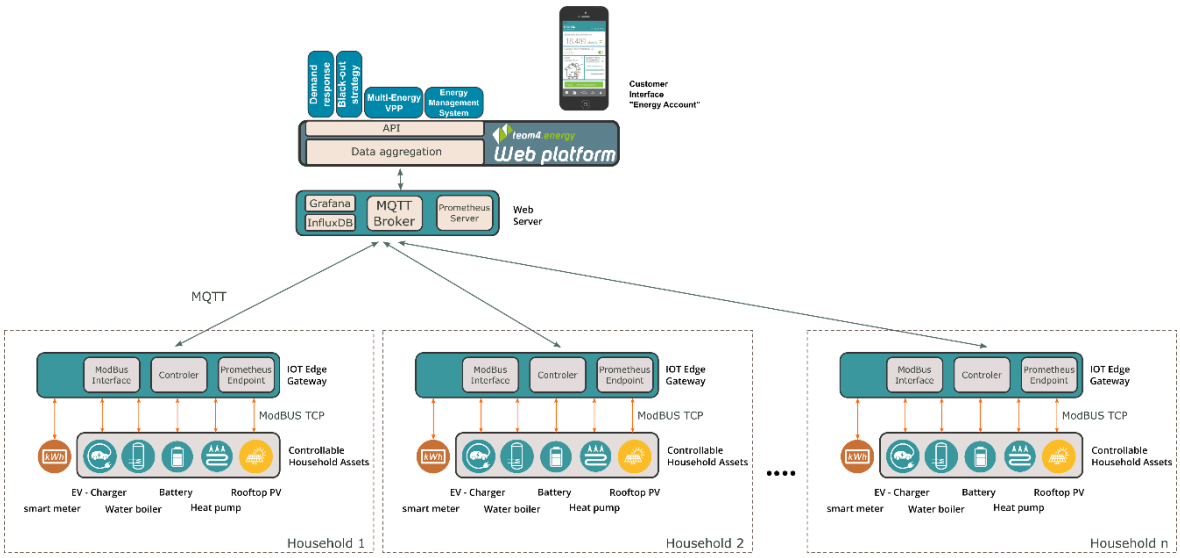

Figure 29: Data architecture in the Ollersdorf demo

Monitoring in Ollersdorf is accomplished by a centralised entity that acts as a MQTT broker with an InfluxDB database in the background that stores the data passed from the *IoT Edge Gateways*. Each participant has its own measurement equipment deployed by qualified contractors. Depending on the household, each *IoT Edge Gateways* can measure the following assets:

1. Rooftop PV (Figure 31)
2. Heat Pump (Figure 32)
3. Boiler (Figure 33)
4. Battery (Figure 34)
5. EV-Charger (Figure 35)

For each of the participating households, there will be a dedicated smart meter (Siemens PAC2200) that measures the overall household consumption data. In cases of households with rooftop PV, there is a second smart meter (also PAC2200) measuring the PV generation data. So, each participating house (no matter if PV, HP, EV, battery, ….) will be measured in 1-min intervals: Power, Voltage (U), Current (I), Apparent power (S), cosphi, frequency (f), on all phases at the grid connection point.

In addition, each participating house with PV will be measured in 1-min intervals at the PV inverter: P, U, I, cosphi, f on all phases.

For the other appliances (HP, battery, EV charger) the datapoints provided by these appliances will be gathered via ModBus TCP. At one pilot house, already connected, the heat pump measures temperature of the room, setpoint temperature (Ttargetroom) and ambient temperature

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(T_ambient) as well as datapoints indicating the current operating mode of the HP. No measurements are gathered from the gas boilers.

At the battery, state of charge (SoC), P, Q, P_charge/Q_charge, are measured. At the EV-Charger: P, U, I, Charge Status (plugged in, charging, idle, …) are measured.

