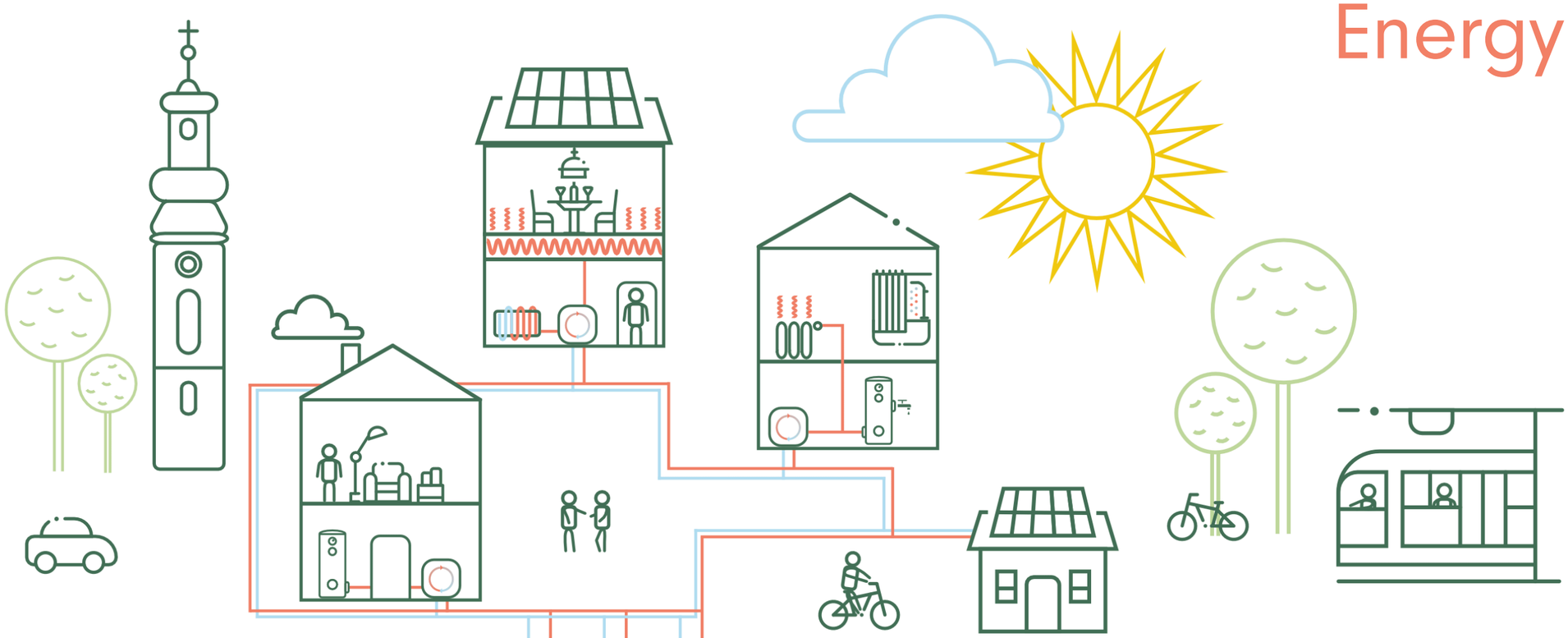
Replication Guide

Replicable Elements for Working Towards Positive Energy Districts



PED StepWise

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What is PED StepWise?

PED StepWise was a three-year project (2023 - 2026) funded by the Driving Urban Transitions Partnership (DUT), which aimed to develop a participatory step-by-step implementation plan for zero carbon neighbourhoods in existing urban areas.

We believe that in times of climate change and the energy crisis, the transition to local and sustainable energy sources is crucial. The transformation of existing neighbourhoods is a challenging but necessary process that can only succeed through joint efforts and strategies. We want to take this journey step by step, develop solutions and work towards a successful energy transition.

PED StepWise

DUT Driving Urban Transitions

Co-funded by the European Union

Three Urban Living Labs:

Short Info

Main Goal



The Living Lab in Vienna consists of a **cooperative-owned settlement** housing around **330 households**. The settlement comprises mainly two-storey buildings and some four-storey multifamily units. These century-old buildings are **mostly reliant on gas heating** and lack renewable energy sources.

The main goal is to decarbonize the buildings through transitioning from gas boilers to a local low-temperature heating network powered by geothermal energy, groundwater wells and heat pumps. The project aims to implement a participatory process to address resident concerns and preferences.



In **Malmö**, the Stadium Area is an **important hub for sports and education**, currently undergoing urban transformation. The area has a mix of buildings, with mainly non-residential buildings and only a few residential units.

