eSTABLISHING COMMUNITY RENEWABLE ENERGY WEBS

establishing Community Renewable Energy Webs - Rolling out a business model and operational tool creating webs of households that jointly manage energy to improve efficiency and renewables uptake

Contract No. 890362

Deliverable 2.5:
List of Quantitative Indicators

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Disclaimer

Executive Summary

The key objective of the e-CREW project is to ensure that many households enrol in the proposed Light House Energy Communities and that those who register actively participate in actions at Community level. The success of the activities done by the CREWs is measured by a set of Key Performance Indicators that monitors the progress and the effectiveness of the e-CREW community roll out. The set of indicators is designed to reflect the effectiveness of the different activities and strategies deployed by the CREWs at individual and at community level and encompass impacts in different domains like social, environmental, economic and project related metrics such as the best practice potential uptake by follower communities.

Some KPIs are designed to keep monthly track of the individual and CREW energy performance. These indicators are fed from the app metering database. Others measure the activity level of the CREW actions, both app usage and participation in collective activities. The energy impacts are converted into economic impacts and environmental impacts to grasp the holistic assessment of the CREW roll out benefits.

Subjective KPIs are measured by means of a survey to members once. Other parameters like engagement rate, membership, renewable uptake are measured twice, one as a baseline at the beginning of the CREW and one more at the end of the project.

The proposal made in this document documents the KPI calculation procedures and the data sources to feed the project scoreboard. With this set of KPIs in mind, the three LC communities and app developers will work to create the necessary procedures and structures to be able to properly collect, store, calculate and show the results of the KPI measurement according to the suggested reporting frequency. Those metrics related to the continuous monitoring performance of the CREW (energy consumption, performance and Renewable Energy Source (RES) autarky level) are proposed to be measured monthly. The metrics related to overall project performance need to be reported at the beginning, as a project baseline, and at the end. The KPI measurement takes place in task T5.3 at M28. A revision of the validity of this KPI list will be made at the beginning of T5.3 to account for any important change having taken place in between the submission of this document and the beginning of the measuring phase.

List of abbreviations and acronyms

CAE - Community Administration Entity
CAI - Collective Action Initiative
CEC - Citizen Energy Community
DHW - Domestic hot water
DoA - Description of Action
EEM - Energy Efficiency Measure
EVO - Energy Valuation Organisation
GHG - Greenhouse gases
GP - GreenPocket
IMPVP - International Performance Measurement and Verification Protocol
IRR - Internal Return Rate
KPI - Key Performance Indicator
LC - Lighthouse Energy Community
NPV - Net Profit Value
PDCA - Plan-Do-Check-Act framework
PV - Photovoltaic
REC - Renewable Energy Community
RES - Renewable Energy Source
SME - Small and Medium Enterprise
SPC - Statistical Process Control
WP - Work package

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1. Objective and scope

This document has been developed within eCREW's task T2.3 "Definition of KPIs and business model indicators". It defines the quantitative Key Performance Indicators (KPIs) that will measure the performance of the eCREW approach based on the roll out in the Lighthouse Communities (LCs). The objective is to assess the eCREW performance compared to the project internal targets, and to measure the eCREW impact at social, environmental and economic level. The impact may be given in absolute terms or relative, or sometimes both, to give different insights to the metric analysed.

The quantitative KPIs and impact indicators will be delivered in two ways: first they are accurately described and second, they are expressed in mathematical terminology to facilitate the calculation. The roll-out in the LCs will be evaluated using this set of indicators, which will happen later on in WP5. At this point, a revision of the present KPI list will be made to check they are still valid and fully applicable to the LCs as they are configured.

The task also aims at providing economic feasibility analysis of potential investments of CREW members. For self-consumption photovoltaics, a cost-benefit assessment will be done using the newly developed PV-feasibility assessment functionality embedded in the app as a result of T3.2. The objective of this economic assessment is to persuade the app users of the tangible economic benefits they could realise by up-taking self-consumption with their own real consumption profile and the split incentive mechanisms developed in T2.1 and adopted by the LCs. For other type of possible investments, tailored economic and financial analysis may be performed on demand and they do not make part of the regular KPI list.

2. Introduction and Context

The eCREW project aims at activating and fostering the inherent and, so far, underused - forces of community-driven Collective Action Initiatives (CAI). Empowering citizens and giving them the tools needed to monitor, produce, store, and consume energy for their own benefits, and to work for the prosperity of the (local) economy, and for tackling climate change as an important and indispensable step on our road to a stable, secure, energy-efficient, and climate-neutral future energy system. Recent European legislation has paved the way for unleashing the potentials of such initiatives by granting them a certain level of support. It explicitly has set the scene for the establishment of Citizen Energy Communities (CECs) and Renewable Energy Communities (RECs).

