LocalRES

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

D4.2 – Detailed demonstration plans

09 June 2023

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

<table>
<tr><td>Project Acronym</td><td colspan="4">LocalRES</td></tr>
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Date	Version	Author	Comment
01/09/2021	v1	Niko Korpela (FLEXENS)	First sketch and ToC
09/09/2021	v2	Niko Korpela (FLEXENS)	Re-structured version in old template
16/09/2021	v3	Niko Korpela (FLEXENS)	Transfer to the LocalRES template from the old working document (v2.0)

12/10/2021	v4	Niko Korpela (FLEXENS)	Updated deliverable template
25/03/2022	v5	Niko Korpela (FLEXENS)	1st Draft complete version
10/06/2022	v6	Niko Korpela (FLEXENS)	1st Daft ready for review
20/09/2022	v7	Niko Korpela (FLEXENS)	New version after peer review
28/10/2022	V8	Niko Korpela (FLEXENS)	Consolidated version (first submitted version)
09/06/2023	V8.1	CARTIF	Revised version

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Executive Summary

This document belongs to the framework of Work Package (WP) 4 within the LocalRES project, which is responsible for implementing the project's pilot demonstration actions. In particular, this report constitutes the deliverable associated with T4.2 – *Detailed demonstration planning*. This task describes the planning process to deploy the LocalRES demonstration actions. This deliverable identifies and documents several essential aspects that must be considered when planning a deployment. Generally, this involves preparation, installation, testing, verification, and handover and shall include, at a minimum, a comprehensive *Installation Plan* that includes a detailed schedule of the actions, a *Plan for Training of Personnel*, and a *Safety Plan*. The *Demonstration actions* part in each planning framework links the demonstration actions with the objectives of the LocalRES project. In order to do so and to measure it, the KPIs defined in the Task 4.1 are utilized.

The *Demo Leaders* will perform the following sequence of deployment activities:

- Provide a *Demonstration Plan Schedule* showing the individual tasks associated with installing equipment/software/hardware, etc. and when specific actions will be deployed.
- Pre-installation activities including working with the client to finalize the *Installation Plan*, *Training Plan*, Communication Plan, Schedule, and other deployment documents.
- Ensure that all safety procedures are in place.
- Oversee proper installation of equipment.
- Verify that each subsystem communicates properly.
- Verify that all installed equipment and software operate properly by conducting systems testing.
- Risks and contingency plans of any needed change to existing installations

This deliverable also outlines some expected interactions between different stakeholders and project members and the LocalRES consortium along with the project execution. A summarised schedule of the deployment of actions prepared during the initial phase of the project is indicated in each demo section:

- Kökar: Table 8
- Berchidda: Table 15
- Ispaster: Table 22
- Ollersdorf: Table 30

It is to be noted that this document was primarily prepared during the first months of the project, and by the time this deliverable was completed different changes had already been occurred affecting the demonstration plans in the demos which have not been reported here. All changes and updates will be included in subsequent deliverables focused on the reporting of the field implementation and data monitoring (D4.3-D4.5).

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List of acronyms and abbreviations

AWHP	Air-to-water heat pump
BESS	Battery Electricity Storage System
DSO	Distribution System Operator
EC1	Economic KPI 1: Share of annual investments towards RES
EIA	Environmental Impact Assessment
EN1	Environmental KPI 1: Energy related emissions
EN2	Environmental KPI 2: Land-use for energy
EN3	Environmental KPI 3: Noise level
EN4	Environmental KPI 4: Visual impact
EV	Electric Vehicle
GA	Grant Agreement
GDPR	General Data Protection Regulation
GSHP	Ground-source heat pump
HP	Heat Pump
ICE	Internal Combustion Engine
ICT	Information and Communication Technology
LPG	Liquified Petroleum Gas
NTO1	Non-Technical Objective 1: *To give feedback and recommendations to market design and policies with a focus on the RECs*
NTO2	Non-Technical Objective 2: *Dissemination and communication*
MEVPP	Multi-Energy Virtual Power Plant
PT	Planning Tool
PV	Photovoltaic
REC	Renewable Energy Community
RES	Renewable Energy Source
SCADA	Supervisory Control And Data Acquisition
SEMS	Smart Energy Management System
SI	System Integrator

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SO1	Social KPI 1: Citizen engagement
SO2	Social KPI 2: Employment rate
SO3	Social KPI 3: Regulatory REC barriers
SO4	Social KPI 4: Energy poverty
STO1	Scientific Technical Objective 1: *To define services driven by REC and its related business models*
STO2	Scientific Technical Objective 2: *To empower renewable energy communities via a planning (analytical and design) tool*
STO3	Scientific Technical Objective 3: *To effectively integrate multiple energy networks and combine energy vectors via a MEVPP in a sector coupling approach*
STO4	Scientific Technical Objective 4: *To demonstrate solutions for the decarbonisation of the local energy systems in 4 different EU contexts*
TESS	Thermal Energy Storage System
TE1	Technical KPI 1: Peak electricity demand
TE2	Technical KPI 2: Energy demand
TE3	Technical KPI 3: Number of ICEs per capita
TE4	Technical KPI 4: Number of EVs per capita
TE5	Technical KPI 5: Cumulative energy storage capacity
TE6	Technical KPI 6: Electricity import
TE7	Technical KPI 7: Renewable energy self-production
TRL	Technology Readiness Level
VAWT	Vertical Axis Wind Turbine

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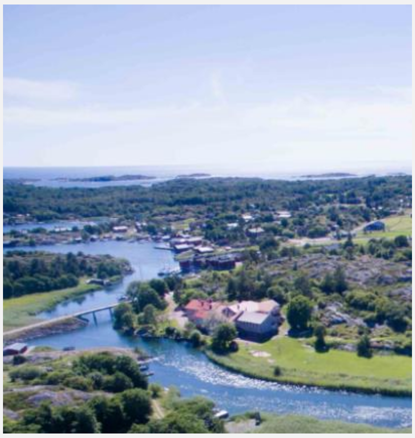
1/ Introduction

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. The focus of LocalRES is on Renewable Energy Communities (RECs).

LocalRES includes four demonstration cases in remote communities across Europe, where the LocalRES concept will be deployed, and innovative local energy systems with a sector-coupling approach will be demonstrated. The systems are expected to be able to interconnect and optimise the joint operation of different energy vectors (electricity, heating), by maximising the contribution of Renewable Energy Sources (RES) and enhancing the energy system flexibility and security of supply. The four demonstration sites in Finland, Italy, Spain and Austria, were presented in deliverable D4.1, and are summarized in Table 1, indicating **where** they are located, **who** are the main actors involved and **which** technologies and demonstration actions are expected to be installed and deployed

Table 1: Summary of LocalRES demo sites (Source: D4.1 and D1.2)

Description of the demo sites	
Kökar	 **Location:** Kökar archipelago (Åland islands, Finland) **Type:** geographical island **Land area:** 64 km^2 **Population:** 234 persons (2018) **Grid:** underwater power lines; weak grid connection with occasional outages (3-4/year) **Stakeholders:** Local energy group (citizens), FLEXENS (Project developer), Kökar service (craftsmen/workers), Kökar Municipality (public staff), VTT (RTO), Ålands Elandelslag (DSO), Consilia Solutions AB (datahub entity), Single Wing Energy Oy (Tech. provider), Polar Night Energy (Tech. provider), technicians. **Existing technologies in the village:** Reserve generators, smart meters, ground-source heat pumps (GSHP), air-water heat pumps (HP), wood heating/oil heating, direct electric heating systems, e-car, wind power plant, solar PV **In the demo case (to be installed)**: Smart EMS (Action 1.6+1.8), EV chargers (Action 1.7), TESS+ air-water HPs+ VAWT (Action 1.3+1.5), solar PV (Action 1.4+ 1.8), Battery energy storage system (BESS – Action 1.8) **Other:** contribution to Aland sustainability agenda (Action 1.1), community engagement (Action 1.2)

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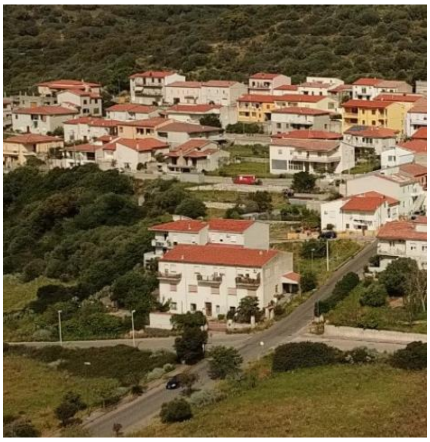
Berchidda



Location: Berchidda (Italy)
Type: Rural community / village
Land area: 201 km^2
Population: 2648 inhabitants (2021)
Grid: municipal-owned grid
Stakeholders: Citizens, Berchidda municipality (owns electric grid and it is a local distributor), AEC - Azienda Elettrica Comunale (Public Energy Office and DSO-TSO). R2M (installer), GRIDABILITY (Energy utility / installer), Energy4com (private non-profit company, legal issues), Axpo energy supplier in the area (not involved in LocalRES).
Existing technologies in the village: PV plants (1,000kWp total), batteries, gas and oil boilers, traditional fireplaces

In the demo case: digital applications (for aggregation, demand response, smart meters – Action 2.5), electric storage (Action 2.2), EV charging points (Action 2.3), air-air HPs (Action 2.4), existing PV and batteries
Other: Community engagement (Action 2.1)

Ispaster

Location: Ispaster (Bizkaia, Spain)
Type: Rural community / village
Land area: 22 km^2
Population: 740 inhabitants
Grid: municipal-owned microgrid and DHN
Stakeholders: Citizens, Ispaster municipality, Barrizar (ESCO cooperative, operator and maintenance of the district), Public sector (regional/provides funds), Aiguasol (cooperative, technical assistance)
Existing technologies in the village: besides the demo case, the rest of the village is supplied with the national grid and gas and oil boilers, air-water chiller for the restaurant
In the demo case: Existing microgrid supplied by 28.3 kWp PV and batteries (178 kWh Pb-Ac), existing solar thermal and biomass driving a district heating network (DHN), Besides that, a solar PV with storage system (Action 3.3 +3.6) has been foreseen, as well as the extension of the DHN (Action 3.2), the installation of HP-based solutions (Action 3.5), a CHP system (Action 3.5) and a public EV charger (Action 3.4).
Other: Community engagement (Action 3.1), smart control (Action 3.7), Policy recommendations (Action 3.8), Business model innovation (Action 3.9)

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<table>
<tr><td>Ollersdorf</td><td>
Location: Ollersdorf (Austria)
Type: Rural community / village
Land area: 8.9 km^2
Population: 1000 inhabitants
Grid: special concerns of the local community before potential blackout scenarios
Stakeholders: Citizens, AIT (demo site coordinator, installation of equipment), Ollersdorf Municipality (management and interaction with local stakeholders), University of Passau (matching mechanism, blackout strategies)
Existing technologies in the village: PV, biomass-based heating system (wood pellets burners), HPs, smart meters, e-cars, EV chargers, a battery storage, one fast charger. In the future batteries, Smart Energy Management System (SEMS), and EV chargers are foreseen
Use case: biomass-CHP. Heat pumps, PV panels, electric boilers, battery storage, smart EMS (optimisation of energy flows, P2P; Action 4.3+4.5), ICT platform (Action 4.2)
Other: Community engagement (Action 4.1), community information system (Action 4.4), future energy scenario and impact of scaling up (Action 4.6)</td></tr>
</table>

This document is a *Demonstration Pla*n, which shows the planning steps to implementing the LocalRES demonstration plans and putting them into production; in other words, to deploy the LocalRES demonstration actions. The document provides detailed deployment guidelines and helps driving the deployment phases in next steps. Generally, this involves preparation, installation, testing, verification, and handover. The introduction of the *Demonstration Plan* summarizes the high-level activities necessary to get the target system into a production environment. It is to be noted that by the time this deliverable was completed, different changes had already been occurred affecting the demonstration plans in the demos, but have not been reported here. All changes and updates will be included in subsequent deliverables focused on the reporting of the field implementation and data monitoring (D4.3-D4.5).

1.1. Purpose and scope

The ***Demonstration Plan* aims to describe the factors necessary for a smooth deployment of the intervention actions** and transition to the operational phase of the demo sites. The **plan covers the tasks involved in preparing, installing, training, stabilizing, and transferring the solutions to daily operations**. Additionally, it includes details on different installation scenarios, monitoring for stability, and verification of the reliability of the implemented solution.

The *Demonstration Plan* shall include, at a minimum, a comprehensive *Installation Plan* that includes a detailed *Schedule* of the actions, a *Plan for Training of Personnel*, and a *Safety Plan*. The *Safety plan* has not been addressed in detail in this deliverable per demo site, but it would be considered as a

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requisite to be accomplished in all steps of the *Installation Plan* (section 2.1 describes more in detail what should be considered).

The *Demo Leaders* will perform the following sequence of deployment activities:

- Provide a *Demonstration Plan Schedule* showing the individual tasks associated with installing equipment/software/hardware, etc.
- Pre-installation activities including working with the client to finalize the *Installation Plan*, *Training Plan*, *Communication Plan*, *Schedule*, and other deployment documents.
- Ensure that all safety procedures are in place.
- Oversee proper installation of equipment.
- Verify that each subsystem communicates properly.
- Verify that all installed equipment and software operate properly by conducting systems testing.

The *Demo Leaders* shall provide specific step-by-step sequenced scenarios for installing software, hardware, a communications network, and the subsystem, combined with a schedule of these various activities.

The scope of the work here is rather broad as there are multiple sites in multiple locations with varying policies and regulations. In addition, the technical solutions that are implemented differ from one another, so naturally that will impact the nature of the specific *Demonstration Plans*. However, some rules and principles will be followed in all sites, such as safety, training, implementation, and transfer to operation.

1.2. Objectives

This deliverable aims to compile the plans for deployment for all four demos uniformly. The idea is to **provide the reader with information about the implementation actions in the various phases of the project**, while also considering the policies in place regarding information sharing. The aim is also to be able to **denote which Scientific Technical Objectives (STOs) and Non-Technical objectives (NTOs) are addressed by which pilot functionalities listed in the Grant Agreement (GA) and how they will affect the KPIs determined in T4.1** and included in deliverable D4.1. Both the LocalRES STOs and the NTOs are described more detailed in the GA, and their titles are listed below. Additionally, the KPIs are listed below, but their detailed descriptions and metrics are presented in D4.1.

STOs and NTOs as defined in the GA are summarized in Table 2:

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Table 2: STO and NTO related to WP4 – Demonstration actions

Name of STO and NTO	Summary
STO1 – *To define services driven by REC and its related business models*	REC driven business models for each LocalRES demonstration case, based on the study of the regulation framework and the specific local aspects, will be defined. Potentially, the business models will be validated in WP4 – *Demonstration actions*.
STO2 – *To empower renewable energy communities via a planning (analytical and design) tool*	LocalRES will develop a digital planning tool (PT) for enhancing access to the information for citizens and communities. Users from the community will test and validate the PT in WP2. Potentially, the use of the tool could be replicated and used in the demos by citizens in WP4.
STO3 – *To effectively integrate multiple energy networks and combine energy vectors via a MEVPP in a sector coupling approach*	LocalRES will develop a Multi-Energy VPP (MEVPP) to optimise the joint operation of the energy networks and vectors (electricity, heating, mobility, etc.) included in the local energy systems. The MEVPP able to i) integrate existing control algorithms, weather/ demand predictions, demand response mechanisms and management strategies for the integration of flexible assets and energy generation with 1-sec horizon, and ii) deploy the participation of REC in the diverse energy markets. In WP4 the MEVPP will be validated
STO4 – *To demonstrate solutions for the decarbonisation of the local energy systems in 4 different EU contexts*	Four demonstration sites (Kökar Island, Berchidda Island, Ispaster and Ollersdorf) will constitute RECs in which different actions will be deployed aiming to: i) reduce 50% the energy grid exchange; ii) meet a RES contribution of 60%; iii) save 20% of the end-users' energy bill, and iv) deliver energy and CO2 emission savings of 25%. In WP4 the KPIs will be monitored to ensure the achievement of the indicators.
NTO1–*To give feedback and recommendations to market design and policies with a focus on the RECs*	From the lessons learnt of the project and demonstration sites, LocalRES will provide EU and national institutions with relevant information and good and bad experiences from the RECs deployment to ensure a good monitoring and implementation of the processes in other contexts. WP4 will contribute to this by monitoring the different drawbacks and enablers encountered in the demos.
NTO2– *Dissemination and communication*	A comprehensive dissemination and communication plan will be established at the beginning of the project to ensure exchange and learn across countries. LocalRES will get together with relevant stakeholders to exchange demo cases via webinars, study tours and workshops. WP4 will contribute to those workshops and webinars, and to disseminate at local level.

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LIST OF KEY PERFORMANCE INDICATORS

Economic, technical, environmental and social KPIs were defined in the evaluation framework of T4.1, which is explained in deliverable D4.1. Below, the KPIs are listed as a reference to what needs to be calculated in the demonstration campaign.

