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STANDARDISATION STRATEGY

Authors

Julen Imana Sobrino (ICLEI EURO)

Xavier Casanova Colomé (ICLEI EURO)

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PROJECT EXECUTIVE SUMMARY

TIPS4PED will design, develop, and test in a relevant environment the effectiveness and the techno-economic viability of a Digital Twin based Platform, to support municipalities in the implementation of Positive Energy Districts. The TIPS4PED Platform will be able to support municipalities in the decision-making delivering a series of evidence-based results, increasing the environmental sustainability of cities, and reducing operational costs. The project will adopt a people-centric approach, which aims to engage, train and empower citizens and potential stakeholders. TIPS4PED will do this by leveraging on consortium knowledge and prior EU experience and motivation from the goals set forth by the European Commission.

To design and manage the PED effectively and foster its implementation through city planning actions, different modules will be available on the Integrated Assessment Platform, to support municipalities from the technical perspective, as well as the social, financial, regulatory, and administrative ones. The tools will be developed thanks to a end-user's co-design approach, capable of providing constant feedback to the software development process.

The TIPS4PED solutions will be tested in one Light House city (Turin), where the Integrated Assessment Platform (IAP) will be connected to a sensor system for the real time management of the assets, and replication studies will be conducted in three Follower Cities (Cork, Kozani and Budapest). The testing and replication phase will result in the creation of 4 cities Digital Twins and decarbonization roadmaps. TIPS4PED seeks to suggest scalable and easily reproducible technologies and digital optimization as a key solution for to achieve 2030 EU goals, while taking into consideration various market circumstances, and environmental, safety, and regulatory aspects.

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DELIVERABLE EXECUTIVE SUMMARY

This document defines the standardisation strategy of the TIPS4PED project, outlining how its results can effectively contribute to existing and ongoing European and international standardisation processes related to Positive Energy Districts (PEDs) enabled by Local Digital Twins (LDTs).

To support this objective, the document provides a summary of TIPS4PED Key Exploitable Results (KERs) that have the strongest potential to follow a standardisation pathway or to turn into a standard. Among these KERs, we can highlight the Integrated Assessment Platform and the different tools it hosts for supporting the development of PEDs. Additionally, the document provides a comprehensive overview of the relevant policy and standardisation landscape relevant to the development of PEDs. This overview delves into the European policy framework, key standardisation bodies, existing standards and related projects and initiatives.

This mapping exercise identifies the main standardisation gaps to the development of PEDs in European cities to which TIPS4PED KERs can provide valuable input. As a result, the document outlines a set of recommendations for further standardisation that can help cover the identified gaps.

This standardisation strategy positions TIPS4PED as an active contributor to the evolving standardisation landscape and replication of LDT-enabled PEDs in Europe.

LIST OF ABBREVIATIONS AND ACRONYMS

Acronym	Meaning
PED	Positive Energy District
LDT	Local Digital Twin
SDO	Standards Developing Organisation
TC	Technical Committee
WG	Working Group
CWA	CEN Workshop Agreement
KER	Key Exploitable Result
IAP	Integrated Assessment Platform

1 INTRODUCTION

The objective of this deliverable is to provide a standardisation strategy for the TIPS4PED project based on an overview of relevant standardisation initiatives and a gap analysis that link the topics of PEDs, platform development and LDTs. The assessment of the current policy and standardisation landscape will create an enabling environment for the broad adoption of TIPS4PED results and provide a set of recommendations for their standardisation.

Together with its EU sister projects, TIPS4PED seeks to advance both LDTs and PEDs beyond the conceptual and design phase, establishing them as core instruments for implementing local green and digital transitions. By linking data-driven decision-making with energy-positive urban development, the project contributes to Europe's broader ambition of achieving climate neutrality and resilience through integrated, mission-oriented approaches.

To achieve this, the TIPS4PED standardisation strategy focuses on the design, implementation, and management of PEDs supported by LDTs. The aim is to provide a practical, consensus-based foundation for replication and scaling, ensuring that PEDs and LDTs can be integrated into municipal planning, management, and governance processes across Europe.

PEDs are understood as an operational cornerstone of Europe's climate-neutrality ambitions bridging technology, governance, and citizen engagement in the delivery of sustainable, data-driven urban transformation. A PED is defined as "an urban neighbourhood with annual net zero energy import and net zero CO₂ emissions working towards a surplus production of renewable energy, integrated into an urban and regional energy system" (JPI Urban Europe).