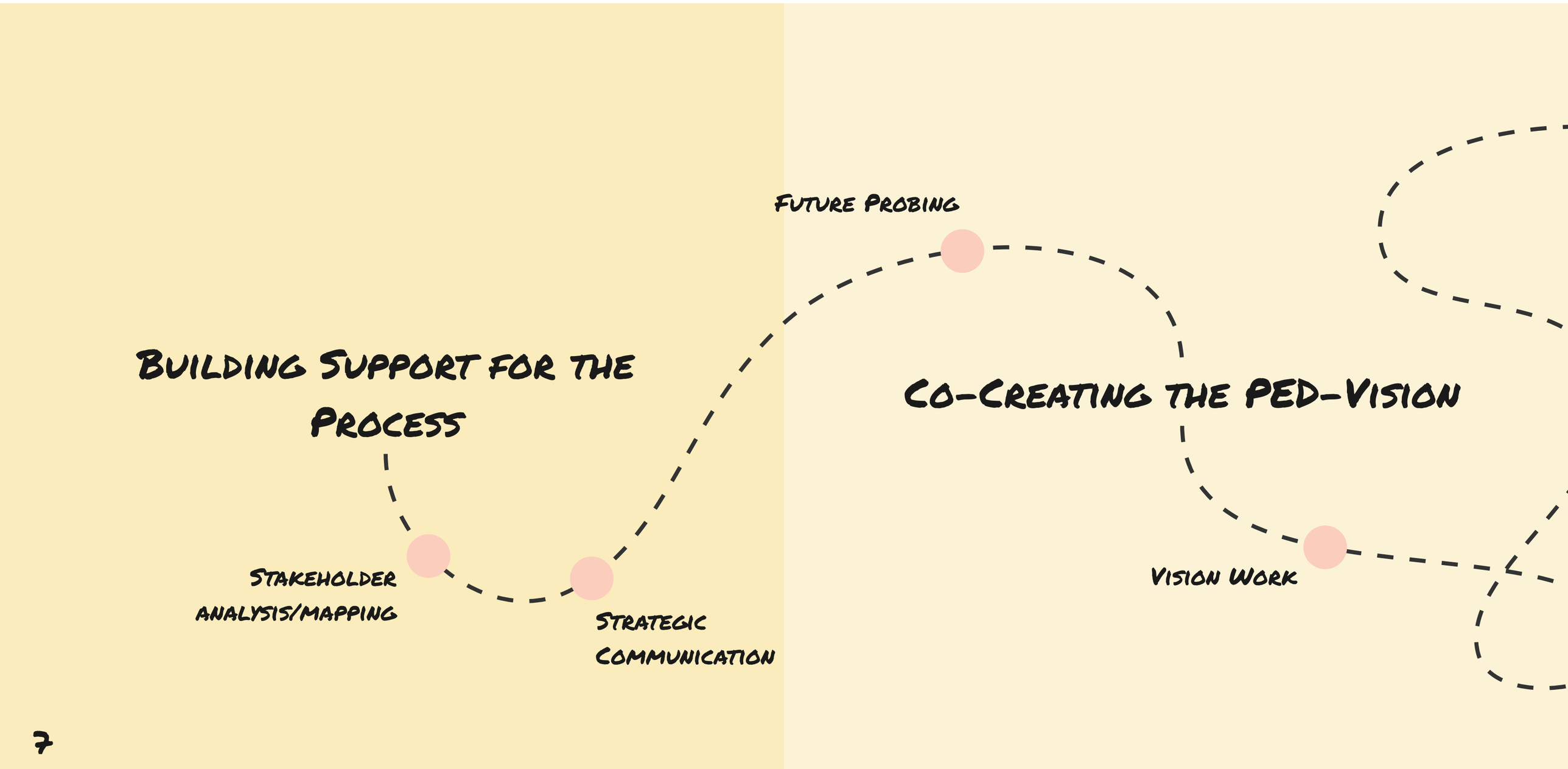
An implementation plan that enables a neighbourhood where buildings and local solutions contribute to efficient use of energy and resources. Moreover, develop methods for cooperation on energy strategies at the neighbourhood level between stakeholders in the area and local public administration.



In **Utrecht**, the Science Park comprises approximately **80 buildings**, hosting **2 universities**, **several hospitals**, **170 businesses**, sports facilities, student housing, and a botanical garden.

Decarbonize the heat and electricity supply and move towards CO_2 neutrality standards. The project aims to draw and implement a process with the various organizations present in the area, fostering a co-creative and collective process to achieve their decarbonization ambitions.