The technical KPIs are:

- TE1 - Electricity peak demand [MWh/h]
- TE2 - Energy consumption [MWh/a]
- TE3 - Number of ICE vehicles per capita [#]
- TE4 - Number of EVs per capita [#]
- TE5 - Cumulative ESS capacity [%]
- TE6 - Electricity import [%]
- TE7 - Renewable electricity self-production [%]

The environmental KPIs are:

- EN1 - Energy related emissions [t_{CO2eqv}/a]
- EN2 - Land use for energy [m^2/MW]
- EN3 - Noise level [0 = None/ 1 = Low/ 2 = Medium/ 3 = High/ 4 = Very high]
- EN4 - Visual impact [0 = None/ 1 = Low/ 2 = Medium/ 3 = High/ 4 = Very high]

The social KPIs are:

- SO1 - Citizen engagement [%]
- SO2 - Employment rate [%]
- SO3 - Regulatory REC barriers [None/Partial/Full]
- SO4 - Energy poverty [%]

The economic KPI is:

- EC1 - Share of annual investments towards RES [%]

1.3. Relation to other activities of the project

The implementation actions in Task 4.3 will be based on this *Demonstration Plan* document. The planning is done by considering the data architecture, software design, and ICT platform testing defined in the WP3. In Table 3, the relation between deliverable D4.2 and other deliverables in the project is listed. Moreover, in Table 4 the relation between Task 4.2 and other project tasks can be seen:

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Table 3: Relation of D4.2 to other deliverables.

Deliverables	Relation
D3.1.- Monitoring, common data model, and interfaces report	Demonstration Plans are created considering the requirements defined in D3.1. The task T3.1 itself is about common definition of the requirements and definitions of digitalisation of RECs (data architecture, data storage communication interfaces and graphical user interfaces).
D4.1. - KPI-driven evaluation framework and baseline	The demo actions and functionalities described in this deliverable are assessed using the KPIs listed in the D4.1.
D4.3-D4.5. - Field implementation and data monitoring reports	The field implementation reports should assess how well the Demonstration Plan is followed.

Table 4: Relation of T4.2 to other tasks.

Tasks	Relation
Task 3.1.- REC digitalization requirements	Common requirements for all the demos were defined in Task 3.1. During this, task-specific local requirements will be added together as part of the detailed *Demonstration Planning*, including at least site information, roles & responsibilities, schedule, resources, installation process, site monitoring, and training, will be defined. Special attention will be paid to the planning definition related to IT infrastructure and user interfaces.
Task 4.1.- Demonstration actions KPIs definition and baseline studies	The baseline situation described in T4.1 will be changed according to the demonstration plan presented in task 4.2, and its implications on the project objectives will be evaluated using the framework and KPIS from T4.1.
Task 4.3.- Field demonstration actions and data monitoring	The detailed *Demonstration Plans* created in this task include specifications of equipment, communication interfaces, needed changes to existing installations, etc. Decisions on the details of LocalRES functionalities to be implemented at each demonstration site will be made, all activities will be scheduled, and their progress will be followed up in Task 4.3.

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2/ Demonstration Action Planning Framework

Although the demonstration sites are in different locations and the national regulations might vary, the *Installation Considerations* listed here must be coherent. The first and foremost aspect to consider is safety; therefore, the critical guidelines for safety are presented in this section. Other considerations for a planning framework include code and industry standards, installation planning, weather and productivity, installation site maintenance, and installation records. The previously mentioned factors need to follow the guidelines and basic principles set here as it will make deployment reporting and monitoring throughout the project easier.

2.1. Safety

Those responsible for the demo action implementations, i.e., *System Integrators*, will be consequently responsible for the safety of the installers. The *Demo Leaders* are in each site are responsible for that *System Integrators* comply.

The *System Integrator* shall make sure that subcontractor personnel are licenced and qualified, and thus approved by the European Commission. Moreover, all third parties need to be selected via an appropriate tender process.

The *System Integrator* shall ensure that all personnel are adhering to the safety requirements throughout the project development, i.e., via the coordination of regular safety briefings. Additionally, the *System Integrators* ensure that all third parties involved are provided with the on-site safety requirements that comply with both European[1] and national standards.

The *System Integrator* shall develop, submit for *Demo Leader* approval, and update a *Safety Plan*. This plan shall be adhered to ensure the safety of all personnel as well as other individuals approaching the work site.

Note: All staff must participate in a safety orientation session before installation activities.

Note: If the agreed-upon safety requirements and code of conduct are breached, the *System Integrator* shall ensure that the incident is properly documented and that appropriate consequences are put in place.

2.2. Code & Industry Standards

The *System Integrator* shall adhere to all applicable codes and standards. The *Demo Leader* will periodically arrange a check-up, in cooperation with *System Integrator*, to confirm that the work sites

[1] European Agency for Safety and Health at Work

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meet all required standards. The check-up must occur in the working sites with a presence of a proper licenced authority.

2.3. Installation Planning

The *System Integrator* shall develop an *Installation Schedule*, submitted to the *Demo Leader* for approval and updated as described in the following paragraph. Changes are subject to approval by the *Demo Leader*.

The *System Integrator* shall update the schedule weekly with the progress of detailed tasks in a percentage-completed format. The schedule will provide a two-week forecast used during the *System Integrator / Demo Leader* weekly progress and planning meetings. The *System Integrator* will be expected to coordinate all work with other *Contractors* and *Third Parties* to ensure that parallel projects are completed as quickly as possible.

2.4. Weather & Productivity

The *System Integrator* shall make every effort to plan the schedule such that delays due to foreseeable inclement weather conditions are kept to a minimum. For this reason, schedules should take advantage of fine weather forecasts where the focus should be on outside work; for example, the construction or installation of facilities, underground cabling, and other external activities. If an unforeseeable event causes a delay, the *System Integrator* shall consult with the project coordinator and other consortium partners to resolve the situation with minimum damage.

2.5. Installation Site Maintenance

The *System Integrator* and their subcontractors shall ensure that the work area is kept as tidy as possible. The *System Integrator* should be sensitive to the interruptions their work may have on office staff and the general public and take appropriate measures to address their concerns.

2.6. Installation Records

The *System Integrator* shall provide a detailed installation log of the work effort for each site. The log will be developed, maintained, and submitted to the *Demo Leader* at each agreed-upon review meeting.

3/ Transfer to Operation

This chapter describes how all responsibilities will be transferred from standby by the *System Integrator* to the *End User*'s operations and support groups.

3.1. Resources

The *Demo Leaders* must identify and acquire the resources necessary to support the deployed system. The *Demo Leader*'s responsibility is also to supervise the transition to ensure a smooth transfer to operation. The responsibilities include ensuring that the implementation stays within the budget and timeframe set in the GA. In addition, the allocated human resources should correspond.

3.2. Transition Activities

As the *System Integrator* transfers the project into operation, the following guidelines need to be considered concerning the implemented actions:

- Before transition, ensure that user expectations are met with a series of tests.
- Facilitate a trial period where the old and the new systems are run simultaneously in parallel to ensure the availability of energy for the users during the transition period.
- Migration of data from the old system to a potential new environment.
- Training the *End User* to operate the equipment and software systems properly to minimize the risk of user errors in the future.
- Setup of a support service and help desk to assist users even after the transition.
- Document the learned lessons during the implementation, beta testing, and transition phase in order to improve future projects.

3.3. Monitoring

The *System Integrator* and *Demo Leader* shall agree on the reporting and monitoring practices that will be carried out throughout the whole implementation phase of the project and at a predetermined time after the implementation. Optimally, a series of frequent meetings would be arranged, where the two would go through a pre-formulated agenda step-by-step. The meeting agenda could follow the example below or some similar structure:

I. *Call to order*

II. *Roll call*

<< Record the list of attendees >>

III. *Approval of minutes from the last meeting*

<< Yes/No >>

IV. *Open issues*

<< Description of all open issues >>

V. *New business*

<< Description of all new issues >>

VI. *Adjournment*

<< Description of all adjourned issues >>

VII. *Next steps*

<< Description of next steps, i.e., tasks, action points, and responsibilities>>

Furthermore, the *Demo Leader* must define performance indicators based on which the progression can be followed and evaluated effectively, and the correct actions can be taken at the right time. Additionally, it is equally vital that incidents and close calls are brought up in these meetings to be resolved and avoided in the future.

3.4. Notification of Deployment

All users and stakeholders will be notified of the successful release of the deployed solution. The user groups that require notification are the end-user, consortium partners, and case-dependent local authorities, such as DSOs and utilities. Ideally, the deployment notification will be sent via a communication tool commonly used in the demo to try to maximize the distribution of the information among the involved actors. Additional communication activities to promote a close collaboration and involvement of local actors shall be considered.

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4/ Demonstration Plan for Kökar

This chapter includes, in essence, the *Demonstration Plan* for the LocalRES demonstration on the island of Kökar, Finland. The chapter provides valuable information about both the physical site and the planned actions, as well as insights into the schedule and roles & responsibilities in the work group.

4.1. Site Information – Kökar

Kökar is one of the six self-governed small archipelago municipalities in the Åland Islands with a total land area of 64 km^2 (total area of 2,165 km^2). The population of Kökar island is officially 234 persons (2018), but from a political perspective, the island is a full-scale municipality. In reality, 160-170 persons live on Kökar in the winter, almost 1,000 in the summer, and the island is visited by some 18,000 tourists per year. The situation results in a high volatility and puts extra demand on the flexibility of the infrastructure. The demonstration actions in Kökar are emphasized in two locations: a school and a nursing home. These two sites will accommodate most of the installations included in the LocalRES Project. The school also acts as the municipality's public library, and the premises are also used extensively in the evenings by clubs, associations, and private individuals. The nursing home, Sommar-/Barnängen, provides residence for ten inhabitants, with healthcare staff present around the clock. The nursing home also accommodates a central kitchen where meals are prepared for the nursing home, nearby kindergarten, and the school of Kökar, making it one of the largest electricity consumers on the island. In addition to the two sites, around 20 households across the island will be recruited to get demand response capable equipment installed in their homes.

Kökar is connected to the mainland by ferries and electric and telephone underwater cables. A weak grid connection with occasional outages in the distribution grid causes local energy problems on Kökar. Reserve generators must be taken to the island when outages occur (e.g., for the elderly home). Additional information about the current situation in Kökar can be found in the baseline study included in deliverable D4.1.

Site Diagram – Kökar

Below, Figure 1 presents the island of Kökar, with the two main demo action sites marked. Number 1 marks the location of the Karlby school, and number 2 shows the location of the nursing home

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complex. The participating households are not presented to protect their privacy following the GDPR (General Data Protection Regulation).

Figure 1: Map of Kökar with the school (1) and nursing home (2) marked.

System Overview – Kökar

The demo actions planned for Kökar will be implemented in cooperation between the municipality of Kökar and the private company Flexens Oy Ab, which is one of the LocalRES project partners. Flexens' primary responsibility is coordinating the LocalRES-related demo actions and recruiting private household participants. Meanwhile, Kökar municipality is responsible for tendering and procurement of the equipment (excluding the households), choosing the contractors, and coordinating on-site system integration.

Table 5: Kökar project system overview

System overview	Details
Project Executive	Flexens
Project Owner	The Municipality of Kökar
System Integrator	The Municipality of Kökar
System name	Kökar Renewable Energy Community
System type	RES Production, demand response, blackout strategies, energy efficiency.
Operational status	In development

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Demonstration actions – Kökar

The planned demonstration actions and functionalities in Kökar together with their corresponding identification numbers are presented in Table 6 below. Moreover, the table presents the project objectives that the demo actions mainly contribute to, and the KPIs initially proposed to evaluate the impact of the actions. Furthermore, the relation of all demo actions to the project's STOs and NTOs, and which KPIs they will affect is presented in Table 33 in Annex 1. How the KPIs are defined in detail and measured in practice is described in section 2 of deliverable D4.1.

Table 6: Demonstration actions in Kökar, and respective objectives and KPIs.

1 – Kökar demonstration site actions		Objectives	KPIs
1.1	Contribution to Åland sustainability Agenda by reducing CO_2 emissions and increasing the RES share	STO1, STO2, NTO1, NTO2	TE2, TE7, EN1, SO2, SO3, SO4, EC1
1.2	Community engagement	STO1, STO2, NTO2	SO1, SO3
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	STO4	TE5, TE6, TE7, EN1, EN2, EN3, EN4
1.4	Solar PV panels for the school	STO4	TE6, TE7, EN1, EN2, EN4
1.5	Micro-wind system for the school	STO4	TE6, TE7, EN1, EN2, EN3, EN4
1.6	Smart energy management system for the school and demo households	STO3, STO4	TE1, TE2, SO4
1.7	Public charging station for EVs	STO4	TE1, TE3, TE4, TE6, EN1, EN3
1.8	Solar PV system, battery storage and smart EMS in the Elderly (nursing) home	STO3, STO4	TE1, TE2, TE5, TE6, TE7, EN1, EN2, EN4, SO4

1.1 - CONTRIBUTION TO ÅLAND SUSTAINABILITY AGENDA BY REDUCING CO2 EMISSIONS AND INCREASING THE RES SHARE

All of the demonstration actions that will take place in the island of Kökar will contribute to Åland's Sustainability and Development Agenda[2] by effectively reducing greenhouse gas emissions, improving energy efficiency, and increasing renewable energy production. This action is expected to contribute to the STO1, STO2, NTO1, and NTO2 by driving policies aiming to increase RES capacity, reducing emissions, incubating jobs around the REC and paving way for regulation that incentives investing more in renewable energy at the municipal level.

[2] Åland's Sustainability & Development Agenda

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1.2 - COMMUNITY ENGAGEMENT

Engaging the local inhabitants is a key aspect and a starting point for the demonstration actions in Kökar and the potential constitution of an energy community. The goal is to share information about the project and its objectives openly to the locals and provide them an opportunity share their insight and concerns. Throughout the project, frequent two-way communication is expected to be upheld, and workshops are planned to be arranged for locals to keep them informed and engaged. Furthermore, the Planning Tool, created in WP2, is to be tested once finished in collaboration with the local community. This demo action is expected to contribute to the STO1, STO2, and NTO2 by enabling and empowering the communication around the REC while considering the communal needs and opportunities for new business models. Moreover, community engagement will play a key role in the definition of the Planning Tool, as the communities will be given a change to influence the tool's design through co-design and participatory sessions. 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.

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

The school of Kökar is currently connected to the local power grid and heated with an old 90 kW_{th} oil boiler accompanied by a 26 kW_{th} electric boiler that provides heating for the tap water during summer when oil is not used. This system will be replaced in the LocalRES Kökar demo with a hybrid heating solution. The hybrid system will consist of a large 100 kW_{th}/9MWh_{th} thermal energy storage system (TESS) and 2x25 kW_{th} air-to-water heat pumps (AWHP) that will be partially powered by 50 kWp solar PV installed on the roof of the school and 5 kW+10 kW vertical axis micro wind turbines (VAWT). A blueprint of the proposed system is presented in Figure 2 below. This demo action will contribute to STO4 as it implements multiple emission reducing energy systems in a sector-coupling approach.

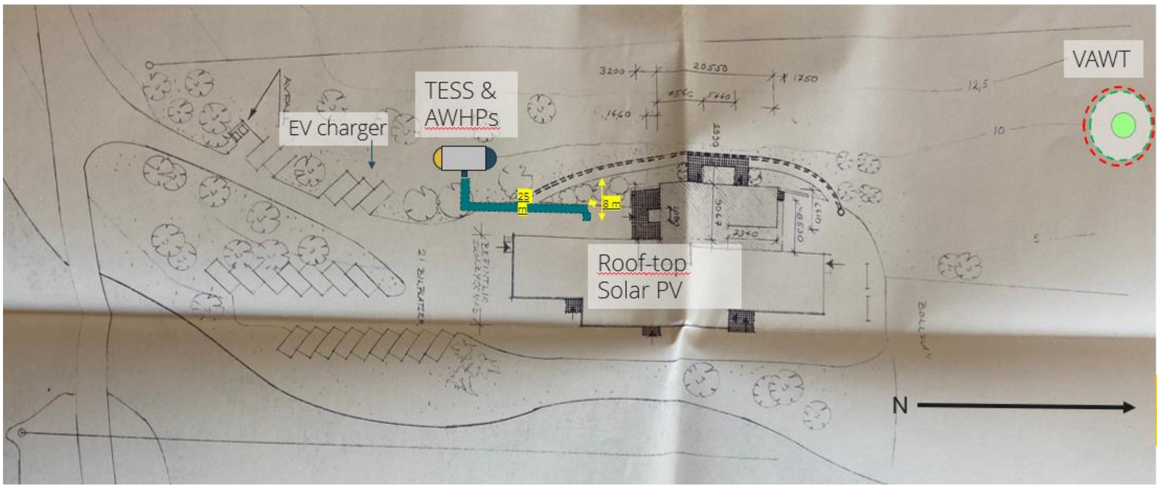

Figure 2: Blueprint of Kökar school with the planned installations.

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1.4 - SOLAR PV PANELS FOR THE SCHOOL

The roof of the Karlby school in Kökar can fit around 50 kWp on solar PV panels. The solar system would contribute to power the appliances, but also the excess production would be used to power the hybrid heating system or be stored in the TESS. This action will contribute to achieving the STO4, as it reduces the carbon emissions in the energy system by adding emissionless generation, and helps to bring down the energy costs for the municipality.