A Key Performance Indicator (KPI) system enables to set up a regular routine of measuring and reporting key parameters to control a process, a company or a system. In this case, the objective is to monitor and control key parameters dealing with the performance of the CREW and according to the CREW targets and objectives. The CREW targets encompass several domains and can be summarised as follows:

- Social objectives. The CREWs have the target to enrol and engage a high number of users with common characteristics (domestic and Small and Medium Enterprise (SME) consumers linked to the LC Community Administration Entities (CAE) companies and cooperatives in the same geographical area). The CREWs are also expected to lead the participatory activities and provide value by means of a usable and practical app and other collective activities. The level of participation and satisfaction with both app and activities need to me measured.
- Environmental objectives. The main reason for consumers to engage is to increase their energy performance and enjoy energy savings jointly. The monitoring of energy metrics and environmental impacts are a “Must” to control and report. The self-consumption maximization at CREW level and the uptake of renewable generation sources is also a key objective of eCREW.
- Economic objectives. This is an important motivation by CREW members. The monitoring of economic metrics related to energy, self-consumption and investment return is needed within the everyday life of a CREW.

Thus,

The approach of the Plan-Do-Check-Act (PDCA) framework [1] fits well with the need of a KPI set to be able to check what is being done, and act to correct and improve in a kind of circular strategy, This way, the KPI results collected regulary are compared against top and bottom thresholds to trigger different alarms and reactive actions:

- Green light. Targets are met and no further action is required.
- Red light. Immediate reactive actions are needed to assess the issue, go down to the root causes and suggest temporary and definitive solutions to each root cause.
- Yellow light. The metric stays in between the thresholds. A continuous monitoring is needed and some long term corrective measures and improvements are suggested to move the indicator towards green light status.

The limits for green, yellow and red are not known yet. Most of them will be calculated as a result of a Statistical Process Control by adding 2 or 3 times the standard deviation to the average value of the data sample.

The KPI set has been designed under the following premises:

- Representativity
- Easy to calculate and report
- Accesibility of input data.
- Meaningfulness
- Complementarity.

3. KPI revision and previous projects experiences.

The elicitation of these success indicators, including those addressing the effectiveness of the respective functionalities, follows a hierarchical process: in a first step indicators are taken from existing work (e.g. IMPVP, or as developed in PEAKapp specifically for the app system as applied in eCREW, or as developed in the COMETS project to assess the efficacy of Collective Actions) and are extended and/or tailored to the objectives of eCREW.

Due to the similarities between the PEAKapp (www.peakapp.eu) and eCREW projects, an attempt has been made to reuse those KPIs that have been successfully used to evaluate the functionality of the app, adapting them to the needs and objectives of the eCREW project. The PEAKapp project developed and tested a software tool that collected load profiles of households' electricity consumption, transformed this rather technical data into user friendly aggregates, and feed the gathered information back to the households in a way that engage and motivate increased household energy efficiency. To analyse the information collected by the tool, different KPIs were defined in PEAKapp. On the one hand, some of these KPIs allowed to measure the success of the app, by observing the interaction between consumers and the tool and checking if the app actually stimulated energy efficiency behaviour and related decisions of users. On the other hand, another series of KPIs (called eKPIs) were defined to measure the environmental impacts derived from the use of the app and the change in user behaviour. Within the KPIs related to the functionality of the app, those that allowed to evaluate user interaction with the tool and satisfaction with it (such as: active users, average session duration, number of downloads, call center calls), have been used as a baseline, by modifying them to the eCREW project requirements. Regarding the environmental KPIs, we have revised those that allowed to measure the environmental impact of PEAKapp (GHG reduction) and those that allowed to measure how household energy consumption patterns were changing (such as energy savings, monetary savings or load shifting).

COMETS project (www.comets-project.eu) is oriented to the research of Collective Action initiatives (CAI). In this sense, this project shares the importance of collective action to achieve a relevant and outstanding impact at community scale. Since the collective action plan in eCREW is not fully defined yet the KPI choice in this regard is limited to measure the engagement success by the new energy communities, the overall satisfaction of CREW members with their participation in the community and the level of participation in the collective activities to be triggered by the CREW CAEs.

Since one of the indirect project targets is focused on energy efficiency, and this has been underlined by some potential CREW members, a good source of energy efficiency indicators come from existing protocols of energy savings measurement and verification methodologies. One of the most well-known is the International Performance Measurement and Verification Protocol (IPMVP) [2] created by the Energy Valuation Organisation (EVO: www.evo-world.org). This methodology establishes four options to assess and verify energy savings derived from an Energy Efficiency Measure (EEM). The methodology specifies a procedure to characterise an ex-ante scenario in which an energy performance model or baseline is calculated to simulate the system behaviour before the EEM takes place as a mathematical function with some independent variables that affect the system. In the ex-post scenario, the actual consumption is measured and compared to the baseline modelled value, adjusted with some correction values. This methodology requires a historical data to derive the baseline from in the ex-ante scenario and should ensure that the adjustments made in the model really reflect the current external conditions in the former scenario. This methodology could be used on demand in eCREW to assess specific energy efficiency measures in the CREW. The pre-requisites needed to set up this methodology in eCREW are:

- Identify the type of EEM, the scope (individual, building level, CREW level, ….) the demands affected (heating, cooling, DHW, self-consumption, other) and the precise date of EEM implementation.
- Mathematical model for the consumption simulation as a function of one or more independent variables.

