RE-EMPOWERED

Renewable Energy EMPOWERing
European & InDian Communities

Deliverable 6.4: Feedback from local communities

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R Document, report	**PU** Public
DEM Demonstrator, pilot, prototype	**CO** Confidential, only for members of the consortium (including the Commission Services)
DEC Websites, patent fillings, videos, etc.	**EU-RES** Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)
OTHER ETHICS Ethics requirement	**EU-CON** Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC)
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EXECUTIVE SUMMARY

This deliverable reports on the feedback obtained from the local communities, demo operators and other stakeholders concerning the RE-EMPOWERED ecoTools. This was achieved through frequent interactions between the ecoTool leaders, the pilot-site leaders, the demo-operators and the local communities. Pilot leaders were tasked with collecting feedback from local stakeholders about their needs during the development phases, as well as after the deployment of the tools. To facilitate this process, they appointed local individuals, referred to as "community enablers", who served as contact points to enhance communication efficiency. The feedback was then forwarded to the ecoTool leaders for consideration and improvements.

This deliverable includes the adopted methodology for feedback collection, a description of the ecoTools that was distributed to the users, and the analysis of the feedback. The analysis shows that the overall feedback was positive, while differences between India and EU have been noted.

Apart from the written feedback that is presented in this deliverable, constructive feedback was obtained in oral form during the several community engagement and training activities, which are reported in D6.1 “Engagement status report” and D6.2 “Training activities report” respectively.

KEYWORDS:

User feedback, stakeholder, local community, questionnaire, tools, community enabler, demo-site operator

TABLE OF CONTENTS

1 Introduction

1.1 Purpose and scope of the document

The RE-EMPOWERED project aims to develop and demonstrate novel tools to provide a complete solution for all stages of a Microgrid/Energy Island or Multi-Microgrid application. Apart from software solutions (e.g. ecoPlatform, ecoPlanning, ecoEMS), hardware solutions (e.g. ecoDR, ecoConverter) are developed and demonstrated.

This deliverable reports the stakeholders' feedback for customer-driven development of the ecoTools. The functionalities of many of those tools have been tailor-made for the specific pilots. The obtained feedback from the consumers/users was used from the respective tool developers in order to upgrade and improve certain aspects of their tools. Dedicated questionnaires and direct communication were used to accomplish the suggested interaction with residents. Additionally, pilot leaders designated local persons as points of contact (referred to as "community enablers") in order to have a single point of contact and improve communication.

1.2 Structure of the document

The methodology for gathering data and the participant's feedback collection process are explained in Chapter 2. Chapter 3 includes a description of the standard and the advanced features of each ecoTool, which was distributed to the users along with the feedback forms. The analysis of feedback, including significant insights and interpretation, is presented in Chapter 4. Chapter 5 concludes the report, while the consolidated feedback from the users is included in the Annex.

2 Methodology

In the RE-EMPOWERED project 10 ecoTools have been designed and developed by the partners. In addition, some commercial items have been customized for the needs of the project. Table 1 shows the tools, as well as the stakeholders which are the most direct users of each tool.

Table 1. Tools and direct users

No	Types of Tools	Direct users
RE-EMPOWERED-Developed Tools		
01	ecoMicrogrid	Demo-site operator
02	ecoPlanning	Demo-site operator
03	ecoDR	Citizens, demo-site operator
04	ecoMonitor	Demo-site operator, Local authority
05	ecoResilience	Demo-site operator
06	ecoConverter	Demo-site operator
07	ecoVehicle	Citizens, Demo-site operator
08	ecoCommunity	Citizens, Demo-site operator
09	ecoEMS	Demo-site operator
10	ecoPlatform	Demo-site operator
Commercial Items customized by the partners		
01	E-Loader	Citizens, Demo-site operator
02	E-Boat	Citizens, Demo-site operator

In this task, the focus was given on the RE-EMPOWERED developed tools, so feedback was collected for these tools. As shown in Table 1 there are basically two different categories of direct users of the tools: local citizens and demo-site operators. Due to the significant differences in their technical backgrounds, different approaches had to be applied. Feedback from the citizens was obtained via the community enabler, while feedback from the demo-site operators was obtained via the pilot-leaders (i.e. project partners).

During the design/development phase of the ecoTools, each ecoTool leader was asked to prepare a feedback form along with description of standard features and advanced features of their tool, that was going to be developed. The purpose of describing the features of each tool was to make awareness about the tools among the demo-site operators, the citizens, as well as the community enabler, who would collect the feedback from the citizens. The feedback forms were collected from the ecoTool leaders and forwarded to the community enabler and demo-site operator through the pilot leader. This process was conducted twice: during the design/development phase and also right after the deployment phase. The community enabler collected the feedback data from the citizens at both stages. The collection of feedback was mainly carried out in physical form, and to a limited extent from the ecoCommunity app. The number of respondents was tentatively 2 to 5 for each tool. Different participants may have chosen different options against a particular feature. To facilitate the data collection process at the Indian demo-sites, all the options selected by the participants for an ecoTool were mentioned in a single questionnaire. This consolidated feedback is presented in Annex A and Annex B. It should be noted that the responses were anonymous and handled according to the GDPR (at the EU sites), while gender issues were also considered.

3 Features of the ecoTools

As already explained, the community enabler gathers the feedback from the local citizens at the pilot sites. The community enabler and also the demo-site operator initially did not have good understanding of the ecoTools, therefore they had to be provided with a detailed description of each tool in order to become knowledgeable. In light of this, each tool leader was requested to provide a more straightforward explanation of the many characteristics of each tool, so that the demo-site operator and community enabler may better comprehend its operation. Each tool has advanced functionalities as well as standard features, which are explained below. This information was shared along with the feedback forms.

3.1 Standard features

3.1.1 ecoMicrogrid

Sr. no	Standard features	Description
01	Real-time monitoring	The Energy Management System (EMS) provides real-time monitoring of various components within the microgrid, such as generation sources, storage systems, loads, and grid connections. This allows for continuous assessment of system performance and identification of any anomalies.
02	Energy Optimization	The EMS employs advanced algorithms and optimization techniques to maximize energy efficiency and minimize operating costs. It considers factors such as energy demand, generation capacity, energy storage levels, and pricing signals to optimize the dispatch of energy resources.
03	Energy Forecasting	The EMS utilizes forecasting models to predict energy generation and consumption patterns within the microgrid. Accurate energy forecasts enable better planning, scheduling, and resource allocation to optimize overall system performance.
04	Integration with Renewable Energy Sources	The EMS supports the integration and control of renewable energy sources, such as solar panels, wind turbines, and storage systems. It optimizes the utilization of renewable energy and manages their intermittent nature effectively.
05	Demand Response	The EMS enables demand response functionality, allowing for the dynamic adjustment of electricity consumption based on grid conditions. This feature helps to balance supply and demand, improve grid stability, and optimize energy usage
06	Fault Detection and Diagnostics	The EMS includes fault detection and diagnostic capabilities to identify any faults within the microgrid. It assists in troubleshooting and prompt resolution of issues to maintain system reliability.
07	Control and Automation	The EMS offers control and automation capabilities to manage the operation of the microgrid. It includes functions such as start-up and shut down of the backup generators.

3.1.2 ecoPlanning

Sr. no	Standard features	Description
01	Unit Commitment Algorithm	Achieves the most economic generation mix considering the locally available energy sources.
02	Demand/Peak modelling	The tool enables modelling the expectations of how the load demand growth will be over the next 7 years. User defines various demand/peak (retrievable and editable for configuration at any point in time).
03	Energy Planning	Supports decision making based on KPIs about determination of how the energy system will be upscaled in the coming years to cover the growing needs of the local population
04	Applicability	The tool is applicable for smaller systems and larger island areas with interconnections operation
05	DSM Schemes	Consumer engagement through Demand Response, so the tool may support the efficient and secure operation of the system

3.1.3 ecoDR

Sr. no	Standard features	Description
01	Management of Non-critical load	Power of non-critical output port can be remotely shut down by other ecoTools for fulfilling the power need of critical port during the case of limited generation by RES
02	On board computation of power and energy	Based on measured voltage and current, power is computed locally. Based on derived power and time interval energy is computed.
03	Data Availability	Time stamped energy data or other useful parameters will be sent to ecoMicrogrid from ecoDR
04	Energy Limit	Disconnect the load in case the energy consumption exceeds the predefined energy threshold limit
05	Load limiting Functionality	The current sensing circuit measures the load current and triggers the relay in case of overload. Over-current protection functionality is incorporated in the smart meter to make it work as an over-current protection relay.
06	Variable time delay on overload protection	To resume power supply after cut off due to overload protection. Variable cut-off delay time between two successive overload events.

3.1.4 ecoMonitor

Sr. no	Standard features	Description
01	Measures the concentration of various toxic gases present in local environment	Measures the concentration of SO2, NO2, O3, CO. Measures particulate matters concentration (PM2.5/PM10) Measures ambient temperature and humidity Provide insights regarding possible corrective actions and impact of the RES integration.

