TANGO-W

Transformative capacity in energy-food-water

Needs and challenges of ULLs for building urban transformative capacity:

Analysis and mapping of strategic and prototype cases in Austria, Lithuania, Norway, and Sweden

October 2022

Lead Partner: Nordregio

Authors: Luciane Aguiar Borges and Lisa Rohrer, with contributions from Doris Wilhelmer

Version: 1.0

URBAN EUROPE

European Commission

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003758

Disclaimer

On the authorship of the report: Luciane Aguiar Borges and Lisa Rohrer are the main authors of this report. Doris Wilhelmer contributed with the text in Section 5.2 (Austrian cases) and Jolanta Dvarionienė with the text on Section 5.4 (Lithuanian case). All TANGO-W partner have provided input to this report by carrying out interviews with local stakeholders. For further information on their contribution see Section 2 on Methodology, Annex 3, and Acknowledgements.

About TANGO-W

The TANGO-W project is an applied research project that develops urban transformative capacities (UTC) as a novel governance ability at the interface of food, energy, and water. TANGO-W follows Wolfram's (2016) capacity building approach, adopting a needs and requirements-based focus on the capacity building priorities of urban stakeholders. At the heart of TANGO-W is the two-level capacity building approach. At the urban level, TANGO-W designs and implements Urban Living Labs 2.0 (ULL). At the European level, TANGO-W establishes a transdisciplinary Community of Practice (CoP) as an integrative coordinating transformation system. Both provide the spaces for the development of UTC according to the needs of urban actors in several dimensions (i.e., transformative governance formats, shaping new transformation roles, self-organisation, and technical skills and tools). At the same time, the ULLs and CoPs act as novel governance formats at the local and EU levels to accelerate urban change in a desired, sustainable direction. The activities of TANGO-W result in policy recommendations for replication and upscaling measures as well as in training concepts and pilot courses that support capacity building in TANGO-W fellow cities.

Technical references

Project acronym	TANGO-W
Project title	Transformative cApacity in eNerGy fOod and Water
Project coordinator	Dr. Doris Wilhelmer, Austrian Institute of Technology GmbH (AIT) Phone: +43 50550-4527 Email: doris.wilhelmer@ait.ac.at
Project duration	April 2022–February 2025

Deliverable no.	2.1 City needs and challenge maps
Dissemination level	PU
Work package	2
Task	2.1 City challenge and need analysis
Lead beneficiary	Nordregio
Contributing beneficiary/beneficiaries	SIN, WEIZ, 4ER, KTU, AIT, MARKER, HALDEN, CAMPUS ROSLAGEN, STOCKHOLMS STAD
Due date of deliverable	October 2022 (M08)
Actual delivery date	27 October 2022

Responsibility Assignment (RACI) Matrix

Responsible	Luciane Aguiar Borges (Nordregio)
Accountable	Stian Melhus (SIN)
Consulted	Lisa Rohrer (Nordregio), Doris Wilhelmer (AIT), Pia Weinlinger (AIT), Peter Biegelbauer (AIT), Jolanta Dvarioniene (KTU), Thomas Nacht (4ER), Robert Pratter (4ER), Maria Lennartsson (Stockholms Stad), Donatella Acquaviva (Campus Roslagen), Helena Rødseth (Marker), Hilde Marie Wold (Halden), Gottfried Koeberl (Weiz), Kristina Kamicaityte (Alytus), Stefan Guggenberger (Klagenfurt)
Informed	AIT, SIN, KTU, 4ER, Stockholms Stad, Campus Roslagen, City of Alytus, Halden Municipality, Marker Municipality, City of Weiz, City of Klagenfurt

Document history

Version	Date	Author	Summary of changes
1.0	19/10/2022	Nordregio	First draft
2.0	26/10/2022	Nordregio	Final version

Acknowledgements

The authors are thankful to Doris Wilhelmer (AIT), Pia Weinlinger (AIT), Peter Biegelbauer (AIT) and Manfred Kofranek for suggestions on the interview guides. Maria Lennartsson (Stockholms Stad), Donatella Acquaviva (Campus Roslagen), Stian Melhus (SIN), Hilde Marie Wold (Halden Municipality), Helene Rødseth (Marker Municipality), Stefan Guggenberger (Stadt Klagenfurt), Bernadette Karner (Weiz), and Kristina Kamicaityte (Alytus Municipality) for carrying out interviews with stakeholders from the TANGO-W ULLs.

Table of Contents

List of Tables

Executive summary

This report provides a baseline for the seven TANGO-W Urban Living Labs (ULLs). The report has the three-fold aim of: (1) documenting the food, energy, and water interventions that will take place in each ULL, including mapping of main stakeholders and objectives of ULL phases, (2) identifying challenges and needs for Urban Transformative Capacities (UTC) in each ULL, and (3) analysing the status of the cases across different parameters relevant for developing UTC.

To accomplish these aims, a literature review approaching UTC and the food-energy-water (F-E-W) nexus was conducted. Primarily Wolfram (2016) UTC framework endorsed the design of the interviews and the analysis of the cases. The interviews conducted with local stakeholders from each TANGO-W ULL shed light on six criteria: (1) participation; (2) decision making, (3) shared vision, (4) resources; (5) Internal reflection and review; and (6) capacities. Each of these are derived from Wolfram (2016) and are deemed vital for the development of UTC.

TANGO-W ULL in a nutshell

Focusing on interventions surrounding the F-E-W nexus in seven urban living labs (ULLs) in Sweden Austria, Norway, and Lithuania, TANGO-W will deepen the understanding of urban demands and needs to expand UTC as a driver of urban change. The ULLs are the testbeds to identify new capacities, knowledge, roles, and governance approaches needed to support transformative change towards urban sustainability. These ULLs constitute the core of the project and are briefly explained below.

The Swedish cases include the development of an ***urban agriculture strategy for the Stockholm Royal Sea Port,*** that will count with the involvement of a large array of stakeholders (e.g., planners, business, researchers) to discuss the potential of open public areas (e.g., squares and parks), façade surfaces (e.g., buildings walls and roofs), and underground spaces to be used for food production. A second Swedish case is the implementation of an ***aquaponic system in Bovieran housing complex in Norrtälje***. In this endeavour, 48 households, experts, students, and real estate actors will be involved to conceptualise, implement, and manage aquaponic in a residential setting.

The Austrian cases include the development of a ***foresight process for Weiz Municipality*** to respond to sustainability challenges that should be met. The process, involving the development of scenarios, a vision, and a roadmap with medium- and long-term measures, aims to involve a broad range of stakeholder including residents, public actors, and the private sector. Another Austrian ULL aims at establishing the ***Hi-Harbach renewable energy community in Klagenfurt***. In addition to establishing an energy community in this newly developed neighbourhood, urban gardening services will be developed, and will be available to residents free of charge. To implement this case, several stakeholders (e.g., residents, REC expert, planners) are expected to become engaged.

The Norwegian cases include the development of a ***food waste reduction programme for Halden Municipality.*** A kindergarten will be the testbed to develop this programme, but the aim is to extend it to the entire municipality. Therefore, this ULL will directly engage with students, teachers, and citizens. The other Norwegian ULL will focus on developing ***a programme to raise awareness about urban water usage and sustainable food production in Marker Municipality***. The focus of the programme is to build awareness around using unfiltered water resources to produce local and sustainable food and for inhabitant purposes where filtered water usage is unnecessary. In addition to building awareness around

water resources, the municipality seeks to both inform and learn from citizens, businesses, and external organisations about using renewable energy to produce sustainable food.

The Lithuanian case is a ***foresight process for making Alytus an energy efficient and sustainable city.*** The ULL will focus on enhancing, among a wide range of actors, the use of renewable energy sources (especially solar panels on public buildings), renovating multi-apartment buildings, modernising street lighting, reducing carbon emissions through sustainable mobility in the city, improving waste management, better managing water resources and wastewater management, and promoting the development of a circular economy.

TANGO-W ULL analysis

TANGO-W is made up of two prototype cases[1] and five strategic cases[2]. The cases will operate on a spectrum ranging from specific sites (Bovieran residence in Norrtälje) to districts (SRS, Hi-Harbach), to municipal-wide interventions (with visioning and implementation of sustainable programmes in Weiz, Alytus, Marker, and Halden). The cases also have diverse links to specific junctions of the F-E-W nexus and can therefore narrow their work according to the unique characteristics of how these fields of action merge. Despite the specificities of each ULL, all cases will provide lessons learned/insights about new roles, skills, and resources for the implementation of initiatives that foster urban sustainability by bridging gaps across the F-E-W nexus.

The following six parameters were identified to analyse the needs and challenges for UTC each case. As the cases are in the initial phase of implementation, the analysis of these parameters considers existing capacity, which has been evaluated based on the replies of the surveys.

Participation: All TANGO-W ULLs score low to medium in this parameter. Many, such as Halden, Marker, and Norrtälje, have faced resistance or doubts among stakeholders to the projects, and varying levels of past citizen engagement, such as in Weiz where former administrations did not make efforts to enable citizens to drive public processes. Some of the ULLs, such as in Stockholm, also face challenges with raising participation for the projects within the city administration itself, revealing a need to implement more sustaining participatory processes among stakeholders as well as public actors.

Decision making: While TANGO-W ULLs such as Alytus struggle with bureaucratic hurdles, like gaining approval from the national government and navigating disagreements across party lines, Stockholm indicates that they already have some established ways of working with research and development, which gives their ULL a strong footing for decision-making. Despite their struggles to break free from operating according to the status quo within the local government, the mayor of Weiz has been driving the process to create a vision already, thereby leading the way within the administration. Klagenfurt is navigating how to delegate responsibilities among involved parties (present and future), and Halden mentioned that future changes in political scenery and new regulations can always threaten the processes of decision-making and influence the roles and responsibilities of stakeholders.

Shared vision: Most of the strategic TANGO-W cases will focus their attention on strengthening this criterion for UTC during the project lifetime, and all cases—strategic and prototype—will be engaged in

[1] TANGO-W prototype cases involve the specific implementation of a technological system or innovation within F-E-W

[2] TANGO-W strategic cases aim to develop new attitudes and patterns of action and on changing cooperation roles and playing rules.

foresight processes among stakeholders. But the process of undergoing such a process is less familiar for some ULLs than others. For example, Stockholm already operates out of a vision, and even the specific district of the Royal Sea Port has been mandated through a sustainability policy to test innovative sustainable solutions in the area, giving credence to the ULL. Weiz, however, will begin to develop a Vision 2050 for the municipality through TANGO-W, and must brace for the potential confusion and uncertainties that come with the territory of planning for an unknown future. Other ULLs, such as in Marker, also face hesitancies around envisioning the long-term expectations of urban agriculture.

Resources: The Swedish cases tend to have the most security when it comes to resources for the ULL, which could be due to the mere size of Stockholm, for example, compared to Alytus or Marker. But Weiz also has strong people and infrastructure to carry out their foresight process goals. Halden, Marker, Alytus, Klagenfurt, and Weiz have all suggested that funding poses a threat to the work, whether due to the potential future changes to subsidies, tariffs, or simply that local funds cannot cover sustainability improvements on their own. When it comes to building UTC, the question of resources is not merely about existing economic, human, environmental, or material resources, but also requires evaluating the structures that enable the production and consumption of such resources to either continue or to change to meet new needs or requirements.

Internal reflection and review: Across TANGO-W ULLs, Stockholm and Weiz have strong positions to reflect on the implementation of sustainable solutions/transformative processes. Even though issues related to urban agriculture have not yet been addressed, Stockholm Royal Sea Port has the mandate and has been engaged in several experiments (e.g., MACRO – Food in Circular Robust Systems) to implement sustainable solutions. The City is learning from mistakes and progressing through a process of evaluation, learning, and moving forward. Weiz also has a history using monitoring processes, which is how they have come to be known for their sustainability practices throughout Austria, and Klagenfurt's sophisticated impact monitoring system for reviewing success in their city gives them a robust foundation for future reflective work. Still, one of the expected outcomes from TANGO-W is to have a critical perspective on current ways of working, and most of the ULLs do not have iterative approaches that welcome self-reflection or review processes that allow for revisions during a development process.

Capacities: Stockholm has acquired more experience with UTC due to their participation in other projects, the strong power of the municipality to influence land processes to developers, and the solid networks and cooperations that can continue to be utilised and expanded. The history of urban farming within Stockholm also gives some weight to the specific ULL. Klagenfurt also has developed know-how on the implementation of energy communities, specifically through their partnership with 4ward Energy. While they have solidified already a Smart City Core Team, Klagenfurt also suffers from several uncertainties, including the lack of a structure for energy communities, concerns with operating costs, and the complexities of creating a tax model that can last. Weiz has some strengths in this area given the mayoral support and has indicated many opportunities for cooperation and communication during the foresight process. Halden especially has needs and challenges in this area due to their silo governance structures. Although Norrtälje has several opportunities for replication and future benefits of the aquaponics implementation, they also suffer from working on a prototype that has not yet been tested in a live-work environment, and the complexities of ownership around the system create challenges. The other ULLs also have several opportunities for change but lack a precedence for working at the F-E-W nexus.

1. Introduction

Cities are home to approximately 75% of the European population (World Bank, n.d.) and are responsible for large proportion of green-house gas emissions and enormous consumption of resources. Despite this, they are regarded as places where transformation towards more sustainable futures can take place by changing planning and governance approaches (e.g., The Leipzig Charter 2020).

Urban Transformative Capacity (UTC) is an important element to trigger the transformative power of cities. UTC encompasses the collective ability of all actors in an urban innovation ecosystem to conceive of, prepare for, initiate, and perform transformative change at social, organizational, and ecosystem levels, thus enabling sustainable future development (Wolfram 2016).

Focusing on interventions surrounding the food-energy- water (F-E-W) nexus in seven urban living labs (ULLs) in Sweden Austria, Norway, and Lithuania, TANGO-W will deepen the understanding of urban demands and needs to expand UTC as a driver of urban change. The ULLs are the testbeds to identify new capacities, knowledge, roles, and governance approaches needed to support transformative change towards urban sustainability. Therefore, the TANGO-W ULLs lie at the core of the project.

Responding to this ambition, this report provides an overview of TANGO-W ULLs needs and challenges and has the three-fold aim of: (1) documenting the F-E-W interventions that will take place in each ULL, including mapping of main stakeholders and objectives of ULL phases, (2) identifying challenges and needs for UTC in each ULL and (3) analysing the status of the cases across different parameters that are relevant for developing UTC.

This task has been mostly informed by interviews conducted with local stakeholders in TANGO-W ULLs, and literature review, specifically Wolfram (2016) UTC framework, has supported the design of the interviews and the analysis of the cases. The findings suggest that TANGO-W ULLs operate within diversity of scales (specific sites, districts, or municipal), encompass different types of interventions (e.g., prototype and strategic) while maintaining in common the interest to integrate sustainable food, energy, and water systems and develop capacities for sustainable governance in each site, district, and/or municipality.

2. Methodology

The process of identifying needs and challenges of the TANGO-W ULLs involved the combination of several qualitative methods including a review of existing literature in the field of urban transformative capacity and the food-energy-water nexus, the design and implementation of semi-structured interviews with stakeholders in each ULL setting, study visits, and in-person and online meetings among TANGO-W partners.

Between April and June 2022, a literature review was conducted to gain a broad understanding of the F-E-W nexus and the concept of Urban Transformative Capacities (UTC). This review informed the design of a preliminary draft of an interview guide which was trialled with the City of Stockholm and Campus Roslagen during an in-person meeting of the Swedish team (June 2022 at the Campus Roslagen office). This step was important for further developing and sharpening two interview guides. The UTC framework in Wolfram, (2016) was specifically used as a basis for the initial interview question, using the development

factors of the criteria as a foundation for developing questions on the technical implementation of the TANGO-W ULLs.

After acknowledging the comments and suggestions from the City of Stockholm and Campus Roslagen, AIT provided additional revisions to the interview guides during the project meeting held in Vienna (June 2022). During this meeting it was decided that, to describe the needs and challenges of each TANGO-W ULL, interviews should be conducted with three different types of stakeholders: (1) the *guardians of the process* (those who stand for current processes and can legitimise change, e.g., TANGO-W city partners); the *decision-makers* (those who can decide or support institutions, e.g., politicians); and *affected persons* (those who are affected and capable of shaping the processes, e.g., clients or end-users).

After considering the comments and suggestions to reshape the questions, Nordregio finalised the design of two interview guides, one to be used with the guardians of the process, and the second to be used with the decision-makers and/or the affected persons (see Annexes 1 and 2). The guides are structured so as to invite interviewees to share about the case itself; to define the processes from conceptualisation to operationalisation; to identify stakeholders and their power, vulnerability, anticipated support, or anticipated scepticism; and to consider strengths and weaknesses of the case for accomplishing its intended purpose. In July, Nordregio carried out an online workshop with TANGO-W partners to introduce the guides and establish interview procedures, wherein each research partner (AIT, SIN, NR, and KTU) should conduct the interview with the guardians of the process, and each city partner should then conduct an interview with one or two decision-makers or affected persons of the case. If time permits, the researchers were encouraged to host a discussion with all interviewees together to further discuss or clarify aspects of the case.

Between July and August, the research partners from each TANGO-W country carried out the interviews with the guardians of the process and these with at least one decision-maker or affected person for their case. Most of the interviews were online and conducted in local language, excepting in Sweden where the working language is English due to the multi-cultural background of the team members. Stakeholders from each TANGO-W ULL were responsible for coordinating and performing at least one interview with people that could be affected by the implementation of the case. The interviewees received the questions in advance, but the online exchange was paramount for explaining the goals of TANGO-W project and the aims of the different ULLs. This was also an opportunity to reach out to local stakeholders that are likely to become involved in other workshops (e.g., the visioning processes to be held at a later date). The list of interviewees can be found in the Annex 3.

After the interviews were conducted, TANGO-W research partners were responsible for providing a summary document, using a template provided by Nordregio, including a description of the ULL, an explanation of realising change, a summary of expectations, and a brief identification of good practices for the ULL from within Europe. This document (one summary per ULL) enabled consistency across each case to analyse the inputs from the interview guides. By the middle of September 2022, the research partners delivered to Nordregio the summaries. Nordregio revised and followed-up with the research partners and ULL stakeholders on possible gaps in knowledge, doubts on the text, or changes due to further discussions at city level. This material was used to prepare a draft SWOT analysis for each ULL, which was then discussed and elaborated upon in a workshop during the TANGO-W face-to-face CoP in Marker (September 2022).