- Historic data to create the baseline, both for energy consumption and independent variables selected in the mathematical model, with accurate measurement of the energy consumption ex-ante and ex-post.

This methodology is particularly suited for specific EEM at individual level with a clear implementation date that enables to separate the ex-ante and ex-post energy performance scenarios. Applying this methodology to a variety of EEM of different nature, affecting different demands and extended to the full CREW with several implementation times would not stick to the methodology. Hence it has been deemed not applicable for the eCREW set of KPIs in general terms. The application of the IPMVP methodology may be relevant to measure the savings of specific energy efficiency measures to be deployed by one or more CREW members in their premises, and hence, may be called upon on demand.

4. Description of the selected eCREW KPIs

This chapter describes both verbally and mathematically the selected KPIs. The KPIs related to the app usage will be captured with Matomo Analytics (www.matomo.org), a well-known and proven web analytic allowing to keep ownership of all data and keep data privacy of sensitive information. The KPI related to the CREW management will be gathered by the CAE partners and the data availability has been discussed and agreed upon with them.

The final list of KPIs proposed is classified in four groups as follows

- Social KPIs. This group encompasses those metrics related to membership and app usage metrics.
- Energy and environmental KPIs. This group reports energy consumption, generation, self-consumption rate and carbon footprint at aggregated CREW level. Individual metrics are offered to users via app, but are not reported as CREWs KPIs for confidentiality reasons.
- Economic KPIs. This set of metrics show the energy costs and the self-consumption savings in monetary terms at CREW level.
- Project success KPIs. This set of metrics deals with the CREW activity and participation metrics that measure the success of the engagement and collective action strategies at CREW level. There are also some devoted to the follower communities within the project.

In this section a thorough description is made per each KPI with the following information that enable to describe, classify, characterise, measure, report and find input data:

- Indicator title and description
- Objective of the indicator
- Type of indicator (objective, subjective, estimated)
- Type of metric (absolute, relative, average)
- Units
- Frequency of measurement and reporting
- Input source
- Comments, exceptions and possible issues.

4.1. Social KPIs

Social impact is the main target of the eCREW model of communities. This set of metrics intend to measure the social impact of the CREW-type communities.

4.1.1. Number of CREW households and members

Description: This metric shows the size of the CREW and the time-comparison allows to monitor the growth rate of the CREW. It is also necessary to calculate the average of other scoreboard metrics

Objective: Measure the size of the CREW, the enrolment success, and the growth or variation rate along time.

Type of indicator: objective

Type of metric: absolute

Calculation: Count of households, Count of members.

Units: Number of households, Number of members,

Frequency: at least twice. Once at the end of the initial enrolment campaign and again at the end of the project to check the variation rate along the project involvement.

Input source: LC partners

Comments and issues: This metric is actually twofold as the unit of energy consumption and generation is the household but the number members could be larger since more than one person can be part of the community

4.1.2. App usage rate

Description: this metric shows the app utility for CREW members relying on an objective metric, by measuring and monitoring the anonymised activity level of the app by CREW users in a period. This is expected to be reported by the Matomo analytics tool and reported monthly to compare participation and usage levels through time. Low usage rates may imply low perceived usefulness of the app, or other usability or technical issues that can be addressed by training and manuals.

Objective: Measure objectively the usefulness of the app and the participation and engagement level of CREW members.

Type of indicator: objective

Type of metric: relative

Calculation: Directly reported by Matomo.

Units: % of users with app activity in the period.

Frequency: monthly

Input source: Matomo web-based analytics.

Comments and issues: This metric is completed with the app time of usage to measure the usage intensity by the active members. A more precise analysis may be made on demand to now the usage rate per app functionality and assess the interest of users for the different app features.

4.1.3. App time of usage

Description: This metric reports the average number of hours of app usage and interaction with users in given periods to assess the usefulness of the app different functionalities. A low usage rate but high app time of usage may reveal different user profiles and usage models. This information is also relevant for the app developers to enhance the app features or address usage model issues with the solutions.

Objective: Measure the app usage intensity by the active users.

Type of indicator: objective

Type of metric: average

Calculation: Average of hours per user in the period per month, per week or per day.

Units: average hours / user

Frequency: monthly

Input source: Matomo web-based analytics.

Comments and issues: This metric is completed with the app usage rate to understand the number of active users of the app functionalities. A separate analysis per app functionality may be made on demand to know more about how users interact with the different app features.

4.1.4. Support service inquiries

Description: This KPI gives an objective metric of CREW member interactions with the LC and is a metric of member participation within the CREW. It may also be the sign with a specific problem or reveal particular members' interest on an issue.

Objective: Measure the engagement and interest of user with the CREW.

Type of indicator: objective

Type of metric: absolute, average

Calculation: total number of inquiries received. Average per CREW member. Inquiries may be comments, questions, complaints, requests, related to the CREW that are initiated by any CREW members, by any means (email, fora, telephone, any other available channel). String of messages about the same topic are counted as 1 inquiry received.

Units: Number of inquiries. Number of inquiries / user

Frequency: monthly

Input source: LC CAE administrator.