1.5 - MICRO-WIND SYSTEM FOR THE SCHOOL

The school property is also the location for two VAWTs, that are rated 10 kW and 5 kW. The design of the turbines is likely to differ in each case. VAWTs were selected over horizontal axis ones as they are more silent and discrete by nature, which are important factors when planning in proximity from school and residential buildings. The generation of wind turbines also complement the production of the solar PV system, and therefore can be used to power the school's appliances and hybrid heating system throughout the year. This action will contribute to achieving the STO4, as it reduces the carbon emissions in the energy system by adding emissionless generation, and helps to bring down the energy costs for the municipality.

1.6 - SMART ENERGY MANAGEMENT SYSTEM FOR THE SCHOOL AND DEMO HOUSEHOLDS

Both municipal demo buildings and around 20 private households are set to get SEMS installed. The purpose of these devices is to optimize the flow of energy and heating in the buildings and manage the demand side of the formed community potentially constituted. The aim is to reduce the buildings' energy costs and relief pressure on the vulnerable island grid. Therefore, it is reasonable to state that implementing this demo action will contribute to STO3 and STO4 as it will essentially enable integration of multiple energy networks via the MEVPP by demonstrating novel solutions.

1.7 - PUBLIC CHARGING STATION FOR EVS

The Kökar demo also includes the installation of a public EV charging station. The most likely location for it is within the school's borders. The charger will contribute to advancing the penetration of electric vehicles in the island's car base by offering a place to charge for those who do not have access to a home charger. The demo action 1.7 will contribute to STO4 as it demonstrates new technology to the island that is not in place yet.

1.8 - SOLAR PV SYSTEM, BATTERY STORAGE AND SMART EMS IN THE ELDERLY (NURSING) HOME

The nursing home is one of the largest electricity consumers on the whole island as it accommodates a central kitchen where most of the meals served in the public buildings are prepared, and it is heated by a 25kW$_{th}$ ground-source heat pump (GSHP). The plan is to install up to 70kW solar PV capacity on the roof and couple it with an approximately 40kW/100kWh-battery electricity storage system (BESS) to provide support against blackout scenarios for this vulnerable residence. Additionally, a SEMS will be installed to ensure the optimality of both power production and consumption. See Figure 3 for more details. This demonstration action will contribute to the

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STO3 and STO4 since it demonstrates new technology that are integrated in a sector-coupling approach via the MEVPP.

Figure 3: Satellite image of the nursing home with PV arrays and BESS location indicated

Site Preparation – Kökar

Here some factors specific to Kökar that need to be considered by the *System Integrator* before the implementation are listed. Necessary pre-deployment tasks include (the list is not exhaustive):

- Permissions from DSO to connect solar and wind power to the grid.
- Prepare documents for building permits (including a report that local and national requirements are met).
- Do investigations on the existing ground/building and installation conditions to check what's needed to be done before installation.
- Check demands and requirements from the school and nursing home activities and authorities.
- Preparations for new cables, verifying the necessary space and piercing for the canalization route works.
- Ensure that escape routes are clear, and that real estate service can work without futile interruptions.

Site Readiness – Kökar

Below in Table 7 is a checklist for deploying the demo actions in Kökar.

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Table 7: Deployment Checklist for Kökar demo

Deployment Checklist	Yes / No
Are adequate resources available?	Yes
Is workers' space available?	Yes
Describe pre-deployment task	Yes
Have contractors received security clearance?	N/A
Do contractors fulfil act on contractors' liability?	N/A
Have personnel received training?	No
Have user groups communicated that installation engineers will arrive on a specific date?	No
Has insurance been taken out for third-party personnel etc.?	No
Is there adequate vehicle park space for the installation team?	Yes
Are all agreements and contracts signed off?	No
Do you have all the required permits cleared?	No
Environmental impact assessment for the installations	Yes

4.2. Schedule – Kökar

Table 8 summarizes the initial schedule proposed for the main phases and actions in Kökar demo during the first months of the project, despite the dates included have suffered subsequent changes. These changes will be reported in next deliverables (D4.3-D4.5).

Table 8: Milestones/subtasks for the Kökar demo

Milestones	Deliverable	Responsibility	End Date
Permitting	Building permit	Project Manager	27/6/2022
EIA	EIA document	Project Manager	27/6/2022
Procurement	Tender review	Project Manager	27/6/2022
Installation	Receipt of installation	Installation Manager	31/10/2022
Transfer to operation	Notification of transfer	System Integrator	1/1/2024
Monitoring	Monitoring reports	Demo Leader	28/2/2025
Handover	Signed contract	Demo Leader	30/4/2025

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4.3. Roles & Responsibilities – Kökar

In this chapter, the key roles that are required to ensure successful deployment and agreed operation quality are presented. The listed responsibilities are not exhaustive but work as a framework for the demo groups.

Table 9: 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, licenses, permissions, etc.
Installation Manager	Kökar Service	Responsible for the fluent execution of the installation work
Demo Leader/Advisor	Flexens	Responsible for overseeing the projects progression and providing additional expertise on the project execution

Project Manager – Kökar

The *System Integrator* shall nominate a *Project Manager* subject to the *Client*'s approval. The *Project Manager* is the *Demo Leader*'s point of contact throughout the project. The *Project Manager* shall oversee budget matters, schedules, and risk management and ensure that all resources are allocated to the project as efficiently as possible.

The *Project Manager*'s primary responsibilities include, at a minimum, the following:

- Primary communications with the *Demo Leader*, their consultants, and third parties.
- Ensure that the *System Integrator* adheres to the quality control process.
- Schedule and administer weekly status meetings, monthly/quarterly reviews, and communications.
- Interface with the *Installation Manager*, subcontractors, and third parties.
- Coordinate with regulatory agencies, permitting agencies, vendors, etc.

System Integrator – Kökar

The *System Integrator* shall ensure that the system deployment requirements and processes are adhered to, including confirmation that the requirements are met.

> Caution: Only workers qualified by the *System Integrator* shall work on-site to perform installation work.

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The *System Integrator*'s responsibilities are the following:

- Develop the documentation required to support the deployment process.
- *System Integrator* staff shall perform all the work associated with deploying the system, including testing activities described in the *Test Plan*.
- The *System Integrator* will have the required licenses and other installation permits before starting any work.
- Identify the area of responsibility and deployment tasks to be performed etc.

Installation Manager – Kökar

The *Installation Manager* will be responsible for the installation of on-site equipment as well as local installation support requirements.

The *Installation Manager*'s responsibilities include, at a minimum:

- Evaluate the work site, i.e., the location where the deployment will occur.
- Make any recommendations or identify risks/issues that could undermine the project.
- Supervise the installation, testing, and start of equipment.
- Maintain field records and installation logs.
- Develop and maintain safety records; perform periodic safety checks.
- Remain on-site during the equipment and system installation phase of the project.
- Oversee the post-commissioning testing phase.
- Confirm that subcontractor work is completed properly and meets system requirements.

Consultants / Subcontractors / Third Parties / Other Roles

This section clarifies how these parties ensure that the *System Integrator* creates and properly maintains equipment and system deployment-related processes, policies, and operating procedures. Furthermore, the system deployment and installation documentation shall define how work is to be performed by subcontractor(s). Consultants shall provide technical assistance to the *System Integrator* during the equipment and system deployment.

The responsibilities of *Consultants*, *Subcontractors*, and *Third Parties* include, but is not exhaustive to the following:

- Support *System Integrator*
- Support *Project Manager*
- Support *Installation Manager*

4.4. Resources – Kökar

This chapter identifies the technical and human resources required to carry out the deployment activities described previously. The focused subchapter is facilities, equipment, software, and documentation. Each subchapter respectively lists in more detail what resources are required in each demonstration.

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Facilities – Kökar

Facilities that are needed for the implementation of the new installations are:

- Electric power station in the building.
- Heat central in the building.
- Network room for intranet and internet.

Equipment – Kökar

Table 10 includes the equipment that has been planned for the LocalRES demo actions in Kökar:

Table 10: Equipment - Kökar

Product	Budget (€)	Purpose/description
Vertical Axis Wind Turbine	20,000	Electric power to heat storage
Solar PV 50kW	100,000	Electric power to heat storage
Hybrid heating system	355,000	Heat storage, heat pumps, and VAWT
Energy management system for the school	30,000	To optimize the system
EV charger 22kW	20,000	For municipality and public cars
PV + BESS + SEMS	150,000	100kWh / 60kWbackup energy
SEMS for households	60,000	Optimizing heating in each building
Total	**735,000 €**	

Software, IT infrastructure, and UI – Kökar

In terms of current IT infrastructure, there are no systems in place that will limit the integrations of the planned demonstrations. The exact interfaces and protocols are yet to be determined for the planned installations. Regarding UI, it will be designed to visualize energy flows and store data that track KPIs to measure the impact of the planned demonstrations regarding the project objectives. A more detailed description of the software, IT-infrastructure and UI can be found in deliverable D3.1. If not explicitly expressed otherwise, the above applies for all demo sites.

In general, the software and IT infrastructure planned for Kökar consist of the system optimization platform included in the SEMS and the operative control from the MEVPP.

The use cases of this platform include:

- Collective peak-shaving via connected and controllable loads
- Automatic energy optimization
- Collective self-consumption optimization
- EV-charger optimization

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- Energy storage management including BESS and TESS
- Demand response capabilities
- Anomalies detection at REC level

In addition, building heating optimization is provided using a SEMS. The optimization will be done at a level of individual buildings that take part of the REC. To save energy, the SEMS considers solar radiation and other heating sources, i.e., fireplace, to optimize heat generation from electric heating to meet the desired indoor temperature, both increasing comfort and saving energy. The management system can also be used to minimize operational cost of the electric heating system by considering the day-ahead spot price on the relevant Nord Pool market for Kökar, SE3. Desired indoor temperature will always override spot price signals to ensure comfort, but the temperature is allowed to fluctuate e.g., between 21-23 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 be able to decrease consumption during those hours. Furthermore, several households can be aggregated and used by the DSO to shave peaks if needed, for example local congestions on the importing line to Kökar. 20 households should on average have 40 kW of aggregated flexibility available that can be utilized in the MEVPP and also 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.

For the other Kökar demo sites, the school and the nursing home plus kinder garden, the SEMS will be used to optimize the self-generation use behind the meter for direct consumption and for storing in relevant energy storages. The day-ahead spot price will also be used to optimize 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.

Documentation and permits – Kökar

The identified documentation and permits for the Kökar demo can be obtained from the list below, although additional requirements may be necessary:

- Buildings' technical documentation
- Building permit for the TESS
- Grid connection permit form the DSO for the generation units
- Environmental Impact Assessment (EIA) for each work site

4.5. Installation Process – Kökar

The site installations will be done by a Phased approach on each site and a coordinated phased approach between sites. This approach means, in essence, that the implementation action will be executed in coherent phases to take full advantage of the workforce and resources. In the first phase, the construction of the thermal energy storage will start. The second phase includes installing PV, wind, and heat pumps. In the third phase, the SEMs are installed, and all assets are

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then connected, and the system will start the testing period. After successful tests, the system is ready to go online for the monitoring period, after which it will be handed over to the end-user.

Preparing – Kökar

The physical demonstration site will be prepared to implement the demo actions. The preparation procedure will follow the following steps:

1. The validation of site information (according to Kökar's Main time plan).
2. The review and finalization of the deployment schedule (according to Kökar production schedule).
3. Review of user and staff procedures (according to coordinated testing schedule).
4. Notification to the point of contact at the site of the deployment start time and date.
5. Confirmation that this has been communicated to all impacted staff.

VALIDATION

The validation will be done during the coordinated test period, where all tests and deficiencies are documented and finally validated by the *Installation Manager* before the authority and final testing.

SCHEDULING

A project schedule is structured so that the required installations are completed before the next one can start. The installations can be done without any daily interruptions for the school and nursing home, but it is necessary to plan for one break in power and heat in both locations during the night and weekend.

REVIEWS

After the validation and final testing, the municipality real estate department will activate their guidelines and security rules and access to the systems with the user that address that they need access.

4.6. Site Monitoring – Kökar

The work sites in Kökar have the *Installation Manager* responsible for handling all contacts with authorities regarding permitting and arranging the site monitoring. The *Installation Manager* will regularly report to the *Project Manager* and keep them updated.

Monitoring for defects – Kökar

If there are some defects, they will be taken care of in the construction meeting that occurs every 14 days and includes economic and regulatory issues.

Sign-off – Kökar

The municipality's building technical committee is authorized to sign off on the deployment.

Customer Satisfaction – Kökar

After the full implementation of the demo action and the monitoring period that lasts at least one full year, a survey will be sent to the end-users and demo participants. This survey will collect information about the user experience, and the satisfaction rate will be determined. The survey will be created after the full deployment of the demonstration actions. In the survey, the respondents will assess the user-experience of the new system based on their subjective experience compared to the old one.

4.7. Training – Kökar

Training Plan – Kökar

A preliminary training plan for the Kökar demo is drafted next (by week number):

- W41 - 2022 Joint testing and function control of installed equipment.
- W41 - 2022 Joint commissioning and testing against existing installation.
- W43 - 2022 Joint coordinated testing of all equipment and Admin training.
- W44 - 2022 Joint training of End User, IT Staff, QA Staff.
- W45 - 2022 Joint control that all documents and training are completed, and the authority documentation is performed and completed.
- W46 - 2022 Joint training of support staff and hand over the installations to the Municipality.

End-user Training – Kökar

The municipality's real estate technicians will participate in the final function control and coordinated testing of the systems and get the main functions of operating the system. They will also review operations and maintenance routines off the system. Twice a year, during the warranty time, they will get updated function control of the systems and highlight problems.

Support Staff Training – Kökar

The staff will be informed and trained by the real estate technicians.

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5/ Demonstration Plan for Berchidda

This chapter includes, in essence, the *Demonstration Plan* for the LocalRES demonstration in the Village of Berchidda on the island of Sardinia, Italy. The chapter provides information about both the physical site and the planned actions, as well as insight into the schedule and roles & responsibilities in the work group.

5.1. Site Information – Berchidda

The Italian pilot of LocalRES is in Sardinia, in the town of Berchidda, located on the southern slopes of Mount Limbara, in the north of this island region. The municipality land covers approximately 201km^2, and it is located at an average altitude of 300m, surrounded by a wide hilly area in a radius of almost 20km.

In the Berchidda pilot, households will be equipped with fiscal meters owned by the municipality and provided by Landys and NesosNet (the second is part of the GridAbility joint venture). 20 homes will soon be equipped with individual storage batteries of 5.1 kWh storage capacity each within the HESTIA project.

Within LocalRES project, the installation of ~10 to 20 domestic heat pumps is initially foreseen by the beginning of 2023. For the installation of heat pumps, a recruitment of the households through an expression of interest is already ongoing, and is expected to be completed soon. In each household where the heat pumps will be installed, a NesosNet smart meter will be connected for continuous data gathering and transmission to the GridAbility secured database.

Moreover, the development of the EV infrastructure is envisioned to be developed through the installation of public EV charging stations in 2023. The exact location of these is being evaluated by R2M Energy in tandem with the municipality.

Site Diagram – Berchidda

At the time this deliverable was complete, the recruitment phase of the participants for the HP pump systems will be installed is not yet determined.

As of today, the publication of the expression of interest in the project and their HP systems has been aimed at the entire population of Berchidda, which has approximately 2,715 inhabitants and 1,792 residential dwellings (see Figure 4) that could be reached. Similarly, the exact location of the charging stations is still being discussed, and will be included in subsequent updates about the demonstration actions.

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Figure 4: Berchidda City Map

System Overview – Berchidda

Energy efficiency, energy system flexibility, grid stability, and RES penetration will be enhanced in the Italian demo site, Berchidda. GridAbility, as Berchidda's pilot coordinator, will lead the LocalRES-related demo actions in cooperation with the Municipality of Berchidda and the support of R2M Energy. The municipality will play a key role in the engagement and recruitment of the population. As the DSO of Berchidda's electric grid in the form of AEC, it will also operate in the grid management and system sizing. GridAbility is responsible for the leasing and installing HP systems, while R2M Energy is in charge of EV charging points' design, leasing, and installation at selected strategic positions. The system overview is summarized in Table 11 below:

Table 11: Berchidda project system overview

System overview	Details
Project Executive	GridAbility
Project Owner	Municipality of Berchidda and Participants/Households
System name	Berchidda's REC
System type	Production, demand response, P2H, V2G, etc…
Operational status	In development

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Demonstration actions – Berchidda

The planned demonstration actions and functionalities in Berchidda together with their corresponding identification number identifications are presented in Table 12 below. Moreover, the table presents the project objectives that the demo actions mainly contribute to, and the KPIs initially proposed to evaluate this impact. Furthermore, the relation of all demo actions to the project's STOs and NTOs, and which KPIs they will affect is presented in Table 33 in annex 1. How the KPIs are defined in detail and measured in practice is described in section 2 of deliverable D4.1.

Table 12: Demonstration actions in Berchidda, and respective objectives and KPIs.

