

# BIPED D4.2

# STAKEHOLDER FORUM

*Forum Overview, Methodology, Progress Update and Next Steps*





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<b>Project name</b>	BIPED: Building Intelligent Positive Energy Districts
<b>Duration</b>	January 2024 – December 2026
<b>Project ID</b>	101139060
<b>Coordinator</b>	Technical University of Denmark
<b>Type of action</b>	Innovation Action
<b>Call ID</b>	HORIZON-MISS-2023-CIT-01
<b>Website</b>	<a href="https://www.bi-ped.eu/">https://www.bi-ped.eu/</a>
<b>Document name</b>	BIPED D4.2 STAKEHOLDER FORUM
<b>Document status</b>	Final
<b>Delivery date</b>	20/12/2024
<b>Dissemination</b>	Public
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**Funded by  
the European Union**

BIPED is funded under the EU Horizon Europe Research and Innovation programme. Grant ID: 101139060. Every effort has been made to ensure the accuracy of information provided in this document, which reflects only the authors' views. The European Commission is not responsible for any use that may be made of the information contained herein. Credits: cover image from [Adobe Stock](#).

## Document history

Version	Date	Contributor	Description
0.1	30.10.2024	Ivy Yang (OASC)	Draft Structure
0.2	21.11.2024	WP1: Shahrzad M. Pour & Razgar Ebrahimi (DTU) WP2: Martin Traunmüller (AIT) WP3: Johanne Bräuner Nygaard Hansen (AAKS) WP4: John Sheils (KPMG) WP5: Pavel Kogut (DRI) Regulatory: Tomáš Pavelka (UTR)	WPs input
0.3	03.12.2024	Ivy Yang (OASC)	First Draft
0.4	11.12.2024	Johanne Bräuner Nygaard Hansen (AAKS) Shahrzad M. Pour (DTU) Anna Yankulova (KPMG)	Internal Review
1.0	13.12.2024	Ivy Yang (OASC)	Final Version
<b>1.0</b>	19.12.2024	Razgar Ebrahimi (DTU)	Final check and submission

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## D4.2 Stakeholder/End-user Forum

## Abbreviation

**BIPED:** Building Intelligent Positive Energy Districts

**CDE:** Communication, Dissemination, Exploitation

**CRM:** Customer Relationship Management

**DT:** Digital Twins

**D(X):** Deliverable (X)

**LDT:** Local Digital Twins

**M&E:** Monitoring and Evaluation

**M(X):** Month X

**PED:** Positive Energy Districts

**T(X):** Task X

**WP(X):** Work Package (X)

### ● Executive summary

This deliverable, Deliverable 4.2 (D4.2), captures the progress of Task 4.4, Establishment Stakeholder/End-User Forum, (T4.4) from Month 1 (M1) to M12. Located within Work Package 4 (WP4) on Impact Monitoring, Guidance and Replicability, the main objective of T4.4 is to establish a key stakeholder forum, namely with the identified end users, to support the BIPED project vision to create a Local Digital Twin (LDT) solution to advance the establishment, development and implementation of Positive Energy Districts (PEDs) across Europe, starting with a pilot case in the Brabrand district of Aarhus, Denmark.

Compared to other stakeholder-related activities in BIPED, with T2.5 focusing on the data space communities and WP3 leading the engagement of pilot cases, T4.4 complements both from a unique angle. It not only brings the focus on end-user identification and engagement, but also facilitates the exchange between pilot and non-pilot cases. With this unique angle, the core contributions of this forum to the overall project objective are generally twofold. First, by interacting with the identified key end-users, this forum helps to ensure that the BIPED digital twin solution is not only technically robust, but also meets the needs of actual potential real-life users, thereby increasing the usability of the solution and thus the likelihood of its adoption. Secondly, by encouraging interaction between pilot and non-pilot end users, the forum also creates a mutually beneficial feedback loop. While pilot end-users can benefit from external expert insights to further refine the initial pilot-based BIPED solution foundation, external end-users can also experience the process with pilot end-users, which may also encourage their later support in exploring further scalability and replicability of the BIPED Digital Twin (DT) solution.

During the first one third of the project, from M1 and M12, one key focus across all WP activities has been to translate proposal vision into practical implementation plan and establish some foundational steps - Phase 1 of creating knowledge baseline and design thinking. T4.4 takes place throughout the whole project length of 36 months and the D4.2 has been positioned to be developed at this critical stage to build a foundation for T4.4 in order to guide the upcoming steps in the remainder of the project.

In order to provide such a foundation and guidance for T4.4, this D4.2 highlights the two key advances made by T4.4 from M1 to M12: proactive search for clarity and alignment for better synergy. This report begins with a summary of the identified clarification of T4.4's position and contribution to the evolving project vision and plan. This is followed by a detailed breakdown of the methodology developed to clarify the scope of the focus on the notion of 'end users' in BIPED, synchronisation with both the updated BIPED DT solution end-goal vision and project roadmap, and an implementation strategy to guide future Forum activities.

Building on this evolution of the T4.4 strategy, this report provides an overview of where T4.4 efforts to date (M12) fit into this strategic plan, and also provides a projection of next steps with specific expectations from each content WP (WP2 - 5) for the remaining two years. Discussions of T4.4 planning and implementation throughout this report have been embedded in a broader consideration of the Forum's linkage to other WP plans, which makes the updated design and operational strategy of T4.4 presented in this deliverable a more solid foundation to guide the following practices to maximise the contribution of T4.4 to the success of the project.

# 1. Introduction

As part of Work Package 4 (WP4), this deliverable, Deliverable 4.2 (D4.2), reflects the progress of Task 4.4: Establishment of the Stakeholder/End-User Forum (T4.4), abbreviated as "Forum" in the following discussion. T4.4 runs throughout the three years of the project. D4.2, due in Month 12 (M12), is intended to summarise the first year of development and, on that basis, provide guidance for efforts in the remaining months of the project.

The BIPED vision starts with initial exploration at the pilot level to build an LDT design to address the challenges of the Positive Energy District (PED)<sup>1</sup> in Bradbrand, Aarhus. As the project is intended to support PED efforts across Europe, BIPED's ultimate goal is to bring the pilot-based LDT design to other European district contexts, making BIPED DT a more flexible, scalable, replicable and sustainable PED solution across Europe. Achieving this goal requires high quality engagement with key end-users, defined in this context as those whose opinions determine the direction of functionality and usability that the BIPED design should achieve. This need for end-user input is the rationale behind the creation of T4.4.

Of all the stakeholder related activities in BIPED, compared to T2.5 on data space communities and WP3 on broader stakeholder engagement in Aarhus, T4.4 provides a unique contribution on two main fronts. First, T4.4 sharpens the stakeholder engagement with a clearer focus on end-users. Second, it takes the initial design of the BIPED DT solution, based on the pilot city context, beyond the pilot level by engaging with non-pilot potential end-users. This linking of end-users between pilot and non-pilot settings is mutually beneficial. While pilot end-users can benefit from the expert insights of non-pilot potential end-users through the facilitation of the forum, non-pilot experts and end-users can also experience the development journey at the pilot level, which may encourage their support for later exploration of BIPED scalability and replication.

Based on the project roadmap discussed in the following sections, M1 to M2 represented the first of three phases over the course of the project, focusing on knowledge building and design thinking. At the time of this report (M12), together with the first rounds of deliverables in M6, the activities of the different WPs have succeeded in establishing some basic steps to advance the objectives of each WP. Therefore, M12 marks a key milestone where internal alignment and synergies are most needed, based on actual practices over the past months, to guide the upcoming collaboration between the WPs.

For this objective of synergies and alignment, D4.2 was envisaged in the original proposal to be delivered at this point. The main objective of this report is to provide better clarity to specify the purpose and value of T4.4 based on the evolved project plan and to create better synergies with the activities of other WPs for more efficient collaboration to achieve the BIPED goal. D4.2 serves as a foundation with observations and lessons learned over the past 12 months to guide the establishment and facilitation of the Forum for the remaining two years. The core content sections in this deliverable are thus structured as follows:

- **Section 2: Core objectives of the Forum and Its Role** provides a more detailed overview of the core objectives of this Forum. In particular, the section clarifies the unique contribution of this Forum among all other stakeholder engagement related

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<sup>1</sup> In BIPED, Positive Energy District is defined as “an urban neighbourhood with annual net zero energy import and net zero CO<sub>2</sub> emissions working towards a surplus production of renewable energy, integrated in an urban and regional energy system”, in accordance with the JPI Urban Europe definition. (<https://jpi-urbaneurope.eu/ped/> )



## D4.2 Stakeholder/End-user Forum

activities planned in BIPED across WP2, 3 and 4, which is then followed by a thorough breakdown of how the Forum contributes to each of the WP objectives.

- **Section 3: Methodology and Roadmap** summarises the methodology developed to categorise the stakeholders involved in order to further identify the end users that should be considered for the Forum. Based on this, the section also highlights how the planning of the Forum is in synergy with the overall development flow of the project - the Roadmap.
- **Section 4: Progress Summary** summarises the progress made during the first year of the project in accordance with the methodological breakdown and roadmap presented in Section 3.
- **Section 5: Reflection and Next Steps** builds on the discussions in the previous sections and highlights some core reflections based on the progress up to date (M12). It also lists the priorities for the next two years with specific expectations for each WP objective.