Comments and issues: Complaints may be given a higher priority and be reported separately. A classification by topic or by channel may be made to obtain more information from this KPI. Frequency may be also changed according to the value of the information received.

4.1.5. App overall satisfaction rate

Description: this metric gives a subjective view of the app usefulness by directly asking the user for their satisfaction rating after having used the app for a time.

Objective: Measure user satisfaction with the app from a user perception side.

Type of indicator: subjective.

Type of metric: average

Calculation: average of ratings from a survey.

Units: average of a 1-5 overall satisfaction scale

Frequency: Once at the middle or end of the project.

Input source: User survey.

Comments and issues: More insights can be asked for in the survey to be able to understand the reasons of the satisfaction scoring in different aspects about the app: download and installation, functionality, interface, clarity, usability, accuracy, suitability, troubleshooting and reliability.

4.1.6. eCREW services satisfaction rate

Description: this metric gives a subjective view of the CREW services and overall participation activities by directly asking the user for their satisfaction rating after being members for some time.

Objective: Measure user satisfaction with the CREW services from a user perception side.

Type of indicator: subjective.

Type of metric: average

Calculation: average of ratings from a survey.

Units: average of a 1-5 overall satisfaction scale

Frequency: Once at the middle or end of the project.

Input source: User survey.

Comments and issues: More insights can be asked for in the survey to be able to understand the reasons of the satisfaction scoring in different aspects about the different services offered by the CREW to the members (information, advice and couching, participation activities, technical and administrative support, …).

4.2. Environmental KPIs

This set of indicators measure the CREW impact at energy and carbon footprint impact. Most of the metrics come from direct aggregated meter reading or simple conversion calculations. Metrics related to self-consumption and RES generation are only meaningful for CREWS with self-consumption management.

4.2.1. Energy consumption at CREW level

Description: This metric shows the total energy consumption of the whole CREW in a constant period (1 month). It is useful to monitor the energy performance and should be compared with control boundaries to check for deviations and trigger corrective measures if needed.

Objective: Energy performance

Type of indicator: objective

Type of metric: absolute and average. This value is provided individually by the app to every member with smart meters. However, the reported metric is at aggregated level. An average value per CREW member may algo be calculated as a reference

Calculation: Energy consumption = $\sum_{i=1}^{n}\sum_{j=1}^{m} C\ (i,j)$ With:

C hourly consumption of user i at hour j,

i number of aggregated CREW consumers i=1..n

j number of hours in the period, 1 day j=1..24, 1 month j=1..720 aprox

Units: kWh/month, avg kWh/month and user.

Frequency: monthly for monthly progress monitoring

Input source: metering information

Comments and issues: Energy savings are not metered by supply meters and hence do not add up to the total CREW energy consumption.

4.2.2. Average energy consumption benchmark gap

Description: This metric shows the energy gap between a target threshold and the actual average energy consumption metered to see in kWh/user and in percentual points the energy performance of the average CREW member. The target threshold may be the national consumption average, or a dynamic and realistic target that is being reduced as new savings achievements are attained. It is useful to boost further savings and good practices at CREW level, by setting a collective objective to be reached cooperatively.

Objective: Energy performance

Type of indicator: objective

Type of metric: average and relative. This value is calculated by the CREW monthly comparing the threshold with the previously calculated “energy consumption” metric, averaged per CREW user.

Calculation: average energy consumption benchmark gap = $Threshold - average(\sum_{i=1}^{n}\sum_{j=1}^{m} C\ (i,j))$

% gap = $\frac{gap}{average(\sum_{i=1}^{n}\sum_{j=1}^{m} C\ (i,j))}\ x\ 100$ With

C hourly consumption of user i at hour j,

i number of aggregated CREW consumers i=1..n

j number of hours in the period, 1 day j=1..24, 1 month j=1..720 aprox

Units: avg kWh/month and user. % of gap.

Frequency: monthly for monthly progress monitoring

Input source: calculated from metering information

Comments and issues: Energy savings are not metered by supply meters and hence do not add up to the total CREW energy consumption.

4.2.3. CREW Self-consumption coverage rate

Description: This metric shows the CREW autarky level or decree of energy consumption coverage with respect to the CREW's energy demand in a period of time, in this case, one month. Data is taken from metering

Objective: Energy performance

Type of indicator: estimated from metering data.

Type of metric: relative with respect to total energy demand.

Calculation: Self-consumption coverage rate % = (1- $\frac{\sum_{j=1}^{m}(\sum_{j=1}^{m}(C\ (i,j)-E(i,j))}{\sum_{i=1}^{n}\sum_{j=1}^{m} C\ (i,j)}$) $x\ 100$ With:

C net hourly energy consumption of prosumer i at hour j,

E hourly energy excess of energy of prosumer i at hour j. If the prosumer has no PV, then E = 0, if he/she has, then E is the energy surplus available for other consumers and to the grid. Then, it is assumed that if the aggregated ∑(C – E) > 0 all the surplus is internally consumed in the CREW. If ∑C = ∑E the coverage rate would be 100 %. If ∑E = 0, the coverage rate = 0 %. If ∑(C – E) > 0, then the coverage rate > 100 %

i number of aggregated CREW prosumers i=1..n

j number of hours in the period, 1 day j=1..24, 1 month j=1..720 aprox.