2 – Berchidda demonstration site		Objectives	KPIs
2.1	Community engagement	STO1, STO2, NTO1, NTO2	SO1, SO3
2.2	Energy storage with optimised community logic	STO4	TE5, TE6
2.3	E-mobility, by installing EV infrastructure with Vehicle-To-Grid (V2G) capabilities	STO4	TE1, TE3, TE4, TE6, EN1, EN3
2.4	Uptake of RES: potential installation of PV, wind turbine, HPs	STO4	TE1, TE2, TE6, TE7, EN1, EN2, EN3, EN4, SO4,
2.5	Smart management of the distributed energy sources	STO3, STO4	TE1, TE2, TE6, SO4

2.1 - COMMUNITY ENGAGEMENT

R2M Energy, GridAbility, and AEC will conduct a recruitment campaign to get prosumers on board for the demo actions. There is already an existing strong, engaged community in Berchidda Municipality derived from a channel of trust led by GridAbility with the HESTIA project. Within LocalRES, this community engagement will be pushed one step forward by promoting the creation of a REC in the area. Around 10 to 20 households will be targeted to install heat pumps that will be part of the LocalRES project and the local energy community. Moreover, community engagement will play a key role in the definition of the Planning Tool, as the communities will be given a change to influence the tool's design through co-design and participatory sessions. Furthermore, the community engagement in Berchidda will contribute to promoting people-powered renewables to other locations. Consequently, community engagement will contribute to STO1, STO2, NTO1 and NTO2.

2.2 - ENERGY STORAGE

Among the demonstration actions outlined in the LocalRES GA, the Municipality of Berchidda had planned to develop the implementation of a distributed storage system with electrochemical batteries using their own budget to be used to support load shifting for demand response services and the increased utilization of generation from solar PV installations, as well as optimize self-consumption. However, due to unforeseen and unpredictable recent events (including the fallout

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related to the so-called "SuperEcoBonus" incentives that have created unavailability of labour and construction companies, the impact of constraints on global logistics related to the war in Ukraine, the generalized increase in the price of energy and fuels in the markets, and the various Lockdowns in Shanghai, which are causing significant increases in the cost of equipment), the municipality has had to revise its spending plans and redirect the available budget to cover increases in the cost of construction materials in order to be able to complete the work under other government contracts. For these reasons, the city administration has recently decided to postpone the installation of four 50 kWh storage systems at various locations in the municipality as initially planned, totalling 200 kWh of storage, in favour of more urgent grid maintenance and other public works. Nevertheless, different alternatives to allow fulfilling the impacts in Berchidda associated to this action are being evaluated internally at the moment. One of these options includes establishing a collaboration with HESTIA project as a replacement for the municipal funding together with other sources, with the aim of having at least 100kWh of battery capacity and therefore deploy the developments linked to these assets (e.g. optimized battery logic). The different options available will be carefully evaluated, the progress of the task will be monitored, and different mitigation plans will be studied. When realized, this demo action would contribute to STO4 by demonstrating technology aiming to decarbonize the local energy system, reduce grid exchange, and lower energy related costs in the community.

2.3 - E-MOBILITY

There are currently no EV charging points in the Municipality of Berchidda. Within the LocalRES project, Berchidda wants to promote electric mobility in the town by installing charging infrastructure, partnerships, and developing business models. The development of services related to electric vehicles encourages tourism in the municipality by exploiting its strategic location straddling two different tourist areas: Costa Smeralda and Olbia on the east coast and the area around Alghero on the west coast. By developing a robust infrastructure for e-mobility, Berchidda would become the intermediate charging station in Northern Sardinia and improve connections between the two ends of the island.

R2M will install new EV charging stations for the community (exact number to be determined, depending on the high prices and the new situation in the village derived from the global context). V2G services are planned, thus making e-mobility a marketing aspect for tourism (potential agreements with airport rental companies, recurring services or cultural events). This action will contribute to STO4, as it demonstrates a new technology in the island that is not in place yet.

2.4 - UPTAKE OF RES

The formation of the local energy community in Berchidda during the project and the possibility for ordinary consumers to become prosumers and participate in the community will enhance the penetration of RES in the area. The municipality of Berchidda is currently studying the possibility of installing a centralised photovoltaic plant and a 60kWp wind turbine. Moreover, the project will directly install HP systems that, in many cases, will be coupled with private investment into PV. This action will contribute to achieving the STO4, as it reduces the carbon emissions in the energy system by adding emissionless generation, and helps bringing down the energy costs for the municipality.

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2.5 - SMART MANAGEMENT OF THE DISTRIBUTED SOURCES

The last objective of the Municipality of Berchidda within LocalRES is to improve the management of thermal and electric energy demand through the community's batteries. The task will be possible partly through the installations of heat pumps in 10 to 20 households to cover their heating and cooling demand combined with the GridAbility smart meters. Nevertheless, as previously said, the new reality in the village makes unclear how the acquisition of batteries will be completed at the moment this report was prepared, and more details will be provided in subsequent reports. In any case, the aim of this action is to take advantage of the distributed energy resources (PV, battery storage already present in the demo, heat pumps, smart meters) to increase the grid flexibility and self-reliance, enabling better exploitation of the demand response (DR) mechanisms. Therefore, it is reasonable to state that implementing this demo action will contribute to STO3 and STO4 as it will essentially enable integration of multiple energy networks via MEVPP by demonstrating novel solutions.

Site Preparation – Berchidda

As mentioned above, two main deployments in terms of technologies will be conducted in parallel at the Berchidda site within the scope of LocalRES: one for the heat pumps + smart meter in 10 to 20 households and one for EV charging points in strategic positions of the city.

The actions that are necessary for the heat pump's deployment are:

- The recruitment phase of the population to secure 10 to 20 households.
- Site visit to check if buildings' documentations are up to standard, to collect buildings' information.
- Heat pump's design phase: Building energy modelling of the dwellings to design heat pumps according to their energy needs and national energy efficiency requirements.
- Site visit with an installer to check needed space, if piercing for canalization routs works or other works are needed.
- Proposal of the heat pump project to the participant and confirmation of approval by the latter.
- Leasing requests for heat pumps.
- Prepare documents for installation permits to be submitted to the Municipality (SUAPE, exLegge10, report that heat pump projects meet local and national requirements) before installation.

Regarding the site preparation for the deployment of the EV charging points, it must be considered that, although electric mobility in Italy has not yet reached the expansion that we can already find in other European countries, the regulatory framework is already outlined and very clear in terms of charging station construction, their management, and how the charging service should be offered to the public.

The most important regulatory references in Italy are:

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- DIRECTIVE 2014/94/EU of the European Parliament and of the Council of October 22, 2014, on the implementation of an alternative fuel infrastructure (better known as the AFID - Alternative Fuels Infrastructure Directive).
- Law No. 134 of August 7, 2012, Art. 17f, para. 1 (better known as PNIRE - National Infrastructure Plan for the recharging of electric-powered vehicles).

The first document (AFID Directive) contains the requirements that must be compulsorily met to develop infrastructure to serve alternative fuels (among which electricity is at the top).

The second document (PNIRE) is a set of guidelines promoted by the Ministry of Infrastructure and Transport to guide the development of electric mobility in Italy.

The purpose of the legislation is to ensure the development of an interoperable and easily accessible infrastructure.

The exact definition of a charging point open to the public is the following: *publicly accessible recharging or refuelling point,* which means a recharging or refuelling point for alternative fuel supply that provides, at the Union level, non-discriminatory access to all users. Non-discriminatory access may include different conditions of authentication, use, and payment.

Thus, there is no distinction between "private charging points open to the public" (understood as installations carried out by private entities on private land) and "public charging points" (understood as installations carried out on public land by public entities or private entities).

The only objective is to define requirements with general validity applicable to any publicly accessible charging point to ensure the widest usability by end-users (those who drive an electric vehicle).

The installation of electric vehicle charging infrastructure with public access is not subject to the issuance of a building permit and is considered a free building activity. The installation is stipulated in Article 32b of Decree-Law No. 77/2021 as converted, with amendments, by Law No. 108 of July 29, 2021. Also, to simplify the procedures for installing electric vehicle charging infrastructure, the person carrying out the installation of electric vehicle charging infrastructure on public land submits to the road owner entity the application for the occupation of public land. In addition, the construction of the charging infrastructure and related connection works to the distribution network agreed with the competent electricity distribution service concessionaire (in this case, the competent distributor is the same AEC project partner).

However, the procedures are subject to the simplified application requirement, and the assessing agency, as provided for in Article 14-bis of Law No. 241 of August 7, 1990, issues a permit for the construction and occupation of public land for the charging infrastructure. The deadline for issuing the said permit is set at 30 days.

Said permit shall have a minimum duration of 10 years and a measure of unlimited duration, in the name of the grid operator, for the related connection works.

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Site Readiness – Berchidda

In order to ensure a smooth process and a good start to equipment's deployment, documents need to be prepared, and site checks need to be performed along with other actions to verify the site readiness. Some of these actions are reported in Table 13 below.

Table 13: Deployment Checklist for Berchidda demo

Deployment Checklist	Yes / No
Has the location of the heat pumps been defined?	No (ongoing)
Has the location of the EV charging points been defined?	No (ongoing)
Are adequate resources available?	Yes[3]
Is workers' space available?	Yes
Describe pre-deployment task	Yes
Have contractors received security clearance?	N/A
Do contractors fulfil act on contractors' liability?	N/A
Have personnel received training?	N/A (no need)
Have user groups communicated that installation engineers will arrive on a specific date?	No
Are all agreements and contracts signed off?	No
Do you have all the required permits cleared?	No

5.2. Roles & Responsibilities – Berchidda

The following sub-chapter lists the roles and responsibilities of the organization involved in the deployment at the Italian demo site. They have been summarized in Table 14 below.

Table 14: Roles & Responsibilities in Berchidda Demo

Role	Name	Responsibility
Project manager	GridAbility	Responsible for communication, schedules, resourcing, etc.
System Integrator	GridAbility and AEC	Responsible for the documentation, licenses, permissions, etc.
Installation manager	To be defined, will be subcontracted by GridAbility	Responsible for the fluent execution of the installation work
Community manager	To be defined with the community (section 5.2)	Formalization of Berchidda REC
Energy Manager	R2M Energy	Provides additional expertise on the smart grid energy management

[3] Except for the community batteries, as per last actions at municipal level, as previously explained.

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Project Manager – Berchidda: GridAbility

The Project Manager's primary responsibilities include, at a minimum, the ones listed below:

- Primary communications with the *Demo Leader*, their consultants, and third parties
- Ensure the *System Integrator* adheres to the quality control process
- Schedule and administer weekly status meetings, monthly/quarterly reviews, and communications
- Interface with the *Installation Manager*, subcontractors, and third parties
- Coordinate with regulatory agencies, permitting agencies, vendors, etc

System Integrator – Berchidda: GridAbility and AEC

WARNING: Only workers qualified by the *System Integrator* staff shall work on-site to perform installation work.

The *System Integrator*'s responsibilities include:

- Develop the documentation required to support the deployment process.
- *System Integrator* staff shall perform all the work associated with deploying the system, including testing activities described in the Test Plan.
- *System Integrator* will have the required licenses and other installation permits before starting any work.
- Identify the area of responsibility and deployment tasks to be performed etc.

Installation Manager – Berchidda

The *Installation Manager*'s responsibilities include, at a minimum, the following ones listed below:

- Evaluate the work site, i.e., the location where the deployment will occur.
- Make any recommendations or identify risks/issues that could undermine the project.
- Supervise the installation and testing of equipment.
- Supervise equipment installation and start-up.
- Maintain field records and installation logs.
- Develop and maintain safety records; perform periodic safety checks.
- Remain on-site during the equipment and system installation phase of the Project.
- Oversee the post-commissioning testing phase.
- Confirm that subcontractor work is completed properly and meets System Requirements.

Community Manager

AEC is in charge of defining the *Community Manager* of the Berchidda's REC with the community members. The *Community Manager* works closely with the *System Integrator* to coordinate and communicate the implemented actions and interventions at the demo site. The *Community*

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Manager serves as the main contact between the *Project Manager*, the municipality, and its citizens. The *Community Manager* shall mainly oversee the community engagement.

Also, the *Community Manager* will be responsible for managing the onboarding process of the citizens becoming members of the Community. Thus, will have to manage the process through the Dashboard provided by the PROSUME Platform, the Community Wallet, and the Banking system provided by the Community's officially registered bank account.

The *Community Manager*'s primary responsibilities include, at a minimum, the following:

- Primary communications with the *Demo Leader*, their consultants, and third parties.
- Ensure the *System Integrator* adheres to the quality control process.
- Schedule and administer monthly status meetings, reviews, and communications.
- Interface with the *Installation Manager*, subcontractors, and third parties.
- Do the onboarding of the upcoming Community Members through the PROSUME Platform.
- Guarantee proper registration of the various members.
- Oversee and compare the electricity consumption/production flows with the billing flows as provided by the PROSUME Platform.
- Manage the Bank account of the Community.
- Manage the Community Wallet as provided by the PROSUME Platform.
- Oversee payment processes (as provided by the Italian Regulation of Energy Communities) from the State incentives to the "Community Wallet" to the prosumers (members).
- Coordinate with regulatory agencies, permitting agencies, vendors, etc.

Energy Manager – Berchidda: R2M Energy

R2M Energy's role will be the *Energy Manager* of Berchidda's REC. The *Energy Manager* will advise and organize strategies to implement more sustainable solutions, facilitating energy conservation by identifying and implementing various energy-saving options, leading awareness programs, and monitoring energy consumption.

The *Energy Manager*'s responsibilities include:

- Carrying out site inspections and completing energy surveys.
- Collecting energy monitoring data and keeping accurate records.
- Dealing with energy contract negotiations.
- Developing and overseeing strategies to reduce energy consumption.
- Encouraging the use of renewable and sustainable energy resources.
- Keeping up to date with energy legislation.
- Negotiating with contractors and external stakeholders.
- Identify the area of responsibility and deployment tasks to be performed.

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5.3. Schedule – Berchidda

Table 15 summarizes the initial schedule proposed for the main phases and actions in Berchidda demo during the first months of the project (after removing actions related to the batteries until a final solution is proposed), despite the dates included have suffered subsequent changes. These changes will be reported in next deliverables (D4.3-D4.5).

Table 15: Milestones by action for Berchidda demo

Action	Deliverable	Responsibility	End Date
Community engagement	Definition of engagement activities	GridAbility	14/02/2022
	Engagement sessions	GridAbility	13/04/2022
	Engagement document signature	GridAbility	15/11/2022
	REC creation	GridAbility	15/12/2022
Heat Pumps deployment	Household's agreement	GridAbility	15/08/2022
	Design and installation project	GridAbility	15/10/2022
	Leasing paperwork	GridAbility	15/11/2022
	Submission of permits	GridAbility	15/11/2022
	Heat pumps installation	GridAbility	15/03/2023
E-Mobility	Preliminary work (analysis of EV chargers, capacity, etc.)	R2M Energy	15/09/2022
	Leasing paperwork	R2M Energy	15/11/2022
	Submission of permits	R2M Energy + AEC	15/12/2023
	Purchase and Installation of EV chargers	R2M Energy	15/03/2023
Smart metering	Purchase and installation	NesosNet	15/11/2022

5.4. Resources – Berchidda

GridAbility will perform the HPs' design and sizing and coordinate the HPs and the smart meter deployment, while R2M Energy will lead the EV charger's deployment. At the same time, on-site installation work will be performed by a licensed contractor that will be defined with the heat pumps and EV chargers' suppliers to ensure that he is already acquainted with the needed equipment.

Facilities – Berchidda

In the Italian pilot site, the LocalRES project plans to deploy mainly HPs in residential buildings and EV chargers in strategic public points of the city as physical and technical equipment.

The residential dwellings selected to participate in LocalRES will have to meet regulatory compliance requirements and have an adequate technical room or space available to install the new heating system. In comparison, the EV chargers will be installed in strategic points such as public parking lots and around the city, where residents and tourists can charge their electric vehicles.

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Equipment – Berchidda

The list of equipment planned to be deployed at the Italian pilot site within the LocalRES project and associated budget as per the latest GA is reported in Table 16 below, with a brief purpose/description.

Table 16: Equipment - Berchidda

Product	Budget	Purpose/description
Heat Pumps	150,000€	Primary Heating/Cooling + P2H + Heat storage
EV charging points NesosNet EnergyHUB	120,000€	E-mobility, V2G Smart monitoring of household's consumption and production
Total	**270,000€**	

Software, IT infrastructure, and UI – Berchidda

Berchidda is in the process of being established as an "Energy Community" following the Italian regulation binding to the REDII directive. To develop the community and take advantage of the State-funded incentives, the Municipality has to register as a recognized LEC and establish proper software tools and support technology to enable user-friendly management of the governance of the community. It has become the role of the NesosNet Platform and the PROSUME SaaS Platform to ease the work of the *Community Manager* and automate its governance through measurement and monitoring data management with the first and smart billing processes and automated payment methods linked to the specific Community established rules with the second one.

The NesosNet Platform manages devices that measure variables of various types (temperature, energy, etc.) related to the environment or a specific asset (air conditioner, solar panel, etc.). The NesosNet Platform, through proprietary gateways, connects to the devices, captures significant data, brings it to the cloud, and offers customers the following features:

- Data storage and history building;
- Real-time monitoring of devices;
- Intelligent event management;
- Remote control of devices;
- Data processing for extraction of significant information (production or consumption peaks, malfunctions, etc.);
- Forecasting on aspects of interest (forecasting consumption trends, etc.);
- Implementation of automated policies to regulate production and optimize consumption.

Measurement and monitoring data management functionality is a feature already implemented on the platform and enables the collection of comprehensive information about the analysed sites/devices using Big Data technologies. The functionality provides:

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- Single platform to acquire, save, and make accessible measurements of fixed and non-fixed quantities related to any monitored site;
- Platform integration of pre-existing or external data, even if acquired with systems other than Exacto;
- Homogeneous management of different fixed quantities and data, with the ability to combine them into formulas and graphs to perform complete and detailed analyses of one's systems;
- Comprehensive data history for making decisions on future policies and observing the effects of past decisions over time.