## ● 2. Core objectives of the Forum and its Role

To better understand the purpose of the core contribution of T4.4, there are two key aspects to consider. First, it is important to clarify the purpose of the task by design, i.e. what the task is designed to achieve. Second is where this task is positioned in the project in relation to other activities to get a broad overview of the unique contribution of T4.4 to the project vision, especially in comparison to activities with a similar purpose of stakeholder engagement. Based on this, an emphasis on how the task contributes to each WP is important to ensure that integration across work streams is achieved.

### ○ 2.1. BIPED Stakeholder/End-user Core Objectives

The establishment of a stakeholder and end-user Forum is a cornerstone of the BIPED project to ensure that the digital twin solution is not only robust in design, but also aligned with the diverse needs of its users. The Forum complements the stakeholder efforts at the pilot city level by supporting the identification and engagement of the target end-users for the BIPED DT solution. Most importantly, with insights from key stakeholders and potential end-users outside the pilot setting, this Forum plays a crucial role in ensuring the broader applicability of the developed LDT solution by other cities and users. It also takes a proactive stance in preparing the solution for later exploration of scalability and replicability, instilling confidence in the project's future.

Therefore, this Forum serves as an inclusive, dynamic platform that fosters continuous engagement, collaboration and feedback from a wide range of stakeholders within and mostly beyond the pilot city of Aarhus. By actively involving city representatives, infrastructure operators, technology providers, policy makers and academic experts, the Forum aims to co-create BIPED innovative solutions that directly address real-world challenges.

Through regular workshops, virtual collaborations, and targeted working groups, the stakeholders and end-user Forum will act as a vital bridge between technical development and on-the-ground BIPED application, empowering cities to lead the transition toward a smarter, more resilient, and sustainable urban platform, contributing to the iterative development of the Digital Twin solution. Specifically, its value can directly feed into the two key project objectives as shown in the table 1 below:

○ *Table 1. Key Project Objectives to which the Forum Contributes*

Objectives	Description
<b>Critical mechanism for validating the interoperability and scalability of the LDT's components.</b>	Aligned with the recent strategic realignment of the Local Digital Twin toolbox, this Forum will also serve as a <b>critical mechanism for validating the interoperability and scalability of the LDT's components</b> . The new strategy emphasizes modularity, adaptability to diverse urban contexts, and alignment with European and global data-sharing frameworks. To this end, the Forum will actively explore how the toolbox can integrate seamlessly with existing systems while addressing evolving urban

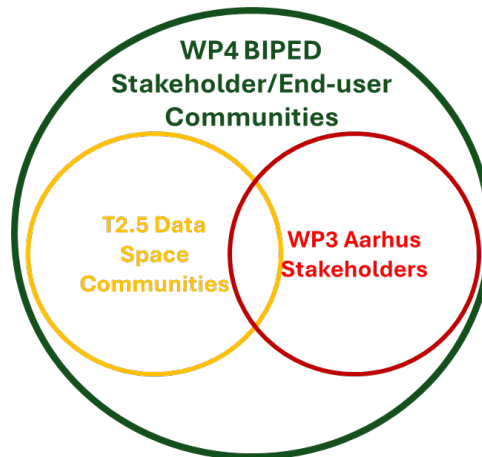
	challenges, including climate resilience, efficient resource management, and citizen-centric governance.
<b>Use case demonstrations and validation scenarios</b>	Moreover, the Forum will facilitate the creation of <b>use case demonstrations and validation scenarios</b> , enabling participants to provide context-specific insights that enhance the relevance and utility of the toolbox. This participatory approach not only ensures the solution's technical robustness but also builds trust and ownership among future adopters, fostering wider acceptance and long-term uptake.

## ○ 2.2. The Role of the Forum in BIPED

In general, there are three stakeholder engagement streams embedded in the BIPED design. Based on the numerical order of the WPs, the first stream is in WP2 - T2.5 of data space provisioning with the aim of connecting the project LDT development to the existing key data space communities. The second stream is in WP3 with the primary focus on the engagement of pilot cities to ensure the development of the LDT solution. The third stream that this deliverable focuses on is T4.4 of the Stakeholder/End-User Forum.

Compared to the other two streams, the T4.4 stream reflected in this deliverable contributes from a unique complementary yet broader angle, which is mainly reflected in two aspects. Firstly, with its specific focus on 'end users', this stream helps to identify the key potential users whose feedback should be prioritised for the initial development of the BIPED DT solution. This is essential to sharpen the focus of engagement to achieve the initial development of the solution based on the pilot setting. Secondly, T4.4 focuses on engagement beyond the pilot level. By reaching out to, identifying and engaging with stakeholders and potential end-users outside of the Brabant, Aarhus, the Forum also helps to prepare the designed solution for the project's later exploration of scalability and replicability beyond the initial pilot setting.

In this forum, connecting key stakeholders and end-users within and beyond the pilot city is valuable for both sides. On the one hand, the targeted pilot end-users can benefit from the insights of external experts to further develop the initial LDT design. At the same time, external stakeholders and potential users can also be motivated by experiencing the initial development in the pilot setting, thus encouraging their support in the later phase of taking the LDT solution beyond Aarhus. Therefore, T4.4 includes key stakeholders/end-users from both T2.5 and WP3, but also goes beyond them to include communities beyond the pilot setting, as shown in the figure 1 below.



- Figure 1. T4.4 (WP4) Relationship with Other Stakeholder Engagement Activities

- 2.2.1. Connection of the Forum to WPs activities

To better link T4.4 with other WP activities, below is a summary of how the Forum is expected to contribute to each WP's objectives:

- **Connection to WP2**

- **WP2 Overview:**

WP2 develops technologically the BIPED digital twin for the Brabrand district in Aarhus, Denmark, incorporating models for energy usage, mobility, and cross-sectoral data to a digital twin platform: Developed digital twin integrates real-time urban data with a 3D city model, drawing on geospatial data, building models, topography, textures, land use, and metadata and incorporates data on energy systems, mobility, traffic, sensors and other cross-sectoral properties, such as urban demographics or economic variables. For developed and integrated data models extending the commonly used digital twin modelling for PED development, an extended PED assessment framework, will be developed assessing its performance. Furthermore, as part of WP2, BIPED digital twin is being integrated and deeply nested into the European Data Space environment, engaging with data space communities to foster collaboration and facilitate the access to AI-enabled data services.

- **Expected Contribution from T4.4**

The Stakeholder Forum is an important part of building a digital twin to support the development of a PED for a neighbourhood such as Brabrand. By integrating different data-driven models, the BIPED digital twin provides detailed information for decision makers, urban planners, local business and the public to make decisions that will have a big impact on the local community, sustainability, economy and future urban development. This leads to the need for very detailed local knowledge of local needs and challenges. In order to develop and integrate models that truly support the solution of local needs, it is crucial to involve such stakeholders and provide them with such insights to inform the technical development and ensure that the needs are addressed by BIPED. In addition, different groups have different interests

that need to be taken into account to ensure that no one is left out. From a technical development perspective, and as BIPED is a highly data driven project, it is important to get local data owners on board to access and use the data needed for modelling purposes.

- **Connection to WP3**

- **WP3 Overview:**

WP3 co-develops and implements the PED in the Brabrand district of Aarhus by engaging and involving a diverse range of local stakeholders. The BIPED project has identified four major stakeholder groups: public sector decision makers, private enterprises, citizens, communities & local interest groups, and innovation communities. Given BIPED's ambition for high-impact, human-in-the-loop design and implementation, WP3's efforts to democratise and implement the PED will continue throughout the entire duration of the BIPED project. WP3 will use the digital twin to improve evidence-based decision-making and to create district development pathways with a clear timeline for associated transformation actions. Furthermore, it will involve and train necessary public and private actors at the district and city level in building and using digital twins for co-creation, communication, public consultation/dialogues, and good practice sharing.

- **Expected Contribution from T4.4**

Creating a stakeholder/end-user Forum is essential for WP3 to link local stakeholders and end users with the scaling of BIPED's solution. This Forum supports WP3 by engaging diverse stakeholders, providing continuous feedback, and facilitating knowledge sharing. It helps train public and private actors in using digital twins, promotes co-creation and collaboration, and ensures effective communication and public consultation. Integrating the strong connections with Aarhus stakeholders and end users into the broader project allows others to benefit from the insights and experiences that Aarhus is gaining. This involvement ensures WP3 activities are inclusive, validated, and aligned with community needs throughout the project.

- **Connection to WP4:**

- **WP4 overview:**

WP4 Impact Monitoring, Guidelines & Replicability focuses on exploring the flexibility and replicability of the BIPED DT solution to ensure long term and sustainable impact across Europe. This includes developing a comprehensive impact monitoring and evaluation framework and strategy, establishing a forum for continuous feedback from end-users, developing a robust risk management and data security strategy for the digital twin, creating an action plan with clear guidelines and recommendations, and assessing the replicability of the project approach for other cities and contexts.

- **Expected Contribution from T4.4**

To be able to achieve the goal of providing a practical action plan and guidelines, this requires close collaboration between the monitoring and evaluation (M&E) strategy and end-user engagement. The evaluation process will combine a thorough review of partner and stakeholder feedback (collected through forms, interviews and workshops) with quantitative data analysis. This data will be used to assess project activities and interventions,

with the BIPED Evaluation Forum playing a key role in refining the evaluation process (Table 2)<sup>2</sup>. The BIPED Evaluation Forum (starting in December 2024) will bring together internal project stakeholders to share perspectives and insights. Through collaborative workshops and discussions, the Forum will analyse qualitative data, identify challenges and formulate actionable recommendations. This will foster a common understanding of the project's progress and ensure alignment on objectives.

