



TOWARDS SMART ZERO CO<sub>2</sub> CITIES ACROSS EUROPE  
VITORIA-GASTEIZ + TARTU + SØNDERBORG

**Cities4ZERO: The Urban Transformation Strategy for Cities' Decarbonisation.** A journey towards the *Smart Zero Carbon City*

**WP2, Task 2.6**

Deliverable 2.8: Integrated and systemic SmartEnCity urban regeneration strategy\_v2

Date of document

31/10/2019 (M 45)

Deliverable Version:	D2.8, V1.0
Dissemination Level:	PU <sup>1</sup>
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<sup>1</sup> PU = Public

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## Document History

Project Acronym	SmartEnCity
Project Title	Towards Smart Zero CO2 Cities across Europe
Project Coordinator	Francisco Rodriguez Tecnalia francisco.rodriguez@tecnalia.com
Project Duration	1 <sup>st</sup> February 2016 - 31 <sup>st</sup> July 2021 (66 months)

Deliverable No.		D2.8 Integrated and systemic SmartEnCity urban regeneration strategy_v2	
Diss. Level		Public	
Deliverable Lead		TEC	
Status		Working	
		Verified by other WPs	
	X	Final version	
Due date of deliverable		31/10/2019	
Actual submission date		31/10/2019	
Work Package		WP 2 - SmartEnCity Regeneration Strategy	
WP Lead		IBS	
Contributing beneficiary(ies)		IBS, TEC, VIS, CEA, MON, ACC, CAR, SONF, ZERO, PLAN, AAU, TAR, SCL, TREA, UTAR, LECC, RINA-C, ASEN, SEC, SEZ, ACCING	
Date	Version	Person/Partner	Comments
01/02/2019	V0.1	Koldo Urrutia / TEC	Initial proposal
15/05/2019	V0.2	Koldo Urrutia / TEC	First merge of partner contributions
01/09/2019	V0.3	Koldo Urrutia / TEC	Preliminary draft for internal review
20/10/2019	V0.4	Koldo Urrutia / TEC	Consolidated Draft for external review
31/10/2019	V1.0	Koldo Urrutia / TEC	Final version for submission

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## Executive summary

**Cities4ZERO: The Urban Transformation Strategy for Cities' Decarbonisation** is a **step-by-step strategy** for a Smart Urban Decarbonisation transition, guiding cities through the process of developing the most appropriate **strategies, plans and projects** as well as looking for **commitment of key local stakeholders** for an effective transition; all from an **integrated planning approach**.

This strategy intends to align cities' decarbonisation and smart city solutions implementation, through the **Smart Zero Carbon City** concept, which targets the main decarbonisation elements from a participatory and technology-supported perspective:

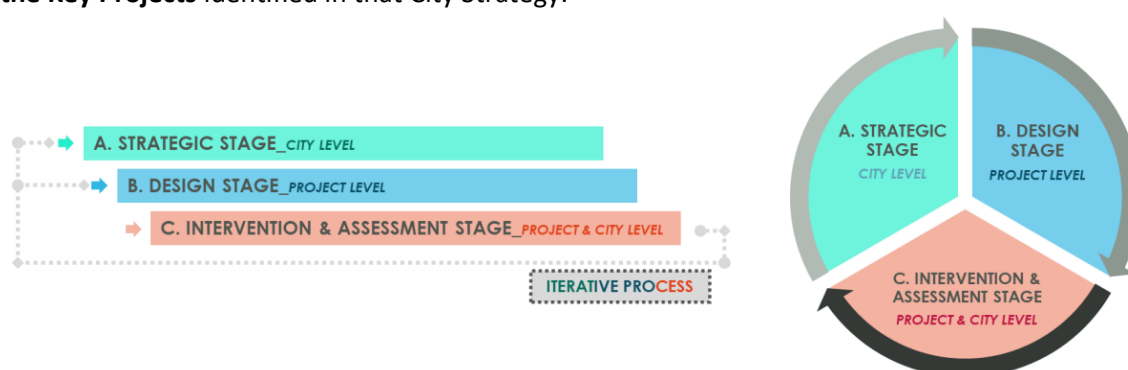
*"A **Smart Zero Carbon City (SZCC)** is a resource-efficient urban environment where carbon footprint is nearly eliminated; energy demand is kept to a minimum through the use of demand control technologies that save energy and promote raised awareness; energy supply is entirely renewable and clean; and resources are intelligently managed by aware and efficient citizens, as well as both public and private stakeholders"*

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From this concept, the important question is how to deploy the SZCC and **how to effectively implement this concept in our cities**. To answer this question, SmartEnCity project examines planning, implementation, monitoring and replication works to identify the key factors playing towards smart urban decarbonisation (SZCC concept), reviewing an ongoing process of five years of coordinated initiatives in the cities of Vitoria-Gasteiz (ES), Tartu (EE), Sonderborg (DK), Lecce (IT) and Asenovgrad (BG).

This commissioning process, altogether with complementary best practices in urban transformation processes, has been the main input to produce **Cities4ZERO**; a methodology produced to successfully **guide cities** in their ambitious urban transformation process. *What is Cities4ZERO offering to cities? How can this step-by-step strategy help municipalities in their way towards decarbonisation?* Main elements of the strategy are presented below.

Cities4Zero consists of **16 steps, structured in three stages**. The Stage A will deal with the development of the **City Strategy towards decarbonisation**, while Stages B and C will **develop the Key Projects** identified in that City Strategy.

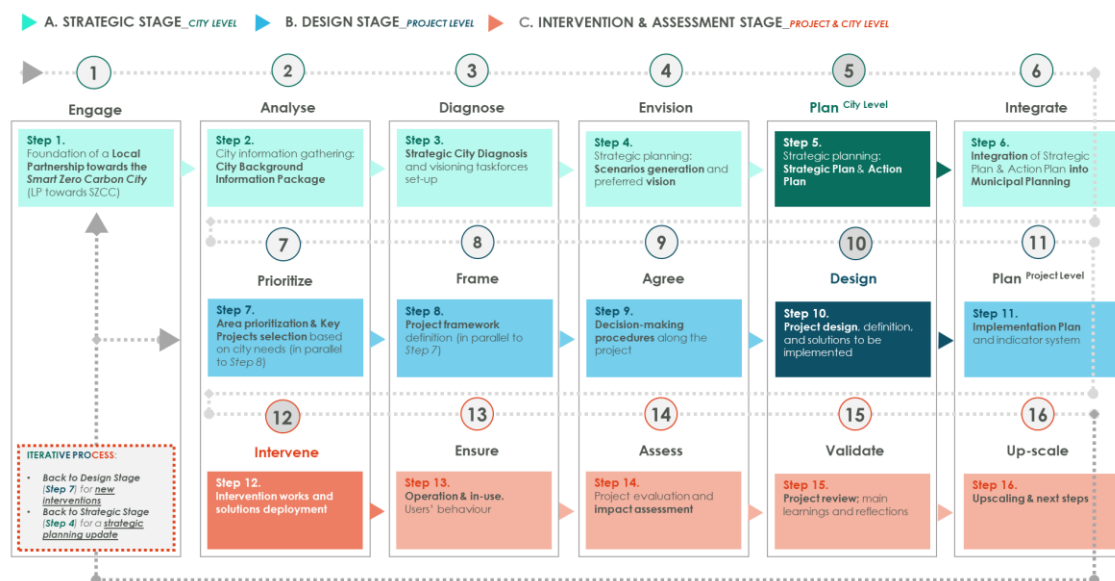


- **A. Strategic Stage (STEPS 1 to 6):** provides a **strategic planning framework** which enables the city administration to perform an effective transition towards the Smart Zero Carbon City (SZCC), including:
  - Key **city stakeholders' engagement** and institutional analysis
  - **Analysis and diagnosis** of city strengths and opportunities
  - **Co-visioning** process for urban transformation towards energy transition, including potential **future scenarios**

- Development of **Strategic Plans** to deploy that vision and **identification of Key Projects**, ensuring commitment of engaged stakeholders and municipal support
- B. Design Stage (STEPS 7 to 11):** guides through the **development of Key Projects** identified in Stage A, according to the Strategic Plans of the city, paving the way for tangible interventions towards the SZCC, including:
  - Project prioritization and selection** based on city needs
  - City transformation framework** with policies, plans, best practices, regulation, etc.
  - Funding & financing** mechanisms
  - Citizen Engagement Strategies** for project development
  - Project design and tools**
  - Project implementation plan** & indicator systems
- C. Intervention & Assessment Stage (STEPS 12 to 16):** structures the **implementation of Key Projects** identified in Stage A and designed in Stage B, finally transforming the urban environment; including:
  - Intervention works**, solutions deployment, and commissioning
  - Monitoring, maintenance**, and users training
  - Interventions' **performance and impact assessment**
  - Post management and communication through **City Information Open Platforms**
  - Project and strategy validation**
  - Up-scaling** of successful experiences

This step-by-step methodology is **not conceived as a linear process, but as a circular one**. The whole process (Stages A, B and C) cyclically iterates when felt partially obsolete to **readjust the focus of Strategies, Plans and Key Projects** towards the final decarbonisation goal, according to the co-formulated city vision.

The final aim of Cities4ZERO is to involve European cities on the path towards decarbonisation, mainly targeting the wide range of small and mid-sized cities in the region (83,43% of cities). As SmartEnCity slogan states, *“you don’t have to be a capital city to make a major difference!”*.



## Table of contents

<b>Cities4ZERO: THE URBAN TRANSFORMATION STRATEGY FOR CITIES' DECARBONISATION</b>	<b>6</b>
<b>1. INTRODUCTION. Context and approach</b>	<b>6</b>
1.1 <b>THE CHALLENGE.</b> Why do cities need a transition?	6
1.2 <b>EU FRAMEWORK.</b> How is the EU boosting this urban transition?	6
1.3 <b>OUR GUIDING CONCEPT.</b> How could cities approach this journey?	8
<b>2. THE URBAN TRANSFORMATION STRATEGY FOR CITIES' DECARBONISATION</b>	<b>9</b>
2.1 <b>WHAT IS IT?</b> Cities4ZERO: a journey towards the SZCC	9
2.2 <b>THIS DOCUMENT IS FOR CITIES.</b> Local urban environments at focus	10
2.3 <b>WHY FOLLOW THIS STRATEGY?</b> Value proposition for cities	10
2.4 <b>HOW DOES IT WORK?</b> Overview and stages of the strategy	11
<b>Cities4ZERO: THE URBAN TRANSFORMATION STRATEGY FOR CITIES' DECARBONISATION</b>	<b>14</b>
<b>A. Strategic stage</b> <small>CITY LEVEL</small>	<b>14</b>
Step 1. ENGAGE	15
Step 2. ANALYSE	16
Step 3. DIAGNOSE	18
Step 4. ENVISION	20
Step 5. PLAN CITY LEVEL	22
Step 6. INTEGRATE	25
<b>Strategic Stage wrap-up</b>	<b>28</b>
<b>DEVELOPMENT OF KEY PROJECTS</b>	<b>29</b>
<b>B. Design stage</b> <small>PROJECT LEVEL</small>	<b>29</b>
Step 7. PRIORITIZE	30
Step 8. FRAME	33
Step 9. AGREE	35
Step 10. DESIGN	38
<b>Design Stage wrap-up</b>	<b>43</b>
<b>C. Intervention &amp; assessment stage</b> <small>PROJECT &amp; CITY LEVEL</small>	<b>44</b>
Step 12. INTERVENE	45
Step 13. ENSURE	47
Step 14. ASSESS	49
Step 15. VALIDATE	52
Step 16. UP-SCALE	53
<b>Intervention &amp; Assessment Stage wrap-up</b>	<b>54</b>
<b>CONCLUSIONS &amp; LESSONS LEARNED</b>	<b>55</b>
<b>ANNEXES</b>	<b>57</b>
1. RESOURCES	57
2. KEY POINTS AND TOOLS OF EACH STAGE	60
3. CITY CHECK-UP ASSESSMENT TOOL	62
4. BIBLIOGRAPHY AND BEST PRACTICES	69

## Cities4ZERO: THE URBAN TRANSFORMATION STRATEGY FOR CITIES' DECARBONISATION A JOURNEY TOWARDS THE SMART ZERO CARBON CITY (SZCC)

### 1. INTRODUCTION. Context and approach

#### 1.1 THE CHALLENGE. Why do cities need a transition?

Society is nowadays facing one of the **hardest challenges in history**. Our progress has been highly dependent on burning fossil fuels since industrial revolution in 19th Century, obtaining energy at lowest possible costs since then, thus **boosting Green House Gas (GHG) emissions**. Over time, the result of this human activity has brought a destabilizing phenomenon to our time: **Climate Change**, whose unforeseen consequences are already modifying global natural patterns.

Focusing on GHG emissions and the impact this fossil-fuel dependency has on local environments, the World Health Organization (WHO) states that 92% of global population lives in places where **air quality** levels exceed WHO limits<sup>1</sup>. In this line, cities are the most vulnerable environments, eventually registering **unacceptable pollution levels**. Moreover, more than half of the global population nowadays lives in cities, forecasting this rate to overcome 70% by 2050<sup>1</sup>, provoking a huge **impact on global public health**.

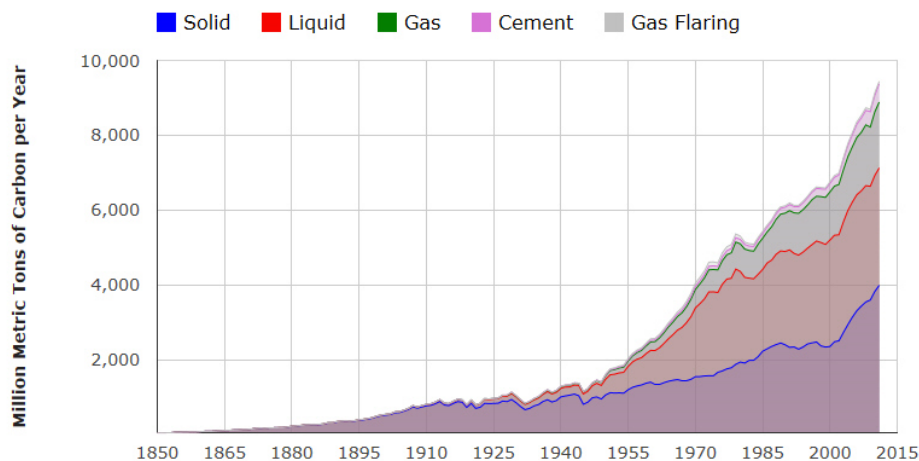


Figure 1. Global CO<sub>2</sub> Emissions (Boden et al, US Department of Energy, 2017)

Within this fossil fuels path dependency, **decarbonisation of cities** is a priority when tackling both global and mainly local challenges. Oxford University defines *decarbonisation* as “*reducing the amount of gaseous carbon compounds released in or as a result of an environment or process*”<sup>2</sup>, matching the aim of cities to reduce the emissions entailed to its urban metabolism process for a healthier urban environment and the potential mitigation of Climate Change.

#### 1.2 EU FRAMEWORK. How is the EU boosting this urban transition?

Addressing this decarbonisation intent, the European Commission (EC) has set specific **targets for 2020 and 2030**, reducing GHG emissions by 20% and 40% respectively below 1990 levels. Additionally, they submitted in November 2018 a strategy for a **climate neutral economy by 2050**, paving the way towards the net-zero emissions target adopted in the Paris Agreement<sup>3</sup>. Indeed, according to Eurobarometer results, this is the path that most European citizens want to follow, as 85% agree that fighting Climate Change and using energy more efficiently can lead to economic growth<sup>4</sup>. Regarding the international context, this vision is also in line with some of the UN Sustainable Development Goals (SDGs), pushing for *Climate Action* (SDG13), *Sustainable Cities and Communities* (SDG11), and *Affordable and Clean Energy* (SDG7).



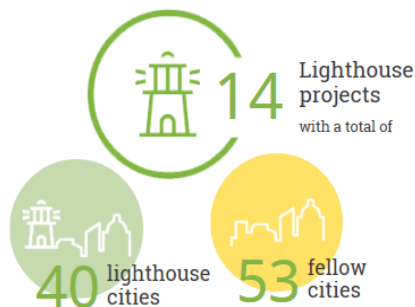
Figure 2. Sustainable Development Goals report (UN, 2019)

Focusing on cities, the EC is deploying two main initiatives to achieve those decarbonisation targets through local implementations in urban environments.

Firstly, fostering strategic processes, with the **Covenant of Mayors** initiative gathering 7.755 signatories since 2008, with 6.038 Sustainable Energy Action Plans (SEAP) submitted and 1.743 of those already being monitored. This initiative intends to accelerate the decarbonisation of EU territories, strengthening their capacity to adapt to unavoidable Climate Change impacts, allowing their citizens to access secure, sustainable and affordable energy<sup>5</sup>. In 2016, the initiative evolved to demand from cities Sustainable Energy and Climate Action Plans (SECAP), based on a Baseline Emission Inventory and a Climate Risk & Vulnerability Assessment, as well as a report on progress every two years, committing cities to support GHG reduction EU targets by 2030.

Secondly, fostering real implementation in cities, the EC launched in 2012 the **European Innovation Partnership on Smart Cities and Communities** (EIP-SCC), a platform intending to engage cities, industries, SMEs, investors and researchers, bringing them all together to design and deliver smart-sustainable solutions and projects. This EIP-SCC initiative is funded by the European Commission's Research and Innovation Framework Horizon 2020 and the Strategic Energy Technology Plan (SET Plan)<sup>6</sup>, aligning all forces towards EU decarbonisation targets and the economic growth of the region.

## Smart Cities and Community Lighthouse projects



## MORE THAN 530 SMART CITY PILOT PROJECTS

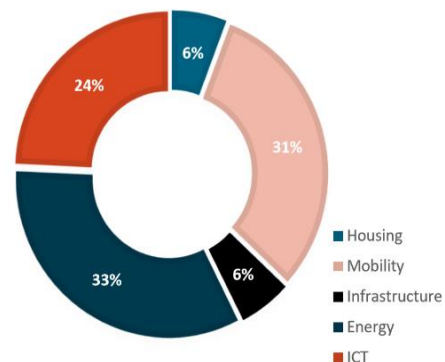


Figure 3. SCC1 Joint initiative projects, part of the SCIS and EIP-SCC platforms (SCIS, 2019)



The EIP-SCC initiative presented the **Strategic Implementation Plan** (2013) for speeding up the transformation of European Cities into "Smart Cities". The plan outlines their ideas on how to best harness innovative technologies, innovative funding mechanisms and innovative public-private partnerships. This plan also highlights actions needed to create the right framework conditions to make our cities better places to live and to do business in, and to reduce energy use, carbon emissions and congestion (further information on Annex 4).