The following diagram summarizes the sensors description and overall concept of the monitoring for Ollersdorf:

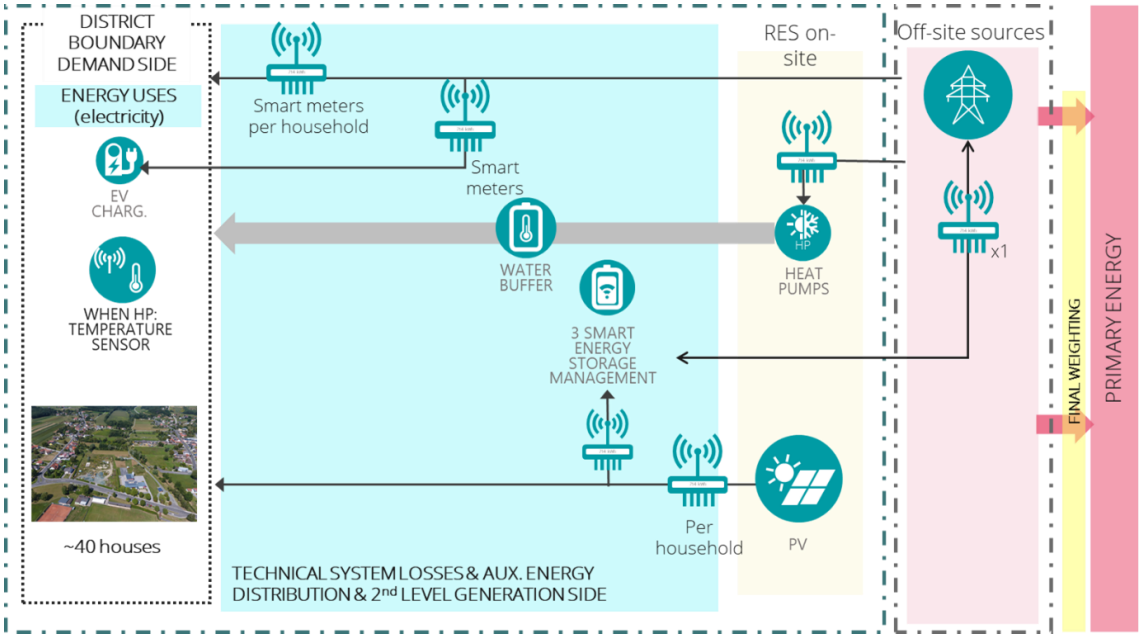

Figure 30: Ollersdorf monitoring sensors concept

For the monitored data a Grafana dashboard is available, some sample graphs are shown below.