The End-user Forum can play a crucial role in enhancing the evaluation process of project interventions. The Forum can provide a platform for consolidating insights from stakeholders by facilitating the collection and analysis of both qualitative and quantitative data, gathered via feedback forms, interviews, informal discussions, and group workshops. This approach can ensure that the evaluation process is continuously refined and adapted to ensure best practice within the M&E framework.

o *Table 2. Mechanisms and Process for Assessment*

Who	What	When	How
<ul style="list-style-type: none"> <li>- Key Actors</li> <li>- Focus Groups</li> <li>- Partners</li> </ul>	<ul style="list-style-type: none"> <li>- <b>What data is available?</b></li> <li>- <b>What do the partners want to highlight from each intervention?</b></li> <li>- <b>What needs to be recommended for replication?</b></li> </ul>	<ul style="list-style-type: none"> <li>- Scheduling of data provision requests</li> <li>- Data collection during workshops</li> <li>- After action reviews (feedback forms)</li> </ul>	<ul style="list-style-type: none"> <li>- <b>How to gather the data that is needed</b></li> <li>- Questionnaires, interviews or other process to collect data</li> <li>- <b>How will we report the results?</b></li> </ul>
Primary Involvement	Quantitative & Qualitative Data	Events / Interventions	Evaluation Mechanisms
<p>BIPED Partners</p> <p><b>Second Involvement:</b></p> <p>Identified External Stakeholders (NGO, Academic, Public, Enterprise)</p>	<p><b>What datasets are available to the project?</b></p> <p><b>How is project KPI data captured?</b></p> <p><b>Where is it stored? (Google Drive, SCM-SRT)</b></p> <p>Challenges, lessons learned, solutions and recommendations emerging from project initiatives</p>	<p>Process for collection of data for the lifespan of the project</p> <p>Feedback on events and activities within Aarhus</p> <p>Event calendar to allow project consortium to track activities</p>	<p>Recurring meetings to foster collaboration within data collection meetings</p> <p>Series of data collection sheets / event feedback forms</p>

<sup>2</sup> Refer to D4.1 for more information on M&E strategy

## D4.2 Stakeholder/End-user Forum

		Mechanism to ensure recurring assessment of activities/initiatives	Use of information and dissemination within the project consortium (management meetings, WP specific meetings) and externally (project website and social media channels)  Reporting formats (flyers, reports, fact sheets)
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- **Connection to WP5:**

- **WP5 Overview:**

WP5 is the main driver of project-level Communication, Dissemination, Exploitation (CDE) activities.<sup>3</sup> The goal of WP5 is to make BIPED a recognisable brand in the energy community, to make it an authoritative voice on PEDs and LDTs, and to make project results so appealing that potential adopters in new cities and contexts will see value in using BIPED to pursue their policy, social, technical or economic objectives. WP5 does not work in a vacuum. It relies on cooperation with other WPs where local CDE activities (WP3), international CDE activities (WP4) and technical activities (WP2) take place.

- **Expected Contribution from T4.4:**

The composition of the Forum will play a critical role in its expected impact. BIPED is keen to ensure a balanced participation, which will enhance the quality of outputs and ensure market acceptance and uptake. Some key groups to be included in the Forum are local representatives from Denmark, other EU projects related to PEDs, experts from academia and the private/public sector. The specific list of participants will be tailored based on the defined needs. Depending on who is in the forum, different engagement opportunities can be envisaged to support the dissemination activities of WP5, for example:

- Local Danish stakeholders: co-create the BIPED story with a focus on the policy context (see chapter 5 for details)
- EU projects: participate in a Horizon Results Booster
- Multi-sectoral experts: remove abstraction from the positive-energy-X concept to understand how it manifests itself, how it scales and can be measured at the level of a building, neighbourhood, district
- Other cities: adopt the BIPED template to create their own story and build a positive-energy-X

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<sup>3</sup> CDE: communication, dissemination, exploitation

## ● 3. Methodology

For T4.4, a key objective of the first 12 months of the project is to translate the proposed end-user engagement and Forum's vision into an implementable strategy. This strategy will also need to be well synchronised with the continuing evolution and updates to the design and development of the other WPs and the overall project objectives and plan. This deliverable, D4.2, marks the achievement of this milestone in the development of such a strategy. M12 is a critical time to achieve this planning step for T4.4, as foundational steps have now been achieved across all WP activities, leading to the need for more systematic alignment on next steps.

This section summarises the T4.4 methodology that has been developed over the last 12 months. Starting with the clarification of what an end-user is in the broader context of stakeholders, this section provides an overview of how a forum with key stakeholders and specifically end-users contributes to and synergises with the final vision and project roadmap for the BIPED DT solution. Operationally, the sub-sections also include a summary of how the targeted end-user groups will be mapped and designed to be involved, together with a description of how these processes will be documented. At the end of this section, a dedicated sub-section also highlights some key regulatory considerations that the T4.4 design has taken into account, both for design and operation.

### ○ 3.1 End-Users: Beyond General Stakeholders

The involvement of key stakeholders is critical for BIPED, and whereas a balanced stakeholder engagement is needed, end-users are the focal point. The primary group that this forum is designed to focus on are the key stakeholders, specifically the end users. By definition, end-users are those who will directly use the solution being developed, in this case the BIPED DT solution. Based on this logic, end-users are a specific group of stakeholders. Therefore, while all end-users are stakeholders, not all stakeholders are end-users. Thus, in order to establish a forum that is built by end-users, a necessary process is to identify end-users from the broader set of targeted stakeholders.

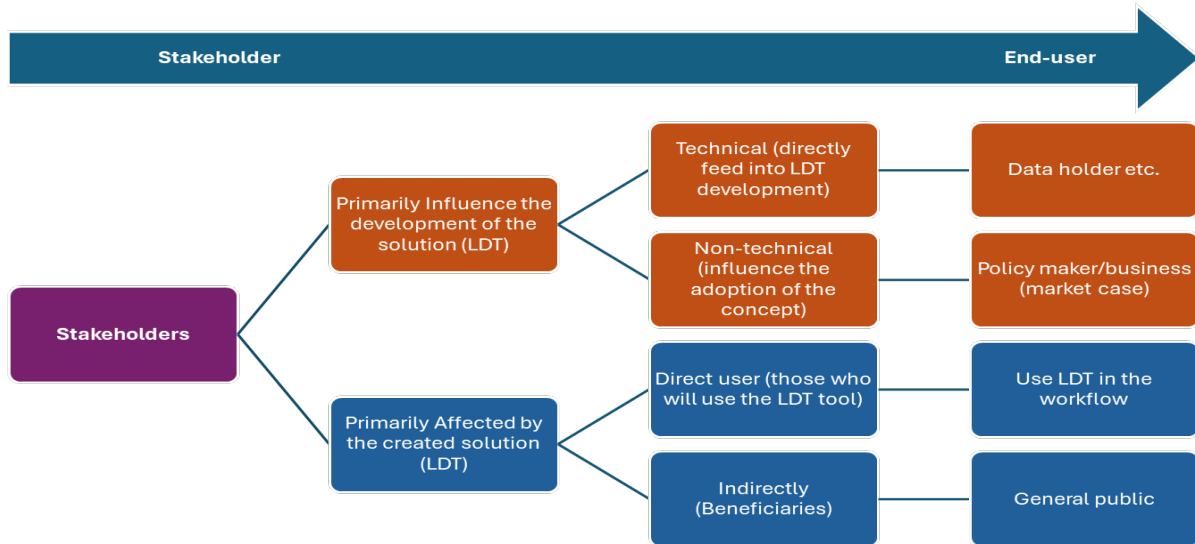
As shown in the diagram below (figure 2), the concept of 'stakeholder' in the EU context can be broadly divided into two categories. The first category is those who can primarily directly influence the development of the solution, which in the case of BIPED is the LDT solution. While this may refer to those with direct technical expertise whose feedback can be directly used to guide the BIPED DT development process, such as key data holders, etc., it also includes those non-technical key stakeholders, such as policy makers and business actors, whose opinions on the BIPED will influence the critical support the project can receive for the development, implementation and adoption of the solution.

The second category is those who are primarily affected by the solution being created, the BIPED DT solution. This may include the direct users who will use the solution in their workflow. For example, if the BIPED solution is designed to support the work of the public sector, this may refer to those in the respective departments who will directly oversee the implementation. On the other hand, those primarily affected by the solution may also be indirect beneficiaries, whose aspects of life may be affected by the creation of the solution, although they do not have their hands on the solution directly. An example would be the general public if the solution is primarily used by the public sector.

Of course, there is overlap between the two categories of consideration. For example, some public sector technical experts may be both the key technical influencers in the LDT development and those whose workflow will need to be adapted due to the BIPED DT creation if adopted. The value of this process of deconstructing the 'stakeholder' concept is to gain clarity on where the end users sit within the wider stakeholder consideration. As shown in the diagram below (Figure 2), a more direct link can be made with those who are likely to adopt this into their workflow, along the lines of what an end-user is. At the same



time, those whose opinions determine the acceptance of the BIPED concept, such as policy makers, should also be considered as 'indirect' end-users, who should also be prioritised by the end-user focused engagement envisaged by the Forum.