### 1.3 OUR GUIDING CONCEPT. How could cities approach this journey?

In this context, the alignment among cities' **decarbonisation** and **Smart City solutions** implementation needs an **overarching concept** stating a vision and its goals, framing all plans and interventions this ambitious urban transition requires. In this line, theoretical and experimental research on *SmartEnCity – Towards Smart Zero CO<sub>2</sub> Cities across Europe* (EIP-SCC project) has allowed to develop the **Smart Zero Carbon City concept**<sup>7</sup>, still missing on urban planning paradigm, setting a vision able to **guide cities towards smart urban decarbonisation**:

*"A Smart Zero Carbon City (SZCC) is a resource-efficient urban environment where carbon footprint is nearly eliminated; energy demand is kept to a minimum through the use of demand control technologies that save energy and promote raised awareness; energy supply is entirely renewable and clean; and resources are intelligently managed by aware and efficient citizens, as well as both public and private stakeholders"*

SmartEnCity consortium

The concept is targeting main decarbonisation elements connected to **cities' energy systems**: energy demand, energy supply, and energy management; all from a **participatory and technology-supported perspective**. Here, energy elements are at the core, as almost all GHG emissions generated in urban environments come from activities related to cities' energy systems. However, SmartEnCity research and its interventions understand **the city from a multi-systemic urban planning perspective** and not the energy system as an isolated silo, where all city systems interact with each other and contribute to this transition, thus pushing planners to look at the **decarbonisation challenge from an integrated approach**, getting all city sectors on board.



Figure 4. Main city systems interconnected in urban transformation processes (Urrutia, 2019)



From this overarching concept, the important question is how to deploy the SZCC and **how to effectively implement this concept in our cities**. To answer this question, SmartEnCity project examines planning, implementation, monitoring and replication works to identify the key factors playing towards smart urban decarbonisation (SZCC concept), reviewing an ongoing process of five years of coordinated initiatives in the cities of Vitoria-Gasteiz (ES), Tartu (EE), Sonderborg (DK), Lecce (IT) and Asenovgrad (BG).

This commissioning process, altogether with complementary best practices in urban transformation processes, has been the main input to produce **Cities4ZERO: THE URBAN TRANSFORMATION STRATEGY FOR CITIES' DECARBONISATION**; a methodology produced to successfully **guide cities** in their ambitious urban transformation.



Figure 5. SmartEnCity Lighthouse and Follower Cities within SCC1 initiative (Urrutia, 2019)

## 2. THE URBAN TRANSFORMATION STRATEGY FOR CITIES' DECARBONISATION

### 2.1 WHAT IS IT? Cities4ZERO: a journey towards the SZCC

**Cities4ZERO** is a **step-by-step methodology** for a Smart Urban Decarbonisation transition guiding the city through the process of developing the most appropriate strategies, plans and projects as well as looking for commitment of key local stakeholders for an effective transition; all from an integrated planning approach.

Regarding the main topics addressed in Cities4ZERO, and even though all city systems are influenced by this transition, SmartEnCity project and this strategy are focused on the systems which have a **higher impact on the city decarbonisation** process, which are:

- Energy & Integrated Infrastructures
- Built Environment, Public Space & Green Infrastructures
- Mobility & Logistics
- Governance & Engagement
- ICTs & Enabling Technologies

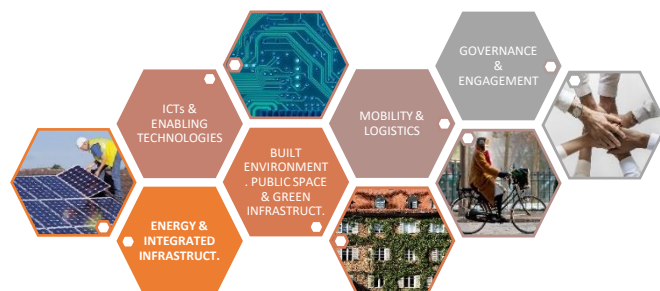


Figure 6. Main city systems addressed in Cities4ZERO (Urrutia, 2019)

## 2.2 THIS DOCUMENT IS FOR CITIES. Local urban environments at focus

**Cities4ZERO is targeted towards cities**, fostering the effective decarbonisation of EU urban environments, based on their city needs and context. Each city has **unique features**, culture, geography, goals, etc., which set the context to design a strategy tailored to the local city needs. Furthermore, these local conditions influence the design and development of projects and therefore, it is crucial to consider differences and explore commonalities in this transition.

Cities4ZERO is valid for any kind of city, despite diverse local needs, as all **municipalities are facing common challenges** in this urban transformation process. Each specific local steering process will be in charge of tailoring the Cities4ZERO steps to the ad-hoc local situation of each city. Because city context matters!

As a potential audience, this document addresses city and regional administrations, NGOs, urban planners and developers, urban researchers, energy utilities, service providers, design & construction professionals, community representatives, and potential investors.

Regarding city scales, the main principles of this strategy have been built upon the experiences of **small and medium-sized cities**, far from the scale, visibility and the available resources of large EU capitals. Among the 962 European cities that surpass 45,000 inhabitants, according to Eurostat data, 793 have a population of between 45,000 and 300,000 inhabitants<sup>8</sup>, reaching **83.43% of EU cities**, an indicative figure of the major impact that small and medium-size cities will have on the GHG emission targets set by the EU for 2020 and 2030<sup>9</sup>. As the slogan of SmartEnCity project indicates, ***“you don’t have to be a capital city to make a major difference”***<sup>10</sup>, we are seeking to involve this wide range of European cities on the path of decarbonisation<sup>7</sup>.

## 2.3 WHY FOLLOW THIS STRATEGY? Value proposition for cities

This is the **value proposition** that Cities4ZERO is offering to cities, aligned with the three stages according to which the strategy is structured:

- **A. Strategic Stage:** provides a strategic planning framework which enables the city administration to perform an effective transition towards the Smart Zero Carbon City (SZCC), including:
  - Key **city stakeholders’ engagement** and institutional analysis
  - **Analysis and diagnosis** of city strengths and opportunities
  - **Co-visioning** process for urban transformation towards energy transition, including potential **future scenarios**
  - Development of **Strategic Plans** to deploy that vision and **identification of Key Projects**, ensuring commitment of engaged stakeholders
- **B. Design Stage:** guides on the development of Key Projects identified in Stage A, according to the Strategic Plans of the city, paving the way for tangible interventions towards the SZCC, including:
  - **Project prioritization and selection** based on city needs
  - **City transformation framework** with policies, plans, best practices, regulation, etc.
  - **Funding & financing** mechanisms
  - **Citizen Engagement Strategies** for project development
  - **Project design and tools**
  - Project **implementation plan** & indicator system

- **C. Intervention & Assessment Stage:** structures the implementation of Key Projects identified in Stage A and designed in Stage B, finally transforming the urban environment; including:
  - **Intervention works**, solutions deployment, and commissioning
  - **Monitoring, maintenance**, and user training
  - Interventions' **performance and impact assessment**
  - Post management and communication through **City Information Open Platforms**
  - Project and strategy **validation**
  - **Up-scaling** of successful experiences

#### 2.4 HOW DOES IT WORK? Overview and stages of the strategy

Cities4Zero consists of **16 steps, structured in three stages**. The Stage A will deal with the development of the **City Strategy**, while Stages B and C will develop the **Key Projects** identified in that City Strategy. In line with the value proposition for cities, Cities4ZERO is thus divided in the following three stages:

- Strategic Stage**, providing the strategic framework at city level (**STEPS 1 to 6**)
- Design Stage**, framing and designing the Key Projects to deploy the strategy at city level (**STEPS 7 to 11**)
- Intervention & Assessment Stage**, implementing and evaluating all foreplaned interventions (**STEPS 12 to 16**)

This step-by-step methodology is **not conceived as a linear process, but as a circular one**. The whole process (Stages A, B and C) cyclically iterates when felt partially obsolete to **readjust the focus of Strategies, Plans and Key Projects** towards the final decarbonisation goal, according to the co-formulated city vision.

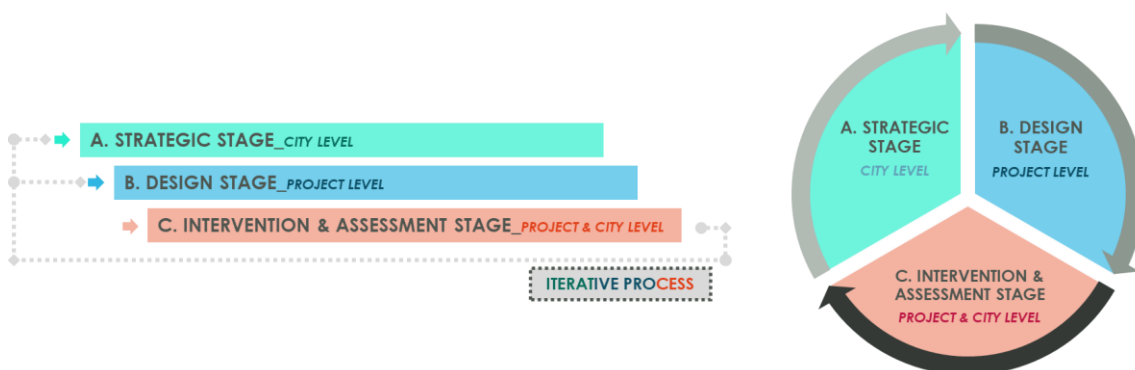


Figure 7. Cities4ZERO stages overview and iterative process (Urrutia, 2019)

Depending on the current status of each municipality, **the point of departure can vary** as some methodological steps might be already fulfilled. The first exercise for cities consists in **evaluating their situation regarding this process** and which steps from Stage A will be a priority for them<sup>3</sup>.

As a starting point, the SmartEnCity team has developed the [City Check-up Assessment](#) tool. By filling a questionnaire, cities can “test” themselves and see where their city is regarding this urban transformation process. It is an **easy way to start your city journey towards a smart zero carbon future; it takes less than 10 minutes!**

Find the interactive tool clicking [here](#) or a printed version in Annex 3 of this document.

<sup>3</sup> City Check-up Assessment tool can be accessed on:

[https://docs.google.com/forms/d/e/1FAIpQLScOjmJCSpEpxToG51uBFuUj8ku18Z-NRzW\\_vpGB3PvZqIOcJQ/formResponse](https://docs.google.com/forms/d/e/1FAIpQLScOjmJCSpEpxToG51uBFuUj8ku18Z-NRzW_vpGB3PvZqIOcJQ/formResponse)

Finally, step-by-step does not always mean that it has to be a straight line; reality is sometimes a little more complex than plans. Either way, this methodology will work as a **solid reference framework**.

*Local authorities have a key role in urban decarbonization, due to their wide range of action and impact; they are big consumers of energy, they can plan and regulate locally, procure, provide services, promote infrastructures, finance and facilitate financing, influence citizens (...). For all those reasons, they have the ability to become role models for their environments. If local authorities are steadily committed, cities can meet their targets in next decades.*

Koldo Urrutia, **integrated planning researcher at Tecnalia R&I**

**Now it's time to get into it; enjoy!**

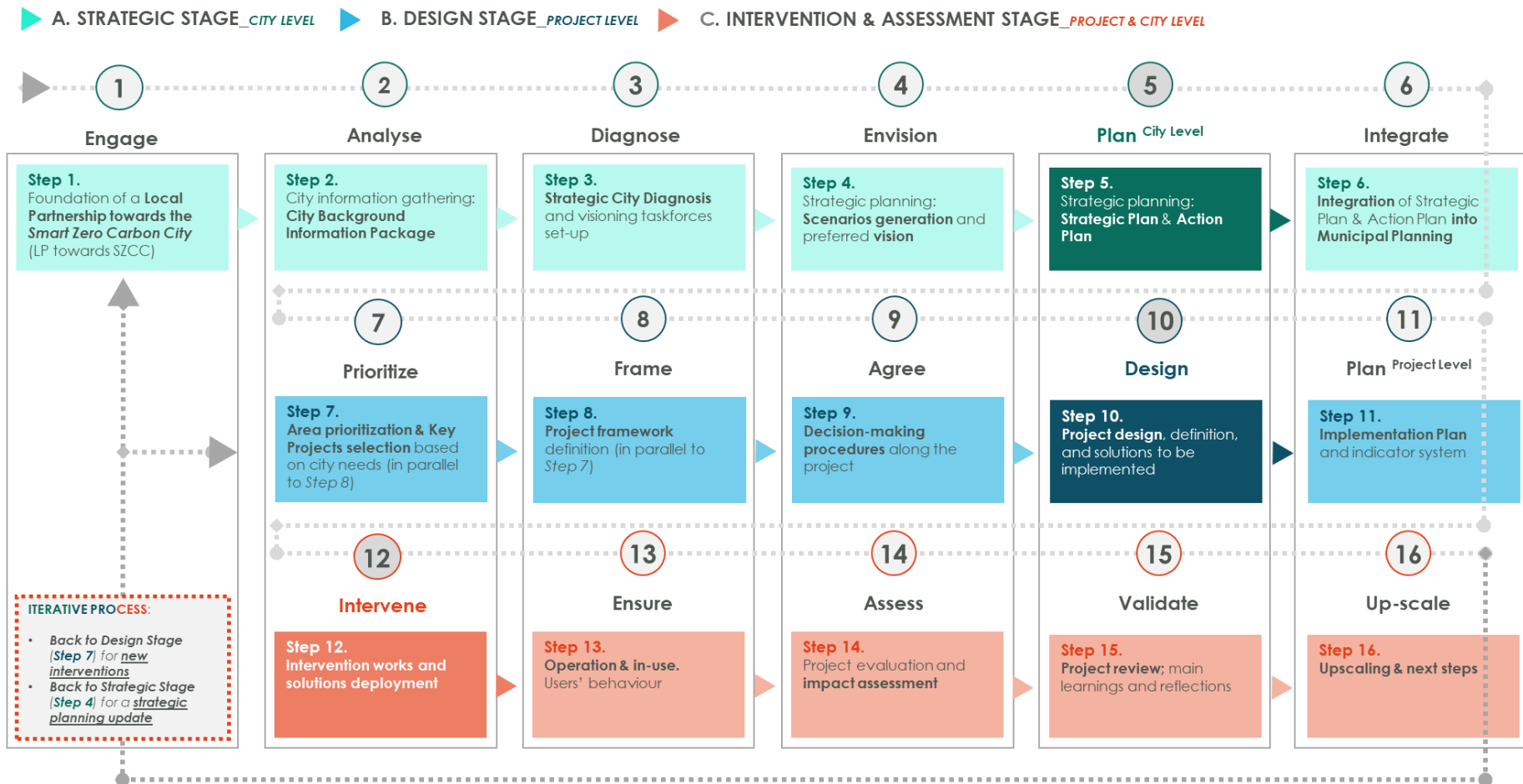


Figure 8. Cities4ZERO strategy. Overview of the process and 16 steps (Urrutia, 2019)

## Cities4ZERO: THE URBAN TRANSFORMATION STRATEGY FOR CITIES' DECARBONISATION

### A. Strategic stage CITY LEVEL

The main objective of the *Strategic Stage* is to provide a **framework** which enables the city to perform an **effective transition towards the Smart Zero Carbon City (SZCC)**. In later stages, the methodology delves into a concrete projects' definition (*B. Design Stage*) and implementation (*C. Intervention & Assessment Stage*), landing on specific projects identified in this *Strategic Stage* at city level.

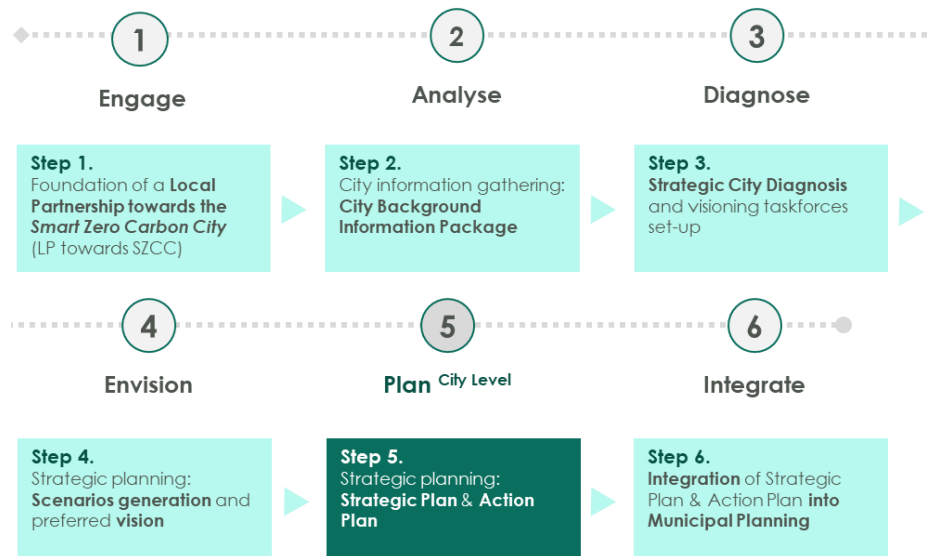


Figure 9. Strategic stage overview<sup>4</sup>

The framework of this *Strategic Stage* consists of **six steps** delving on main activities to be performed at **city-planning level**. The first step (1. ENGAGE) describes the **foundation of a permanent local steering group (Local Partnership towards the SZCC)** lead by the local authority for this transition towards the SZCC, suggesting an alternative governance model with key local stakeholders on board. With this group in place, the city needs to perform a thorough **City Characterization** (2. ANALYSE) and a **Strategic City Diagnosis** (3. DIAGNOSE) to understand what the point of departure for the city transition is. This comprehensive background analysis allows to perform a **strategic planning process**, starting with the co-development of a **city vision** (4. ENVISION), based on potential decarbonisation scenarios for the city. That resulting vision will provide an umbrella to develop a *Strategic Plan*, which will steer the city towards the achievement of that agreed vision, defining also an *Action Plan* to perform specific actions with that purpose (5. **PLAN<sup>City level</sup> – key Step of Stage A**). The last step of the *Strategic Stage* (6. INTEGRATE) fosters the **integration of Strategic Plan contents into municipal planning instruments**, ensuring the alignment and official approval of all processes to avoid legal, administrative and land-use barriers, while leveraging synergies among municipal departments and competences, all carefully steered by the *Local Partnership towards the SZCC*.