Phases & Methods



Energy efficiency epiphany

Energy Mapping, Area Analysis and Scenario Development

Technical and economic feasibility

Sense-making

Produce PED Roadmap and Action Plan

Mission Mapping

Participatory Action Tree

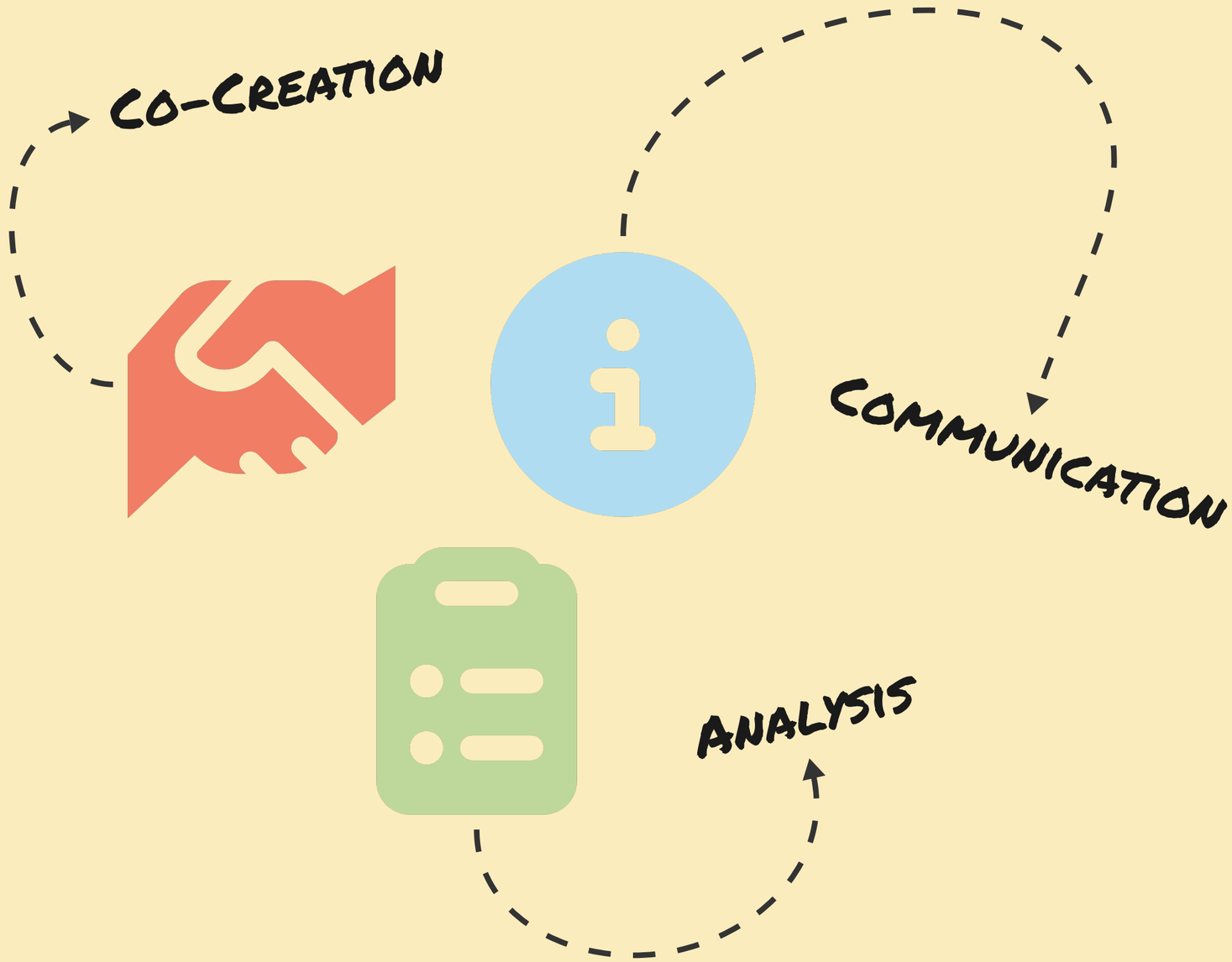
What is the Replication Guide?

In the Replication Guide, we bring together a range of elements of particular value for the replication of Positive Energy District (PED) development. The structure of the guide is based on the Positive Energy Planning Process (PEPP) developed by White Arkitekter. As PED StepWise focused on the early stages of PED development, it covers the first four phases of the original seven-phase PEPP process:

- Building Support for the Process
- Co-Creating the PED Vision
- Energy Mapping, Area Analysis and Scenario Development
- Producing the PED Roadmap and Action Plan

The remaining three phases of the PEPP process (support the implementation phase; follow-up, mointoring and verification; scaling up and replication) were beyond the scope of PED StepWise. Since the three Living Labs operated under different local conditions and governance structures, not all methods and formats were applied in every location. On the following pages, we reflect on experiences that proved especially valuable in each Living Lab.

The elements comprise different forms of activities, which are indicated by **distinct symbols**:



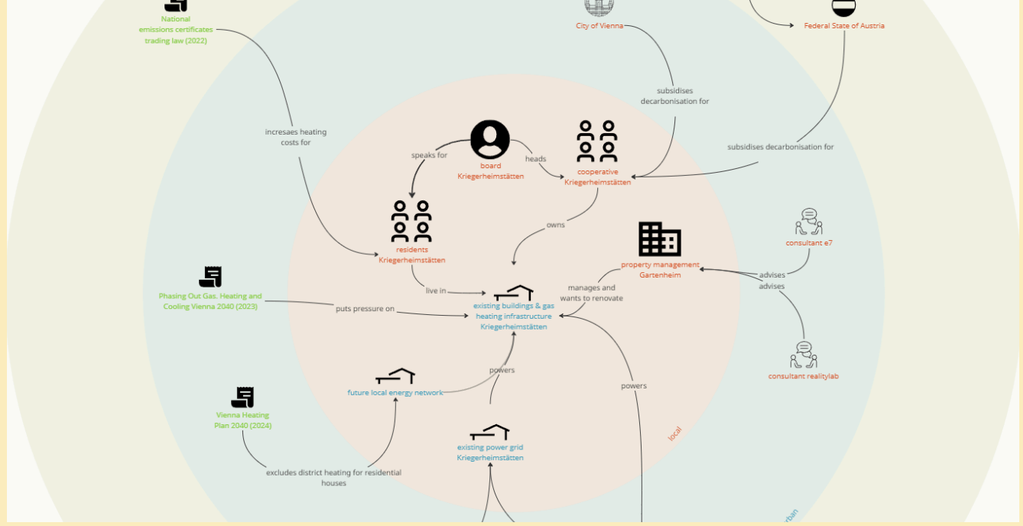
Building Support for the Process

The **first phase** creates the foundation for a collaborative and inclusive PED development process. Its main purpose is to build sufficient commitment, understanding and organisational capacity among the actors who will shape or be affected by the district's transformation. PED development involves many stakeholders with different responsibilities, resources, interests and levels of influence. Establishing a common basis for cooperation, including clear roles and decision-making authority, is therefore essential before developing a shared vision or exploring technical solutions. In line with the PEPP process, this phase covers setting the stage, building partnerships, identifying and understanding relevant stakeholders, strengthening capacities and establishing a basis for communication.

A central goal is to create a shared understanding of why the PED process is being initiated, what it aims to achieve, how different actors can contribute, and how participation can create value and benefits for all involved. Key stakeholders need to develop sufficient ownership of the process to support its continuation, while roles, expectations and possibilities for collaboration should become clearer.