		Providing improved access to clean, affordable, and reliable energy with substantial social and health benefits. Monitor the improvement of local air quality
02	Communication with other ecoTools	The sensed parameters are transmitted to other ecoTools for remote monitoring, display and analysis

3.1.5 ecoResilience

Sr. no	Standard features	Description
01	Development of cyclone resilient support structures for solar photovoltaic and wind energy systems	Energy harvesting systems to withstand more than 200km/hr wind speed. Withstanding super cyclonic storms (such as Fani, Amphan, etc.)
02	Minimize wind loads on support structures	For PV: Align the main wind load carrying support structure along the wind direction through the use of passive aerodynamic control surfaces on the PV arrays. For Wind Turbine: Reduce the height of the tower with a minimum use of mechanical components to reduce loads on the wind turbine system and dismantling of blades before the cyclone
03	Exploitation of available wind energy	Educate the locals for sustainable energy solutions and wind turbine systems Develop & Demonstrate the wind energy harvesting to locals through small wind turbines• Utilization of locally available logs
04	Innovations to reduce loads on structures Utilize locally available manpower and materials	Addition of passive aerodynamic control surfaces to minimize the wind loads which helps in reducing materials and its cost by close to 30% Involvement of locals reduce O & M cost Skill development for the locals &creating an opportunity to become self-sustained in energy

3.1.6 ecoConverter

Sr. no	Standard features	Description
01	Partial Power Converters (PPC): for higher capture of solar energy.	A Partial Power Converter (PPC) will be developed for PV multi-string architecture to ensure MPPT operation under partial shading scenario. The use of PPC increases overall efficiency of the system as only a small portion of total PV power needs to be processed through this converter. This indicates that a PPC of 5 kW power rating is required to integrate 20 kW PV power into the DC grid.
02	A plug and play type communication enabled inverter: for its Modular structure, Built-in communication, IPM based configuration for higher power density.	A plug-and-play type modular DC/AC inverter will be developed at 20 kW power level. Communication will be provided as an integral part of the converter, so that data exchange can be possible between smartmeters, control units, and inverters. All components of the converter will be mounted on a single PCB to minimize EMI/EMC related issues. SiC devices will be used to make the converter compact and highly power efficient. Relevant control algorithms (e.g., fast decoupled P-Q control, dc-bus voltage regulation, mitigation of power quality issues, inertia improvement considering

		100% renewable integration, ancillary services) will be developed to provide various system requirements from the perspective of islanded AC microgrid.
03	A STATCOM: A multilevel converter topology is used which is modular, and hence, can be upgraded to higher power level with less complexity, Loss of the converter is low	A STATCOM of 10 kVA capacity will be developed to address the power quality issues of the microgrid
04	A Load Flow Controller (LFC): Lower rating of the converter compared to power transfer between the microgrids.	A Load Flow Controller (LFC) with 5 kW capacity will be developed to integrate two adjacent microgrids
05	A SiC based dc-dc converter: high gain value.	A SiC based 10 kW dc-dc converter will be developed for BESS integration with the 20 kW microgrid system.
06	An FPGA based digital control platform: The board will have higher numbers of ADC, DAC, digital I/O ports.	An FPGA platform for the implementation of the control algorithms.

3.1.7 ecoVehicle

Sr. no	Standard features	Description
01	Temperature Regulated	The challenge faced by charging the vehicle (battery)are the proper regulation of the battery Temperature, Life and Charging time. Hence it controls the temperature of the battery. Battery Temperature will be estimated during Chargingprocess. The key components in this technology are powerfactor correction circuit to improve the power factor. Capability of buck converter to inject the current ofmagnitude 30A in continuous mode at 48V
02	Charging time	Charging time is 3.5hrs (up to 0.3C). Hence this charger provides fast charging rate whichreduce the costs.

3.1.8 ecoCommunity

Sr. no	Standard features	Description
01	Energy Consumption	The 'Consumption' module of the tool displays the cumulative electrical/thermal consumption meter reading of the user. The module also displays the historic daily and monthly consumption patterns of the requested year or month.
02	Bills and Payments	Based on the assigned energy plans of the energy user, the 'Bills and Payments' module of the tool generates energy bills of the users using the energy consumption data. The users will be able to pay the energy bills through a payment gateway service and can see the summary of their bills and payments.
03	Problem Reporting	Using the 'Report Problem' module the energy users can report any problems or issues faced with respect to the tool or in the usage of the energy systems. The report will be submitted to the demo site administrators and the user can view the progress of the issue.
04	Forum	Users can share their experiences and views on common topics of interest in the community forum.
05	Help & Support	Various support materials including guides, manuals, FAQs etc. will be available for the support of users in using the various tools as well as troubleshooting minor problems and issues.

3.1.9 ecoEMS

Sr. no	Standard features	Description
01	Real-time Monitoring	The EMS provides real-time monitoring of generation sources.
02	Energy Optimization	The core of the EMS consists of a sophisticated optimization algorithm to maximize energy efficiency and minimize operating costs.
03	Energy Forecasting	The EMS utilizes forecasting models to predict electrical demand and renewables generation of the assets, which are crucial for the best energy scheduling of the power system.
04	DSM coordination	One of the main mechanisms to achieve these goals is to schedule the different energy vectors by tapping into their flexibility
05	Control	It offers control capabilities to manage the operation of the power system. The output of the tool could send orders to assets for commit/decommit generating units.

3.1.10 ecoPlatform

Sr. no	Standard features	Description
01	Data management and storage	The ecoPlatform allows for the initialization and definition of new data streams via an online interface or offline configuration. Data is stored in a centralized database, each with a unique identifier. Data retrieval and batch processing are supported, with CSV format for easy export.

02	Real-time communication	Acts as a service bus connecting multiple edge devices and services through MQTT protocol. Services communicate by subscribing to shared data streams. Messages are exchanged in JSON format.
03	Communication status monitoring	Monitors the status of communication between ecoPlatform and connected tools. It logs message deliveries and raises alarms in case of communication failure or message loss.
04	Data quality monitoring	Performs basic data processing to detect anomalies or outliers before storing data in the database. Quality issues are logged for each data stream.
05	User Interface	A web-based user interface allows users to view both historical and real-time data, monitor communication channels, and perform basic analytics.
06	System documentation	Comprehensive system documentation is provided, including architecture, deployment dependencies, and operational manuals for future expansions (available in GitLab: https://gitlab.com/re-empowered/ecoplatform).
07	System maintenance	Maintenance services are included for two years, ensuring seamless system operation, configuration, and testing with other digital services.

3.2 Advanced/Innovative features

3.2.1 ecoMicrogrid

Sr. no	Advanced features	Description
01	Multi-vector optimization	The EMS employs advanced algorithms for multi-vector optimization, which considers the synergies and interactions among different energy vectors within the microgrid. This optimization approach maximizes the overall system performance by coordinating and optimizing the use of electricity and cooling.
02	Predictive Control	The EMS employs advanced algorithms and optimization techniques to maximize energy efficiency and minimize operating costs. It considers factors such as energy demand, generation capacity, energy storage levels, and pricing signals to optimize the dispatch of energy resources.
03	Scalability and Flexibility	The EMS features a modular design architecture that allows for better expandability. The system is designed to accommodate future expansion and can easily integrate additional components or capacity as needed. This modular approach enhances flexibility and ensures the system can adapt to changing requirements and incorporate new technologies seamlessly.
04	All-in-one single hardware solution	All-in-one single hardware solution that provides a comprehensive and integrated platform for managing multiple functions using a single device
05	Industrial-based solution for data acquisition.	An industrial solution is used for the data acquisition that support a large variate of communication protocols (e.g. Modbus, IEC 61850, DNP 3.0)
06	Load Scheduling	Demand side management applications that provide the day ahead available energy in different time slots to facilitate the booking of flexible loads in the MG.

07	Dynamic Pricing	Provision of an indication of the MG operating cost considering the current state and/or possible future states. Can be used as an indication for MG security status or/and for billing.

3.2.2 ecoPlanning

Sr. no	Advanced features	Description
01	Generation Adequacy	ecoPlanning offers this study to examine the necessity of deployment of new electricity generation units (conventional and renewable) on the Electric Systems (ES) of Non-Interconnected Islands (NIIs)
02	RES hosting capacity	ecoPlanning examines if available electrical “bandwith” that permits new Renewable assets to be deployed on the Electric System under examination
03	Interconnection of NIIs with the mainland power system	Through the Interconnections feature, ecoPlanning enables to examine the linked operation of two different islanded power systems as a unique power system.
04	Peak Shaving	ecoPlanning offers the option to reduce the peak demand by a certain percentage (e.g. 15%). The total demand for the examined island is not modified (i.e. the demand during the peak-hours is transferred to timeslots that a decreased demand is noted)
05	Increasing the RES penetration	ecoPlanning allows the exploitation of RES synergies with demand response schemes. More specifically, ecoPlanning offers the option of transferring part of the system’s demand towards hours with increased RES penetration
06	Exploiting the flexibility of EV charging	ecoPlanning allows the selection of the total capacity of the EVs’ batteries that can be considered in demand response schemes (e.g. 10 MWh). The user also selects the RES capacity – and the type of RES – that is associated with the particular management schemes.
07	Application of a demand response scheme according to the user’s preferences	ecoPlanning offers the user the choice of applying a specific time-series in ecoPlanning, in order to view the results of their developed management scheme.
08	Combining the operation of electricity and water networks through desalination units and electrical distribution pumps	ecoPlanning allows the definition of the amount of the desalination loads that can be served and outputs the results. This functionality enables the synergy between the electricity and water energy vectors, eliminates the RES curtailment, contributes to the peak shaving and provides to the community a vital resource as the pure water supply
09	Adding flexibility to the system with hydrogen storage	ecoPlanning enables the user to apply a hydrogen storage unit to the system, in order to investigate the exploitation of the flexibility offered and the benefits to the grid’s operation. EcoPlanning provides the results for the optimal storage capacity, the increase of RES penetration and the limitation of thermal power units’ production.