As mentioned in the introduction of this document, it is highly recommended to use the [City Check-up Assessment](#) tool before starting with Step 1, so the reader has an overview of the process, contextualised to his/her specific local environment.

<sup>4</sup> Within SmartEnCity project, *Follower Cities* – Lecce, Asenovgrad- are fulfilling all steps in this first stage (A), including a Strategic Plan & Action Plan. *Lighthouse Cities* – Vitoria-Gasteiz, Tartu, Sonderborg- will fulfil all steps of this strategy, including the three stages (A/B/C).





## Step 1. ENGAGE. Foundation of a Local Partnership towards the Smart Zero Carbon City (LP towards the SZCC)

The first cornerstone in this journey requires the **foundation of a local group headed by the local authority (LP towards the SZCC)**, which will steer the urban transformation process towards the SZCC. This local group must **engage key local stakeholders**, including representatives from all *quadruple helix* branches (government, industry, academia and citizenship), as well as **define the governance model** for this urban transformation process. This local group can eventually be supported by external consultancy if some competences are missed within the municipality.

Before starting with the urban transformation strategy, **pre-planning tasks** of this group must reflect on overall strategy requirements and approvals such as: timeline, coordination with other partners, potential institutional adaptations, budgetary needs, (...), **determining the needs** for shaping, regulating, stimulating and capacity building of potential projects or initiatives framed within this urban transformation process towards decarbonisation.

### The case of ProjectZero: A Local Partnership towards the Smart Zero Carbon Sonderborg (DK)

Sonderborg municipality started its journey in 2007 and its **commitment towards decarbonisation** has been growing since then, achieving already a significant reduction of CO<sub>2</sub> emissions (35%) and energy consumption (14%) by 2018. Since 2007, this strategic process has kept **both public and private interest** and cooperation alive, providing **stability to the process in the long term**. As an example, the co-development of last update of their decarbonisation strategy has gathered more than 100 local stakeholders working on the proposals, inspiring businesses and citizens, spreading the feeling of belonging to a sustainable community that, together, works towards a common meaningful goal.

In this kind of long-term strategic process, **the creation of a local energy planning authority** inside the municipality can provide the required support, being able to steer these processes and **cooperate** with other public departments and private stakeholders. In the case of Sonderborg, this strategic process was launched through **a public-private partnership -ProjectZero-**, even overcoming the public sector and spreading its roots in industry and academia (example of LP towards SZCC). This inclusive partnership has been **key in the acceptance and involvement of the local community** in this initiative.

The latest successful ProjectZero initiative, in collaboration with SmartEnCity project, has been the release of the **Roadmap2025, 50 steps towards a carbon neutral Sonderborg**<sup>11</sup> (Step 5.PLAN<sup>CITY LEVEL</sup>), when the city intends to attain a 75% carbon reduction, a key milestone before becoming **carbon neutral in 2029**.

### Regulation can foster a local governance shift

As an example, national and regional administrations can push for local sustainability by multiple regulatory initiatives. As a successful initiative, the Basque Government (Spain) has committed all municipalities within its boundaries **to create a local energy steering group** (in case they don't have one already). This local group is in charge of crucial tasks related to municipal decarbonization:

- Producing an **inventory** of public buildings, facilities, vehicles and public lighting, including consumption and other specificities.
- **Controlling energy consumption** of all that inventory, with remote energy meters

**Step 1. ENGAGE**  
Foundation of a Local Partnership towards the Smart Zero Carbon City (LP towards SZCC)

**Stable local partnership** committed through the urban transformation process

- Stakeholder mapping > Quadruple helix principle: government, industry, academia, citizenship
- Foundation of LP towards the SZCC, headed by local authority. Group set-up & pre-planning tasks.
- Budgetary implications

**Governance model definition**

- Institutional analysis and local taskforce creation (if necessary; LP towards SZCC)
- Open innovation
- Decision-making procedures
- Committees
- Governance adjustments

- To perform **energy audits** of that inventory (energy supply, efficiency, , recommendations, etc.)
- To **develop Energy Action Plans**, with diagnosis, strategy, and actions for the city.
- Making all this **information publicly available**.



## Step 2. ANALYSE. City information gathering: City Background Information Package (CBIP)

When facing a strategic urban transformation process, a thorough analysis gathering comprehensive information on the current state of the city is crucial for a successful regeneration; *Where are we?*

A pre-analysis must perform a **literature review at city level**, delving on existing policies, regulations, strategies and plans, complemented by semi-structured **interviews with experts and surveys on citizens' perception**. On that basis, a **city characterization** provides a deeper understanding on the socio-economic and sectorial (energy, building stock, mobility, ICTs, engagement, waste, water, etc.) features and status of the city, where **city indicators** (*SZCC Readiness Level*<sup>5</sup>) can provide a desirable quantitative approach to this characterization. Here, a carbon emissions baseline is key to perform further strategies and projects towards energy transition.

All gathered information within this step will be bundled into a **City Background Information Package (CBIP)**, as a solid reference for further steps in this methodology. **Like an X-Ray of our city!**

### How to perform a city characterization: what domains need to be included in your City Characterization?

Of course, each city has its own features, but all cities have some commonalities regarding sustainability and decarbonisation processes.

The SmartEnCity team developed a thorough review of relevant documents and methodologies in the field such as Aalborg Commitments, the Leipzig Charter, BREAM, LEED, HQE2R, DGNB, or DPL, studying their knowledge domains and indicators' tables. As a result, the **city characterization template was classified into six domains**<sup>5</sup>, covering the most relevant systems of the city:

- **Local conditions;**
- **Energy** supply and consuming patterns;
- **Building stock** and retrofitting needs;
- **Urban mobility;**
- **ICT infrastructures** and services;
- Citizen and stakeholders' **engagement**.

Each of these sections is described under a common format of a) Storytelling describing the section qualitatively in text, and b) a Fact box presenting the indicators as a wrap-up quantitative summary of the

### Step 2. ANALYSE

City information gathering:  
**City Background  
Information Package**

#### Pre-analysis –

*Where are we?*

- **Literature review at city level**; existing documents & strategies
- In-depth **interviews with experts** (potential working groups representatives)
- **Surveys** on citizen's perception

#### Analysis –

City Characterisation

- Socio-economic
- Business & financial
- Urban environment & quality of life
- Policies and regulations
- **Sectors of the city** - Energy, building stock, mobility, ICTs, engagement, waste, water, etc.
- **CO<sub>2</sub> emissions' baseline**
- *SZCC Readiness Level*

<sup>5</sup> A wider range of local conditions can be addressed in this characterisation, if there are available resources:

Historical, political and traditional data aspects, crucial for city grow so far and in the near future; Land distribution, district characteristics, city connections between different zones; Economic facts, industry and main services; Business aspects & funding, gross added value (GAV) by sectors; Environment aspects and level of the implementation of green infrastructure, renovation, transport, governances; Energy supply and consuming patterns by sectors; Building stock and retrofitting needs; Urban mobility city profile; Policies and regulations; ICT infrastructures and services; Citizen and stakeholders engagement; Lessons learnt so far, strategies pending and funding schemes.

section. This method has proven to give a comprehensive view of each area of the city, while describing the content with an intuitive common thread.

Regarding the indicators of each domain, a simpler version was produced in the study *Smart Zero Carbon City Readiness Level*<sup>7</sup>, applying the key characterization indicators to four small and mid-sized cities in the north of Spain (Table 1).

About the emissions baseline, the two key parameters to be monitored in the decarbonisation process are: the total amount of CO<sub>2</sub> emissions and the total energy consumption in the city. Both must be determined at least on a yearly basis in order to commission progress and impact of our actions.

**Table 1. Characterization indicators in *Smart Zero Carbon City Readiness Level* study**

	INDICATOR	\CITY	VITORIA	SAN SEBASTIAN	IRUN	SESTAO
CHARACTERISTICS OF THE CITY	Size (Km <sup>2</sup> )		276.8	60.89	42.4	3.61
	Population (inhabitants)		246.042	186.095	62.279	27.286
	Population density (inhab./Km <sup>2</sup> )		888.88	3050	1,468.84	7.558.45
	Average age of the population (years)		43.1	45.32	43.9	46.31
	Average income (€)		26.765	37.805	26.765	12.888
	Unemployment rate (%)		13.8	10.9	13.16	17.89
	Waste generated (Ton./inhab./year)		0.358	0.43	0.735	0.317
	Sound pollution (% inhab. Exposed > 55dB per night)		19	28	12	1.74
CITY PLANS / STRATEGIES	Strategy of energy efficiency of built environment (PAES)		Yes	Yes	Yes	No
	Strategy of promotion of sustainable mobility (PMUS)		Yes	Yes	Yes	No
	Sustainability strategy		Yes	Yes	Yes	Yes
	Smart City Strategy		No	Yes	No	No
	Involvement in Smart City projects (1 Completely disagree -5 Completely agree)		4	5	2	5
ENERGY	Total CO2 emissions (t/year)		758835	1296144	336237	Unavail.
	> Fossil fuels (GWh/year)		2038.5	2,725.122	931.246	420.48
	> District Heating (GWh/year)		0	0	0	0
	> Biomass (GWh/year)		10.61	2.1813	0.1125	0.0923
	> Photovoltaic (GWh/year)		0.91	1.630276	0.3130	0.1348
	> Thermosolar (GWh/year)		3.3	0.567404	0.6690	0.1126
	> Hydraulic (GWh/year)		0	Unavail.	0.2055	0
	> Geothermal (GWh/year)		Unavail.	1.408296	Unavail.	0
	> Mini-Wind (GWh/year)		0.05	0.00814	0.0005	0
	Total energy consumption (GWh/year)		2650	3408	1116	Unavail.
MOBILITY	Total energetic consumption per capita (MWh/inhab./year)		12.09	18.68	18.3	15.7
	> Pedestrian (%)		54.4	49	50.7	12.7
	> Bicycle (%)		12.3	3.8	0.8	0.5
	> Public transport (%)		7.7	19	11.9	46.5
	> Private vehicle (%)		24.7	26	34.8	38.1
	Num. of vehicles per capita.		0.577	0.398	0.659	0.5185
	Percentage of electric vehicles (%)		0.027	0.0005	0.027	0.007
	Number of electric vehicles recharging points		6	5	3	3
	Number of annual trips on public transport per capita		66.67	153	26.29	181
	Bike lanes and cyclable paths (km/ hab.)		0.00057	0.00039	0.00031	0.00037
ITC INFRASTRUCTURE & SERVICES	Public transport using renewable energy (%)		4	Unavail.	0	9
	Number of air quality stations		4	5	0	2
	Number of noise monitoring stations		7	5	0	0
	Number of meteorological stations		5	4	0	1
	Number of public bike loan points		0	16	0	0
	Number of information panels for parking		12	9	0	0
	Number of areas with free WIFI		Unavail.	(305.494m <sup>2</sup> )	5	7
	ITC platforms for public usage (online registration, participation. etc.)		Yes	Yes	Yes	Yes
CITIZENSHIP	Recycling rate (%)		26.5	38.1	43.59	39.7
	Participation in the most recent municipal elections (%)		64.76	66.7	60.47	61.18
	Number of information points in the city		11	9	9	4
	Number of municipal web-pages within the municipal area		2	21	1	1
	Degree of participation in planning processes (Likert scale)		Very high participation	Very high participation	Queries (Mean)	Queries (Mean)



### Step 3. DIAGNOSE. Strategic City Diagnosis and visioning taskforces set-up

Once key stakeholders are initially engaged within the *LP towards the SZCC* (Step 1) and city information is gathered on the *CBIP* (Step 2), it is time to organize those stakeholders in working groups to provide valuable input for the **strategic planning tasks**; namely:

- Strategic City Diagnosis (Step 3)
- Scenarios and city vision generation (Step 4)
- Strategic Plan & Action Plan (Step 5)

The **Strategic City Diagnosis** will consist of a thorough **SWOT** analysis of the city, supported by *CBIP* (Step 2, including GIS data), and a **city-trends** analysis, exploring relevant connections to regional/ national/ international targets, policies and institutions in the field of *SZCC*. This Diagnosis will provide **critical topics and main input for scenarios and city vision generation** (Step 4).

#### The City Diagnosis process in SmartEnCity

SmartEnCity project involves **participatory foresight methods to support the cities' strategic planning process**. As the **foresight exercise** is about gathering future intelligence and **building common visions for making present-day decisions** and mobilizing joint actions, the method will contribute to shaping the cities' Strategic Plans & Action Plans (Step 5).

The aim of this step (3. DIAGNOSE) is to make the necessary preparations for Step 4 scenario-building activities (4. ENVISION). The **Local Partnership towards the SZCC taskforce** (Step 1) **will coordinate** the Strategic Plan development process in the city and help to carry out the foresight exercise. The roles of the members should then be decided, and the main decision-making procedures specified. Hiring external experts for helping to organize the scenario-building phase is also an option.

A good foresight exercise starts from setting the **strategic question** that guides the next activities (e.g. "*How can we make our city carbon-neutral by 2030?*"). The timeframe of the foresight process should not be more than **10-15 years** into the future to develop good courses of action. The task force should then proceed by going over the current situation of the city and the existing barriers – information gathered in Step 2 (2. ANALYSE) will serve as great input for this.

Once the general framework is in place, the task force should complete an **in-depth SWOT analysis** of the city. Start by identifying the driving forces of change, analysing today's smart city trends by applying the "**external opportunities**" and "**external threats**" logic of a standard SWOT analysis and focusing on the strategic question. This will need some desk research and preliminary analysis. The aspects to mention are global Smart City trends that are relevant to any city in the world, which need to be taken into account in order to be better prepared for future developments.

After identifying the most influential trends, the task force should also determine the city's main **strengths and weaknesses** based on relevant background materials. When combined with the external aspects, the SWOT analysis should then provide enough input into scenario planning. Step 3 can then be finalized by assessing the **probability** (i.e. likelihood that the trend will become a reality) and **relevance** (the importance of the trend for the city's development) of each of the main trends among the task force. The

#### Step 3. DIAGNOSE Strategic City Diagnosis and visioning taskforces set-up

##### Taskforce set-up for Diagnosis (Step 3) & Vision (Step 4)

- **Key stakeholders** involved and aligned with the *LP towards SZCC (step 1)*.
- **Thematic working groups.** Input for **Steps 3, 4 and 5**.

##### Workshop set-up (Step 4)

- Probability and relevance of **critical topics**
- Input for scenarios generation

##### Strategic City Diagnosis development

- **SWOT analysis**
- **City-trends analysis** (DELPHI, brainstorm, value trees, etc.)
- **Connection to national and international targets, policies & institutions**

Stakeholders to be potentially involved in working groups:

- ✓ Municipality technicians
- ✓ Politicians
- ✓ Industry leaders
- ✓ Research experts (university, research centres, innovative industry)
- ✓ Land owners & other promoters
- ✓ Citizens' associations
- ✓ Consultants
- ✓ Product developers
- ✓ Suppliers

logic is that the highly relevant, but uncertain drivers of change should lead to defining the main strategic actions to be taken.

In 2016, the Institute of Baltic Studies conducted a **survey** among SmartEnCity partners to **identify the most uncertain and relevant smart city trends** across the partner cities. As an example, answers included aspects like “cities will become active players in their local energy markets” and “contrary to developing countries, transport fuel demand in developed countries will drop”.

*“Keep in mind that you are interested in the **“important uncertainties”**. The aspects that are important and likely to occur should be taken into account anyways – but how should you approach the **developments that might or might not become reality?**”*

Merit Tatar, project manager at IBS Institute of Baltic Studies

**Table 2. What elements could be part of a SWOT analysis?**

<b>Strengths</b>	<b>Weaknesses</b>
<ul style="list-style-type: none"> <li>• Strategies location, connections</li> <li>• Administrative capital</li> <li>• Land use dedicated to economic activities</li> <li>• Good level of average income</li> <li>• Diversified economy</li> <li>• City services connected to industry</li> <li>• Increase of population range</li> <li>• Green spaces available (out/in)</li> <li>• Energy politics, plans, local alternatives</li> <li>• Building stock character, compactness, habitability conditions, subsidised housing, municipality support</li> <li>• Urban Mobility culture, infrastructure, assets</li> <li>• ICT infrastructure and services possibilities, platforms existence, IT tools spread</li> <li>• Citizen Engagement will, institutions available, high education, social diversity</li> </ul>	<ul style="list-style-type: none"> <li>• Aging of the population, local conditions inequality among districts</li> <li>• Economic crisis</li> <li>• Strong dependency on imported energy supply, poor take-up of renewable resources</li> <li>• Insufficient energy building retrofitting actions associated to efficiency, energy production, and energy consumptions</li> <li>• Not equilibrated housing demand vs building offer</li> <li>• Urban areas requiring the renovation and modernization</li> </ul>
<b>Opportunities</b>	<b>Threats</b>
<ul style="list-style-type: none"> <li>• Projecting an attractive image of the city and its potential</li> <li>• Sustainable development</li> <li>• Innovation and development of new technologies</li> </ul>	<ul style="list-style-type: none"> <li>• Trend of population loss</li> <li>• Increase of social inequalities among communities</li> <li>• Strong competitiveness of the global market, with advances and modernised industries</li> <li>• Consolidation of long-term unemployed citizens</li> <li>• Loss of green spaces and natural environment</li> <li>• Energy dependency of the city from external sources</li> </ul>

## Lessons learned & tips

- The **foresight approach** applied in SmartEnCity is only one of many possible frameworks. There are many foresight methods that are used for different purposes and contexts. Popper (2008) has even developed a framework for classifying foresight methods and altogether outlines 33 foresight methods!
- The **smart city trends and challenges reflect the opportunities and threats of a SWOT analysis**, but in order to complete the picture, the city should also consider **its own specific strengths and weaknesses** when gathering input for the Strategic Plan (Step 5).
- Note that **opportunities and threats are external** to your activity, i.e. you cannot change them efficiently, and one aspect might be an opportunity and a threat at the same time (e.g.: changes in national/ EU legislation). **Do not mix trends with internal factors** (e.g. strength with an opportunity, weakness with a threat; such as “if we do that, this would be our opportunity; if we do this, this will be our threat”). Opportunities and threats are not direct consequences of your actions but are rather **beyond your control**.
- In SmartEnCity, we suggest using **SWOT analysis as the basis of the scenario-building exercise**. However, there are several other tools that you may also want to use in this exercise, like PESTLE, STEEPV, Porter’s 5 forces, etc. We advise you to use the **PESTLE analysis** as it is a very useful tool that helps to make SWOT more comprehensive, with in-depth analysis of external factors.