Units: €/month

Frequency: monthly for monthly progress monitoring

Input source: calculated from metering information. Alternatively, it can be taken directly from the CAE internal accounting database.

Comments and issues: Only for CREWs with self-consumption management

4.2.4. CREW renewable energy generation

Description: This metric shows the total energy generation of the whole CREW in a constant period (1 month). It is useful to monitor the aggregated energy self-consumption potential and the environmental impact of the CREW RES generation with the emissions avoided.

Objective: Energy performance

Type of indicator: objective

Type of metric: absolute and average. This value is provided individually by the app to every producer with smart meters. However, the reported metric is at aggregated level. An average value per CREW member may algo be calculated as a reference.

Calculation: Energy consumption = $\sum_{i=1}^{n}\sum_{j=1}^{m} G\ \ (i,j)$ With:

G hourly generation of user i at hour j, i number of aggregated CREW prosumers i=1..n

j number of hours in the period, 1 day j=1..24, 1 month j=1..720 aprox

Units: kWh/month, avg kWh/month and user.

Frequency: monthly for monthly progress monitoring

Input source: metering information

Comments and issues: Since seasonal differences are to be expected, the real historic data comparison should be made on annual basis. The monthly reporting is recommended as this metering is continuously being monitored and reported through the app to the prosumers.

4.2.5. CREW Emissions avoided

Description: It calculates the CO_2 emission savings derived from the CREW RES generation in a period as an environmental impact of the CREW.

Objective: Measure the avoided carbon footprint and the GHG reduction per period.

Type of indicator: estimated

Type of metric: absolute. An average per user can also be calculated as a reference

Calculation: Emissions avoided = $\sum_{i=1}^{n}\sum_{j=1}^{m} G\ (i,j)\ x\ Em_j$ With:

G hourly generation of producer i at hour j,

Em: emission factor of the energy mix at hour j. It may be constant for any hour in the period.

i number of aggregated CREW producers i=1..n

j number of hours in the period, 1 day j=1..24, 1 month j=1..720 aprox

Units: kg CO_2/month

Frequency: monthly / yearly

Input source: calculated from RES generation

Comments and issues: this metric depends on the emission factors of the electricity mix at local or national level. These numbers may need constant update for the sake of accuracy.

4.3 Economic KPIs

This set of indicators derives from the previous one and convert energy consumption and savings into currency (€ or lira) using the energy tariff rates as conversion factors. Changes to more economic tariffs or shift loads from peak to valley periods can derive into economic impacts with no variation in environmental and energy figures.

4.3.1. CREW Energy costs

Description: This metric shows the total energy consumption in economic terms of the whole CREW in a constant period (1 month). It is useful to monitor economic performance and should be compared with control boundaries to check for deviations and trigger corrective measures if needed.

Objective: Economic performance

Type of indicator: estimated

Type of metric: absolute. This value is provided individually by the app to every member with smart meters. However, the reported metric is at aggregated level. An average value per CREW member may algo be calculated as a reference.

Calculation: Energy costs = $\sum_{i=1}^{n}\sum_{j=1}^{m} C\ (i,j)\ x\ P\ (i,j)$ With:

C hourly consumption of user i at hour j,

P hourly energy price of user i at hour j. If self-consumed energy P=0, if consumed from a CREW member energy surplus generation, P = split incentive price.

i number of aggregated CREW consumers i=1..n

j number of hours in the period, 1 day j=1..24, 1 month j=1..720 aprox

Units: €/month, avg €/month and user

Frequency: monthly for monthly progress monitoring

Input source: calculated from metering information and tariffs

Comments and issues: As an aggregated metric, it is difficult to figure out the cause of deviations. The metric should be disaggregated in the energy and tariff components to investigate further.

4.3.2. CREW economic savings from self-consumption

Description: This metric shows the total savings derived from RES generated and self-consumed in economic terms. There are two sources of savings, one is the savings from grid energy avoided, evaluated at supply price, and the second is the energy surplus, that is compensated at a lower tariff according to the split incentive scheme designed for the CREW

Objective: Economic performance

Type of indicator: estimated

Type of metric: absolute. An average value per CREW member may algo be calculated as a reference.

Calculation: Energy costs = $\sum_{i=1}^{n}\sum_{j=1}^{m}(S\ (i,j)\ x\ P\ (i,j) +\ E\ (i,j)\ x\ (Comp\ prosumer\ (i,j) + Comp\ consumer\ (i,j)))$ With:

S hourly self-consumed energy of prosumer i at hour j,

P hourly energy supply tariff price of user i at hour j.

E hourly energy excess of energy of prosumer i at hour j

Comp prosumer hourly energy excess compensation price of prosumer i at hour j. If a split incentive system is in place, then this incentive is the compensation price to apply to prosumers.

Comp consumer hourly energy excess compensation price of consumer i at hour j. If a split incentive system is in place, then this incentive is the compensation price to apply to consumers. It is assumed that all the energy surplus is consumed within the CREW

i number of aggregated CREW prosumers i=1..n j number of hours in the period, 1 day j=1..24, 1 month j=1..720 aprox.