The target audience of this deliverable includes the standardisation community (European and international SDOs and TCs), local and regional authorities, policymakers, technology providers, the research community, and other stakeholders involved in the development and deployment of PEDs and LDTs.

2 METHODOLOGY

The TIPS4PED Standardisation Strategy is based on an overview of the current standardisation and policy framework for the development of PEDs in European cities. The assessment of current policies, standardisation bodies and related initiatives are followed by a gap analysis for identifying priority actions and recommendations for further standardisation of the project findings. This approach is built on the following steps:

1. **Project results:** gather the project's Key Exploitable Results (KERs) and identify the solutions or findings that are most relevant to be standardised. Those KERs are identified and described in the next section of this document.
2. **Gap analysis:** based on an exhaustive overview of the standardisation and policy ecosystem relevant to the development of PEDs, identify gaps and areas for action.
3. **Engagement with standardisation:** liaise with CEN/TCs¹ and key working groups, align with existing initiatives (e.g. EU Cities Mission, ongoing CWA processes, ad hoc groups) and contribute to standardisation discussions.
4. **CEN Workshop Agreement (CWA):** based on this process and analysis, translate the project results into practical guidance for cities in the form of a CWA or similar output. This guidance will be co-created with partners and key stakeholders.

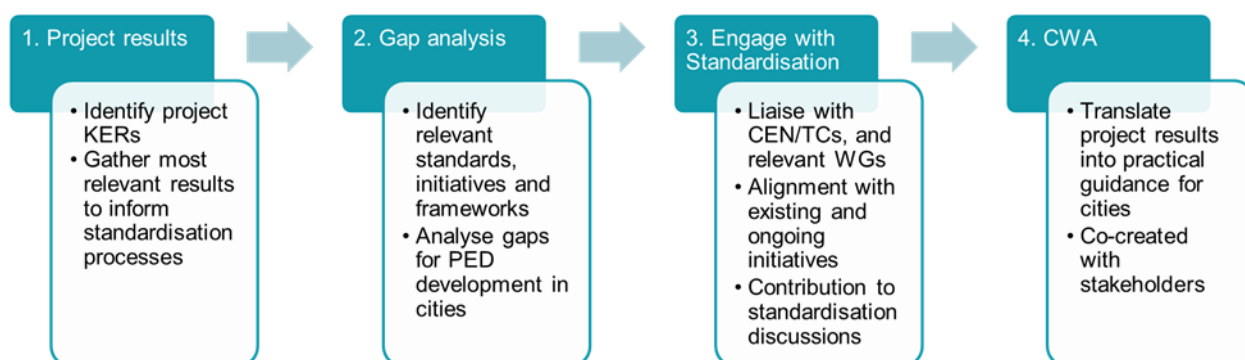


Figure 1: TIPS4PED standardisation approach

The standardisation approach adopted in TIPS4PED is grounded in a co-creation process, ensuring continuous stakeholder engagement. This approach has been implemented throughout the project by actively involving consortium partners and relevant external initiatives, including sister projects, in dedicated exchanges on policy and standardisation topics. A workshop held in Barcelona in November 2024 engaged project partners in identifying and analysing the policy framework relevant to TIPS4PED, while a subsequent workshop organised in Brussels in November 2025 brought together partners and sister projects to discuss standardisation needs and to explore the development of a CEN Workshop Agreement (CWA).

¹ CEN is one of the official European standardisation bodies, and its Technical Committees (TCs) are established with precise titles and scopes, to prepare CEN deliverables. More information here: <https://boss.cen.eu/technicalstructures/pages/tc/>

3 TIPS4PED KERS RELEVANT FOR STANDARDISATION

The first step of the TIPS4PED standardisation approach consists in identifying the Key Exploitable Results (KERs) that are most relevant for standardisation. These KERs represent the project's main technical, methodological, and policy-related outputs that have the potential to contribute to standardisation activities.

The transfer of these results and project findings into standardisation can be done through different pathways, like the contribution to existing TCs and Working Groups (WGs), as well as the development of dedicated standardisation deliverables such as a CWA.

The KERs included in this section were selected due to their direct relevance to identified standardisation gaps and for providing valuable insights for stakeholders involved in the design, planning, operation and monitoring of PEDs supported by LDTs. To facilitate the analysis and potential integration into standardisation, the identified KERs have been grouped into the following clusters:

3.1 Digital Infrastructure & Tools for PEDs

This cluster provides KERs related to the digital infrastructure and operational tools used for the development and management of PEDs in cities. These results are particularly relevant for standardisation as they contribute to defining common data models, system architectures and key features, which are essential to ensure interoperability, scalability and integration.

