persist

positive energy districts
driven by citizens

## Deliverable 5.2

# ASSESSMENT PROTOCOL for

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DUT Driving Urban Transitions

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# Executive Summary

The present deliverable, D5.2 - Assessment Protocol, establishes the framework through which the PERSIST consortium will carry out the assessment of all demonstration actions developed across the various Living Labs involved. It outlines the associated KPI system and the management process for all sensitive data required for accurate assessment. Additionally, it includes a section explaining the importance of Gender Mainstreaming and Gender Analysis of data, along with guidance for their proper application.

Likewise, this document is intended to serve as an exportable protocol for any EDP currently under development or planned for the future. To this end, it proposes a flexible KPI and evaluation system adaptable to different scales. The objective is to ensure applicability across diverse cases, taking into account specific goals, contextual characteristics, and other distinguishing factors.

The document begins by contextualizing the topic, explaining what an EDP is, its strategic objectives, and its fundamental characteristics. Once the application scenario is defined, it highlights the importance of having a common protocol as a tool to ensure that the transition process aligns with shared objectives and enables the development of comparable scenarios over time. This comparability is essential for gaining a comprehensive understanding of the changes achieved and the impacts generated. The introductory section concludes by outlining the structure of the document to enhance readability, usability, and operational effectiveness.

The document then presents the designed KPI system, detailing its development process, which draws upon relevant literature, the diverse expertise of the consortium partners, and insights gathered through online exchange sessions. Before introducing each KPI individually, the structure and applicability of the KPIs are clarified, and the KPI sheet—created to formalize each indicator—is described. This sheet is designed to synthesize all essential information, ensuring ease of application and practical use. Prior to the detailed presentation of the KPIs, the document explains the rationale behind the integration of gender equality considerations throughout the design process. It outlines how gender perspectives are embedded transversally and how data should be managed and assessed to prevent gender blindness.

Finally, the KPI Cards are included, organized by level of application—[PED, Living Lab, Project]—and by category.

Given the handling of sensitive data, particularly in relation to social indicators, the document concludes with a section dedicated to defining a common Data Monitoring System. Except where specific local regulations apply, this system will be implemented across all NSPs. This section outlines the procedures for monitoring, generating, processing, collecting, and disseminating data during project demonstration activities and stakeholder engagement, including citizens.

It also details how data will be made accessible for verification and reuse, as well as the protocols for data retention and preservation following the conclusion of the project.

In addition, the Data Management System outlines the standards to be followed—including compliance with European obligations—and specifies how research data will be retained. It also identifies which datasets will be made available as open access for verification and potential reuse.

# ABBREVIATION

| | |
|---|---|
| **EDP** | Positive Energy District |
| **PEN** | Positive Energy Neighbourhood |
| **SET** | European Strategic Energy Technology |
| **TEET** | European Strategic Energy Technology Plan |
| **KPI** | Key Performance Indicator |
| **EIGE** | European Institute for Gender Iquality |
| **FAIR** | Findable, Accessible, Interoperable, Reusable |

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# 1. Contextualisation

According to the widely discussed and recognized SDP Framework proposed by the EDP Programme Directorate, an EDP/NSP is defined as follows:

*Positive Energy Districts are energy-efficient and energy-flexible urban areas or groups of connected buildings which produce net zero greenhouse gas emissions and actively manage an annual local or regional surplus production of renewable energy. They require integration of different systems and infrastructures and interaction between buildings, the users and the regional energy, mobility and ICT systems, while securing the energy supply and a good life for all in line with social, economic and environmental sustainability*.

In this context, an EDP is considered a district with zero net CO2 emissions, working towards a surplus of annual local renewable energy production in pursuit of a just energy transition.

However, the SDPs are characterised by a **comprehensive approach** that includes technological, spatial, regulatory, financial, legal, environmental, social and economic perspectives. Under this approach, it is strategic to develop them in a framework of **open innovation**, driven by local administrations in cooperation with the business sector and investors, the world of research, citizen organizations and the citizens themselves as entities that use and transform all urban space.

In this scenario, in the framework of the PERSIST [Positive Energy Districts driven by citizens] project, the present *Protocol for the Evaluation of* PEDs is proposed, aimed at facilitating their implementation as a key element of an integrally sustainable urban development.

The PERSIST project involves **7 Living Labs** [Lucerne, Winterthur, Pamplona, Alba Iulia, Verdal, Riga, Lisbon] which, although at different stages of development, are working towards a transition of neighbourhoods in different European cities towards becoming PEDs.

The different Living Labs have developed tools and techniques that they exchange in order to broaden their experimentation scenario in order to strengthen them, validate them and ensure their replicability.

Specifically, work is carried out among the 3 most established Living Labs, with the remaining 4 test sites being considered. All offer access to the homes, neighbourhoods, workplaces and leisure infrastructures where the research will be carried out.

Living Labs

- Lucerne. Swizerland
- Pamplona. Spain
- Alba lulia. Romania

Test sites

- Winterthur. Swizerland
- Verdal. Norway
- Riga. Latvia

- Lisbon. Portugal

With a view to replicability, this Protocol is configured as a strategic tool that will be experimented and tested within the framework of the project in order to fine-tune it. The importance of the Protocol lies in a number of key aspects:

- Develop, implement and disseminate a common monitoring and evaluation framework that, while respecting local differences, seeks to ensure that each EDP achieves the strategic objectives that characterise it, involving the specific ones that may occur in different contexts.
- Avoid limiting SDPs to technological aspects, and incorporate spatial, regulatory, legal, financial, social and economic perspectives.
- Set up a process of monitoring and evaluation of EDP pilot projects in order to share and systematise knowledge, tools and techniques useful for their implementation.

The development of guidelines for systemic and standardised monitoring and evaluation of SDPs is essential to ensure high quality monitoring, including data measurement, collection, processing, evaluation and storage.

## 2. Why this Assessment Protocol

*Positive Energy Districts and Neighbourhoods for Sustainable Urban Development* are considered a key tool in the framework of the *European Strategic Energy Technology (SET) Plan* which has been revised in 2023 through the *COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on the revision of the Strategic Energy Technology (SET) Plan* [COM/2023/634 final].

In today's globalised world, cities, as vital centres of production and exchange of goods, people and knowledge, are the main consumers of energy and account for more than 70% of global CO2 emissions. In this scenario, urban areas represent the primary drivers of climate change, as their activities are the main sources of GHG emissions.

It is therefore key that cities, **individually and in a coordinated manner**, take strong action to set the agenda for a sustainable future.

To drive this change, in 2018, the Smart Cities Implementation Working Group of the European Strategic Energy Technology Plan [SET-Plan] proposes to go beyond the simple scope of carbon neutrality and proposes that the transition process turns urban environments into PED/PENs by acting at district and neighbourhood level.

For this reason, defining a common framework for the SDPs, outlining the issues to be taken into account and their monitoring and evaluation system, is considered strategic. The NSPs are currently **experimental scenarios** and only the evaluation of their impact can contribute to improve the model and ensure that this way of moving towards global sustainability in a fair way is standardised and extended.

Hence the desire to generate this document in the framework of the PERSIST project where, as mentioned above, different Living Labs and testing sites linked to PENs are involved. Living Labs and places that interact with each other and experiment in different contexts.

## 3. Document's structure

This document describes the System of Key Performance Indicators, designed among different actors from different European countries, its usefulness and its design process.

A total of 51 KPIs have been defined and organised into the following 7 categories:

1. Technology
2. Social
3. Policy
4. Envirnonment
5. Energy
6. Economic
7. Dissemination and Communication

For each KPI, useful characteristics have been defined to facilitate its applicability. In particular:

- Category
- Level [PED, PROJECT. Living Lab].
- KPI Name
- Description
- Scale [Building, District] Scale [Building, District] Scale [Building, District] Scale
- Unit
- Calculation
- KPI reporting frequency
- Baseline needed?

These characteristics are specified in a tab per KPI. The sheets are distinguished by Level and, within each Level, by Category. The 51 sheets close the part of the document relating to the evaluation system itself.

The fiches are distinguished according to the level of application and, within each level, by different colours according to the reference category.

| NIVEL: PED | | | | | | |
|---|---|---|---|---|---|---|
| TECHNOLOGY | | | | | | TE-01 |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | | | | | | |
| DESCRIPTION | | | | | | |
| SCALE | Building | | | District | | |
| UNIT | | | | | | |
| CALCULATION | | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Yearly | At the end | After every activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

*Figure 1. KPI sheet example*

As many KPIs involve the management of sensitive data, the Protocol includes the Data Monitoring System where the procedure to be taken into account, according to ethical and normative entities in each context, to ensure a correct and common data management, is included.

# 4. System of Key Performance Indicator [KPI] for PED

A KPI system is a set of quantifiable data useful for tracking and measuring progress towards specific goals and objectives. KPIs help stakeholders involved in SDP development to identify what is working, as well as what needs to be improved, by measuring progress and level of impact, assessing whether and to what extent pre-set results are being achieved.