Units: €/month

Frequency: monthly for monthly progress monitoring

Input source: calculated from metering information and tariffs. Alternatively, it can be taken directly from the CAE internal accounting database.

Comments and issues: Only for CREWs with self-consumption management

4.3.3. Payback time of potential PV facilities of CREW members

Description: This metric calculates the individual payback time of a potential PV facility of a CREW member through the embedded app functionality developed by eCREW in the frame of T3.2. It is calculated for a given PV size and a historic consumption profile. This metric is not reported in the KPI dashboard since it is a personal and individual metric calculated on demand through the app.

Objective: Provide a preview of the economic outturn of a PV investment for a potential CREW investor through the eCREW app

Type of indicator: estimated

Type of metric: absolute

Calculation: See D3.2 for details. The Net Profit Value (NPV), the Internal Return Rate (IRR) and the payback of the investment are provided

Units: years (for payback), the NPV is calculated in € or lira with a discount rate. The IRR is percentual per year.

Frequency: on demand

Input source: historic consumption database metering, PV size and costs, location and installation yield.

Comments and issues: Not reported as a KPI or a CREW metric.

4.4 Project specific KPIs

This set of KPIs aim at quantifying in an objective way the internal eCREW targets in terms of engagement, participation, replication and RES uptake that are described in the Description of Action (DoA). These metrics are to be assessed once at the end of the project although some may be monitored regularly to check progress along the CREW rollout. The information required for the reporting and calculation should be provided by the LC CAEs.

4.4.1. Participation in CREW collective actions

Description: This metric shows the participation rate of CREW members in the different possible collective activities prepared and led by the LC CAE along the project. Since these activities are not defined yet, this KPI is generic and just refers to the participation rate per main activity.

Objective: Measure the participation rate in the different collective CREW activities.

Type of indicator: objective

Type of metric: absolute / relative

Calculation: Count of active participants per activity. Relative number of participants with respect to total CREW members.

Units: Number of participants, % of participants

Frequency: per activity. On demand.

Input source: LC partners

4.4.2. CREW Projects and initiatives deployed

Description: This KPI is set to measure the effect of the CREW community in deploying initiatives at collective level, either coming from private sources or initiated by the CREW. Since the nature and type of these initiatives is yet to be decided, this metric is generic and just refers to the number of initiatives actually deployed. Proposals in design or planning phase may not be eligible as they do not have any impact on CREW members.

Objective: Measure the impact of the collective CREW activity by the number of proposals deployed such as projects and initiatives, as a way to quantify the impact of the collective action in the community.

Type of indicator: objective

Type of metric: absolute

Calculation: count of deployed actions and initiatives.

Units: Number of initiatives deployed.

Frequency: Once at the end of the project.

Input source: LC CAE

Comments and issues: This metric is subject to changes to adapt it better to the final activities of the communities.

4.4.3. CREW Engagement rate

Description: This KPI measures the relative number of recruited new members in relation to the total number of contacted people, as a way to measure the effectiveness of the CREW enrolment message to potential new members and the suitability of the communication channels selected.

Objective: this metric aims at measuring the enrolment strategy success at every LC.

Type of indicator: Objective

Type of metric: relative

Calculation: Engagement rate % = $\frac{Count\ of\ enroled\ members\ x\ 100}{Count\ of\ contacted\ people}$

Units: % per campaign

Frequency: Twice, first time at the end of the enrolment campaign, second time at the end of the project.

Input source: LC CAE

Comments and issues: If several campaigns were launched, this metric may be calculated separately per campaign to measure the effectiveness of the different enrolment strategies.

4.4.4. Number of follower communities and members

Description: This KPI quantifies the eCREW success on disseminating and replicating the LC models to other potential communities that want to benefit from the best practices and policies of the CREWs. The metric is twofold, reporting both the number of follower communities and the potential aggregated number of new members in them.

Objective: to measure the replicability and the effectiveness of the communication campaign to other potential communities.

Type of indicator: objective / estimated

Type of metric: absolute.

Calculation: Count of follower communities. Estimation of potential members in the follower communities.

Units: Number of communities, number of potential new members.

Frequency: once at the end of the project

Input source: eCREW project partners (T6.1)

Comments and issues: The number of follower community member may not be available and hence, may not be reported accurately.

4.4.5. CREW RES Uptake

Description: this KPI measures the success of the CREW model to boost new RES facilities for self-consumption within the community, either by installing new plants or by enrolling prosumers with generation capacity. The metric measures the total CREW renewable power available by all prosumers in the CREW.

Objective: Quantify the CREW success in raising investments on new RES generation sources and attracting prosumers with RES generation capacity

Type of indicator: objective

Type of metric: absolute

Calculation: RES Uptake = Total RES generation Power – baseline RES generation power.

Units: kW of installed power. PV, kWp

Frequency: Once at the end of the project. There could be interim checks of this metric to see evolution.

Input source: LC CAE

Comments and issues: A baseline with the initial RES power is to be made at the beginning.