- Figure 2. T4.4 Deconstruction of the Concept of 'Stakeholder' to 'End-user' in the EU Context (OASC)

- 3.2 Synchronization with the BIPED DT Development Plan and Project Roadmap

The creation of the Forum is intended to contribute to the achievement of the project objective, which is based on two core parts of the planning: the BIPED DT solution end goal vision and the overall project roadmap. The BIPED DT solution vision is to specify what kind of LDT solution the project intends to achieve in the end. The roadmap is the path the project will take to achieve the final vision. The following subsections therefore provide an overview to specify how the T4.4 angle contributes to both parts: the BIPED DT solution end-goal vision and the general roadmap. On the one hand, this will identify the need for T4.4 in specific aspects of the LDT development project. On the other hand, it also shows how the function of T4.4 evolves with the project development.

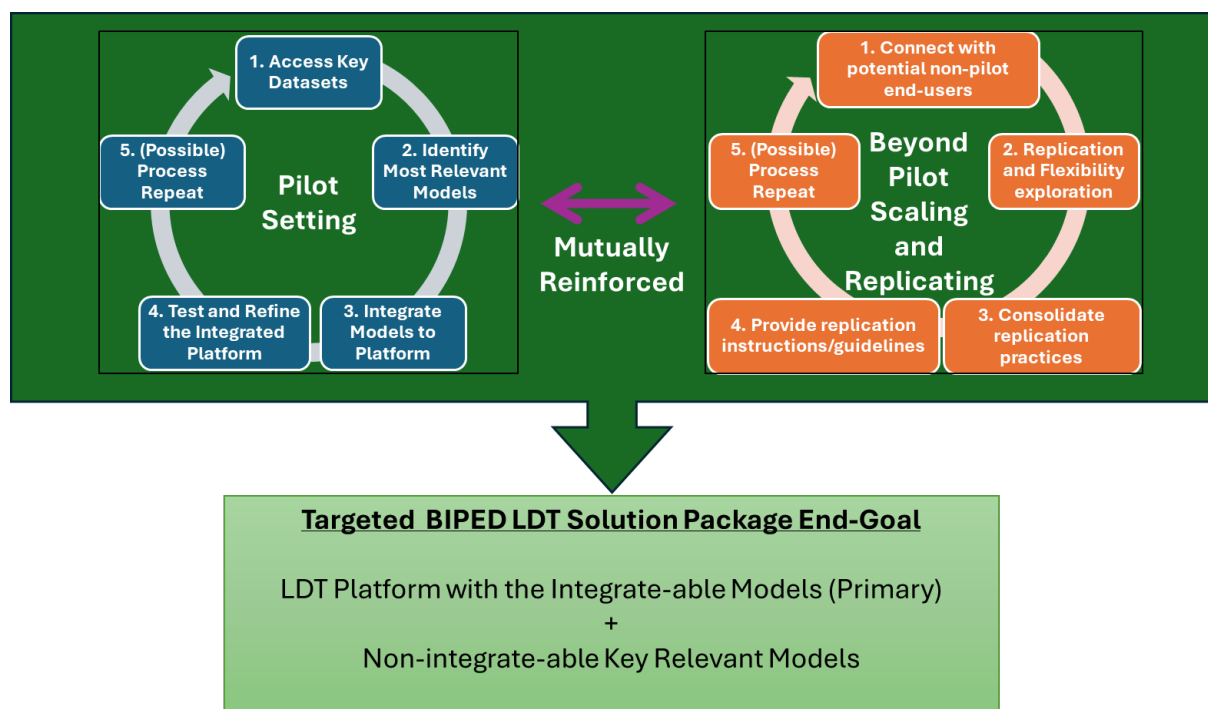
- 3.2.1. Synchronisation with the Latest BIPED DT Solution Vision

In addition to the challenges that would be faced by an LDT solution for a specific problem with a refined focus for a specific area of a context, an LDT solution design for PED adds even more complexity. This added complexity comes from the dynamic nature of a 'district' - an in-built complex ecosystem with multiple variables such as diversity of occupants, infrastructure conditions, etc. It is already a challenge to capture all these levels of diversity and variety in the virtual domain, or to decide on a sufficient level of representation. In addition, this aspiration to make connections between mobility, energy, cross-sectoral and soft data practices adds further complexity to the design and exploration of the BIPED DT. Depending on who is asked from which angle within these chosen domains, the answers would differ as to what functionalities they would like to see realised by the BIPED DT solution.

In order to reflect and best address the diverse needs within a district in the spirit of a PED, the BIPED DT design will be demand-driven, driven by a wide range of models and

algorithms in line with LDT considerations and usage that could include for example a short-term and long-term planning. Starting with the initial exploration at the pilot level (Aarhus, Denmark), with the most relevant models in the energy and mobility sector, that cover the cross-sectoral and soft data domains. Those models will be integrated in the unified platform provided by DKSR, a technical consortium partner, enabling a consolidated BIPED DT platform. For models of high relevance that cannot be integrated, they will also be included alongside the DKSR platform as part of the final BIPED DT solution package.

This reflects the current thinking (M12) of the BIPED DT end goal, which will be further developed and refined during the remainder of the project. A further breakdown of this vision is required to provide an overview of how the Forum's contribution (T4.4) synergises with this LDT end goal plan. Further details and updates on the BIPED DT Strategic Plan and the current status (M12) of its development can be found in D2.1 (M6) and D2.2 (M12). As a high-level summary, Figure (3) below shows the overall flow of development from the pilot level focus to the latest targeted LDT end goal outcome vision of the project. It highlights some key steps in each aspect under consideration: pilot and non-pilot, and how the final package BIPED aims to deliver at the end of the project period.



● Figure 3. BIPED DT Solution End-Goal Vision Breakdown

**Starting from the pilot level**, the process involves roughly 5 steps. Below is an overview of each step and how T4.4, the Forum, synergizes with the objective of each step:

- **Step 1: Access to Key Datasets**
  - Description: The aim of this step is to map, identify and gain access to key datasets at a pilot level covering the core areas under consideration. This includes key district infrastructure data, which is essential for the initial development of a digital twin of the target district. Other domains such as energy, mobility, cross-sectoral and soft data are also needed to explore later functionality for positive energy flow. This step has already taken place and has been the focus of the last 12 months.

## D4.2 Stakeholder/End-user Forum

- Forum's contribution: For this step, T4.4 has mainly contributed to supporting WP3's activities to identify and engage with key stakeholders in the pilot area to support WP2's work to gain access to these key datasets.
- **Step 2: Identify Most Relevant Models**
  - Description: In order to connect and address challenges across all target domains, this step focuses on mapping existing models across these domains that are consistent with the expected BIPED DT functionalities. The models under consideration are primarily those already developed by the consortium partners, but the consortium is also considering those presented by local stakeholders through ongoing engagement in line with the scope of the project.
  - Forum's (T4.4) Contribution: to help to identify the most relevant models, together with WP3, the Forum supports the identification of key stakeholders and end-users for each considered model for testing and evaluation.
- **Step 3: Integrate Models to the DKSR platform**
  - Overview: With the datasets and most relevant models, this step will be to integrate the identified key models to the main platform provided by the consortium partner, DKSR.
  - Forum's (T4.4) Contribution: to support getting insights from the needed key stakeholders/end-users to support this integration process. This will be primarily with those at the pilot level, but if requested, the Forum will also help to facilitate engagement with non-pilot experts and potential end-users for additional input.
- **Step 4: Test and refine the Integrated DKSR platform/models/KPIs**
  - Overview: After the integration step, the integrated platform will be further tested and refined for the targeted functionalities.
  - Model and KPI Refinement: Together with WP2 and WP3, the models and KPIs will be refined having stakeholders opinions along the project.
  - Forum's (T4.4) Contribution: Together with WP3, the Forum will support the identification and engagement with the necessary end-user groups to test and provide input on the integrated solution for improvement but also to any model and KPIs refinement. This will be primarily with those at the pilot level, but if requested, the Forum will also help to facilitate engagement with non-pilot experts and potential end-users for additional input.
- **Step 5: (Possible) Process Repeat**
  - Overview: Depending on the performance and outcome of the testing and refinement, the process may return to the previous step(s) for further improvement.
  - Forum's (T4.4) Contribution: If it is necessary to revisit the previous step(s), this forum will continue to provide the support listed in each step.

**At the later stage of non-pilot settings**, the focus will then be on exploring the scalability and replicability of the initially pilot-focused BIPED DT design in other parts of Europe. The aim of this process is to support and encourage the successful replication of the BIPED DT solution design to a solution model that allows for wider applicability. As shown in Figure (3), this stage consists of the following steps:

- **Step1: non-pilot end-user outreach**
  - Overview: Identify and liaise with potential end users from non-pilot districts/cities to explore BIPED DT replication in other settings.
  - Forum's (T4.4) Contribution: to support outreach to external stakeholders and the identification and compilation of non-pilot end-user contacts and networks.
  
- **Step 2: Replication and Flexibility Exploration**
  - Overview: work with external end-users to explore the flexibility and replicability of the BIPED DT.
  - Forum's (T4.4) Contribution: facilitate regular interaction with external end users to reflect on the exploration process and gather insights to feed back into further refinement and improvement of the LDT design.
  