3.2.3 ecoDR

Sr. no	Advanced features	Description
01	Two output ports - critical and non-critical	ecoDR tool has two output ports viz. critical and non-critical ports. Power of non-critical outputs can be remotely shut down by other ecoTools for fulfilling the power need of critical port during the case of limited generation by RES. This leads to an increase in the reliability of tool by load management
02	Energy and Load limit	ecoDR hardware has the facility to compute the output power and energy both. In case of limited generation of energy by RES this checks the exploitation of energy by any consumers and has fair distribution of energy among consumers. This leads to increase the reliability of tool by load management
03	Arbitration in overload protection(Variable time delay)	After disconnection of power due to overload protection triggering, to resume power supply variable time arbitration is being implemented. This leads to a consumer-friendly and energy-efficient approach to resuming power
04	Visible indicator for poor power factor	To reflect consumers if they are using very poor factor loads. This brings awareness among consumers
05	Peak demand of current, voltage and energy	To present users with peak data for various parameters. This brings awareness among consumers.

3.2.4 ecoMonitor

Sr. no	Advanced features	Description
01	Simple tool for monitoring of common AQI parameters	5 most common air quality index (AQI) parameters(as per WHO recommendations) are monitored
02	Real time data transmission	Data will be transmitted via Modbus protocol to ecoPlatform
03	Solar Powered	Solar powered with low power consumption – long power back up
04	Remote data monitoring	The sensed AQI parameters are transmitted to other ecoTools for remote monitoring, display and analysis
05	Visual alarm	Visual alarm have been implemented within the display by changing the colour of the measurement value

3.2.5 ecoResilience

Sr. no	Advanced features	Description
01	Incorporation of passive aerodynamic control surfaces to align the panels with wind direction	The proposed passive mechanism helps to change the orientation of PV panel frame during cyclone. This reduces the aerodynamics wind loads (One third during the cyclone compared to conventional structures) on support structure by reducing the exposed frontal area of the panels
02	Provision to adjust the height of the wind turbine hybrid support structure	The upper part of the hybrid support structure, i.e., the monopole structure is brought down close to ground before cyclone to minimize the wind loads on wind turbine system and remove blades (most vulnerable part of the system). The tower will be lifted after cyclone.

3.2.6 ecoConverter

Sr. no	Advanced features	Description
01	Higher capture of solar energy	We are using a 5kW rated Partial Power Converters (PPC) for higher capture of solar energy. It is used for PV integration.
02	Higher power density	We are using a 10kW plug and play type microgrid ready inverter for its Modular structure, Built-in communication, IPM based configuration for higher power density.
03	High dc gain value	We are using a 10kW SiC based dc-dc converter for BESS and wind power integration.
04	High power with low loss and low complexity system	We are using a Power Quality Conditioner (STATCOM) of 10KVA where a multilevel converter topology is used which is modular, and hence, can be upgraded to higher power level with less complexity, loss of the converter is lower than the conventional one.

3.2.7 ecoVehicle

Sr. no	Advanced features	Description
01	Temperature Control	The challenge faced by charging the vehicle (battery)are the proper regulation of the battery Temperature, Life and Charging time. Hence itcontrols the temperature of the battery. Battery Temperature will be estimated duringCharging process. The key components in this technology is powerfactor correction circuit to improve the power factor. Capability of buck converter to inject the current ofmagnitude 30A in continuous mode at 48V.
02	Cloud Connectivity	The data provided in the charging app will be stored in a cloud system for future. This may be useful for implementing other tools and energy market.

3.2.8 ecoCommunity

Sr. no	Advanced features	Description
01	Pricing/Status Indication	The tool displays a red-green signal indicating the forecasted energy prices/ system status for the upcoming hours. The red indicates a higher energy price/ low energy availability, and the green indicates a low energy price/ high energy availability. Users can utilise this indication to decide whether to connect their loads. In the case of users who are billed using the dynamic pricing plan, the information will be utilised while generating their bills.
02	DSM communal load time slot booking	The usage of the communal loads in the demo site is coordinated among the users. The tool displays a set of time slots for using the communal load which can be booked by users. This avoids conflicts in usage and better utilisation of the load.
03	DSM flexible private load time slot booking	Based on the available energy in the system, the user can book the time slots for using their large private non-critical or flexible loads.
04	DSM thermal load control	Based on the available renewable resources, the ecoEMS tool controls the heating demand of the users. Using ecoCommunity tool, the user can accept or reject this control for various time slots.
05	Manager	In the case of users who do not have access to digital devices, the users can approach the assigned demo site manager who will be

		able to access the ecoCommunity tool and the features on their behalf. The manager access level of the tool displays the list of assigned users and can interact with the tool as the selected consumer.
06	Offline access	The tool stores the data and various input from the users during the offline state and synchronises the same when the internet is available.
07	Weather Notifications	Based on the notifications from Indian Meteorological Department, the tool generates weather notifications under extreme weather events

3.2.9 ecoEMS

Sr. no	Advanced features	Description
01	Multi-vector optimization	The EMS employs advanced algorithms for multi-vector optimization, which considers the synergies and interactions among different energy vectors within the power system.
02	Adaptability	EcoEMS is a versatile solution that can be tailored to accommodate the unique requirements of different power systems. One notable example is the inclusion of Hybrid stations, which, under Greek legislation, presents a challenge in terms of cost when using conventional tools.
03	Expandability	Multi-vector optimization has been incorporated in the algorithm, dealing with expansion planning of the electrical system.
04	Cooperation with other modules/technologies/services	The algorithm permits the deployment of different scales of power systems and cooperates with other modules, such as forecasting, both for load and RES generation.
05	Standalone tool	The optimization problem has been designed and rewritten in Python, using high-tech and art-of work libraries. User Interface and whole module (back end, data acquisition, database design and storage) have been developed through the scopes of this project.

3.2.10 ecoPlatform

Sr. no	Advanced features	Description
01	Data exchange via MQTT/HTTP API	Supports both MQTT and HTTP APIs for data exchange. The MQTT API is ideal for real-time notifications, while the HTTP API is suited for bulk data transfers.
02	Alarms	Dataset owners can define value bounds and silence periods for data streams. If data falls outside the defined parameters, alarms are triggered, with notifications sent via email.
03	Pipeline cache	To reduce database load, a cache stores metadata such as dataset IDs and routing keys. The cache is refreshed every 10 minutes for up-to-date operations.

4 Analyses of Feedback

Feedback has been collected from stakeholders from Indian and European demo sites. The feedback obtained for each tool is analyzed below:

4.1 Interpretation

4.1.1 ecoMicrogrid

EcoMicrogrid is an advanced Energy Management System (EMS) designed specifically for microgrids and small off-grid systems. The users from India and Europe recognize that all features incorporated in ecoMicrogrid EMS are useful. Indian users prefer the EMS support by providing real-time monitoring of renewable energy generation. Whereas European users prefer the EMS support by optimizing the utilization of renewable energy and managing their intermittent nature. As per current understanding on ecoMicrogrid EMS, European users are more knowledgeable than Indian counterparts. The stakeholders from the European side clearly state their satisfaction with the performance of the tool and with its contribution in reducing the operating costs of the microgrid.

4.1.2 ecoPlanning

The main objective of ecoPlanning is to serve as a tool for performing simulations that support the decision-making process of non-interconnected systems, considering the time and size of different types of generation, energy storage and other infrastructure parameters. Feedback was taken from European users only. The users recognize that all features incorporated in ecoPlanning tools are useful. They feel that the tool may enhance the secure operation by optimizing load shedding, generator start-up/shutdown, and power curtailment. The users are well aware about ecoPlanning tool.

4.1.3 ecoDR

The ecoDR tool focuses on the development of advanced metering infrastructure (AMI) with inbuilt load controller and protection functionalities. Feedback had been taken from both Indian and European users. The feature of the two separated output ports as well as the load limiting functionality aroused the interest of both European and Indian site users whereas the users from Indian sites also appreciate the remote monitoring and energy limiting features. Indian users are keen on using the remote monitoring features, while users of the European site are less favorable in using these features.