Table 1. List of eCREW KPIs

Category	Indicator	Objective	Type of indicator	Type of indicator	Units	Scope	Frequency	Input source
Social	Members joining	CREW participation rate	objective	absolute	number of members	CREW	twice	LC
	App usage rate	CREW participation rate	objective	Abs / relative	%	CREW	monthly	Matomo
	App Time of usage	CREW participation rate	objective	absolute	average (h/user)	CREW	monthly	Matomo
	Support service inquires	CREW participation rate	objective	absolute	Number of inquiries	CREW	monthly	LC
	Satisfaction with app	App satisfaction	subjective	average	1-5 scale	CREW	once at the end	survey
	Satisfaction with eCREW services	CREW satisfaction	subjective	average	1-5 scale	CREW	once at the end	survey
Environmental	Energy consumption at CREW level	energy performance	objective	Abs / avg	kWh,	CREW	monthly	meters
	Average consumption benchmark gap	energy performance	objective	relative	% gap of kWh	CREW	monthly	calculated
	CREW self-consumption coverage	energy performance	estimated	relative	%	CREW	monthly	meters
	CREW RES generation	energy performance	objective	Abs / avg	kWh	CREW	monthly	meters
	CREW Emissions avoided	GHG reduction	estimated	absolute	kg CO2/month	CREW	monthly	calculated
Economic	Payback time of potential PV facilities	cost-benefit analysis	estimated	absolute	years	individual	On demand	Calculated, not reported
	Economic savings from self-consumption	economic performance	estimated	Abs / relative	€/CREW	CREW	monthly	calculated
	Energy costs at CREW level	economic performance	estimated	absolute	€/CREW	CREW	monthly	calculated
Project success indicators.	Participation in CREW collective actions	CREW participation rate	objective	Abs / relative	participant number, %	CREW	per activity	LC
	Iniciatives deployed	CREW performance	objective	absolute	Count	CREW	once at the end	LC
	Engagement rate	CREW performance	objective	relative	%	CREW	twice	LC
	Number of follower communities	Project performance	objective	absolute	number	CREW	once at the end	LC
	Members of FCs	Project performance	objective	absolute	number	CREW	once at the end	LC
	RES Uptake	RES uptake	objective	absolute	kW	CREW	once at the end	LC

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5. Measurement and Deployment plan

In the definition of the most suitable KPIs and reporting frequency, due attention has been paid to the measurement and deployment plan. In accordance with this, several factors have been assessed for each KPI:

- Data unavailability. Input data for the direct reporting or KPI calculation should be available and easy to reach.
- Calculation complexity. KPIs should be easy to calculate and should not need heavy computational resources. This factor is important to ensure the KPI trustfulness and univocity. Discussions should be focused on the results and not on the calculation procedures.
- Data collection burden. KPIs should encompass all eCREW project targets and impacts but should not impose a high data gathering burden.

The deployment plan is to be detailly drafted in T5.3 "Quantification of the KPIs and business model indicators". However, a preliminary exercise has been made to make sure that the three barriers above are not serious impediments for the deployment of the measurement and reporting plan later on in the project. Again, this exercise will be repeated in Septermber 2022 (M28) at the beginning of task T5.3.

Data availability

To ensure data is available for all KPIs, all data providers have been questioned according to the type of KPI.

- App usage rate and intensity. (GreenPocket) These metrics will be made available through the Matomo web analytics. It has been successfully tested in the PeakApp project and, hence, there is great confidence on the availability of this data. More specific analytics such as usage rate and intensity per app function are not tested and are not part of the KPI scoreboard. Hence, these metrics will be used on demand with the purpose to investigate further the user interactions with the app and the limitations of it.
- Energy metering data. (GreenPocket, LCs). This information is captured by the smart meters, and the LCs download the data daily in GP's database for the app. In Turkey the smart meters are being installed. In Germany and Spain this data is already available on daily basis.
- Electricity tariffs. (LC CAEs) All CREW members invited are currently customers / associates of the LC CAEs. Electricity tariffs are, hence, available for all users. The App can show monitoring data both in energy terms and in economic terms. Integration of tariff data in Turkish Lira is part of T3.3.

Calculation complexity

The majority of the KPIs are aggregated values of metering figures, with potential conversion factors for the economic and carbon footprint KPIs. The best way to centralise the data calculation is in GP's systems where all metering and tariff data are stored. The KPIs are either the aggregation of individually calculated metrics or need to be programmed from scratch.

Data collection burden

Data is expected to be extracted, sent and stored in GP's systems automatically. Tariffs will be entered manually but they are not supposed to change often. Hence, the burden associated with data collection for monthly-reported KPIs is not expected to be high.

For other KPIs like enrolment and participation metrics they have to be collected manually by LCs. This is why the minimum frequency of reporting is set to be twice: once at the beginning of the CREW rollout, and again at the end

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of the project, to check for progress and take the final picture of the CREW in relation to every KPI. There is the possibility of increasing reporting frequency on demand to monitor more closely metrics that are not performing well or are below expectancies.

For user satisfaction metrics, this data is not available, and it is subjective. Hence it needs to be collected by means of surveys and questionnaires. Due to the anonymity and the difficulty of getting this data, this exercise will be made once along the project and only average results will be reported. There is a possibility of repeating the exercise along the project with a smaller sample size.