Simultaneously to this process, team members of AIT used the UTC criteria provided by Wolfram (2016) as a lens to define six qualitative monitoring criteria for the TANGO-W ULLs. These criteria were presented at the face-to-face CoP in Marker. Using these components as a baseline checklist for evaluating capacity, Nordregio folded these monitoring criteria into the analysis process. Therefore, the final analysis of the needs and challenges of TANGO-W ULLs has been book-ended by Wolfram's UTC criteria, applied as a basis for the interview guides and then in a modified version to review and rank each ULL according to its strength and areas for growth. This report is thus a culmination of the exchanges and strategies outlined above, enabling each ULL to be placed in conversation with the others and mapped in a UTC matrix to reveal points of weakness, imbalance, and need for targeted transformation.

3. Urban Transformative Capacities for F-E-W

Those working with municipalities today are often working within complex governance systems which rely on certain structures, patterns, and ways of working. In our age of multiple crises and threats such as climate change, energy poverty, social discordance, and economic hardship, urban planners, policymakers, and decision-makers must assess their capacity to influence their local contexts in a way that has profound impact against impending pressures, both external and internal.

Cities seeking to develop circular systems that make wiser use of resources and co-design urban spaces with community-based practices cannot enact change overnight. Combatting profound threats cannot be accomplished through superficial actions but requires deep-seated transformation that introduces friction to existing patterns of thought. It is through these changed underlying patterns that cooperation roles and communities of stakeholders create new ways of collaborating and working. Depending on the context, some cities require a greater degree of transformation among key actors than others to achieve long-term local goals or global agendas. According to Wolfram (2016, p. 125), **urban transformative capacity (UTC)** is about enabling and driving "systemic change towards sustainability." UTC therefore involves a focus on resources (availability, accessibility, and different types), power (or the "capacity of actors to mobilise resources to achieve a certain goal"), and resistance (due to existing systems, technologies, or ways of thinking).

> "Urban transformative capacity is the collective ability of the stakeholders involved in urban development to conceive of, prepare for, initiate, and perform path deviant change towards sustainability within and across multiple complex systems that constitute the cities they relate to. It is a quantitative measure for an emergent property that reflects attributes of urban stakeholders, their interactions and the context they are embedded in." (Wolfram, 2016, p. 125)

In his conceptualisation of UTC, Wolfram identifies three overarching areas of transformation: (1) agency and interaction forms, (2) development processes, and (3) relational dimensions (see Table 1). Alongside more specific components, capacity development factors, and 60 indicator statements, the framework can be used to assess UTC of a given locality or case study. These components are interdependent, and the neglect or challenge of sustaining one component may have detrimental effects to achieving the others.

Table 1: Wolfram's (2015) conceptual framework for UTC

TRANSFORMATION AREA	COMPONENT	DEVELOPMENT FACTORS
Agency & interaction forms	C1: Inclusive and multiform governance	C1.1: Participation and inclusiveness C1.2: Diverse governance models and networks C1.3: Sustained intermediaries and hybridization
	C2: Transformative leadership	--
	C3: Empowered and autonomous CoP	C3.1: Addressing social needs and motives C3.2: Community empowerment and autonomy
Development process	C4: System awareness and memory	C4.1: Baseline analysis and system awareness C4.2: Recognition of path dependencies
	C5: Urban sustainability foresight	C5.1: Diversity and transdisciplinary co-production of knowledge C5.2: Collective vision for radical sustainability changes C5.3: Alternative scenarios and future pathways
	C6: Diverse community-based experimentation and disruptive solutions	--
	C7: Innovation embedded and coupling	C7.1: Access to resource for capacity development C7.2: Planning and mainstream transformative action C7.3: Reflexive and supportive regulatory frameworks
	C8: Reflexivity and social learning	--
Relational dimensions	C9: Working across agency levels	--
	C10: Working across political administrative levels and geographical scales	--

Considering Wolfram's framework as a foundation, TANGO-W has established a modified collection of six qualitative areas for assessing UTC in each ULL (see Table 2). These transformative capacity areas provide an interpretation of Wolfram's 10 criteria; they maintain clear links to the UTC requirements for development, but they have been re-formulated for the purposes of qualitatively monitoring the progress of TANGO-W's seven ULLs. These six criteria make up the TANGO-W UTC analysis framework which has been further elaborated upon with specific inquiries for the sake of mapping needs and challenges further in this report.

*Table 2: TANGO-W UTC analysis framework**

AREA	CRITERIA	LINKS TO WOLFRAM
Participation	Participation of citizens and different types of organizations in defining goals, planning, implementation of measures and review	C1 (C1.1, C1.2, C1.3), C3 (C3.1, C3.2), C5 (C5.1)
Decision-making	Decision making within ULL during different phases of the project (who is involved, how many persons, way of deciding, etc.)	C2, C3 (C3.1, C3.2)

Visioning	Areas covered by shared vision (different social, economic, environmental, and quality of life needs)	C3 (C3.1), C5 (C5.1, C5.2, C5.3), C6, C7(C7.2)
Resources	Resources provided for different types of activities during the project (information and knowledge sharing, time for discussion and decision making, financial resources for technical and social implementation, etc.)	C7 (C7.1)
Reflexivity	Results from internal reflection and review - lessons learned	C4 (C4.1, C4.2), C6, C7 (C7.3), C8
Capacities	Capacities developed by different participating groups and individuals (knowledge and skills, network resources/social capital, financial resources)	C9, C10

*The areas and criteria description outlined in Table 1.2 are based on the presentation from AIT on 'Monitoring' held during the meeting in Marker/Halden on the 30 September 2022.

3.1. Food-Energy-Water nexus

A nexus-thinking approach to food, energy, and water is one way to strategically plan for a sustainable future. As stated by the UN, the **F-E-W nexus** is at the "heart of sustainable development" (United Nations, n.d.). By evaluating the interlinkages of these three key resources, planners and policymakers can move away from isolated decision-making and act more holistically, with greater understanding of how the supply and demand of one resource can interfere with the other two. The food-energy-water nexus approach identifies "trade-offs and synergies of water, energy, and food systems, internalise social and environmental impacts, and guide the development of cross-sectoral policies" (Albrecht et al., 2018). In short, the F-E-W nexus approach is a framework for resource management. Within the TANGO-W project, these three resources are understood as taking part in an ever-evolving dance, with constant flows of inputs and outputs, and regular moments of friction.

Several scholars have identified important limitations to the F-E-W nexus approach for sustainable development. Siloed work and lack of coordination between policies across these sectors has been pointed out as one of the main pitfalls. To counteract this innovative governance approaches, establishment of collaborations and partnerships and adequate investments are advised (Adom et al., 2022; Albrecht et al., 2018; Covarrubias, 2019).

TANGO-W project adopts the nexus approach in tandem with analysing urban transformative capacities. The project continuously asks not only whether governments, organisations, and communities have the capacity to manage each resource area, but also how to develop capacity within each community to systemically transform how these resources are governed in relation to one another. This requires thoughtful consideration of production methods, consumption behaviours, distribution practices, waste disposal processes, recycling technique, among other supply, demand, and use systems.

Complementary to these analytical market and circular economy perspectives, however, is the reflection on existing decision-making or novel governance processes. Here, TANGO-W addresses the questions of *which city decision-makers need to make decisions* with *which stakeholders of the F-E W nexus* and *on the basis of which issues*, so that resource-saving, transdisciplinary solutions become possible for the inhabitants of the cities. This is about changing the roles and rules of cooperation within cities and between cities and their relevant stakeholders. Cross-community cooperation is a prerequisite for success in complex, socio-technological change processes: Only when political decision-makers, experts from the administration, representatives of companies, and civil society are committed to new measures in the

areas of food, energy, and water can new technologies and products be introduced and also sustainably operated and implemented.

This background provides categories to understand how the seven TANGO-W Urban Living Labs (ULLs) work at particular junctions of the F-E-W nexus, how these junctions support or complicate the nexus as a whole, and how each ULL can reimagine their current food, energy, and/or water systems in ways that maintain security, overcome scarcity, and combat local environmental, social, and economic challenges. In our current globalised age, it is also important to understand the local F-E-W systems in the context of global production, distribution, consumption, and disposal of food, energy, and water resources. At the same time, it is important to perceive the influence of different forms of governance and democratic processes on transformation processes in order to design and implement supportive interventions accordingly.

4. TANGO-W ULL classifications

TANGO-W evaluates seven ULLs, each of which operate, to varying degrees, within the F-E-W nexus and which navigate, in their unique contexts, existing governance capacities for enacting change.

The TANGO-W cases can be classified into two categories: (1) strategic cases and (2) prototype cases. ***Strategic cases*** are those that aim to develop new attitudes and patterns of action and on changing cooperation roles and playing rules. ULLs that fall into this category are mainly interested in evaluating food, energy, and water as fields of action in combination with other topics on their local agenda. These ULLs do not involve implementing a specific technological solution or prototype; rather, they are interested in implementing new ways of working, especially through participatory methods, to shape a vision, programme, or process. ***Prototype cases*** are those that involve the specific implementation of a technological system or innovation within the areas of food, energy, or water. ULLs categorised as prototype cases are also interested in reflecting upon participation but also on the content and long-term success of the operationalised project.

The scope of the cases varies substantially, even among ULLs in the same category, as they start from varying levels of maturity and aim to achieve different outcomes during the project lifetime. For example, Campus Roslagen aims at designing, implementing, and following up on the management of an aquaponic system in a senior residential facility. On the other hand, Alytus City Municipality strives to coordinate existing strategies through a foresight process, which will include developing measures within a roadmap for the next 3 to 5 years. Therefore, understanding the ULLs with regards to their maturity is relevant as the challenges and needs will differ widely depending on their objectives.

Regardless of whether they are classified as strategic or prototype cases, each ULL plans to undergo three phases during the project lifetime: (1) Conceptualisation, (2) Implementation/transformation and (3) operationalisation. Depending on the case maturity, the needs and challenges can span over one or multiple phases.

Activities in the ***conceptualisation phase*** concern planning and, in the instance of prototype cases, preparing for the implementation of the F-E-W systems. The design activities can be practically oriented construction activities such as deciding the location and size of the aquaponic system in Bovieran, Norrtälje. They also include planning for and preparing the social systems that need to be in place for the implementation of the technology. For example, in the case of the City of Stockholm it could be informing

and/or gathering the opinions and perspectives of the residents of Royal Sea Port about the possibility of implementing underground food production in the area or identifying needs for specific skills and competencies to implement and manage such a system. For strategic cases, this phase is about planning for the foresight process, including identifying stakeholders, preparing for workshops, and/or conducting outreach activities.

The ***implementation phase*** consists of activities that take place once the construction is finalised, and includes the social requirements needed to maintain the technological system. For example, activities may consist of determining how to correctly maintain the aquaponic system and indicate responsibilities for cleaning, harvesting the food as well as deciding to whom the harvest belongs. For strategic cases, the implementation phase is about carrying out the foresight process, which means bringing together participating stakeholders, facilitating interactions among key players, defining new ways of working, and/or testing new governance structures.

Finally, the ***operationalisation phase*** includes the social requirements needed to maintain the technological system for prototype cases. For example, activities may consist of determining how to correctly maintain the aquaponic system and indicate responsibilities for cleaning, harvesting the food, and deciding to whom the harvest belongs. In strategic cases, activities in this phase concern the integration of the roadmaps and indicators of the impact monitoring system within existing urban planning processes (e.g., acknowledgement of the indicators in other documents, developing systems for revising the vision, etc.).

5. Challenges and needs TANGO-W cases

5.1. Swedish cases

Urban Agriculture in Stockholm Royal Sea Port, Stockholm

Stockholm has a long tradition of systematically addressing environmental and climate aspects and has the vision to be a global leader in environmental and climate initiatives by achieving the goals of the Paris Agreement. To further the environmental work, Stockholm Royal Seaport (SRS) was identified and appointed by Stockholm City Council to be a forerunner in sustainable urban development and operate as a fossil fuel-free city district by 2030. The area has been a testbed to sustainable urban development since the early 2000s when planning renovations of the former industrial neighbourhood began. In 2015, SRS was named the Best Sustainable District by C40 Sustainable Cities at the UN climate conference in Paris (COP21).

Over the 12 past years, a number of innovative processes and projects have been developed, tested, and applied throughout Stockholm. Some examples are the target and requirement setting and subsequent monitoring of all developers, resulting in high compliance in energy performance, mobility, urban greenery, waste management, etc. Other projects are C/O City, which was initiated in the district to develop tools for increasing ecosystem services, and Connected SRS, which tests digitalisation as a tool to evaluate functions of different components of open green space and determine how to optimise operation and maintenance thereof.

Within the TANGO-W project, the aim of the SRS ULL is to develop a strategy for the implementation of urban agriculture in the district. To this end, a large array of stakeholders, including researchers, will be

brought together to discuss the potential of open public areas (e.g., squares and parks), façade surfaces (e.g., buildings walls and roofs) and underground spaces to be used for food production. The aim is to embrace the production of food as 'urban infrastructure' and thus, the ambition is to go beyond the production of green leaves and grow caloric food which is paramount for delivering food security. As the area used to be an industrial site, there are caverns that were previously used for storing large amounts of fuel for the greater Stockholm Region. The study will identify the feasibility (what type? How?) of growing food in dark spaces as well as on building surfaces and open public spaces. The ability to improve urban agricultural production in Stockholm has the potential to reduce food miles and thus enhance shorter food supply chains, which can improve the long-term sustainability of the city.

As this knowledge will assist to develop a strategy for the implementation of agriculture in public spaces, SRS is primarily a *strategic case* but with the opportunity to prototype some of the agriculture productions (e.g., growing food on walls). The project offers the potential to be replicated in other developments and municipalities that have the aim to include food as infrastructure. According to the guardians of the process, the case has the following objectives in the different phases of implementation:

- In the first stage of ***conceptualisation***, the City will begin discussing the potential for urban agriculture (UA) in SRS with different stakeholders and experts.
- During the ***implementation phase***, stakeholders will define strategies for UA through (i) co-creation workshops, (ii) visualisation of potentials, and (iii) study visits.
- In the ***operationalisation phase***, the City will develop a strategy and tools for implementation of the strategy, develop business models, and develop potential additional pilots or R&D projects for urban agriculture.

Realising change

The interviewees (guardians of the process) pointed out some potential challenges to developing and implementing the urban agriculture strategy for SRS. Among these are to raise awareness and interest of the Planning and Development Administration to enable the incorporation of the UA strategy in forthcoming land allocation processes. Due to the novelty of this strategy, interviewees raised concerns about the need to develop regulations and technical requirements (e.g., irrigation systems, buildings' structural capacity) to effectively support growing food in urban spaces. In addition, concerns about the safety of the food produced in urban spaces due to urban pollution (e.g., air pollution) were also mentioned.

One policymaker who was interviewed also added that the novelty of the project can raise scepticism among some stakeholders as agriculture is still an activity that mostly takes place in rural areas. Linked to this argument is the high price of urban land which collides with its use for growing food.

An opportunity for the development and implementation of the strategy is the growing awareness of the importance of establishing short food supply chains that will assure food security in an uncertain future exposed to the negative impacts of climate change that can cause disturbances to the production and distribution of food across the globe. The guardian of the process also added that, currently, there are no policies or governance frameworks that limit or prevent the objectives of the case from being met. As outlined in the description of the case, SRS is already a testbed for sustainable solutions. Therefore, rather than being constrained, the development of the area is supported by the Stockholm Royal Seaport

Sustainability Policy, which encourages producing ecosystem services by supporting the cultivation of edible resources (e.g., fruits, berries) in courtyards and parks. In addition, the large and heterogeneous network of stakeholders that the City of Stockholm has been partnering with to develop urban sustainable solutions was also mentioned as an opportunity for the implementation of the strategy.

The guardian of the process viewed the potential of scalability of the project with optimism; engagement of businesses and NGOs is positive to anchor the importance of producing food in cities. In the long term, even the property owners may be able to realise the business case potential of growing food on building facades and rooftops as it can contribute to greening the developments, improving air quality, minimising the negative impacts of climate change (e.g., temperature, rainwater management), and contributing to food security. In addition to these arguments, the interviewee also mentioned the potential of adding targets related to urban agriculture to the Green Space Index (GSI).[3] This GSI is a planning tool that indicates the proportion of open space's eco-efficiency based on their capacity to provide ecosystem services.[4]

Who is involved in making change

Several stakeholders were mentioned as having influence in the development of the strategy. Among these are the different departments of the City of Stockholm (development, planning, traffic, Norrmalm's district), researchers from the Swedish University of Agricultural Sciences (SLU) who will investigate the requirements to grow food in dark spaces, private developers, Stockholm Business Region, businesses (agriculture, architects, etc), the residents of the area, and urban agricultural NGOs.

According to the guardians of the process, the most vulnerable stakeholders are the developers, who will have to comply with the requirements of the strategy and may be exposed to risks (such as market acceptance of growing food in buildings) and uncertainties (like technical requirements such as irrigation systems that enable agriculture in buildings). Conversely, the members of the City of Stockholm Development Administration were identified as the most powerful stakeholders, both from the perspective of the guardians of the process and the decision-makers, because the City of Stockholm holds the power to implement sustainability requirements in all land development.

According to the guardians of the process, the stakeholders who could gain the most with the implementation of the strategies are the entrepreneurs, who will have the real context to try out innovative solutions for producing food in cities.

The working group for the SRS strategy "Let nature do the work"[5] is the stakeholder that will most support the project, according to the guardian of the process. This working group has the vision of raising awareness of the potential of ecosystem services to increase the resilience of cities while contributing to world-class sustainable urban development in Sweden. On the other hand, the Planning and Development Administration within the City of Stockholm is likely to be sceptical of realising the change as the implementation of the strategy will challenge current ways of planning.

---

[3] https://vaxer.stockholm/omraden/norra-djurgardsstaden/in-english/results2017/green-structure/

[4] https://vaxer.stockholm/globalassets/omraden/-stadsutvecklingsomraden/ostermalm-norra-djurgardsstaden/royal-seaport/a-sustainable-urban-district/how-we-work/monitoring_report_2017_eng_juni_2018.pdf

[5] https://www.cocity.se/wp-content/uploads/2019/11/cocity_urban_ecosystem_services_summary.pdf

The guardians of the process outlined several strengths to initiate and follow up on the development of urban agriculture strategy for SRS such as the institutional and planning structure of the area that enhances innovative solutions and the access to a broad network of stakeholders (business, NGOs, entrepreneurs) that strive for implementing agriculture in cities.