4.1.4 ecoMonitor

The ecoMonitor tool focuses on the development of solar powered, portable control platform equipped with multiple sensors for remote monitoring of air quality parameters. Feedback was taken from both Indian and European users. The European users appreciate the features of solar powered continuous mode of operation of ecoMonitor tool. The Indian users are interested in the

monitoring features such as temperature, gas concentration and humidity monitoring. Both side users are fond of using remote monitoring system, however the European site users have not considered the utilization rate of the tool's monitoring features in a day, while Indian users mostly declare usage of more than 10 times per day. Visual alarm features are considered very useful by both Indian and European users.

4.1.5 ecoResilience

The ecoResilience tool focuses on the development of the cyclone resistant support structures for both ground-mounted solar PV arrays and wind turbines. Feedback of this tool was taken from both Indian and European users. Both side users found the support structure design, its mechanism of mounting, dismantling and wind load minimizing technique very interesting and useful with good potential for exploitation in coastal areas. Also, the training given in the workshop for fabrication and maintenance of wind turbine systems received positive feedback.

4.1.6 ecoConverter

The ecoConverter deals with the development of several power electronic converters and their control to form a multi-source micro-grid. Feedback of this tool had been taken from Indian site users. The users like all the tool's main features namely load balancing, power control technique, maximization of RES utilization, energy forecasting and optimization technique etc. The users prefer the said integration by providing real-time monitoring of renewable energy generation. The users think, that the reliability could be enhanced by providing real-time monitoring and control of key microgrid components.

4.1.7 ecoVehicle

The ecoVehicle will be used to electrify and upgrade small vehicles for transport. Feedback of this tool had been taken from Indian users only. The users appreciate the infrastructure of charging station and the fast charging capability as well as all other features of the tool. From users reports we deduce that fast charging feature is very useful and is mostly preferred as the charging time of the vehicle required is reported as 3-4 hours.

4.1.8 ecoCommunity

The ecoCommunity tool provides an Android application platform for the energy community users to access their energy meter readings, view consumption patterns, and view dynamic energy pricing/microgrid status. Feedback of this tool had been taken from both Indian and European users. Both side users like the tool and find it moderately easy to navigate. The European users are satisfied with 10% cheaper energy in green-hours compared to red-hours, whereas the expectation from Indian users is above 50%. The European users prefer online bill payment feature in ecoCommunity, whereas the users from India prefer offline mode. However, both side users appreciate the timeslot booking module of ecoCommunity for booking the use of communal loads and expect better coordination among users. The users from European side are well satisfied with the performance of the tool.

4.1.9 ecoEMS

The ecoEMS tool is an Energy Management System aiming to optimize the overall performance of isolated and weakly interconnected systems. Feedback on this tool has been obtained from the European users only. The users find useful and necessary all the EMS features provided, namely load balancing & power flow control, RES maximization, energy forecasting and optimization, cost minimization etc. In total EMS users seems to have a good understanding of the functionalities of the tool. They mostly appreciate the EMS capability to optimize the utilization of renewable energy and manage RES intermittent nature and the Load Scheduling Demand Side Management module in order to integrate RES in their power system, as well as its capability to optimize load shedding and generator start-up/shutdown and power curtailment in order to enhance the secure operation of their power system. There seems to be nothing more specific to be requested form users for ecoEMS and this is an indication of their satisfaction with the tool.

4.1.10 ecoPlatform

ecoPlatform is an ICT interoperable platform for the integration of all developed solutions and facilitates digitization and interoperability of the local energy systems. Feedback on this tool has been obtained from European users. The users are satisfied with the real-time data communication capabilities stating that tool's features completely meets their needs. Also, users prefer using MQTT communication protocol for real-time data streaming. They found that the feature like alarm and notifications are useful particularly during communication failures and data issues. The people from European site are generally satisfied with the performance of the tool, but more advanced data analytics and visualizations would be welcome.

4.2 Key Insights

A summary of the above analysis is provided here:

ecoMicrogrid

Indian users value real-time monitoring of renewable energy generation, while European users prioritize optimizing renewable energy utilization and managing intermittency. European users demonstrate a higher understanding of microgrid energy management systems (EMS) compared to Indian users.

ecoPlanning

European users appreciate the tool's ability to enhance secure operations through load shedding, generator optimization, and power curtailment. The tool is recognized for its potential to support decision-making regarding renewable energy integration, demand-side management (DSM), and infrastructure planning.

ecoDR

Indian users favor features like remote monitoring and energy-limiting functionality, while European users prefer load-limiting and two-output port features. Remote monitoring is more frequently used in India, reflecting differing operational priorities.

ecoMonitor

European users value the solar-powered continuous operation of the tool, while Indian users focus on monitoring temperature, gas concentration, and humidity. Both groups appreciate the visual alarm feature and remote monitoring capabilities.

ecoResilience

Both Indian and European users highly appreciate the cyclone-resistant support structures for solar PV and wind turbines, particularly the mechanisms for minimizing wind loads and vertical displacement of wind turbine structures. Training workshops for fabrication and maintenance were found useful, especially in coastal areas.

ecoConverter

Indian users appreciate features like load balancing, power control, and real-time monitoring, which enhance reliability and maximize renewable energy utilization.

ecoVehicle

Indian users favor fast charging infrastructure and the design of conductive chargers, with a preference for charging times of 3-4 hours.

ecoCommunity

Both Indian and European users find the tool moderately easy to navigate. European users prefer online bill payment, while Indian users lean towards offline modes. The timeslot booking module for communal loads is widely appreciated for improving coordination among users.

ecoEMS

European users value features like load balancing, renewable energy optimization, and real-time monitoring. They value the system reliability enhancement through load shedding and generator optimization.

ecoPlatform

European users are satisfied with real-time data communication and prefer MQTT for data streaming. Features like alarms and notifications are considered effective. There were suggestions for more advanced data analytics and visualization tools.

5 Conclusions

The RE-EMPOWERED project has engaged local communities in India and Europe to gather valuable feedback on its ecoToolset, obtained from different types of users of the ecoTools, such as local citizens, demo operators and relevant stakeholders. Apart from the written feedback that is presented in this deliverable, constructive feedback was obtained in oral form during the several community engagement and training activities, which are reported in D6.1 and D6.2 respectively. As expected, the user feedback has resulted in the improvement of certain aspects of the tools. The feedback indicates a strong appreciation for the tools' functionalities, with users highlighting the importance of real-time monitoring, optimization of renewable energy utilization, and demand side management.

Key insights reveal that Indian users prioritize practical features such as remote monitoring and fast charging, while European users focus on advanced optimization and integration capabilities. Both groups value user-friendly interfaces and effective communication features, emphasizing the need for tools that cater to their specific regional contexts.

The project underscores the significance of stakeholder engagement in developing energy solutions that are not only innovative but also practical and adaptable. In this process, the user feedback has been valuable.

Annex

A: Feedback received during development stages of the tools

The feedback received during development stages of the tools is presented below:

A.1(i): ecoMicrogrid (*India*)

Sr. no	Questions	Feedback
1.	**As a user of the Microgrid Energy Management System (EMS), which functions would you expect the EMS to provide for your microgrid?**	1. Load balancing and power flow control 2. Minimize operating costs 3. Maximize RES utilization 4. Energy forecasting and optimization 5. Real-time monitoring of microgrid components √All of the above
Remark/Suggestion: Choose the option that includes all the relevant functions for your microgrid (e.g., d) All of the above).		
2.	**How does the EMS support the integration of renewable energy sources into your microgrid?**	1. By optimizing the utilization of renewable energy and managing their intermittent nature 2. √By providing real-time monitoring of renewable energy generation 3. By the Load Scheduling that provide the day ahead available energy in different time slots to facilitate the booking of flexible loads in the MG. Not sure/I don't know
Remark/Suggestion: Choose the option that best describes the role of the EMS in integrating renewable energy sources into your microgrid (e.g., a) By optimizing the utilization of renewable energy and managing their intermittent nature).		
3.	**How does the EMS enhance the reliability of your microgrid operation?**	1. √By providing real-time monitoring and control of key microgrid components 2. By automatically taking required actions to maintain system stability 3. By optimizing load shedding, generator start-up/shutdown, and power curtailment Not sure/I don't know
Remark/Suggestion: Choose the option(s) that describe how the EMS enhances the reliability of your microgrid operation (e.g., a) By providing real-time monitoring and control of key microgrid components).		
4.	**On a scale of 1 to 5, how would you rate your current understanding of Microgrid Energy Management Systems (EMS)?**	1. Very limited understanding 2. √Limited understanding, but familiar with the basics 3. Moderate understanding, aware of key concepts and functionalities 4. Good understanding, knowledgeable about advanced features and applications