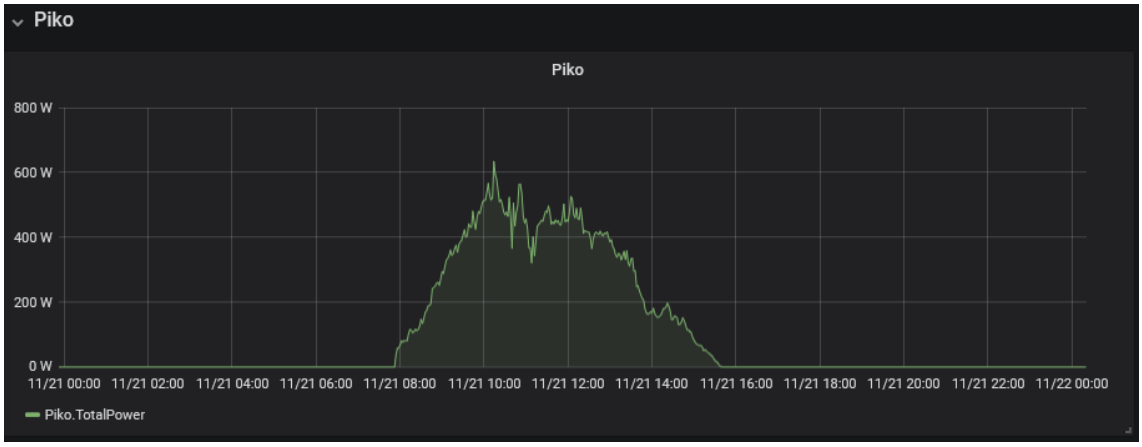

Figure 31: Timeline of rooftop PV production in a sample household in 24h period

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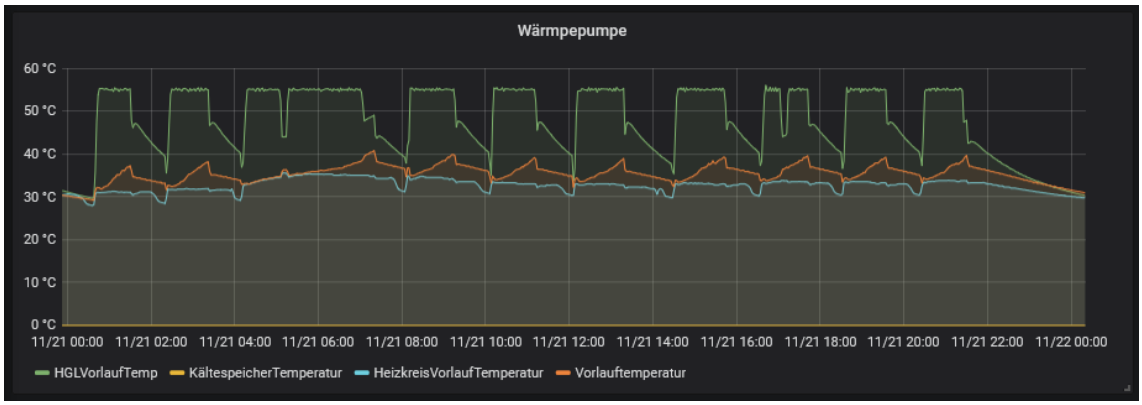

Figure 32: Timeline of various temperature measurements in the heat pump system of a sample household in a 24h period

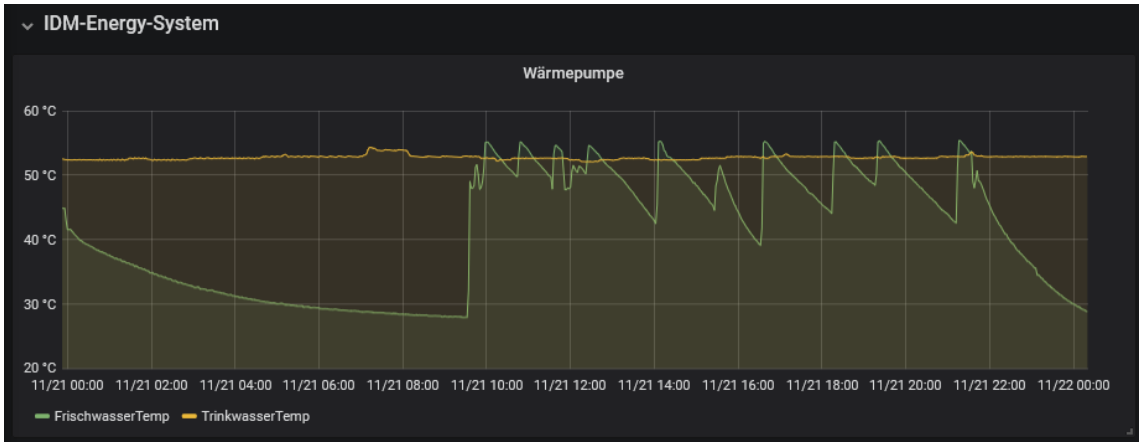

Figure 33: Timeline of various temperatures in the domestic hot water system of a sample household in a 24h period