This phase is also about creating trust and establishing transparent communication from the beginning. Particularly in existing districts, stakeholders may have different expectations, previous experiences or concerns that influence their willingness to participate. By the end of the phase, a sufficiently broad basis of support, knowledge and cooperation should exist to move towards developing a shared PED vision.

Experiences from **PED StepWise** underscore two elements of particular relevance and importance during this phase: **Stakeholder Analysis**, to better understand the stakeholder landscape, and **Strategic Communication**, to build relationships and strengthen engagement among relevant actors.



Stakeholder Analysis

In the Austrian Living Lab*, we conducted a **stakeholder analysis** to understand who influences the PED transformation, who is affected by it, and how actors relate to each other. We examined the cooperative's formal governance and decision-making structures as well as the interests, responsibilities, resources, and influence of residents, the voluntary board, planners, public authorities, and other relevant actors. The analysis provided a basis for determining which stakeholders to involve, at what stage, and in which roles, as well as how to address their interests and needs throughout the process. This directly supported the PEPP phase *Building Support for the Process*, which highlights stakeholder mapping and the development of a communication strategy as essential early activities.

* Stakeholder analyses were conducted in all Living Labs, but we focus here on the Austrian experience.

"

A major challenge in the Austrian Living Lab was that **formal structures did not fully reflect how decisions and relationships worked in practice**. The board had substantial responsibility but limited capacities, while residents differed in knowledge, interest and identification with the cooperative. Perspectives also changed as plans became more concrete, revealing concerns about communication and participation.

Stakeholder analysis should therefore be treated as a **continuous process rather than a one-off exercise**. Revisit it as plans evolve and translate findings into both engagement and technical analysis. Preferences or concerns regarding specific energy systems can inform the assessment of technical options and scenarios. In this way, stakeholder analysis helps shape **who participates, how information is communicated, which options are explored, and how decisions are prepared**.

Learnings/Challenges/Recommendations

Main takeaway for replication

Technical planning should be preceded by a thorough stakeholder assessment. Special attention should be paid to informal power relations, trust-building, and identifying decision-makers early, as these factors can be as important as technical feasibility for successful PED implementation.



Strategic Communication

The PEPP framework includes communication as a fundamental and strategic process component. Establishing an open and trusting environment for dialogue among core team partners is crucial, and joint decisions on what to communicate, to whom and when, provide a means by which to compare, settle and uphold expectations.

In our living lab, we engaged in external communication on several levels:

- Locally – to involve and inform stakeholders in the area
- Nationally – to share PED and Research and Development related news in general
- Internationally – to inform the project and to learn from the other living labs

Reflecting on our efforts and struggles to manage communication on the national level, we see how a joint communication strategy, in alignment with PEPP, holds the potential to become **a facilitator that leads towards visions locally.** Our recommendations include insights regarding room for improvement:

- Establish a dedicated communication group early to develop, coordinate and regularly update a communication plan.
- Initially set tentative milestones, by core team and communication group together, suggesting what should be communicated, to whom, by whom and when.
- Use internal communication to clarify commitments, align expectations and make differences in motivations and objectives visible.
- Plan external communication alongside the project work from the outset, rather than adding it at a later stage.
- Treat communication as the connective tissue of the collaboration, not only as a way to share results externally.
- Address conflicting expectations openly when they arise. Avoiding them can slow down progress and weaken collaboration.
- Review communication continuously throughout the project, as changing conditions and new partners may require adjustments.
- In PED Stepwise Malmö, internal communication and external communication planning were not addressed early or systematically enough. This meant that important opportunities to align expectations were missed

Learnings/Challenges/Recommendations

Main takeaway for replication

In a collaborative setting, a joint, structured and sustained approach to communication provides a means for expectation management. Recognition of communication as a tool for continuous alignment of expectations—and its application as more than a dissemination instrument—may help partners in clarifying divergences, in building trust, and in maintaining momentum toward shared and separate visions alike.

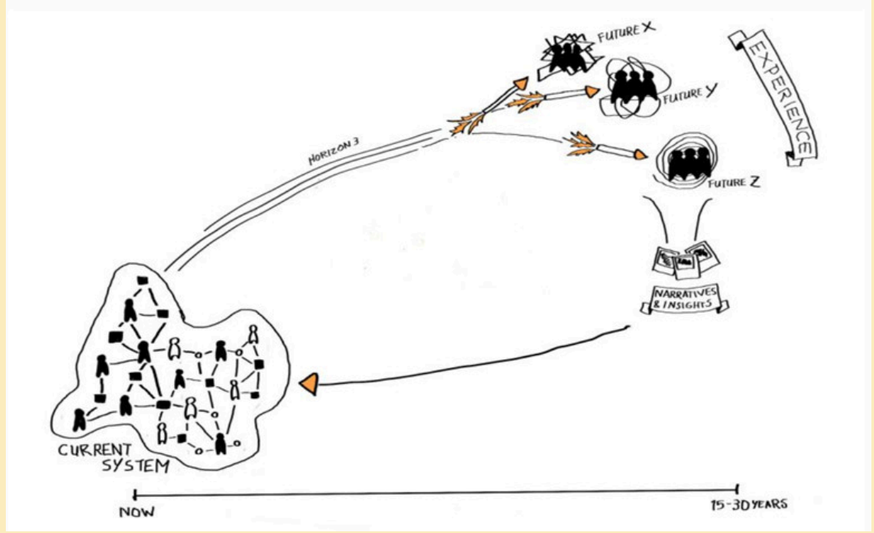
Co-Creating the PED-Vision

The **second phase** establishes a shared direction for the future development of the district. Its purpose is to develop a common understanding of what the PED should become, which objectives it should pursue and what the transformation should deliver for the actors involved. According to the PEPP process, this includes defining the PED vision and objectives, establishing the relevant system boundaries, understanding stakeholders' drivers and perspectives, considering sustainability and circularity, and exploring the economic and organisational conditions that could support the transformation.