- **Integrated Assessment Platform (IAP):** A multidisciplinary decision-support platform at TRL 7-8 that enables municipalities to design, develop, and manage PEDs through Digital Twins.
- **Tools for the feasibility, design, operation of PEDs:** a set of tools for the characterisation of potential PED areas, scenario simulation, generation of decarbonisation roadmaps and monitoring and optimisation of PED assets.
- **Other data-services:** tools for specialised services including private e-mobility, public transport energy transition strategies, battery management optimization, socioeconomic impact assessments and energy poverty mitigation.
- **Semantic Interoperability Layer:** A layer ensuring consistency among platform components and external data sources through harmonized connectors and ontologies.
- **Data Modelling Framework:** A standardized taxonomy and data templates to inform the mapping, harvesting, and exchange of building and urban data.

3.2 Methodological and Replication Frameworks

This cluster includes KERs that focus on the processes and methodologies supporting the stakeholder engagement strategies and replication of the project solutions on a local and national level. These results are relevant for standardisation as they contribute to establishing common approaches and guidance for cities, helping to ensure that PED solutions can be implemented, adapted, and scaled across different geographical and regulatory environments.

- **Co-Design Models:** a methodology for stakeholder engagement using participatory design and gamification to co-create urban solutions and platform interfaces.

- **PED Digital Twinning Methodology:** Step-by-step methodology to design and operate PEDs with digital twin tools on a local level.
- **National Replication Pathway Methodology & Reports:** national replication approaches in Italy, Ireland, Hungary and Greece, conducted via National Roundtables and the development of National Replication Pathways.

3.3 Policy, Capacity Building and Standardisation-Oriented Outputs

This cluster includes KERs that address the policy, economic and capacity-building aspects of PED development. They provide a set of recommendations and learning resources relevant to standardisation, as they support the replication of TIPS4PED results on a European level by translating project outcomes into widely applicable guidance.

- **Finance/Economy Guidelines:** Recommendations and specific guidance on financial structures (crowdfunding, reward-based schemes) to foster PED upscaling and replication.
- **Policy Brief:** Analysis and recommendations for European policy and standardisation bodies regarding PED proliferation and Digital Twin adoption.
- **Learning Resources:** Collection of learning resources and capacity building materials made available on the project website, including the TIPS4PED Wiki and recordings from training sessions.

These KERs constitute a comprehensive set of results and findings covering technical, methodological and policy dimensions, positioning TIPS4PED as a strong contributor to ongoing and future standardisation efforts in the field of LDT-enabled PEDs. The project outputs have the potential to fill the existing gap between LDTs and guidelines for cities on how to apply them in the development of PEDs.

4 OVERVIEW OF EXISTING STANDARDISATION AND POLICY INITIATIVES

This section describes the current standardisation ecosystem supporting the PED development, and provides an overview of existing relevant policies, standards, and initiatives. It covers the European policy framework, standardisation bodies, published standards, and related projects and initiatives that collectively define the framework in which the TIPS4PED outputs can be standardised.

This overview is followed by a gap analysis that allows identifying relevant standardisation pathways for project KERs while ensuring alignment with existing European standardisation practices. The aim is to understand the environment, analyse existing gaps, and ensure that the project's standardisation activities provide added value and avoid overlapping existing initiatives.

4.1 European policy framework

The European policy landscape directly influences and shapes the development of PEDs in cities and is key for the standardisation strategy of TIPS4PED. This section provides an overview of the main EU policies and initiatives relevant to PEDs and LDTs, ensuring that the standardisation activities proposed in TIPS4PED are aligned with EU priorities.

The **European Green Deal** is one of the main drivers of the policy framework for PEDs in Europe. It sets the objective of making Europe climate-neutral by 2050 and focuses on the transformation of key sectors for PEDs such as energy, buildings and mobility. PEDs are fully aligned with the Green Deal, promoting decarbonisation, local renewable energy generation or fostering integrated urban solutions.

The **EU Cities Mission** (Climate-Neutral and Smart Cities) is one of the main policy instruments implementing the objectives of the Green Deal at city level. It aims to support 100 European cities in becoming climate-neutral by 2030 and enable all European cities to follow suit by 2050. Additionally, the Mission focuses on innovation, replication and integration of digital solutions, which are as well strongly aligned with PEDs.