They also enable and facilitate the process of data-driven decision-making. By basing decisions on data, it is possible to reduce the risk of making decisions based on assumptions or preconceived or out-of-context ideas. In addition, they can improve communication and collaboration between different stakeholders by providing a common language and framework for discussion and consensus building.

On the other hand, KPIs help to identify strengths and weaknesses and to plan actions that enhance the former and counteract the latter, thus facilitating a continuous improvement process.

The System of Key Performance Indicators designed is proposed as a broad common reference framework. Not all KPIs will be applicable in every context where the relevant ones will be selected on the basis of specific objectives, processes and projects or other constraints.

## KPI DESCRIPTION

The KPI system is articulated according to the 4 levels of application mentioned above [EDP, Living Lab, Project, All]. This structure facilitates their application depending on the characteristics and objectives of each EDP.

As can be seen in the graph below, the KPIs associated with each level differ in number, with the majority being associated with the SDPs [34]. These are considered the framework indicators, although not all of them are of mandatory applicability in each context. At project level there are 11 indicators, at Living Lab level 5 and at all 3 levels simultaneously, only 1 KPI.

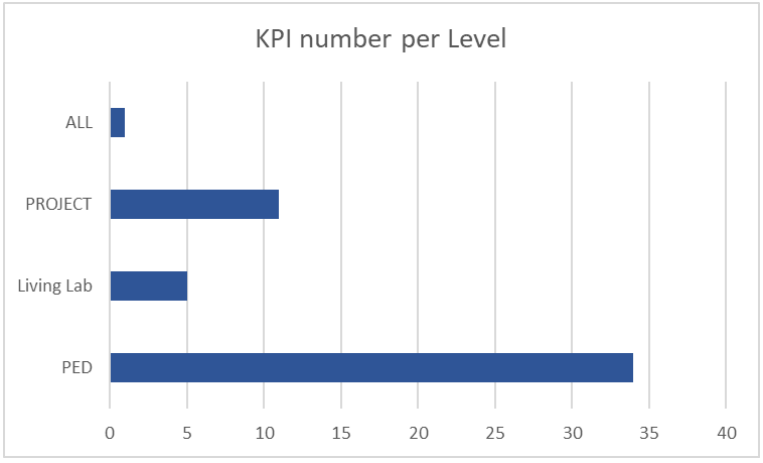


*Figure 2. KPI number per Level*

If we analyse the distribution of KPIs by level and category, we can see that at the PED level, all categories are included except for Dissemination and Communication, with more weight given to indicators related to energy issues. At the Living Lab level, only social indicators are related, as this structure is in charge of coordinating open

innovation and interaction with the different stakeholders. Likewise, the Dissemination and Communication Category only affects the Project level, with the related activities being linked to specific actions. The graph below shows the distribution of KPI categories by level of application.

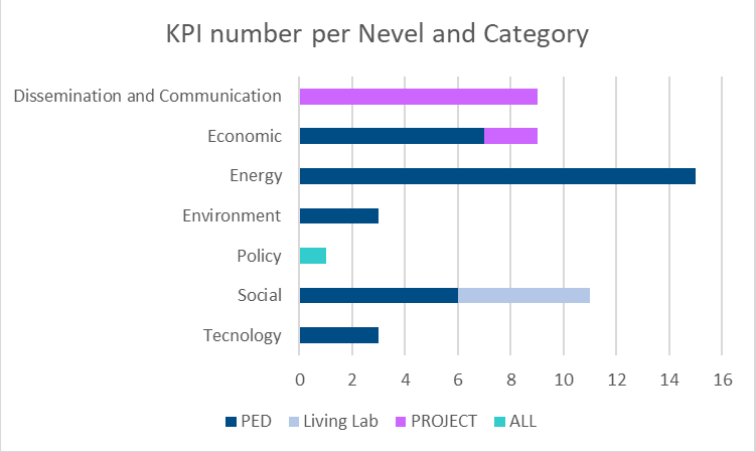


*Figure 3. KPI number per Nevel and Category*

On the other hand, the proposed KPI system aims to cover the integral dimension of an EDP. Hence the diversity of the evaluation categories defined. However, given the framework objectives of the EDPs, each category has a specific weight within the set [number of associated KPIs].

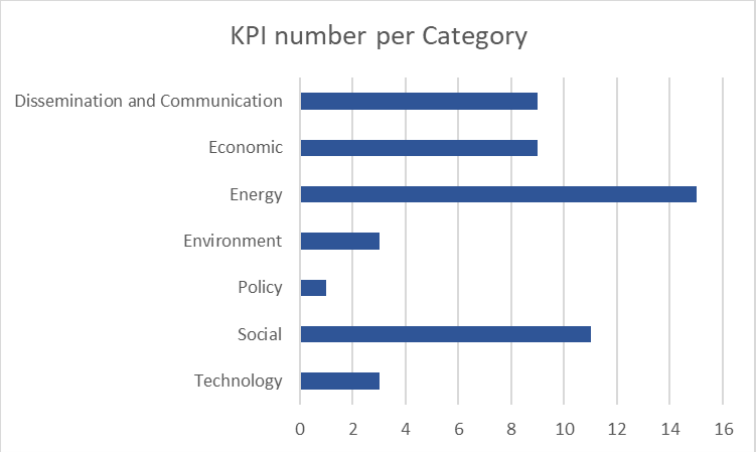


*Figure 4. KPI number per Category*

As can be seen, and in line with the central objective of an SDP, energy issues are the most important. This is followed by social, economic, dissemination and communication issues. In terms of economic aspects, these are key to assessing the level of commitment of each context to a just energy transition and to ensure proper financial management to guarantee sustainability and evolution over time. The social, dissemination and communication aspects are strictly linked to each other and are of strategic importance if the aim is to actively involve local citizens. An aware, informed and committed citizenry.

The environmental and technical aspects, partly implicit in the energy aspects, together with the political aspects, are less present

The aspects assessed for each category are briefly specified below.

**1. Technology**. Category that evaluates technical and technological aspects related to their application in buildings or at district level and that enhance energy efficiency and smart management.

**2. Social**. This category evaluates the level of involvement of the different stakeholders, the innovation in the co-creation processes and the impact on improving the quality of life and the level of energy autonomy of citizens.

**3. Policy**. Category that assesses the political commitment to the implementation of the SDGs, analysing the relevant legislation or regulations.

**4. Environment**. Category that evaluates the environmental impact in terms of emissions, in addition to analysing aspects related to demand, energy storage and scalability of solutions.

**5. Energy**. Category that evaluates aspects related to energy management at district level - production, consumption, flexibility, storage -, the energy efficiency of buildings and related savings, the involvement of citizens through the creation of Energy Communities and projects they promote to advance towards the EDP.

**5. Economical**. Category assessing the economic impact of the EDP in terms of business creation, jobs and public and/or private investments in renewable energy, including new democratic models of local energy exchange.

**6. Dissemination and Communication**. Category assessing the impact of social networks of all stakeholders involved, the number of communication tools and actions developed and their impact, scientific publications related to the energy transition process.

As can be seen, and will be shown through the list of KPIs and the associated factsheets, the categories are not only varied, but also interlinked, strengthening the holistic vision that an SDP should pursue.

## Design Process

The design process of the KPIs presented in this document has been designed following a scientific procedure articulated in several stages.

**Documentary analysis**. Identification of European reference projects in the field of EDP and selection of Deliverables and/or scientific articles of interest in the field of KPI. This search was carried out among different partner entities of some of the Living Labs involved in the PERSIST project. Specifically, the following 5 projects have been identified.

- ATELIER. https://smartcity-atelier.eu/
- Making City. https://makingcity.eu/
- POCITYF. https://pocityf.eu/
- SPARK. https://international-partnerships.ec.europa.eu/policies/programming/projects/spark-change-climate-justice_en
- VITALISE. https://vitalise-project.eu/

For each of these projects, the documents listed in the following table have been studied in detail.

| PROJECT | DOCUMENT |
|---|---|
| **ATELIER** | University of Deusto, Amsterdam University of Applied Science, Paul Scherrer Institute, 2020. *Deliverable 9.1: Repository of definitions of terms, key characteristics archetypes, and a set of KPIs* |
| **Making City** | Jussi Rönty (VTT), Klaus Känsälä (VTT), Samuli Rinne (OUKA), Jasper Tonen (GRO), Cecilia Sanz-Montalvillo (CAR), Cristina de Torre (CAR), Carla Rodríguez (CAR) Joram Nauta (TNO), Sophie Dourlens-Quaranta (R2M). 2029. *D5.1 - City Level Indicators* |
| **POCITYF** | Komninos Angelakoglou, Nikos Nikolopoulos, Paraskevi Giourka, Inger-Lise Svensson, Panagiotis Tsarchopoulos, Athanasios Tryferidis and Dimitrios Tzovaras. 2019. *A Methodological Framework for the Selection of Key Performance Indicators to Assess Smart City Solutions*. Smart Cities 2019, 2, 269-306. |
| **SPARK** | Aristotelis Ntafalias, Giorgos Papadopoulos, Panagiotis Papadopoulos and Aapo Huovila. 2022. *A Comprehensive Methodology for Assessing the Impact of Smart City Interventions: Evidence from Espoo Transformation Process*. Smart Cities 2022, 5, 90-107. |
| **VITALISE** | Panagiotis Kartsidis (AUTH), Alexandra Anagnostopoulou (AUTH), Despoina Petsani (AUTH), Sylvie Bernaerts (LICALAB), Teemu Santonen (LAUREA). 2021. *D1.2 First version of Ethics and Safety* |

*Table 1. References Project/Document for KPI*

Different partners of a previous European project linked to the EDPs have analysed these documents in depth according to their area of specialisation, which has led to the definition of a first list of categories of interest and related KPIs.