#### Step 4. ENVISION. Strategic planning: scenarios generation and preferred vision

Bearing in mind the main inputs from Strategic City Diagnosis (Step 3), key stakeholders will face a **city visioning workshop** with the assistance of a moderator, co-developing an agreed vision for the future of the city. *Where do we want to go?*

As city managers, working groups will **generate different scenarios** for the city, while facing the **formulated strategic question within the agreed timeframe**. *How are we making our city carbon neutral by 2040?* According to the scenarios developed, participants will try to reach consensus **formulating a preferred vision for the city**.

After the workshop, results will be refined and shared with other cities and experts, finally obtaining the agreed city vision and background scenarios for developing a Strategic Plan for the city.

##### Scenarios' workshop: a shared vision towards city decarbonisation

Step 4 directly follows Step 3 (3.DIAGNOSE) and its outputs. The foresight approach will provide valuable input for the Strategic Plan as **it focuses on describing a variety of potential futures with relevant stakeholders, agreeing on a shared vision** and shaping the outcomes in the preferred direction. This is exactly what happens in Step 4.

Step 4 starts by attracting the relevant stakeholders to participate in the scenario building workshop(s). These might include **city planners, politicians, businesses, service providers, academia and community representatives**. Remember that bringing together various stakeholders and guiding their individual choices towards consensus is one of the main benefits and challenges of foresight.

It is advised to organize at least two scenario building workshops for maximizing the impact. During the first workshop, the aim is to **establish scenario logics** – this is a 2x2 matrix of the most impactful but uncertain trends that the participants have agreed on. Work should continue in groups to develop the 3-4 major scenarios that appear in the matrix. The aim of the working group is to **describe a future scenario whereby the city successfully takes advantage of the most important opportunities while avoiding the major threats**. In addition, each group will map the main preconditions that are needed for this scenario to become reality. After presenting the group work results, a general discussion of the **most attractive and realistic scenarios** should end the workshop.

The first workshop should be followed by taskforce members **developing each of the scenarios and elaborating them further**. This might involve additional desk research and expert interviews. The aim of the second stakeholder workshop should be to summarize the elaborated scenarios and to **reach an agreement, a preferred vision**. This can be any of the scenarios or a combination of their elements, a so-called “**master scenario**”. Continue discussing specific priorities and steps that should be taken in order to move towards the preferred scenario. Which present-day decisions should you make to push the outcome into the preferred direction, enhancing the desired future of taking actions to prevent non-

#### Step 4. ENVISION Strategic planning: Scenarios generation and preferred vision

##### Workshop - Visions of the future *Where do we want to go?*

- Establish scenario logics
- **Strategic question & Vision timeframe approach** > *How making our city carbon neutral by 2030?*
- Development within working groups
- **Scenarios' generation**
- Try to reach consensus
- Develop a **preferred vision**

##### Refine results towards strategic planning

- Develop and **refine preferred scenarios**
- Follow-up event with stakeholders
- **Share results with cities, citizens & experts, including feedback. Public discussion**

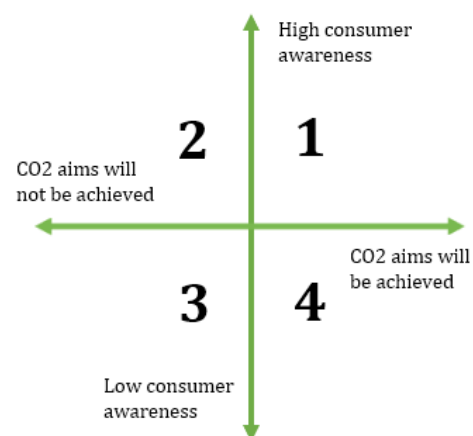


Figure 10. 2x2 matrix in Tartu's scenarios workshop (IBS, 2019)



desirable futures? This is valuable input for starting off the Strategic Plan and Action Plan development process.

Step 4 should be finalized by **sharing the results of the workshops to all the stakeholders and specifying next steps in the Strategic Plan** development process.

#### **Tartu Energy 2030+; A city vision for Tartu**

By January 2019, the city of Tartu (EE) completed Step 4 as part of SmartEnCity project. Tartu organized two scenario building workshops – the first one brought together more than 50 stakeholders and focused on developing four scenarios related to consumer awareness and setting CO<sub>2</sub> goals, and the second one brought together more than 40 stakeholders and focused on deciding on the most desirable scenario, coming up with a vision for the Tartu Energy 2030+ strategy.



**Figure 11. 1st scenario-building workshop in Tartu (IBS, 2018)**

Similar experiences have been developed in the cities of Vitoria-Gasteiz, Sonderborg, Lecce and Asenovgrad, all part of SmartEnCity project.

*“10 years is a short time in the energy sector as the respective investments are already being prepared – this is why it’s crucial to plan ahead and identify our cities’ priorities today”*

**Raimond Tamm, Deputy Mayor of Tartu**

#### **Lessons learned & tips**

- **Organizing at least two scenario building workshops is recommended** to complete Step 4, but other arrangements are possible as well, e.g. organizing one intensive workshop that starts with scenario development and ends with agreeing on the preferred vision and steps to be taken towards that vision.
- When inviting stakeholders to participate in scenario building workshop(s), make sure you get a variety of **insights from various fields of expertise from “big topics” in Integrated Energy Planning** (energy supply & demand, efficiency in buildings, mobility, ICT, community engagement) and from various interest groups.
- As an additional preparatory step, you might want to **validate the findings of Step 3** (i.e. SWOT for your IEP) **among the involved stakeholders**, e.g. by conducting a survey or using the Delphi method for assessing the quality of the listed opportunities and threats, evaluating the probability and relevance/impact of each of the trends. This will provide good input for speculating on the most likely visions of the future in the scenario planning workshop(s).
- At the first workshop, **each group will work with one specific scenario** based on the 2x2 matrix. However, **depending on the group and availability of time**, you may choose the format where all groups discuss all the scenarios and you can later integrate the results. Alternatively, you may choose the format where the whole group discusses the scenarios/ axes together or single participants focus on those axes in the matrix that they have strong opinions about.
- The **key questions** for each group to **describe a scenario** include: *how will developments along the scenario axes influence your city?, what will be the response of your city?, how can developments in energy, mobility & ICT domains help?, what will happen to real income, social cohesion and happiness of citizens in your city?, how does the scenario respond to your main strategic question? (Steps 3/4), is it a scenario that should be prevented or strived for in today’s urban planning?, how can we influence the scenario through city’s IEP?*
- After the workshops, it is important to **keep on engaging the stakeholders. Agree on how to move on, developing the IEP and Action Plan.** *Do you need complementary activities to support the IEP development process? (e.g. more participative planning events, additional surveys or qualitative research to plan actions). What kind of documents will the Strategic Plan and Action Plan be?, how will they fit in with the other urban plans/ strategies? (e.g. is it an updated version of an earlier strategy?), who will be the main stakeholders implementing it?, what will the political commitment to these documents be like?*



## Step 5. PLAN CITY LEVEL. Strategic planning: Strategic Plan & Action Plan

All materials and activities performed in Steps 1 through 4 provide a comprehensive background to develop a **Strategic Plan and an Action Plan** for the city, paving the way towards the city vision goal.

The Strategic Plan of the city will **transform the city vision** (Step 4) **into specific goals**. From those goals, strategic axes and lines will structure the Strategic Plan, which will be further landed into an **Action Plan**. The Action Plan is the document where specific actions and **Key Projects** are identified, appointing stakeholders, budget and timeframe for their development. The desirable implementation timeframe of those Key Projects is five years, when the Action Plan must be updated to readjust the focus to the evolving situation.

For the **identification of Key Projects**, it is important to **involve the thematic working groups** engaged in Steps 3 and 4, as those stakeholders, besides being experts in each field, will be more committed in the future implementation of projects identified.

The development of Key Projects identified starts in **B. DESIGN STAGE**, from Step 7 on.

### Step 5. PLAN Strategic planning: Strategic Plan & Action Plan

#### Develop a **Strategic Plan** (IUP/ sectorial plans -IEP-)

- Bear in mind stakeholders, materials and decisions made in **Steps 1,2,3&4**
- **Vision & overall City Objective. Strategic City Goals**
- **Main Axes & Strategic Lines**
- Main funding sources identification

#### Develop an **Action Plan**

- **Actions & tangible targets**
- Contribution to *Strategic City Goals*
- Roadmap & timeframe (5-year max.)
- Potential **Key Projects identification**, involving working groups (projects' development from **Step 7** on)
- **Indicator System** at city level & Impact Analysis

### A Strategic Plan for Cities Decarbonization. How do we approach it conceptually?

This strategic planning process requires an **integrated planning approach**, where **urban planning and all city systems converge** into one single path. This is what we call an **Integrated Urban Plan (IUP)**, an overarching plan for all sectorial strategies and plans in the city:

"An **Integrated Urban Plan (IUP)** is a **sustainability-smart-focused strategic plan** which integrates the existing **city sectorial strategies, policies and projects** to achieve a lasting improvement in the economic, physical, social and environmental conditions of a city or an area within the city, ensuring the **active participation** of all concerned social groups and stakeholders on a well-coordinated, continuous and balanced manner."

SmartEnCity consortium

This strategic approach is **also valid for other sectorial integrated plans**, when just one city system is at focus, bearing in mind an **effective integration with other city systems**. As an example, in the case of SmartEnCity cities, **the energy sector is at focus**, while considering the **integration with other city systems**: mobility, building stock, ICT, citizen engagement, economy, quality of life, etc. This is what we call an **Integrated Energy Plan (IEP)**, with the city energy system at the core, integrating other key city systems significantly affecting energy and decarbonisation, such as mobility, built environment or citizen engagement (user behaviour).

"Integrated Energy Planning (IEP) is an approach to find **environmentally friendly, institutionally sound, socially acceptable and cost-effective solutions** of the best mix of energy supply and demand options for a **defined area to support long-term regional sustainable development**. It is a **transparent and participatory planning process**, an opportunity for planners to present complex, uncertain issues in structured, holistic and transparent ways, for **interested parties to review, understand and support the planning decisions**. Furthermore, Integrated planning entails **defining the goals and the problems to implement the appropriate solutions**."<sup>16</sup>

Myrakian & De Guio, 2013

### What does a Strategic Plan & Action Plan look like?

The format of a Strategic Plan & Action Plan can be structured under the following contents' breakdown, suitable for such documents (green figure). This is a synthetic example, based on [San Sebastian Smart Plan](#) and [Sonderborg's Roadmap2025](#):

> **City Vision:** Carbon neutrality for 2030, based on economic green growth

> **Strategic Axis 1** (1 out of 3 axes): Sustainable Energy

> **Strategic Line 1.3** (out of 5 lines): Districts with Nearly Zero Consumption

> **Action 1.3.1** (out of 3 main actions): City Diagnosis for vulnerable energy districts identification, promoting the “retrofitting pack” based on local businesses.

> **Key Project from Action 1.3.1:** Integrated retrofitting of 350 dwellings in Old-Town District, including connections to District Heating network.

### Stakeholders engagement, key for an effective future implementation of a Strategic Plan & Action Plan

As mentioned in Step 1 (ENGAGE), the Local Partnership towards the SZCC will drive the Strategic Plan process as well as it will represent and involve the Municipality, as owner; the Industry, as main developer; and the Knowledge Sector, as expert on strategic processes and implemented technologies. In the **Strategic Plan & Action Plan**, it is not enough to just develop relevant contents for the city, but also it is important to **co-create those contents engaging the key city stakeholders, making them aware and committed for an effective implementation** of those contents, as shown in the previous steps (1.ENGAGE; 3.DIAGNOSE; 4.ENVISION): “*The new strategic discourse needs to emphasize the process than the content, the actors more than the structures separating of the planning and operational elements of the process*” (Williams, 2002). An example of this engaging approach is the **Sonderborg Roadmap2025** (IEP, focused on energy), where local stakeholders agreed on 50 projects coming from 8 working groups, each of them contributing to the decarbonisation of the city. The amount of CO<sub>2</sub> emissions reduction was calculated through EnergyPLAN and Energy Balance software tools, contrasting the contribution of each project to the city energy system.

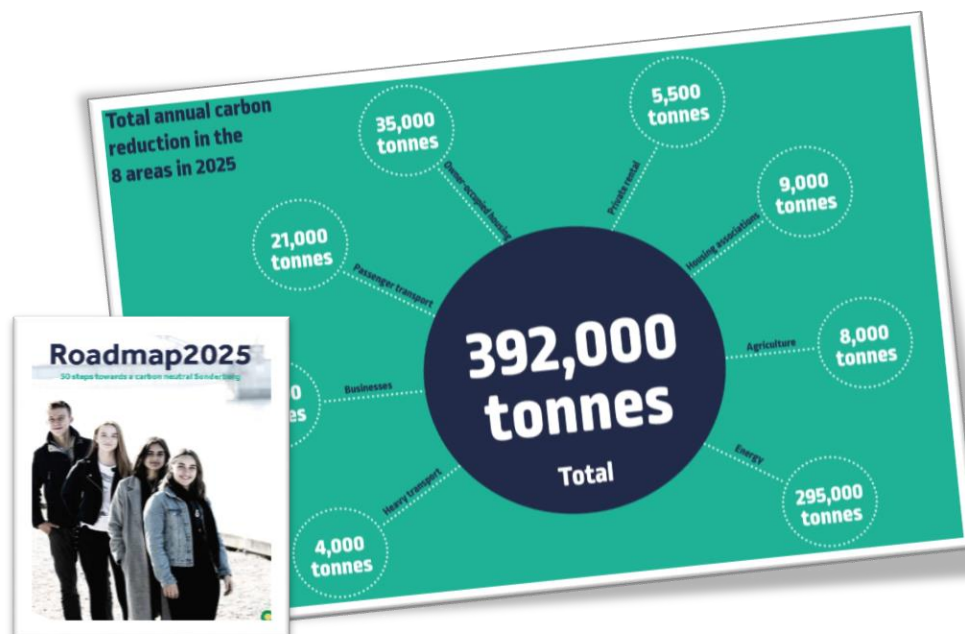


Figure 12. Sonderborg Roadmap 2025 and CO<sub>2</sub> emissions contribution summary

## Tools for scenarios generation & IEP development; better decision-making within city energy planning

“Tools can contribute to a broader scope, more comprehensive assessments, and better legitimacy of the energy planning”<sup>12</sup>. A clear **picture of the local energy system** is key to understand and plan a feasible path to follow towards decarbonisation, **enabling the generation of alternative energy scenarios** for the future. In SmartEnCity project, two tools (energyPLAN and Energy Balance) have been used to calculate and visualise the current status of cities’ energy systems, as well as to forecast the potential effects from the projects proposed by the stakeholder working groups. Using these modelling tools, energy systems can be quantified for different ambitions and timeframes in the IEP process. In this way, both tools supported the basic knowledge for the working groups, identifying **which project proposals were most interesting for cities’ decarbonisation goal**.

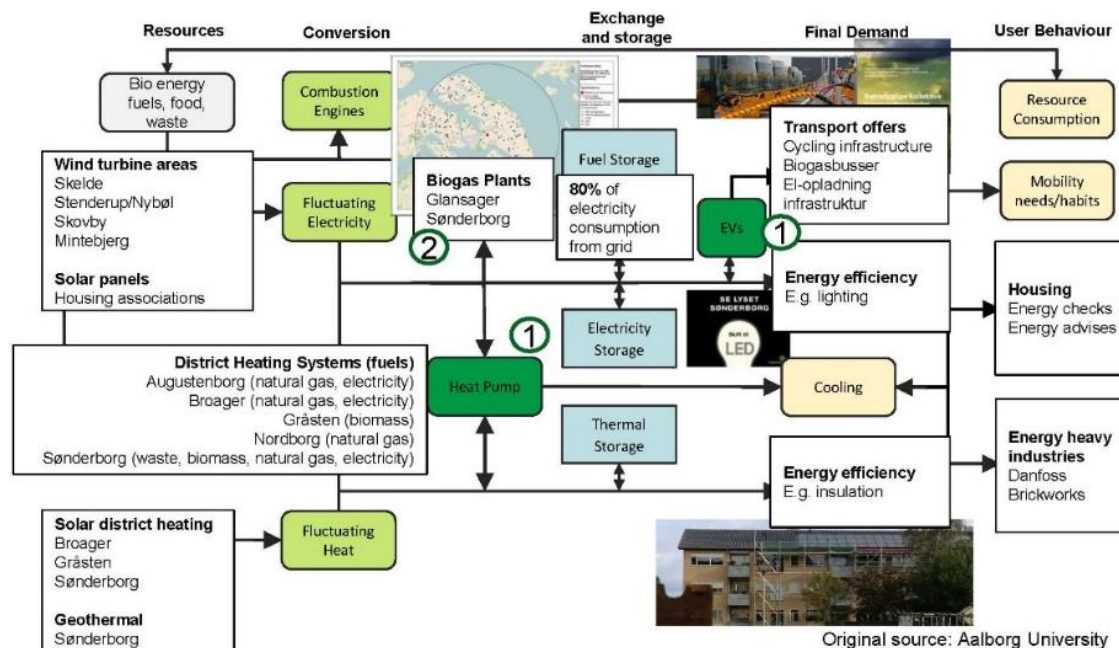


Figure 13. Sønderborg’s Smart Energy System model for IEP process (PlanEnergi and Aalborg University)

## Lessons learned & tips

- The accuracy of the Strategic Plan & Action Plan will depend on the careful analysis and diagnosis (2.ANALYSE; 3.DIAGNOSE) of the city context. The strategies selected should target the city vision (4.ENVISION), considering both the **long-term, medium-term and short-term strategies**.
- The **Communication Strategy** of these activities, intending an effective engagement and avoiding potential barriers, shall be planned and agreed upon the early beginning of the process.
- The Strategic Plan & Action Plan implementation will need to find the appropriate business models, funding & financing mechanisms to deploy the identified actions and projects (8.FRAME).
- It is highly recommended to **implement an Indicator system at city level** to perform an Impact Analysis, both for the Strategic Plan and the Action Plan, to measure the progress of both strategic documents.
- The **LP towards SZCC will have to lead the whole process and collaboration between all stakeholders**, being able to deal with conflicting interests among them.