The PED concept needs to be translated into the specific local context. This means determining the scope of the district and developing objectives that reflect its particular characteristics and ambitions. The vision should incorporate the different motivations, needs, concerns and expectations of relevant stakeholders. These may relate to energy and climate objectives, but also to affordability, quality of life, security of supply, viable investments or the long-term development of the neighbourhood.

The goal is therefore not simply to define an energy target, such as reducing CO_2 emissions or increasing the use of renewable energy, but to create a broader shared picture of a desirable and sustainable future. The resulting vision and goals should be ambitious enough to provide direction while remaining meaningful and feasible for the stakeholders involved.

In **PED StepWise**, this phase was particularly highlighted by two experiences: **Future Probing**, where possible futures and stakeholder aspirations were explored, and **Vision Work**, where these perspectives were translated into a shared direction for the PED.



Future Probing

Future Probing is a sense making method that helps teams explore the uncharted terrain that lies ahead and the desirability and consequences of possible courses of action to move forward. It challenges groups to formulate alternative futures in dialogue and visualize them. Creating, experiencing and discussing these 'probes' raises awareness about people's current frames, their motives and values when dealing with such futures. In the words of George Lucas: *"You can't do it unless you can imagine it".*

In our session we challenged 3 groups to build alternate futures (15 year horizon) with LEGO: 2 positives and 1 negative, visualizing the 'cost of doing nothing'. After presenting, narratives and insights were collected and plotted on our current system and time lines. This highlighted the sequence and urgency of needed course of action.

A more detailed description of the method can be found in the paper.

- As an ice breaker, set the scene for the desired horizon. What does the world look like in that year? Give the groups a short assignment where they have to move around and use their bodies, to get into a creative state-of-mind.

- Instead of just writing down their future, let them visualize it using clay, scrap books, LEGO or other physical means. This triggers different parts of the brain and will bring different results.

Learnings/Challenges/Recommendations

Main takeaway for replication

This exercise will force some people out of their comfort zone, utilizing different ways of thinking and expressing themselves to collectively co-create a future desired-, or undesired scenario. Make sure you have an experienced facilitator that can navigate and mitigate tensions to keep everyone engaged. If the participants trust the process however, the results are surprising and fulfilling.



Vision Work

Early on in the project, a joint vision and corresponding goals for the Malmö Stadium Area were developed against the backdrop of a PED framework. This was achieved in a participatory and iterative process where **each of the project partner organisations presented its already adopted sustainability and energy goals.** This exercise had a dual benefit: participants developed familiaríty with their own organisational ambitions and became comfortable putting them into a wider context. At the same time, the exchange revealed the **high level of ambition** already present among the partners, which inspired the further raising of ambitions for a shared vision and goals.

Joint directions were drawn up in alignment with established commercial and physical design frameworks. This provided a sense of reachabilty and helped ensure that all partners were able to see their interests and priorities mirrored in a common direction. The PED StepWise vision was then drafted, discussed, refined and decided on in a successive workshop, emanating as weil in a set of shared goals that included the investigation and demonstration of virtual energy sharing.

- A shared vision can powerfully support wider transformation when it is actively communicated beyond the project group. In our case, the vision was developed and agreed on within the process, but it did not permeate widely enough within key organisations or among external stakeholders. This limited its visibility and usefulness as a guide to subsequent efforts.
- The level of ambition needs to be formally anchored at the appropriate decision-making level. Although the participating representatives contributed valuable knowledge and perspectives, the overall ambition was not explicitly endorsed by the relevant decision-making bodies. This made it more difficult to translate the vision into organisational commitments and concrete action.

These observations constitute a reminder that vision work requires both inclusive participation and appropriate organisational anchoring. They do not reflect shortcomings of individual participants.

Learnings/Challenges/Recommendations

Main takeaway for replication

A shared vision needs to be communicated, institutionally endorsed and developed with the people who can help realise it.

Making individual ambitions visible can raise the level of ambition of the shared vision.

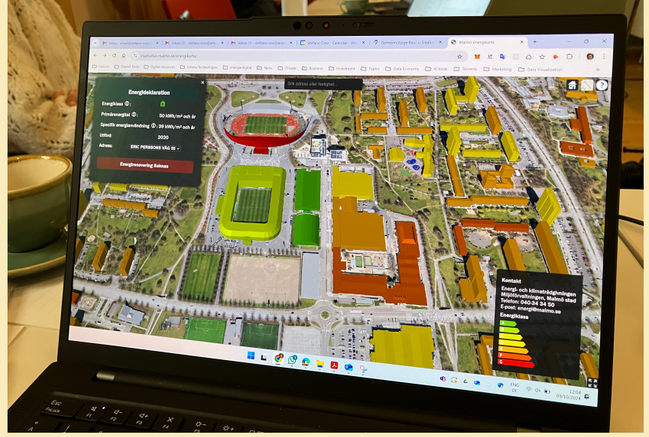
Energy Mapping, Area Analysis and Scenario Development

The **third phase** connects the shared PED vision with the actual conditions, potentials and constraints of the district. Its purpose is to establish a sound basis for understanding where the district currently stands and which pathways could lead towards the agreed objectives. In the PEPP process, this involves understanding the current energy situation, considering relevant regulations and policies, analysing the characteristics and potentials of the area, identifying challenges and opportunities, and developing and assessing alternative PED scenarios.