The **EU Rolling Plan for ICT Standardisation** provides a strategic link between EU policies and standardisation activities in the field of information and communication technologies (ICT). Its aim is to help standards makers guide their efforts towards achieving EU policy objectives. TIPS4PED is aligned with several priority areas identified in the ICT Rolling Plan, including “Smart and Sustainable Cities and Communities”, “Data Interoperability” or “Local Digital Twins”. By considering the priorities and recommendations outlined in the Rolling Plan, the project ensures that its standardisation activities are consistent with the EU policy landscape.

Regarding energy and buildings legislation, the Energy Performance of Buildings Directive (EPBD), the Energy Efficiency Directive (EED) and the Renewable Energy Directive (RED) are highly relevant to the development of PEDs. They establish the regulatory foundations for improving energy performance, increasing the share of renewable energy and promoting integrated approaches at building and district level.

The growing importance of digitalisation is also reflected in the European policy framework through the European Strategy for Data and related initiatives such as the Data Governance Act, the Data Act and the AI Act. These frameworks aim to facilitate secure and interoperable data sharing while protecting the rights and interests of citizens.

Regarding the EU's research and innovation landscape, numerous projects contribute to advancing PED concepts, under initiatives like Horizon Europe or the Digital Europe Programme. The EU Standardisation Strategy underlines the importance of translating research outcomes into standardisation deliverables to support scalability and market adoption.

4.2 Standardisation bodies

There are several standardisation bodies operating at international, European, and national levels that are relevant to the development of Positive Energy Districts (PEDs) and related domains. The activities of these standardisation bodies include Technical Committees (TCs) and Working Groups (WGs) addressing areas such as energy systems, smart cities, data interoperability and digital technologies. By mapping these bodies and their ongoing work, this section aims to identify where relevant standardisation efforts are already taking place and where TIPS4PED can contribute.

4.2.1 International bodies

ISO (International Organization for Standardization) is an independent, non-governmental, international standard development organization which works on a broad range of areas and topics. ISO is a network of national standardisation bodies, each of which represents ISO in its own country. ISO's TCs work on specific topics and domains, with the following being identified as the most relevant to PED development: ISO/TC 22/SC 37 Electrically Propelled Vehicles, ISO/TC 180 Solar Energy, ISO/TC 204 Intelligent Transport Systems, ISO/TC 268/SC 1 Smart Community Infrastructures, ISO/TC 268/SC 2 Sustainable Mobility and Transportation, ISO/TC 301 Energy Management and Energy Savings and ISO/TC 341 Heat Supply Network.

IEC (International Electrotechnical Commission) is an international standards organisation that prepares and publishes international standards for all electrical, electronic and related technologies. The IEC also manages four worldwide conformity assessment systems that represent the only globally standardised approach to testing, inspection and certification. Among the numerous WGs within IEC, the following TCs have been identified as the most relevant ones to PEDs: IEC/SyC Smart Energy, IEC/TC 8 System Aspects of Electrical Energy Supply, IEC/TC 57 Power Systems Management and Associated Information Exchange, IEC/TC 69 Electrical Power/Energy Transfer Systems for Electrically Propelled Road Vehicles and Industrial Trucks, IEC/TC 120 Electrical Energy Storage (EES) Systems and IEC/TC 23/SC 23K Electrical Energy Efficiency Products.

ITU (International Telecommunication Union) is the United Nations specialised agency responsible for many matters related to information and communication technologies (ICTs). The organisation follows a membership model with members including 194 Member States and more than one thousand companies, universities and international and regional organisations. Among the WGs within ITU, ITU-T Study Group 20 – Internet of Things (IoT), Digital Twins, and Smart Sustainable Cities and Communities is the most relevant one tackling topics related to the development of PEDs.

IEEE (Institute of Electrical and Electronics Engineers) is an American charitable professional organisation for electrical engineering, which develops international standards. The following initiatives and working groups within IEEE are worth mentioning in relation to PED development: the Smart Cities Initiative (SCI), SA P2784 Smart City Planning and Technology Integration working group; the Standards Coordinating Committee 21 Fuel Cells, Photovoltaics, Distributed Generation, and Energy Storage; the Power & Energy Society's Smart Buildings, Loads and Customer Systems Technical Committee.