## Step 6. INTEGRATE. Integration of Strategic Planning into Municipal Planning

The local authority needs to guarantee the legal, administrative and physical **conditions** to deploy the actions and Key Projects identified in the Strategic Plan and its Action Plan (Step 5), **ensuring full-integration** in the municipal planning instruments.

In this regard, it might be advisable to do an **update or modification of the Land-use City Masterplan**, ensuring legal viability and land-use provision for identified actions. Furthermore, a review and **acknowledgement of the Strategic Plan & Action Plan contents** by local legislation and municipal competences is highly recommended, **avoiding foreseen barriers**. This acknowledgement by all municipal departments and strategies will enhance cross-cutting collaboration among disciplines, **fostering synergies and breaking sectorial silos** at the same time.

This Strategic Plan integration process must be **carefully steered by the LP towards the SZCC** (Step 1), ensuring the alignment among existing and foreseen initiatives for a **soft transition**, incorporating **new governance perspectives** and a more **integrated approach** to traditional land-use planning.

### The integration process of Sonderborg Strategic Plan (IEP) in municipal planning

In Sonderborg's case, the IEP process was prepared and organized to **fit into a much broader municipal process of updating the municipal plan** for Sonderborg, which is updated every second year. In Sonderborg, the municipal plan is the formal steering document for politicians and municipal employees, and therefore, there was a natural fit for the outcome of the IEP process – both in terms of diagnosing Sonderborg's energy system and **envisioning realistic plans towards decarbonizing the energy system** – to work as knowledge inputs for administration and politicians, **becoming more integrated in the general urban planning process**. The lack of this kind of integration has been identified as a **key barrier** to overcome when implementing concrete energy-related initiatives in municipalities, mainly concerning budget and urban planning issues.

In this case, ProjectZero (Sonderborg's Local Partnership towards SZCC) **presented to the municipality the 50 Key Projects identified in Roadmap2025**. For two months, the departments of the municipality analysed one-by-one all 50 proposals, studying **how to engage on them or support them from the public administration**. After this integration process, Sonderborg municipality released an **internal booklet** where all these agreements and commitments were stated, becoming a fantastic example of creating a suitable environment for Key Projects to grow from the public administration side.

10 of those 50 project proposals have been summarised in the table below:

### Step 6. INTEGRATE Integration of Strategic Plan & Action Plan into Municipal Planning

**Integrate Strategic Plan & Action Plan contents into Municipal planning and strategies**

- Municipality support for strategies/actions/projects
  - Update/ modification of Land-use City Masterplan
  - Ensure legal viability and land-use provision.
  - Acknowledgement by exiting local legislation, municipal strategies, competences, and departments
  - Breaking sectorial silos, fostering cross-cutting collaboration among municipal departments
- City Government approval, securing commitment

Integration process steered by LP towards SZCC (step 1)



Stakeholder group	Main theme	Project proposal	Project description
Housing Associations	Energy efficiency	Advanced energy data collection	Digital heat control and real time data collection in Housing Association buildings and apartments, allowing a quick response to energy waste or improper use of installations. Management and energy-retrofitting documentation for associations and residents, visualising the benefits. Residents can compare energy consumption of their apartment with the average of the building block.
Agriculture	Energy efficiency	Packaged ventilation systems for farms	Accelerate substitution of old ventilation systems in the farming industry with new more efficient ventilation systems through an approach where old ventilation systems are identified, and partners are grouped to offer more attractive packaged solutions.
Owner-occupied housing	Clean supply	Oil and gas in district heating areas	The project aims to eliminate gas boilers (3700) and oil boilers for heating inside district heating areas of Sonderborg, connecting these buildings to the district heating. Furthermore, district heating supply will be based on biomass, sorted waste, solar thermal energy, geothermal energy and heat pumps.
Owner-occupied housing	Clean supply	Oil and gas outside district heating areas	The goal is to change all oil burners (1850) and 50% of gas boilers (1650) outside district heating areas by heat pumps before 2029. The other 50% of gas boilers will use local biogas.
Passenger transport	Clean supply / Awareness	Electric cars and plug-in hybrids	Increase of electric and plug-in hybrid cars, expanding charging network and offering additional incentives such as free parking, free commuting in the local ferry, and local awareness events (procurement assessment and test of electric cars, in collaboration with local car businesses)
Heavy transport	Clean supply	Infrastructure and alternative fuels	Local businesses with heavy transport needs are grouped and supported in a process for co-funding and investing in adequate strategically located infrastructure in Sonderborg, to make new fuels a realistic alternative to diesel.
Agriculture	Clean supply	Test area - green tractors	The project aims to offer a group of local farmers the possibility to test tractor technologies that use biogas or electricity as fuel instead of diesel.
Energy	Clean supply	Photovoltaic field plants	A total of 100 MW installed photovoltaics by 2025 is the goal of this project. Local stakeholders, businesses and the municipality's proactive planning have ensured the rapid realisation of the project. At the same time, Sonderborg Municipality is in the process of drawing up a municipal plan, designating areas to be used for large solar cells.
Energy	Clean supply	Biogas plants in western Sonderborg and Glansager	Two large biogas plants will be built before 2025 (45 million of m <sup>3</sup> /year). The plants will process manure from local agriculture. The biogas is being upgraded to natural gas quality (biomethane) and is fed into the natural gas network. In the longer term, biogas should be further upgraded with hydrogen, allowing more flexible power consumption and enabling to double total production of biomethane at the plants.
Owner-occupied housing	Awareness	Roadmap for retrofitting costumers	<p>Sonderborg has applied a customer journey approach to strengthen renovation efforts, in close collaboration among the municipality, financial institutions and craftsmen. Local stakeholders have developed ideas to strengthen the process:</p> <ul style="list-style-type: none"> <li>▪ The municipal department will strengthen communication about the need to take energy and climate into account when considering either retrofitting a building or demolishing and rebuilding it. Communication is reinforced by targeted inspirational leaflets.</li> <li>▪ The primary schools' green curriculum will develop a practice track, enabling students to apply their energy and climate skills at home and in their community.</li> <li>▪ All Sonderborg area banks and real estate agents take energy and climate into consideration, giving advice and paying special attention to the right timing of their customers' housing market transactions, or roof/ heating replacements.</li> <li>▪ EUC Syd will target new training programmes for the area's construction and installation companies. The nearly 80 companies that have previously educated themselves as energy consultants form the basis for training, focusing on the strengthened efficiency and business potential through all the steps of the customer journey.</li> <li>▪ ProjectZero will develop badges/stickers for home-owners who have made a special effort.</li> </ul>



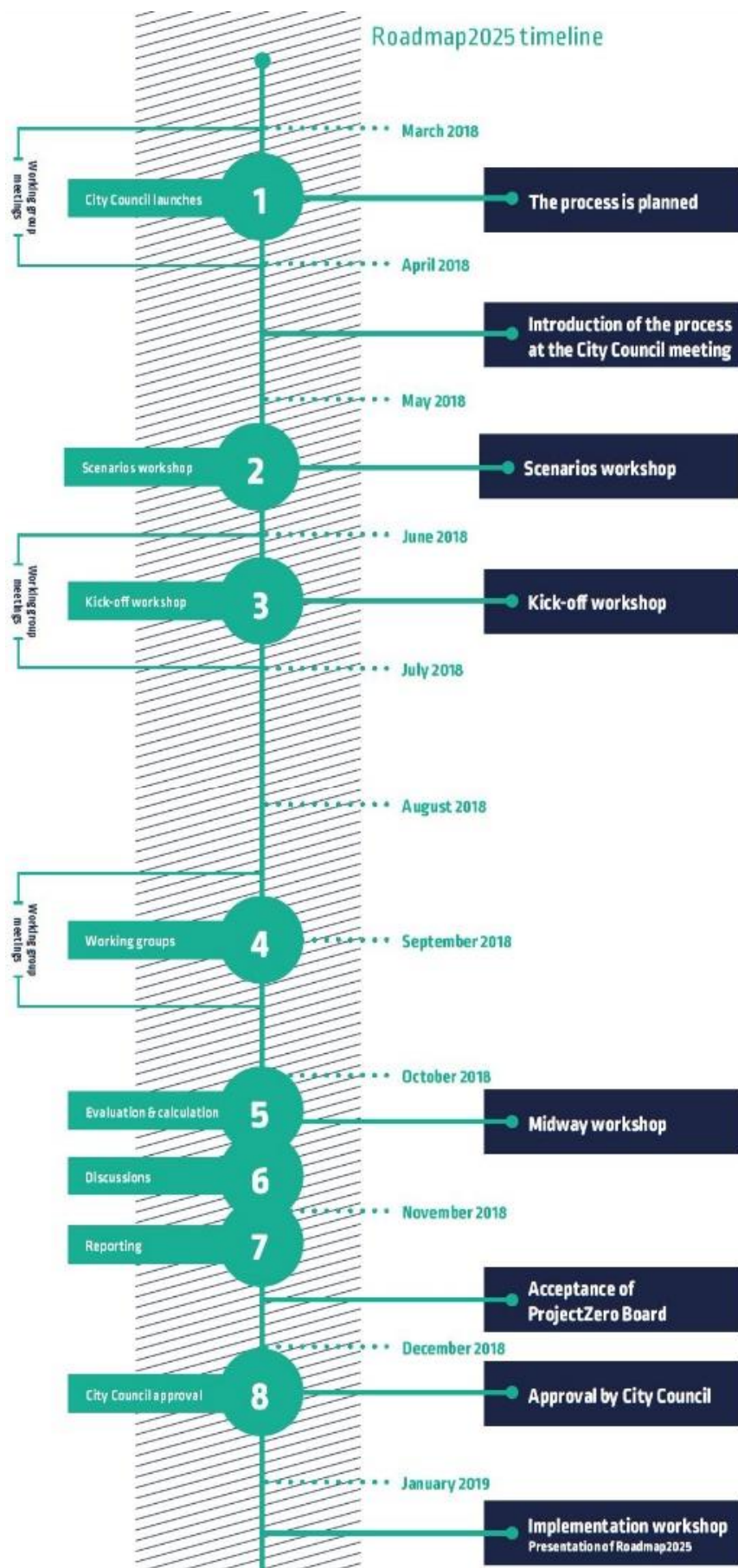


Figure 14. Timeline of Sonderborg's Roadmap 2025 development (ProjectZero, 2019)

## Strategic Stage wrap-up

### A. STRATEGIC STAGE\_CITY LEVEL

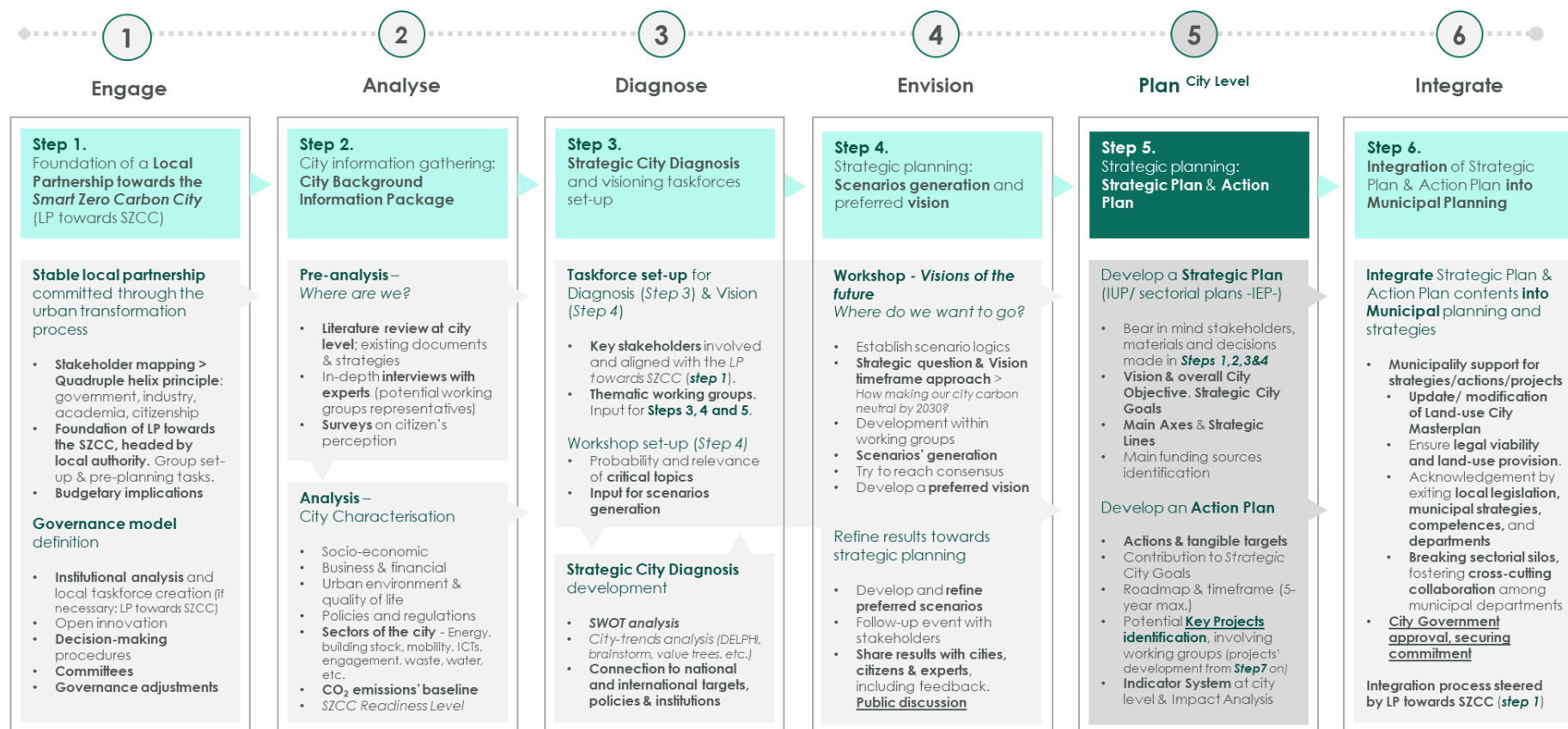


Figure 15. Cities4ZERO. Strategic stage overview (Urrutia, 2019)

## DEVELOPMENT OF KEY PROJECTS

### B. Design stage <sup>PROJECT LEVEL</sup>

The aim of this stage is to take a step beyond the strategic plans of the city (Step 5. PLAN <sup>CITY LEVEL</sup>. Strategic Plan and Action Plan) through the **development of Key Projects identified as enablers for those strategic plans**. This stage (B. Design Stage) will prioritize, frame, carefully co-design and plan those projects, while the last stage (C. Intervention & Assessment Stage) will bring them to reality, monitoring and evaluating their performance and impact for further research and plans. Through the iterative development of all Key Projects identified, the transition towards the SZCC will become a closer reality.

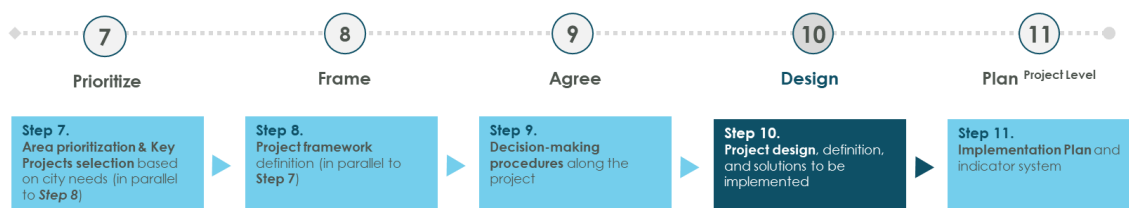


Figure 16. Design stage overview

The framework of this *Design Stage* consists of **five steps** which fall into the specificities of the project level, always bearing in mind all main lines previously agreed upon at city level (A. Strategic Stage). The stage will start with a **prioritization based on city needs**, choosing most relevant projects and city areas (7. PRIORITIZE), defining the objectives and a rough draft for a district integrated intervention. In parallel to Step 7, it is crucial to build a **City Transformation Framework** (8. FRAME), analysing the local environment of implementation regarding the sectors entailed in the intervention, including potential financing mechanisms and business models for all solutions. Once the project is framed, key **agreements** are needed (LP towards the SZCC, industry, academia, citizens) according to our governance model (9. AGREE), to hence carefully **co-design and co-define the project** and all solutions entailed, making use of a suitable *Design Toolbox* (10. DESIGN – **key Step of Stage B**). Finally, in this stage (11. PLAN <sup>PROJECT LEVEL</sup>), the result will be transformed into an **Implementation Plan** which, assisted by an Indicator system, will ensure the effective deployment, quality and evaluation of the project to be implemented in its final stage (C. Intervention & Assessment Stage).



## Step 7. PRIORITIZE. Area prioritization & project selection based on city needs

In this second stage, from those Key Projects identified in the Strategic Plan & Action Plan (Step 5), a **project prioritization will select and combine the most interesting initiatives for the city**, focusing on those city-areas where the benefits of those initiatives will have most impact for the citizens. This prioritization will build upon the Strategic City Diagnosis performed in Steps 2 and 3, using GIS tools for spatial analysis, identifying priority areas and bottlenecks as well as demarking the area of intervention.

In parallel to this step, a **City Transformation Framework** will be developed within Step 8, which will allow a **pre-definition of a district integrated intervention** from the demarked area, defining the overall objectives of the project while choosing the main sectors and elements of the intervention, aligning the project with the city Action Plan. This first level of project definition will help to find financing sources and agreement among all parts at stake (Steps 8 and 9). The project will be fully designed in Step 10, with all stakeholders on board.

In this step, the Local Partnership towards the SZCC will prioritise and define the potential intervention area. In this process, this core group will work as a coordination node among municipal departments, agencies, and external stakeholders to reach a wider consensus on the decisions to be made. For final choices, there will be some key elements to carefully bear in mind:

- Strategic city diagnosis developed from Steps 2 and 3, including a Spatial Analysis based on GIS<sup>6</sup>, targeting vulnerable areas, strategic locations and overall city and districts' needs
- Strategic Plan objectives from Step 5 (city strategy)
- Municipal Planning (urban development plan – acknowledged by Step 6)

For this choice, it is recommended to focus on social, economic or environmental vulnerable urban areas, those that experience a lower quality of life in comparison to other urban areas.