Within the LocalRES project, the NesosNet Platform will be adapted to the Berchidda demo site accordingly to its specific needs, the feedback collected from the participants, and the experience developed in the project. Whereas the PROSUME Platform that integrates the Community Manager Dashboard, the Community Manager Wallet, and the Prosumer APP wallet will be launched this year, following the developments of the LocalRES and HESTIA requirements, it will be widely tested also within the Berchidda Pilot use case.

Table 17: Software planned to be deployed in Berchidda demo

Product	Purpose
NesosNet Platform	Smart Management Platform
PROSUME Platform	Community Management Platform

5.5. Installation Process – Berchidda

As previously said, in the Berchidda pilot two main parallel deployments of technologies will be conducted.

- Deploy of new EV charging points in public spaces for public usage will be deployed; the first one for setting and testing and then the rest.
- Deployment of 10 to 20 Heat Pump and Smart meter systems in residential households will be performed all at once.

Preparing – Berchidda

The deployment site preparation will include the following tasks:

1. Validate site information.
2. Review and finalize deployment schedule.
3. Notify the point of contact at the Site of the deployment start time date.
4. Confirm that this has been communicated to all impacted staff.

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VALIDATION

The *Project Manager* will perform a preliminary analysis based on the data and information collected. Then, alongside the *Installation Manager*, they will conduct an on-site survey to verify the site condition and identify any possible technical issues that will be discussed to discuss the best solution.

SCHEDULING

The deployment actions will follow the schedule presented in subchapter 5.3 above.

REVIEWS

After the installation, the community manager, supported technically by the measuring and monitoring manager, will activate the procedures for help desk support, the user access rights, security policies, and all their rules related to user needs and user control.

INTERNAL COMMUNICATION PLAN

GridAbility will lead bi-weekly online meetings with its internal consortium to coordinate the activities and keep updated on the progress of each task from each party. In contrast, it will keep a more formal communication through emails with the sub-contracted parties and organize online meetings or telephone calls when necessary.

5.6. Site Monitoring – Berchidda

Berchidda's pilot site will be monitored mainly by the demo coordinator, GridAbility, with the technical support of R2M Energy and the on-site presence of the Municipality.

Monitoring for defects – Berchidda

The main contact of the end-users will be the Municipality of Berchidda and the pilot coordinator, GridAbility. They will be in charge of answering to them when technical problems emerge with the equipment installed in their houses and of coordinating with the local installer for a site visit to the dwelling to fix the defect. Thus, a technical assistance agreement for the project's duration will be signed between the pilot coordinator and the local installer.

Sign-off – Berchidda

As pilot coordinator of the Berchidda demo site, GridAbility will handle the deployment's permits, sign the project reports and submit them for authorization to the Municipality.

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Customer Satisfaction – Berchidda

A series of surveys will be conducted to collect their feedback and assess their satisfaction with the installation process. A first basic questionnaire will be provided to the local installer, who will be instructed to collect initial feedback from the end-users, such as the content on the equipment, the installation's result, and the coordination process of the installation with 4 ranges of satisfactory scale. Then, when the installation of heat pumps and smart meters has been finalized, a workshop with the project's participants will be organized to address any questions they may have. A more detailed questionnaire will be circulated to collect more thorough answers with comments.

5.7. Training – Berchidda

This section describes the training activities at the installation site for end-users and support staff.

Training Plan – Berchidda

The installation of the technical equipment will be conducted by sub-contracted installers that have been trained directly by the equipment supplier's company to ensure proper installation. Thus, no additional training sessions will be needed to be planned before the installation. However, the pilot coordinator will jointly test and control all phases of the deployment process.

End-user Training – Berchidda

The local installer will guide the participants through the first settings and provide them with user guides on the heat pump and the different apps for the heat pump monitoring and the households' energy fluxes to the grid. Moreover, with the supervision of the demo site coordinator, they will give them an overview of the apps, guide them through the basic visualization, and answer all their questions and doubts in person.

Support Staff Training – Berchidda

The support staff will be trained and guided by the Italian pilot coordinator, GridAbility, to use and maintain the solution. The support staff will assist the participants with the support of the Municipality of Berchidda and AEC throughout the project's duration via formal emails, informal phone calls, and site visits when needed.

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6/ Demonstration Plan for Ispaster

This chapter includes, in essence, the *Demonstration Plan* for the LocalRES demonstration in the village of Ispaster, Spain. The chapter provides valuable information about both the physical site and the planned actions, as well as insights into the schedule and roles & responsibilities in the work group.

6.1. Site Information – Ispaster- Elexalde

Site Diagram – Ispaster

Ispaster is located in the province of Biscay, specifically in the *Lea-Artibai* region (see Figure 5). It is 56 km from Bilbao's provincial capital and has very few public transport routes. The municipality has a population of around 750 inhabitants living in twelve neighbourhoods. The main district is called *Elexalde*, a neighbourhood with 350 inhabitants, the town hall site, public school, cultural centre, and most of the public services. The expected range of inhabitants that potentially would become part of the REC in Ispaster is 50-150.

Figure 5: Location of Elexalde on the map (Spain, Basque Country, and Ispaster)

Current status of the Ispaster Demo Site

There are two isolated energy networks:

- A hybrid one (90 kW biomass + 42 kW solar thermal vacuum tubes) District Heating (DH) network with 12 consumption points,
- A (28.3 kWp, 20,8 MWh/year PV = 49,5 kW system's power) micro-grid supported by batteries (178 kWh Pb-Ac) with 10 consumption points for public buildings.

The rest of the area is powered by the external grid, and the thermal demand is covered via a network of Liquefied Petroleum Gas (LPG) tanks and diesel and gas boilers. There is a ventilation system in the sports centre, and the rest of the system is completed with a waste-heat recovery system powered by the PV micro-grid. Such a system feeds a multipurpose mezzanine and public

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restaurant and includes an exhaust air-heat recovery (1.02 kW, 1,656 m^3/h, perform. 77.9%) in conjunction with an air-water chiller (5.77 kW), an accumulator (500 l) and a cooling coil for refreshment. Smart and thermal meters allow electricity and thermal energy consumption monitoring in a local open SCADA (Supervisory Control And Data Acquisition) system for the micro grid and DH.

There also existing batteries that are sized to cover 3-days electricity demand. In addition, it is to be mentioned that the grid connection is weak and insufficient to supply new demands, with occasional outages, voltage swings, and blackouts (by fallen trees or strong winds) in the distribution grid that cause local energy problems on Ispaster.

In the mid to long term, the main goal is to become an autonomous and isolated energy island based on 100% renewable energy. In line with this goal, Ispaster initiated a programme for further implementation of Agenda 21 in 2008, and the Covenant of Mayors (Adapt. 2030) in 2016.

Figure 6 below shows the location of generation assets in the Ispaster demo site:

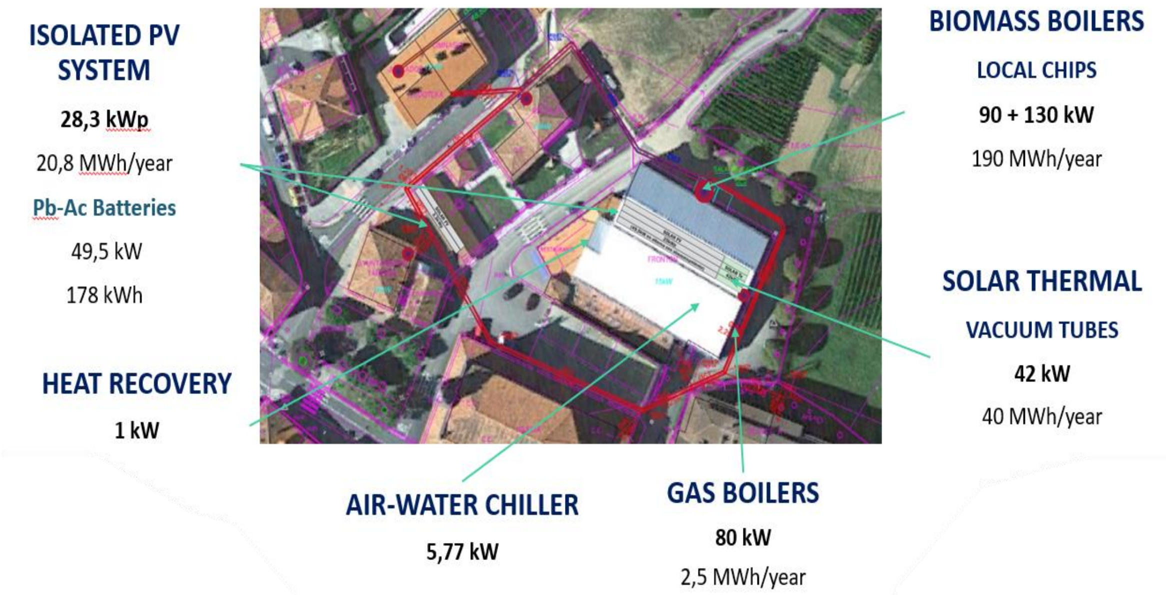

Figure 6: Generation assets (already in place) in Ispaster

The red ring in Figure 6 surrounds the sports centre, town hall, two taverns, culture house, school, and public services (i.e. elderly home, play centre and library, day nursery, school canteen).10 dwellings are already connected to this generation ring. On top of the roofs, there are PV panels with 28.3kWs.

Two boilers which use biomass chips are used during the whole year, but in summer the consumption is very small. Solar thermal vacuum tubes (42 kW) allow having hot water between April and October with a low need for using the biomass boilers.

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Two taverns and 10 buildings are being supplied with hot water and heating.

In summer the consumption is lower, so a refreshment system is in place and used for the sports centre and the 2 taverns. They are also supplied with hot water.

These gas boilers are a backup plan to supply energy when maintenance works in the DH.

System Overview – Ispaster

The system will be deployed in cooperation between the municipality of Ispaster and Barrizar ESCO. Ispaster municipality is responsible for permissions and site procurement, and Barrizar ESCO will coordinate the demo actions.

The idea is to upgrade the current DHN and micro-grid, install a CHP unit, EV charging stations, PV panels, and storage. The purpose is to cover the energy demands of 3 public services (doctor's office, medicine cabinet, and Egiluz cultural centre) and some private dwellings with heat pumps instead of LPG. Will also be installed a smart control system for communication and management. One municipal electric vehicle is already purchased, and 3 charging points will be installed soon.

Table 18: Ispaster project system overview

Project role	Details
Project Executive	EZE Barrizar Koop.
Project Owner	Ispaster's municipality
System name	Ispaster's REC
System type	Production, demand response, blackout strategies, etc.
Operational status	In development (existing systems already operating)

Demonstration actions – Ispaster

The planned demonstration actions and functionalities in Ispaster together with their corresponding identification number identifications are presented in Table 19 below. Moreover, the table presents the project objectives that the demo actions mainly contribute to, and the KPIs initially proposed to evaluate this impact. Furthermore, the relation of all demo actions to the project's STOs and NTOs, and which KPIs they will affect is presented in Table 33 in annex 1. How the KPIs are defined in detail and measured in practice is described in section 2 of deliverable D4.1.

Table 19: Demonstration actions in Ispaster, and respective objectives and KPIs.

3 – Ispaster demonstration site		Objectives	KPIs
3.1	Community engagement	STO1, STO2, NTO1, NTO2	SO1
3.2	Upgrade of the DHN and connection of new customers	STO4	TE1, TE2, TE6, EN1, EN3, EN4

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3.3	Expansion of the micro-grid through the installation of new PV	STO4	TE1, TE2, TE6, TE7, EN1, EN3, EN4
3.4	E-mobility through the installation of EV-charging infrastructure and the purchase of an EV	STO4	TE1, TE3, TE4, TE6, EN1, EN3
3.5	Power to heat in residential buildings, replacing existing fuel-based systems	STO4	TE1, TE2, TE6, EN1
3.6	Electric storage	STO4	TE5, TE6
3.7	Smart control, monitoring and management	STO3, STO4	TE1, TE2, TE6, SO4,
3.8	Policy recommendations, in social acceptance, financial or regulatory issues	STO1, STO2, NTO1, NTO2	TE2, TE7, EN1, SO2, SO3, SO4, EC1
3.9	Business model innovation	STO1	SO2

3.1 – COMMUNITY ENGAGEMENT

Aiguasol, Tecnalia, the Ispaster's Council, who owns the DHN and the micro-grid) and EZE Barrizar (small energy services cooperative, responsible for managing the energy system) are thoroughly working to promote the constitution of a REC in the area. Community engagement will be pushed one step forward, and grid flexibility, self-consumption and demand response mechanisms will be further explored. Moreover, community engagement will play a key role in the definition of the Planning Tool, as the communities will be given a change to influence the tool's design through co-design and participatory sessions. Furthermore, the community engagement in Ispaster will contribute to promoting people-powered renewables in other locations in the region. Consequently, community engagement will contribute to STO1, STO2, NTO1 and NTO2.

3.2 - UPGRADE OF THE DHN AND CONNECTION OF NEW CONSUMERS

Three public buildings are left to connect to the microgrid and district heating. Also, two private buildings are potentially interested to be connected to the DHN. The demo considers the integration of a CHP biomass unit (60 kW_{th} + 5 kW_{e}) pellets to upgrade the DHN. This action will contribute to achieving the STO4, as it reduces the carbon emissions in the energy system, and helps to bring down the energy costs.

3.3 - EXPANSION OF THE MICRO-GRID:

It is planned to install 100 kWp of PV on roofs in Elexalde (main district). This will increase the micro-grid capacity allowing to supply renewable energy to more users. This action will contribute to achieving the STO4, as it reduces the carbon emissions in the energy system by adding emissionless generation, and helps to bring down the energy costs for the municipality.

3.4 - E-MOBILITY:

The municipality will purchase a new e-car and install new EV-charging stations. One charging station will be used for the public services and another one will be used by the citizens. This action

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will contribute to achieving the STO4, as it reduces the carbon emissions from traffic by promoting emissionless transportation.

3.5 - POWER TO HEAT IN RESIDENTIAL BUILDINGS.

The current individual gas boilers of the dwellings in an existing multi-apartment building will be proposed to be replaced by a high efficiency solution for heating based on the heat pump technology that will be connected to the micro-grid and potentially to the DH, providing an additional point for sector-coupling in addition to the CHP with the aim of increasing the local energy system flexibility. The needed interventions at building level will be done (addressing emitters, distribution pipes, storage, etc.). This will allow to supply 100% renewable heat to the dwellings. Demand response strategies will be implemented using 13,000 litres DHW storage and thermal inertia of the dwellings. This action will contribute to achieving the STO4, as it reduces the carbon emissions in the energy system by replacing emission causing heating, and helps to bring down the energy costs for the municipality.

3.6 - ELECTRICAL STORAGE.

New electrical batteries (200 kWh) will enhance the microgrid's flexibility for the microservices. When realized, this demo action would contribute to STO4 by demonstrating technology aiming to decarbonize the local energy system, reduce grid exchange, and lower energy related costs in the community.

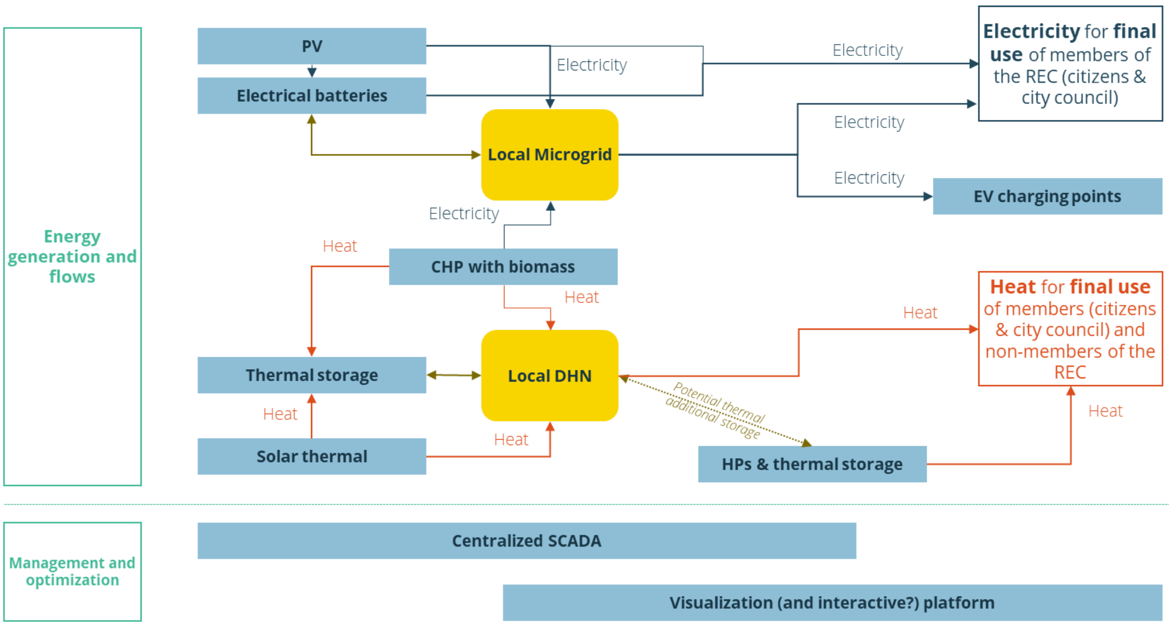

Figure 7: REC concept in Ispaster at assets and energy flow level

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3.7 - SMART CONTROL, MONITORING, AND MANAGEMENT.