4.2.2 European bodies

At the European level, there are three main standardisation bodies: **CEN** (the European Committee for Standardisation), **CENELEC** (the European Committee for Electrotechnical Standardisation) and **ETSI** (the European Telecommunication Standards Institute). These bodies develop key standardisation activities for the development of PEDs in Europe, with the following TCs identified as particularly relevant to this field:

- **ETSI's Technical Committee on Data Solutions** (TC DATA) develops standards that enable trustworthy, interoperable and scalable data solutions across the ICT ecosystem.
- **CEN TC 465** is dedicated to Sustainable and Smart Cities and Communities. Particularly, TIPS4PED participated in the development of the **Ad hoc Group on Climate-Neutral Smart Cities and Communities** together with other parties like Net Zero Cities. The group is established to accelerate the integration of sustainability and digitalisation in European urban development as explained in its report.

4.2.3 National bodies

Additionally, there are standardisation bodies operating at the national level which represent their country's interests in international organisations. These bodies create standardisation products that can be relevant to PED development. Some of these organisations include **DIN** in Germany, **UNI** in Italy, **AENOR** in Spain, **AFNOR** in France or **NEN** in The Netherlands.

4.3 PED Standardisation initiatives

This subsection provides an overview of standardisation initiatives at the international, European, and national levels that are relevant to PED development. It identifies published standards and ongoing standardisation activities that can support PED implementation and replication on different domains.

Overall, the current standardisation landscape is broad and offers a strong foundation for PEDs. However, these standards are often developed within specific domains, highlighting the need for greater integration and alignment to support holistic PED approaches.

4.3.1 Digital twins, data, and interoperability

Several standards address the role of data, platforms, and digital twins in urban contexts. For example, **ITU-T Y.4600** and **ISO/IEC 30173** provide foundational definitions and requirements for digital twin systems. **ISO/IEC 30182** provides guidance for establishing a model for data interoperability. At national level, **DIN SPEC 91607** further complements these frameworks by providing practical use cases and maturity models.

4.3.2 Energy systems and buildings

Energy-related standards are essential to PED development. Standards such as **ISO 52000-1** and **ISO 50001** provide methodologies for energy performance and management. In addition, **ISO 15118** supports the integration of electric mobility into energy systems.

4.3.3 Smart cities frameworks and indicators

Several standards define smart city frameworks and performance indicators. For instance, **ISO 37120** and **ISO 37122** provide indicators for different services, while **IEC SRD 63188** contributes to system-level structuring of urban solutions. These frameworks are relevant for monitoring and evaluating PED performance.

4.3.4 Governance, participation and implementation

Fewer standards explicitly address governance and stakeholder engagement for PEDs. National initiatives such as [UNI 11965](#) highlight emerging efforts in this area. At European level, instruments such as CWA, a pre-standardisation document developed through a consensus-based process, (e.g. [CWA 17381](#), [CWA 17382](#)) provide practice-oriented guidance that can support implementation.

A wider overview of existing standardisation initiatives relevant to PED development can be found in Annex 1.

4.4 Other projects and initiatives

In addition to formal standardisation activities, several European and international projects and initiatives are relevant to PEDs and LDTs. These initiatives provide methodological frameworks, tools and practical guidance that can inform and complement standardisation efforts.

The [LDT4SSC](#) project advances EU approaches to LDTs through the development of interoperable data models, governance frameworks, and scalable digital infrastructures for cities. Its [outputs](#) include a structured methodology guiding implementation from ideation to deployment, as well as tools for impact assessment and cost-benefit analysis, supporting evidence-based decision-making across urban domains such as energy, mobility and buildings.

[Living-in.EU](#) plays a key role in promoting interoperable digital solutions for cities and communities. Through its Technical Working Group, the initiative develops common technical specifications and the so-called Minimal Interoperability Mechanisms (MIMs Plus), which provide practical guidance for ensuring interoperability across data, systems and platforms, including applications relevant to digital twins and integrated urban services.

At the international level, the United for Smart Sustainable Cities ([U4SSC](#)) initiative, coordinated by the ITU, develops globally recognised frameworks and KPIs to support urban sustainability and digital transformation. In particular, its KPIs for Smart Sustainable Cities provide a structured approach for measuring and benchmarking city performance, which is necessary for the assessment of LDT-enabled PED solutions.