		5. Expert-level understanding, well-versed in the technology and its intricacies
Remark/Suggestion: Choose the option that best represents your current level of understanding of Microgrid Energy Management Systems (EMS) on a scale from 1 to 5.		
5.	**Is there any additional function or feature you would like to see in the Microgrid Energy Management System (EMS) to meet your specific needs or requirements?**	1. Yes, I have specific functions or features in mind. Please specify. 2. √No, the existing functions and features meet my needs. 3. I'm not sure/I don't know.
Remark/Suggestion: Choose the option that best reflects your opinion regarding the need for additional functions or features in the EMS		

A.1(ii): ecoMicrogrid (*Europe*)

Sr. no	Questions	Feedback
1.	**As a user of the Microgrid Energy Management System (EMS), which functions would you expect the EMS to provide for your microgrid?**	1. Load balancing and power flow control 2. Minimize operating costs 3. Maximize RES utilization 4. Energy forecasting and optimization 5. Real-time monitoring of microgrid components 6. √All of the above
Remark/Suggestion: Choose the option that includes all the relevant functions for your microgrid (e.g., d) All of the above).		
2.	**How does the EMS support the integration of renewable energy sources into your microgrid?**	1. √By optimizing the utilization of renewable energy and managing their intermittent nature 2. By providing real-time monitoring of renewable energy generation 3. By the Load Scheduling that provide the day ahead available energy in different time slots to facilitate the booking of flexible loads in the MG. 4. Not sure/I don't know
Remark/Suggestion: Choose the option that best describes the role of the EMS in integrating renewable energy sources into your microgrid (e.g., a) By optimizing the utilization of renewable energy and managing their intermittent nature).		
3.	**How does the EMS enhance the reliability of your microgrid operation?**	1. By providing real-time monitoring and control of key microgrid components 2. By automatically taking required actions to maintain system stability 3. √By optimizing load shedding, generator start-up/shutdown, and power curtailment 4. Not sure/I don't know

Remark/Suggestion: Choose the option(s) that describe how the EMS enhances the reliability of your microgrid operation (e.g., a) By providing real-time monitoring and control of key microgrid components).		
4.	**On a scale of 1 to 5, how would you rate your current understanding of Microgrid Energy Management Systems (EMS)?**	1. Very limited understanding 2. Limited understanding, but familiar with the basics 3. Moderate understanding, aware of key concepts and functionalities 4. √Good understanding, knowledgeable about advanced features and applications 5 Expert-level understanding, well-versed in the technology and its intricacies
Remark/Suggestion: Choose the option that best represents your current level of understanding of Microgrid Energy Management Systems (EMS) on a scale from 1 to 5.		
5.	**Is there any additional function or feature you would like to see in the Microgrid Energy Management System (EMS) to meet your specific needs or requirements?**	1. Yes, I have specific functions or features in mind. Please specify. 2. √No, the existing functions and features meet my needs. 3. I'm not sure/I don't know.
Remark/Suggestion: Choose the option that best reflects your opinion regarding the need for additional functions or features in the EMS		

A.2: ecoPlanning (*Europe*)

Sr. no	Questions	Feedback
1.	**As a user of the ecoPlanning, which functions would you expect the tool to provide for the power system?**	1. Load balancing and power flow control 2. Minimize operating costs 3. Maximize RES utilization/minimize RES curtailments 4. Analytical Report and KPIs 5. √All of the above
Remark/Suggestion: Choose the option that includes all the relevant functions for your application (e.g., d) All of the above).		
2.	**How does the ecoPlanning support the integration of Demand Side Management into your power system?**	1. √By importing a specific load time series which already includes load transfers from DSM 2. √By applying Peak Shaving and RES Increase Penetration to avoid RES curtailments and new thermal-units deployment 3. √By incorporating Hydrogen or aggregated EVs storage 4. Not sure/I don't know
Remark/Suggestion: Choose the option that best describes the role of the Planning in integrating renewable energy sources into your microgrid (e.g., a) By optimizing the utilization of renewable energy and managing their intermittent nature).		
3.		1. √By providing more or other reserve requirements 2. √By optimizing load shedding, generator start-up/shutdown, and power curtailment

	How does the tool enhance the secured operation of the power system?	3. It works fine just as it is 4. Not sure/I don't know
Remark/Suggestion: Choose the option(s) that describe how the Planning enhances the reliability of your microgrid operation (e.g., a) By providing real-time monitoring and control of key microgrid components).		
4.	**On a scale of 1 to 5, how would you rate your current understanding of ecoPlanning?**	1. Very limited understanding 2. Limited understanding, but familiar with the basics 3. Moderate understanding, aware of key concepts and functionalities 4. √Good understanding, knowledgeable about advanced features and applications 5. Expert-level understanding, well-versed in the technology and its intricacies
5.	**Is there any additional function or feature you would like to see in the ecoPlanning to meet your specific needs or requirements?**	1. Yes, I have specific functions or features in mind. Please specify. 2. No, the existing functions and features meet my needs. 3. √I'm not sure/I don't know.

A.3(i) ecoDR (*India*)

Sr. no	Questions	Feedback	
1.	**Do you like the design of the smart meter?**	√ Yes ☐ No	
Remark/Suggestion:			
2.	**Which of the features do you like the most? Why?**	☐ √Two output port ☐√ Remote-monitoring ☐ Overload protection ☐ Variable time delay on overload protection	☐ √Load limiting functionality ☐ √Energy limiting functionality ☐ Predefined threshold load limit. ☐ Predefined threshold energy limit.
Remark/Suggestion:			
3.	**Do you like the two output port features (critical and noncritical)?**	√ Yes ☐ No	
Remark/Suggestion:			
4.	**Do you like remote monitoring features?**	√ Yes ☐ No	

5.	**How many times a day do you use remote monitoring features?**	√ < 10 times ☐ > 15 times ☐ Nil

Remark/Suggestion:		
6.	**Is load resumption after cutoff due to overload suitable for you?**	√ Yes ☐ No
Remark/Suggestion:		
7.	**Do you like variable time delay after power cut off due to overload?**	√ Yes ☐ No
Remark/Suggestion:		
8.	**Presently variable time delay after power cut off due to overload is 1 min – 5min- 30min- off for the day. Are you satisfied with this feature? If no, any suggestion?**	√ Yes ☐ No
Remark/Suggestion:		
9.	**Do you like the load-limiting functionality?**	√ Yes ☐ No
Remark/Suggestion:		
10.	**Do you like the energy-limiting functionality?**	√ Yes ☐ No
11.	**Are you satisfied with the predefined threshold load limit?**	√ Yes ☐ No
12.	**Are you satisfied with the predefined threshold energy limit?**	√ Yes ☐ No

A.3(ii) ecoDR (*Europe*)

Sr. no	Questions	Feedback
1.	**Do you like the design of the smart meter?**	√ Yes ☐ No

Remark/Suggestion:			
2.	**Which of the features do you like the most? Why?**	☐ √Two output port ☐ Remote-monitoring ☐ Overload protection ☐ Variable time delay on overload protection	☐ √Load limiting functionality ☐ Energy limiting functionality ☐ Predefined threshold load limit. ☐ Predefined threshold energy limit.
Remark/Suggestion:			
3.	**Do you like the two output port features (critical and noncritical)?**	√ Yes ☐ No	

Remark/Suggestion:		
4.	**Do you like remote monitoring features?**	☑ Yes ☐ No
5.	**How many times a day do you use remote monitoring features?**	☐ **< 10 times** ☐ **> 15 times** ☐ **Nil**√
Remark/Suggestion:		
6.	**Is load resumption after cutoff due to overload suitable for you?**	☑ Yes ☐ No
Remark/Suggestion:		
7.	**Do you like variable time delay after power cut off due to overload?**	☑ Yes ☐ No
Remark/Suggestion:		
8.	**Presently variable time delay after power cut off due to overload is 1 min – 5min- 30min- off for the day. Are you satisfied with this feature? If no, any suggestion?**	☑ Yes ☐ No
Remark/Suggestion:		
9.	**Do you like the load-limiting functionality?**	☑ Yes ☐ No
Remark/Suggestion:		
10.	**Do you like the energy-limiting functionality?**	☑ Yes ☐ No
11.	**Are you satisfied with the predefined threshold load limit?**	☑ Yes ☐ No
12.	**Are you satisfied with the predefined threshold energy limit?**	☑ Yes ☐ No

A.4(i): ecoMonitor (India)

Sr. no	Questions	Feedback
1.	**Do you like the design of the air quality monitoring device?**	☑ Yes ☐ No
Remark/Suggestion:		
2.*	**Which one of the following features do you like the most? Why?**	☐ **☑** Monitoring gas concentration ☐ Monitoring PM 2.5/10 ☐ **☑** Monitoring temperature and humidity ☐ **☑** Solar powered ☐ Continuous mode of operation ☐ Outdoor application ☐ **☑** Visual Alarm

Remark/Suggestion		
3.	**Do you like remote-monitoring features?**	√ Yes ☐ No
Remark/Suggestion:		
4.	**How many times in a day you use remote monitoring features?**	☐ < 5 times √ > 10 times ☐ Nil
Remark/Suggestion:		
5.	**Are presently monitored six AQI parameters sufficient? If no, suggest.**	√ Yes No
Remark/Suggestion:		
6.	**Do you find this solar powered feature useful?**	√ Yes ☐ No
Remark/Suggestion:		
7.	**Do you like visual alarm features?**	√ Yes ☐ No