A scoreboard will be created in T5.3 to monitor all CREW KPIs and check evolution, trends and deviations. For monthly indicators, a Statistical Process Control (SPC) [3] may be suggested, using the historic data accumulated to calculate a mean and the upper and lower limits based on the standard deviations of the data samples. Large deviations from these limits will be reported to assess the root causes and suggest corrective measures. Other KPIs may be monitored and compared against fixed limits. Corrective and mitigation actions will be proposed according to the PDCA methodology.

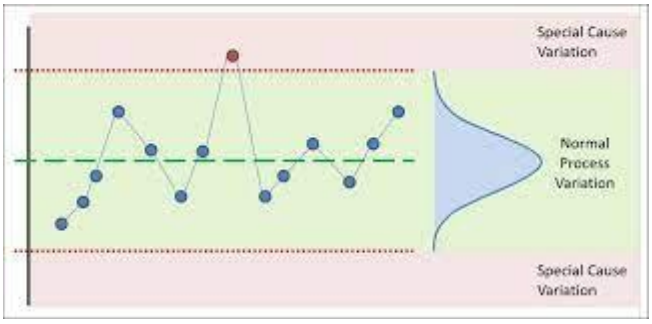

Figure 1. SPC example for KPI monitoring. Source CQE Academy.

6. Conclusions

For the transition of the energy system towards a more sustainable model of electricity production, distribution and consumption, the active participation of citizens in the process is a crucial requirement, besides and beyond the technical, regulatory and market solutions. Digitalisation of energy markets offers the possibility of re-locating the role of the consumer with greater empowerment and more active participation in different segments of the value chain. The use of big data technology to provide useful information to the CREW users directly reinforce their role as citizens to take part in the low-carbon shift strategy. The eCREW project sets up an application to make this data available to users in a comprehensive and attractive manner to push for implicit and explicit action towards a more sustainable use of energy in the domestic sector through energy communities and collective action.

The impact of the eCREW project is diverse and encompasses several domains that have to be monitored, such as i) the social impacts, measured by the collective use of a common app and the satisfaction level with the CREW app and services; ii) the environmental impacts assessed by the energy consumption monitoring and self-consumption coverage in communities with renewable generation capabilities; iii) the economic impact evaluation by monetising the energy flows from demand and self-consumption; and iv) the project specific targets such as participation level, activities, engagement and follower communities impact. Some impacts like the CREW RES uptake are both environmental impacts and project specific KPIs.

As a first step, energy related metrics and participatory previous experience metrics have been reviewed to leverage from the most successful practices. In this sense, experience with web-based analytics tools have been found of interest for eCREW. In the same way, methodologies for energy saving verification based on ex-ante and ex-post scenarios have been dismissed for assessing savings at CREW level.

A review of the project objectives has been made to elicit the most representative and relevant metrics. The main project targets included in the set of KPIs at CREW level are:

- Participation and enrolment in the community.
- The energy performance and self-generation
- The energy costs and economic savings
- The CREW RES uptake
- The impact outside the communities by means of the follower communities.

The set of metrics has been described both verbally and mathematically and will be deployed in the CREWs at the last phase of the eCREW project. The KPIs have been selected under the following principles:

- Input data is available, either at the LC metering database, the app data and the LC CAEs themselves.
- Easy calculation. The metrics are easy to calculate and report as they are direct count or based on aggregated or averaged individual values reported by the app to the CREW members.
- Data collection burden is minimised since most data is automatically updated on regular basis into the app database. Other than that, the frequency of data capturing is limited to twice along the project (baseline and end of the project), or on demand (to measure the participation impact of a collective action or activity).
- The KPI set provides a holistic view of the impacts intended by the CREW roll-out at every LC.
- The KPI list respects the data privacy of the CREW members since no individual-related data is provided.

Finally, this set of metrics has to be revised and deployed at every CREW setting up the reporting and reaction procedures to deviations.

6.1 Next steps

At the beginning of task T5.3 “Quantification of the KPIs and business model indicators” in M28 a revision of the proposed KPI list will be made, looking at the available data, the calculation procedures and difficulties and the reporting issues. Changes may be made to add or remove KPIs, always maintaining the balance of impacts and ensuring the project targets are monitored. No major changes are expected, nevertheless.

With the confirmed list of KPIs, a baseline or fist-time measurement of all KPIs will be made, developing the calculation algorithms and solving the procedure issues. A scoreboard will be created and updated regularly with regular KPI measurements. KPIs may be disaggregated into components on demand to find out the reasons of variations and deviations. Corrective and mitigation actions will be proposed according to the PDCA methodology.

7. References

[1] R. Moen and C. Norman, "Evolution of the PDCA Cycle," *Society*, 2009.
[2] EVO, "International Performance Measurement and Verification Protocol," 2012.
[3] L. C. Braga, A. R. Braga, and C. M. P. Braga, "On the characterization and monitoring of building energy demand using statistical process control methodologies," *Energy Build.*, 2013, doi: 10.1016/j.enbuild.2013.05.002.