**2. Contrast and validation**. This process has been developed by alternating the exchange of comments on the KPI base document with online working sessions to exchange views and knowledge and reach consensus.

Specifically, 5 rounds of comments were made, 3 of which were internal to one of the Living Labs involved in PERSIST and 2 within the framework of the PERSIST project itself. In this phase, many comments have been agreed and closed, and the remaining ones have been worked on in online co-creation sessions. A total of 3 sessions were held.

This process is complemented by the internal work of the KPI design leadership team, which has also alternated between exchanges on the document itself and co-creation sessions to reach the final version.

Finally, this latest version has been shared again with all the partner organisations for final validation.

Apart from the references indicated above and the work of exchange between different experts in different areas of knowledge, the design of the KPIs has taken into account the characteristics that a KPI must have in order to be effective and viable. The indicators do not necessarily have to meet all the characteristics, but they must guarantee their efficiency and effective usefulness. A KPI must be.

- **Specific**: It must be clear, precise and measure a specific aspect.
- **Measurable**: It should be quantifiable, either with available data or with data to be collected through qualitative techniques.
- **Achievable**: Measurement information has to be accessible and reliable.

- **Relevant**: It must be aligned with strategic objectives, it must be useful for decision making and performance improvement.
- **Time-bound**: A deadline should be assigned for measuring, monitoring and evaluating progress.

These characteristics have guided the final selection of KPIs that are intended to be effective and replicable in any context where an EDP is implemented.

## KPI. Data Sheet

The information related to each KPI, which is necessary for its application in the monitoring and evaluation process, has been structured in a Worksheet which is proposed as an operational tool to facilitate the use of the proposed system.

The fiche structures all the characteristics listed in point 3 of the Protocol and specified below.

**Code**. This is an alphanumeric code that identifies each KPI by specifying its category of membership - two capital letters of the category name - and its progressive number within the category. Letters and numbers are separated by a hyphen

- TE-No. Technology
- SO-Social No.
- PO-No. Policy
- EV- No. Environment
- EG-No. Energy
- EC-No. Economic.
- CD-Nº. Dissemination and Communication

**Category**. Specifies the category to which each KPI belongs in order to facilitate its eligibility and relevance in each context.

**Level** Specifies at which level each KPI impacts, thus guiding its application and the data to be taken into account in each case. Each KPI can operate at more than one level

- EDP
- Living Lab
- Project
- All

**KPI Name**. Name of each KPI that facilitates the reading and selection process by providing a first description of the content.

**Description**. Describes the KPI in more detail to facilitate its understanding and eligibility. Where appropriate, the level of disaggregation of the data is also indicated.

**Scale**. Indicates whether the indicator is applicable at building or urban scale.

- Building
- District

**Unit**. Specifies the unit of measurement for each KPI, which can be the result of a qualitative technique such as a survey. Unifying the units of measurement facilitates the exchange between different SDPs and enables comparability.

- %
- % per ~~sex~~ gender
- NO.
- Range
- MWh/Year
- KWh/Year
- No/total
- Ton CO2/Year
- PT/Year
- M€
- In absolute terms
- KWh/m2/Year
- No. per Type owners
- % out total

**Calculation**. It indicates the way in which each KPI is to be calculated, which can be either quantitative or qualitative, depending mainly on the category to which it belongs.

**KPI reporting frequency**. Specifies at which moment or moments in the development of the process each specific KPI must be applied. Also in this case there are KPIs that are applied at different times.

- At the beginning
- Monthly
- Annually
- Yearly
- At the end
- After every activity

**Baseline**. If necessary or appropriate, a starting point is indicated to guide the monitoring and subsequent evaluation process in a quality manner.

- Yes
- No mandatory
- No

As mentioned above, the cards are divided by level of application and, within each level, by category. The different categories are differentiated by colour.

## Gender Mainstreaming

The European Institute for Gender Equality [EIGE] defines **Gender Mainstreaming** as a *Systematic consideration of the differences between the conditions, situations and needs of **women and men** in all policies and actions*. [https://eige.europa.eu/publications-resources/thesaurus/terms/1070]

The ultimate goal of Gender Maistreaming is to achieve effective equality between women and men. This is why it is clearly committed to systematically recording the gender-differentiated impacts of policies, programmes and projects. This recording, through a rigorous segregation of data by sex, is fundamental to carry out a gender analysis, which is what makes it possible to reveal the dependence of structural gender inequalities on socially, politically and culturally constructed stereotypes. This analysis

is the only tool for defining measures and actions to counteract gender inequalities instead of reinforcing them as happens, consciously or unconsciously, when research applies an androcentric, gender-blind approach that "forgets" and "hides" more than half of the world's population.

With regard to energy issues, EIGE points out that: *Women and men contribute differently to the causes of climate change. Individual carbon footprints are a product of gendered roles, responsibilities and identities* [https://eige.europa.eu/gender-mainstreaming/toolkits/gender-responsive-evaluation-greena/tool-8/step-1/specific-objective-i]

This scenario is the result of existing differences in the way women and men go about their daily lives and in the choices that accompany them. In particular, decisions in terms of mobility, energy use, consumption choices and sustainable behaviours are not equal by gender and determine differential impacts. Thus, women and men contribute differently to greenhouse gas emissions and energy savings.

Likewise, the impacts on both sexes are differential in view of the chronic situation of women's inferiority in terms of access to resources and rights on equal terms with men.

Therefore, in view of the framework objectives of the SDPs, their evaluation should be structured in such a way that the following points can be taken into account:

- Detect whether women's and men's contributions to production and emission reductions are taken into account by analysing their energy use behaviour, mobility patterns and consumption behaviour.
- Record data to detect possible differences between women and men in the impact of measures to improve energy efficiency and promote renewable energies.
- Assess whether the energy transition process considers women as agents of climate action and whether their specific capacities are taken into account when leading behavioural changes towards achieving the SDP.
- Ensure a balanced participation of women and men in all consultations, co-creation spaces and actions that may be held in relation to energy or mobility infrastructures.

This requires the identification of relevant data to provide a picture of the gender equality situation in a given context and that all these data, which directly or indirectly affect individuals, are disaggregated by sex. Other variables of interest in terms of age, income level, etc. need to be cross-referenced, as gender imbalances are reproduced in each of these variables.

This level of disaggregation is the fundamental basis for carrying out an accurate **gender analysis**, which EIGE, in accordance with the European Commission, defines as: '*the study of differences in the conditions, needs, participation rates, access to resources and development, control of assets, decision-making powers, etc., **between women and men** in their assigned gender roles* [https://eige.europa.eu/gender-mainstreaming/tools-methods/gender-analysis].

Gender analysis, aimed at identifying and addressing gender inequalities, has to apply an approach that allows for a gender-based approach:

- Uncover the differences between women and men, and their dependence on the unequal distribution of resources, opportunities and power;
- Define measures to clearly identify the different needs of women and men in order to address them at all stages of the transition process towards an SDP.
- Take into account and show that policies, programmes and projects can have different effects on women and men;
- Empower women and promote their socio-political participation, visualising and strengthening their engagement in community life.