The analysis should reveal how energy demand and supply, buildings and infrastructure, renewable-energy potentials, spatial conditions and the regulatory environment interact. This makes it possible to identify barriers and constraints as well as synergies and opportunities that could support the PED transformation.

Based on this understanding, alternative development scenarios can be formulated. They represent possible pathways towards the PED vision and help make choices, consequences and trade-offs visible. Technical and energy performance should therefore be considered alongside economic implications and other locally relevant factors. The outcome is a well-founded understanding of feasible alternatives and their implications.

In **PED StepWise**, two methods were particularly relevant to this phase: **Energy Efficiency Epiphany**, to strengthen the understanding of energy-related potentials and implications, and **Technical and Economic Feasibility**, to assess whether potential solutions are technically achievable and economically viable.



Energy efficiency epiphany

A key insight from the PEPP process was that the pathway towards a Positive Energy District (PED) should **begin with the existing building stock**. Before sizing future energy systems or estimating new renewable-energy capacity, it is essential to **identify the energy-efficiency potential** already available in buildings and technical systems. Energy mapping at district scale often focuses on present and projected energy demand. Complementing this with a systematic assessment of efficiency measures can substantially change the starting point for planning. **Existing buildings and technical systems often contain substantial potential for improved energy performance**. Better operation, commissioning, monitoring, control and maintenance can provide an immediate starting point, while renovation and technical upgrades, such as window renovation, additional insulation and improved airtightness, can deliver further profitable improvements over time. At district level, opportunities to make use of for example surplus heat should also be considered. During a **capacity-building workshop** within the PEPP process, we **presented the potential for energy efficiency** in society more broadly and showed examples from other areas, which directly inspired to action.

- The city properties division revisited its building portfolio from this perspective. The results revealed a considerably larger potential for cost-effective energy improvements. This became an encouraging example of how a district's energy balance can be improved not only through new energy supply, but also by reducing avoidable demand at the source.

- The result also highlighted an important implementation challenge. The primary constraint to realise the energy efficiency potential was not necessarily access to investment capital, but the organisational capacity required to identify, prioritise, procure, implement and follow up measures over time. For PED development, energy efficiency should therefore be understood as both a technical and an organisational strategy: it requires dedicated competence, time and long-term operational ownership.

Learnings/Challenges/Recommendations

Main takeaway for replication

Energy efficiency is a powerful starting point for transforming existing districts.
It can deliver immediate benefits, support future investment and reduce the need for new energy production. Making the potential visible can build momentum, confidence and engagement among stakeholders. Sharing successful examples can inspire action beyond the original project group.
Before increasing supply, always explore how much energy you can save.



Technical and Economical Feasibility

The **technical and economic feasibility** assessment for the Austrian Living Lab considered three potential district configurations and created a **heat map** for each: 1. the entire project area, 2. only the multifamily buildings, and 3. the multifamily buildings together with a selected number of townhouses

First, the local **groundwater potentia**l was evaluated and found to be highly suitable for heat supply. **Dynamic simulations** were then carried out for each scenario in order to calculate the heat demand across seasons, the peak load conditions, and the optimal sizing of key components such as pipes, heat pumps, and storage systems.

Based on these results, the **total costs** of each scenario were calculated over a 30-year assessment period Finally, the **costs of the district heating network** were compared with those of installing and operating individual heating systems for each building.

A successful technical and economic analysis requires a **clear understanding of the district context,** including existing energy systems and residents' expectations.

Detailed technical assessments are essential to identify local energy potentials and opportunities for PED implementation (e.g. gorundwater available on site)

Developing PEDs in existing districts **can be challenging** due to limited availability and digitalization of technical data.

Demonstrating economic feasibility and including a **cost overview for the end user** are key to gaining residents' support.

Learnings/Challenges/Recommendations

Main takeaway for replication

The district boundaries, included buildings, and existing energy supply systems should be clearly defined before starting the technical analysis.

Resident acceptance of the PED concept depends on cost comparisons with alternative solutions and clear evidence of its economic feasibility.

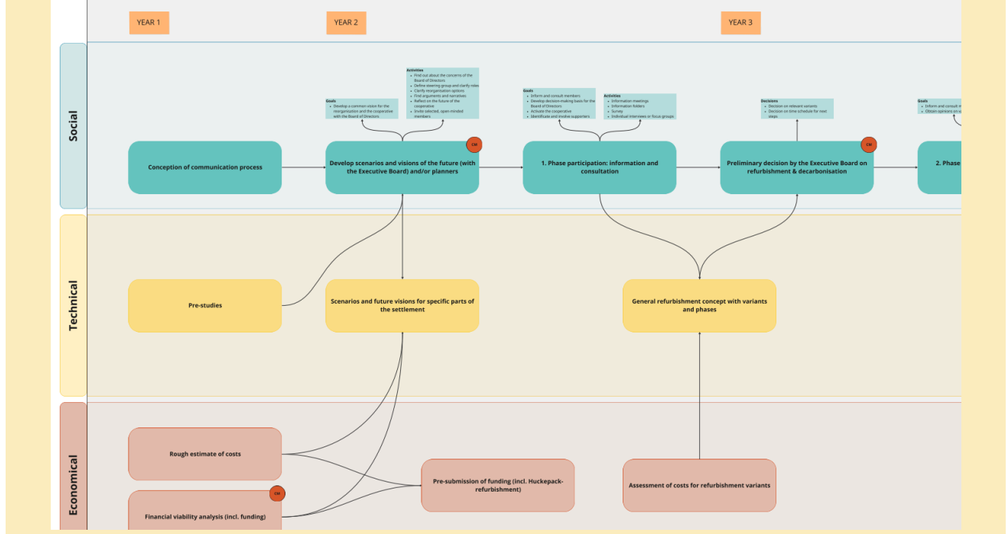
Produce PED roadmap and action plan

The **fourth phase** translates the preferred development pathway into a shared framework for future action. Its purpose is to move from vision, analysis and possible scenarios towards an agreed strategy that can guide subsequent implementation. In the PEPP process, this includes finalising the area energy strategy, establishing agreements and energy targets with key actors, clarifying tasks and responsibilities, defining the roadmap and timetable, and establishing the basis for future monitoring, operation and verification.