When the intervention area has been demarked and all boundaries are clearly defined, projects and solutions identified in the Action Plan (Step 5) can be prioritised and pre-selected according to the characteristics, needs, challenges and the potential of the selected area. This project prioritization must combine the most promising initiatives for the area, securing the most beneficial impacts for the citizens, in social, economic and environmental terms.

Area and projects' selection would be ideally chosen in a parallel process, feeding one another. Furthermore, analyses on funding/ financing mechanisms and a city transformation framework (Step 8) will support this process.

"This step launches the design phase and must closely rely on the process developed in the strategic stage at city level"

Mikel Cepeda, **Smart & Sustainable Cities expert at LKS Krean**

**Step 7. PRIORITIZE**  
**Area prioritization & Key Projects selection** based on city needs (in parallel to Step 8)

From Strategic City Diagnosis (Steps 2&3) >  
**Area prioritization and selection**  
*Where do we intervene?*

- **Spatial analysis** (GIS)
- Identification of priority areas & bottlenecks
- Demarcation of the area of intervention

**Pre-definition of district integrated intervention – overall approach**

- **General strategy**, aligned with Action Plan (Step 5), **matching city & project levels**
- **Selection of intervention sectors** (Energy, mobility, ICT, etc.) & main elements
- **Project general objectives definition**: Technical, Environmental, Social, Economic

<sup>6</sup> QGIS - A free and open source Geographic Information System: <https://www.qgis.org/en/site/>



Finally, a rough draft for a district integrated intervention project at this stage (pre-definition) will provide a good overview to enrich the following steps (8, 9 and 10), allowing more accurate analyses (funding, regulation, standards, engagement and communication, etc.).

#### **Vitoria-Gasteiz prioritization case: Coronación district**

Coronación district is a north-west district of Vitoria-Gasteiz, built to accommodate mainly immigrants coming to the city during 50s and 60s to work in the industry. Most of **buildings were constructed during 60s and 70s** (85% of dwellings were built before 1970), presenting minor urban changes after that period.

In demographic terms, almost **one third of the residents are more than 65 years old**, whereas in the overall city, that population sector just accounts for 20%. Furthermore, the **foreign population rate** in the district is 16.4%, almost doubling the city rate (8.8%, Vitoria-Gasteiz Municipality). The overall **population loss of the district** added to high percentage of elderly residents implies a steady decrease in the number of residents, accounting in 2016 for 11,924 inhabitants and 6,100 dwellings (*Districts in numbers*<sup>7</sup>, Vitoria-Gasteiz Municipality).



**Figure 17. Vitoria-Gasteiz building stock by year of construction (Tecnalia, 2016)**

According to **Vitoria-Gasteiz's districts analysis**, Coronación is not an attractive neighbourhood for families and businesses. Despite its close location to the city centre, the current **social situation and a degraded building stock**, mostly not renovated, are favouring a decrease in number of residents. In fact, in 2011 Coronación was appointed by the *Diagnosis of retrofitting intervention needs in residential buildings in the Basque Country*<sup>8</sup> as **the district with more intervention needs**. In this study, the most vulnerable districts of Vitoria-Gasteiz were analysed, considering aspects such as **habitability, accessibility, energy efficiency and social values**. Besides building stock issues, the district presents **problems related to the environmental quality of the public space**. According to sustainability indicators developed by the Municipality, ratios of green areas per inhabitant and **number of trees per street slot** are significantly far from minimum recommended values. Due to all these reasons, an **integrated intervention in Coronación district was highly recommended** in order to cope with the identified problems, always from a holistic perspective which bears in mind the urban, social and environmental reality to be faced.

After a thorough **field study**<sup>9</sup> analysis developed by Tecnalia concerning the intervention area, some relevant numbers and conclusions were extracted. In terms of building accessibility, 68% of the buildings have an elevator (vertical accessibility), and 49% of buildings have an accessible entrance (horizontal accessibility). However, just 40% of buildings are completely accessible (both horizontally and vertically). Thus, there is a large number of buildings where a retrofit in the entrance and/or the elevator would imply a significant accessibility improvement. Special mention deserves the fact that five buildings with accessibility problems accommodate more than 50% of elderly residents. Regarding building typologies combined with energy efficiency performance, 51% of the buildings have individual heating, their facades

<sup>7</sup> Vitoria-Gasteiz Municipality website, districts in numbers. <http://www.vitoria-gasteiz.org/>

<sup>8</sup> Tecnalia and Basque Government (2011). *Diagnosis of intervention necessities in the renovation of building stock in the Basque Country Autonomous Community*

<sup>9</sup> Tecnalia (2015). *Coronación field study*.

are double-layer without insulation, and between 50% and 70% of their windows have been replaced. Hence focusing on the energy efficiency perspective, a wide range of buildings present potential retrofitting improvements, especially in the envelope due to their non-insulated facades. Concerning structural security of buildings, most of them are in a good condition; just two buildings are in emergency, and 20 buildings can be slightly improved in structural terms.

As a result of these conclusions, a **proposal of building intervention priority** was developed in order to identify which buildings need a more urgent intervention, considering the building situation and the potential each of them entails (Figure below - red: very high; orange: high; yellow: medium; green: low; white: no data).

This prioritisation concluded that four buildings needed a short-term intervention (3.7% of buildings of the demarked area), and recommended that 44 buildings need to be intervened in a short/medium-term (40% of buildings of the demarked area).

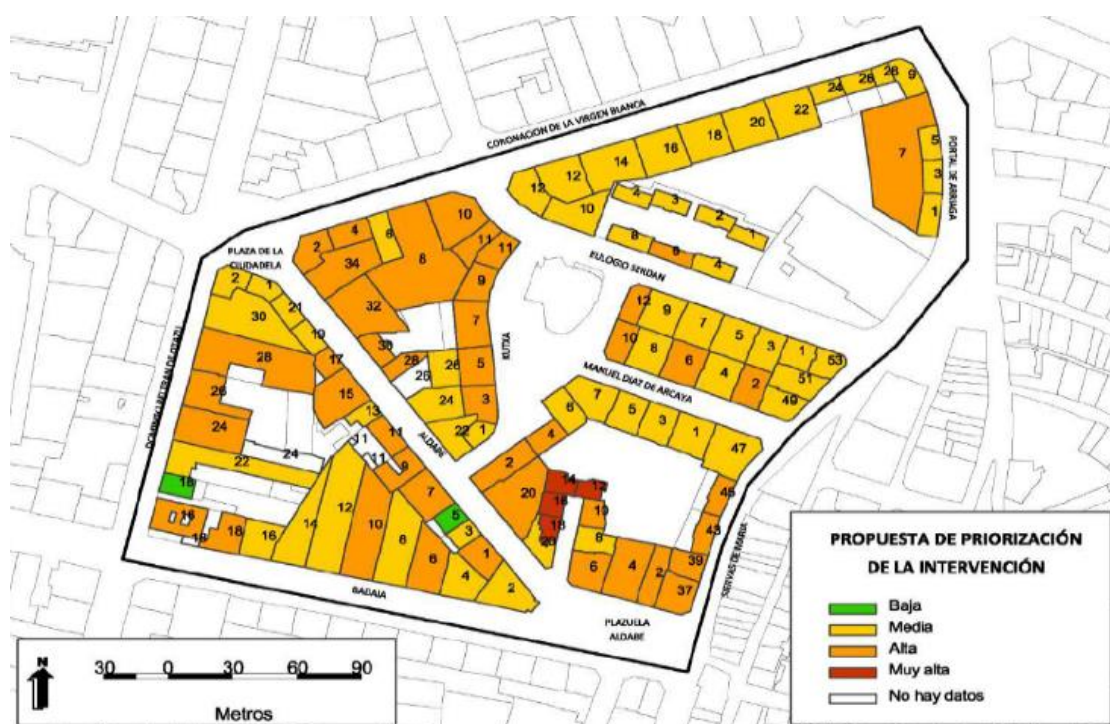


Figure 18. Intervention proposal for Coronación district (Tecnalia, 2016)





## Step 8. FRAME. Project framework definition

The main objective of this step, together with step 7, is to **ensure project viability in institutional, legal and economic terms**, leveraging potential opportunities whilst tackling foreseen barriers in the development process.

In parallel to the pre-definition of the project in Step 7, Step 8 will support the process with the development of a **City Transformation Framework**. This framework will consist of a deep analysis on local plans, policies, regulations, standards, barriers, good practices and potential risks regarding **city transformation processes and the city sectors entailed in the future intervention**. This analysis will allow the identification of synergies, boundaries and barriers for the selected interventions in the project.

As part of the City Transformation Framework, potential **funding and financing mechanisms** will explore how to cope with the required investments of the project. With that purpose, an overall budget will be estimated, fostering **public-private** partnerships and sources (European, national, regional, local, multilateral, NGOs, etc.). In this line, **business models** will be drafted for each solution to be implemented, fostering the economic sustainability of the overall intervention.

### Step 8. FRAME Project framework definition (in parallel to Step 7)

#### Funding & Financing mechanisms *How do we pay all this?*

- Public (EU, national, regional, local) & Private sources.
- **Public-private partnerships**
- General budget

#### Business models of all solutions

- To be fine-tuned in [Step 10](#)

#### City Transformation Framework

Deep analysis on **policies, plans, regulations, standards, barriers, good practices and risks regarding city transformation processes and the city sectors entailed**

- Identification of **synergies, boundaries and barriers** for selected interventions

### Financial mechanisms, a shared commitment

The economic viability of the whole intervention and of each of the solutions to be implemented needs to be carefully addressed. In this case, the municipal budget must show commitment with the interventions, being an enabler to engage other financial resources which may support the interventions. First, it is important to involve the municipal agencies/ departments with expertise connected to the interventions. Secondly, the process must be somehow appealing for private companies, NGOs, research institutions; they can get an active role in co-financing and co-developing solutions, fostering public-private partnerships. This multi-stakeholder approach will be attractive to apply for funding to regional, national, European, multilateral schemes; funding opportunities which must be definitely explored.

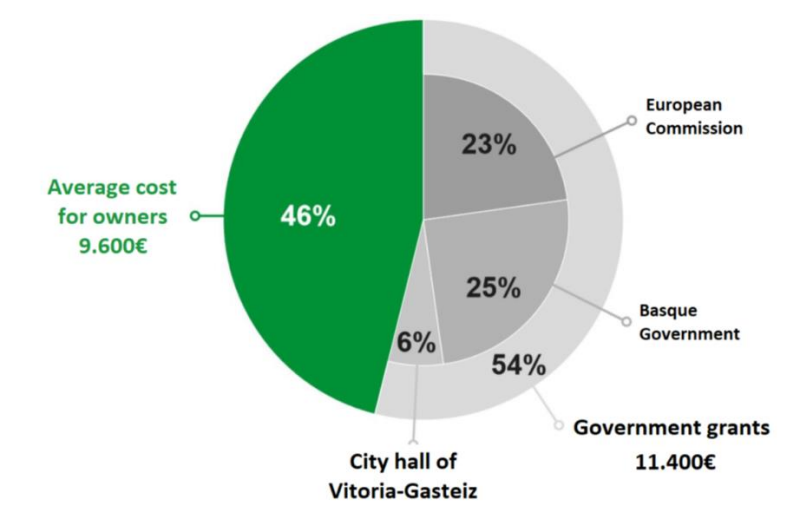


Figure 19. Financing opportunities from European Commission (Murguiondo, 2019)

### **Financing energy-retrofitting in fragmented property schemes: the case of Vitoria-Gasteiz**

Financing energy-retrofitting in Coronación district (Vitoria-Gasteiz, Spain) has been a big challenge, due to a high-fragmented property scheme in a vulnerable socio-economic area. The lack of owners' resources added to the difficulties of agreement when each owner has a say (and a vote!) it is a stumbling block in energy-retrofitting operations in some European countries.

In the case of Coronación, a multi-financing approach and a well-meditated engaging campaign were key to success. Here, the municipality, the Basque Government and the European Commission joined forces with partial subsidies, so the owners had to pay only 46% of total retrofitting costs. Furthermore, the financing local entities agreed on a procedure that allowed to receive the subsidies directly from the public administration, so housing owners didn't have to put 100% of the money in advance, but just the 46% they were finally paying. Finally, an agreement between the municipality, the Basque Government and Visesa (public promoter of the operation) created the Guarantee Fund, an ad-hoc financial instrument for those social sectors with insufficient economic capacity.



**Figure 20. Financing mix for energy-retrofitting and district heating connection in Vitoria-Gasteiz (Visesa)**

### **Framework, because city context matters!**

Besides the economic requirements, the City Transformation Framework must analyse the local environment, with a deep analysis on local plans, policies, regulations, standards, barriers, good practices and potential risks entailed to the intervention to be developed. With this purpose, this task will build upon the City Background Information Package developed in Step 2 (Analyse) at city level, delving now into the specificities of the intervention area and its solutions.

This framework will show the main gaps and strengths of a city's plans, still in time to design according to them.

"Project framework definition sets the basis for the project success in terms of institutional, legal, and economic viability"

Mikel Cepeda, **Smart & Sustainable Cities expert at LKS Krea**



## Step 9. AGREE. Decision-making procedures along the project

The success of planned interventions will depend very much on the level of agreement achieved among all parts at stake in the city (and district). That's why it is important to **carefully engage all key stakeholders to ensure their alignment** during and after the project.

The city governance model already defined in Step 1 will now be transferred into the project level, defining **decision-making procedures** along all steps of the project. An **Integrated Management Plan** will be accordingly defined, including decision-making roles for all stakeholders:

- Strategic, tactical: *LP towards the SZCC*,
- Operational: Technical committee (with main experts, including industry and academia),
- Collaborative: Citizens committee, representing their interests and insights.

Special attention must be paid to an effective **Citizen Engagement Strategy**, defining a model able to incorporate an interesting and well-communicated value proposition for the citizens, allowing social innovation practices and collaborative approaches.

### Step 9. AGREE Decision-making procedures along the project

#### Integrated Management Plan according to the Govern. Model (Step 1) including:

- **Local partnership towards the SZCC** (strategic)
- **Technical committee** (operational, including industry & academia)
- **Citizens committee** (collaborative)

#### Citizen Engagement Strategy (CES) model: concept, prototype & construction

- **Social Innovation Model**
- **Public Participation Spectrum**
- Governance, purpose, key stakeholders & roles, value proposition, segments & target groups, communication, spaces & feedback

"There is no unique recipe to develop a citizen engagement strategy; the design process must be adapted to each local reality. It is about developing proposals following the required project specifications, while creating tangible touch-points which can be reshaped by the citizens".

Eukene Barrenetxea, **Engagement expert at H-Enea Living Lab**

### The Engagement process in SmartEnCity: the CES Model

The SmartEnCity engagement team developed a qualitative research in the three Lighthouse Cities Vitoria-Gasteiz, Tartu, and Sonderborg, obtaining a descriptive tool called **Citizen Engagement Strategy Model (CES Model)**. The purpose of this tool is to grasp all required conditions for an effective local engagement, which is based on the definition of nine main areas within a local context:

- 1) **Governance: WHO** are the key decision makers for strategies and implementations in the local context?
- 2) **Purpose: WHY** implement a Citizen Engagement Strategy in your city? What are the goals of the project?
- 3) **Key Actors and Roles: WITH WHOM** are you designing and implementing the engagement of citizens into the process?
- 4) **Value Proposition: WHAT** are the benefits for people attending an educative program or purchasing a specific product or service from a vendor? The value proposition will depend on local cultural conditions regarding sustainability and smart technologies. The process of developing the value proposition will cross different stages. This initial phase is good to attract lead users which may then lead to a domino effect.
- 5) **Segments and Target Groups: TO WHOM** are you delivering the activities? Identify and classify which groups and segments are targeted by each activity.
- 6) **Communication: WHICH COMMUNICATION** activities, materials and channels are you using to engage and reach out to citizens?

7) **Spaces: WHERE?** Real and virtual spaces where interactions with the citizens can happen.

8) **Feedback: HOW** are you reshaping and adjusting the value proposition, in connection to the desired results?

9) **Citizen Engagement Strategies definition: HOW are you connecting the nine elements to achieve your goals?** Here, all nine key points converge into one strategy. There is no unique recipe to develop a strategy; the design must be adapted to each reality. It is important to understand the initial conditions of the city and each specific area. In all cases, the information delivery to the target groups should be constant and coherent. A dedicated communication and engagement working group should be created for that aim. Citizen engagement in demonstration projects has a distinctive characteristic: the proposals must be defined as much as possible in the different value proposal development stages (concept, prototype and product). It is not about generating expectations. It is about conceptualizing and developing proposals following project specifications and creating tangible touch-points, which can be reshaped by the citizens along the way.