There are different frameworks for conducting a proper gender analysis. The most commonly used frameworks are compiled below as a basis for cross-cutting application in the EDP evaluation process.

| | DOCUMENT |
|---|---|
| **1** | Caroline Moser. 1993. *Gender Planning and Development: Theory, Practice and Training*. Routledge, New York |
| **2** | Caren Levy. 1996. *The process of institutionalising gender in policy and planning: The "web" of institutionalisation*, Working Paper No 74, University College London, London. |
| **3** | United Nations Development. 2001. *Programme, Gender in development programme - Learning & information pack*. |
| **4** | Naila Kabeer. 1994. *Reversed realities - Gender hierarchies in development thought*, Verso, London. |
| **5** | Swedish Gender Mainstreaming Support Committee (JämStöd), 2007. *Gender mainstreaming manual - A book of practical methods from the Swedish Gender Mainstreaming* Support Committee, Stockholm, 2007. |
| **6** | Viviene Taylor. 1999. *A Quick Guide to Gender Mainstreaming in Development Planning*. Commonwealth Secretariat, London. |

*Table 2. References Document to perform a Gender Analysis*

# KPI. List

| NEVEL: **PEN** | |
|---|---|
| TECHNOLOGY | |
| **TE-01** | IoT devices, smart electrification technologies, and building optimisation solutions |
| **TE-02** | Smart City Index Progress |
| **TE-03** | Smart readiness |
| SOCIAL | |
| **SO-01** | Percentage of identified stakeholders to be involved vs stakeholders involved |
| **SO-02** | Reduction of Population at risk of poverty and social exclusion |
| **SO-03** | Energy poverty reduction |
| **SO-04** | Investments in PED Projectts from energy surplus sharing proceeds (community benefits) |
| **SO-05** | Improvement of users' quality of life out of the total number of inhabitants of the neighbourhood |
| **SO-06** | Access to energy |
| ENVIRONMENTAL | |
| **EV-01** | Primary energy demand and operational demand reduction during use phase (energy savings) |
| **EV-02** | Number of solutions for scale-up |
| **EV-03** | Reduction GHG emissions and environmental impacts |
| ENERGY | |
| **EN-01** | Renewable energy production total and by type of source (biomass, PV, thermal, etc) |
| **EN-02** | Renewable energy consumption total and by type of source (biomass, PV, thermal, etc) |
| **EN-03** | Flexibility of load in PED |
| **EN-04** | Grid reliability |
| **EN-05** | Accuracy of building heating and electric load forecasting |
| **EN-06** | Accuracy of flexibility available |
| **EN-07** | Local energy storage |
| **EN-08** | Number of local community-driven energy Projectts and programs |
| **EN-09** | Number of Projectts related to support PED development |
| **EN-10** | Final customers profiles |
| **EN-11** | Home Energy Efficiency Ratings |
| **EN-12** | Local energy markets, P2P and/or P2X platforms for energy sharing and trading |
| **EN-13** | Ownership of the infrastructure |
| **EN-14** | Grid capacity |

| | |
|---|---|
| **EN-15** | Grid operatos (TSO-DSO) coordination |
| ECONOMIC | |
| **EC-01** | New business established within district related to PED development |
| **EC-02** | Number of new job positions related to the development of the PED |
| **EC-03** | Number of possible business models proposed for PEDs |
| **EC-04** | Quantity of energy shared in Markets (P2P, grid, etc) KWh per type of sharing/ selling mode |
| **EC-05** | Investment in RES |
| **EC-06** | Public and private investment levels in grid upgrades |
| **EC-07** | "ROI (Return on Investment)over the PEN system lifetime (hypothesis for possible business plans) |
| NEVEL: **Living Lab** | |
| SOCIAL | |
| **SO-01** | Activities organized by the Living Lab per year involving the different type of stakeholders |
| **SO-02** | "Range of co-creation tools used when implementing energy transitions in neighbohoods |
| **SO-03** | Number of people involved in the different activities of the Projectt/PED (workshops, events, etc) |
| **SO-04** | Assessment of co-creation and engagement activities and workshops by the participants (establishment of an average score) |
| **SO-05** | Increase of energy awareness in the neighbourhood |
| NEVEL: **PROJECTT** | |
| ECONOMIC | |
| **EC-01** | SMEs activated by the Projectt |
| **EC-02** | Innovation clusters connected with PERSIST |
| DISSEMINATION and COMMUNICATION | |
| **DC-01** | Projectt Website |
| **DC-02** | Social Media |
| **DC-03** | Partner's Social Media Channels |
| **DC-04** | Communication Material - flyer, rollups, postcard campaign<br>No sexist language" |
| **DC-05** | Share & Connect Newsletter |
| **DC-06** | Press releases & op-eds, news & blogs |
| **DC-07** | Scientific publications |
| **DC-08** | Events (Participation & Organisation) |
| **DC-09** | Video Campaign |
| NEVEL: **ALL** | |
| POLICY | |
| **PO-01** | Number of policy recommendations / guides related to establishment/development of the PED |

| NEVEL: **PEN** | |
|---|---|
| **Number of Category** | **5** |
| **Number of KPI** | **34** |
| **NUEMBER OF KPI PER CATEGORY** | |
| TECHNOLOGY | **3** |
| SOCIAL | **6** |
| ENVIRONMENTAL | **3** |
| ENERGY | **15** |
| ECONOMIC | **5** |

<table>
<tr><th colspan="7">LEVEL: PED</th></tr>
<tr><td>TECHNOLOGY</td><td colspan="4"></td><td colspan="2">TE-01</td></tr>
<tr><td>LEVEL</td><td colspan="2">PED</td><td colspan="2">Living Lab</td><td colspan="2">Project</td></tr>
<tr><td>KPI NAME</td><td colspan="6">IoT devices, smart electrification technologies, and building optimisation solutions</td></tr>
<tr><td>DESCRIPTION</td><td colspan="6"></td></tr>
<tr><td>SCALE</td><td colspan="3">Building</td><td colspan="3">District</td></tr>
<tr><td>UNIT</td><td colspan="3">Number</td><td colspan="3"></td></tr>
<tr><td>CALCULATION</td><td colspan="6">Total number per type of device</td></tr>
<tr><td>REPORTING FREQUENCY</td><td>At the beginning</td><td>Monthly</td><td>Annually</td><td>Before renovation</td><td>At the end</td><td>After every Intervention or activity</td></tr>
<tr><td>BASELINE</td><td colspan="2">YES</td><td colspan="2">NOT MANDATORY</td><td colspan="2">NO</td></tr>
</table>

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| TECHNOLOGY | | | | | | **TE-02** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Smart City Index Progress | | | | | |
| DESCRIPTION | Local area's progress using IMD's Smart City Index 2023 or EU's Smart City Guidance Package | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Percentage and/or Score | | | % Score | | |
| CALCULATION | Use either the IMD Smart City Index or EU Smart City Guidance Package scoring. If using the IMD Index, track changes in key indicators (e.g., infrastructure, technology, governance). If using the EU Guidance Package, use its scoring framework to assess progress. | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |



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| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| TECHNOLOGY | | | | | | **TE-03** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Smart readiness | | | | | |
| DESCRIPTION | Number of smart meters vs number of total meters | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Percentage | | | % | | |
| CALCULATION | Number of smart meters/number of total meters | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

<table>
<tr><th colspan="7">LEVEL: PED</th></tr>
<tr><td>SOCIAL</td><td colspan="5"></td><td>SO-01</td></tr>
<tr><td>LEVEL</td><td colspan="2">PED</td><td colspan="2">Living Lab</td><td colspan="2">Project</td></tr>
<tr><td>KPI NAME</td><td colspan="6">Percentage of identified stakeholders to be involved vs stakeholders involved</td></tr>
<tr><td>DESCRIPTION</td><td colspan="6">Percentage of stakeholders involved at the end of the Projectt out of the number of actors identified at the beginning of the Projectt through the sociogram study.</td></tr>
<tr><td>SCALE</td><td colspan="3">Building</td><td colspan="3">District</td></tr>
<tr><td>UNIT</td><td colspan="3">Percentage disaggregated by sex</td><td colspan="3">% per sex</td></tr>
<tr><td>CALCULATION</td><td colspan="6">Number of identified stakeholders reached/ Number of identified stakeholders) *100</td></tr>
<tr><td>REPORTING FREQUENCY</td><td>At the beginning</td><td>Monthly</td><td>Annually</td><td>Before renovation</td><td>At the end</td><td>After every Intervention or activity</td></tr>
<tr><td>BASELINE</td><td colspan="2">YES</td><td colspan="2">NOT MANDATORY</td><td colspan="2">NO</td></tr>
</table>

<table>
<tr><th colspan="7">LEVEL: PED</th></tr>
<tr><td>SOCIAL</td><td colspan="4"></td><td colspan="2">SO-02</td></tr>
<tr><td>LEVEL</td><td colspan="2">PED</td><td colspan="2">Living Lab</td><td colspan="2">Project</td></tr>
<tr><td>KPI NAME</td><td colspan="6">Reduction of Population at risk of poverty and social exclusion</td></tr>
<tr><td>DESCRIPTION</td><td colspan="6">Reduction of Population at risk of poverty and social exclusion.</td></tr>
<tr><td>SCALE</td><td colspan="3">Building</td><td colspan="3">District</td></tr>
<tr><td>UNIT</td><td colspan="3">Percentage disaggregated by sex</td><td colspan="3">% per sex</td></tr>
<tr><td>CALCULATION</td><td colspan="6">Calculating number of women and man that receive an Income Guarantee Allowance</td></tr>
<tr><td>REPORTING FREQUENCY</td><td>At the beginning</td><td>Monthly</td><td>Annually</td><td>Before renovation</td><td>At the end</td><td>After every Intervention or activity</td></tr>
<tr><td>BASELINE</td><td colspan="2">YES</td><td colspan="2">NOT MANDATORY</td><td colspan="2">NO</td></tr>
</table>