A SCADA system is in place, but is not working properly (Wi-Fi and internet connection are failing). The SCADA system must be upgraded, and new thermal and electrical smart meters, sensors, and detectors must be installed to optimize the operation of the different assets. As a result of these interventions and the previously existing assets, the aimed system schematic can be obtained from Figure 7. Therefore, it is reasonable to state that implementing this demo action will contribute to STO3 and STO4 as it will essentially enable integration of multiple energy networks via MEVPP by demonstrating novel solutions.

3.8 – POLICY RECOMMENDATIONS

The municipality as well as both the Regional Energy Agency (Basque Energy Board, EVE) and Government (Basque Government) are strongly committed with Ispaster's Energy Strategy. The performance assessment will not only allow to validate the technical interventions, but also other factors such as user acceptance, barriers on implementation, regulatory framework, financial issues and other explicit needs derived from the implementation. The knowledge gained will be useful for future policy improvements. This demo action contributes to STO1, STO2, NTO1 and NTO2.

3.9 – BUSINESS MODEL INNOVATION

The interventions made so far have allowed to set an initial basis regarding the operation of the energy island, establishment of energy supply contracts and business-related issues. Current business model is based on a public-private-partnership approach. The public administration is the owner and investor of the equipment and the networks are operated and managed by a local ESCO. The experience of the last years is being very valuable to set the cost baselines for the energy supply contracts and draw conclusions on the economic feasibility of the different RES systems operation. The aim is to further work on this direction, since new knowledge will be acquired and implemented into real business models. The Ispaster framework will allow to conclude the key issues when defining business model for the ESCO, who will be the key player in replicating the demonstrated solutions in the future. This model contributes to STO1 as it defines services and business models driven by the formed REC.

Site Preparation – Ispaster

In terms of site preparation, a new parking space will have to be created in the public area to install the vehicle charging point. In addition, a public place will have to be adapted to install the new battery system. If the chosen place is currently used for other purposes, the necessary measures must be taken to convert it into a space that complies with the legislation.

On the other hand, in the private sector, the users who will install new thermal systems based on heat pumps will have to adapt their systems in their households. This work will consist in removing existing equipment (mostly LPG boilers), adapting the hydraulic systems, and installing new metering devices if necessary.

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Permissions requested: civil works for enlargement of DH and public locations for storage in batteries and hot water.

Site Readiness – Ispaster

Table 20 is a simple checklist for the deployment of the demo actions in Ispaster to evaluate site readiness:

Table 20: Deployment Checklist for Ispaster demo

Deployment Checklist	Yes / No
Are adequate resources available?	No
Is workers' space available?	Yes
Describe pre-deployment task	Yes
Have contractors received security clearance?	N/A
Do contractors fulfil act on contractors' liability?	N/A
Have personnel received training?	No
Have user groups communicated that installation engineers will arrive on a specific date?	No
Has insurance been taken out for third-party personnel etc.?	Yes
Is there adequate vehicle park space for the installation team?	Yes
Are all agreements and contracts signed off?	No
Do you have all the required permits cleared?	No

6.2. Roles & Responsibilities – Ispaster

In this section, the key roles which are required to promote a successful deployment and agreed operation quality are presented. Table 21 summarizes the main roles and responsibilities of the Spanish demo site:

Table 21: Roles & Responsibilities in Ispaster Demo

Role	Name	Responsibility
Project manager	BARRIZAR	Responsible for communication, schedules, resourcing, etc.
System Integrator	Barrizar & Ispaster Municipality	Responsible for the documentation, licenses, permissions, etc.
Data integrator	AIGUASOL	Responsible for integrating data from the monitoring systems with the pilot's database and with the platforms that require those data.

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Installation manager	BARRIZAR & Subcontracted	Responsible for the fluent execution of the installation work
Consultant social dynamization	TECNALIA	Support on the social aspects related to the establishment of the REC (no legal support)
	AIGUASOL	Provides additional expertise on the project execution
Consultant Energy management Blackout Strategies	AIGUASOL	Provides expertise in the area of energy management

Project Manager – Ispaster: Barrizar

The *Project Manager* is responsible for coordinating all the actions related to the Ispaster demo site. The responsibilities include the following main tasks:

- Timing of the actions to be carried out on the Ispaster demo site
- Supervise each action in all their phases: visit, planning, design, implementation, and evaluation.
- Communication with all LocalRES consortium participants concerning the actions to be carried out in the Ispaster Demo Site.
- Ensuring the planned deployment is carried out as planned by the LocalRES consortium.

System Integrator – Ispaster: Barrizar

The *System Integrator* shall ensure that the system deployment requirements and processes are adhered to, including confirmation that the requirements are met.

> **WARNING: Only qualified System Integrator staff shall work on-site to perform installation work.**

The *System Integrator* will ensure that is aware of all details related to equipment, spaces, and requirements of the demo site. The responsibilities include the following main tasks:

- Know the characteristics of all the energy equipment present on the demo site.
- Look for spaces with favourable conditions to carry out the actions designed by the LocalRES consortium.
- Know the legislation related to each of the technologies to be implemented and the possible barriers that may arise in the installation process. In addition, to look for possible grants to co-finance the proposed actions.

Data Integrator – Ispaster: Aiguasol

The *Data Integrator* is responsible for deploying the necessary infrastructure to assure communication between the hardware that compiles all monitoring data of the local, physical monitoring network (i.e., SCADA) and the platforms that will treat and use those data. In other words, this figure is responsible for bridging the gap between data hardware and data software infrastructure. The communication channel enabled between the two endpoints shall be bilateral to allow control parameters to be defined by the software structures. Moreover, this actor is responsible for guaranteeing that the data interchanged between endpoints comply with the requirements regarding resolution, scale, integration, and the units they correspond to.

Installation Manager – Ispaster

The *Installation Manager*'s responsibilities include, at a minimum:

- Evaluate the work site, i.e., the location where the deployment will occur.
- Make any recommendations or identify risks/issues that could undermine the project.
- Supervise the installation and testing of equipment.
- Supervise equipment installation and start-up.
- Maintain field records and installation logs.
- Develop and maintain safety records; perform periodic safety checks.
- Remain on-site during the equipment and system installation phase of the project.
- Oversee the post-commissioning testing phase.
- Confirm that subcontractor work is completed properly and meets system requirements.

Consultants / Subcontractors / Third Parties / Other Roles – Ispaster

SCADA PROGRAMMER AND CONSULTANT

Responsibilities:

- SCADA update for data management of current and future systems. Preparation of Data map, consultancy for the development of datapoint list, and new hardware to communicate with the virtual platform.
- Support System and Data Integrator

SUBCONTRACTOR

- Installation of needed devices for communication, control and monitoring: meters, sensors, etc.
- Support Project Manager
- Support Installation Manager

The Demo Leader has the right to accept or reject any subcontractor.

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CONSULTANT SOCIAL DYNAMIZATION - TECNALIA

TECNALIA, in close collaboration with BARRIZAR, ISPASTERko Udala, and AIGUASOL, is developing activities that involve the interaction of citizens, which mainly consist of:

- informative and training sessions on Energy Communities
- sessions aimed at guiding and dynamizing the process of establishing a Renewable Energy Community in Ispaster (identification of possible legal figures, possible drafting of statutes.)
- support BARRIZAR in the "recruitment" of citizens for demonstration actions (installation of heat pumps, PV on the roof…), basing the actions on a pre-established and agreed working-schedule
- encourage citizen engagement in Ispaster

In addition, TECNALIA is contributing, together with BARRIZAR, ISPASTERko Udala, and Aiguasol, to the dynamization of the participatory and co-design sessions associated to the Planning Tool in Ispaster; process led by MTU (WP2), in order to capture the type of inputs and interests of the community.

Finally, TECNALIA also contributes to the political recommendations that derive from the work in Ispaster, mainly through the dynamization of sessions (if needed) and the review of corresponding deliverables.

6.3. Schedule – Ispaster

Table 22 summarizes the schedule which was initially defined for the main phases and actions in Ispaster demo during the first months of the project, despite some of the dates included have suffered subsequent changes. These changes will be reported in next deliverables (D4.3-D4.5).

Table 22: Summary of milestones for the Ispaster demo

Milestone /action	Deliverable	Responsibility	End Date
Definition of the implementation plan	Demonstration Planning meeting	Project Manager	23/12/22
E-mobility	Distribute Project Plan	Project Manager	25/04/22
	The EV is purchased and the chargers installed		06/07/22
Enlargement of the DHN	Review Project Schedule	Project Manager	03/05/22
Enlargement of the DHN	Civil works & Connexion done	Project Manager	28/11/22
Creation of the energy community	Develop matrix of resources/skills	Project Manager	05/05/22
	Engagement sessions		09/12/22
	Document signature		02/02/22
	REC creation		25/04/23

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A new monitoring system is up and running	Identify pre-deployment activities	Project Manager	18/04/22
	Monitoring Strategy´s definition		13/07/22
	Smart control, data capture & expound, website		26/12/22
A New PV system is installed	Stakeholders, budgets, funds	Project Manager	08/04/22
	Permits for Locations in households & Church		01/12/22
	Installation &Connexions		19/06/23
New electrical storage is installed	Permits for location in public basement	Project Manager	15/04/22
	Installation & connexions		19/06/23
P2H systems are installed	Household´s agreement	Project Manager	09/12/22
	Design, Project & Permits	Project Manager	17/03/22
	Heat pumps installation	Project Manager	27/06/23
CHP boiler is installed	Identify best option & location	Project Manager	01/12/22
	Purchase & Installation		25/06/23

6.4. Resources – Ispaster

Internal staff:

1. HP installation technician for design, schemes, and coordination.
2. Construction manager for the enlargement of the DHN. Control of civil works and installations to be properly done.
3. Technician to install the needed devices (meters, sensors, etc.) for the Energy management system.

Contractors needed to install:

1. HP-based heating solutions
2. PV & electric storage
3. Civil works for the enlargement of DHN
4. Plumber to install and connect insulated piping, thermal station, puffer, etc.

Facilities – Ispaster

The facilities required to test and deploy the system include:

- A publicly owned space that must be suitable for the location of the new electrical storage system.
- Locations to install the proposed solar photovoltaic systems. These sites could be roofs of private residential buildings, roofs of public buildings (church), or available land near the main neighbourhood (Elexalde).

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- A publicly owned space must be suitable for installing the new CHP boiler. This space may exist or be built if necessary, looking first for land with the optimal conditions.
- A public parking space where the new electric vehicle charging system can be installed.
- Space available in private homes to install new thermal systems based on heat pumps.

Equipment – Ispaster

Table 23 includes the equipment that has been planned for the LocalRES demo actions in Kökar:

Table 23: Equipment - Ispaster

Product/action	Budget	Purpose/description
Enlargement of DHN	60,000	Heat and DHW to public services
CHP Unit 55kWte+5 kWe + new location & installation	90,000	Integration into DHN & Micro grid
100 kWp PV system	130,000	Microgrid expansion
Simon 2 charging points + EV	35,000	E-mobility
Heat pump-based solutions	42,000	Heating solution with PV support
200 kWh Lithium batteries	30,000	Storage & 56 kW backup power
IT infrastructure	17,000	Siemens IPC 127E Atom E3940, 4GB RAM; Update of current SCADA. New sensors, meters, etc.
SMES	15,000	Monitoring and control hardware, IT platform

Software, IT infrastructure, and UI – Ispaster

The image below (Figure 8) offers a simplified diagram of the overall infrastructure architecture which has been proposed for the Ispaster demo and the information flow between elements. The image includes the components of the web infrastructure (represented in blue on the upper half) that will be described in the following subsections and the hardware elements (on the half bottom of the image).

The IT infrastructure developed for the Ispaster pilot consists of a web-based system composed of independent modules with a centralized database (Table 24). Most of the modules are implemented in Python. The architecture of the IT infrastructure is based on Docker microservices. Docker enables the deployment of complex automatized data services, ensuring reliability, robustness, and easy scalability.

Table 24: Modules of the IT infrastructure (software) in Ispaster

Product	Purpose
Datuma	Data storage
Integration module	Data collection from external providers
Calculation engine	Calculation of indicators for analysis
Forecasting module	Generation of forecast data

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Execution module	Decision making regarding the execution of modules, verification of a proper operation of modules and detection of anomalies
User Interface	Visualization of monitoring data, indicators, and information regarding the community; communication with other members of the energy community; contact with technical services providers

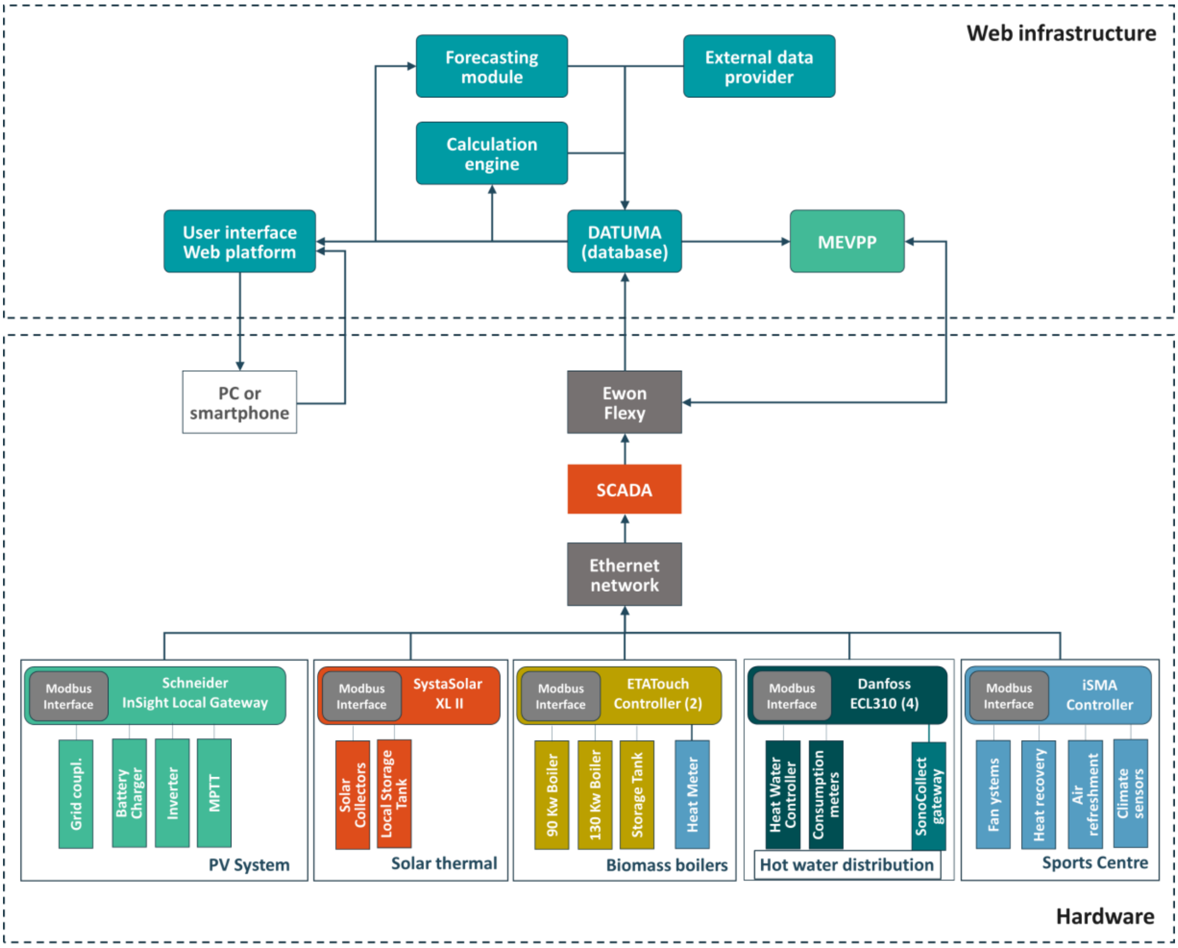

Figure 8: Diagram of the IT infrastructure (software) in Ispaster

DATUMA

Datuma is a multi-level system that integrates several databases depending on the different data formats and data treatment requirements. Datuma is also a semi-centralized database that will store data read from the local energy systems and consumers, indicators calculated by the calculation engine, and data gathered from external data providers. Datuma integrates the Open Time Series Database (OpenTSDB) in order to store time-series data, which is the format of most of the data collected, and a MySQL database to store relational data. It is also able to exchange files via an FTP server.

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INTEGRATION MODULE

Some data will be collected from external providers, such as meteorological data, electricity prices, and end-user electricity consumption, the utilities contracted by the users gather that. The integration module consists of a Dockerized microservice to gather data from external data providers. Once deployed, this microservice will trigger a periodical order to execute a Python routine that accesses the API services of the respective providers, requests data, and stores them in Datuma.