- **Step 3: Consolidation of the Exploration Practices**
  - Overview: Consolidate and review replication exploration practices outside the pilot communities. This will also be compared with the pilot level testing for further reflection on how to make the BIPED DT solution more widely applicable.
  - Forum's contribution (T4.4): Active facilitation of exchanges through workshops, meetings and seminars etc. between end users from both non-pilot and pilot levels to compare notes and explore the potential for wider applicability of BIPED DT.
  
- **Step 4: Provide Replication Instructions and Guidelines**
  - Overview: based on the exploration practices, this step is to transform the experience of flexibility and replicability together with the pilot level process into practical instructions and guidelines for future adoption beyond the project duration.
  - Forum's (T4.4) Contribution: through the Forum, engagement with end users who have direct experience with the BIPED DT platform to tailor a set of instructions and guidelines for future experimentation.
  
- **Step 5: (Possible) Process Repeat**
  - Overview: Depending on the result, the process may return to the previous step(s) for further improvement.
  - Forum's (T4.4) Contribution: If it is necessary to revisit the previous step(s), this forum will continue to provide the support listed in each step.

Compared to the pilot phase, the Forum's contribution during this process will be similar to that described above. The main differences are twofold. The focus of end-user engagement in this setting(s) will be shifted more towards or extended to non-pilot end-users. In addition, the Forum will support the work to refine targeted functionalities, and minimise pilot-specific variables in the design to enable seamless wider applicability as part of this project stage.

As shown in D2.2, BIPED has now (M12) reached a new milestone with the updated release of the LDT solution foundation based on the pilot setting. With this foundation, the development and refinement of LDT solutions between those in the pilot setting and those in the non-pilot setting(s) will become increasingly mutually reinforcing in the future. While the involvement of end users outside the pilot can bring external expert insights to further strengthen the design at the pilot level, the external (potential) end users can also

experience the process of the pilot experience through the facilitation of the T4.4 Forum, which can also encourage their support in improving the BIPED design for wider applicability. This mutual reinforcement can create a positive flow of interaction between pilot and non-pilot end-users and key stakeholders to support the BIPED to reach its final goal of the solution package (Figure 3).

■ 3.2.2. Synchronisation with the Project Roadmap

Translating the latest BIPED DT vision plan discussed in the above section into a project roadmap, the three-year duration of the project can be therefore broadly divided into three phases, as shown in the table below. Each phase has a different focus that represents the progression of the project. Year 1 (Y1), from M1 to M12, is the first stage and focuses on achieving an initial foundation of the LDT solution based on the pilot setting. Year 2 (Y2), the next year of the project calendar from M12 to M24, will focus on the implementation and refinement of the design developed in Y1. The last year’s (Y3) aim is then on scalability and replication of the solution to initiate testing and adoption of the solution beyond the pilot setting.

Linking this general trajectory with the objectives of T4.4, for Y1, in order to achieve the initial base of the LDT design, T4.4 has primarily supported the activities of WP3 of the Aarhus focused engagement, such as helping to raise awareness of the project and working with WP2 to identify feedback needs in the pilot scope. Entering Y2, with a base of the LDT solution, T4.4 will be able to better support the identification of pilot level end users and work with them to further develop the usability of the solution. There will also be a focus, particularly in the latter half of the year, on incorporating more feedback from non-pilot stakeholders to prepare for scalability and replicability. Building on this, in Y3, T4.4 will play an even more active role in facilitating the testing and eventual replication of the designed LDT by non-pilot end users.

Therefore, as the project moves from the pilot setting to outside the pilot, T4.4’s role in stakeholder engagement will also change from supporting at the pilot level to leading engagement at the non-pilot level for scalability and replication. The table below summarises this evolution of T4.4’s focus over the project years.

○ Table 3. The Forum’s Support Angle Roadmap

Text	Year 1 (M1-M12) 2024	Year 2 (M12-M24) 2025	Year 3 (M24-M36) 2026
<b>Phase (Original Text from the Proposal)</b>	Development (Knowledge Baseline and Design Thinking)	Implementation (PED Design and Validation)	Replication (Scaling and Sustainability)
<b>Target Stakeholder Groups for Engagement</b>	Primarily Aarhus-focused for the initial design and development of the LDT solution	Aarhus-focused for usability second half: non-Aarhus stakeholder feedback (development focused)	Broader stakeholder/end-user engagement outside of the pilot
<b>Forum’s Support Angle</b>	<ol style="list-style-type: none"> <li>1. Support WP3 to raise awareness of the project</li> <li>2. Provide</li> </ol>	<ol style="list-style-type: none"> <li>1. Improve usability of the solution in the pilot setting</li> <li>2. Raising awareness</li> </ol>	<ol style="list-style-type: none"> <li>1. Scalability</li> <li>2. Replicability</li> </ol>

	needed support for the initial LDT development	3. Feedback for LDT development beyond the pilot-specific focus	beyond Aarhus
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### ○ 3.3 Operational Strategy of the Forum

The format of the Forum's engagement is flexible, depending on the needs and availability of resources. It may therefore be through the facilitation of workshops, seminars and panel discussions, but also through surveys, polls, etc. Based on synergetic clarity with other WPs on the specific needs for feedback from the Forum, the form and frequency of the Forum will be adapted accordingly. Where budget allows, face-to-face exchanges in the Forum will be facilitated, but in the main most engagement has been and will be online, which also allows for better coordination of participants' schedules.

As part of the Forum's operational strategy, in combination with the discussion in the previous parts of the methodology, the following sections outline the specific strategy used to identify end users and the documentation process to record engagement for internal communication and alignment.

#### ■ 3.3.1. Methodology to Identify End-users from

As highlighted in section 2, while all end-users are stakeholders, not all stakeholders are end-users. End-users are a specific group of stakeholders whose opinions are critical to the development, usability and adoption of the solutions at hand, which in this case is ultimately the BIPED DT solution set. Therefore, engagement with end users should be a priority to drive the development of BIPED DT. In order to combine the discussion in the previous section on the final vision of the BIPED solution and the project roadmap, the Cartesian coordinate graph below is designed to categorise stakeholders in order to identify end-users.

As shown in Figure (4), the vertical axis represents the degree to which the target stakeholder is technical, having direct technical expertise to understand the technical design of the BIPED DT. The horizontal axis measures whether the stakeholder will directly use the BIPED DT, if adopted, or will be more of a beneficiary, whose aspects of life will be primarily affected by the solution. It is important to note that the consideration here is 'primarily', as a technical expert who would be a direct user may also be a beneficiary. The purpose of this system is to identify the more direct end users whose opinions would directly influence the design, development, implementation and adoption of the BIPED solution.

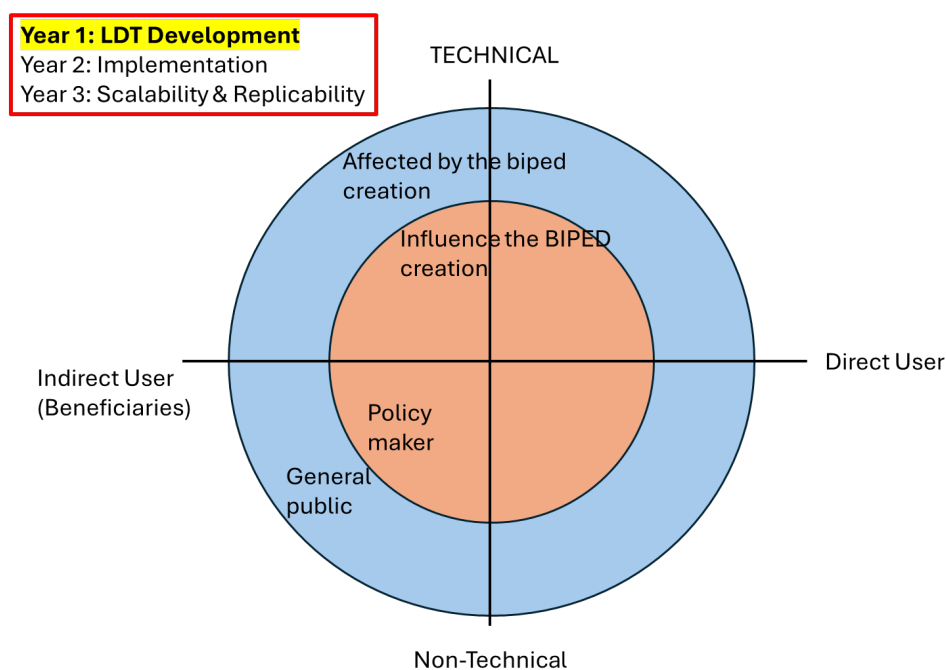
Therefore, the two circles were to help to distinguish the level of priority based on the BIPED DT objective at a certain stage. To recall, the whole project length can be roughly divided into three phases. Phase 1 has been on creating a knowledge baseline and design thinking for initial development of the BIPED DT. Phase 2, roughly in year 2 from M12 to M24, will focus on further PED design and validation for implementability and usability. Phase 3 then will aim at replicability and flexibility of the BIPED DT design.

As a result, for each year, this Cartesian coordinate graph should be created with a different focus of each phase, based on which end users can be identified. Figure (4) is an example for year 1. In this case, the aim is to create an initial technical knowledge base of the BIPED DT. The orange circle then represents those stakeholders who can directly influence the achievement of the objective of this phase and who should then be prioritised for engagement. The outer circle (in blue) represents those who will be affected by the achievement of the objective of this stage. As this stage has been considered more at the pilot level, a similar strategy of identifying key stakeholders to prioritise for engagement is reflected in the WP3 activities (see D3.1 for more details).