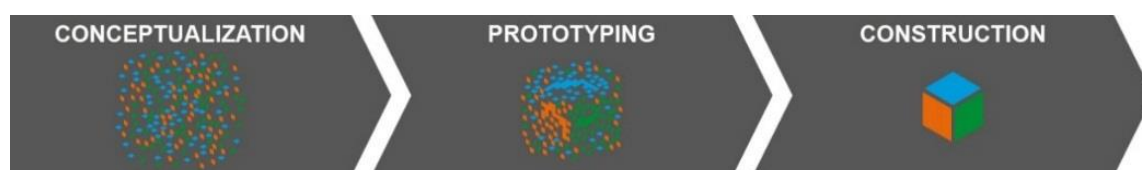


Figure 21. Development stages of a Citizen Engagement Strategy (H-ENEA, 2017)


INCREASING IMPACT ON THE DECISION 					
	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision. We will seek your feedback on drafts and proposals.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will work together with you to formulate solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

Figure 22. Public Participation Spectrum: the role of public authorities (IAP2, 2014)



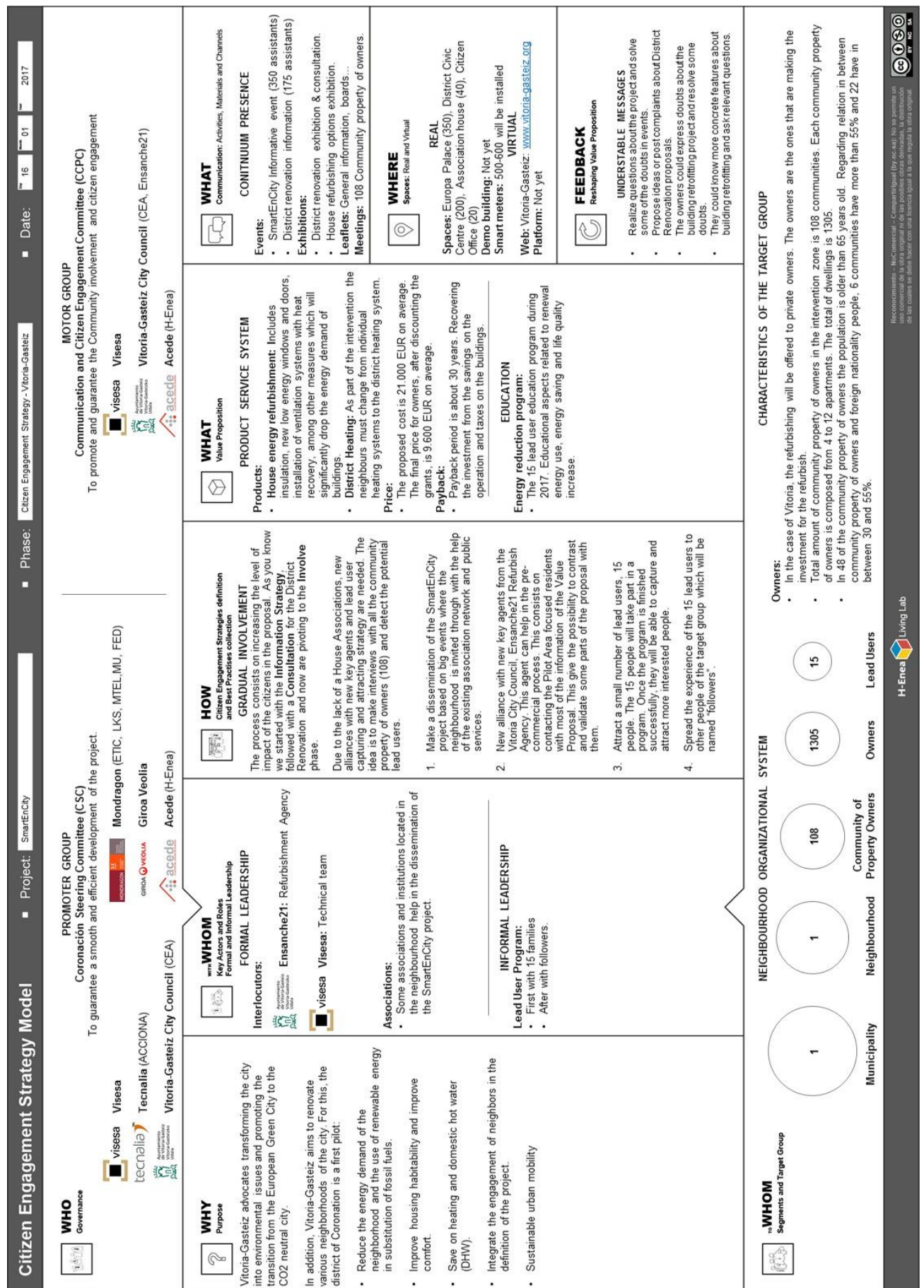


Figure 23. Citizen Engagement Strategy applied in integrated intervention in Vitoria-Gasteiz (H-ENEA 2017)





## Step 10. DESIGN. Project design, definition and solutions to be implemented

Once the project and the city-area have been selected (Step 7), financing requirements have been met (Step 8), and consensus about the integrated intervention is as wide as possible among all parts at stake (Step 9), it is time to **carefully co-define and co-design project solutions** to be finally implemented. This process will be built upon the pre-definition of the interventions developed in Step 7.

Firstly (A), **the optimal solutions and technologies** must be selected for each sector of the district integrated intervention. As an inspiration, EU Commission funded projects (SCC-1 *Smart Cities & Communities*) have been developing more than 500 innovative city solutions in 93 European cities since 2014, all gathered and sustained in the EU Smart Cities Information System (<https://smartcities-infosystem.eu/>).

Secondly (B), the intervention area will probably require a public space reconfiguration through a **detailed project definition**. A design team will include experts on the fields regarding solutions to be implemented, fostering collaborative design while defining the project. This project will fulfil all requirements of the Integrated Management Plan developed in Step 9.

**Step 10. DESIGN**  
Project design, definition, and solutions to be implemented

**Optimal technology & solutions selection** for each sector in the district

- SCC1 projects & solutions' portfolio: Energy, building stock, mobility, ICT, engagement, waste, water (...)

**Intervention area design & project definition**  
Positive Energy Districts

- Design team of **experts according to solutions to be implemented**
- **Collaborative design**
- Accurate budget
- Tendering & bidding

### DESIGN TOOLBOX

Integration of GIS, BIM, CityGML and system-illustrative tools. Simulation models. Digital twins (in building & city operations)

Both definition processes, (A) and (B), should be supported by the **Positive Energy District's concept** and a comprehensive **design toolbox** able to integrate GIS, BIM, system-illustrative tools and simulation models. These tools will significantly optimize the effectiveness of interventions as well as maintenance, operation and monitoring of all solutions during their lifespan (e.g.: models, building & city digital twins).

Project design and solutions from this step will define key issues related to Step 11 (implementation plan) and Step 12 (intervention works and solutions deployment).

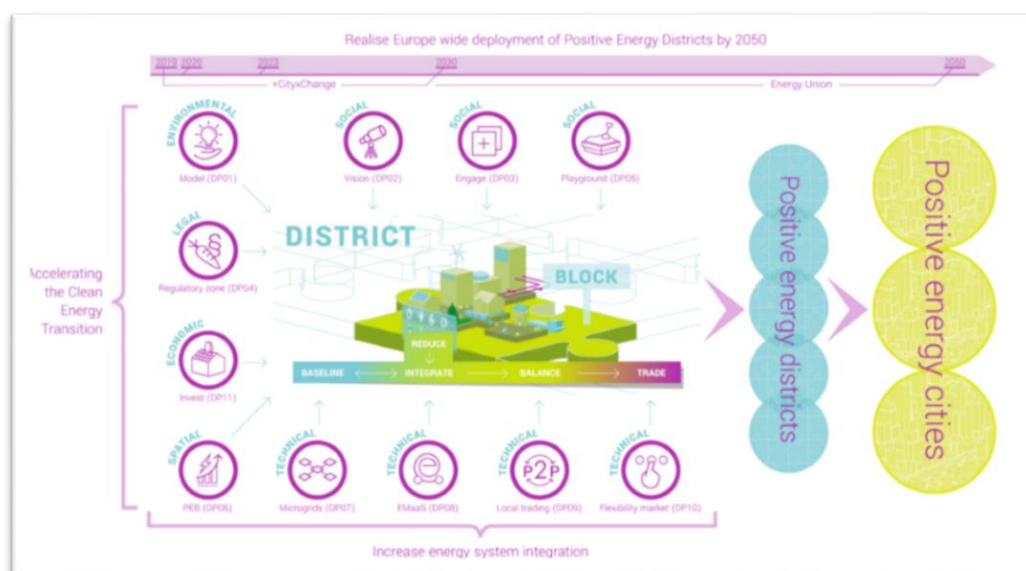


Figure 24. Positive Energy Districts Vision, accelerating Clean Energy Transition by 2050 (+CityxChange, 2018)

### Positive Energy Districts working definition

“Positive Energy Districts (PED) are mixed-use energy-efficient districts that have net zero carbon dioxide (CO<sub>2</sub>) emissions and actively manage an annual local surplus production of renewable energy (RES). They require interaction and integration between buildings, the users and the regional energy, mobility and ICT systems, while ensuring social, economic and environmental sustainability for current and future generations”

Annemie Wyckmans, **Programme Coordinator of EERA JP Smart Cities**

Key points to solve in Project design and solutions’ selection process:

- **Project requirements:** Which are the needs to be solved, the objectives to be reached and the performance to be achieved.
- **Program definition:** Which will be the building/infrastructure/public space contents and functions.
- **Alternatives definition:** Optimal solutions and technologies definition among existing ones, selection based on a multicriteria analysis including cost, effectiveness and impact, time and technical viability criteria.
- **Design team:** Ideally through municipal coordination, citizens and civil organizations’ input, and supported by a multidisciplinary technical team including all capacities required. Bio-climatic design skills should be considered for urban and building design, besides all knowledge entailed to active measures and Renewable Energy Sources.
- **Detailed project design:** Complete detailed definition for project deployment.

“Project definition must consider whole institutional and social context in order to guarantee the best choice on technical and non-technical solutions to be managed in intervention and assessment stages”

Mikel Cepeda, **Smart & Sustainable Cities expert at LKS Krean**

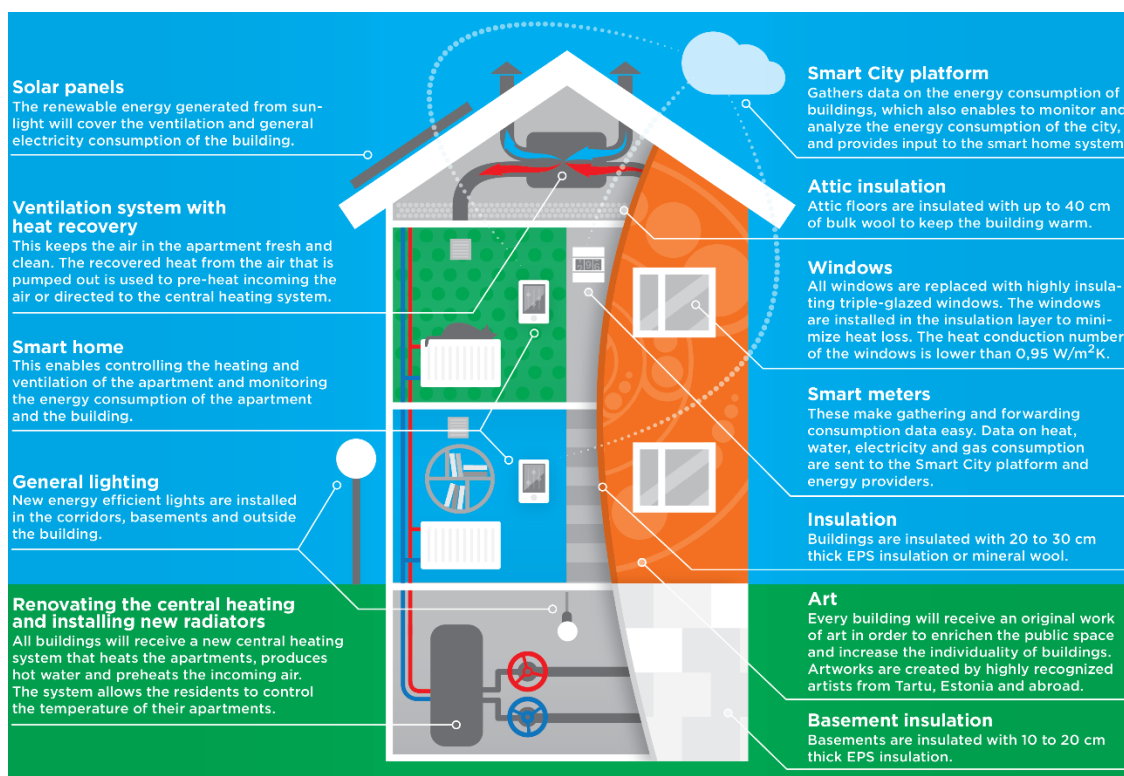


Figure 25. Retrofitting in Tartu Lighthouse project (Tartu SmartEnCity consortium, 2019)

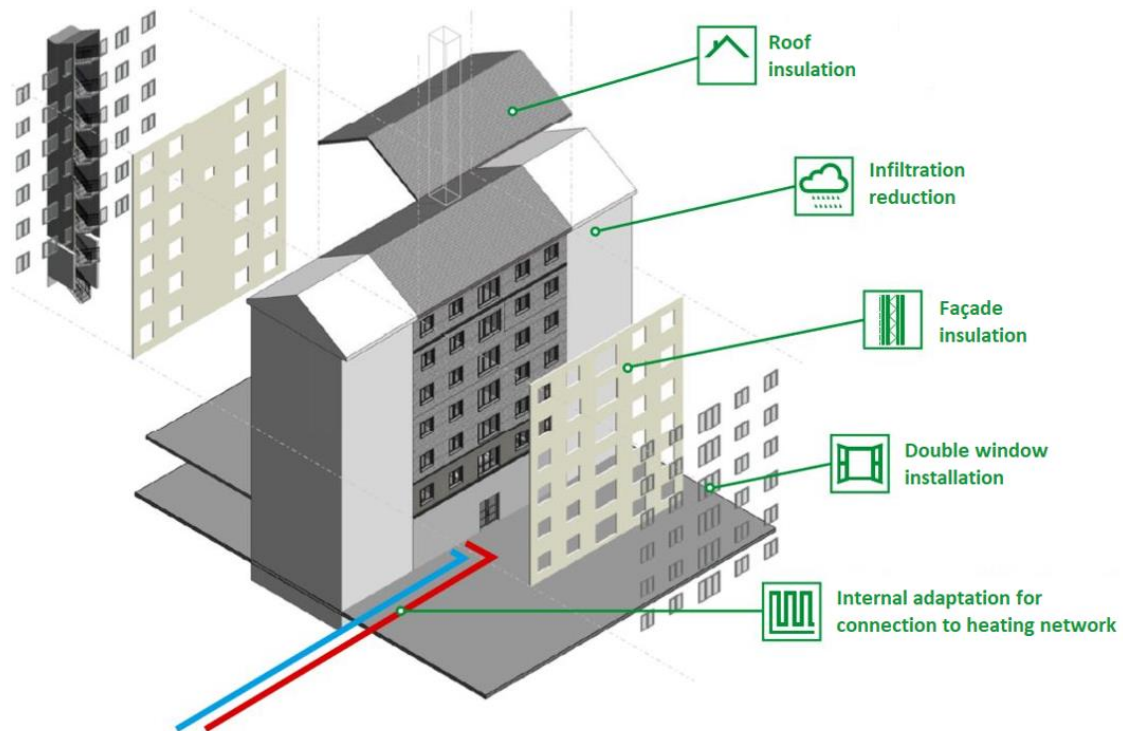


Figure 26. Retrofitting and District Heating connection in Vitoria-Gasteiz Lighthouse project (Visesa)

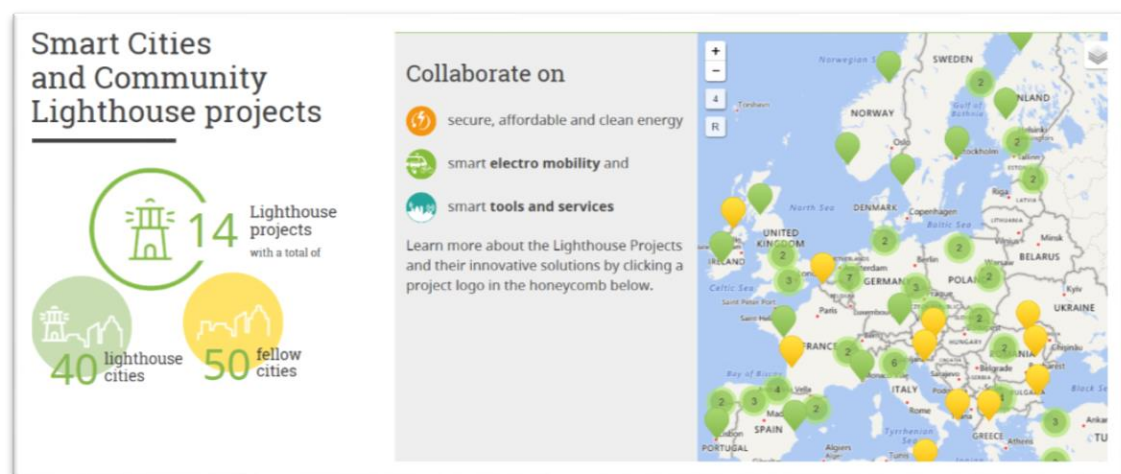


Figure 27. SCC Lighthouse projects. SCIS website (2019)



## Step 11. PLAN PROJECT LEVEL. Implementation Plan and indicator system

The project design developed in Step 10 will be included in an **Implementation Plan**, which will provide measures to control the outcome and development of interventions, such as a quality management plan, a risk management plan, a description of the sequence of activities, and an execution plan for all solutions.

Concerning procurement and contracting, both local and national contexts of each city will have specificities that need to be met. In some cases, **Public Procurement for Innovation (PPI)** processes can be helpful as some problems might need deeper reflections, avoiding straight forward solutions that may not meet the expectations for the problem at focus.

As aforementioned in Step 5 for the city level, it is recommendable to implement an **Indicator system at project level**, with an evaluation plan, a data collection plan and a monitoring program (Step 13), defining a baseline for the interventions and the expected performance of those, hence being possible to assess the results after processing all the data (Step 14). All that data will be also valuable in case the city develops a **City Information Open Platform (CIOP)** to analyse and visualise all the data for better decision-making. This on-line platform can also improve transparency with citizens, setting different levels of access depending on the user (decision-maker/ technician/ citizen).

### Step 11. PLAN Implementation Plan and indicator system

#### Implementation Plan including all interventions

- Quality management plan
- Risk management plan
- Activities' sequence (GANTT diagram)
- Execution Plan
- Procurement/contracting. **Public Procurement of Innovation (PPI)**

#### Indicator system definition at project level

- Evaluation plan
- Data collection plan and procedures
- Monitoring program
- City Information Open Platform (CIOP) architecture definition
- **Baseline definition**
- Expected performance

#### What is Public procurement for innovation (PPI)?

"PPI is a demand side innovation **policy instrument**. It occurs when a public organisation places an order for the fulfilment of certain functions or needs which cannot be met at that moment or within a reasonable period of time through a new or improved product" (Edquist et al, 2015).

The public administration can express its needs, which **are not met by market solutions**, through specific performance requirements to be met by the innovative solutions, by means of **improved products/ services or co-developed solutions** overcoming the existing ones in the market.

The regulatory framework for PPI is described by **Directive 2014/24/EU**, where the innovation legal concept and its characteristics are incorporated.