Expectations

According to the guardian of the process, the added value of participating in TANGO-W is that the project creates a space for self-reflecting on their own practices as planners in the SRS. This aspect is relevant for transformative leadership as it allows not only a critical reflection on issues related to the performance of tasks but also encourages a deep reflection on norms and values that foreground the teamwork (Messmann & Mulder, 2015).

Nevertheless, the policymaker reckoned that the implementation of the urban agriculture strategy would only marginally improve urban sustainability. In her opinion, the great potential to establish sustainable districts would be in the area of energy, specifically in connection to heat and power plants that can profit from waste combustion. However, this does not apply to the context of SRS.

The international recognition of the SRS as a sustainable district points out that the experiment with urban agriculture in the area will have an impact not only regionally and nationally but can also inspire other districts across Europe and beyond to consider the adoption of similar strategies The policymaker who was interviewed also added that planning should strive for the implementation of edible sources in cities. In his words: 'especially if you live in apartment buildings, it is definitely an advantage to have an apple tree or berries in your courtyard. More of that!'

Good practices

- Growing Underground, London, UK: The UK start-up Growing Underground is cultivating micro-greens in a vertical hydroponic system at 33 metres below ground in an abandoned air raid shelter owned by the governmental transport body Transport for London (Jans-Singh et al., 2020; Walsh, 2021). The start-up is a private, profit-oriented initiative located below Clapham High Street in South London (ibid), making it an intra-urban farm located at the micro-level within the city-system of London. Resource inputs are transformed to produce micro-greens in a hydroponic system, which delivers a nutrient solution to the plants that are grown soil-less in a textile growing medium. The hydroponic system is a closed-loop system, as water that is not taken up by or transpired from plants is filtered and circulated back into the growing system (Jans-Singh et al., 2020; Zero Carbon Farms, n.d.; Walsh, 2021).
- Urban Farming Food Chain, Los Angeles, USA: Urban Farming Food Chain is an architectural and planning intervention in Los Angeles that defines a green path consisting of a network of vertical farming that utilises walls of existing buildings. The 'agriwalls' (9 x 1.8 m) are equipped with interconnected recycled stainless-steel panels (60x60 cm each). The irrigation system is coupled to these panels and is fully automated. The four agriwalls installed in the green path are made up of a total of 180 panels which together allow growing approximately 4,000 kg of fruits and vegetable around the year (Elmazek, 2016).

Table 3: City of Stockholm Royal Sea Port SWOT analysis

STRENGTHS	WEAKNESSES
DECISION-MAKING • **Established way of working with Research and Development:** Culture of anchoring things in Research and Development exists, bring people together in working groups, for example, before reaching higher level decisions VISIONING • **Existing policies mandate and safeguard the work** of testing innovative sustainable solutions in the district (via the Stockholm Royal Seaport Sustainability Policy). This policy includes a target for producing ecosystem services (enhance the cultivation of edible sources in the city). RESOURCES • Creation of **resources** (participation in development project, budget rely on external application – tendering) • **Size of the city** creates opportunities. It can capitalise on resources (allocation of resources once a decision has been taken), and the city has realised it can capitalise on sustainability (provision of green growth) REFLEXIVITY • Other SU projects have been successfully implemented (not only immediate success but re-evaluation and iterations. This provides a strength of **learning from previous mistakes and advancing** within a process of stop, evaluate, learn, and go forward CAPACITIES • **Strong power of the municipality** which has the possibility to influence the allocation of land process to developers, for example, by introducing strict requirements in the land sale contracts • **Solid networks** with different actors and cooperation exist • **Know-how** has been established over the past 12 years	CAPACITIES • **Size of the city** creates opportunities and advances, but it is also challenging to work with such a large body • If there is **resistance** it takes **time to convince the whole organisation** (cross-department cooperation can be difficult) • Working out of silos takes time to change: RSP is an exception not the rule • **Exchange of a personnel** is inevitable because processes are so lengthy, which can hinder project consistency
OPPORTUNITIES	**THREATS**
CAPACITIES • **Global awareness** of the importance of establishing short food supply chains; resilience and self-sufficiency awareness • **Connection with large and heterogeneous networks**: NGOs, businesses researchers, developers to draw from	PARTICIPATION • **Raising interest within the planning administration**: To enable incorporating the strategy in forthcoming land allocation processes • **Get acceptance from the political leaders:** agriculture is still dissociated from cities VISIOINING

• **The district is a testbed for innovative sustainable solutions:** Loudden (the area under development in Royal Sea Port) has the possibility to become a radically sustainable neighbourhood/district. • We have a **history of urban farming** in Stockholm in some aspects with urban allotment gardens. Gardening has become a way for meditating for urban dwellers during COVID (reconnection with nature, and how food should taste)	• **Anchor the strategy among the developers** who may focus on the risks rather than on the benefits of urban agriculture • **Novelty of the project** can be seen as a risk for some stakeholders RESOURCES • **Food safety:** urban pollution, especially air, may negatively impact the quality of food grown in the district. • Regulations and technical requirements for adding greenspace for gardening on facades: need to investigate the requirements thoroughly • **High land costs** threaten the implementation of agriculture in cities

Implementing aquaponics system in Bovieran housing complex, Norrtälje

Inspired by the French Riviera, the company Balden developed the Bovieran concept, which builds housing complexes targeting elderly dwellers (55+ years old). Bovieran combines safe living with social interaction in a green and welcoming environment. The residential complex offers modern apartments with common areas equipped with winter gardens where residents can socialise and extend the social outdoor season in the cold climate of Sweden. Other facilities include a wellness centre (gym, sauna, treatments), common rooms for parties, dinners and courses, and outdoor spaces with barbecues and a spice garden. Guest apartments are also available enabling the stay of visitors and relatives of the tenants. The apartments are privately owned, and the residents' association decide how the common areas are to be used. Currently, there are 26 Bovieran residential complexes across Sweden and there are plans to build five more in the near future.

The Bovieran complex located in Norrtalje consists of 48 apartments. The apartments have an average of 75.5 sqm with a yearly housing association fee per sqm is 709 kr. The inner garden of the apartment complex mirrors a tropical landscape with exotic trees and a pond covered by a glass roof. The tenants have expressed the wish of establishing an aquaponics system that will serve both as a food supply and as a recreational activity. According to an interviewee who is part of the board, the implementation of aquaponics will encourage social interaction and well-being while promoting food resilience and preservation of resources for future generations. This will be achieved with the reduction of water consumption in farming, avoidance of runoff of nutrients in the environment, offering a common activity to residents and providing them with the possibility of growing fresh and accessible vegetables all year-around. Furthermore, the aquaponics system will be implemented with renewable sources of energy (solar panels).

Within the TANGO-W project the Bovieran is a *prototype case* which is expected to provide insights into the community management of aquaponics and offers the potential to be replicated in the other Bovieran residential complexes. According to the guardians of the process, the case has the following objectives in the different phases of implementation:

- Under the ***conceptualisation phase***, Campus Roslagen will highlight to the Boverian tenants the value (social, environmental, innovative) of implementing an aquaponics system in a residential setting, engage as many people as possible in the design of the system, divide responsibilities for its maintenance, and encourage a participatory process with Bovieran dwellers to choose a system that best satisfies their needs.

- During the ***implementation phase***, Campus Roslagen will engage the dwellers in the construction to reinforce their ownership and power to influence the design of the aquaponics system. This phase will also involve participation from the Boverian association board, Boverian residents within a working group specifically responsible for developing the aquaponics system, aquaponics experts, Ambius (the company responsible for maintaining the residence's common areas), students of the "aquaponics engineer" professional course (who will assist on the conceptualisation and implementation of the system), and Campus Roslagen (who is the consultancy service for the design, implementation, and maintenance of the system).

- After the system is constructed at the site, the ***operationalisation phase*** will consist of assuring that the responsibilities defined in the conceptualisation phase are respected and drawing a detailed work plan for the maintenance of the system.

In addition to Boverian case, Campus Roslagen has also considered an opportunity to implement an aquaponics system in a local school in Norrtälje as an alternative prototyping case. In this alternative ULL, Campus Roslagen would conduct a visioning process with the teachers and students (upper class students from 12-15 years old) to identify roles and responsibilities of maintaining the aquaponics system. The case has the opportunity to use nutrient-rich water to grow edible plants in the school setting, and the system can be used across multiple disciplines in the school for students to learn about food, energy, and water systems, principles of circular economy, and hands-on learning about sustainability. The initial plan for Campus Roslagen has been to engage Boverian in the project, but the option to implement in the school remains an alternative in the event that the board members decide against it.

Realising change

The guardians of the process pointed out that potential challenges to implementing the aquaponics system is the objection of different stakeholders. The tenant board and any other resident that stands against the project could hinder its implementation. This holds true especially during the implementation phase as routines in housing can change significantly, with the presence of the aquaponics experts and students from Campus Roslagen who will assist in the installation of the system. While the presence of other people can be seen by some Bovieran residents as an opportunity to interact with other social groups, it can also be identified as a disturbance of the daily life of such a homogeneous residential site occupied by individuals who may have been attracted to Bovieran due to the peacefulness pledged by the concept. The guardians of the process also referred to individuals who have strong opinions and could persuade other residents to oppose the implementation of the system. In this respect, the structure of the decision-making of Boverian, which is based on 100% consensus among the members of the board, is reckoned as a weakness rather than a strength. Already, the ULL has faced the challenge of one board member who has expressed disinterest in the aquaponics system, thus negating the resounding positivity from all other tenants in the board and preventing the work at the Norrtälje Boverian from progressing until further notice.

Another potential challenge is that some of the residents may oppose the type of food produced in aquaponics systems because it relies on fish excrement as a nutrient for growing vegetables. Pollard et al., (2017) suggests that one of the barriers for the social acceptance of consuming green leaves produced through aquaponics is concerns with ethics surrounding fish wellbeing. The lack of an official agreement between Campus Roslagen and the Bovieran board was also mentioned by the guardians of the process as a challenge.

The accountability of the board with economic issues was cited by the policy makers as an aspect that could hinder the implementation of the project, especially if the maintenance costs are high in comparison with the number of residents that effectively use and enjoy the aquaponics. The guardians of the process also reckoned that while aquaponics is relatively easy to maintain the cultivation of food in water tanks and the lack of boundaries as it exists in traditional gardening with soil-based cultivation in plots makes the ownership of the system tricky. The tragedy of (unmanaged) commons (Hardin, 1968) where everyone owns but no one takes responsibility is a risk that could jeopardise the operation of the system.

Nevertheless, means to prevent these challenges include providing tailored information and engagement strategies to Bovieran residents (e.g., workshops, meetings, letters) and to Bovieran managers/maintainers (e.g., guided visit to the existing aquaponic system prototype in Campus Roslagen) which could provide a tangible example of the system and the straightforward requirements to operate it). Furthermore, highlighting the potential of aquaponics to contribute to (larger) sustainability goals (e.g., SDGs 1, 2, 6, 7, and 11), climate change mitigation, and resilient communities can also strengthen the justification for implementing the system.

The governance model of Bovieran, which is based on a shared property (*bostadsrätt*), was mentioned as an opportunity too, not only as a hindrance: if the board is in favour of a certain measure (in this case, aquaponics) it can influence and convince the residents, or at least start a dialogue about that measure. The expertise of Campus Roslagen in aquaponics, and the growing interest on this technology, was also mentioned as a factor that could counteract the lack of consensus among the different stakeholders as Campus Roslagen can provide evidence about the feasibility and advantages of aquaponics. The guardians of the process also suggested to employ tailored information and engagement strategies, not only to the stakeholders directly impacted by the project in Norrtälje, but also to the other Boverian residential complexes across Sweden. Embracing local food production as part of the Boverian concept would significantly lessen the risks of rejection of the project. Nevertheless, to implement such an ambition strategy in all Boverian complexes would require considerable efforts and time but undoubtedly would assist the scalability of the system.

Who is involved in making change

There are several key groups involved in implementing an aquaponics system in the Norrtälje Boverian complex. The decision-makers for the Bovieran case are include (1) the board, consisting of representatives of the tenants, (2) Ambius, the company that maintains and is responsible for the plants and general maintenance of the common outdoor space and winter garden, and (3) the tenants, because it is crucial to identify a maintenance/working group that will be responsible for operating the aquaponics system among those living at Boverian.

According to the guardians of the process, the **most vulnerable stakeholders** are the residents that are not part of the board and thus are deprived of decision power. Conversely, the members of the board and Ambius were identified as the **most powerful stakeholders** both from the perspective of the guardians of

the process and the decision-makers. Ambius can, for example, disagree with the installation of aquaponics if additional maintenance tasks would be added to its duties.

One of the decision-makers (a member of the board) reckoned that the involvement of the board is crucial to inform all Boverian residents about why and what they are building. Their participation is paramount to assuring that the system is built to fit the local conditions.

According to the guardians of the process, the ***stakeholders who could gain the most*** are the residents of Bovieran, as they will have access to fresh vegetables and enlarge their leisure possibilities of socialising with other dwellers. Campus Roslagen was also mentioned as the organisation that can showcase the aquaponic concept, provide to its students the possibility of working in a practical case, and strengthen its institutional profile. Food stores could also profit as the project could spur the commercialisation of locally produced food, which is already a marketing strategy employed by some local supermarkets. The ***stakeholders that would lose the most*** from the implementation of the system are the Bovieran residents who are against the physical (e.g., implementation of water tanks, solar panels, etc.) and social (e.g., presence of students, aquaponic experts) changes within the residential complex.

According to the guardians of the process, the ***stakeholders who will most support and benefit the project*** are the residents who take interest in aquaponics. The Bovieran board at national level and the company responsible for the maintenance could also support the project if they realise the added value of local food production with aquaponics to add in their business model (e.g., increase financial value of the property due to local food production, green standards). Otherwise, these stakeholders could also become the ***most sceptical*** to the implementation of the project if the added value is not communicated well enough or understood thoroughly.

Expectations

Campus Roslagen outlined several strengths to initiate and follow up on the transformation process in Boverian Norrtälje. Among these is their experience with multi-stakeholder collaboration and expertise in profiling aquaponics systems to grow food. Campus Roslagen is a frontrunner in offering education on this technology, and this has enabled them to establish a solid and growing network of students and professionals working in the field.

The knowledge on transformative capacities to implement sustainable solutions that the TANGO-W project will provide is valuable to Campus Roslagen as it can be used to assist the strategic planning of the organisation concerning the expansion of their teaching capacity (for example, the inclusion of new subjects in the curriculum of the aquaponics engineering course) and even the establishment of new departments that may be needed to address the demands identified in TANGO-W. In addition, Campus Roslagen can benefit from their participation in TANGO-W with knowledge on new methods/strategies for collaborative design and revised system approaches to work with F-E-W nexus issues at a municipal level. The Bovieran site in Norrtälje is also an opportunity for the students enrolled in the Campus Roslagen aquaponics course to apply their acquired knowledge and thereby gain hands-on experience. Another added value of engaging in the TANGO-W project is to raise awareness about the possibility of integrating food production and circular methods in municipal planning.

The interviewee from Campus Roslagen also noted that the implementation of the aquaponics system can have a positive impact on other housing associations as the lessons learned in the Norrtälje complex will unveil both the potential and obstacles of integrating agriculture in residential buildings. Two other

interviewees (a member of the board and a resident of Bovieran) added that the implementation of the aquaponics system will possibly draw the attention of the local media, and this can be beneficial for inspiring other house associations and raising environmental awareness.

Good practices

- Gröna Solberga, Stockholm, Sweden: Kretsloppsbolaget implemented an aquaponics system in a residential building in Solberga, which is residential area testbed for innovations.[6] The aquaponics system includes a fish tank and three beds for growing vegetables and herbs. The project addresses environmental and climate-related challenges (e.g., reduced water usage for food and energy efficiency by using energy in existing buildings) and includes a social component with the experiment of collective governance/management of the aquaponics system. The implementation of the system faced several practical challenges, such as identifying a suitable basement space for the system, adapting this space to the aquaponics system requirements), and equipping the space with sufficient access to heat, electricity, ventilation, water, and light. This case provides lessons for the management of aquaponics in a collective housing environment, and it also highlights challenges such as the need to develop a sustainable business model for small-scale aquaponics food production that addresses questions such as: Who are the customers? What is their willingness to pay? How should fish and vegetables be distributed to customers? (Perjo & Bjerkesjö, 2019)
- ROOF WATER-FARM, Berlin, Germany: This project combines wastewater treatment technology with food production as a "closed-loop urban farming approach." Hydroponics and aquaponics are used as building-integrated, water-based farming strategies.

Table 4: Norrtälje aquaponics system in Bovieran SWOT analysis

STRENGTHS	WEAKNESSES
VISIONING • **Momentum:** general public seems to express interest in these sorts of sustainable technologies RESOURCES • **Aquaponics expertise**: The expertise of Campus Roslagen in aquaponics and the growing interest on this technology can counteract the lack of consensus among different stakeholders. Campus Roslagen can provide evidence about the feasibility and advantages of aquaponics • Ambius (company that provides the plants and maintenance) already have expertise in lighting as well as the plants • The **materials** needed for implementing the system are common and easy to find and construct • **Existing context of Boverian allows for adoption of aquaponics system** both socially and technically. The residences already accommodate for greenspaces, etc. • The **system can save water** compared to other types of farming; the **system can also**	DECISION-MAKING • **Current decision-making structures can prevent implementation**: The guardians of the process referred to individuals who have strong opinions and could persuade other residents to oppose the implementation of the system. In this respect, the democratic structure of the decision-making of Boverian, based on total consensus among the members was reckoned as a weakness rather than a strength. • **Lack of official agreement**: The lack of official agreement between Campus Roslagen and the Bovieran board was also mentioned by the guardians of the process as a challenge • **There has already been a decision in one Boverian site against the implementation,** but there is potential still for the implementation to take place in another way CAPACITIES • System has **not yet been tested** in such a site; the novelty of the system makes the

[6] https://www.stockholmshem.se/gronasolberga/

provide social opportunity for residents involved	success unknown and unknown could lead to scepticism • **No existing protocol for management** which leaves the processes open-ended to be determined by each context in which it will be implemented
OPPORTUNITIES	**THREATS**
RESOURCES • **Water scarcity that might threaten traditional farming** could act as a motivator for implementing aquaponics, and provides diversity for growing methods. (Diversification of agricultural production methods) CAPACITIES • **Opportunities for replication** among 26 Boverian sites across Sweden • **Ambius (company that provides the plants and maintenance for Boverian)** already have connections with other offices and businesses, which provides a potential for upscaling. • **Possibilities to communicate about the benefits of implementation**: Campus Roslagen can provide tailored information and engagement strategies to Bovieran residents and managers/maintainers. There are also clear links for the potential of aquaponics to contribute to sustainability goals, climate change mitigation, and resilient communities, all of which provide strong arguments to overcome opposition to implementation • The governance model of Bovieran which is based on a shared property (bostadsrätt) was mentioned as an opportunity. **Provides a precedence** for this and they are already have some interest groups that take care of different elements of the shared environment	DECISION-MAKING • **Uncertainty around changes in leadership** with the Boverian board. If approval was gained, there could be a chance that it was lost when the board changes again (not certain about the likelihood of this) • **Board and/or resident scepticism**: The board association and any other resident that stands against the project could hinder its implementation. While the presence of other people can be seen by some residents as an opportunity to interact with other social groups, it can also be identified as a disturbance of the daily life for residents who perhaps were primarily attracted to Bovieran due to the peacefulness pledged by the concept. RESOURCES • **Disagreements on food production**: Some of the residents may not agree with the type of food produced in aquaponic systems that relies on fish excrement as a nutrient for growing vegetables. • **Economic concerns**: The accountability of the board with economic issues could hinder the implementation of the project, especially if the maintenance costs are high in comparison with the number of residents that effectively use and enjoy the aquaponics. • **Ambitious communication aims require time and effort**: The guardians of the process suggested to employ tailored information/engagement strategies to other Boverian residential complexes across Sweden. While embracing local food production as part of the Boverian concept would lessen the risks of project rejection, to implement such an ambitious strategy in all Boverian complexes would require considerable efforts and time. CAPACITIES • **Complexities with ownership**: While aquaponics is relatively easy to maintain, the cultivation of food in water tanks and the lack of boundaries compared to traditional gardening with soil-based cultivation in plots makes ownership tricky. The tragedy

	of (unmanaged) commons (Hardin, 1968) where everyone owns but no one takes responsibility is a risk that could jeopardise the operation.