A.4(ii): ecoMonitor (Europe)

Sr. no	Questions	Feedback
1.	**Do you like the design of the air quality monitoring device?**	√ Yes ☐ No
Remark/Suggestion:		
2.*	**Which one of the following features do you like the most? Why?**	☐ **Monitoring gas concentration** ☐ **Monitoring PM 2.5/10** ☐ **Monitoring temperature and humidity** ☐ √ **Solar powered** ☐ √**Continuous mode of operation** ☐ **Outdoor application** ☐ **Visual Alarm**
Remark/Suggestion		
3.	**Do you like remote-monitoring features?**	√ **Yes** ☐ **No**
Remark/Suggestion:		
4.	**How many times in a day you use remote monitoring features?**	☐ **< 5 times** ☐ **> 10 times** ☐ **Nil**√
Remark/Suggestion:		
5.	**Are presently monitored six AQI parameters sufficient? If no, suggest.**	√ Yes No
Remark/Suggestion:		
6.	**Do you find this solar powered feature useful?**	√ Yes ☐ No
Remark/Suggestion:		
7.	**Do you like visual alarm features?**	√ Yes ☐ No

A.5 (i) ecoResilience(India)

Sr. no	Questions	Feedback
1.	**Do you like the designs of solar and wind turbine support structures?**	[√] Yes [ ] No

Remark/Suggestion:		
2.	**Do you like the small wind turbine system locally manufactured? Why?**	[√] Yes [ ] No
Remark/Suggestion:		
3.	**Do you like the mechanisms (solar & wind turbine) of the support structures?**	[√] Yes [ ] No
Remark/Suggestion:		

4.	**Do you like the mechanism used for minimizing wind load on PV support structure?**	[√] Yes [ ] No
Remark/Suggestion:		
5.	**Do you like the concept of vertical displacement of WT monopole structure?**	[√] Yes [ ] No
Remark/Suggestion:		
6.	**Are you satisfied with the mechanisms of resilient support structures?**	[√] Yes [ ] No
Remark/Suggestion:		
7.	**Do you think the developed support structures have exploitation potential in coastal areas?**	[√] Yes [ ] No
Remark/Suggestion:		
8.	**Do you think the training given in the workshop for fabrication and maintenance of energy harvesting systems is useful?**	[√] Yes [ ] No
Remark/Suggestions		

A.5 (ii) ecoResilience (*Europe*)

Sr. no	Questions	Feedback
1.	**Do you like the designs of solar and wind turbine support structures?**	[√] Yes [ ] No
Remark/Suggestion:		

2.	**Do you like the small wind turbine system locally manufactured? Why?**	√ Yes ☐ No
Remark/Suggestion:		
3.	**Do you like the mechanisms (solar & wind turbine) of the support structures?**	√ Yes ☐ No
Remark/Suggestion:		
4.	**Do you like the mechanism used for minimizing wind load on PV support structure?**	√ Yes ☐ No
Remark/Suggestion:		
5.	**Do you like the concept of vertical displacement of WT monopole structure?**	√ Yes ☐ No
Remark/Suggestion:		
6.	**Are you satisfied with the mechanisms of resilient support structures?**	√ Yes ☐ No
Remark/Suggestion:		
7.	**Do you think the developed support structures have exploitation potential in coastal areas?**	√ Yes ☐ No
Remark/Suggestion:		
8.	**Do you think the training given in the workshop for fabrication and maintenance of energy harvesting systems is useful?**	√ Yes ☐ No
Remark/Suggestions		

A.6 ecoConverter (*India*)

Sr. no	Questions	Feedback
1.	**How do you feel the reliability of the System?**	√ It is good ☐ Not up to the mark
Remark/Suggestion:	Is there any frequent tripping issue.	
2.	**Are you getting good quality power?**	Yes No
Remark/Suggestion:		
3.	**What is the voltage Frequency fluctuation level at the extreme end?**	√ Almost same ☐ Drops more than 5% from the initial value
Remark/Suggestion:	Voltage and frequency dropping level.	
4.	**How much does the system take to recover after a fault?**	√ Recover very soon ☐ Takes time
Remark/Suggestion:		

5.	**Are you satisfied with given power?**	√ Yes ☐ No
Remark/Suggestion:	If extra required then how much, for which duration you required more and the purpose for this.	

A.7 ecoVehicle (India)

Sr. no	Questions	Feedback
1.	**Do you like the Infrastructure of Charging Station?**	√ Yes ☐ No
Remark/Suggestion:		
2.	**Which of the features do you like the most? Why?**	1. Temperature Regulationo 2. √ Fast Charging time 3. Android Platformo 4. Cloud Connectivity
Remark/Suggestion:		
3.	**Do you like the infrastructure of Charging station at remote areas?**	√ Yes No
Remark/Suggestion:		
4.	**Do you like the design of Conductive charger developed?**	√ Yes ☐ No
Remark/Suggestion:		
5.	**How much time required to charge the Vehicle?**	1. √ 3-4 hours 2. 4-5 hours 3. More than 6 hours
Remark/Sugg		

A.8(i) ecoCommunity (*India*)

Sr. no	Questions	Feedback
1.	**Do you find the user interface of the ecoCommunity tool easy to navigate and interact? If not, please specify the reason below.**	☐ Very easy √ Moderately easy ☐ Difficult
Remark/Suggestion:	The user interface of the ecoCommunity tool is in general user friendly. The "Moderately Easy" answer has to do mainly with the relatively low experience of the users in interacting with these kind of mobile applications.	
2.	**Do you prefer using ecoCommunity tool over the smart meter display to determine energy (electrical/thermal) consumption meter reading?**	√ Yes ☐ No
Remark/Suggestion:		
3.	**How often would you view/monitor the updated energy**	☐ Multiple times a day ☐ √Once a day ☐ Once a week

	(electrical/thermal) consumption meter reading in the ecoCommunity?	☐ Less often ☐ Never
Remark/Suggestion:	At first the tool would be used more often out of curiosity, but afterwards in order for it to be used more often it would require some kind of incentive to the users.	
4.	**Are you interested in viewing the daily and monthly consumption history?**	☑ Yes ☐ No
Remark/Suggestion:		
5.	**For how much cheaper energy in green-hours compared to red-hours would you choose to make use of the energy during green-hours instead of red-hours?**	☐ Do not prefer dynamic pricing ☐ Above 5 % ☐ Above 10 % ☐ Above 25 % ☑ Above 50 % ☐ Above 75 %
Remark/Sugg	In sites where there is no dynamic pricing right now, the red hours could indicate situations of high diesel consumption or instability of the grid.	
6.	**Do you prefer using the online bill payment feature in ecoCommunity tool using cashless modes over an offline payment by cash? If not, please specify the reason below.**	☐ Yes ☐ ☑ No
Remark/Suggestion:	Even though right now there is no electrical bill in the microgrid, future interventions and business plans could make the online bill payment future really useful. However, some issues regarding the confidentiality of data through the interface could arise from the part of the users.	
7.	**Do you prefer using the timeslot booking module of ecoCommunity for booking the use of communal loads and expect a better coordination among users? If not, please specify the reason below.**	☑ Yes ☐ No
Remark/Suggestion:		
8.	**In case of timeslot booking, what is the preferred minimum time duration for each slot?**	☐ 0.5 Hour ☑ 1 Hour ☐ 2 Hours ☐ 3 Hours
Remark/Suggestion:		
9.	**Do you feel that the problem reporting and tracking feature of ecoCommunity is convenient and beneficial for reporting various issue/problems? If not, please specify the reason below.**	☑ Yes ☐ No
Remark/Suggestion:		
10.	**How often would you use the forum feature of ecoCommunity for sharing experiences, relevant**	☐ Very often ☐ ☑ Weekly ☐ Once on a while ☐ Never

	information, and contents with the local energy community.	
Remark/Suggestion:		
11.	**Do you feel that the manuals and FAQs in the help and support module of ecoCommunity can help in understanding the usage of various tools and troubleshooting minor problems? If not, please specify the reason below.**	☐ Slightly ☑ Moderately ☐ Greatly
Remark/Suggestion:		
12.	**In case you do not have access to a mobile phones, are you fine to use the features of the ecoCommunity tool through a Manager who can interact with the various modules on your behalf. If not, please specify the reason below.**	☑ Yes ☐ No
Remark/Suggestion:	The Manager could interact with the various modules, but they should be given instructions by the residents regarding the use of electricity (e.g. use of a water pump once a day, no restrictions on electricity use between 5 pm to 9pm, etc).	