Strategic ambitions need to be translated into clear targets and coordinated actions, while responsibilities and dependencies between actors should become transparent. This helps connect the overall PED vision with the practical conditions for moving towards implementation.

The roadmap provides the temporal and organisational structure for this transition. It should connect short-, medium- and long-term actions and establish a realistic sequence for progressing towards the PED objectives. Establishing how progress will later be monitored and verified also ensures that the PED objectives remain measurable. The outcome is a jointly supported pathway that links the PED vision with concrete commitments, responsibilities, targets and next steps.

In **PED StepWise**, this phase was particularly supported by three methods: **Sense-Making**, to jointly interpret insights and identify priorities; **Mission Mapping**, to structure ambitions into actionable pathways; and the **Participatory Action Tree**, to translate the shared vision into concrete actions and next steps.



Sense-Making

Sense-making is the process of turning complex, transdisciplinary knowledge into coherent and meaningful development scenarios.

Technical solutions, energy concepts and spatial interventions are brought together with financial feasibility, regulatory conditions and social impacts. Different options are compared not only in terms of performance and costs, but also regarding their consequences for the neighbourhood and everyday life. The key task is translation: What does a technical or economic decision actually mean for residents?

By connecting expertise with local needs and perspectives, sense-making transforms the results of co-creation into understandable scenarios that stakeholders can discuss, evaluate and eventually act upon.

Sense-making requires actors with very different backgrounds to develop a common understanding. Technical and financial findings must be interpreted correctly, priorities negotiated and assumptions repeatedly checked against what actually matters to residents. At the same time, everyone needs to be brought up to date as planning evolves.

In the Vienna Living Lab, this became a long and winding process with several loops between technical planning, economic considerations and residents' perspectives. Intermediate results were presented and discussed at an information event. Residents' questions showed how strongly concerns about costs, construction impacts, quality of life and concrete changes to their homes shape how planning scenarios are understood.

Learnings/Challenges/Recommendations

Main takeaway for replication

Treat sense-making as an iterative process, not a single step. Allow time for translation, feedback and revision. Keep technical, economic and social perspectives connected, communicate intermediate results, and continuously check whether emerging scenarios are meaningful from residents' perspectives.



Mission Mapping

The Utrecht Science Park has a wide variety of stakeholders. In order to achieve the district goal we needed to align actors and activities within the network.
We used **Mission Mapping**, a collaborative and visual mapping tool, to develop an overview of activities and ambitions and to cross boundaries in multidisciplinary networks. It brings clarity in complexity without dumbing it down, shows how items and projects from various stakeholders are interrelated, fostering understanding for each other, and creating a shared ownership of each other's mission.

Around a central pre-defined mission or goal (a "north star"), each stakeholder writes down their ambitions and current activities. In groups the stakeholders cluster these around 'ambition islands' and present back to the others. The groups place the islands on a big map relating their location to 5 axis: organisational, technological, cultural, economic, and educational. Choose your owns axis relevant to your neighbourhood or project.
A more detailed description can be found in the paper and website.

- Define a 'north star' or shared vision beforehand based on existing knowledge and let the group refine it if needed. This avoids spending to much time on this. Use exercises like 'Future Probing' (see method earlier) if you are too far removed from a shared vision.

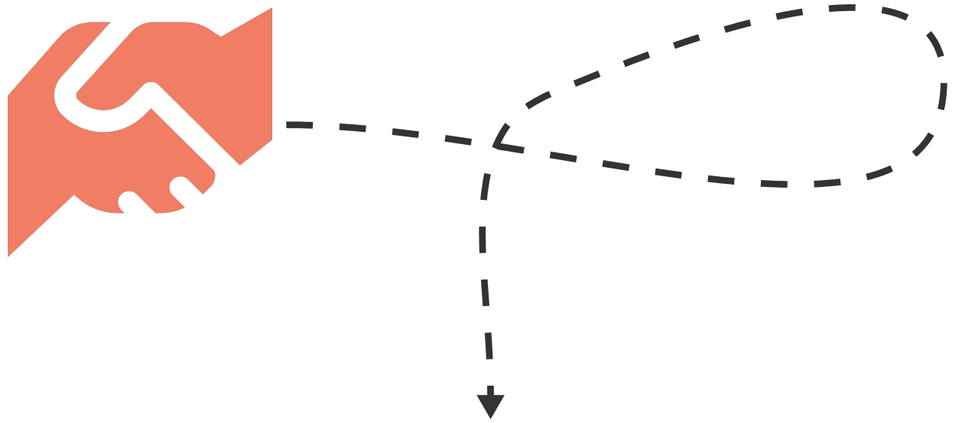
- Record each presentation so that the nuances don't get lost