5.2. Austrian cases

Vision 2050, Weiz

Despite developing various medium- and long-term plans, the City of Weiz has not yet conducted a foresight process alongside its citizens with an integrated, long-term vision for the sustainable development of the urban environment. Many cities around the world have begun to develop foresight processes because they can provide municipal authorities, politicians, agencies, businesses, and citizens with common goals, provide a sense of community, and establish key directions along which the city expects to grow.

In the 2015 municipal structure reform of the province of Styria, the neighbouring municipality of Krottendorf was incorporated into the City of Weiz. As a result, the population grew to over 10,000 inhabitants, and the municipality area increased from 5 km² to 17.5 km². The development of a Weiz mission statement through a foresight process is intended to promote the social integration process and to give all activities a common direction for the new union of these two formerly distinct municipalities. The foresight process involves developing a spectrum of scenarios, a vision, and a roadmap with measures for the next 10 years.

The vision and mission statements will provide direction and articulate goals and urban development themes for the path that politics must take in the future, thereby contributing significantly to the strategic agenda setting of the City of Weiz. In addition to the new direction (goals), agreement on central, shared values and recognition of one's own competencies will also be important for balancing common conflicting positions and concretising action to achieve the goal. The vision provides direction and orientation for all political parties through its long-term focus, but also provides flexibility in its short- and medium-term goals, which may be updated every 4-5 years. It serves as an orientation for all central policy makers in the city, legitimized by a broad-based process.

Representatives within the City of Weiz seek to address the issue of sustainability and create a new future perspective for the city and orientation for all stakeholders of Weiz. The process will involve fields of action and thematic priorities that are important for future urban development (e.g., mobility, energy, food) and consider inhabitants' quality of life in 2050. In addition to articulating long-term objectives, the vision should also include a framework for measures that enable quality of life and quality of stay for citizens in the medium term.

The City of Weiz has already established three important pillars for sustainability—environment, society, and economy—which will act as cornerstones of the vision. The interaction between these three pillars is important for initiating innovative dynamics in Weiz's fields of action. Once goal of the vision is for sustainability to act as a central, cross-cutting issues throughout every thematic field of action considered by the city.

TANGO-W thematic fields of food/nutrition, energy, and water are important in Weiz because together these three resources provide the foundation for many of the city's basic needs. The city needs to consider

how to balance all three fields—in terms of production, consumption, preservation, and provision. When organised and managed together, cities can build resilience in cooperation with neighbouring communities at the intersections of these three resources.

Future-oriented solutions are central concerns of Weiz. Water is a particularly important resource for the city. In recent years, for example, the Wolfssattel nature reserve has been preserved despite pressures from various interest groups. Among other things, the city hopes to expand the conscious use of water by private individuals and producers (e.g., reduction of large pools of private houses). The topic of energy has also been an important field of action for Weiz for the past 30 years, specifically regarding energy storage, hydrogen, etc. In the field of food, the city aims to increase self-sufficiency and producing high quality of food while also reducing CO_2 emissions in and around Weiz by streamlining supply chains.

Due to the overall goal of the strategic agenda setting (foresight) process, Weiz's ULL belongs to the *strategic case* category.

- During the **conceptualisation phase**, Weiz plans to (i) define the project scope with all responsible parties and stakeholders; (ii) establish a common image and language for communication with external parties; (iii) commit to a common plan, including a timeline with milestones for how the vision will be created and applied.
- In the ***implementation/transformation phase***, Weiz will (i) ensure participation from citizens, companies, NGOs, associations, schools, etc.; and (ii) examine possible future developments in 2050 as a starting point for developing a Vision 2050, Scenarios 2050, and a Roadmap 2035.
- Finally, the ***operationalisation phase*** will involve (i) gathering decision-makers from politics and administration as well as citizens, companies, NPOs, associations, youth and marginalized groups. All people should be able to identify with their vision and contribute to the implementation of the roadmap measures.; (ii) prioritising the bundles of measures in the roadmap in such a way that this results in an action plan for Weiz for the next 3 to 5 years. At the same time, indicators of the impact monitoring should allow to quickly tackle first measures on the levels of a) new regulations, b) new thematic living labs in urban quarters, and c) feasibility studies and projects., (iii) patience and staying power from the process owners. Change often takes longer than one plans and happens with unexpected results. The TANGO-W process owners are therefore challenged during implementation to learn to understand the arguments of sceptics and opponents as positive contributions and to integrate them into the planned actions.

Realising change

Interviews with the managing director of the Innovation Center Weiz as well as the mayor and vice mayor revealed several needs and challenges for the development of a Vision 2050 in Weiz. Within the local government, it can be a challenge to move beyond the "we've always done it this way" mentality. Reluctance to change can pose a barrier to creating innovative solutions or conducting long-term planning processes. The interviewees also expressed a fear regarding stakeholder participation: it is easy for local government to involve the same stakeholders rather than breaking out of the status quo and engaging new members of the community who can contribute to the participatory foresight process. Engaging all relevant interest groups is difficult to achieve, and it takes time and effort to identify and mobilise citizens and stakeholders to ensure a balanced participatory process. Though the City would like to co-create the vision, it is difficult to gather representation from all key stakeholders due to other commitments and pressures on their time. This is especially true given the multiple crises facing Weiz, from continued

impacts of COVID-19 to the recent gas and energy crisis. Dramatically rising inflation has also caused fear about the future, which can often reduce creativity and curiosity for future planning, thus severely limiting the development of the vision. All foresight processes involve some degree of uncertainty which creates an inherent obstacle to the goal of this ULL. It may also be difficult to engage older residents who may not take interest in planning for a future Weiz that does not have a strong impact on their own lifetime.

Additionally, facilitators of the foresight process must prepare for potential confusion around the ULL. It will be important to co-define goals, implementation strategies, and measurable indicators early on to prevent paralysis of long-term project plans that may otherwise be perceived as irrelevant for the present.

Finally, the potential lack of financial resources must be considered in advance. It may be difficult to ensure commitment and support throughout the lifetime of such a lengthy project, and funding streams for sustaining the work will need to be secured and concretised within the municipal budget.

There are also several opportunities from which the City of Weiz benefits. Weiz expects support for the vision process through the integration of all subsidiaries. This cooperation should strengthen the process and build co-ownership of the vision across subsidiary managers and experts. The City has also developed partnerships with cities throughout Poland, Germany and Hungary, the E5 network, healthy community, tourism associations, 8-town cooperation, energy region Weiz-Gleisdorf, Raabklamm cooperation, and EU-wide projects since 1997. These networks can play a supporting role in the visioning process and lend insights and exchange of knowledge across contexts.

Due to involvement from the strategic communication department of Weiz, external communication will be developed at the onset of the work, with particular attention towards engaging young people. A specific, young municipal employee has been appointed project manager to build participation with the younger population, whose insights will be key in the foresight process.

Who is involved in making change

Food, energy, and water are fields of action of the foresight process. Visions, goals, and measures are being developed for this purpose. Since the role of citizens and civil society is of central importance both for the successful definition of the vision and for its implementation, the following stakeholder analysis focuses on social drivers and barriers. The change primarily refers to the changed thinking and actions of the relevant actors, without which no changes in the F-E-W nexus are possible.

Traditionally, the City of Weiz has been attentive to social issues. However, some perceive that the city has a growing concern of socio-economic stratification due to a widening gap between richer and poorer inhabitants. In its population of only 11,300 inhabitants, 50 different nationalities are represented in Weiz. Citizens from non-Austrian backgrounds are also perceived as a vulnerable, marginalised group in Weiz. Migrants from Ukraine, Syria, and Afghanistan need support in language learning, finding housing, and coping with everyday life in a new culture. Some immigrant populations in Weiz suffer from negative stigmas around their perceived 'foreignness' which also complicates the social cohesion of the city.

Senior citizens and disabled inhabitants of Weiz are also vulnerable, marginalised groups within Weiz for which a visioning process needs to consider. Further, poor and/or homeless inhabitants also need to be considered, especially due to crises over the past decades that have exacerbated the situations of vulnerable groups (such as the 2008 financial crisis, the COVID-19 pandemic, and the energy crisis in 2022). Important stakeholders for addressing these social concerns include non-profit organisations such as Caritas, Life Support, local churches, and various institutions dedicated to assisting disabled individuals.

Individuals such as the mayor, the city office director, the district governor, and interest group representatives are all influential actors in the visioning process. The municipal guardians of the process perceive the commitment of the mayor as critical for success. The public appreciates being addressed personally by the mayor, so for this reason, his personal activity in the process is paramount. Furthermore, the heads of leading companies and family businesses within Weiz and the institution of the church (specifically Basilika am Weizberg) also play important roles. The integration of some of these influential actors requires unique, individual engagement according to their status and preferences; some of them may prefer to be more directly involved while others might support in indirect capacities or through less public avenues. Experience with previous processes shows that the city must approach everyone individually in order to achieve the greatest effect in terms of possible activation. One municipal administrator who is responsible for social affairs in the municipality will be appointed with identifying relevant target groups and providing data.

The City of Weiz sees the foresight process as an opportunity to raise awareness around change for the city. Above all, political decision-makers welcome the fact that myriad stakeholders are involved in this process and that the project/mission statement is carried by many people rather than a single department or group. Against this background, all stakeholders have the potential to gain something from the process.

However, participation also involves risk and requires stakeholders to become flexible to change expectations and current ways of thinking/working. The prerequisites for this are different for each stakeholder group. While companies must be able to manage change to survive financially, political stakeholders have come under increasing pressure to change in recent years. Political decision-makers perceive the mission statement as an important instrument for change. It would be worthwhile to mobilise and invest a lot of energy and commitment for important building blocks. The Weiz Innovation-Centre, which acts as a catalyst and bridge-builder between "administration" and the "pressure to change", has also learned to react flexibly to a wide variety of demands and changing requirements, just like the local family businesses. The younger generation, which is itself in training and development, could also deal quickly with changing contextual conditions. However, greater flexibility and open-mindedness is needed in the older generations, in the administration of the municipality, and among farmers, among which young farmers increasingly seem to pull the older ones along. Where a balanced interaction between "young" and "old" does not exist, there often arises a rift between the generations who feel committed to different patterns of thought and action.

Accordingly, the guardians of the foresight process for Weiz identified decision-makers and local government staff, as well as those who prefer to rely on known and existing methods, as those stakeholders who may be disengaged from the foresight process. In terms of sectors, those that are dependent on public funds (e.g., non-profit organisations) would lose more from the expected developments than commercial enterprises. Multinational, large, slow-moving companies could also be among the perceived losers from change in the future because they may be too slow to adapt to change requirements.

According to the political decision-makers of the process, the highest scepticism towards the foresight process is expected from the administration as well as from older inhabitants. These stakeholders may be accustomed to the classic foresight process of the previous mayor, which was a predominantly expert-driven process within the departments of the city and without the inclusion of the citizens. With the planned broad involvement of all interest groups and citizens, the political decision-makers expect that groups that have repeatedly opposed all decisions of City Hall on principle in recent years will pose old-

fashioned attacks and complaints. From the perspective of the general public, these groups may appear as protectors against political arbitrariness. Within the city, these groups are called "nag groups" by political decision-makers.

The City of Weiz values citizen participation in the foresight process in order to create a representative vision for everyone and to obtain broad support from the citizens by inviting them to own the city's vision themselves. The approach of a broad participation process of this kind is also new in Weiz and must be well coordinated and prepared with the mayor. One particular municipal employee has been appointed to act as a mouthpiece for the young people in the process, but the project management on the part of the City will be strongly anchored by the Innovation Centre Weiz.

It is expected that the foresight process will improve the sustainability of the community on many levels. This concerns the way of living together itself but also the identification of the people with the mission statement (i.e., their motivation to become part of the common change). This also concerns the new citizens from different nationalities. The process offers Weiz the chance to live and shape the diversity of Europe on a small scale. Citizen participation itself already represents a specific type of external communication, which is to be supplemented by professional media support.

In recent years, too few people have decided on issues that are important for the entire city. The broad participation of the foresight process invites all citizens to be more engaged in the city and its long-term outlook.

The necessity of having to reserve and invest additional time for the foresight process in addition to the densely scheduled daily-routine is seen as a disadvantage. It is also expected that the mayor will be confronted with a plethora of requests and issues that the City of Weiz cannot comprehensively fulfil. This can lead to a heavy burden on the mayor.

Expectations

The City of Weiz expects this process to provide a significant impetus for improving the sustainability of Weiz in terms of social integration, economic prosperity, and the further improvement of environmental quality.

Daily work on future issues is one of the city's cores tasks. Weiz sees its own strengths in its ability to network within the city and to mobilise many stakeholder groups, such as citizens, businesses, etc., to get involved in participatory processes. From the point of view of the City of Weiz, supportive consulting in participatory processes and the successful handling of such processes are also among its own strengths, in addition to cross-city cooperation and active contributions to various networks.

In addition, learning about the background and practical methods of foresight processes is an important learning objective in the TANGO-W project. Therefore, the City of Weiz expects to learn from its fellow TANGO-W ULLs about how considerations of the food-energy-water nexus can be incorporated into the city through its strategic vision planning, and, by means of the vision, embed transformative capacities for sustainable urban development into the city's everyday functions.

The City of Weiz must show that its responsibility extends beyond the city limits in the sense of a successful development of the entire region. This involves cooperation between city and country in the sense of supporting a wide range of lifestyles. The region itself needs offers where and how it can dock well with the city and its development in the sense of co-evolution. Financial crises, the pandemic, and the war in

Ukraine show that Weiz as a city needs the strength, ideas, and motivation of many people in order to be able to meet the challenges of the future in a positive way.

At the same time, the strategic orientation is expected to facilitate successful submissions of future funding projects, as these can be set up in the future as implementation steps of the local/regional basic orientation. In this way, the City of Weiz would like to maintain or further expand its pioneering and good practice role for many other cities/regions within the EU research networks and media, both nationally and EU-wide.

Good practices

- LEADER, EU: Financed by EAFRD funds, LEADER is a programme of measures of the European Union through which innovative actions in rural areas have been promoted since 1991. Since 2020, 77 local regions in Austria belong to the LEADER programme. After the national programmes have been harmonised with the EU funding regulations, LEADER regions can obtain funding for the implementation of innovative projects in the region at intervals of 8 - 10 years by submitting local development strategies. The regional foresight process SCHALTwerk2030 supported the LEADER Region Traun4tler Alpenvorland (Upper Austria) in 2021/2022 to develop a local development and innovation strategy for its 21 municipalities in a participatory way and to submit it successfully to the Federal Ministry of Agriculture, Regions, and Tourism for the funding period 2022 – 2030.

- This year, the Austrian Ministry of Social Affairs, Health, Care, and Consumer Protection (BMSGPK) looks back on 10 years of conception and implementation of national health goals. The tenth anniversary was taken as an opportunity to think about and prepare for a paradigm shift from the "disease system" to "health promotion as a system." For this purpose, a national foresight process was set up in 2021, which was supplemented in 2022 by broad-based participatory processes with experts and vulnerable groups to be able to capture current needs and emergencies in addition to the strategic dimension. In the fall of 2022, strategically relevant measures will be elicited from the perspective of the future with currently urgent measures and combined into a short- and medium-term health promotion programme.

- Smart City Brno 2050, Brno, Czech Republic: Brno developed a new medium- and long-term sustainable city strategy within the framework of the European Smart City project "Ruggedised". Within the framework of a community of practices, different workshop designs and methods were reviewed and tailored to Brno's requirements. In addition to a detailed indicator system for the developed roadmap, the Brno succeeded in involving political decision-makers as topic leaders for different fields of action. This made it possible, with only a short delay, to continue the establishment and implementation of the strategy, which was developed and anchored across party lines after the mayor was voted out of office.