A.8(ii) ecoCommunity (*Europe*)

Sr. no	Questions	Feedback
1.	**Do you find the user interface of the ecoCommunity tool easy to navigate and interact? If not, please specify the reason below.**	☐ Very easy ☑ Moderately easy ☐ Difficult
Remark/Suggestion:	The user interface of the ecoCommunity tool is in general user friendly. The "Moderately Easy" answer has to do mainly with the relatively low experience of the users in interacting with these kind of mobile applications.	
2.	**Do you prefer using ecoCommunity tool over the smart meter display to determine energy (electrical/thermal) consumption meter reading?**	☑ Yes ☐ No
Remark/Suggestion:		
3.	**How often would you view/monitor the updated energy (electrical/thermal) consumption meter reading in the ecoCommunity?**	☐ Multiple times a day ☐ Once a day ☑ Once a week ☐ Less often ☐ Never

Remark/Suggestion:	At first the tool would be used more often out of curiosity, but afterwards in order for it to be used more often it would require some kind of incentive to the users.	
4.	**Are you interested in viewing the daily and monthly consumption history?**	☑ Yes ☐ No
Remark/Suggestion:		
5.	**For how much cheaper energy in green-hours compared to red-hours would you choose to make use of the energy during green-hours instead of red-hours?**	☐ Do not prefer dynamic pricing ☐ Above 5 % ☑ Above 10 % ☐ Above 25 % ☐ Above 50 % ☐ Above 75 %
Remark/Sugg	In sites where there is no dynamic pricing right now (as in Gaidouromandra microgrid), the red hours could indicate situations of high diesel consumption or instability of the grid.	
6.	**Do you prefer using the online bill payment feature in ecoCommunity tool using cashless modes over an offline payment by cash? If not, please specify the reason below.**	☑ Yes ☐ No
Remark/Suggestion:	Even though right now there is no electrical bill in Gaidouromandra microgrid, future interventions and business plans could make the online bill payment future really useful. However, some issues regarding the confidentiality of data through the interface could arise from the part of the users.	
7.	**Do you prefer using the timeslot booking module of ecoCommunity for booking the use ofcommunal loads and expect a better coordination among users? If not, please specify the reasonbelow.**	☑ Yes ☐ No
Remark/Suggestion:		
8.	**In case of timeslot booking, what is the preferred minimum time duration for each slot?**	☐ 0.5 Hour ☑ 1 Hour ☐ 2 Hours ☐ 3 Hours
Remark/Suggestion:		
9.	**Do you feel that the problem reporting and tracking feature of ecoCommunity is convenient and beneficial for reporting various issue/problems? If not, please specify the reason below.**	☑ Yes ☐ No
Remark/Suggestion:		
10.	**How often would you use the forum feature of ecoCommunity for sharing experiences, relevant**	☐ Very often ☐ Weekly ☑ Once on a while ☐ Never

	information, and contents with the local energy community.	
Remark/Suggestion:		
11.	**Do you feel that the manuals and FAQs in the help and support module of ecoCommunity can help in understanding the usage of various tools and troubleshooting minor problems? If not, please specify the reason below.**	☐ Slightly ☑ Moderately ☐ Greatly
Remark/Suggestion:		
12.	**In case you do not have access to a mobile phones, are you fine to use the features of the ecoCommunity tool through a Manager who can interact with the various modules on your behalf. If not, please specify the reason below.**	☑ Yes ☐ No
Remark/Suggestion:	The Manager could interact with the various modules, but they should be given instructions by the residents regarding the use of electricity (e.g. use of a water pump once a day, no restrictions on electricity use between 5 pm to 9pm, etc).	

A.9 ecoEMS (*Europe*)

Sr. no	Questions	Feedback
1.	**As a user of the ecoEMS, which functions would you expect the EMS to provide for the power system?**	Load balancing and power flow control Minimize operating costs Maximize RES utilization Energy forecasting and optimization Real-time monitoring √ **All of the above**

Remark/Suggestion: Choose the option that includes all the relevant functions of the power system		
2.	**How does the EMS support the integration of renewable energy sources into your power system?**	a) **√** By optimizing the utilization of renewable energy and managing their intermittent nature b) By providing real-time monitoring of renewable energy generation c) **√** By the Load Scheduling that provide the day ahead available energy and the Demand Side Management module cooperation d) Not sure/I don't know

Remark/Suggestion: Choose the option that best describes the role of the EMS in integrating renewable energy sources into the power system		
3.	**How does the EMS enhance the secured operation of the power system?**	a) By providing real-time monitoring b) **√** By optimizing load shedding, generator start-up/shutdown, and power curtailment c) Not sure/I don't know
Remark/Suggestion: Choose the option(s) that describe how the EMS enhances the secure operation of the power system		
4.	**On a scale of 1 to 5, how would you rate your current understanding of ecoEMS?**	a) 1 - Very limited understanding b) 2 - Limited understanding, but familiar with the basics c) 3 - Moderate understanding, aware of key concepts and functionalities d)**√** 4 - Good understanding, knowledgeable about advanced features and applications e) 5 - Expert-level understanding, well-versed in the technology and its intricacies
Remark/Suggestion: Choose the option that best represents your current level of understanding of ecoEMS on a scale from 1 to 5.		
5.	**Is there any additional function or feature you would like to see in the ecoEMS to meet your specific needs or requirements?**	a) Yes, I have specific functions or features in mind. Please specify. b) No, the existing functions and features meet my needs. c)**√** I'm not sure/I don't know.
Remark/Suggestion: Choose the option that best reflects your opinion regarding the need for additional functions or features in the EMS		

A.10- ecoPlatform (*Europe*):

Sr. no	Questions	Feedback
1.	**How satisfied are you with the real-time data communication capabilities of the ecoPlatform?**	a) Very satisfied b)√ Satisfied c) Neutral d) Unsatisfied

Remark/Suggestion: Choose the option that best describe your opinion regarding the real-time data communication capabilities of the ecoPlatform.

2.	**Does the data management and storage feature meet your operational needs?**	a)√ Yes, completely b) Yes, to some extend c) Neutrald) No e) Not sure
Remark/Suggestion: Choose the option that best describe your opinion regarding the data management and storage features.		
3.	**Which communication protocol do you prefer for your use cases when working with the ecoPlatform?**	a)√ MQTT for real-time data streaming b) HTTP for bulk data import/export c) Both equally depending on the situation
Remark/Suggestion: Choose the option(s) that describe which protocol do you prefer.		
4.	**How easy is it to use the ecoPlatform's user interface for visualizing data?**	a) Very easy b) **√** Easy c) Moderate d) Difficult e) Very difficult
Remark/Suggestion: Choose the option that best describe your opinion regarding the ecoPlatform's user interface for visualizing data.		
5.	**Are the notifications and alarms for system monitoring effective in addressing potential issues?**	a) √ Very effective b) Effective c) Neutral d) Ineffective e) Not effective at all
Remark/Suggestion: Choose the option that best reflects your opinion regarding the need for additional functions or features in the EMS		

6.	**How useful do you find the alarm and notification feature (e.g., for communication failures or data issues)?**	a) **√** Very useful b) Somewhat useful c) Neutral d) Not very useful e) Not useful at all
Remark/Suggestion: Choose the option that best reflects your opinion regarding the alarm and notifications on the ecoPlatform.		
7.	**What do you consider the most important feature of the ecoPlatform?**	a) **√** Data management and storage b) **√** Real-time communication c) User Interface
Remark/Suggestion: Choose the option(s) that reflects your opinion regarding the most important feature of the ecoPlatform.		

8.	**What additional feature(s) would improve your experience with the ecoPlatform?**	a) **√** More advanced data analytics b) Better alarm customization options c) **√** More data visualization tools d) Expanded data storage capacity e) Other (please specify
Remark/Suggestion: Choose the option(s) that describe what additional feature(s) would improve your experience with the ecoPlatform.		

B: Feedback received after deployment of the tools

The feedback received after deployment of tools is presented below:

B.1 ecoMicrogrid

Sl. No.	Questions	Feedback
1.	**How satisfied are you with the assistance provided by EcoMicrogrid in the day-to-day operation of the microgrid?**	Very Satisfied ☑ Satisfied ☐ Neutral ☐ Unsatisfied ☐ Very Unsatisfied ☐
Any remark/Suggestion:		
2.	**To what extent do you agree that EcoMicrogrid helps in minimizing the operating costs of your microgrid?**	Strongly Agree ☑ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐
Remark/Suggestion:		
3.	**How effective do you find EcoMicrogrid in identifying and diagnosing faults within the microgrid?**	Very helpful ☑ Effective ☐ Neutral ☐ Ineffective ☐ Very Ineffective ☐
Remark/Suggestion:		
4.	**How has real-time pricing information provided by EcoMicrogrid influenced your consumption behavior?**	Significantly Influenced ☐ Moderately Influenced ☑ Neutral ☐

		Slightly Influenced ☐ Not Influenced ☐
Remark/Suggestion:		
5.	**Has EcoMicrogrid increased the reliability of your microgrid, reducing power cuts and interruptions?**	Significantly Increased ☑ Moderately Increased ☐ Neutral ☐ Slightly Increased ☐ Not Increased ☐
Remark/Suggestion:		
6.	**How often do you use the Load Scheduling functionalities of EcoMicrogrid?**	Very Frequently ☐ Frequently ☑ Occasionally ☐ Rarely ☐ Never ☐
Remark/Suggestion:		
7.	**How effective are the Load Scheduling functionalities of EcoMicrogrid in helping you book your loads?**	Very Effective ☑ Effective ☐ Neutral ☐ Ineffective ☐ Very Ineffective ☐
Remark/Suggestion:		