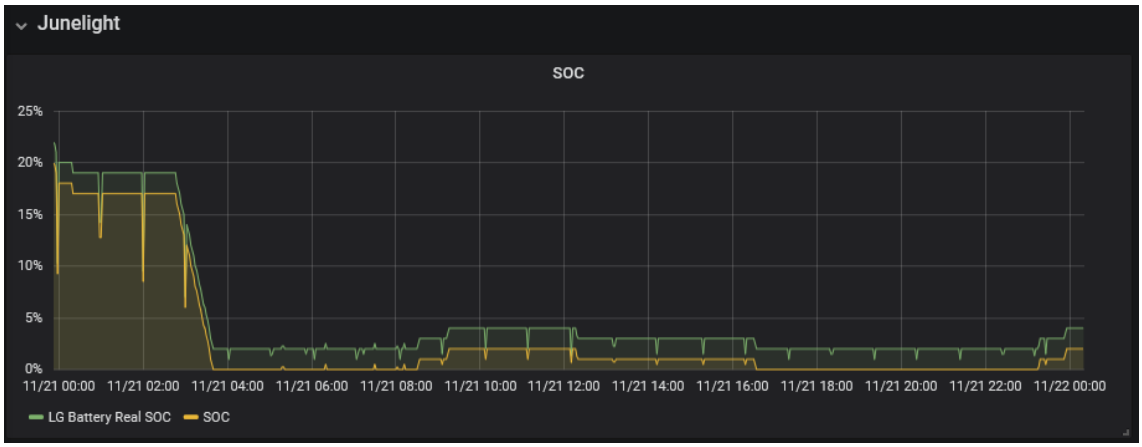

Figure 34: Timeline of SoC of the home battery system of a sample household in a 24h period

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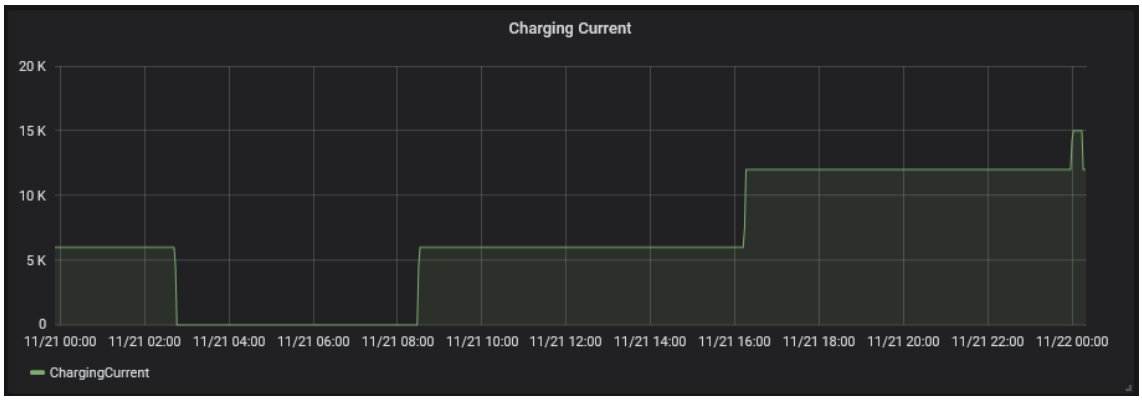

Figure 35: Timeline of charging current (shown in mA) of the EV charger of a sample household in a 24h period

Additionally, each household's PCC (Point of Common Coupling) will always be measured independent of the above list.

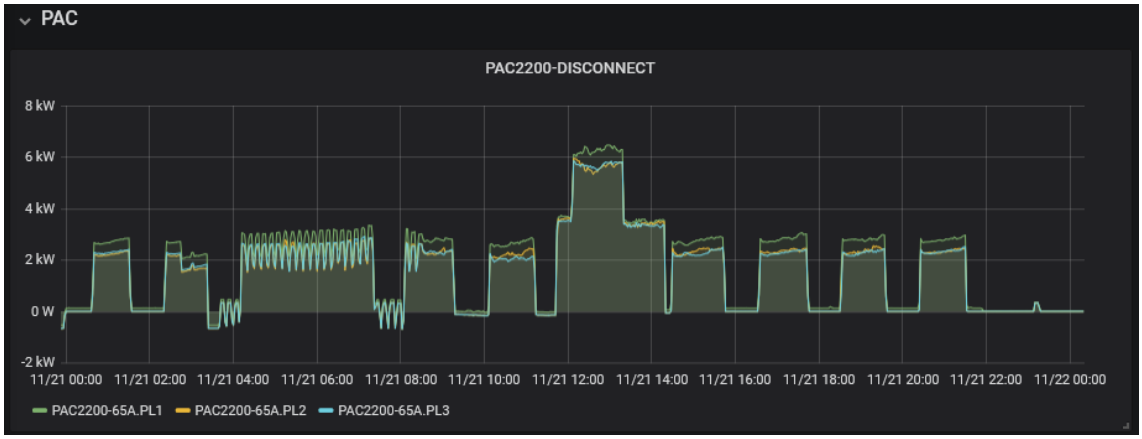

Figure 36: Timeline of power consumption at PCC of a sample household in a 24h period