In addition, several Horizon Europe and related projects focusing on PEDs contribute valuable knowledge, tools and implementation experience. Some of these include [ASCEND](#), [BIPED EU](#), [TIPS4PED](#), [SPARCS EU](#), [exPEDite](#) and [NEUTRALPATH](#). While these initiatives are not standardisation bodies, their results provide important inputs for the development of future standards and pre-standardisation documents.

The TIPS4PED Standardisation Strategy builds on the knowledge presented in this section to generate synergies and avoid duplication of efforts on PED and LDT standardisation processes.

5 STANDARDISATION GAP ANALYSIS FOR LDTs AND PEDs

The overview of current standardisation and policy initiatives highlights that PEDs play a key role in achieving EU sustainability objectives and have a strong potential to contribute to ongoing policy and standardisation efforts. At the same time, based on this overview and on several discussions held with project partners and EU sister projects, we have identified that significant gaps exist in the standardisation landscape, particularly regarding LDT-enabled PEDs. This gap analysis aims to provide a clear understanding of these limitations and to inform recommendations on how TIPS4PED can further contribute to advancing standardisation in this field.

While LDTs are key enabling technology to support data-driven planning, analysis, and management of urban systems, cities often lack practice-oriented guidance on how to apply LDTs in the design, deployment and management of PEDs. Existing standardisation efforts mainly address technical interoperability, data exchange, and reference architectures. Less attention has been given to guidelines on implementation processes, monitoring, and integration into municipal planning.

The TIPS4PED standardisation and replication approach can contribute to tackling these limitations by addressing standardisation gaps complementing, rather than duplicating, existing initiatives. In particular, the following areas represent key gaps where TIPS4PED can provide added value.

5.1 Integrated approaches for PED development:

Existing standardisation initiatives often address individual components (e.g. energy, buildings, mobility), resulting in fragmented approaches that do not reflect the integrated nature of PEDs. PED development requires the coordinated integration of multiple domains that guide its design, planning, implementation and operation. The lack of structured workflows or step-by-step guidelines creates challenges for local authorities and actors in translating high-level concepts into implementation processes.

5.2 Guidance on the application of LDTs in PED development:

Although several standards and frameworks exist for digital twins and data architectures, they are often technology-oriented, without addressing their specific application in the context of PEDs. Cities often lack clarity on how to operationalise LDTs as decision-support tools, particularly in relation to PED development.

5.3 Monitoring and performance evaluation of PEDs:

Another gap is identified with regards to common frameworks for monitoring, evaluation and performance assessment of PEDs. While general indicators or evaluation frameworks for energy performance or smart sustainable cities exist, there is a lack of standardised approaches for KPI definition and evaluation tailored to PEDs.

5.4 Organisational and governance processes of PEDs:

Beyond technical aspects, PED planning and operation requires strong multi-stakeholder coordination, including local authorities, utilities, technology providers, citizens, among others. However, existing standards rarely address organisational, governance and stakeholder engagement processes for PEDs

specifically. This gap is particularly relevant for cities, which often face barriers in terms of stakeholder coordination when implementing PEDs.

5.5 Translation of research and pilot results into standardisation:

Finally, a gap has been identified in the uptake of research and innovation results into standardisation. Numerous Horizon Europe and related projects (including TIPS4PED) generate valuable findings, tools and methodologies for PEDs, but these results are often not translated into widely accessible and standardised guidance. This limits their long-term impact and scalability beyond the project lifetime.

6 STANDARDISATION LIAISON, ENGAGEMENT, AND DISSEMINATION ACTIVITIES

This section outlines the activities conducted within TIPS4PED to engage with the standardisation community and relevant stakeholders. On the one hand, it covers the liaison and specific interactions with relevant TCs and WGs. On the other hand, the section identifies broader engagement and dissemination activities that support the uptake of project results into standardisation processes. These activities provide the basis for the recommendations presented in the following section.

6.1 Liaison with Standardisation Committees

TIPS4PED actively engages with relevant standardisation bodies at European level, within the framework of CEN-CENELEC activities. The project has established initial links with CEN/TC 465 “Sustainable and Smart Cities and Communities”, which is highly relevant for the development PEDs and LDTs. This includes the following interactions:

- On 28 April 2026, TIPS4PED presented its approach to the development of a CWA during an online meeting of the **CEN/TC 465 Task Force on Digital Twins**.
- TIPS4PED project partners contributed to the **CEN/TC 465 Ad hoc Group** on Climate-Neutral Smart Cities and Communities, including the development of its report.
- TIPS4PED is participating in the ongoing **CEN Workshop** being developed within the Citizens4PED project. This engagement enables coordination and exchange between parallel standardisation efforts on PEDs, leveraging synergies and avoiding duplication.