CALCULATION ENGINE

In order to retrieve meaningful information out of the data collected, a module based on a Python subroutine that handles data will be implemented. This module, known as the calculation engine, will request Datuma to access stored data, treat that data and calculate indicators. The indicators generated by this calculation engine will then be sent to be stored in Datuma. The calculated indicators will be available for consultation in the user interface. Besides enabling an easy data analysis process and system's performance evaluation, the results of the calculation engine will also allow for to identification of anomalies, in the first stage, in the data infrastructure system, and later, in the monitored systems.

The calculation engine will mostly recur to Python's Pandas library, a free data manipulation and analysis library that is particularly powerful in dealing with time-series data.

This module and a Docker microservice will be deployed, managed by the Execution Module.

FORECASTING MODULE

Forecast data, such as weather conditions or energy production levels, are necessary to properly advise users on optimizing their consumption. The Forecasting Module generates forecast data based on prediction algorithms. It will consist of a Python library built upon other free-access Python libraries. The specific libraries that support this module will depend on the selected algorithm. There are several algorithms to predict to generate prediction values. The selection of a proper algorithm requires an initial analysis of the data available since it is conditioned by several factors, namely: the behaviour of the variable to be predicted, the quality and characteristics of the available historical data, and its dependence on other known variables or parameters.

Like the calculation engine, this module will be deployed as a Dockerized microservice, integrated into the Execution Module, request Datuma to retrieve the necessary data to proceed with the calculations defined in the subroutine. It will then send the generated results to Datuma.

EXECUTION MODULE

The execution module is the part of the infrastructure responsible for operating the overall cloud infrastructure. This module decides when each microservice shall be executed and in which order. It also verifies if the other modules were correctly executed and if the necessary data was gathered and/or generated. The execution module is also responsible for detecting anomalies in the overall

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infrastructure through data analysis and helping trace the origin of potential faults. If an anomaly is detected, it will trigger an alarm to warn the responsibility for maintenance and technical support.

USER INTERFACE

The User Interface (UI) aims to provide intuitive data analysis and interpretation visualization instruments. The UI used in Ispaster is a multi-purpose platform which will allow each member of the energy community visualizing both historical data and indicators related to their consumption and the production and performance of the energy systems of the community. Moreover, the UI will advise users on their consumption based on results generated by the forecasting module. For instance, if the Forecasting Module predicts a much higher PV production the next day, the user will be advised to move punctual consumption events (such as doing the laundry) to that day. The platform will include an area for the EC members to discuss any subject the members wish, as well as a voting system. Besides, it will integrate a marketplace to contact different entities that are key for the EC development, such as providers of technical services, legal and financial entities, and energy training companies.

To ensure data privacy requirements, users will only have access to their private data (i.e., energy consumption) through the visualization platform, with their authentication credentials. Additionally, the UI will contemplate an admin section for the manager of the energy community and the responsibility for technical support and maintenance of the energy and monitoring network. The admin user will access more detailed technical data concerning the different components of the energy systems that compose the energy network which serves the community and to additional performance indicators. In the case of anomaly detection by the execution module, warning messages will also be displayed.

DOCUMENTATION OF THE DATA INFRASTRUCTURE

After data integration and the IT infrastructure deployment, the procedure to make requests to the database of the pilot will be documented and shared with the partners that need to access stored data. Likewise, a document explaining how to make reading and writing requests to Ewon Flexy will be prepared and made available to the developers of the MEVPP. Ewon Flexy is the datalogger, the hardware component that connects the physical components of the pilot with software cloud infrastructure. Finally, a brief user interface guide will also be created to aid the end-user in navigating the platform. Table 25 summarizes the documentation associated to the data infrastructure preliminarily expected to be developed:

Table 25: Documentation/monitoring – Ispaster

Document	Author
The user manual of the UI	AIGUASOL
Access to Ewon Flexy	AIGUASOL
Access to Datuma	AIGUASOL

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6.5. Installation Process – Ispaster

The site installation work will be carried out considering the characteristics of each site and coordinating with those responsible for each area:

Preparing – Ispaster

The demonstration of each of the actions will have to follow the following steps:

1. Validation of site information.
2. Review the deployment schedule according to the previous planning.
3. Review of users and staff producers.
4. Notification to the main contact of the Site.
5. Confirmation that this has been communicated to all impacted staff.

Each of these steps is explained in the following sections:

VALIDATION

The validation will be carried out through the measurements of the new demo monitoring systems and the calculations of emissions and primary energy savings achieved by the actions carried out.

SCHEDULING

The demo site schedule will be carried out as indicated in the calendar above.

In principle, power supply interruptions will only occur for actions affecting the heat network, so they will be prioritized to be carried out during summertime, when the system is used less. These interruptions are expected to last no longer than a week.

REVIEWS

Once the *Demonstration Plan* has been finalized, the project manager will design, together with the other participants, the necessary review tools to guarantee the security of the community users on the Ispaster demo site.

INTERNAL COMMUNICATION PLAN

The Ispaster demo site team will meet weekly to follow up on Ispaster activities. All participants involved in the demo site will participate in these meetings. In addition, there will also be regular monthly meetings with the entire LocalRES demo teams, where information regarding the demo site will be shared. Moreover, the data infrastructure described in the previous section will include a data analysis functionality that will detect anomalies and alert the responsible for technical support. As previously mentioned, the UI will also show a warning message if any issue is detected.

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6.6. Training – Ispaster

The *Training Plan* for Ispaster demo is structured in two parts. The first part addresses end-users and aims at maximizing the transparency and the democratic behaviour within the REC. A second part is planned to support staff in ensuring that the values and policies agreed upon within the REC are applied fairly in the real operation and maintenance of the technical solution. The next two subchapters describe the training activities at the installation site for end-users and support staff.

End-user Training – Ispaster

Training for the end-users of the REC in Ispaster may start during the LocalRES project, but will not be finalized before the end of the project. The Ispaster REC will be proposed to continue beyond the scope of LocalRES, therefore training will be needed after the end of the project.

End-user training must include the following content:

- Minimal technical knowledge of the system and its operation:
    - The REC members need to understand the system as a whole (not specific knowledge about the devices…). For instance, the end-users generally do not need to understand the thermal cycle in the heat pump. Still, they need to know that a HP consumes electricity and provides heat, that a HP transforms one unit of electricity into 3-4 units of heat (concept of the COP), that the increase of the share self-consumed electricity implies savings for the REC and therefore for the individuals in the REC, etc.

- Social operations of the REC: communication, assemblies, decision-making process, communication and solving of problems, etc:
    - All the REC members need to understand clearly what a REC is. The questions the members need answers to are; what are the benefits and the obligations of being a member, how they can interact, what is the decision-making process, and how a technical or administrative problem can be communicated and how they will be solved at the procedure level, etc.

In the future, especially concerning making decisions about the technical future of the REC, there should be specific training sessions on the technologies and their implications for the REC. Finally, as described in the previous section, a user interface user interface will be made available to guide how to use the visualization platform.

Support Staff Training – Ispaster

As occurs with the training of the end-users, the training to the support staff will start during the LocalRES project, but it will follow up after the end of the project. Some key training actions for support staff will be executed during or just after the end of the LocalRES project:

- Training at a technical level (equipment, devices, control, etc.):

    - testing and function control of newly installed equipment.
    - commissioning and testing of the whole system in a coordinated way, including existing installation.
    - specific training programs provided by the providers of the technical solutions and equipment (if any).
- Training at the management and administrative level:
    - Rules of the REC: mission and vision, values, policies, data confidentiality, decision-making process, management structure, etc.
    - Local and regional regulation: deep knowledge of the law and regulation in Ispaster, Euskadi, and Spain applying the ISPASTER REC is needed.
    - Overall view of the working way in the REC.

As the Ispaster REC evolves at the technical and social level, the support staff will need to refresh their knowledge to be updated and aligned with the future REC.

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7/ Demonstration Plan for Ollersdorf

7.1. Site Information – Ollersdorf

Ollersdorf is a village located in the southeast Austria and around 1,000 inhabitants, with about 20% of households already equipped with solar panels. The area is mostly agricultural, with no industries settled there. The municipality of Ollersdorf is part of the Klimaund Energie Model Region (KEM) "KEM Golf und Thermenregion Stegersbach"; a program of the Austrian Climate and Energy Fund. Ollersdorf is also part of the Innovation Lab act4.energy, an initiative of the Austrian Ministry of Climate Action in the program "City of Tomorrow." As such, Ollersdorf has a clear strategy to focus on renewable energy and smart municipality.

Site Diagram – Ollersdorf

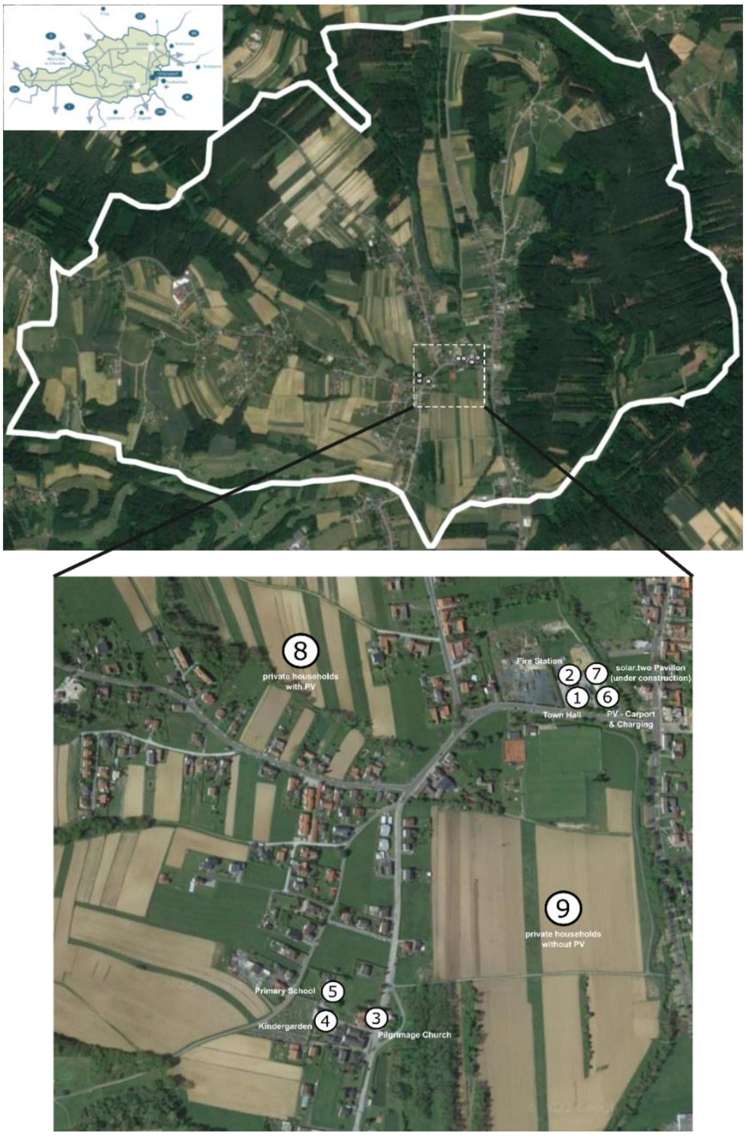

Figure 9: Bird view of the municipality Ollersdorf

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System Overview – Ollersdorf

Within the Austrian municipality of Ollersdorf, a REC will be implemented. This demo site aims to set up an energy community to share locally produced energy, increase the share of RES, and couple different energy sectors (electricity, mobility, heating, wastewater, etc.). Furthermore, (control) strategies in blackout cases for different timescales (from seconds to days) and strategies for re-starting the power system and ICT system will be developed, validated, and deployed.

Table 26: System Overview

System overview	Details
Project Executive	AIT
Project Owner	Municipality of Ollersdorf
System name	Ollersdorf Renewable Energy Community
System type	Production, demand response, blackout strategies, etc.
Operational status	In development

Demonstration actions – Ollersdorf

The planned demonstration actions and functionalities in Ollersdorf together with their corresponding identification numbers are presented in Table 27 below. Moreover, the table presents the project objectives that the demo actions mainly contribute to, and the KPIs initially proposed to evaluate the impact of the actions. Furthermore, the relation of all demo actions to the project's STOs and NTOs, and which KPIs they will affect is presented in Table 33 in annex 1. How the KPIs are defined in detail and measured in practice is described in chapter 2 of D4.1.

Table 27: Demonstration actions in Ollersdorf, and respective objectives and KPIs.

4 – Ollersdorf demonstration site		Objectives	KPIs
4.1	Community engagement	STO1, STO2, NTO1, NTO2	SO1, SO3
4.2	Implementation of smart ICT infrastructure for the smart operation of the local energy system	STO4	TE1, TE2, TE6, SO4
4.3	Implementation of control algorithms and blackout strategies	STO3, STO4	TE1, TE2, TE6, SO1, SO4
4.4	Community information system	STO4, NTO2	SO1
4.5	Blockchain based P2P trading / accounting	STO3	SO1, SO4
4.6	Future energy scenario and impact of scaling up	STO1, STO2, NTO1, NTO2	TE2, TE7, SO2, SO3, SO4, EC1

4.1 - COMMUNITY ENGAGEMENT

The local community will be enticed and empowered to help form and shape the direction of the project's demonstration actions. Moreover, community engagement will play a key role in the

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definition of the Planning Tool, as the communities will be given a change to influence the tool's design through co-design and participatory sessions. Furthermore, the community engagement in Ollersdorf will contribute to promoting people-powered renewables to other similar villages nearby. Consequently, community engagement will contribute to STO1, STO2, NTO1 and NTO2.

4.2 - SMART ICT INFRASTRUCTURE

The implementation of the ICT infrastructure for the smart operation of the local energy system, optimizing the electricity system operation in synergy with local RES (PV panels), sector coupling (Heat pumps and electric boilers), mobility (EVs), and energy storage (batteries). This action will contribute to achieving the STO4, as it demonstrates technology that will optimize the advantage from existing clean energy equipment, and thus helps to bring down the energy costs for the municipality.

4.3 - CONTROL ALGORITHMS AND BLACKOUT STRATEGIES

Development and deployment of control algorithms to optimize the energy flows within the REC and maximize the integration of local resources (RES, E-Vehicles, and energy storage) to support energy communities. Therefore, it is reasonable to state that implementing this demo action will contribute to STO3 and STO4 as it will essentially enable integration of multiple energy networks via the MEVPP by demonstrating novel solutions.

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, by implementing a solution that enables the citizens and passers-by to keep up with the developments in the community.

4.5 - BLOCKCHAIN-BASED PEER-TO-PEER (P2P) TRADING / ACCOUNTING.

Use of a blockchain structure and wallet technologies to ensure P2P renewable energy trading of the local energy community. Smart Meter measurement values will be used in order to account for the energy trading within the REC. Blockchain technology provides important technical aspects (transparency, data cannot be modified or deleted, etc.) and a high level of automation (smart contracts can be used for calculating the energy distribution within the community). Therefore, it is reasonable to state that implementing this demo action will contribute to STO3 as it will essentially enable integration of multiple energy networks via MEVPP by demonstrating novel solutions.

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NOTE: Due to a new regulation *§16e Metering and billing in energy communiti*es passed into Austrian law, P2P is not explicitly prohibited, but it makes it impossible to do any P2P trading, as the measuring and allocation of energy must be done by the grid operator, and there is no process in place to inform the grid operator of any agreements between participants. This severely affects demonstration action 4.5 for Ollersdorf and will be monitored. Mitigation action shall be provided in the following deliverables.

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 will be developed. This action includes 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 includes identifying the measures and strategies to update the local electric grid to allow these changes. An existing automation framework will be further extended and used for simulation and validation of the power system, the ICT system, control strategies and software components within the community. The demo action 4.6 contributes to STO1, STO2, NTO1, and NTO2 as it develops future scenario and assesses its impact so that it could be utilized in other location or used to scale up the current one in Ollersdorf.

Site Preparation – Ollersdorf

For the demo actions, participating households will be equipped with sub-metering and IoT infrastructure to get consumption and generation measurements and connect flexibility assets. The implementation means that smart meters and the IoT Gateway (with their respective power supplies) need to be installed in the participating households and communal buildings.

These installations need to be done by a certified electrician who will install the instruments into the existing fuse boxes of the households. Therefore, these fuse boxes will be inspected before installations and checked if sufficient space is available. If there is insufficient space, a small junction box needs to be fabricated, which holds the devices and will then be connected to the main fuse box.

Beyond that, no site preparation will be necessary.

Site Readiness – Ollersdorf

A checklist has been prepared for determining the site readiness in the demo Ollersdorf, as shown in Table 28 below.

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Table 28: Deployment Checklist for Ollersdorf demo

Deployment Checklist	Yes / No
Are adequate resources available?	Yes
Is workers' space available?	Yes
Describe pre-deployment task	Yes (finalized)
Have contractors received security clearance?	Yes
Do contractors fulfil act on contractors' liability?	N/A
Have personnel received training?	Yes
Have user groups communicated that installation engineers will arrive on a specific date?	Yes
Has insurance been taken out for third-party personnel etc.?	N/A
Is there adequate vehicle park space for the installation team?	Yes
Are all agreements and contracts signed off?	
Do you have all the required permits cleared?	