## D4.2 Stakeholder/End-user Forum

The targeted end users are therefore those that are located in the orange circle with a focus on the right side of the vertical axis, which includes 'technical-direct user' and 'non-technical-direct user'. An example of a 'technical direct user' is a technical expert who, if adopted, will use the BIPED DT directly in their workflow and therefore their options are at the core of the solution being developed. Similarly, an example of a 'non-technical-direct user' will be someone who will be tasked with using the BIPED solution despite having no technical expertise, making the tailoring of usability for them more important. An interesting addition on the left-hand side of the axis is the 'non-technical - indirect user' category, which includes most key policy makers. Although they do not have the necessary technical expertise and will not be using the solution directly, their opinion is important for the support that BIPED can receive to develop and be adopted by the direct end users. Therefore, they should also be considered as key end-users whose opinions can influence the direction of development.

As we move into Years 2 and 3, there will be a different focus and therefore the orange circle will represent different objectives. Based on the developed focus for the next stage, the same system of 'technical-non-technical' and 'direct - indirect users' axes can be updated to identify the end users to engage. This system not only helps to sort out the relevance of the stakeholders to be engaged based on their level of technical expertise and likelihood of using the solution in their workflow, but it also helps with the circle of focus to identify the level of priority for engagement. This is what is needed to identify the end users, which is usually a crowd with the highest relevance and, in most cases, the highest priority.



● Figure 4. BIPED End-User Identification Mapping (Example for Year1)

### ■ 3.3.2 Documentation of the Process

The documentation process is developed in T4.4 to serve two main purposes. First, it is to track key stakeholders identified as end users and record their feedback throughout the planned engagement. Second, the documentation strategy is to align synergies with other WP activities, especially those that are also working on stakeholder engagement (as discussed in section 2.2).



The figures below are screenshots of the files created in the dedicated BIPED project drive to document the progress of T4.4. Figure (5) is the contact mapping CRM that was created, not only to record the metadata of the key stakeholders identified, but also to align the key tasks related to stakeholder engagement in BIPED: T2.5, WP3 and T4.4, as shown in columns J to M.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Title (Mr. Ms. Mrs. Dr. Prof. etc)	First Name	Last Name	Position	Email	Organisatio n/City (Region)	Country	Sector Topic	Sector Domain	General stakeholder or Targetted End-user?	Data Space Community ?	If applies, which data space Community	BIPED Contact for this Contact	Note

● Figure 5. BIPED T2.4/WP3/T4.4 Contacts CRM

Similarly, overlaps between T2.5, WP3 and T4.4 are expected, especially at the pilot level, due to the common nature of stakeholder engagement activities. Therefore, Figure (6) below is the screenshot of the tracking sheet developed to align priorities across these three streams of activities. Figure (7) is the screenshot of the internal form created for any consortium partner to submit a stakeholder engagement request for support from a particular focus area, on the basis of which all three streams of stakeholder engagement activities can be reviewed for follow up and progress. This internal alignment is intended to avoid or minimise the confusion and frustration that can arise when the same stakeholders/groups are approached from different directions for the same project. At the same time, it improves efficiency by allowing these streams of stakeholder activity to join forces where it makes sense to do so. When T4.4 holds individual workshops, it also uses the protocol template developed by BIPED to record for follow-up and future reference. All of these tracking and documentation processes adhere to required data and ethical regulatory considerations, as discussed in more detail in the next subsection.

**READ THIS:** Our current focus is on the August workshop, which relates to columns B and C.

To simplify this,  
 - Please list the questions you would like us to address at this workshop **in column B**;  
 - list the people we should prioritise to invite to address the questions you have listed **in column C**.

Specifically,  
 - for those targeted from a data space community angle, put your input **in the rows for T2.5**;  
 - for those targeted to the Aarhus stakeholder groups, put your input **in the rows for WP3**;  
 - for those targeted to the wider end-user groups (beyond the Aarhus communities and for the later replication phase), put your input **in the rows for T4.4**.

Together with WP3, we will review your input next Thursday (8 Aug). **Please provide your input by Wednesday, 7 Aug**. Thank you very much for your support and let me know if you have any questions.

	2024							
3	Schedule Month	Aug 2024	Sep 2024	Oct 2024	Nov 2024	Dec 2024		
4		Identified priorities (what questions you suggest us to ask for you)	Suggested Target Groups (whom do you think we should prioritise to invite to ask the questions you listed)	Identified priorities (what questions you suggest us to ask for you)	Suggested Target Groups (whom do you think we should prioritise to invite to ask the questions you listed)	Consortium Alignment in Copenhagen	WP2 Tech alignment	WP2 Tech alignment





## D4.2 Stakeholder/End-user Forum

- **Figure 6. BIPED Stakeholder Engagement Priority Alignment**

### BIPED Engagement Request Form

This form is designed to collect requests from BIPED partners for stakeholder engagement in the development of their WPs, deliverables and tasks. Please provide details of your engagement request. Based on this, we will contact you to discuss the next steps.

ivy@oascities.org [Switch account](#) 

 Not shared

**\* Indicates required question**

**Your name \***

Your answer \_\_\_\_\_

**Affiliation \***

Your answer \_\_\_\_\_

Please indicate which of the options below best aligns with your proposed engagement. \*

General stakeholder engagement in Aarhus

Targeted End-user engagement

Data space community engagement

Which task/deliverable/WP does this relate to? Put down all that is relevant. \*

Your answer \_\_\_\_\_

From your perspective, what is the core objective of this requested engagement? \*  
(be a bit specific) i.e. gather user experience for (what), KPI identification (which aspect) etc.

Your answer \_\_\_\_\_

What do you want to prioritise? (What is the desired outcome?)

Your answer \_\_\_\_\_

If you have targeted audience, please specify:

Your answer \_\_\_\_\_

If applies, when is your targeted deadline?

Date

dd/mm/yyyy

Other comment:

Your answer \_\_\_\_\_

**Submit** [Clear form](#)

- Figure 7. BIPED Internal Engagement Request Form

- 3.4 Key Regulatory Considerations and Management

In the light of EU regulatory developments in relation to digital solutions, particularly from a privacy and security perspective, a summary is provided below highlighting some key regulatory considerations that will be addressed to ensure that the design and implementation of the Forum and the overall T4.4 related activities meet the required regulatory considerations. For more details on how BIPED generally deals with data management, privacy and ethical considerations, please refer to the previous D1.3 and D1.4.

- *Privacy*
  - Stakeholder engagement via the Forum will be organised in a way that ensures full privacy compliance, especially as regards the General Data Protection Regulation (GDPR) that applies to collection and processing of personal data.
  - Registrations to the Forum should include a step whereby the users grant their consent with personal data processing. The consent requirement should essentially follow the Informed Consent Form template provided in Annex 3 of the BIPED Data Management Plan (DMP), including the Study Information Sheet. The consent requirement should be prompted as an option to tick the box or click the “agree” button (opt-in) instead of a pre-ticked box (opt-out) format.
  - Where it is inappropriate to obtain consent for data processing from stakeholders (e.g. where an access account is likely to be used by several individual users), the Forum will at least allow prompt users to read the study information sheet (essentially in the form provided in Appendix 3 of the DMP), which sets out the legal basis for the processing of personal data.
    - The data is collected for the legitimate interest of the BIPED consortium as set out in the information form (Art. 6(1)(f) GDPR),

## D4.2 Stakeholder/End-user Forum

- The data is necessary for scientific research or statistical purposes (Art. 9(2)(j) GDPR).
  - The consent form/ information sheets need to set out which personal data will be collected (i.e., names, email addresses, etc.) and who will be able to view and access the data in addition to the BIPED consortium, i.e. the other stakeholders / Forum participants.
  - Users should have an option to remain anonymous as regards visibility to other stakeholders using the Forum (though they may remain identifiable vis-a-vis the BIPED consortium after having agreed the appropriate consent form or read the information sheet).
  - As regards particularly vulnerable groups (private citizens, local residents in the pilot district, local action groups), the preferred way should always be processing their data based on an expressly provided Informed Consent.
  - The BIPED Data Management Plan provides further context for regulatory requirements for data collection and processing by the BIPED consortium.
- *Security*
    - The Forum application / website should be hosted on servers of trusted service providers, which meet the standard cybersecurity requirements.
    - Forum data, including personal data, can be stored on BIPED Consortium Google Workspace subject to the risk mitigators set out in Section 3.5 of the DMP (these being: restricted access only to BIPED consortium partners or on a need-to-know basis by Forum users).
    - Raw data and information containing personal data and with risk of containing special categories of personal data per Art. 9 of the GDPR, such as video/audio recordings from the stakeholder workshops, will be stored and processed on secured servers of the responsible BIPED partner organisations away from the BIPED Google drives. Such data/information may be only uploaded to BIPED drives, integrated to the digital twin or otherwise made public only after being anonymised by the responsible BIPED partner, in line with principles set out by this DMP above. If necessary to store/show video/audio recording in the Forum interface, this may be done based on Informed Consent provided by the data subjects (mentioned that video/audio can be accessed by other Forum participants should be included in the Informed Consent Form).