B.2 ecoMonitor

Sl. No.	Questions	feedback
1.	**How easy is it to read the information displayed On Eco Monitor?**	Very easy ☑ Easy ☐ Neutral ☐ Difficult ☐ Very Difficult ☐
2.	**How helpful do you find the real-time AQI information provided by the ecoMonitor?**	Very helpful ☑ Helpful ☐ Neutral ☐ Unhelpful ☐ Very unhelpful ☐
Remark/Suggestion		
3.	**Are you satisfied with remote-monitoring features?**	Very satisfied ☐ Satisfied ☐ Neutral ☑ Dissatisfied ☐ Very dissatisfied ☐
Remark/Suggestion:		
4.	**Are all the sensors are working Properly?**	**Yes** ■ **No** ☐
If No, which of the following is not working? NO_2 ☐ SO_2 ☐ CO ☐ O_3 ☐ PM ☐ Temperature & Humidity ☐ **Remark/Suggestion:**		

5.	**How satisfied were you with the installation process of ecoMonitor?**	Very satisfied ☑ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied ☐
Remark/Suggestion:		
6.	**How would you rate your overall experience with the ecoMonitor?**	Very satisfied ☐ Satisfied ☑ Neutral ☐ Dissatisfied ☐ Very dissatisfied ☐
Remark/Suggestion:		

B.3 ecoPlanning

Sl. No.	Questions	Feedback
1.	**How easy is it to read the information displayed on ecoPlanning?**	Very easy ■ Easy ☐ Neutral ☐ Difficult ☐ Very Difficult ☐
Any remark/Suggestion:		

2.	**How satisfied are you with the ecoPlanning's ability to simulate the electric demand and peak growth?**	Very satisfied ■ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied ☐
Remark/Suggestion:		
3.	**How satisfied are you with the ecoPlanning's ability to simulate the electric system model?**	Very satisfied ■ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied ☐
Remark/Suggestion:		
4.	**Have you experienced any issues with the ecoPlanning's functionality?**	**Yes** ☐ **No** ☐
If yes, please describe.		
5.	**Are you able to simulate adequately the flexibility of the electric system?**	**Yes** ☐ **No** ☐
Remark/Suggestion:		
6.	**How satisfied were you with the access process of ecoPlanning?**	Very satisfied ■ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied ☐

Remark/Suggestion:		
7.	**How would you rate your overall experience with the ecoPlanning ?**	Very satisfied ■ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied ☐
Remark/Suggestion:		

1. Any additional comments or suggestions?

Any suggestions or comments from consumers based on performance of the ecoTool, how much it is easy to use, any technical issue, the consumers are facing, or anything else.

2. Ratings

Rate the tool based on its overall performance, looks, utility and other features

★★★★★

B.4 ecoCommunity

Sl. No.	Questions	Feedback
1.	**Do you find the user interface of the ecoCommunity tool easy to navigate and interact? If not, please specify the reason below.**	■ **Easy** ☐ **Moderately Easy** ☐ **Difficult**
	Remark/Suggestion:	
2.	**Do you prefer using ecoCommunity tool over the smart meter display to determine energy (electrical/thermal) consumption meter reading?**	■ **Yes** ☐ **No**
	Remark/Suggestion:	
3.	**How often would you view/monitor the updated energy (electrical/thermal) consumption meter reading in the ecoCommunity?**	☐ **Multiple times a day** ☐ **Once a day** ■ **Once a week** ☐ **Less often** ☐ **Never**

	Remark/Suggestion:	
4.	**Are you interested in viewing the daily and monthly consumption history?**	■ **Yes** ☐ **No**
	Remark/Suggestion:	
5.	**For how much cheaper energy in green-hours compared to red-hours would you choose to make use of the energy during green-hours instead of red-hours?** *(Gaidouromantra, Ghoramara, Keonjhar)*	☐ **Do not prefer dynamic pricing** ☐ **Above 5 %** ■ **Above 10 %** ☐ **Above 25 %** ☐ **Above 50 %** ☐ **Above 75 %**
	Remark/Suggestion:	
6.	**Do you prefer using the online bill payment using cashless modes like cards or account transfer over an offline payment by cash? If not, please specify the reason below.** *(Ghoramara, Keonjhar)*	☐ **Yes** ■ **No**
	Remark/Suggestion: In Gaidouromandra microgrid there is no electrical bill	
7.	**Do you prefer using the timeslot booking module of ecoCommunity for booking time of use of large private loads (eg. water pumps, rice mill etc)? If not, please specify the reason below.** *(Gaidouromantra, Ghoramara)*	■ **Yes** ☐ **No**
	Remark/Suggestion:	
	Do you prefer using the timeslot booking module of ecoCommunity for booking the use of communal loads and expect a better coordination among users? If not, please specify the reason below. *(Ghoramara, Keonjhar)*	☐ **Yes** ☐ **No**
	Remark/Suggestion:	
8.	**Do you find using the temperature control acceptance module of ecoCommunity for centralised optimisation results in better management of the energy consumption and increases system efficiency? If not, please specify the reason below.** *(Bornholm)*	☐ **Yes** ☐ **No**

	Remark/Suggestion:	
9.	**In case of timeslot booking, what is the preferred minimum time duration for each slot?**	■ **0.5 Hour** ☐ **1 Hour** ☐ **2 Hours** ☐ **3 Hours**
	Remark/Suggestion:	
10.	**Do you feel that the problem reporting and tracking feature of ecoCommunity is convenient and beneficial for reporting various issue/problems? If not, please specify the reason below.**	■ **Yes** ☐ **No**
	Remark/Suggestion:	
11.	**How often would you use the forum feature of ecoCommunity for sharing experiences, relevant information, and contents with the local energy community.**	☐ **Very often** ☐ **Weekly** ■ **Once on a while** ☐ **Never**
	Remark/Suggestion:	
12.	**Do you feel that the manuals and FAQs in the help and support module of ecoCommunity can help in understanding the usage of various tools and troubleshooting minor problems? If not, please specify the reason below.**	☐ **Slightly** ■ **Moderately** ☐ **Greatly**

B.5 ecoPlatform

Sl. No.	Questions	Feedback
1.	**How satisfied are you with the real-time data communication capabilities of the ecoPlatform?**	a) Very satisfied b) √Satisfied c) Neutral d) Unsatisfied
	Remark/Suggestion: Choose the option that best describe your opinion regarding the real-time data communication capabilities of the ecoPlatform.	
2.	**Does the data management and storage feature meet your operational needs?**	a) Yes, completely b) Yes, to some extend c) √Neutral d) No e) Not sure
	Remark/Suggestion: Choose the option that best describe your opinion regarding the data management and storage features	

3.	**Which communication protocol do you prefer for your use cases when working with the ecoPlatform?**	a) √MQTT for real-time data streaming b) HTTP for bulk data import/export c) Both equally depending on the situation
	Remark/Suggestion: Choose the option(s) that describe which protocol do you prefer	
4.	**How easy is it to use the ecoPlatform's user interface for visualizing data?**	a) Very easy b) Easy c) Moderate d) Difficult e) **√**Very difficult
	Remark/Suggestion: Choose the option that best describe your opinion regarding the ecoPlatform's user interface for visualizing data**.**	
5.	**Are the notifications and alarms for system monitoring effective in addressing potential issues?**	a) Very effective b) **√**Effective c) Neutral d) Ineffective e) Not effective at all
	Remark/Suggestion: Choose the option that best describe your opinion regarding the ecoPlatform's notifications and alarms for system monitoring effective in addressing potential issues.	
6.	**How useful do you find the alarm and notification feature (e.g., for communication failures or data issues)?**	a) Very useful b) Somewhat useful c) Neutral d) **√**Not very useful e) Not useful at all
	Remark/Suggestion: Choose the option that best reflects your opinion regarding the alarm and notifications on the ecoPlatform	
7.	**What do you consider the most important feature of the ecoPlatform?**	a) Data management and storage b) **√**Real-time communication c) User Interface
	Remark/Suggestion: Choose the option(s) that reflects your opinion regarding the most important feature of the ecoPlatform**.**	

8.	**What additional feature(s) would improve your experience with the ecoPlatform?**	a) **√**More advanced data analytics b) Better alarm customization options c) **√**More data visualization tools d) Expanded data storage capacity e) Other (please specify)
	Remark/Suggestion: Choose the option(s) that describe what additional feature(s) would improve your experience with the ecoPlatform	

Any additional comments or suggestions?

Any suggestions or comments from consumers based on performance of the ecoTool, how much it is easy to use, any technical issue, the consumers are facing, or anything else.

Ratings

Rate the tool based on its overall performance, looks, utility and other features