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| SOCIAL | | | | | | **SO-04** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Investments in PED Projectts from energy surplus sharing proceeds (community benefits) | | | | | |
| DESCRIPTION | Investments in PED Projectts from energy surplus sharing proceeds (community benefits) | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Euros/year Projectt | | | | | |
| CALCULATION | Money invested total and per year and Projectt | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

<table>
<tr><th colspan="7">LEVEL: PED</th></tr>
<tr><td>SOCIAL</td><td colspan="4"></td><td colspan="2">SO-05</td></tr>
<tr><td>LEVEL</td><td colspan="2">PED</td><td colspan="2">Living Lab</td><td colspan="2">Project</td></tr>
<tr><td>KPI NAME</td><td colspan="6">Investments in PED Projectts from energy surplus sharing proceeds (community benefits)</td></tr>
<tr><td>DESCRIPTION</td><td colspan="6">Improvement of inhabitants/users' quality of life; for LL's degree of success in the process of urban transformation towards climate neutrality</td></tr>
<tr><td>SCALE</td><td colspan="3">Building</td><td colspan="3">District</td></tr>
<tr><td>UNIT</td><td colspan="3">Percentage disaggregated by sex -age</td><td colspan="3">% per sex-age</td></tr>
<tr><td>CALCULATION</td><td colspan="6">Results from survey at two different stages of the Projectt (before and after intervention) and disaggregated by sex and age</td></tr>
<tr><td>REPORTING FREQUENCY</td><td>At the beginning</td><td>Monthly</td><td>Annually</td><td>Before renovation</td><td>At the end</td><td>After every Intervention or activity</td></tr>
<tr><td>BASELINE</td><td colspan="2">YES</td><td colspan="2">NOT MANDATORY</td><td colspan="2">NO</td></tr>
</table>

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| SOCIAL | | | | | | **SO-06** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Access to energy | | | | | |
| DESCRIPTION | Percentage of the local population (disaggregated by sex) with access to electricity and clean fuels and technology for cooking. Analyse access based on socioeconomic or demographic factors | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Percentage disaggregated by sex | | | % per sex | | |
| CALCULATION | Ideas of how to calculate this? | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENVIRONMENTAL | | | | | | **EV-01** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Primary energy demand and operational demand reduction during use phase (energy savings) | | | | | |
| DESCRIPTION | Reduction by integrated digital design process ,by the optimization, the renovation of building envelopes and BTS by means of simulations and probably early roll-out of digital twins to achieve a significant reduction of primary energy demand. | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Percentage MWh per year | | | % MWh/yr | | |
| CALCULATION | Three different magnitudes will be used in order to calculate the primary energy demand reduction, and operational demand reduction.<br>First, a baseline is established from energy bills, pre renovation monitoring and possibly energy simulations (Epre).<br>Subsequently the theoretical reduction is calculated by means of energy simulations based upon the information of the technical Projectts (Eproj).<br>Finally, the actual reduction will be statistically inferred based upon monitoring data (Epost).<br>– PED or Building Reduction_proj=Eproj-Epre [MWh/yr]<br>– PED or Building Reduction_achieved=Epost-Epre [MWh/yr]<br>– PED or Building Reduction_proj%=(Eproj-Epre)/Epre (*) [%]<br>– PED or Building Reduction_achieved%=(Epost-Epre)/Epre (*) [%]<br><br>Boundaries: one year of the operation phase of the building (B6)<br>Method: Cumulative Energy Demand (for primary energy from demand)<br>Note: (*) use this formula only when the output is a reduction. | | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENVIRONMENTAL | | | | | | **EV-02** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Number of solutions for scale-up | | | | | |
| DESCRIPTION | Number of solutions extrapolated to other context | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number out the total | | | Nº/tot | | |
| CALCULATION | Number of solutions extrapolated to other context / total number of solutions developed | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |



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<table>
<tr><th colspan="7">LEVEL: PED</th></tr>
<tr><td colspan="5">ENVIRONMENTAL</td><td colspan="2">EV-03</td></tr>
<tr><td>LEVEL</td><td colspan="2">PED</td><td colspan="2">Living Lab</td><td colspan="2">Project</td></tr>
<tr><td>KPI NAME</td><td colspan="6">Reduction GHG emissions and environmental impacts</td></tr>
<tr><td>DESCRIPTION</td><td colspan="6">Reduction of GHG emissions and of all the impacts generated over a calendar year by the same activities included in the primary energy inside the PED boundaries.</td></tr>
<tr><td>SCALE</td><td colspan="3">Building</td><td colspan="3">District</td></tr>
<tr><td>UNIT</td><td colspan="3">Percentage tonnes CO2 per year<br>Percentage Pt per year</td><td colspan="3">% ton CO2e/yr<br>% Pt/yr</td></tr>
<tr><td>CALCULATION</td><td colspan="6">We shall compare the Carbon footprint of the operation of the building and of the PED vs the operation of the BAU (building and district) and baseline. We will do a hotspot analysis assessing the whole impact categories by using the single score<br><br>– CFReduction=CFBAU or baseline-CFPED [ton CO2e/y]<br>– CFReduction%=(CFBAU-CFPED)/CFBAU or baseline [%] (*)<br>– Imp_Reduction=Imp_BAU or baseline-Imp_PED [Pt/y]<br>– Imp_Reduction%=(Imp_BAU-Imp_PED)/Imp_BAU or baseline [%] (*)<br><br>Boundaries: 2 analysis: one year of the operation phase of the building and of the district(B6)<br>Note: (*) use this formula only when the output is a reduction.</td></tr>
<tr><td>REPORTING FREQUENCY</td><td>At the beginning</td><td>Monthly</td><td>Annually</td><td>Before renovation</td><td>At the end</td><td>After every Intervention or activity</td></tr>
<tr><td>BASELINE</td><td colspan="2">YES</td><td colspan="2">NOT MANDATORY</td><td colspan="2">NO</td></tr>
</table>

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-01** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Renewable energy production total and by type of source (biomass, PV, thermal, etc) | | | | | |
| DESCRIPTION | Renewable energy production total and by type of source (biomass, PV, thermal, etc) | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Kilowatt-hours per year | | | KWh/yr | | |
| CALCULATION | Renewable energy prouction total and by type of source (biomass, PV, thermal, etc) | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-02** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Renewable energy consumption total and by type of source (biomass, PV, thermal, etc) | | | | | |
| DESCRIPTION | Primary Energy consumption (renewable per type of source vs non-renewable) | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Kilowatt-hours per year | | | KWh/yr | | |
| CALCULATION | Total of Primary Energy Consumption per type of source and disaggregated by renewable and non-renewable | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-03** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Flexibility of load in PED | | | | | |
| DESCRIPTION | Achieved flexibility of electricity consumption | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Percentage | | | % | | |
| CALCULATION | E_consump_flexible_assets/E_consump_new_case [%] | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-04** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Grid reliability | | | | | |
| DESCRIPTION | Frequency and duration of power outages as well as response time for grid repairs and maintenance | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Percentage | | | % | | |
| CALCULATION | Calculate using SAIDI (System Average Interruption Duration Index) and SAIFI (System Average Interruption Frequency Index):<br>– SAIDI = Total Duration of Outages (minutes) / Total Number of Customers Served,<br>– SAIFI = Total Number of Outages / Total Number of Customers Served, Include response time for grid repairs. Use grid operator data for reporting. | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-05** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Accuracy of building heating and electric load forecasting | | | | | |
| DESCRIPTION | Accuracy of building heating and load forecasting is the error between virtual/ digital twin and real monitored data | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Percentage | | | % | | |
| CALCULATION | 100*∑(ABS(error(%)))/n (15-min) | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-06** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Accuracy of flexibility available | | | | | |
| DESCRIPTION | Accuracy of flexibility available (predicted/actual flexibility) | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Percentage | | | % | | |
| CALCULATION | 100*∑(ABS(error(%)))/n (15-min) | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-07** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Local energy storage | | | | | |
| DESCRIPTION | Local energy storage: total installed capacity and potential, by technology | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Kilowatt-hours | | | KWh | | |
| CALCULATION | Total energy storage in the district and per building | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-08** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Number of local community-driven energy projects and programs Local energy storage | | | | | |
| DESCRIPTION | | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | Nº | | |
| CALCULATION | Total number of Energy Ccommunity and number of project conducted by each (if possible) | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-09** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Number of projects related to support PED development | | | | | |
| DESCRIPTION | | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | Nº | | |
| CALCULATION | Total number | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