Table 5: Weiz Vision 2050 SWOT analysis

STRENGTHS	WEAKNESSES
PARTICIPATION • Engagement of the municipality staff DECISION-MAKING • Mayor has been driving the process already VISIOINING	PARTICIPATION • The city didn't include citizens much in previous projects. The municipality perceives that citizens don't generally want change. DECISION-MAKING

• To get people working in the same direction; steering up institutions for sustainable change (office for environment and mobility and Weiz Innovation centre still increasing, this year they will set new goals and measures and reduce the greenhouse gas emissions RESOURCES • The city is in a stable condition REFLEXIVITY • The city is quick to learn from others CAPACITIES • Covenant of mayors; have everyone included • New project of the rebuilding of the city square and gardening and use of water provides some momentum in the areas of interest	• **'We've always done it this way' mentality**: One possible barrier is seen in old attitudes and patterns of action in local government/municipality administrative staff. The process offers the opportunity to bring more flexibility, movement, and willingness to shape and change into the administration. This would enable development in the direction of greater citizen orientation with fewer bureaucratic structures and reposition the municipality as a service institution for citizens. VISIONING • **Long-term approaches inherently involve uncertainty**: Working out or adopting the perspective of 2050 seems unusual, especially for the reason that so much can change by 2050 that does not seem foreseeable from today's perspective. It is also feared that older people will not be interested in a 2050 perspective because they assume that they will have passed away by that time.
OPPORTUNITIES	**THREATS**
PARTICIPATION • **Opportunity to include citizens**; and from a political standpoint it would be good for the mayor to do this vision process • **Municipality staff is very engaged** with this process which is a strength; high level of involvement from the mayor who is leading the way for staff, administration, and citizens of Weiz. CAPACITIES • **Cooperation of subsidiaries**: Weiz expects support for the process through the integration of all subsidiaries, e.g., district heating Weiz, city marketing, Weiz. Their cooperation should strengthen the process in the city itself and give managers and experts of the subsidiaries the possibility to work on the future orientation themselves. • **Cooperation across Europe**: From the point of view of Weiz, the town partnerships in Poland, Germany and Hungary, the E5 network, healthy community, tourism associations, 8-town cooperation, energy region Weiz -Gleisdorf, Raabklamm cooperation will also have a supporting effect, because the process can access the know-how available here. The same applies to the relationships established in EU projects since 1997. • **Communication**: It is planned to involve the "strategic communication department of	PARTICIPATION • **Citizen mobilization**: Interviewees fear that the "usual suspects" will become involved again in the participatory foresight process and that a balanced mobilization of all interest and population groups will be difficult to achieve. Mobilizing citizens and stakeholders is seen as the supreme task. It is also estimated that the mobilization will be made more difficult by the fact that stakeholders are often under pressure in their daily work and may therefore be unable to free up time for the participatory process. It is assumed that most of the people's time and energy is currently spent on coping with the current gas and energy crisis as well as with the COVID pandemic. The current inflation and cost developments cause fear, and fears often reduce creativity and curiosity for the future, which may severely limit the development of a mission statement. Both could lead into an "inertia effect" of the system or people. VISIONING • **Bracing for potential confusion**: Goals and solution strategies for the implementation of the foresight process are to be jointly defined and agreed upon in the steering committee in the fall of 2022. Data graveyards and the listing of countless, unprioritized projects can lead to confusion and paralysis. Accordingly, it is important to offer overview, clarity, and implementation power for decision makers so that important projects become visible and "hit

Weiz " for external communication from the beginning. Especially young people should be addressed, e.g., "Friday`s for Future". For this reason, Julian Macher will take over the project management on the part of the city as 23-year-old municipality employee. Above all, the accompanying communication of the process and the result to the outside is seen as an important support for the expected success. • Renewable energy directive • With an upcoming election, the vision process provides an **opportunity for politicians** to show that they want to get involved and to listen to citizens	the road" of implementation. In addition, quality criteria and indicators should be defined to make IS/SHALL comparisons and thus the result measurable. Only this enables corrective intervention during the implementation process. RESOURCES • **Financial resources as a threat**, for example an end to certain subsidies would be problematic

Hi-Harbach renewable energy community, Klagenfurt

The focus of this ULL is the Hi-Harbach[7] neighborhood development in Klagenfurt where space for up to 1,700 residents is being developed. Hi-Harbach aims to implement new models of living with smart mobility, liveable social spaces, and a coexistence of generations.

The goal of the development area as a ULL within TANGO-W is to establish a renewable energy community (REC) in this area to supply residents with locally generated, renewable electricity under advantageous conditions. In addition, urban gardening services will be developed, which will be available to residents free of charge. A public park, which will be designed for climate change adaptation (trees according to the sponge city principle, water areas for evaporative cooling, drinking water, etc.) will also be implemented within Hi-Harbach. Therefore, the ULL involves all three components of the F-E-W nexus, with a particular emphasis on energy.

With an overall goal of implementing an REC, the Klagenfurt ULL site belongs to the *prototype case* category.

- During the ***conceptual phase***, 4ER and the City of Klagenfurt will (i) identify and involve potential participants; (ii) collect basic data (electricity bill, electricity consumption, PV generation, potential area/grid levels, etc.) of the potential participants, and (iii) carry out necessary calculations (EEG - which savings can participants expect, which tariff model is to be applied, etc.).

- In the ***implementation/transformation-phase***, 4ER and representatives of the City of Klagenfurt will (i) establish the legal entity of the EEG and put it into operation (existing PV plants); (ii) make available urban gardening, and (iii) complete the park facility.

- Under the ***operationalisation phase*** 4ER and representatives of the City of Klagenfurt will facilitate (i) securing the continuous operation of the EEG and granting financial benefits to the participants; (ii) activating and further developing the park and urban gardening offerings, and (iii)

[7] https://hi-harbach.at/

considering the learnings from the ULL for scalability and replication in other development areas within Klagenfurt.

Realising change

Through interviews with decision-makers and guardians of the ULL case, several challenges and opportunities have been revealed. Challenging for the City of Klagenfurt is the clarification of the people in charge for the implementation-process of the measures. This concerns both, the initiation of the planned urban gardening initiative and the foundation of the operator organisation of the future REC in Klagenfurt. The economic presentation of the REC against the background of the rapidly changing tariff situation is also seen as a great challenge. Analogous to Weiz, Klagenfurt also sees the integration and activation of the right stakeholders as a great challenge and success factor for implementation. This applies above all to winning over residents to the idea of the project.

Solution strategies for these include early clarification of the responsibilities of possible initiators and operators. It also seems important to the city that the future tariffs of the energy community should be flexible in order to allow quick reactions to change from outside. In terms of stakeholder involvement, the focus is on using the already existing channels of the NPO "Diakonie" to carry out comprehensive information measures.

Possible barriers could be the willingness of Stadtwerke/ Energy Klagenfurt GmbH and WBT (the entity responsible for construction costs) to engage in the development and implementation of an REC. The operating costs for electricity generation are understood as the responsibility of the future tenants.

According to the guardians and decision-makers of the process, the existence of an overarching Smart City Core Team, which is fed from the relevant departments of the city for innovative future topics, is a strength of Klagenfurt. The networks in the central region of Carinthia, as well as networks on a national level, such as the Smart Cities networking platform, the Austrian Association of Cities and Towns, the Austrian coordination office for energy communities, and the regional coordination office in Carinthia are also perceived as possible supporters. Furthermore, the Klagenfurt Roof-Power-GmbH (KDSG), partners within the EU Cities mission programme and the "solar potential cadastres instrument" are perceived as possible supporters for a successful implementation of the future REC.

Who is involved in making change

The City of Klagenfurt looks back on a changing political history (right-wing conservative, socialist). In the ULL site, people with lower incomes are seen as marginalised groups. Rather than the municipality, it is the social space coordination office of the deaconry that is seen as the point of contact for marginalised groups. As an administrative body, the City of Klagenfurt tends to focus on the task of implementing technological or economic innovations in the ULL site.

The city does not see itself as a process driver but as a particularly influential stakeholder. Klagenfurt's public-utilities and local, cooperative housing developers in social housing are named as further, central influencers for the success of the case.

While winning over stakeholders or marginalised groups is primarily left to the deaconry, the City of Klagenfurt is becoming active in the form of organising regular steering group meetings with influential stakeholders.

The municipal department for Climate and Environmental Protection is the central actor for the success of the Klagenfurt ULL. All national and European smart city and environmental projects converge in this department, and the TANGO-W target area Hi-Harbach is also developed and driven forward by this department.

The City of Klagenfurt sees all residents of the Hi-Harbach development area as potential winners by successfully establishing an REC. Through their future participation in the planned REC, residents could expect both security of supply and cheaper tariffs compared to the current tariffs of the Austrian energy suppliers. Also, the possibility of using urban gardening areas as well as the generously planned public space (park) would support community life in the ULL as well as a more sustainable life by enabling one to grow his own food. The City will also gain knowledge and build competency in the field of renewable energy communities through the project.

At the same time, the goal of the City of Klagenfurt would be to prevent stakeholder groups from losing out because of the project. Relations with stakeholders in the City of Klagenfurt are primarily shaped by the deaconry. Therefore, there is little differentiated perception here about possible supporter or critic groups. The greatest scepticism is expected from unknown, individual residents. In contrast, people in charge from the City of Klagenfurt know the experts and decision-makers in administration and politics and accordingly expect the most support from their own colleagues.

The City of Klagenfurt expects that the implementation of the REC in Hi-Harbach will sustainably support the climate goal of implementing climate neutrality by 2030 in Klagenfurt. At the same time, this will actively initiate the implementation of a project from the energy field of action within the Klagenfurt Smart City Strategy.

The concept development for a functional REC is seen as a challenge. Open questions here are a) the definition of the actors, b) the definition of roles and responsibilities, c) the definition of the role of Klagenfurt's municipal-utility as the city's energy supplier, and d) the definition of the legal framework.

Overall, however, the City sees benefits of the planned REC on several levels: they expect the expansion of exchange and social interaction, the expansion of local energy-production in Klagenfurt, the possibility of optimising the currently high energy prices, and the reduction of CO_2 emissions in the city. A prototype is expected, which can then be scaled up to other parts of the city.

Expectations

Klagenfurt is the only Austrian city to have succeeded in establishing itself as one of the 100 "EU Cities Mission" cities. One of its strengths is its courage to position itself as a front-runner city in terms of achieving climate neutrality by 2030. The TANGO-W project is intended to help ensure that this goal can be successfully implemented.

Klagenfurt sees a great learning opportunity in the exchange of experience with other cities. Best-practice examples from other cities should serve to reduce its own blind spots and to examine and adapt new technologies and services to local contextual conditions and needs. To this end, exchange with other cities and regions is actively sought.

One of the goals is to inspire communities in the Klagenfurt region and national networks in Austria to test REC solutions and implement them wisely in their own context. Here, Klagenfurt sees itself as a multiplier for innovative energy systems.

Klagenfurt expects the successful implementation of REC within the framework of TANGO-W to improve the cooperation with Klagenfurt's municipal utilities and WBT and to increase the credibility of its own arguments in the discourse with politicians. This should improve the overall funding conditions for the City of Klagenfurt.

Good practices

- Energy City Hall REC-1, Magliano Alpi, Italy: A municipality as initiator of the renewable energy community. This case shows how a municipality can offer public buildings for an energy community. It is also an example of cooperation between municipality, households and small businesses for collective self-consumption of electricity.

- Monachil, Granada, Spain: In order to reduce the scepticism towards the topic of energy communities, participatory activities were carried out on the part of the municipality and information was provided about the advantages of energy communities in order to subsequently also form new energy communities. The implementation of capacity building trainings for the establishment of energy communities is also an important task.

- Unsere Energie Kremsmünster, Kremsmünster, Austria: One of the first functioning energy communities in Austria, consisting of 8 members. An energy community founded as an association, with sociocratic elements incorporated into its organisation. The energy community was founded in June 2022, the first billing will take place in winter 2022.

- Energy Community Pilot Project, Mārupe, Latvia: This case is a novelty at the national level. Latvia is now starting to develop energy communities. The practice presents the roadmap and set of activities of two pilot projects in apartment buildings.

- Røverkollen housing cooperative, Oslo, Norway: A novel case at the national level. Røverkollen is a pilot living lab within the H2020 project Green Charge. The objective is to provide environmentally friendly electricity for charging residents EVs at reduced costs, and to provide predictability and security concerning residents charging needs (as the increase in EVs is anticipated).

- COMPTEM – Enercoop, Spain: A H2020 supported pilot project, this is a non-for-profit energy cooperative with the objective of generating rebates on members' energy bills and eventually supplying 100% renewable energy to the whole village of Crevillent. This case is that of good collaboration between the local administration and the energy cooperative. Moreover, the financing model chosen has probably convinced people reluctant to participate.

- Energy Gardens, The Netherlands: An innovative concept to produce an additional socioecological value through an energy community project. Several renewable energy generation projects with multiple functionalities are implemented. Local citizens and stakeholders are directly involved from the start in the project's design, its exploitation, and its maintenance.

Table 6: Hi-Harbarch Klagenfurt SWOT analysis

STRENGTHS	WEAKNESSES
DECISION-MAKING	DECISION-MAKING • We have limitations for what we can do and what is the responsibility of other parties.

<table>
<tr>
<td>

Commitment to sustainability topics throughout the municipality which would be involved

CAPACITIES

Partnership with 4ward energy provides knowledge in area where the municipality does not have knowledge
Some existing networks with people who will live in the area in the future and to involve stakeholders in the area
Smart City Core Team provides strength to the project: The existence of an overarching "Smart City Core Team", which is fed from the relevant departments of the city for innovative future topics, is seen as a strength of Klagenfurt. The networks in the central region of Carinthia as well as networks on a national level, such as the Smart Cities networking platform, the Austrian Association of Cities and Towns and the Austrian coordination office for energy communities or the regional coordination office in Carinthia are also perceived as possible supporters. Also, the Klagenfurt Roof-Power-GmbH (KDSG), partners within the EU Cities mission program and the "solar potential cadastres instrument" of are perceived as possible supporters for a successful implementation of the future, renewable energy community.

</td>
<td>
For example, Urban Gardening measures cannot directly be influenced by the city of Klagenfurt
CAPACITIES

Need to develop structure for energy community: we don't always know which stakeholders will be part of this. (Energy communities are always on a municipal level)
The complexity to create a long-lasting tariff model which ensures that all participants profits from the participation in the REC - changing participants and (fast) changing energy tariffs of the participants

</td>
</tr>
<tr>
<td>OPPORTUNITIES</td>
<td>THREATS</td>
</tr>
<tr>
<td>
RESOURCES

Locally produced electricity will also be used locally
Water management opportunities helps us to implement climate adaptation measures in smaller district and urban gardening opportunities can help people be more independent and sustainable

REFLEXIVITY

Approach of starting with an energy community (it is the first time we are starting with something like this) and it is a huge learning opportunity with potential for upscaling afterwards
The topic brings awareness to energy savings, markets, costs, which are all important topics

CAPACITIES

As a city, we can act as an information point for interested people who want to be part of an energy community; we are not the actor who initiates but we are a mediator who can bring people together, which is a new role for the city

</td>
<td>
PARTICIPATION

Gathering the right stakeholders and gaining their willingness to participate: The integration and activation of the right stakeholders as a great challenge and success factor for implementation. This applies above all to winning over residents for the project idea. Solution strategies for this include early clarification of the responsibilities of possible initiators and operators. It also seems important to the city that the future tariffs of the energy community should be flexible in order to allow quick reactions to changes from outside. In terms of stakeholder involvement, the focus is on using the already existing channels of the NPO "deaconry" to carry out comprehensive information measures.

DECISION-MAKING

Providing early clarity: Challenging for the City of Klagenfurt is the thorough clarification of the people in charge for the implementation-process of the measures. This concerns both the initiation of the planned Urban Gardening initiative and the

</td>
</tr>
</table>

	foundation of the operator organization of the future renewable energy community Klagenfurt. VISIOINING • **Scepticism towards energy communities from the energy provider**; we are lacking some knowledge about what the role of the energy provider will be RESOURCES • **Economic situation**: The economic presentation of the renewable-energy-community (REC) against the background of the rapidly changing tariff situation is also seen as a great challenge. • **Uncertainties within electricity market** CAPACITIES • **Participation of those responsible for construction costs**: Possible barriers could be the willingness of Stadtwerke/ Energy Klagenfurt GmbH and WBT (responsible for construction costs) to engage in the development and implementation of a renewable energy community. The operating costs for electricity generation are seen as the future responsibility of the tenants.

5.3. Norwegian cases

Food waste reduction programme, Halden

Each year, food waste in Norway is worth 1 trillion NOK and contributes to poor environmental qualities in cities. However, the problem of food waste is often hidden from everyday life after waste is carried away and disposed of in landfills. In light of this, Halden Municipality seeks to build awareness around reducing food waste and energy consumption related to food production/consumption. Within the TANGO-W project, Halden will develop guidelines for implementing a food waste reduction programme. The city will develop and offer a plan for handling food waste for the municipal organisation itself as well as for stakeholders and the public. Such guidelines can be used by various municipal departments to organise the processes of food production and waste. Offering and facilitating consumption of locally produced food will be handled at the city planning level. After the guidelines are clarified, Halden will implement the food waste reduction programme at an institutional level, in local kindergartens, where food waste can be measured. The application among the kindergartens will provide input for further workshops to discuss any successes and new learnings around reducing food waste.

The municipality also aims to see how digital monitoring of foods (overview, expiration dates, menu suggestions) or other services can help to understand consumption and food-waste. With an interest in facilitating the consumption of locally produced foods, the municipality wants to establish processes that make the whole value chain more efficient and predictable, "from farm to fork." These initiatives will be highlighted in the innovation programme, My Digital City, which places the citizen in the centre of digital and data-driven development for sustainability. The programme involves cooperation among Smart Innovation Norway (SIN), Østfold University College, the Institute for Energy Technology, and Halden Municipality.

The food waste reduction programme will additionally consider the use of water as a major part of foods/food production, but also as a stand-alone product. The programme will engage local farmers through whom the municipality can learn about water usage (watering needs and effective use of rainwater) in food production and also understand how farmers can sell their locally grown food within the municipality. The planning process for the programme will also involve facilitating key discussions around energy usage in local food production, for example, learning about the necessary time frame for artificial food storage to extend the period between harvest and consumption, measuring the energy required for transporting food, and identifying how producers as well as consumers can save energy through conscious behavioural changes.

Given Halden's ambitions and expectations, it is classified as a *strategic case* with the following objectives under the three implementation phases:

- During the ***conceptualisation phase***, the municipality will identify stakeholders, plan stakeholder workshops, and make outreach activities to inform stakeholders about the food waste production programme

- Activities in the ***implementation/transformation phase*** are related to carrying out a visioning process through several workshops where stakeholders can co-create a vision with strategic objectives linked to food waste reduction. The aim will be to engage representatives of various stakeholder groups in these workshops including inhabitants, NGOs, kindergartens, schools and college/universities, and private businesses and organisations. Canteen owners and other restaurant owners, as well as their customers, will also be invited to participate in such workshops.

- In the ***operationalisation*** phase, the municipality will co-produce guidelines, frameworks, communication strategies, possible digital systems, etc. which will culminate in the establishment of a food waste production programme which can be effectively applied within various public institutions. To begin, the programme will be operationalised in the context of select kindergartens in the municipality where children will be involved in the scheme to reduce food waste.