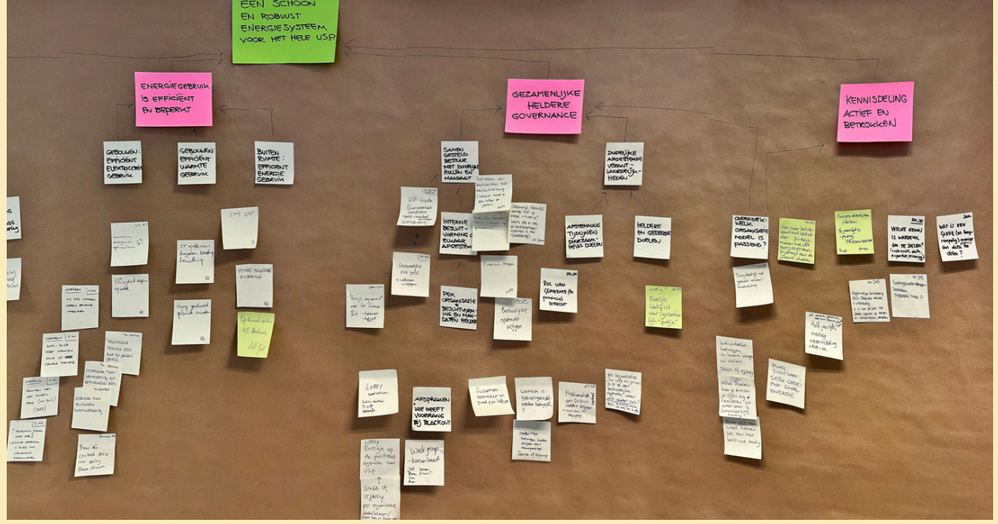
- Digitize the Mission Map in visualisation tools like Miro or Mural, so you always have it close at hand. You can even use it as a dynamic document that keeps evolving.

Learnings/Challenges/Recommendations

Main takeaway for replication

The physical visualization, a big map you can stand on and around, promotes interaction and helps to create a sense of agency and ownership allowing us to move towards collective action. The tool stimulates thinking about collaborative efforts, potential challenges, and opportunities and can provide an outlook towards the future.
For workshop materials and co-facilitation go to missionmapping.nl.





PARTICIPATORY ACTION TREE

A **participatory vision-to-action workshop** helped stakeholders at the Utrecht Science Park translate a shared long-term vision into concrete collective actions. The aim is to form an action tree. The pre-defined goal is the peak of the tree. Together with your participants you start asking: 'What do we need to achieve this goal?', leading to several branches (e.g. clear governance or continuous clean energy). For each branch you keep asking this question, until you have an actionable item that is ready to be picked up. This will give you a roadmap to achieve your overarching goal with actionable starting points, follow up steps and milestones. Through facilitated brainstorming, the proposed actions were later clustered into thematic areas, prioritized and assigned to people in the room.

The resulting action map/tree provides a shared overview of **feasible opportunities,** reveals cross-sector dependencies and supports the development of a joint roadmap with **actions that stakeholders are willing to pursue together.**

- Pre-define your first layer of branches to get the group started.
- Challenge people write their actions in post-its in an active form with a verb and as concrete as possible, so it is phrased as an clear action. Invite them, also to write the desired role in each written action.
- People often find it hard to transition from high-level to detailed tangible tasks, be active as facilitating party to help discussions along and keep asking clarifying questions if you find the post-its too abstract.
- Digitize the action tree afterwards, with names assigned to the task. This creates a visual overview and helps keep each other accountable during the follow-up. Share this overview later by email, so that everyone has the opportunity to reformulate or add new desired actions.

Learnings/Challenges/Recommendations

Main takeaway for replication

Conduct this workshop after stakeholders have developed a shared understanding of the local energy system and there is a shared ambition to work together. Ensure participation from all key organisations and use the outcomes to prioritise a small number of jointly owned, feasible actions with clear follow-up responsibilities.

General Takeaways for Replication

The experiences across the three Living Labs show that **PED development is not a linear process**. Technical, economic, organisational and social aspects are closely interconnected and evolve over time. Visions, scenarios and plans therefore need to be revisited as new knowledge emerges and conditions change. Feedback loops and capacity for adaptation are essential.

Start early and use windows of opportunity. Planning for sustainable energy systems should be integrated into urban development, renovation and infrastructure planning as early as possible. In the Malmö Stadium Area, earlier involvement would have provided better opportunities to coordinate necessary infrastructure measures before key decisions became fixed.

Invest in collaboration and communication. A shared vision requires organisational support, continuous communication and the involvement of relevant decision-makers. Communication should accompany the entire process to align expectations, address different interests and conflicts, and maintain trust.

Connect technical expertise with local perspectives. Technically feasible solutions are not automatically viable solutions. Technical and economic analyses should be connected with stakeholder needs and preferences, organisational capacities and impacts on everyday life. Iterative sense-making helps translate complex findings into scenarios that stakeholders can understand, discuss and eventually act upon.

Document the process systematically. Long-term processes require records of meetings, participants, discussions, decisions and outcomes. Meeting minutes and documentation of the rationale behind key decisions provide continuity when team members leave or are replaced. They enable new participants to reconstruct the process, understand why previous decisions were made and contribute effectively without repeatedly reopening settled questions.

Monitor learning and reflect on the process. Regularly assess what works, what could be improved and what should be done differently next time. Documenting lessons throughout the process helps teams adapt their approaches, avoid repeating mistakes and transfer insights to future PED projects.

Finally, **turn ambitions into ownership and action**. Responsibilities, dependencies, next steps and follow-up mechanisms need to be clearly defined. A roadmap becomes meaningful when stakeholders know not only where they want to go, but also **who will do what, when and with whom**. PED development ultimately depends on moving from shared understanding to jointly owned and feasible action.

PED StepWise