<table>
<tr><th colspan="7">LEVEL: PED</th></tr>
<tr><td>ENERGY</td><td colspan="5"></td><td>EN-10</td></tr>
<tr><td>LEVEL</td><td colspan="2">PED</td><td colspan="2">Living Lab</td><td colspan="2">Project</td></tr>
<tr><td>KPI NAME</td><td colspan="6">Final customers profiles</td></tr>
<tr><td>DESCRIPTION</td><td colspan="6">Total n.º of final customers out total of population (disaggregated by sex), broken down by household and non-household customers.<br>Please provide quantitative data on the average energy annual consumption per capita and per average household (in total and broken down by end-use), average annual energy-related expenditures per capita and per average household (either in absolute terms or in % of individual/household income/expenditures).</td></tr>
<tr><td>SCALE</td><td colspan="3">Building</td><td colspan="3">District</td></tr>
<tr><td>UNIT</td><td colspan="3">In absolute terms<br>Percentage of individual/household income/expenditures</td><td colspan="3">N<br>%º</td></tr>
<tr><td>CALCULATION</td><td colspan="6"></td></tr>
<tr><td>REPORTING FREQUENCY</td><td>At the beginning</td><td>Monthly</td><td>Annually</td><td>Before renovation</td><td>At the end</td><td>After every Intervention or activity</td></tr>
<tr><td>BASELINE</td><td colspan="2">YES</td><td colspan="2">NOT MANDATORY</td><td colspan="2">NO</td></tr>
</table>

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-11** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Home Energy Efficiency Ratings | | | | | |
| DESCRIPTION | Metrics for evaluating the efficiency of residential buildings | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Kilowatt-hours per square meters and year | | | KWh/m2/yr$^{o}$ | | |
| CALCULATION | From monitoring or invoices | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-12** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Local energy markets, P2P and/or P2X platforms for energy sharing and trading | | | | | |
| DESCRIPTION | Number of each | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number per type | | | Nº/type | | |
| CALCULATION | | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-13** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Ownership of the infrastructure | | | | | |
| DESCRIPTION | | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Percentage per type of ownership | | | %/type ownership | | |
| CALCULATION | Quantity of ownership per sector (private, public, community) / total ownership | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-14** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Grid capacity | | | | | |
| DESCRIPTION | | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Kilowatt-hours | | | KWh | | |
| CALCULATION | How to calculate it? | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ENERGY | | | | | | **EN-15** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Grid operators (TSO-DSO) coordination | | | | | |
| DESCRIPTION | | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Score | | | Score | | |
| CALCULATION | Measure the coordination between TSOs and DSOs by developing a scoring framework ( 1-5 scale) for coordination effectiveness based on:<br>1. Number of joint planning meetings per year,<br>2. Presence of data-sharing protocols,<br>3. Implementation of coordinated flexibility strategies | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ECONOMY | | | | | | **EC-01** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | New business established within district related to PED development | | | | | |
| DESCRIPTION | New business established within district related to PED development | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | Nº | | |
| CALCULATION | Total number of New business established within district related to PED development | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ECONOMY | | | | | | **EC-02** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Number of new job positions related to the development of the PED | | | | | |
| DESCRIPTION | Number of new job positions related to the development of the PED. Results disaggregate by sex and age and sector | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | Nº | | |
| CALCULATION | Number of new job positions related to the development of the PED. Results disaggregate by sex and age and sector | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ECONOMY | | | | | | **EC-03** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Number of possible business models proposed for PEDs | | | | | |
| DESCRIPTION | Number of new possible business models offerings support to development of PEDs | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | Nº | | |
| CALCULATION | Number of new possible business models offerings support to development of PEDs | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ECONOMY | | | | | | **EC-04** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Quantity of energy shared in Markets (P2P, grid, etc) KWh per type of sharing/ selling model | | | | | |
| DESCRIPTION | Quantity of energy shared in Markets (P2P, grid, etc) KWh per type of sharing/ selling mode | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Kilowatt-hours per year | | | KWh/yr | | |
| CALCULATION | KWh/year per type of sharing/ selling mode | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ECONOMY | | | | | | **EC-05** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Investment in RES | | | | | |
| DESCRIPTION | Investment in Renewable Energy Systems | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Millions of euros | | | M€ | | |
| CALCULATION | Total euros invested in RES | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PED** | | | | | | |
|---|---|---|---|---|---|---|
| ECONOMY | | | | | | **EC-06** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Public and private investment levels in grid upgrades | | | | | |
| DESCRIPTION | | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Millions of euros | | | M€ | | |
| CALCULATION | Total euros invested disaggregated by public and private | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

<table>
<tr><th colspan="7">LEVEL: PED</th></tr>
<tr><td>ECONOMY</td><td colspan="5"></td><td>EC-07</td></tr>
<tr><td>LEVEL</td><td colspan="2">PED</td><td colspan="2">Living Lab</td><td colspan="2">Project</td></tr>
<tr><td>KPI NAME</td><td colspan="6">ROI (Return on Investment)over the PEN system lifetime (hypothesis for possible business plans)</td></tr>
<tr><td>DESCRIPTION</td><td colspan="6">Increase of ROI over the PEN system lifetime</td></tr>
<tr><td>SCALE</td><td colspan="3">Building</td><td colspan="3">District</td></tr>
<tr><td>UNIT</td><td colspan="3">Percentage</td><td colspan="3">%</td></tr>
<tr><td>CALCULATION</td><td colspan="6">Current Value of Investment−Cost of Investment/−Cost of Investment</td></tr>
<tr><td>REPORTING FREQUENCY</td><td>At the beginning</td><td>Monthly</td><td>Annually</td><td>Before renovation</td><td>At the end</td><td>After every Intervention or activity</td></tr>
<tr><td>BASELINE</td><td colspan="2">YES</td><td colspan="2">NOT MANDATORY</td><td colspan="2">NO</td></tr>
</table>

| NEVEL: **Living Lab** | |
|---|---|
| **Number of Category** | **1** |
| **Number of KPI** | **5** |
| **NUEMBER OF KPI PER CATEGORY** | |
| SOCIAL | **5** |

<table>
<tr><th colspan="7">LEVEL: Living Lab</th></tr>
<tr><td>SOCIAL</td><td colspan="5"></td><td>SO-01</td></tr>
<tr><td>LEVEL</td><td colspan="2">PED</td><td>Living Lab</td><td colspan="2">Project</td><td></td></tr>
<tr><td>KPI NAME</td><td colspan="6">Activities organized by the Living Lab per year involving the different type of stakeholders</td></tr>
<tr><td>DESCRIPTION</td><td colspan="6">Number and types of co-creation and engagement activities per year involving the different types of stakeholders (via grid/ matrix)</td></tr>
<tr><td>SCALE</td><td colspan="3">Building</td><td colspan="3">District</td></tr>
<tr><td>UNIT</td><td colspan="3">Number</td><td colspan="3">Nº</td></tr>
<tr><td>CALCULATION</td><td colspan="6">Total number of activities conducted in a given year involving stakeholders</td></tr>
<tr><td>REPORTING FREQUENCY</td><td>At the beginning</td><td>Monthly</td><td>Annually</td><td>Before renovation</td><td>At the end</td><td>After every Intervention or activity</td></tr>
<tr><td>BASELINE</td><td colspan="2">YES</td><td colspan="2">NOT MANDATORY</td><td colspan="2">NO</td></tr>
</table>

<table>
<tr><th colspan="7">LEVEL: Living Lab</th></tr>
<tr><td colspan="5">SOCIAL</td><td colspan="2">SO-02</td></tr>
<tr><td>LEVEL</td><td colspan="2">PED</td><td>Living Lab</td><td colspan="3">Project</td></tr>
<tr><td>KPI NAME</td><td colspan="6">Range of co-creation tools used when implementing energy transitions in neighborhoods</td></tr>
<tr><td>DESCRIPTION</td><td colspan="6">Range of tools that have been used from the Living Lab with the participants in every phase of the LL integrative process<br>(within the total, specify the Number of tool/total that invite for reflection about gender equality)</td></tr>
<tr><td>SCALE</td><td colspan="3">Building</td><td colspan="3">District</td></tr>
<tr><td>UNIT</td><td colspan="3">Range</td><td colspan="3">Range</td></tr>
<tr><td>CALCULATION</td><td colspan="6">Number of appropriate tools for each step of the Living Lab integrative process (within the total, specify the Number of tool/total that invite for reflection about gender equality)</td></tr>
<tr><td>REPORTING FREQUENCY</td><td>At the beginning</td><td>Monthly</td><td>Annually</td><td>Before renovation</td><td>At the end</td><td>After every Intervention or activity</td></tr>
<tr><td>BASELINE</td><td colspan="2">YES</td><td colspan="2">NOT MANDATORY</td><td colspan="2">NO</td></tr>
</table>

| LEVEL: **Living Lab** | | | | | | |
|---|---|---|---|---|---|---|
| SOCIAL | | | | | | **SO-03** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Number of people involved in the different activities of the project/PED (workshops, events, etc) | | | | | |
| DESCRIPTION | Total number of people involved in activities [disagregated by sex, age, procedence (sector of quadruple helix), income (if possible) and type of event] | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | Nº | | |
| CALCULATION | Total number of people involved in activities [disaggregated by sex, age, precedence (sector of quadruple helix), income (if possible), and type of event] | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