Realising change

Through interviews with Halden Municipality Smart City Project Manager, the Head of Social Development, and the General Manager of Isebakke Municipal Kindergarten, several opportunities for the implementation of this Halden ULL came to light. Firstly, there already exists some momentum around the ULL initiatives from which the municipality can build. For example, the municipality has already approved the development of city gardens which strengthens the potential of the pilot. The municipality also provides opportunities for emphasising sustainability within the sub-plan-growth 2020-2032, the education department, and the social department. In the process of operationalising the programme in kindergartens, an action plan will be prepared for developing skills related to climate challenges among children/young people and facilitating discussions on how to make society more sustainable. Sustainability is already an important topic at the schools, which provides a foundation for the ULL.

The stakeholders also identified several items that can be viewed as potential threats to the work ahead. Interviewees raised concerns that the problems of food waste are not well known to the general public, so gaining support for this particular project will require some efforts of raising awareness of the conditions first. There could also be some pushback from inhabitants who may be sceptical towards the cleanliness

of the foods or other concerns about local food production processes, and strict guidelines regarding food handling in institutions may pose some limitations to the work. The municipality should be aware of potential challenges that arise from key players and consumers. Additionally, stakeholders may not have time or express support for the project due to capacity and other projects that currently hold priority. Changes in the political scenery after local elections could also mean that momentum could change. Furthermore, new regulations regarding how food waste can be reimagined can also emerge. (For example, Norway currently holds to an agricultural policy that bans using food waste as animal feed.) Other unforeseeable threats that could influence the programme might include crises or accidents causing pollution in the municipality which would influence food production and consumption. Halden also suffers from a lack of cross-department working processes leading to governance silos, and they have endured some difficult economic conditions from which they are still slowly emerging. Such weaknesses and threats require strategic and proactive thinking to enable long-term capacity of a food waste reduction programme.

Despite these obstacles, one particular strength for Halden is that, since 2015, the municipality has been building upon the vision of creating an innovative society. The vision of this has spurred the organisation to grow more linkages across departments and to pursue new projects that have the potential to transform the municipality in pioneering ways.

Who is involved in making the change

To understand and develop effective monitoring of local food production, consumption, and food waste, the municipality and its cooperation partners rely on the involvement of several key stakeholders. Throughout the project, public administration will be involved as the guardians of the process. Local farmers and food producers will also be engaged from conceptualisation through operationalisation since they are key to local food production. During implementation and operationalisation, the project will benefit from involvement with institutional leaders, inhabitants, NGOs, and local businesses, all of whom will be part of the uptake, maintenance, monitoring, and use the food waste reduction guidelines.

According to the guardians of the process, the most vulnerable stakeholders are those who currently have the least knowledge about food, food handling, or production. This includes a wide range of people who are considered vulnerable in this process because they may lack awareness of food systems and how production and/or consumption might influence other social, economic, or environmental aspects of life. Alternatively, the most powerful stakeholders are politicians, decision makers, and the municipal director. These figures have the potential to make widespread impact for local inhabitants through enacting policies, funding food waste programmes, etc.

The success of the project will most directly benefit residents of Halden Municipality. For example, by gaining more knowledge about food and food-handling processes, low-income families can eat healthier and reduce economic pressure for relying on 'cheap' foods. Furthermore, developers and property owners, and the municipality as a whole will benefit economically from the successful implementation of the programmes. Local farmers will gain a localised market for their agricultural production as well. All Halden inhabitants also have the opportunity to consume locally grown food, which is often fresher and helps to reduce total food miles and carbon footprint due to importing foods. However, the project will also mean that the municipal technical operation department might lose out. It is also possible that property owners, grocery stores, and food distributors will be required to change their existing operational structures to accommodate new systems, which may negatively affect them in the short-term.

Because the project provides potential economic and climate/environmental benefits for the municipality and is rooted in larger municipal initiatives to become more innovative, it is likely that the project can gain the support of stakeholders such as politicians, municipal environmental advisors, and ambassadors of sustainability. This will be important because many of these stakeholders also hold a lot of power for influencing the success of the food waste reduction programme. Alternatively, the project could suffer from the lack of support from the department of waste management who may be unwilling to adopt new frameworks for working or from some sceptical residents who are disinterested in, feel indifferent towards, or are ignorant about developing a local food system that reduces food waste. Some local food producers may also reject a programme involving local food production due to the fear of serving unsanitary food.

For the decision-makers/end-users, the implementation of the case is advantageous because it is in line with the municipal sub-plan for climate and energy.[8] The project can help to achieve climate and environmental objectives, making it a desirable project to support with time and resources. Importantly, the interviewed guardians and decision-makers raised hesitations concerning the use of resources (specifically time), which can be challenging. To combat this, it will be important to communicate clearly and directly about how the investment in time, energy, and finances now will pay off in the long run. The current food production and consumption processes are not working, and money is wasted on food that ends up getting thrown away. Therefore, the implementation of the programme will provide opportunities to better understand resource use and develop more sustainable food production and consumption in Halden.

Expectations

By implementing these programmes, Halden expects to establish learning capabilities for each of the fields and sectors engaged in the work. The municipality hopes to share the knowledge that is produced in the ULL and inspire other municipalities to transform their own food systems by using similar monitoring tools that improve local food production and consumption. The case can also provide learnings that will influence the municipal sub-plan for climate and energy as it is being developed, which means that the ULL will have a direct impact on future planning and management in Halden.

Halden also expects to build stronger links within the food-energy-water nexus by considering how food systems correspond to, influence, and are affected by energy and water resources.

Good practices

- ZeroW: While not directly a living lab, this project (funded by Horizon Europe with 12 million Euros) is entirely focused on battling food waste. According to the project description, "ZeroW directly addresses the challenge of food loss and waste (FLW) by developing and testing a synergetic mix of innovations in real life conditions, with the aim to deliver ambitious reductions at all stages of the food supply chain from post-harvest to consumption" (Zero W - Horizon 2020, u.d.). It is highly relevant to follow and engage with them in the development of their project while it runs from 2022 until 2025.

- WASTE FEW ULL: This project aims to map and substantially reduce waste (resource inefficiencies) within the urban food-energy- water (F-E-W) nexus in city-regions across three

[8] https://www.halden.kommune.no/_f/p1/if44e2ca6-7033-4148-98fd-12f16bc2b26c/kommunedelplan-for-klima-og-energi-2019-2030_vedtatt.pdf

continents: Europe, Africa, and South America. The project works with four ULLs made up of key stakeholders who conduct participatory research to map resource flows, identify critical dysfunctional linear pathways, agree upon the response most appropriate to the local context, model the market and non-market economic value of each intervention, and engage with decision-makers to close each loop. This project combines a focus on the F-E-W nexus with a food waste perspective which will be highly valuable in the development of the ULL in Halden.

Table 7: Halden food waste reduction programme SWOT analysis

STRENGTHS	**WEAKNESSES**
VISIONING • In 2015, statement that we were going to make an innovative society because we had a large deficit. But this spurred the organisation to have more momentum and the issue has improved. Before 2015, it was extreme silos, and when they said our new strategy is to be the most innovative municipality (decided upon by the mayor), then it kickstarted to say yes to new projects, etc. mindset change has taken place in some way	RESOURCES • Not too strong of an economy CAPACITIES • Complications with silo governance
OPPORTUNITIES	**THREATS**
CAPACITIES • **Some momentum already exists from which to build**: The development of city gardens has been approved in the municipality. This strengthens the potential of the pilot. • **Many actors** which the municipality can lean on • **Municipality sub-plan-growth 2020-2032, education, and social department provide opportunities for emphasising sustainability**: An action plan shall be prepared in order to develop the skills of children/young people related to climate challenges and how to make society more sustainable. Sustainability is important at the schools.	PARTICIPATION • **Resistance to project for various reasons**: Water/Waste management might resist, due to changing work environment. Inhabitants might object to how clean the food is. Resistance to having food in the city because of destruction. Cultural resistance. • **Limited time and energy of stakeholders**: Stakeholders may not have time and may not be positive towards the project. Some people are working on other projects that take priority, and that can be negative. DECISION-MAKING • **Could be a change in the political scenery** which would mean that the momentum could change • **Potential new regulations** regarding how to use food (such as inability to feed animals with food waste which is currently in place) RESOURCES • Potential accidents that could cause **pollution**

Awareness programme: urban water usage and sustainable food production, Marker

Marker Municipality is characterised by its access to natural waterways and forests. While the canals and lakes in the municipality are abundant, the relatively small municipality (around 3600 inhabitants) is eager to maintain its water quality as a key resource for drinking, hydropower, and recreation. Therefore, the

Marker ULL aims to build an awareness programme around using unfiltered water resources to produce local and sustainable food and for inhabitant purposes where filtered water usage is unnecessary. The project involves creating an innovative sustainable food concept which incorporates delivery of food produced using renewable resources to local institutions. Energy is also an important aspect of the ULL. Marker already produces a surplus of wind energy and is growing its hydropower and solar energy resources as well. In addition to building awareness around water resources, the municipality seeks to both inform and learn from citizens, businesses, and external organisations about using renewable energy to produce sustainable food.

This ULL is considered a *strategic case* with the following objectives:

- During the ***conceptualisation phase***, the Marker project manager within TANGO-W will host a dialogue and meetings with stakeholders within the municipality from the water and energy departments, Marker Vindpark (responsible for windpower), and Østfold Energi (responsible for hydropower and solar power solutions), as well as local residents. The municipality will also cooperate with SABICAS[9], a 4-year project funded by the Research Council of Norway researching nature-based solutions around river catchment areas that are affected by human activity.

- The ***implementation/transformation phase*** will be characterised by workshops, sharing information through local press and media, web-based communication, building roles, and distributing responsibilities among stakeholders to secure operationalisation after the project ends. During this phase, inhabitants and local businesses in Marker along with Marker Bondelag (the local agricultural organisation) and Marker Bo- og Servicesenter (elderly home & service centre) will co-create knowledge towards sustainability and renewable solutions. Towards the end of this phase, the municipality will arrange a kick-off around the theme of sustainability to define it within Marker around the food-energy-water nexus and clarify the impact and benefits of securing a sustainable resource system for inhabitants, businesses, and other relevant stakeholders.

- In the ***operationalisation phase***, Marker will connect the TANGO-W project with the "Klima og energiplan" (Climate and Energy Plan) 2021—2030 according to key findings. The municipality will also devise a climate budget and identify strategies for Marker Municipality based on the conceptualisation and transformation phases of the ULL. Finally, the operationalisation phase will include the creation of a TANGO -W Marker Strategy around governance for long-term sustainability in the municipality. Key stakeholders during this phase will include the sustainability advisor in Marker Municipality and the project manager from Marker involved in TANGO-W.

Realising change

Stakeholders involved in the early stages of the project have identified several key challenges to realising change in Marker. The pilot aims to deliver sustainably produced food to local consumers and social institutions, but this distribution process will require careful coordination which could present new obstacles. Secondly, one of the project objectives is to establish ownership of the project with residents, which requires developing local understanding of the project goals and needs. The project may face difficulty ensuring that residents understand the needs and purpose of developing a sustainable food

[9] Naturbaserte løsninger langs elver | SABICAS | Norge

system based on renewable resources. Some hesitations have also been raised regarding the practical value of the project, and it will be valuable for the municipal leaders to go beyond a theoretical approach to sustainability and clearly identify the tangible application of the programme. Although water resources in the municipality are not under immediate threat, there are various unpredictable crises that could threaten the availability of clean water or influence the environment. As a small municipality, Marker also suffers from over-committed inhabitants. Even if interest exists, people may not have the time to get involved in new projects. Further, it is possible for the municipality to change economic investments, and shifts in financial resources would hinder the project's progress. The size of Marker also means that, if the programme is successful, it may be difficult to find opportunities to share good practices and act as an example to other cities because of the tendency to look towards larger urban areas as front-runners in transformative urban projects.

While Marker will need to account for these threats and weaknesses, the municipality also benefits from its tight-knit community. As an intimate town, it can be easier to communicate among inhabitants and encourage enthusiasm and involvement in projects that are implicate Marker residents. Furthermore, many residents in the area are already interested in self-sufficiency projects on their own. The mayor himself, for example, is a local farmer and familiar with urban agricultural practices. The municipality also has several important plans already in place that provide a basis for local sustainable food systems using renewable resources. These include the Climate and Energy Plan 2021-2030, and the Smart Municipality Marker community established in 2018, which influences sustainable thinking in the municipality. Marker also has many employees who are knowledgeable about energy and water solutions, and new employees over recent years have contributed to this. The existing production of wind and hydropower in the region also sets a precedent for the municipality to work with smart and sustainable resources in other areas.

Who is involved in making the change

To deliver a successful strategic project, many stakeholders will need to be involved, but not all stakeholders have an equal distribution of power or interest in the work. According to the guardians of the process, the most vulnerable stakeholders are consumers and inhabitants in Marker. Local inhabitants may also pose a threat to the process due to their possible scepticism of the work. This exposes the importance of awareness building during each of the phases so as to clarify how changes to water systems within food production will be advantageous for inhabitants.

Despite having the least authority in the process, inhabitants are also the stakeholders who stand to gain the most from the pilot project because they will benefit from the environmental, social, and economic benefits of sustainable local food production. Additionally, the local producers are a key stakeholder group because they are involved in making changes to the water systems used in their agricultural production; however, this means that they are also the stakeholders which will be required to make the greatest changes within their existing food production systems.

Marker's Water and Energy Department and Regionalpark Haldenkanalen hold the most power in the process because they both have broad knowledge of the topic and already prioritise sustainable development. Along with Østfold Energi and Marker Solpark, these local and regional authorities are most likely to support the project because it will benefit their organisations. Many of these stakeholders are already on board because they believe the implementation of this project will improve sustainability. However, the municipality needs to increase the focus and effort in relevant areas to display the practical value of the project. Otherwise, the work is at risk of becoming too theoretical and irrelevant for key players to identify and value the potential impact.

Expectations

During the Marker ULL, the municipality expects to build knowledge with regards to sustainability and renewable solutions, implement sustainable solutions, cooperate among stakeholders in a way that leads to long-term actions, and achieve sustainable goals set in the municipality's Climate and Energy Plan.

The case will impact the entire Østfold region in Southeast Norway. It will also influence the national network of parks (Regionalpark Haldenkanalen) by strengthening their sustainability work. Furthermore, through engagement with the ongoing national waterways project, SABICAS, this case will provide inputs regarding the sustainability of nature-based solutions. Finally, neighbouring municipalities, local and regional businesses, and development networks across the Østfold region may benefit from a new learning perspective.

Good practices

- B-WaterSmart, East Frisia, Germany: This is a Horizon 2020 project to develop smart production and use of water. One of the project's ULLs, in East Frisia, is building a pilot plant for the reuse of process water in the dairy industry. According to the project webpage, "water scarcity and increasing water demand result in the overexploitation of resources, quality deterioration and regional imbalances in the availability of water resources." Marker has access to water, but currently suffers from the limited ability to produce it. Therefore, the B-WaterSmart project provides an example of how other municipalities and institutions have utilized unfiltered water to revive filtration systems currently in place as well as consider the demand for future water filtration systems.

- Desira, Oosterwold, The Netherlands: This project aims to improve the exchange of knowledge and experiences with short food supply chains in Oosterwold using digital technologies. At the same time, they are working to support innovative local food supply chain(s) by using digital technologies, both within Oosterwold, and between Oosterwold and the City of Almere. This case is related to Marker's aim to distribute locally grown food in the city. Oosterwold has worked to create awareness and innovative solutions to distribute food locally, therefore providing learning opportunities for Marker to develop within its own context.

Table 8: Marker sustainable local food SWOT analysis

STRENGTHS	WEAKNESSES
PARTICIPATION • Small municipality means it is easy to achieve community and often build communication and involvement as well as enthusiasm around projects that are important for living in our town VISIONING • Climate and energy plans 2021-2030 already exists so we have that to work with CAPACITIES • Strong knowledge of energy solutions and water solutions; new employees are bringing in new knowledge • Production of wind and hydropower energy locally, and soon solar energy produced locally	PARTICIPATION • Building awareness and showing need to think about more sustainable solutions; this needs to be done well to create ownership of sustainable projects • Few inhabitants with limited time. Willingness is not lacking but time to be involved or work on projects could be lacking VISIONING • Long-term of urban agriculture may be difficult to make RESOURCES • Challenging to gain larger recognition given the size of the municipality

• Already established community of Smart Municipality Marker since 2018 which influences sustainable thinking	
OPPORTUNITIES	**THREATS**
PARTICIPATION • Important to build self-sufficient opportunities for citizens and the existing context helps to encourage this • Environmental changes create an acceptance among people (municipality and other stakeholders): understandable to more people that we need to become more sustainable	PARTICIPATION • Stakeholders **have raised hesitations** about theoretical value and practical value is too small RESOURCES • Water resource: even though we have large lakes, it could change and availability of clean water could be impacted by crises • Could have **economic changes** in the municipality or financial resources CAPACITIES • **Distribution**: It will be a challenge to coordinate the distribution of the food/produce to social institutions and local consumers. • **Building understanding locally**: Another challenge will be to create a local understanding of the need of the project. This needs to be done correctly to create ownership to the project.

5.4. Lithuanian case

Foresight for an energy efficient and sustainable city, Alytus

The Alytus City Municipality (ACM) was among the pioneering municipalities in Lithuania when it comes to sustainability. They have signed the Aalborg Charter and started developing a City Local Agenda 21 in 2002. The municipality completed a sustainable development audit evaluating correspondence of activities of the municipality to the principles of the UN Millennium Development Goals. ACM recently reconfirmed its commitments towards sustainability, which was signed by the city mayor. The municipality has developed a strategic plan for development and has defined the long-term strategic directions for further development and modernisation of different municipal systems.

The most important areas and future directions for ACM today are related to improving energy efficiency, using renewable energy sources (especially solar panels on public buildings), renovating multi-apartment buildings, modernising street lighting, reducing carbon emissions through sustainable mobility in the city[10], improving waste management, better managing water resources and wastewater management, and promoting the development of a circular economy.

ACM focuses on the development of a greener city. The innovative aspect of the citizen foresight process is to make interdependencies in the overall urban system and their effects on the quality of life, and to

[10] ACM already has a sustainable mobility plan and wants to implement the foreseen measures (improving the public transport system by making it eco-friendly and more accessible).

make the green ecosystem not only understandable, but also tangible on an emotional level of social interactions. By conducting a foresight process, ACM wants to co-design sustainable strategies for urban development from a citizen-oriented perspective and create added value in the areas of energy efficiency, food, and waste management.