The *IoT Edge Gateways* acts as a proxy and translator between the high-level controllers and control algorithms and the local assets, allowing them to be controlled by the central entity.

Due to the *tree architecture* shown in Figure 29, some scalability is a given, and for the demo in Ollersdorf beyond what is necessary. Generally, the single point-of-failure and single point-of-data can become a bottleneck if no redundancy and load-balancing is available. This also depends on the throughput of the server the central broker is running on.

This enabled the high-level controller and control algorithms to work with the assets - mainly GCM (Grid capacity manager) and BO (Blackout recommendation).

Currently, some data is monitored in Ollersdorf as the deployment of all household devices was delayed during the summer 2022. Data from *one office building and one household* is aggregated and stored in a time-series optimised database. This includes PV generation data, total power

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consumption, and depending of the availability of the respective assets in the individual households: heat consumption, EV charge data records, grid power consumption and grid feed in. The overall household consumption data as well as PV generation data will be gathered from all households. Currently the demo is working to get more data from appliances installed in other houses as well. However, some of the heat pumps do not have data interfaces and for some of the appliances communication interface may not work as expected, so getting these datapoints is ongoing in the project. Collecting data on individual asset level is an ongoing task.

In general, the backend infrastructure is up and running and has proven to be scalable enough to handle multiple new nodes. Data monitoring of all participating households at household level is up and running since the end of 2022. As stated above, monitoring of individual assets is ongoing to be set up and expected to be up and running by 06/2023.

3.4.2. Issues in data monitoring – Ollersdorf

As mentioned in section 2.4.3, the main issue concerning monitoring was the lack of qualified personnel to deploy and integrate the *IoT Edge Gateways* with their accompanying measurement devices. This issue has been fully resolved by 03/2023.

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4/ Conclusions and final remarks

Deliverable D4.3 constitutes the first *Field Implementation and Data Monitoring report* for the LocalRES demonstration sites out of three, to be submitted during the initial, intermediate and final stages of the implementation and monitoring processes, respectively (i.e. D4.3, D4.4, D4.5). The purpose is to report the status and progress regarding the demonstration actions, including the deviations and risks, adaptation of the original plans and proposal of mitigation actions and contingency measures to ensure the successful implementation of the actions.

During this initial phase, relevant progress has been made in the demos, especially in Ollersdorf and Ispaster, but several deviations have occurred, with significant impact on the development of the actions in some cases. Major reasons for these deviations have been external factors out of the control of the demo teams, including the global context that has included COVID restrictions, an energy crisis, shortage of components or limited availability of materials with very significant effects on the original plans of the actions and consequently their effective development, the legal process in Kökar or the new regulation in Austria which has made unfeasible the P2P activities in Ollersdorf demo site as initially proposed.

During next months, carrying out relevant strategic actions will be critical for the successful development of the demonstration actions as planned, including:

- Maintaining a close monitoring and active management in order to steer the demos over the perceived issues, including frequent communications to be able to react swiftly when situations arise.
- Properly implementing the mitigation actions and contingency plans defined in this document.
- Regularly updating the action plan, including new potential risks and the adaptation of mitigation actions and contingency plans if necessary.

Subsequent versions of this deliverable will contain the progress that will be made between the submission of the present document and the preparation of the new ones (D4.4, D4.5), and will update the information of the ongoing critical aspects identified so far, including the resolution of budgetary deficiencies in some of the demonstration actions, the alternative for the P2P activities or the situation in Kökar demo site.

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