## ● 4. Progress summary

As mentioned above, this deliverable, D4.2, is intended to capture the progress made during the first 12 months of the project, which will also form the basis for guiding T4.4 activities for the remainder of the project period. Following the above discussion of where T4.4 fits into the overall BIPED project objectives, the methodologies used to strategise the design and operation of the T4.4 design, and how it synergises with the BIPED DT solution end goal vision and project roadmap, this section highlights the key advances made by T4.4 from M1 to M12, which are generally reflected in the following three main areas.

### **1. Development of the T4.4 methodology and roadmap**

A key achievement of T4.4 has been the development of a methodology to strategise the design and operation of T4.4, not only to better adapt to the evolution of the project plan, but also to support the successful development of the LDT solution at the end. This will require strong and continuous alignment and synchronisation with other WP activities and in particular with the progress of the BIPED DT development. As detailed in the previous section (Section 3: Methodology), this synchronisation framework, the updated clarity of the T4.4 contribution and the evolved operational plan have been achieved over the last 12 months.

As highlighted, M12 marks a critical point in the project's progress. As by far all WPs have used the last 12 months to further develop their implementation plans derived from the original proposal text and have achieved fundamental steps such as the first release of the BIPED DT solution, this end of the first one third of the project duration is critical to realign and further align the WPs and activities to generate better synergies to ensure project success. Therefore, the comprehensive methodology outlined in Section 3 is combined with the real practices of the project over the last 12 months to serve as a more practical basis to guide the following T4.4 activities and ensure better synergies with other WP plans to achieve the overall project goals.

### **2. Support the initial development of the BIPED DT solution**

In this first one third phase of the project, the main focus has been on the pilot setting - to achieve a basic design of the BIPED solution based on the pilot conditions. The progress and technical details made on the LDT side can be read more in D2.1 (M6) and D2.2 (M12). In order to achieve this technical foundation, extensive stakeholder engagement in the Brabrand district is required, which has been mainly led by WP3.

T4.4's contribution to this process over the past 12 months has been to push for greater clarity and alignment to improve synergies between the WPs. In order to establish and facilitate a forum with end users, this requires clarity on what BIPED DT solution the project aims to build, for whom, and to address what concerns. This therefore requires feedback from the pilot side with potential use cases to identify potential angles of BIPED DT usability and functionality. At the same time, this also requires clarity on the technical direction based on available expertise and the availability and accessibility of key resources needed for initial design and development, such as datasets.

In order to ensure the value of T4.4 at the later stage of end-user testing, and specifically for scalability and replicability in districts outside of Brabrand, it is crucial to ensure the success of the pilot setting design. Therefore, T4.4 has had regular weekly meetings with mainly WP3 and WP, together or separately, to push for clarity and establish the necessary alignment and synergies. At times, T4.4 has also helped

to run workshops with stakeholders at the pilot level to raise awareness and communicate the value of BIPED to encourage their support for the BIPED effort. The results of T4.4's contribution to this internal alignment are also reflected in the development methodology diagrams and operational strategy shown in Section 3, which can guide practice for the remainder of the project period.

### **3. Active engagement with external stakeholders to establish a base for future non-pilot scalability and replicability exploration**

As shown in the methodology and roadmap diagram, given the initial focus on the pilot level, the main focus from M1 to M12 has not yet been much on end-users beyond the pilot level. However, in order to prepare for the later scalability and replicability phase, T4.4 has also actively engaged with non-pilot stakeholders through conferences, summits, workshops, seminars, receptions and individual exchanges to identify potential key non-pilot stakeholders for BIPED and, most importantly, potential end-users in other parts of Europe.

Without counting individual bilateral exchanges and internal workshops, from M1 to M12, BIPED has been present at around 16 major external events. These external events have not only helped to raise awareness of BIPED, but also to gain insightful feedback and connections from those working on similar topics, such as PEDs in other EU and non-EU projects, digital solutions in the climate context, and specifically on LDT use cases, etc. These connections provide a valuable basis for future exploration of non-pilot testing and refinement of BIPEDs.

In addition, under T.4.4, BIPED is also in regular exchange with two other sister projects: ExPEDite and Tips4PED for the same EU call and with the same aim of developing an LDT solution for PED challenges. As each project focuses on different pilot cities, these internal exchanges have also helped to establish links with potential BIPED end-users in other cities who are already interested and invested in the intersection between LDT and PEDs.

In addition, T4.4 has also facilitated exchanges with other large EU projects that share a similar broader Green Deal vision, such as NetZeroCities (NZC). These projects, like NZC, have established and/or connected with key networks, primarily in the EU ecosystem, such as the Mission City network, which can also provide such a valuable base for identifying and reaching potential key non-pilot BIPED stakeholders/end-users. In addition, T4.4 has also established links between BIPED and international standardisation organisations, such as the International Electrotechnical Commission (IEC) Study Group on PEDs, which can strengthen the focus and impact of the BIPED solution at the international level and also link to potential end-users.

## ● 5. Reflections and Next Steps

### ○ 5.1. Reflections

What has become even clearer during the development of the methodology plan and operational strategy for T4.4 is the (continuing) need for clarity and synergies between T4.4 and the activities of other WPs. In order to engage efficiently and effectively with end-users, clarity is needed on key questions such as

- Which end-user profile should be targeted?
- Why is this profile important for the BIPED DT?
- What feedback on what topic is expected?
- When should the feedback be collected?
- How will end-user support and participation be communicated and incentivised?

Answers to these questions are critical to successful engagement, providing clarity on what is expected of end-users. Given other priorities in end-users' daily lives, clarification of engagement objectives can not only improve the quality of feedback, but also create a more enjoyable experience for end-users.

Achieving such clarity requires synergy within the project and across WPs. From the perspective of T4.4, synergies and regular alignment are needed with WP2 to specify the need for end-user feedback based on the BIPED DT development plan and priorities, with WP3 on how to complement pilot level engagement and also connect the pilot end-users with the external potential end-users, and with WP5 on how to work together to create a better CDE plan to encourage support from the targeted end-users.

This search for clarity and synergies was behind the creation of the T4.4 methodology and operational strategy in section 3, so it serves as a good basis. However, in order to realise this vision, practical navigation to enable and encourage this search for clarity and synergy in the remaining two years of practice is crucial to ensure the success of the BIPED project's end goals.

### ○ 5.2. Next Steps

To act on the above reflections in the following T4.4 activities, below are summaries from each WP's perspective on their plannings during the remaining two years and how each expects support from T4.4.

#### ■ 5.2.1. 2025 Priorities and Planning

As shown in the roadmap in the Methodology section, with an initial version of the BIPED DT ready, the focus of T4.4 in 2025 will be twofold. The first is to improve its usability, primarily based on the testing and experience of end-users in the pilot setting, in order to further improve the functionality of the existing LDT base. Second, especially in the second half of the year, more efforts should be made to identify and engage non-pilot end-users already for some initial non-pilot testing and to gain insights and feedback to minimise pilot-specific design in the LDT for wider applicability.

For better synergy with other activities across the WPs, below are summaries from each WP of their expected support from T4.4 during this phase of the project. They only reflect the thinking based on the current plans (M12) which will continue to be improved and refined based on the actual practices.

- **WP2:** For 2025, WP2 partners focus on the steady further development of BIPED digital twin for Energy and Mobility properties, as well as the first integration of Cross-sectoral properties, based on the developed platform (D2.1) and the first release of models (D2.2). This includes the further refinement of developed models (energy, mobility) as well as the extension of BIPED by developing and integrating cross-

## D4.2 Stakeholder/End-user Forum

sectorial properties. As the latter constitutes an exploratory task by relating properties such as urban demographics, economics and soft perceptual feedback, to energy consumption, there is a need for steady feedback with the stakeholders on the model's performance. As well there is a need to connect with the stakeholder landscape on data access for integrating into the models. On larger scale, there is a need to connect to EU data space developments, ensuring the awareness and close embedment of BIPED within the EU data space environment. In summary main contributions are expected by stakeholder involvement:

- Support on data availability and accessibility.
  - Input about current challenges and needs where BIPED digital twin can be supportive
  - Expectations from the BIPED digital twin on what it should be able to deliver to be helpful
  - Feedback on developed models and their performance on detect challenges
- 
- **WP3:** In 2025, Work Package 3 will focus on training and education activities, establishing district living labs, including PED community establishment and governance practices, and strengthening both new and existing relationships with stakeholders. The Stakeholder Forum can provide valuable insights into current challenges and needs, offer feedback on our training programs and activities, and assist in the establishment of the district living labs. These contributions will be essential in ensuring our initiatives align with real-world requirements and effectively address community needs. WP3 also seeks the Stakeholder Forum's ongoing support in aligning stakeholder and end-user needs with the development of digital twins. By fostering a collaborative environment, we can ensure our digital twins are technically robust and thoughtfully designed to meet the specific challenges and requirements of the community.
  
  - **WP4:** For 2025, WP4 and task leader KPMG will focus heavily on *Task 4.2: Impact Assessment and Analysis*. This task aims to assess the impact of the various solutions implemented, utilising data collected from stakeholders and end-users through WP2 and WP3. The goal is to identify the economic, social, environmental, and technical impacts on local communities. This assessment will be integral in maintaining and updating a roadmap, which will present all impacts in a cohesive manner and provide a foundation for future replication of these solutions. This work is crucial in demonstrating the benefits and effectiveness of the LDT developed. The Stakeholder Forum will play a crucial role in this task by offering a platform for diverse voices and perspectives, ensuring that the data collected is comprehensive and reflective of the community's needs. The Forum can facilitate discussions that help refine the impact assessment criteria and provide real-time feedback on the solutions implemented, thereby enhancing the accuracy and relevance of the assessment.
  