Therefore, Alytus can be categorised as a *strategic case* in that the ULL will focus on developing a vision for the F-E-W system in the city and integrating several other aspects (such as energy efficiency, waste, and mobility) into the foresight process as well. They will package existing strategies to develop a roadmap of measures for the next 3 to 5 years, and create a participatory action plan in the process.

- In the initial ***conceptualisation phase***, ACM will begin the planning process by identifying and inviting stakeholders to participate in workshops. This will include representatives of municipalities and other state institutions, business and consulting companies, educational institutions, and residents.

- During the ***implementation/transformation phase*** of the ULL, ACM will facilitate the vision creation process during the workshops. A moderator will be invited to conduct the seminar and a graphic designer to create visualisations.

- Within the ***operationalisation phase***, ACM will document and approve visions at the appropriate level. Proposals will be submitted for the 2024-2026 action plan of Alytus City, which will then be submitted for approval by the municipal council.

Realising change

One of the most important criteria for achieving change is inviting stakeholders to participate in the process by giving them clear and worthwhile reason to attend and actively participate. One thing is clear, that the application of certain methods—such as the invitation of well-known, influential, and respected representatives of the public—can be a key to success in this process. In general, public awareness plays a huge role. Inhabitants of Alytus have a possibility to get all relevant information via the municipal site[11], where one can find important information about events, news, information, and data relevant to the ULL, such as data on heat consumption[12], details on Alytus heat networks[13], and Alytus Economy of Apartment Buildings.[14]

The municipality has various departments whose functions include communication and cooperation with the city residents. However, due to high workloads and volumes, limited human resources, such communication between municipal departments and residents is infrequent. This mostly happens during various special events, for example, when preparing to renovate an apartment building, a meeting of residents is announced to inform about the benefits of renovation, commitment required, and the necessary involvement of residents in the processes. Various NGOs also promote the involvement of residents by organising various campaigns, for example, for waste management in public spaces, or organizing various festivals to encourage residents to lead an active lifestyle.

---

[11] www.alytus.lt
[12] http://195.182.88.76/mapguide/sildymas
[13] https://www.alytausst.lt/
[14] https://alytausbu.lt/

In order to achieve changes in the City of Alytus, efforts will be made to invite as many interested parties as possible: starting with representatives of the city government, business and industrial companies, public institutions, and NGOs, as well as decision-makers, scientific representatives, and city residents (including young people, working people, and senior citizens).

Who is involved in making the change

According to the guardians of the process, the most vulnerable stakeholders are Alytus inhabitants and the most powerful are the politicians and decision-makers. The residents of the city are still reluctant to participate in the life of the city, which is due predominantly to the old political system and the attempt not to inform or to remove residents from decision-making processes. This attitude is still very popular not only in Alytus, but also throughout the country. It is necessary to change people's mentality, thinking, and attitude towards city government in order to develop the city in accordance with citizens' needs. Positive examples can already be observed where residents are interested in the processes taking place in the city and have a say in how the public resources of the city are allocated.

According to the guardians of the process, the stakeholders who stand to gain the most are inhabitants, business owners, and politicians. Based on the discussion with the interviewees, the whole society wins in this process, and no one is perceived as a potential loser from implementing this case. According to the guardians of the process, the stakeholders who will most support the project are decision-makers, as they have to seek the changes that the City has promised to make through the strategic plans and other documents. Regarding the stakeholders who are most sceptical, no particular groups were identified by the interviewees because it depends on many factors; in some cases, it could be inhabitants, while in other cases, business owners could grow sceptical of the foresight process, depending on which topic is being discussed and the personal interests and concerns of each stakeholder.

The implementation of the case is advantageous for Alytus citizens as well as all citizens of Lithuania because the case seeks to ensure that all have an equal right to a healthy and clean environment (as stated in the Law on Environment of the Republic of Lithuania). For private businesses, the implementation of the case is also very useful, as through these changes there will be new business opportunities, creation of new jobs, cooperation, etc. For the decision-makers of the process, the implementation of the case is advantageous, as the decision-makers try to fulfil promises to the public, and must implement state policies, which also include certain goals (for example, the city must achieve energy efficiency or install renewable energy resources for energy production).

The guardians and decision-makers who were interviewed did not foresee any disadvantages to the process of co-creating visions for a sustainable Alytus. However, there are still challenges for how to involve local residents and other interested parties because they must understand the added value of the project to support and engage in it.

Expectations

According to the decision-makers, the case will influence many areas of the city's activities and will be a good case for other cities in Lithuania as well. Because the vision will be created based on other project partners or EU good practice cases, it is believed that this project will contribute to the preparation of the Alytus City 2024-2026 strategic activity plan.

One of the most important things is energy efficiency in different areas of activities (buildings, industrial companies, production of energy, heat energy, etc.) It is known from examples of good practices that the

apartment buildings renovation funding programme provides residents with the most favourable economic conditions to renovate real estate and decrease heating costs up to 60%.

ACM also hopes to understand how to establish more centralised wastewater collection systems, as still there are not connected users to the central system. The centralised wastewater collection system reduces wastewater that is not properly treated, meaning lower amounts of untreated wastewater are discharged into natural environment (rivers, lakes, or soil), which has a negative influence on the water systems.

In addition, one of the most important aspects is to promote change in environmental behaviour and public participation in environmental activities to reduce waste, protect the environment, and ensure the sustainable development of the city. Improving the condition of the living environment by promoting and developing habits of the population to sort and responsibly manage household waste is paramount to creating a more sustainable Alytus. Strengthening waste prevention activities by promoting re-use (exchange, repair, and refurbishment) and responsible consumption will involve the support and participation of citizens and whole communities.

Good practices

Water is a scarce resource that must be protected and reused and, in this context, the preservation of the quality of the European rivers' water is a major concern of local, regional, national, and even European authorities.

- BIGDATA4RIVERS: This Interreg Europe programme is, in essence, a driver for the generation and exchange of information and knowledge enabling better planning processes and decision-making regarding the local/regional water management. The interregional learning process allow communities to learn from each other based on their own experiences in the EU Water Framework, Urban and other directives implementation.

- LOCARBO: This is an interregional cooperation project (Interreg Europe) for improving low-carbon economy policies. It aims to improve policy instruments targeting demand-driven initiatives to increase energy efficiency and the use of renewables in buildings, through innovative ways of supporting energy consumers' behaviour change. Many of Europe's local/regional actors struggle with developing targeted, implementation-oriented policies addressing low carbon challenges. This holds particularly for energy wasting buildings irrespective of their ownership or use. Since buildings are responsible for 40% of energy consumption in the EU this is a highly relevant issue in the European context. The challenge to involve and motivate stakeholders (especially energy consumers) is perceived broadly as a major problem for public authorities. Motivation and awareness of consumers are of high significance to influence their behaviour and support more conscious energy decisions. LOCARBO is unique in focusing its activities on bottom-up initiatives and mainly because of the approach to combine and roll-out innovative practices linked to three strongly interrelated thematic pillars (services, organizational structures and technological solutions).

- LCA4Regions: This project has been contributing to a more effective implementation of environmental policy instruments by the application of Life Cycle Methodologies (INTERREG EUROPE programme). Currently, many individual policies are implemented in isolation of others. On top of that, life cycle expertise resides mainly in the business sector while public authorities are much less familiar with the techniques and their functioning. However, the full success of policy

implementation depends on similar expertise also in governmental authorities. The outcomes of improved public policy implementation are greater concordance with stated sustainability objectives, fewer unwanted side-effects and greater transparency in the compromises and offsets that need to be made to move ahead on sustainable economic targets.

Each project region has its own characteristics, methods of design, and implementation of policies. Nevertheless, all of them face a common challenge: the adoption of a more efficient use of natural resources to reduce the non-desirable secondary effects (spill overs) that generate negative economic and environmental impacts.

Table 9: Alytus foresight for energy efficiency SWOT analysis

STRENGTHS	**WEAKNESSES**
CAPACITIES • **City has good examples for other municipalities in the country** because we applied a 3R (reuse, repair, recycle) project that has worked as a good case example for others • **Mayoral support** for new projects and changes to be made in the city	PARTICIPATION • Community is not involved in decision making and scepticism is very high (they want to be involved but they also say no one wants to hear us) there are dedicated events but its hard to get the citizens on board. • A lot of decisions were made in the past without consultation DECISION-MAKING • High bureaucracy it takes time to approve the projects or funds
OPPORTUNITIES	**THREATS**
PARTICIPATION • **Stakeholder participation**: One of the most important criteria for achieving change is inviting stakeholders to participate in the process (i.e., finding reasons for them to come and actively participate). One thing is clear, that the application of certain special methods—the invitation of well-known, influential, respected representatives of the public—can be the key to the successful course of the process. In general, public awareness plays a huge role. • Opportunity to strengthen the case by **engaging younger people** because they have the most to gain from a brighter future • Opportunities to **learn from other cases** within TANGO-W RESOURCES • Opportunity for City of Alytus to use EU and national funds for energy efficiency projects • Many initiatives coming as well from NGOs and bottom-up organisations that have good ideas for city transformation regarding energy efficiency	PARTICIPATION • **Communication between the municipality and its residents**: The municipality has various departments whose functions include communication and cooperation with the city residents. However, due to high workloads and volumes, limited human resources, such communication between city municipality departments and residents is not frequent. DECISION-MAKING • **Still major bureaucracy hurdles** and long amount of time to implement ideas. There are still very strong management from the national government, government has to approve quite a lot. They have to follow the decisions of the state. They have new programme and there are strategies and actions and they have to accept everything. • There are also different parties that are competing different council mayor and they are deciding too (next to the mayor) RESOURCES • Funds of the city itself are not enough and so they are reliant on national and European-wide funds, but these funds are determined a bit higher up, and local level needs more

	freedom to make decisions on resource management CAPACITIES • City is getting older because younger people are moving away à we need different services and activities

6. Analysis TANGO-W cases

TANGO-W is made up of two prototype cases and five strategic cases (see Table 10). The cases also hold a range of scales, with some invested in specific sites (Boverian residence in Norrtälje), districts (Stockholm's Royal Sea Port, Klagenfurt's Hi-Harbach district), or operating on municipal-wide scale (Weiz, Alytus, and Marker), with Halden oscillating between the site of the kindergartens and the municipal scale in their case. Therefore, TANGO-W contains a diversity of scales while maintaining in common the interest to integrate sustainable food, energy, and water systems and develop capacities for sustainable governance in each site, district, and/or municipality.

Table 10: Summary of TANGO-W ULLs by case type

STRATEGIC	PROTOTYPE
Weiz Halden Marker Alytus Stockholm	Norrtälje Klagenfurt Stockholm*

* Stockholm will operate as a strategic case, but also has the ambition to potentially prototype an urban agriculture solution on building facades if time and capacities allow.

Many ULLs have explicit links to specific junctions of the F-E-W nexus and can therefore narrow their work according to the unique characteristics of how these two fields of action merge. For example, Marker will specifically address how the preservation and care of local waterways can have an impact on sustainable local food production in the municipality. Additionally, Klagenfurt's focus on developing an energy community also involves the potential for merging energy solutions with opportunities for urban gardening in the Hi-Harbach district. Despite the specificities of each case all of them will provide lessons learned/insights about new roles, skills, resources for the implementation of initiatives that foster urban sustainability by bridging gaps across the F-E-W nexus.

6.1. Ranking UTC needs and challenges

As previously described, the parameters for analysing the needs and challenges for UTC of each ULL include (1) participation, (2) decision making, (3) shared vision, (4) resources and (5) internal reflection and review and (6) capacities. As the cases are in the initial phase of implementation, the analysis of the parameters considers existing capacity, which has been evaluated based on the replies of the surveys among guardians and decision-makers as well as via the reflections collected through SWOT analyses. For example, the 'visioning' related to the implementation of the ULL has not yet taken place; however, for the sake of this analysis, we considered if the municipality has the tradition (past behaviour) of using visioning as a mean to engage people.

Based on the knowledge gathered, Tables 11 provide a mapping of the needs and challenges of each ULL according to the TANGO-W assessment criteria. Each strength, opportunity, weakness, or threat has been

tagged in relation to the six criteria and considered according to the baseline analysis questions articulated in the table below. ULLs that are weak in these areas have been marked in *red*. ULLs that have both opportunities and weaknesses associated with the criteria have been marked in *yellow*. ULLs that have existing strong capacity for criteria have been marked in *green*.

Table 11: Assessment of TANGO-W ULLs considering their existing governance capacity

CRITERIA	INQUIRY	S	N	W	K	H	M	A
Participation	Does the case have existing channels for involving citizens and different types of organisations in defining goals, etc.?							
Decision-making	Does the case have a plan for who will be responsible for each phase of the project?							
Visioning	Does the municipality already work with a shared vision? Does this vision have specific goals/objectives connected to the case in question?							
Resources	Does the case have a sustainable budget, staffing, knowledge, and technical infrastructure to enable the success of the case?							
Internal reflection and review	Has the municipality already implemented other sustainable solutions? Have they learned from these previous cases? Does the municipality provide mechanisms for self-assessment and monitoring during and after the implementation of projects?							
Capacities	Does the municipality work across different sectors and agencies? Is there a precedent for working at the F-E-W nexus?							

UTC criteria mapping explained

Participation

Participation is a hallmark of transformative capacity, especially because it enables citizens to take ownership of the sustainable development in their own cities. Engagement with stakeholders, however, needs to operate as more than a checklist to manifest long-lasting change; engagement must build legitimacy and trust among actors, involve diverse networks of representatives, and must also be sustained over time. Extensive literature in participatory processes (e.g., Arnstein, 1969; Brandsen et al., 2018; Fung, 2006) provides valuable concepts and lessons for enhancing fair and just participation that can be useful for building UTC. For example, Arnstein's (1969) ladder of participation systematizes different levels of influence people may be granted in participatory processes, ranging from manipulation to citizen control (see Figure 1). In the lowest level, people are manipulated to believe they were involved in decision making when, in reality, they had no power to influence, as opposed to the higher rungs in which citizens drive processes and hold power over various elements of a project. Sarzynski (2015) offers useful advice for the implementation of participatory process. The author suggests five aspects that are relevant to design an inclusive and fair participatory process, including replying to the

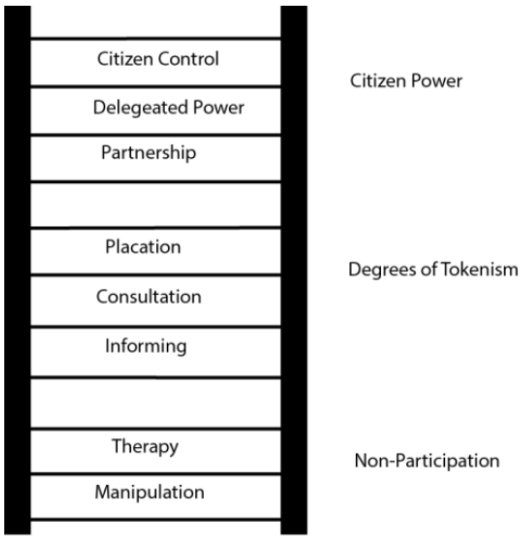

Figure 1. Arnstein's ladder of participation (1969)

following questions: (1) Who participates? (2) When does participation happen? (3) In which way do people participate? (4) How much do people participate? And (5) Why do people participate?

The TANGO-W ULLs all rank low to medium in this area. Many, such as Halden, Marker, and Norrtälje, have faced resistance or sceptism among stakeholders to the projects, and varying levels of past citizen engagement, such as in Weiz where, despite having conducted regular strategy processes, former administrations did not enable citizens to drive such processes. Some of the ULLs, such as in Stockholm, also face challenges with raising participation for the projects within the city administration itself, revealing a need to implement more sustaining participatory processes among stakeholders as well as among public actors.

Decision-making

Decision-making for transformative processes requires leadership that enables and utilises the capacity of individuals to become agents of change. This implies delegation and shared ownership which requires embracing different perspectives through dialogue, exchange, and reflection to reach consensus. The fairness and democratic nature of such a process is dependent on the capacity of the individuals or communities to engage (e.g., resources, autonomy, knowledge) but mostly on the capacity of the institution that legitimises the process to coordinate opportunities to engage and empower individuals in a transparent manner.

While TANGO-W ULLs such as Alytus struggle with major bureaucratic hurdles, like gaining approval from the national government and disagreements across party lines, Stockholm indicates that they already have some established ways of working with research and development, which gives their ULL a strong footing for decision-making. Despite their struggles to break free from operating according to the status quo within the local government, the mayor of Weiz has been driving the process to create a vision already, thereby leading the way within the administration. Klagenfurt is navigating how to delegate responsibilities among involved parties (present and future), and Halden mentioned that future changes in political scenery and new regulations can always threaten the processes of decision-making and influence the roles and responsibilities of stakeholders.

Visioning

According to Wolfram (2016), "foresight should create a collective vision of radical departure from the current path, as well as alternative scenarios based on system thinking." One key to visioning processes for UTC is the preparation of multiple pathways or scenarios. To develop in this area, the ULLs will need to consider not only who to involve in the foresight processes but also determine which aspects of the vision are set in stone and which are flexible to develop along the way. They must also balance how different systems (food, energy, and water systems, for example), may evolve co-dependently and prepare critical milestones to consider new pathways that may emerge during the long-term working out of the vision.

Most of the strategic TANGO-W cases will focus their attention on strengthening this criterion for UTC during the project lifetime, and all cases—strategic and prototype—will be engaged in foresight processes among stakeholders. But the process of undergoing such a process is less familiar for some ULLs than others. For example, Stockholm already operates out of a vision, and even the specific district of the Royal Sea Port has been mandated through a sustainability policy to test innovative sustainable solutions in the area, giving credence to the ULL. Weiz, however, will begin to develop a Vision 2050 for the municipality through their foresight process, and must brace for the potential confusion and uncertainties that come

with the territory of planning for an unknown future. Other ULLs, such as in Marker, also face hesitancies around envisioning the long-term expectations of urban agriculture.

Resources

Access to resources is paramount for the conceptualisation and implementation of transformative processes. These processes require new innovative solutions (technological and social) therefore they are complex and risky. They are complex because their implementation depends on the cooperation between different actors and risky due to the higher investments they demand compared with the implementation of standard processes or solutions. Financial and material resources are necessary for overcoming obstacles to innovative practices and to sustain them over time so that they become anchored into the institutional practices and ultimately embraced into legal frameworks.