7.2. Roles & Responsibilities – Ollersdorf

The key roles and responsibilities of the Austrian demo site are summarized in Table 29 below:

Table 29: Roles & Responsibilities in Ollersdorf Demo

Role	Name	Responsibility
Project manager	Austrian Institute of Technology	Responsible for communication, schedules, resourcing, etc.
Community Manager	Energie Kompass	Responsible for interaction with local municipality and installation/integration
System Integrator	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

Project Manager – Ollersdorf

The *System Integrator* shall nominate a *Project Manager* subject to the *Client*'s approval. The *Project Manager* is the *Demo Leader*'s point of contact throughout the project. The *Project Manager* shall oversee budget matters, schedules, and risk management and ensure that all resources are allocated to the project as efficiently as possible.

The *Project Manager*'s primary responsibilities include, at a minimum, the following:

- Primary communications with the *Demo Leader*, their consultants, and third parties.
- Ensure that the *System Integrator* adheres to the quality control process.
- Schedule and administer weekly status meetings, monthly/quarterly reviews, and communications.
- Interface with the *Installation Manager*, subcontractors, and third parties.
- Coordinate with regulatory agencies, permitting agencies, vendors, etc.

Community Manager – Ollersdorf

The *Community Manager* works closely with the *System Integrator* to coordinate and communicate the implemented actions and interventions at the demo site. The *Community Manager* serves as the main contact between the *Project Manager*, the municipality, and its citizens. The *Community Manager* shall mainly oversee the community engagement.

The *Community Manager*'s primary responsibilities include, at a minimum, the following:

- Primary communications with the *Demo Leader*, their consultants, and third parties
- Ensure the *System Integrator* adheres to the quality control process
- Schedule and administer weekly status meetings, monthly/quarterly reviews, and communications
- Interface with the *Installation Manager*, subcontractors, and third parties
- Coordinate with regulatory agencies, permitting agencies, vendors, etc.

System Integrator

WARNING: Only qualified System Integrator staff shall work on-site to perform installation work.

No infrastructure work is carried out in Ollersdorf, and all installed components, such as the smart meters and IoT devices, are standardized parts that local electricians will install. These installations do not require any preconditions or measures beyond the standardized Austrian labour

System integration is mostly software and IT task in Ollersdorf, and the *System Integrator* is responsible for setting up the IT infrastructure concerning functionality, data safety, and IT security. Therefore, the *System Integrator*'s responsibilities in this case are limited to:

- *System Integrator* will have the required licenses and other installation permits before starting any work.

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Installation Manager – Ollersdorf

Installation management is also done by the *System Integrator*, who will be responsible for procuring a licensed electric installation company to install requited IoT devices.

The *Installation Manager*'s responsibilities include, at a minimum:

- Evaluate the work site, i.e., the location where the deployment will occur. Make any recommendations or identify risks/issues that could undermine the project.
- Supervise the installation of equipment
- Develop and maintain safety records; perform periodic safety checks
- Confirm that subcontractor work is completed properly and meets system requirements

Consultants / Subcontractors / Third Parties / Other Roles – Ollersdorf

CONSULTANT: ENERGY MANAGEMENT

The consultant shall provide expertise to ensure the optimal approach and strategies for local energy management systems. They shall assist during discussions and provide input depending on the requirement.

This consultant shall also provide in-depth feedback and expertise during the planning and deployment of the local optimization algorithm. This consultant is tightly linked to the Blackout strategies consultant.

CONSULTANT: SITE MONITORING

The consultant shall provide expertise and experience in on-site asset monitoring. Here the consultant shall provide feedback and recommendations on what is a useful parameter and what is not – as well as identify the optimal placement of measurement probes or equipment so that the data collected is of high quality.

CONSULTANT: BLACKOUT STRATEGIES

The consultant shall provide expertise and experience while planning tools and services. The work can also expand into providing feedback during the planning of flexible assets. Moreover, this consultant shall work together to plan and develop on-site blackout mitigation/recommendation strategies. It additionally entails a tight feedback loop for the energy management consultant.

7.3. Schedule – Ollersdorf

Table 30 summarizes the initial schedule proposed for the main phases and actions in Ollersdorf demo during the first months of the project, despite some of the dates included have suffered subsequent changes. These changes will be reported in next deliverables (D4.3-D4.5).

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Table 30: Milestones and phases for Ollersdorf demo

Phase	Deliverable	Responsibility	End Date
Preliminary works	Determine training needs	System Integrator	11/21
	Interest to participate from residents	Community Manager/ System Integrator	11/21
	[Blackout] Specification document for implementation	Project Manager/ Consultants	05/22
Pre-deployment	Demonstration Planning meeting	Project Manager	11/21
	Determine roles & responsibilities	Project Manager	09/21
	Review Project Schedule	Project Manager	01/22
	Develop matrix of resources/skills	Project Manager/ System Integrator	01/22
	Identify pre-deployment activities	Project Manager	01/22
	Assign staff	Project Manager/ System Integrator	02/22
	Residents sign up to participate	Community Manager/ System Integrator	12/21
	Helpline set up	System Integrator	12/21
	[Alg. development] Finished grid Topology model	Project Manager/ Consultants	06/22
	[Blackout] Approved Concept of implementation	Project Manager/ Consultants	06/22
	[MVPP/ASGC] Lab validation complete	Project Manager/ Consultants	04/22
	[Blackout] Approved Concept of implementation	Project Manager/ Consultants	05/22
Deployment Phase	ICT HW ready to be used on-site	System Integrator/Installation Manager	12/21
	teams4energy deployed and ready to integrate	System Integrator/Installation Manager	01/22
	Monitoring equipment installed according to regulation	System Integrator/Installation Manager	11/22
	Demo location integrated into teams4energy	System Integrator/Installation Manager	12/22
	Deployment to participants done	System Integrator/Installation Manager	01/23
	All participants are integrated into teams4energy	System Integrator/Installation Manager	03/23

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	[Optimization] alg. Integrated into local ICT	Project Manager/ System Integrator/ Consultants	10/22
	[Blackout] flexibility reserve integrated into local ICT	Project Manager/ System Integrator/ Consultants	11/22
	[Blackout] KPIs visualized in local ICT	Project Manager/ System Integrator/ Consultants	12/22
EOP	[MVPP/ASGC] Field validation complete	Project Manager/ Consultants	05/25

7.4. Resources – Ollersdorf

Facilities – Ollersdorf

ICT Facilities will be considered, such as IoT and algorithms/services.

IOT

Before deployment of the IoT devices, they need to be set up and configured by the *System Integrator* at their premises. For the IoT devices, an image file with the operating system and all software components is prepared that is first copied to any device to be installed. Then config files containing the household-specific information and setup are copied into the respective folders. After the software is installed, a basic connection test using an LTE modem is performed to check if the device correctly registers in the system backend end server.

ALGORITHM/SERVICES

Algorithms and services will be considered to:

- Local aggregate data of at least 6 months
- Access to MOCK API for integration testing
- RT Testbed/C-HIL

Equipment – Ollersdorf

Table 31 includes the devices that have been planned for the LocalRES demo actions in Ollersdorf:

Table 31: Equipment Ollersdorf demo

Product	Budget	Purpose/description
Smart Meter SIEMENS 7KM PAC2200	55.000 € + 11.500 € installation cost	Real-time measurement of PV generation and total household consumption in the participating households
IoT Edge Device SIEMENS IoT2050		Data aggregation and communication to the cloud data infrastructure

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Ethernet Hub (D-Link DGS-105 network switch 5 Port 1 GBit/s or similar)		Data communication with assets within participating households
LTE Modem (e.g., Huawei Mobile Wi-Fi 3s E5576-320, TP-Link M7000, or similar)		Data communication via mobile internet access between household and cloud data infrastructure

Software, IT infrastructure and UI – Ollersdorf

Most of the software and ICT infrastructure is already available on-site, provided by Energie Kompass. The assets include an API/DB server and a production front-end UI called *Team4Energy*.

The DB server stores the aggregated data provided by the participants. The data is stored anonymised, but each participant is issued a unique key to associate data with each account on the *Team4Energy* platform.

The *Team4Energy* platform is a mainly web-based application designed around the idea of simple interactions and expressive data. The method enables the participants to monitor their data at around 15min intervals via their accounts. Customer ICT infrastructure will be deployed during the deployment phase with an already ready-made communication and aggregation firmware that internally talks mainly RS485 and Modbus/Modbus TCP and uses an MQTT overlay to communicate to the database backend.

Table 32: Software in Ollersdorf demo

Product	Version	Budget	Purpose
InfluxDB	X	FOSS	Datastore
Linux - Ubuntu	LTS	FOSS	OS
Mosquitto	X	FOSS	MQTT Broker

Documentation/monitoring – Ollersdorf

Since the system is already known and mainly developed in-house by Energie Kompass, documentation, maintenance, and monitoring are already available.

Technical Documentation is provided to the subcontractor in charge of deployment and installation at the participants' location. The communication/ICT-based installation and deployment will be done before electrical installation. This process will be done in-house at Energie Kompass, where the unit's operation will also be tested.

Monitoring is intrinsically tied to the aggregation of data; i.e., If the unit does not provide data for some time or data is not sane, the unit or local installation might be faulty, and maintenance will be done.

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7.5. Installation Process – Ollersdorf

Deployment of the aggregation infrastructure for LocalRES will be done in two main steps.

- **Single unit roll-out**: everything is deployed to a single participant.
- **Mass roll-out**: deployment of the rest of the participants.

The main reason for this approach is that it allows the installer to get familiar with what needs to be done and what setbacks can occur. In an optimal condition, the single-unit deployment should be done in the most "difficult" household since we learn the most from experience. E.g., *do we need to adjust some firmware parameters? Will we need additional time to integrate an on-site asset due to special conditions etc.?*

From the learned information and experience, we can now adjust the deployment schedule, sequence, or priority. In addition, it enables us to fix or adjust software parameters, software bugs, timing issues, etc. and deploy the fixes to the devices before mass roll-out

Preparing – Ollersdorf

As the system is designed as a "drop-in" system, there is not much to prepare except for on-site communication installation and a separate Mains monitoring device.

The demonstration of each of the actions will follow the following steps:

1. Validation of site information.
2. Scheduling: to review the deployment schedule according to the previous planning.
3. Review: of users and staff producers.
4. Communications: notification to the main contact of the Site, and confirmation that this has been communicated to all impacted staff.

Each of these steps is explained in the following sections:

VALIDATION

Validation will be done by validating the energy measurements obtained compared to the smart meter measurement performed by DSO smart meter.

SCHEDULING

Scheduling for deployment is based on the simple concept of the *low-volume rollout – large volume rollout*. Moreover, it defines a small volume of *products* being deployed/tested in their designated location with the supervision of the development team. The method allows for implicit training and experience for the actual integrator as well as ITL experience and testing of designed deployment techniques. Additionally, it covers communication integration tests and firmware tests. With this set of data and *lessons-learnt* last-minute adjustments, fixes and optimizations can be done before mass roll-out. Furthermore, it allows for a much more seamless deployment of large volumes as the initial problems should have been ironed out by that time.

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A similar approach will be taken with the deployment of Algorithms and Services. These will previously be tested in a local testbed of arbitrary complexity. Before final deployment, an integration testing session will be announced to observe the interaction and behaviour of the system in the real scenario. In this case, the development of the services is tightly connected, and the testbed shall be used by both parties allowing interaction behaviour to be evaluated before we move to the real assets. After integration sessions, the last bugs shall be ironed out, and a final integration and deployment session shall be planned. These sessions will be announced and planned so that possible service outages will not disrupt the local economy.

REVIEWS

Each installation or deployment at a participant shall be supervised and signed off on by the *Installation Manager* (or assigned staff). The *Project Manager*, *Installation Manager*, and the *Site-monitoring consultant* will do a final review and check.

INTERNAL COMMUNICATION

The *System Integrator* is responsible for the communication with subcontractors. As deployment will be done in a step-by-step procedure, no recurring meetings are planned, and communication will be done on a case-by-case basis before the start of each deployment batch.

A monthly 2-hour meeting shall be used to formally discuss all issues and statuses. Additional meetings shall be called at the project manager's and sub-leaders’ digression.

In addition, the Microsoft Teams platform is used for centralized document and data storage. it can be also used for simple text-based chat.

7.6. Site Monitoring – Ollersdorf

After initial installation, we shall observe and validate the system before releasing it into an operational state. As of that point, the sites will be mainly monitored by accessing measurement data aggregated at each node. The access will allow somewhat automated monitoring for values/measurements that do not adhere to the expected ranges. Also, the participants can report any anomalies that they might observe. The method allows us to have a second instance of observation.

Monitoring for defects – Ollersdorf

As mentioned in the main description of section 7.6, we will mainly monitor for defects by automated range measurement and sanity checks.

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Sign-off – Ollersdorf

Installation of the system will be done in a step-by-step rollout (as described above), and each household's installation will be signed off separately. The sign-off process is also done separately for hardware installation and software installation.

Hardware sign-off is done by *System Integrator* together with the respective participant. Acceptance criteria are:

- All hardware components are fully installed
- The installation has been done following Austrian norms and codes
- All components are connected to the power supply
- All data cable connections are made
- The LTE modem is installed and has internet connectivity

After the hardware is signed off according to the criteria above, software sign-off is carried out by System Integrator and the respective participant according to the following criteria:

- IoT device correctly registers in the data backend
- All available household assets (e.g., PV, battery, heat pump, or wall box) communicate to the backend
- The available assets provide data into the customer UI

Customer Satisfaction – Ollersdorf

Two surveys will measure customer satisfaction (I.e., participating households and municipal buildings). One at the beginning of the demo phase, questioning expectations and the initial experience during the deployment and setup phase.

At the end of the demo phase, a second, more in-depth survey will question the following aspects:

- How well did the system perform technically (faults, outages, software bugs?)
- How well did the system performance concerning expectations?
- How well did the system UI perform, and how good was the usability?
- How well did the system contribute to the municipalities energy development goals?

Surveys will be interpreted both individually and as aggregate for the whole municipality, but always respecting the GDPR.

7.7. Training – Ollersdorf

End users will only interact with the web application for which no dedicated training is needed. The operation of the web app interface will be shown to customers during the respective on-premise installation.

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8/ Conclusion

This document provides all the basic information concerning the deployment of the LocalRES demonstration actions at an initial stage of the project. It is to be noted that this deliverable document is not an exhaustive project plan but an open document that will be used as a reference in future work. Since the demonstrations are very different technically, the Demonstration Plans need to be unique to the site, but they will follow the same basic working principles, as defined in this report.

Despite this document includes an initial planning which was prepared during the first months of the project, it has already become evident that multiple unforeseeable and external factors have already impacted the timing or technical approaches of the implementation actions, as drafted in previous pages. Therefore, the here stated information should not be considered as the final decision but rather the initial vision, which will be updated in subsequent deliverables D4.3-D4.5.

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Annex 1 - Summary of project objectives, demo actions, and KPIs

Table 33: Summary of project objectives, demo actions, and KPIs:

	STO1	STO2	STO3	STO4	NTO1	NTO2
Technical KPIs						
TE1. Peak elec. dem.			1.6, 1.8, 2.5, 3.7, 4.3	1.6, 1.7, 1.8, 2.3, 2.4, 2.5, 3.2, 3.3, 3.4, 3.5, 3.7, 4.2		
TE2. Energy consumption			1.6, 1.8, 2.5, 3.7, 4.3	1.6, 1.8, 2.4, 2.5, 3.2, 3.3, 3.5, 3.7, 4.2	1.1, 3.8, 4.6	
TE3. No. of ICEs per capita				1.7, 2.3, 3.4		
TE4. No. of EVs per capita				1.7, 2.3, 3.4		
TE5. Cum. ESS capacity				1.3, 1.8, 2.2, 3.6		
TE6. Electricity import				1.3, 1.4, 1.5, 1.7, 1.8, 2.2, 2.3, 2.4, 2.5, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 4.2, 4.3		
TE7. RES electricity self-prod.				1.3, 1.4, 1.5, 1.8, 2.4, 3.3	1.1, 3.8, 4.6	
ENVIRONMENTAL KPIs						
EN1. Energy-related emissions				1.3, 1.4, 1.5, 1.7, 1.8, 2.3, 2.4, 3.2, 3.3, 3.4, 3.5	1.1, 3.8, 4.6	
EN2. Land use for energy				1.3, 1.4, 1.5, 1.8, 2.4, 3.3		
EN3. Noise level				1.3, 1.5, 1.7, 2.3, 2.4, 3.2, 3.4		
EN4. Visual impact				1.3, 1.4, 1.5, 1.8, 2.4, 3.2, 3.3		
Social KPIs						
SO1. Citizen engagement	1.2, 2.1, 3.1, 4.1	1.2, 2.1, 3.1, 4.1	4.3, 4.5	4.4,	1.2, 2.1, 3.1, 4.1	1.2, 2.1, 3.1, 4.1, 4.4
SO2. Employment rate	1.1, 3.8, 3.9				1.1, 3.8, 4.6	
SO3. Regulatory REC barriers	1.2, 2.1, 3.1, 3.8, 4.1	1.1, 3.8, 4.6			1.1, 3.8, 4.6	1.1, 3.8, 4.6
SO4. Energy poverty		1.1, 3.8, 4.6	1.6, 1.8, 2.5, 3.7, 4.3, 4.5	1.6, 2.4, 2.5, 3.7, 4.2	1.1, 3.8, 4.6	
Economic KPIs						
EC1. Share of annual investments towards RES	1.1, 3.8, 4.6	1.1, 3.8, 4.6			1.1, 3.8, 4.6	1.1, 3.8, 4.6

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