  - **WP5:** A successful PED plan requires a clear understanding of the Positive Energy X concept, so that cities can say that district X needs so much more clean energy to achieve a surplus, share it with other districts, offset so many emissions, etc. In 2025, WP5 will focus on creating the BIPED story with a focus on the political context in Aarhus. The story is needed to: 1) show that we understand the energy context in Branrand and what it takes to make the district energy positive and possibly also climate neutral in the long term; 2) show that a digital twin is not the end goal, but a tool for PED development, whose use cases contribute to this goal in one way or another; 3) be realistic about what can be achieved within the project timeframe and

scope; in essence, we can only propose a plan (based on credible simulation results) that the city would then need to endorse and implement after the project. The following text gives an idea of the main points of the story that need to be validated, updated (with real world information), fine-tuned and ideally endorsed by local stakeholders. Once the main contours have been established, other dimensions can be added. These may include the role of standards and MIMs in achieving scalability and replicability of the developed LDT and flexibility in energy systems. The role of characteristics other than energy and mobility, namely social, economic and environmental characteristics, in contributing to the energy footprint of Brabrand.

### **Initial text for story development**

Aarhus is becoming climate-neutral, one district at a time, starting with Brabrand. Brabrand's carbon footprint represents % of the city's 1.3 million CO<sub>2</sub> emissions. District emissions are spread across transport (%), industry (%), agriculture (%), buildings (%) etc.

Energy needed to power these activities amounts to X million kWh annually. Of these, only % are produced locally from renewable sources, with the rest coming from "abroad".

BIPED is preparing a plan to help Brabrand

- Become energy self-sufficient, including by boosting the supply of locally sourced renewables
- Change status from energy importer to the exporter of (surplus) clean energy
- Offset existing emissions through energy efficiency and decarbonisation measures
- Become the first climate neutral district in Aarhus whose success can be replicated in other districts

Recommendations listed in the plan are going to be based on simulation results produced using state of the art digital twin. The technology will model cross-sectoral scenarios covering energy, mobility, social and other domains, to suggest an optimal policy mix for PED development.

Brabrand' energy transition will take more than 3 years to achieve, so work on the ambitious district transformation will continue after the project by the city as part of a broader climate strategy.

### **CDE entanglement**

The goal is to initiate collaboration that would trigger a chain reaction in which multiple reinforcing CDE opportunities emerge, multiply, and grow in intensity. Consider this hypothetical entanglement with a sister project (the first three activities are already happening with Tips4Ped and exPEDite).

1. Projects meet on a joint introductory call
2. Projects support each other on social media
3. Projects organise a joint event (webinar, workshop)
4. Projects co-author a publication (policy brief)
5. Projects organise a podcast
6. Projects promote each other's deliverables/outputs/events in a newsletter
7. Projects participate in each other's campaign, or launch a new one
8. Projects provide input to each other's results by answering surveys
9. Projects evaluate each other's outputs (e.g. technical tools) by testing them
10. Projects participate in Horizon Results Booster



Some of these steps are also relevant to Forum stakeholders other than EU projects e.g. local or national stakeholders, cross-sectoral experts, cities in Europe and beyond

### ■ 5.2.2. 2026 Priorities and Planning

Referring back to the roadmaps and the methodology plan, in the final one third stage of the project, in 2026, the BIPED DT tool should have been further developed based on the pilot setting. Therefore, the 2026 stage will be primarily driven by exploring scalability and replicability - bringing the initial BIPED pilot-based design to broader European cities and districts. This will require greater engagement with non-pilot end users and broader key stakeholders.

Specifically, T4.4 is expected to support the individual WPs at this stage as follows. It is important to note that the projections below are only based on the current thinking of the BIPED project. As the overall project implementation plan continues to evolve with practice throughout the project, these WP expectations will be further refined and clarified.

- **WP2:** For 2026, WP2 partners focus on the steady further development of BIPED digital twin for Energy, Mobility and Cross-sectoral properties, based on the developed platform (D2.1) and the second release of models (D2.3). This includes the further refinement and extension of developed models (energy, mobility, cross-sectoral) of BIPED by developing and integrating additional properties and models. Especially for development of cross-sectoral models, the need for steady feedback continues with the stakeholders on the model's performance. As well there is a need to connect with the stakeholder landscape on data access for integrating into the models, and a well established standing in the EU data space landscape is expected. In summary main contributions are expected by stakeholder involvement:
  - Continuous support on data availability and accessibility
  - Review of BIPED models and their outcomes, including reflection on expectations as defined in 2025
  - Feedback on developed models and their performance on detect challenges
  - Close involvement with EU data space stakeholders
- **WP3:** In 2026, WP3 will concentrate on two key areas: implementing the digital twin in evidence-based actions and developing a handbook on governance practices for PED communities. WP3 seeks the Stakeholder Forum's support in these endeavours, particularly during the implementation phase and in creating a scalable handbook that can be adopted by other cities, communities and countries.
- **WP4:** In 2026, the focus will shift towards *Task 4.5: Recommendations for Energy/Mobility Transition*, which will span until the end of the BIPED project. This task will draw upon all project results and lessons learned to produce a comprehensive set of recommendations aimed at decision-makers. The recommendations will focus on strategies to replicate and scale the LDT. This process will involve a thorough evaluation exercise carried out throughout WP4, with the insights packaged into a series of policy briefs for wide dissemination. These policy briefs will serve as critical tools for guiding and informing policy makers on the best practices for implementing and scaling the LDT, ensuring that the project's outcomes have a widespread impact. The Stakeholder Forum will be instrumental in this task by serving as a bridge between the project team and the broader community. It can provide valuable insights and validation for the recommendations, ensuring they are practical and actionable. The Forum can also help in formulating

and disseminating the policy briefs and fostering buy-in from key stakeholders, thereby enhancing the likelihood of successful implementation.

- **WP5:** More concrete ideas will emerge as we get closer to the final year of the project. At this stage, help with the following would be greatly appreciated:
  - Finalising and promoting the Brabrand story as a good practice on PED development
  - Creating and sharing with other cities a template for developing their own case study
  - Publishing a primer on positive-energy-X concept that removes ambiguity from terms PEB, PEN and PED, and allows interested adopters to make informed decisions based on capabilities and needs

## ● 6. Conclusion

This deliverable, D4.2, captures the progress made from M1 to M12 by T4.4 that aims at establishing and facilitating an end-user forum for BIPED. The covered 12 months marks the first one third length of the T4.4 duration and the overall project.

This D4.2 report started with providing an updated version of the T4.4 objective behind the vision of the Forum design highlighting the differences of end-users from the general stakeholder engagement. Specifically, it clarifies the unique angle of contribution compared to the other two main streams of stakeholder engagement activities: T2.5 and WP3. In contrast to the other two, T4.4, embedded in the WP4, brings more focus specifically onto the end-users that have more direct influence on the BIPED DT development. Moreover, this forum extends beyond the initial pilot scope to include potential end-users from other areas. This exchange benefits key stakeholders from both ends: pilot users gain insights from outside experts, while non-pilot users learn from the experiences of the pilot group, encouraging wider adoption and support for the project.

Based on this clarified objective, D4.2 also included a detailed methodology plan to operationalise design thinking in practice. This plan includes a conceptual breakdown to clarify the concept of end-users in the BIPED context and provides an overview of how the Forum contributes to the core steps to help the project achieve its LDT solution end goal. In line with the spirit of the project roadmap, from M1 to M12 the 'Knowledge Baseline and Design Thinking' phase took place, with the aim of further translating the project vision into actionable plans based on initial real-world practices and developing some foundational steps. As shown in Section 4, the main progress made by T4.4 during this phase can be summarised in three aspects. The first is the design of the comprehensive methodology plan presented in Section 3. Second, T4.4's support to the achievement of the milestone of the first version of the BIPED DT by continuously pushing for internal alignment and synergies, especially with WP3 and WP2. Third is the preparatory step achieved by T4.4 through active engagement in events to map a first base of potential end-users beyond the pilot level.

A key consideration based on the progress made so far (M12), highlighted in section 5, is the need for continued internal alignment and clarity in order to maximise the expected contribution of the Forum. Given the existence of three streams of stakeholder engagement, this can help to reduce unnecessary duplication and redundancy of activities. In times of need, it may also help to identify opportunities to join forces across the streams to improve efficiency and provide the necessary feedback to support the development of the LDT. In addition, greater clarity is needed to identify the specific needs for end-user engagement. This will not only help to better meet the needs of the project's technical partners to progress the LDT design. Most importantly, it supports a more positive flow of communication with stakeholders and end-users, where they are provided with clear expectations and objectives.

Throughout this report, the discussion of the design and planning of T4.4 has been done in the context of synergies with other WPs, i.e. how what is planned for T4.4 is relevant to other WPs, what value T4.4 can bring to which WP activity, how T4.4 is synergistic with the broader thinking of the project objectives and plan. Thus, there are inputs from each WP's perspective in key sections to ensure that the updated methodology developed for T4.4 in particular starts from a baseline of alignment that makes it a more solid foundation for guiding practice in the remainder of the project period.