The Swedish cases tend to have the most security when it comes to resources for the ULL, which could be due to the mere size of Stockholm, for example, compared to Alytus or Marker. But Weiz also has strong people and infrastructure to carry out their foresight process goals. Halden, Marker, Alytus, Klagenfurt, and Weiz have all suggested that funding poses a threat to the work, whether due to the potential future changes to subsidies, tariffs, or simply that local funds cannot cover sustainability improvements on their own. When it comes to building UTC, the question of resources is not merely about existing economic, human, environmental, or material resources, but also requires evaluating the structures that enable the production and consumption of such resources to either continue or to change to meet new needs or requirements.

Internal reflection and review

Collective understanding of the barriers or any resistance is fundamental to anticipate the performance of transformative processes towards sustainability. Learnings are valuable to identify institutional persistence, structural inertia, and contextual factors that prevent the adoption of innovative alternatives that can better respond to current challenges. Internal reflection and review is vital "for creating system knowledge and memory to explain and anticipate urban performance, and inform collective agency and capacity development processes" (Wolfram, 2016, p. 126).

Across TANGO-W ULLs, Stockholm has a better position to reflect on the implementation of sustainable solutions/transformative process. Even though issues related to urban agriculture have not yet been addressed, Stockholm Royal Sea Port has the mandate and has been engaged in several experiments (e.g., MACRO – Food in Circular Robust Systems) to implement sustainable solutions. The City is learning from the mistakes and progressing through a process of evaluation, learning, and moving forward. Weiz also has a history using monitoring processes, which is how they have come to be known for their sustainability practices throughout Austria, and Klagenfurt's sophisticated impact monitoring system for reviewing success in their city gives them a robust foundation for future reflective work. Still, one of the expected outcomes from TANGO-W is to have a critical perspective on current ways of working, and most of the ULLs do not have iterative approaches that welcome self-reflection or review processes that allow for revisions during a development process.

Capacities

According to Wolfram (2016) the development of capacities is a cross-cutting issue that needs to occur during the entire process of conceptualisation, implementation, and management of urban transformative processes. The development of UTC is not limited to policymakers or civil servants but should reach all

affected people (e.g., individuals, communities, business), as all are equally important and co-responsible actors for the successful implementation of transformative change.

Another important aspect is the capability to work across political-administrative levels and geographical scales. While the emphasis is in the local level—where the transformation takes place—awareness about the impacts in other scales (e.g., regional, national, internationals) is vital for co-design tools, methodologies, and governance pathways that can trigger, steer, hasten, and embrace transformative change towards sustainability.

Considering the current situation of the TANGO-W ULLs, Stockholm has acquired more experience with UTC due to their participation in other projects, the strong power of the municipality to influence land processes to developers, and the solid networks and cooperations that can continue to be utilised and expanded. The history of urban farming within Stockholm also gives some weight to the specific ULL. Klagenfurt also has developed know-how on the implementation of energy communities, specifically through their partnership with 4ward Energy. While they have solidified already a Smart City Core Team, Klagenfurt also suffers from several uncertainties, including the lack of a structure for energy communities, concerns with operating costs, and the complexities of creating a tax model that can last. Weiz has some strengths in this area given the mayoral support and has indicated many opportunities for cooperation and communication during the foresight process. Halden especially has needs and challenges in this area due to their silo governance structures. Although Norrtälje has several opportunities for replication and future benefits of the aquaponics implementation, they also suffer from working on a prototype that has not yet been tested in a live-work environment, and the complexities of ownership around the system create challenges. The other ULLs also have several opportunities for change, but lack a precedence for working at the F-E-W nexus.

7. Final Considerations

This report provided an overview of the challenges and needs of the seven TANGO-W ULLs. These cases will be the testbed for the implementation of transformative change within the F-E-W nexus, providing the learning environment for the development of urban transformative capacities that can support the transition to sustainable cities.

This deliverable is a steppingstone for the TANGO-W project as it reports on particularities of each case and explores their synergies and common needs and challenges. Thus, the report constitutes the basis for upcoming deliverables. It will be a valuable input for Task 2.3 (Good Practice Analysis) and Task 2.4 (Living Lab 2.0 concept design). It is also relevant for Task 4.2 (Prototyping new business models & values chains within the national parameters), as it identifies the stakeholders that are involved in triggering transformative change, and Task 4.3. (Local UTC monitoring), as it provides the baseline for the monitoring the development of transformative capacities in each TANGO-W ULL.

8. References

Adom, R. K., Simatele, M. D., & Reid, M. (2022). Addressing the challenges of water-energy-food nexus programme in the context of sustainable development and climate change in South Africa. *Journal of Water and Climate Change*, *13*(7). https://doi.org/doi: 10.2166/wcc.2022.099

Albrecht, T. R., Crootof, A., & Scott, C. A. (2018). The Water-Energy-Food Nexus: A systematic review of methods for nexus assessment. *Environmental Research Letters*, *13*(4).

Arnstein, S. R. (1969). A ladder of citizen participation. *Journal of the American Institute of Planners*, *35*(4), 216–224.

Brandsen, T., Verschuere, B., & Steen, T. (2018). *Co-Production and Co-Creation: Engaging Citizens in Public Services*. Routledge.

Covarrubias, M. (2019). The nexus between water, energy and food in cities: Towards conceptualizing socio-material interconnections. *Sustainability Science*, *14*, 277–287. https://doi.org/10.1007/s11625-018-0591-0

Fung, A. (2006). Varieties of Participation in Complex Governance. *Public Administration Review*, *66*(s1), 66–75. https://doi.org/10.1111/j.1540-6210.2006.00667.x

Hardin, G. (1968). The Tragedy of the Commons. *Science*, *162*(3859), 1243–1248. http://www.jstor.org/stable/1724745

Messmann, G., & Mulder, R. (2015). Reflection as a facilitator of teachers' innovative work behavior. *International Journal of Training and Development*, *19*(2), 125–137. https://doi.org/10.1111/ijtd.12052

Perjo, L., & Bjerkesjö, P. (2019). *Co-creation for socio-ecological urban development? - The case of Gröna Solberga* (C 451). IVL Swedish Environmental Research Institute Ltd. https://www.ivl.se/download/18.694ca0617a1de98f472d7d/1628414657375/FULLTEXT01.pdf

Pollard, G., Ward, J. D., & Koth, B. (2017). Aquaponics in Urban Agriculture: Social Acceptance and Urban Food Planning. *Horticulturae*, *3*(39). https://doi.org/10.3390/horticulturae3020039

Sarzynski, A. (2015). Public participation, civic capacity, and climate change adaptation in cities. *Urban Climate*, *14*, 52–67. https://doi.org/10.1016/j.uclim.2015.08.002

United Nations. (n.d.). *Water, Food and Energy—Water Facts*. Retrieved October 10, 2022, from https://www.unwater.org/water-facts/water-food-and-energy

Wolfram, M. (2016). Conceptualizing urban transformative capacity: A framework for research and policy. *Cities*, *51*, 121–130.

9. Annexes

9.1. Annex 1: Interview guide for the Guardians of the Process

TANGO-W: CITY CHALLENGES & NEEDS INTERVIEW GUIDE

INTRODUCTION

The aim of this survey is to gather the perspective of different types of stakeholders (see Box 1) that can influence and/or are influenced by the implementation of your TANGO-W experiment. This information is fundamental for identifying the needs and challenges for the implementation of Urban Transformative Capacities (UTC; see Box 2 in the context of your case).

Box 1. Three types of stakeholders (Mitchell, Angle, & Wood, 1997)		
Guardians (legitimacy): Who stands for current processes? Who do we need to legitimise the change? e.g., researchers	Decision-makers (power): Who can decide or support the institutions? *e.g., politicians*	Affected parties (urgency): Who is affected? Who is capable of shaping and could/should be invited into the process? *e.g., clients*

Box 2. What are Urban Transformative Capacities (UTC)
Urban Transformative Capacity (UTC) is the "collective ability of the stakeholders involved in urban development to conceive of, prepare for, initiate, and perform path deviant change towards sustainability within and across multiple complex systems that constitute the cities they relate to. It is a quantitative measure for an emergent property that reflects attributes of urban stakeholders, their interactions and the context they are embedded in" (Wolfram, 2016, p. 125).

In Box 3 below, please add the information about this interview

Box 3. Interview details	
Date of interview	
Location of interview	
Role of the interviewee	*Guardian (city partner)*
Name of the interviewee	

TANGO-W CASE DESCRIPTION

1. In Box 4 below, please describe your case, the problem it seeks to solve, the objective, and how it engages with the Food-Energy-Water nexus and challenges existing urban solutions

Box 4. Description and objective of your case and the F-E-W nexus
(PLEASE DELETE AND ADD YOUR CASE) Example: Bovieran is a housing concept for elderly dwellers (55+). In their Norrtälje location, consisting of 48 apartments, tenants have expressed the wish of establishing an aquaponics system that will serve both as food supply and as a recreational activity. Renewable sources of energy will be implemented during TANGO-W project, primarily to support the operation of the aquaponics system. Bovieran currently has 26 residential complexes throughout Sweden. By piloting the implementation and community management of an aquaponics system, the case has the potential to be replicated in the other Bovieran residential complexes.

2. TANGO- W cases are classified into two types: strategic and prototype. Regardless of the type the TANGO-W cases may go through three different phases (see description below). Please identify the type of case you have in your city and briefly describe how you understand the **main objectives** for each of the three phases in your project.

Box 5. TANGO-W cases types, phases and objectives			
Type of case	**Cases Phase**		
( ) Prototype (e.g. implementation of aquaponic system, test PV plant with food production)	Conceptualisation Activities in this phase concern planning and preparing the implementation of the F-E-W systems in each case. The design activities can be practically oriented construction activities (e.g. deciding the location and size of the aquaponic system) but also include planning for and preparing the social systems that need to be in place for the implementation of the technology. (Includes visioning process)	Implementation/Transformation This phase also involves construction or application in cooperation with the end user. This phase is characterised by building up roles for ensuring decision making and operation also after project end.	Operationalisation Activities in this phase include the social requirements needed to maintain the technological system. For example, activities may consist of determining how to correctly maintain the aquaponic system and indicate responsibilities for cleaning, harvesting the food, and deciding to whom the harvest belongs.

( ) Strategic (develop a vision for F-E-W)	Activities in this phase concern to the planning of the visioning process (e.g. identification of the stakeholders, planning workshops, reach out activities to inform stakeholders)	Activities in this phase are related to carrying out the visioning process through workshops, discussions, etc.	Activities in this phase concern to the implementation of the vision in planning system (e.g. acknowledgement of the vision in documents)
	Main objectives for the three phases in your case		

3 Who are the stakeholders expected to be involved in the three phases (see Box 6) of your TANGO-W case? Please identify their roles in Box 7. (E.g., *residents of Bovieran: users of the aquaponic systems*).

Box 6. Stakeholder identification according to three phases		
Conceptualisation	Implementation/Transformation	Operationalisation
C1: C2: C3: …	I1: I2: I3: …	O1: O2: O3: …

4. Who are the most vulnerable stakeholders[15] in your network?

   4a. What are the strategies to engage and empower them in your case?

5. Who are the most powerful stakeholders in your network?

   5a. What are the strategies to engage them in your case?

6. Which resources (e.g., financial, knowledge, time) are required for stakeholders to participate in your case?

7. Each TANGO-W case aims at transforming its capacity towards urban sustainability within the F-E-W nexus. Which stakeholders gain the most from the expected change in your case?

   7a. Which stakeholders lose the most from the expected change in your case?

[15] Vulnerable stakeholders are those who are at risk of not having their voices heard in the process. These are typically stakeholders with high interest in the project but limited power.

8. From which stakeholders do you expect the most support for realising change (e.g., implementation of an aquaponics system, the visioning process for sustainable urban development)?

9. From which stakeholders do you expect the most scepticism for realising change?

10. Is there any knowledge (e.g., economic evidence, efficiency) that would be helpful in making the need for change visible and thus increase motivation for change? If yes, which stakeholders possess this knowledge, and how can you engage with those stakeholders?

11. How do you communicate, or plan to communicate, with the stakeholders (e.g., frequency, communication tools such as newsletters and emails)? Please explain if you think you need to communicate with different stakeholders in different ways.

12. What are the main challenges you may face to conceptualise/implement/operationalise your case? (e.g., institutions, regulations, infrastructures, routines, values, norms, people may not accept the way food is grown, technological challenges, resources, social resistance, laws)

12 a. How will you overcome the challenges described in the previous question? Please explain.

13. What are the key social needs (e.g., equity, justice, preservation of resources for future generations, inclusivity) related to your case? How will they be addressed?

14. What methods (e.g., interviews, workshops, meetings) do you plan to use to involve stakeholders to make decisions and take ownership of the case?

15. Are there any policies or governance frameworks (e.g., lack of partnerships, lack of cooperation across departments) which limit or prevent the objectives of the case from being met (see Box 5)? If so, please explain.

16. Are there any existing policies or governance frameworks (e.g., public-private partnerships, cooperation across departments) that strengthen or empower the objectives of the case to succeed? If so, please explain.

17. Are there any structures (e.g., networks of stakeholders and/or organisations that deal with similar issues, financial incentives) that allow/prevent for scalability of your case to other contexts? Please explain how they do/do not support this.

18. Each TANGO-W case will have a visioning process. Have you already planned the methods (e.g. workshops, activities) that you will employ in the visioning workshop?

19. Despite having not yet implemented the visioning process, please use the table below to identify strengths and potential risks for the implementation of the visioning process within your case.

Box 7: Strengths and risks with the visioning process	
Strengths in the visioning process	Risks with the visioning process

20. Where do you currently see your (or your organisation) strengths in relation to initiating and accompanying the transformation process?

21. What would you (or your organisation) like to acquire (e.g., learning strategies that facilitate cooperation across sectors) during the TANGO-W project?

22. Do you think your case will have any impact on regional and national systems and decisions? If so, how? (e.g. my case will inspire other cities in my region to showcase similar solutions)

9.2. Annex 2: Interview guide for the Decision Makers

TANGO-W: CITY CHALLENGES & NEEDS INTERVIEW GUIDE

INTRODUCTION

The aim of this survey is to gather the perspective of different types of stakeholders that can influence and/or are influenced by the implementation of # add the name and description of your case (see Box1).

Box 1. Description and objective of your case and the F-E-W nexus (to be taken from the survey – guardians of the process)
Example: Bovieran is a housing concept for elderly dwellers (55+). In their Norrtälje location, consisting of 48 apartments, tenants have expressed the wish of establishing an aquaponics system that will serve both as food supply and as a recreational activity. Renewable sources of energy will be implemented during TANGO-W project, primarily to support the operation of the aquaponics system. Bovieran currently has 26 residential complexes throughout Sweden. By piloting the implementation and community management of an aquaponics system, the case has the potential to be replicated in the other Bovieran residential complexes.

In Box 2 below, please add the information about this interview

Box 2. Interview details	
Date of interview	
Location of interview	
Role of the interviewee	
Name of the interviewee	

In relation to the implementation of the case described above please give your opinion on the following:

1. Is this case important to you?

   1a. If yes, why?

   1b. If no, why not?

2. Would you like to be involved?

   2a. If yes, in what capacity (e.g. participation in meetings, workshops)?

   2b. If no, why not?

3. Do you think your participation/involvement will/would make a difference in the process of implementing this case?

   3a. If yes, why?

   3.b. If not, why not?

4. What would increase (e.g., information about advantages of the implementation of the case) your willingness to participate in the case (e.g. take part in meetings, discussions)?

5. Is the implementation of this case advantageous to you? If yes, why?

6. Is the implementation of this case harmful to you? If yes, why?

7. Do you have any hesitations (e.g., any motive that keeps you from participation, uncertainties about the value of the case, or doubts about the probability of the case succeeding) about the implementation of the case?

8. Would you like to keep informed about the process of implementation of the case?

   8a. If yes, which means of communication would be the best (e.g., e-mail, newsletter)?

   8b. If no, why?

9. Do you believe the implementation of this case will improve the sustainability (e.g. foster the social connections/inclusion, improve the economic situation, enhance the environmental qualities) of your city/community?

THE REMAINING QUESTIONS ARE ONLY FOR POLICY OR DECISION MAKERS

10. **.** Are there any policies or governance frameworks (e.g., lack of partnerships, lack of cooperation across departments) which limit or prevent the case from being implemented? If so, please explain.

11. Are there any existing policies or governance frameworks (e.g., public-private partnerships, cooperation across departments) that strengthen or empower the case from being implemented? If so, please explain.

12. Do you think your case will have any impact on regional and national systems and decisions? If so, how? (e.g. my case will inspire other cities in my region to showcase similar solutions)

9.3. Annex 3: List of Interviewees

Table 11: List of interviewees per case

ULL	Guardians of the process (TANGO-W partners)	Decision Makers – affected people
Stockholm Stad	Online interview: Researcher from Nordregio and one civil servant from Stockholm Stad	2 online interviews: Stockholm Stad interviewed (i) the Planning Manager Stockholm Royal Seaport and (ii) developer who is Gardener and landscape engineer at the municipal housing company Stockholmshem
Norrtälje	Online interview: Researcher from Nordregio and two people from Campus Roslagen	2 online interviews: Campus Roslagen interviewed (i) a Nortälje Municipality representative and (ii) two representatives of Bovieran in Norrtälje, one board member and one dweller
Weiz	Online interview: Researcher from AIT and Management of the Innovation Centre Weiz	2 f2f interviews: Innovation Centre of Weiz interviewed a) the mayor of Weiz, b) the deputy mayor of Weiz, c) an engaged citizen
Klagenfurt	Online interview: Researcher from 4ER interviewed local project manager of IPAK/ Klagenfurt	2 online interviews: Local project manager interviewed Head of the Environment and Climate Protection Department of the city of Klagenfurt
Halden	Online interview: Researcher from SIN and	2 online interviews: Halden Municipality Smart City Project Manager interviewed (i) Halden's Head of Social Development, and (ii) the General Manager of Isebakke Municipal Kindergarten
Marker	Online interview: Researcher from SIN, Stian Melhus and Helene Rødseth	3 f2f interviews: Tango-W Marker Project Manager interviewed (i) Smart Community Project Manager, (ii) Markers Chief Municipal Officer and (iii) the General Manager of Haldenvassdragets Vannområde/Project Manager Sabicas
Alytus	Online interview: Researcher from KTU interviewed a civil servant from Alytus City Municipality	1 online and 1 f2f interview: Alytus City Municipality the Finance and Investments Department interviewed (i) Municipality the Chief specialist (ii) the Deputy director of administration