<table>
<tr><th colspan="7">LEVEL: Living Lab</th></tr>
<tr><td colspan="5">SOCIAL</td><td colspan="2">SO-04</td></tr>
<tr><td>LEVEL</td><td colspan="2">PED</td><td>Living Lab</td><td colspan="3">Project</td></tr>
<tr><td>KPI NAME</td><td colspan="6">Assessment of co-creation and engagement activities and workshops by the participants (establishment of an average score)</td></tr>
<tr><td>DESCRIPTION</td><td colspan="6">Evaluation by the participants, based on their individual perception. At the end of each co-creation and engagement activity and workshop, the participants are asked to evaluate it (numerical evaluation from 1 to 5 to four questions: quality of the information received, degree of participation, results obtained in the workshop/event and atmosphere.)<br>Separate answers per sex</td></tr>
<tr><td>SCALE</td><td colspan="3">Building</td><td colspan="3">District</td></tr>
<tr><td>UNIT</td><td colspan="3">Percentage</td><td colspan="3">%</td></tr>
<tr><td>CALCULATION</td><td colspan="6">Per event and question: number of people answering each rate per question / total number of people answering per question<br>Results disaggregated by sex</td></tr>
<tr><td>REPORTING FREQUENCY</td><td>At the beginning</td><td>Monthly</td><td>Annually</td><td>Before renovation</td><td>At the end</td><td>After every Intervention or activity</td></tr>
<tr><td>BASELINE</td><td colspan="2">YES</td><td colspan="2">NOT MANDATORY</td><td colspan="2">NO</td></tr>
</table>

| LEVEL: **Living Lab** | | | | | | |
|---|---|---|---|---|---|---|
| SOCIAL | | | | | | **SO-05** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Increase of energy awareness in the neighbourhood | | | | | |
| DESCRIPTION | Degree of success of awareness level within the District to support urban transformation towards climate neutrality. Results disaggregated by sex and age | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Percentage | | | % | | |
| CALCULATION | Results from survey at two different stages of the project: Increase of energy awareness in the neighbourhood out of the total number of inhabitants of the neighbourhood (disaggregated by sex and age) | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| NEVEL: **PROJECT** | |
|---|---|
| **Number of Category** | **2** |
| **Number of KPI** | **11** |
| **NUEMBER OF KPI PER CATEGORY** | |
| ECONOMIC | **2** |
| DISSEMINATION AND COMMUNICATION | **9** |

| LEVEL: **PROJECT** | | | | | | |
|---|---|---|---|---|---|---|
| ECONOMY | | | | | | **EC-01** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | SMEs (Small and medium-sized enterprises) activated by the project | | | | | |
| DESCRIPTION | Number of SMEs activated by the project. If possible indicate if the SMEs are led by women, men or non binary | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | Nº | | |
| CALCULATION | Total number of SMEs | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PROJECT** | | | | | | |
|---|---|---|---|---|---|---|
| ECONOMY | | | | | | **EC-02** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Innovation clusters connected with the Project | | | | | |
| DESCRIPTION | Number of Innovation clusters connected with the Project | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | Nº | | |
| CALCULATION | Total number of clusters | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PROJECT** | | | | | | |
|---|---|---|---|---|---|---|
| DISSEMINATION AND COMMUNICATION | | | | | | **DC-01** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Project website | | | | | |
| DESCRIPTION | Number of visitors to project website | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | Nº | | |
| CALCULATION | Total number of visitors | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PROJECT** | | | | | | |
|---|---|---|---|---|---|---|
| DISSEMINATION AND COMMUNICATION | | | | | | **DC-02** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Social media | | | | | |
| DESCRIPTION | Total likes, shares, and followers (per sex and sector if possible) in social media networks. To raise interest in the Project, to inform about progress and news, to promote events, to foster discussions on Project topics, and to create synergies with relevant initiatives and partner's network | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number per sex and sector | | | Nº per sex-sector | | |
| CALCULATION | Total number disaggregated by sex and sector | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PROJECT** | | | | | | |
|---|---|---|---|---|---|---|
| DISSEMINATION AND COMMUNICATION | | | | | | **DC-03** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Partner's Social Media Channels | | | | | |
| DESCRIPTION | Total likes, shares, and followers (per sex and sector if possible) in social media networks (total) To Project, to inform about project news, to foster discussions on main Lab topics | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number per sex and sector | | | Nº per sex-sector | | |
| CALCULATION | Total number disaggregated by sex and sector | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PROJECT** | | | | | | |
|---|---|---|---|---|---|---|
| DISSEMINATION AND COMMUNICATION | | | | | | **DC-04** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Communication Material - flyer, rollups, postcard campaign | | | | | |
| DESCRIPTION | Number of Distributed (printed and digital) materials. To Project, to evoke engagement, to foster discussions on main topics. All material use a no sexist language. | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | Nº | | |
| CALCULATION | Total number of materials | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PROJECT** | | | | | | |
|---|---|---|---|---|---|---|
| DISSEMINATION AND COMMUNICATION | | | | | | **DC-05** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Share & Connect Newsletter | | | | | |
| DESCRIPTION | Newsletter subscribers- to communicate project progress, news from the Living Labs, inform about news from related projects and the field in general, linking to the website<br>Subscriber per sex | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number per sex | | | Nº per sex | | |
| CALCULATION | Total number of subscriber disaggregated by sex | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PROJECT** | | | | | | |
|---|---|---|---|---|---|---|
| DISSEMINATION AND COMMUNICATION | | | | | | **DC-06** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Press releases & op-eds, news & blogs | | | | | |
| DESCRIPTION | Number of articles to communicate project progress, news from the Living Labs, engaged residents | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | Nº | | |
| CALCULATION | Total number of articles | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PROJECT** | | | | | | |
|---|---|---|---|---|---|---|
| DISSEMINATION AND COMMUNICATION | | | | | | **DC-07** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Scientific publications | | | | | |
| DESCRIPTION | Scientific publications- to communicate scientific results and approaches. Specify number of publication in journal about gender perspective | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | Nº | | |
| CALCULATION | Total number of articles | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| LEVEL: **PROJECT** | | | | | | |
|---|---|---|---|---|---|---|
| DISSEMINATION AND COMMUNICATION | | | | | | **DC-08** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Events (Participation & Organisation) | | | | | |
| DESCRIPTION | Number of dissemination events attended and number of participants (per partner) per event (disaggregated by sex) . | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number per sex | | | Nºper sex | | |
| CALCULATION | Total number of dissemination events | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |



Co-funded by the European Union

| LEVEL: **PROJECT** | | | | | | |
|---|---|---|---|---|---|---|
| DISSEMINATION AND COMMUNICATION | | | | | | **DC-09** |
| LEVEL | PED | | Living Lab | | Project | |
| KPI NAME | Video Campaign | | | | | |
| DESCRIPTION | Videos produced and number of views to describe demonstrators progress and give insights. Gender equality in the videos. | | | | | |
| SCALE | Building | | | District | | |
| UNIT | Number | | | | | |
| CALCULATION | Total number of videos | | | | | |
| REPORTING FREQUENCY | At the beginning | Monthly | Annually | Before renovation | At the end | After every Intervention or activity |
| BASELINE | YES | | NOT MANDATORY | | NO | |

| NEVEL: **ALL** | |
|---|---|
| **Number of Category** | **1** |
| **Number of KPI** | **1** |
| **NUEMBER OF KPI PER CATEGORY** | |
| POLICY | **1** |

<table>
<tr><th colspan="7">LEVEL: ALL</th></tr>
<tr><td colspan="5">DISSEMINATION AND COMMUNICATION</td><td colspan="2">DC-09</td></tr>
<tr><td>LEVEL</td><td colspan="2">PED</td><td colspan="2">Living Lab</td><td colspan="2">Project</td></tr>
<tr><td>KPI NAME</td><td colspan="6">Number of policy recommendations / guides related to establishment/development of the PED</td></tr>
<tr><td>DESCRIPTION</td><td colspan="6">Number of policy recommendations or guidelines shared with decision-makers at any level (local, regional, national or European)</td></tr>
<tr><td>SCALE</td><td colspan="3">Building</td><td colspan="3">District</td></tr>
<tr><td>UNIT</td><td colspan="3">Number</td><td colspan="3">Nº</td></tr>
<tr><td>CALCULATION</td><td colspan="6">Number of policy recommendations / guides</td></tr>
<tr><td>REPORTING FREQUENCY</td><td>At the beginning</td><td>Monthly</td><td>Annually</td><td>Before renovation</td><td>At the end</td><td>After every Intervention or activity</td></tr>
<tr><td>BASELINE</td><td colspan="2">YES</td><td colspan="2">NOT MANDATORY</td><td colspan="2">NO</td></tr>
</table>

# 5. Data monitoring system

As we have seen, the KPI system collects sensitive data regarding people and the detection of their behaviour in buildings and/or urban spaces. This makes it necessary for this Protocol to establish common guidelines to be followed for proper data management.