6.2 Engagement and Dissemination Activities

The TIPS4PED standardisation approach is supported by a strong and stakeholder engagement and dissemination process. This includes the organisation of dedicated workshops and collaborative activities with project partners and external stakeholders:

- TIPS4PED and its sister projects maintain a continuous collaboration, jointly participating in events and recurring catch-up meetings.
- TIPS4PED partners have participated in the Scalable Cities Business Models and Financing Task Group (BMF TG). This engagement contributes to aligning project outcomes with broader European discussions on scalable and replicable urban solutions.
- A workshop held in Barcelona in November 2024 engaged project partners and invited representatives from Net Zero Cities and the sister project BIPED, in identifying and analysing the policy framework relevant to TIPS4PED.
- Another workshop organised in Brussels in November 2025 brought together partners and sister projects to discuss standardisation needs and to explore the development of a CWA.
- The development of the TIPS4PED CWA constitutes a central element of the standardisation engagement. It will provide practical guidance on the development of LDT-enabled PEDs.

The following section builds on this experience to define targeted recommendations for future standardisation actions. Additional dissemination efforts will include participation in relevant events, collaboration with European initiatives, and continued exchange with sister projects.

7 RECOMMENDATIONS FOR FURTHER STANDARDISATION WITHIN TIPS4PED WORK

Building on the overview of the current standardisation and policy framework for PED development in Europe, and the subsequent gap analysis carried out in this document, the current section aims to provide recommendations to support the further development of standardisation activities. These should contribute to ongoing and future initiatives within European standardisation processes, including those led by CEN-CENELEC.

The following recommendations focus on areas where additional guidance is needed to facilitate the implementation and replication of PEDs. Particularly, there is a need for providing tailored guidance on the development of PEDs in cities, bridging the gap between technical standards and practical application, and supporting municipalities and stakeholders in their adoption.

- **Develop integrated methodological frameworks for PEDs:** develop guidelines or process-oriented frameworks that support the full lifecycle of PEDs, including planning, design, implementation, operation and replication. Such frameworks should ensure alignment across relevant domains like energy, mobility, buildings and digitalisation.
- **Standardise the application of LDTs in PEDs:** provide guidance on the practical application of LDTs in municipalities, to support decision-making with a focus on PED development.
- **Establishment of common monitoring frameworks:** provide evaluation frameworks for the monitoring and performance assessment of PEDs. These should include a set of key performance indicators (KPIs) and methodologies that integrate real-time and historical data from various sources.
- **Guidance on stakeholder engagement and organisation:** develop standardised approaches for governance structures and stakeholder engagement processes in PED development. These should include mechanisms for multi-stakeholder coordination and co-creation with citizens and local actors.
- **Support replicability across different urban contexts:** standardisation activities should ensure that the PED approaches and solutions are transferable and applicable across cities with varying size, regulatory frameworks and socio-economic conditions.

The TIPS4PED KERs have a strong potential to address the above recommendations by translating project outcomes into structured, implementation-oriented guidance. In particular, the development of the **CEN Workshop Agreement (CWA)** will be key as an effective mechanism to consolidate these results into a consensus-based document with high visibility and uptake potential.

CWAs provide a flexible and efficient instrument, engaging project partners and external stakeholders to collect methodologies, processes and best practices without the longer timelines associated with formal European Standards. Other recommended complementary pathways to follow include strengthening liaison with relevant TCs, in particular CEN/TC 465, and ensuring that the outcomes of the CWA are effectively communicated and positioned. Additionally, inputs to EU-level initiatives (e.g. BRIDGE), or the development of policy recommendations and guidance documents are recommended.

TIPS4PED partners will work collaboratively to leverage the project's KERs to address the identified gaps, through the development of standardisation pathways, including the already ongoing CWA.

8 CONCLUSIONS

This document provides an overview of the current standardisation and policy landscape relevant to LDT-enabled PEDs in Europe, covering the European policy framework, standardisation bodies, existing standards, and other initiatives. This analysis highlights that valuable standards, methodologies, and initiatives already exist across key domains like energy systems, buildings, mobility, digital infrastructure and smart city development.