Considering that this Protocol is valid for any EDP, Living Lab and project developed in these frameworks, multiple cities and countries of membership come into play. This implies that data can be very heterogeneous, depending on each context with different characteristics and specific and local objectives. In this heterogeneous scenario, it is strategic to define a common framework that addresses ethical requirements as well as data security and privacy.

This diversity also calls for the need to take into account reference frameworks at different scales, European and local. In particular, it is necessary to take into account:

- *REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data and repealing Directive 95/46/EC (General Data Protection Regulation*). (Regulation (EU) 2016/679)90 [https://www.boe.es/doue/2016/119/L00001-00088.pdf]
- *Convention 108 for the Protection of Individuals with regard to Automatic Processing of Personal Data* [https://www.oas.org/es/sla/ddi/docs/u12%20convenio%20n%20108.pdf].
- National laws on the matter.
- Regulations indicated by the Ethics Committees that correspond to each entity involved in an EDP.

This part of the document, on the Data Management Plan, sets out the framework within which the consortium of actors involved in a SDP will monitor/generate, process and collect data during the demonstration and/or implementation activities of the project and the active involvement and co-creation actions with local actors. It also addresses how data will be exploited or made accessible for verification and re-use and how data will be retained and preserved after the end of the project.

Ethical, privacy and security considerations are also specified to comply with all relevant European and national legislation and directives for the country in which the data collections are carried out and, furthermore, in which the dataset is retained and preserved.

In particular, where personal data are involved, the party obtaining the data is responsible for obtaining the consent of the data subjects, for anonymising the data as early as possible in their processing where possible, and for ensuring that all parties receiving and processing these data are obliged to follow the same data protection standards.

## Objectives

The framework objective is to establish a procedure on how to document, store and control access to data in accordance with the European framework guidelines indicated in the previous paragraph. More specifically, it is about:

- Define a protocol and format for data storage and transmission, and identify methods for taking data from different sources.
- Specify the type of data to be processed and, where appropriate, specific related procedures.
- Ensure that data are stored and/or converted in a way that facilitates comparisons between different EDPs and over time.

## Data type

Given the comprehensive nature of EDPs and the complexity of their work, there are different types of data to be recorded, sometimes requiring different treatments.

**Research data**. All data needed to evaluate the KPI system and data needed to disseminate the results in public documents or events or scientific publications. In the pursuit of innovation and impact enhancement, it is desirable to apply the principles of open science, which requires particularly careful data management. However, as the H2020 guidelines state, research data linked to exploitable results will not be put in the open domain in case they compromise their commercialisation prospects or are inadequately protected. The coordinating entity of each EDP will be responsible for ensuring that the provisions on scientific publications and data management guidelines set from Europe and in each local context, if applicable, are complied with. Finally, as stated in Horizon Europe's *FAIR Data - A Quick Guide for Researchers*, scientific research data must be findable, accessible, interoperable and reusable to ensure that it is properly managed beyond the original purpose for which it was collected.

**Operational and observation data**. Operational data are all data generated, acquired and kept during the process of defining and implementing the SDP. Observational data refers to data from the qualitative activities developed, such as surveys, interviews, fieldwork data or co-creation activities. All these data are considered sensitive data as they are provided by the consortium partners or for the stakeholders involved. For this reason they will be kept strictly confidential and will be exploited and, above all, disseminated in an anonymised form.

**Monitoring and evaluation data**. All data related to the monitoring of the KPI system in its different scales of application. This data is essential to keep track of the performance of all actions developed. These data will be regularly reported and published in the relevant repositories where access rights will be established.

**Documentation**, Proper data management has to cover the whole process lifecycle of each EDP and must be consistent with context-specific exploitation and intellectual property rights requirements. This concerns all documentation produced during the process and, in particular, that intended for dissemination or shared with external actors.

Many of these data, related to the demonstrators and Living Labs as part of the PEDs, are related to the people living in the experimental districts and neighbourhoods. These are **personal data** such as gender, age, social situation, educational and

income level, results of interaction with social agents or **technical data**, which, however, allow information about behaviours and preferences to be extracted. In short, they are considered **sensitive data**.

Given this sensitive nature, a certain degree of diligence is required in their processing, respecting the right to privacy of the persons concerned in accordance with the regulations in force at European level and in each participating country.

The rights to capture, store and process data must be linked to the **informed consent** of all actors involved. Even so, it is imperative that data relating to individuals is kept confidential and anonymised, in compliance with the General Data Protection Regulation (GDPR).

All partners in a consortium must make a specific commitment in this respect.

## Ethics and consent

For an ethical management of the data, it is strategic that each consortium that manages one or more PEDs, appoints an Ethics Committee, chaired by a team or person in charge of Ethics. This Committee must be composed of a representative of each country involved, responsible for ensuring that the activities follow the ethical, privacy and security considerations indicated in this Protocol, being integrated with the specific legislation of the country of reference or ethical standards of the entity it represents.

The Ethics Manager, whether an individual or a team, is responsible for supporting the consortium partners in the data generation/acquisition process during any activity related to data generation/acquisition, handling, exchange and preservation.

The Ethics Committee must ensure that each member of the consortium prepares, disseminates and compiles **informed consents** which, as a minimum, must clarify the following issues.

**Context**, where it is explained:

- Why data is collected
- How they will be used
- For how long will they be stored
- How they can be modified

**Property**, where indicated:

- Who owns the data.

**Transparency**, where indicated:

- What access is given to the owner
- How transparent is the access considering that the persons concerned must have full and transparent access to the algorithms used to generate and aggregate the datasets.

**Consent**, where it is specified:

- Which individuals or other entities need to give their consent to use the data.

**Privacy**, where specified:

- What measures are in place to ensure data privacy.

**Opening**, Where indicated:

- How many of the aggregated datasets are open access, although in general it is important that as much data as possible is open access.

As mentioned above, all data will be treated anonymously, unless the persons concerned choose to provide their e-mail address in order to be kept informed and to participate in the co-creation processes.

## Data processing and management

The database compiled during the development of a SDP is an open database. It is periodically reviewed and updated and kept in dated versions. Review and updating is done at flexible intervals depending on the evolution of the EDP process.

This database has to be managed securely. The first step is to anonymise the data. In addition, it is appropriate to encrypt the data and to distribute backup copies when dealing with sensitive data of individual stakeholders. The aim of these measures is to ensure the consistency of the data throughout the life of the project and the existence of alternatives to the master files, should they disappear or become corrupted.

As stated in the H2020 Guidelines on FAIR Data Management, all research data generated has to be findable, accessible, interoperable and reusable. To implement FAIR Data Management, it is useful to use a common data management system following the template presented in the Table below.

| TASK/ACTIVITY | PROCEDURE |
|---|---|
| Description | |
| Purpose and relevance of data collection and relation to objectives | |
| Methodology | |
| Data source and data ownership | |
| Standards, data formats and vocabularies | |
| Storage | |
| Security and privacy consideration | |
| Exploitation and dissemination | |
| Dissemination level, limitation, approach and justification | |
| Stakeholders | |

*Table 3. Data Management System Table*

Moreover, it is strategic to appoint the following figures among the consortium team.

**Responsible person**. This is the person responsible for monitoring the dataset throughout the entire lifecycle of the EDP implementation process and beyond. This person works in close collaboration with the compiler and the curator to ensure transparency and compliance of all activities related to the dataset.

**Collector**. This is the figure in charge of all tasks related to the collection or generation/acquisition of the dataset. He/she has to ensure that the data are collected properly and in accordance with the general procedures set out in the Data Management Plan.

**Curator**. This is the person responsible for archiving and, where appropriate, preserving the dataset during the process of each EDP and for 5 years after its completion. In addition, he/she is responsible for ensuring that the guidelines on data preservation and conservation are applied, e.g. proper storage of the dataset in the repository, costs in relation to data preservation, etc.

This ensures that data sets are clearly documented and responsibilities well defined within the process lifecycle of each EDP.

## Data retention and preservation

According to *REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016*, data should be kept for as short a time as possible.

This period should take into account the reasons why the data processing is necessary, as well as the legal obligations to retain data for a certain period of time according to the data retention laws in force in each country.

Exceptionally, personal data may be retained for longer periods for archiving purposes in the public interest or for scientific or historical research, provided that appropriate technical and organisational measures, such as anonymisation, encryption, etc., are put in place.

The number of years for which data is retained is a decision for each EDP, depending on the type and duration of the process, the type of data collected and the specific regulations affecting the countries to which the consortium members belong. The Ethics Committee monitors compliance with the established deadlines.

Moreover, public results will have to be preserved and published on the project website, while internal datasets have to be backed up to allow their retrieval for re-use and/or verification purposes.