However, the analysis also shows that the current landscape is largely domain-specific, without an integrated focus across sectors essential to PED development. There is a lack of process-oriented guidance to support cities and stakeholders in the planning, implementation, and operation of PEDs. Particularly, gaps have been identified in the areas of integrated approaches for PED development, application of LDTs in PEDs, monitoring and evaluation of PEDs, organisational processes of PEDs and translation of research results into standardisation.

Project findings and KERs developed within TIPS4PED provide a valuable basis to bridge this gap by translating research outcomes into structured, user-oriented guidance. The development of a CWA is identified as a particularly recommended mechanism to achieve this objective. As a flexible and consensus-based pre-standardisation product, a CWA enables the consolidation of project results and methodologies and the involvement of relevant stakeholders outside the project itself. At the same time, other complementary pathways (contributions to TCs within CEN-CENELEC, engagement in European initiatives, development of policy recommendations) remain important to ensure long-term impact.

Overall, this document confirms the relevance and timeliness of TIPS4PED's standardisation activities. By adopting a more integrated and implementation-oriented standardisation strategy, the project has the potential to support the replicable deployment of PEDs across European cities.

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10 ANNEX 1 - STANDARDISATION INITIATIVES

The following list provides an overview of existing standardisation initiatives at the international, European and national level relevant to the development of PEDs.

- [ITU-T Y.4600](#) Requirements and capabilities of a digital twin system for smart cities
- [ITU-T Y.4201](#) High-level requirements and reference framework of smart city platforms
- [ITU-T Y.4900](#) Overview of key performance indicators in smart sustainable cities
- [ITU-T Y.4461](#) Framework of open data in smart cities
- [ISO 15118](#) Road vehicles - Vehicle-to-grid communication interface
- [IEC SRD 63188:2022](#) Smart cities reference architecture methodology
- [IEC SRD 63520:2024](#) Smart cities Concept system building for energy challenge
- [ISO 52000-1:2017](#) Energy performance of buildings
- [ISO 50001 Energy management](#): for organizations to improve quality and environmental management.
- [ISO 37120:2018](#) Sustainable cities and communities - Indicators for city services and quality of life.
- [ISO 37122](#) indicators for smart cities
- [ISO 37106](#) Smart city operating models
- [ISO/IEC 30173](#) Digital twin - concepts and terminology
- [ISO/IEC 30182](#) Smart city concept model - guidance for establishing a model for data interoperability
- [CWA \(ongoing\)](#) "Guidelines for the Integrated and Context-Sensitive Development of Positive Energy Districts" developed by the project Citizens4PED.
- [CWA 17382](#) – Sustainable Energy Retrofit Process Management for Multi-Occupancy Residential Buildings with Owner Communities
- [CWA 17381](#) The Description and Assessment of Good Practices for Smart City solutions
- [EN 17680](#) Sustainability of construction works - Evaluation of the potential for sustainable refurbishment of building
- [DIN SPEC 91607:2024-11](#) This DIN SPEC provides an overview of Urban Digital Twins, including use cases, capabilities, and a maturity model. Around 100 municipal use cases were identified and mapped to different municipal areas of action.
- [DIN SPEC 91357 Common reference architecture for open urban platforms](#) This DIN SPEC describes an exchange platform for urban IoT data and services. It supports interoperability through common terminology, open APIs, and data licensing models, while also addressing data privacy aspects.
- [DIN EN 16798](#) Energy evaluation of buildings - Ventilation of buildings - Part 1: Input parameters for the indoor climate for the design and evaluation of the energy efficiency of buildings with regard to indoor air quality, temperature, light and acoustics
- [Standardization of impact measurement for climate protection measures \(DIN SPEC 91637\)](#) DThis DIN SPEC defines requirements for measuring the impact of climate protection measures using a standardised methodology, enabling climate-related decisions and investments to be monitored through indicators.
- [UNI 11965:2024 \(in italian\)](#) - Sustainable cities, communities and infrastructures - Requirements for active community and stakeholder involvement in the management of Local Government

- [UNI 11973:2025](#) – Cities, communities and sustainable infrastructure - Contributions of buildings to sustainability - Methodological model for the integration and interconnection of sustainable buildings in cities
- [UNE 178101](#) Smart cities. Infrastructures. Public transport networks.
- [UNE 178301](#) Open Data. Includes a component of citizen engagement
- [UNE 178202:2016](#) Smart cities. Management indicators based on dashboards city management.