### Stakeholders in Implementation Plans

The process of generating Implementation Plans comprises a high variety of experts on the different fields, besides a coordination node at city level to guarantee harmonized operations. This same can apply when speaking about the definition of adequate indicator systems. Those experts can be technicians from the municipal agencies or departments in charge of the specific interventions or they can be external experts from companies or R&D centres or agencies to cover the needed knowledge depending on the field applied to the interventions (energy, transport or mobility, LCA, etc.).

Multiple stakeholders interact in this step. It is thus possible that difficulties will be encountered in some cases for the correct generation of the plan, since many different scopes must be taken into account. Furthermore, the economic aspect must be kept in mind to assure the total budget of the interventions is maintained. The better the planning and preparation, the less likely it will be to diverge from schedule, encountering unexpected problems.

### Preparations for an effective project evaluation

The quality management that will be followed to assess the results complies with the initial objectives marked for this intervention. To do so it is necessary to predefine those performance indicators that will return the measure of change. The calculation of this set of KPIs (Key Performance Indicators) implies in some cases to install monitoring devices, detecting which are needed in advance to include their installation and verification as one more of the subtasks in the schedule, through a specific monitoring plan. In parallel, a plan for data management must also be generated.

The set of KPIs defined for the intervention assessment must be done focusing on the one side on the objectives marked for this intervention and on the other side also on the specificities of this particular intervention. It's not the same to assess mobility actions, district level actions or building renovation actions. For a better comparison and evaluation, a baseline following the characterization done in Step 2 of this strategy is useful to pit this picture against the new situation after the works end.

### Lessons learned & tips from Stage B

- **Engage stakeholders** in the prioritization process, including communities, citizens and local businesses (Steps 7 and 9).
- **Customize the project** to fit the city's/district's particular situation (Steps 7, 9 and 10).
- **Enact policies to give support** and enhance transformation regarding standards and institutional framework towards a greater scaling potential process (Step 8).
- Develop a local business retention policy **taking care of the businesses your city already has**, communicating at the same time that your community is an **attractive place** for businesses to locate (Step 8).
- **Customize solutions** to fit the district/building specific situation (Step 10).
- **Enable monitoring** as well as tracking project deployment performance. Through indicators at district/city scales, you will be able to track to what extent your goals have been achieved (Step 11).
- Bear in mind the **timing for tenders** when generating the plan schedule and its deadlines and milestones. Add the necessary cushion for possible delays in case of appeals (Step 11).
- Establish also **cushion periods in those cases needing negotiations with neighbours** and citizen associations, the longer the more actors are implied (Steps 9 and 11).
- When working on the tendering documents, include all necessary elements by the tenderers, comprising also the monitoring elements and the **future availability of data for assessment** (Step 11).



## Design Stage wrap-up

### B. DESIGN STAGE PROJECT LEVEL

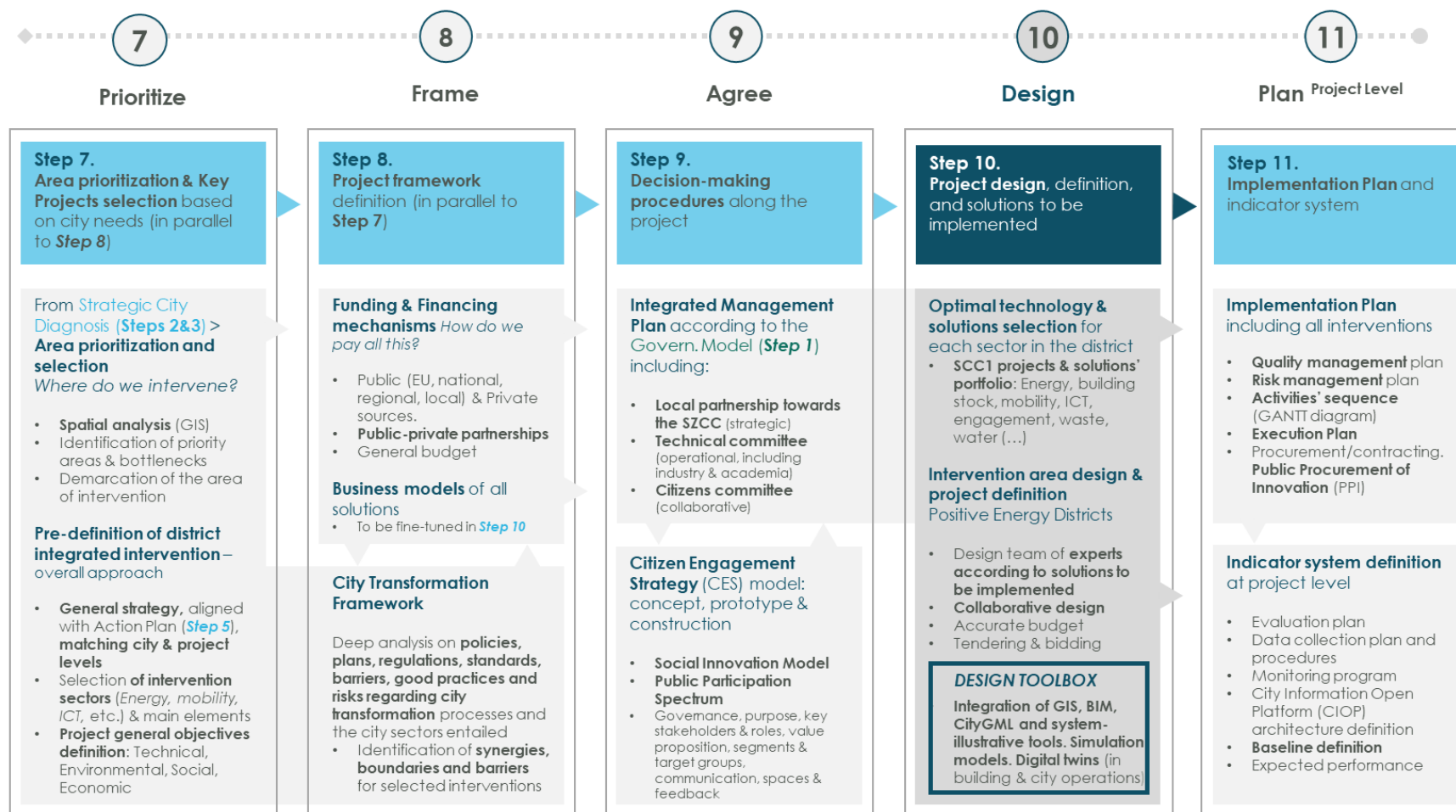


Figure 28. Figure 13. Cities4ZERO. Design stage overview (Urrutia, 2019)

### C. Intervention & assessment stage PROJECT & CITY LEVEL

The last stage of Cities4ZERO (C. Intervention & Assessment Stage) deploys the **integrated interventions**, through the **implementation of Key Projects** previously identified in the first stage (A. Strategic Stage) and designed in the second stage (B. Design Stage).



**Figure 29. Intervention & assessment stage overview**

The *Intervention & Assessment Stage* consists of five final steps focusing on **implementing, assessing and up-scaling the aforementioned solutions**, all of them aligned with the strategic plans of the city (Step 5. PLAN). The first step of this stage **implements all solutions** (12. **INTERVENE – key Step of Stage C**), including construction works. The intervention will leverage potential synergies among sectors and include strong engagement activities, while works are appropriately commissioned by experts. Step 13 will take care of the **operation & in-use period** (13. **ENSURE**), ensuring a healthy lifespan of interventions, mainly through on-going commissioning, monitoring, users' training and community-based initiatives. Once all data and performance results have been collected and analysed, it is time to **assess the project and its impacts** (14. **ASSESS**), according to performance indicators generated in Step 11. All data generated during the project can feed the City Information Open Platform mentioned in Step 11, where the city can perform analyses for better decision-making as well as visualise data to inform the citizens. Step 15 will perform a **project review** (15. **VALIDATE**), checking the fulfilment of the project objectives and asking for feedback to key stakeholders, including citizens & end-users, industry and academia. Through this review and the assessment of Step 14, the steering group (LP towards the SZCC) will be able to **check if the interventions were aligned with the Strategic Plan & Action Plan at city level** (Step 5), and to what extent they have been successful, exploitable or replicable. The final step of this third stage explores the replication potential of the process and implemented SZCC solutions, through local **up-scaling strategies for the city** (16. **UP-SCALE**), considering urban labs for replication and exploitation paths for local partners. The connection to European sources such as the SCC1 solutions portfolio and SCIS (Smart Cities Information System, mentioned in Step 10) will always be helpful for further inspiration.

This methodology will end with a final workshop steered by the local taskforce (LP towards the SZCC), **reflecting on next steps and future interventions**. This workshop ensures the **iteration of the whole process depending on city needs**:

1. If the **Strategic Plan and Action Plan are still considered valid after this process**, and if an update is not yet necessary, **the city can pick and develop new Key Projects** coming back to Step 7 (7. **PRIORITIZE**), selected from the project list published in the **Action Plan** (Step 5).
2. In case the **Strategic Plan and/or Action Plan are considered as partially obsolete**, where an update is appropriate for a better project focus, the city can come back to Step 4 (4. **ENVISION**) and **update its strategic planning process for a reconsidered planning umbrella** (Strategic Plan and Action Plan).

This continuous iteration will readjust the focus of city projects and strategies towards the final SZCC goal.



## Step 12. INTERVENE. Intervention works and solutions deployment

After the strategic planning process and design of interventions, **it's time to act!** Stage 3 starts with the district integrated intervention, entailing **execution works and the implementation of solutions**. Both for design, implementation and assessment stages, [Building Information Modelling \(BIM\)](#) principles are highly recommended, fostering an integrated and effective deployment.

In parallel to intervention works, intensive **engagement and communication activities** are highly recommended, according to the Citizen Engagement Strategy developed in Step 9. This is identified as a key success factor, or even as an enabler, as in some cases projects and solutions might not be feasible without the agreement of potentially affected citizens.

Regarding technical and management issues, implementation will need a **Commissioning Plan and follow-up committees** representing all stakes, to take care of the process. Also, **monitoring equipment** must be installed, to be able to measure performance and hence appropriately assess interventions later on.

### Step 12. INTERVENE Intervention works and solutions deployment

#### Execution works

- **Integrated works intervention**, leveraging potential synergies among city sectors and solutions. **EU guidelines & backup material** on each sector:

Energy	Waste
Mobility	Water
ICTs	(...)
Retrofitting	

- **Engagement & communication activities**
- Follow-up committees
- Commissioning Plan
- Monitoring equipment deployment

The integrated development of the intervention will leverage potential synergies among city sectors and solutions, as well as avoiding potential barriers. As an inspiration, there are **guidelines at European level** on how to develop projects **for different city sectors**:

- Energy – [Hotmaps project/ PlanHeat project](#)
- Retrofitting – [ZenN project - Nearly Zero Energy Neighbourhoods](#)
- Mobility – [SUMP 2.0 guidelines are currently being updated 2019/2020](#)
- ICTs – [Urbana Platforms Management Framework \(EIP\)](#)
- Green Infrastructures – [Oppla – EU Repository of Nature-Based Solutions](#)
- Waste – [UrbanWaste - Urban strategies for Waste Management](#)
- Water – [Urban water atlas for Europe; Urban Water Management](#)
- Citizen Engagement – [MySmartLife – Key stakeholders' engagement in urban transformation](#)
- Integrated development of interventions – SCC1 projects:
  - SmartEnCity <https://smartencity.eu/>
  - GrowSmarter <http://www.grow-smarter.eu/home/>
  - RemoUrban <http://www.remourban.eu/>
  - Triangulum <http://www.triangulum-project.eu/>
  - Replicate <https://replicate-project.eu/>
  - SharingCities <http://www.sharingcities.eu/>
  - SmarterTogether <https://www.smarter-together.eu/>
  - mySMARTLife <https://www.mysmartlife.eu/mysmartlife/>
  - Ruggedised <https://ruggedised.eu/home/>
  - +CityxChange <https://cityxchange.eu/>
  - MakingCity <http://makingcity.eu/>
  - Stardust <http://stardustproject.eu/>
  - MatchUP <http://www.matchup-project.eu/>
  - IRIS <https://www.irissmartcities.eu/>

### Final interventions; where all plans converge

Step 12 deploys the planned interventions based on detailed projects and planning generated in step 11, **implementing the solutions according to the respective schedules and requisites**. Furthermore, it assures the **monitoring equipment is put in place** and data gathering for future evaluation is correctly launched.

This intervention step, where the implementation plans become reality, involves **a large variety of experts and technicians**. Additionally, the **coordination team** at city level will have to guard the correct deployment of the works and the **overall economic control**. At this stage, those experts appointed to follow-up the interventions will also take care of the adequate installation of the monitoring equipment and the data acquisition systems. As in previous Step 11, suitable experts should be selected, internal or external, with the competences to address each action (energy, transport or mobility, LCA, etc.).

**Management** aspects in this step are crucial. **Works must be deployed on time** and they need to comply with the requirements defined in previous steps to achieve the energy and emissions targets. Furthermore, the **schedule and cost aspects must be guarded**. Those are parallel aspects that have mutual implications since delays on some works usually go hand in hand with cost increases.

Furthermore, the **scales** of individual sub-projects must be kept in mind. For example, in the case of building retrofitting actions, there is a big difference whether you are working with a block of buildings or single homes. The more owners (citizens!) are involved, the longer the projects usually take.

Regarding **implementation expertise**, the more prepared and skilled the workers and technicians taking the actions are, the bigger will be the guarantee of attaining the envisaged objectives.

Finally, in the case of **interventions involving citizens** (as homeowners, for example), the execution stage can require an additional initial phase (quite long in some cases) to raise awareness in the neighbourhood, and a second phase for negotiations afterwards.

### Tenders and execution works: a sensitive balance

A challenge with public tenders are the **delays that can appear** due to municipal administrative burden, as the beginning of **works have to wait until permits are obtained**. Also, it must be considered that large-scale building renovation actions can lead to **saturation of the market** of project designers and construction companies, which causes the tendering processes to be deserted or with little competition. It is therefore recommended to execute the tenders in phases, bidding continuously, instead of in large blocks, to avoid a lack of bidders (construction companies), hence provoking delays.

“In the case of building renovation projects, it is important to involve technical experts (ventilation, heating, electricity, etc.) in the early stages of the process to ensure that the right solutions are already in place during the design and planning phase. “

Jaanus Tamm, Tartu Lighthouse intervention manager

### Who is who in this process:

- **Steering local taskforce:** Local Partnership towards the SZCC
- **Project Manager:** Expert on side of industry, complemented by expert on research sector (Research & Technology Centers, Universities, Technology Companies)
- **Design Team:** Architecture firms, Engineering firms, Consultancies, Energy Service Companies (ESCOs), Technology Suppliers, Research & Technology Centers
- **Construction Team:** Construction Companies
- **Implementation Team:** Engineering, Consultancies, Energy Service Companies (ESCOs)
- **Facility Manager:** Engineering, Consultancies, Energy Service Companies
- **Others:** Product Developers, Suppliers



### Step 13. ENSURE. Operation & in-use

Right after interventions are in place, the **operation & in-use** period starts. Here, ensuring a **healthy lifespan of interventions** is the main priority.

An **ongoing commissioning** will determine roles and responsibilities for each intervention. In this task, BIM models (**digital twins**) can significantly improve the **operation & maintenance works**, if we appropriately deploy sensors on buildings, infrastructures, vehicles, etc., as technicians will have a virtual update of all elements, simulating improvements or corrections, and finally implementing them in reality if considered beneficial. Furthermore, **Facilities Management Plans** will provide protocols, key maintenance information and end-user manuals for an effective performance of all buildings and infrastructures deployed.

In this line, the effectiveness of interventions may depend on **end-user behaviour**, which must be tackled by engaging them through **training and communication activities**. Here, community-based initiatives, economic incentives (or disincentives) and regulation modifications considering exemptions, agreements, pricing, etc. can be good tools for a correct use of interventions.

At this step, just right after the interventions, it is important to run **performance tests** and to start the **monitoring** period, which will allow data availability for assessment in Step 14. This will also allow to certify **Quality Assurance** of interventions.

#### Step 13. ENSURE Operation & in-use. Users' behaviour

##### Ensuring a healthy lifespan

- **Operation & maintenance** including **BIM digital twins** for buildings & infrastruct.
- **Ongoing-commissioning.** Roles and responsibilities
- Performance tests
- **Monitoring** period after deployment. Data availability & Quality Assurance
- Facilities management plan

##### Users training and behaviour

- **Users' training,** communication and engagement
- **Economic incentives** and disincentives
- **Regulation:** exemptions, agreements, pricing, etc.

##### Community-based initiatives

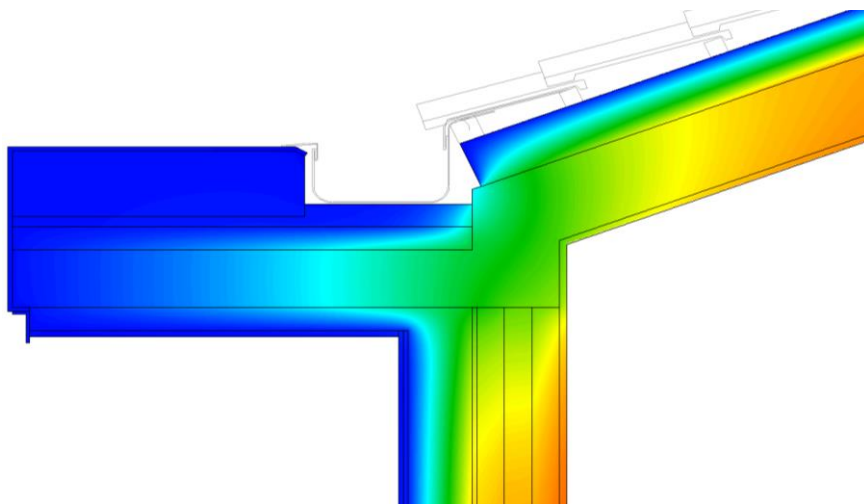


Figure 30. Temperature distribution in thermal modelling. Envelope retrofitting in Vitoria-Gasteiz (Tecnalia)

In this step, it is important to ensure the participation of Key Stakeholders involved in previous phases (10. DESIGN; 11.INTERVENE), or an arrangement of the official transfer of crucial information and knowledge; all coordinated by a local taskforce (LP towards the SZCC). Otherwise, the interventions will have difficulties to perform as they were intended to.

In this line, the Tartu case is presented below, where Smart Home Systems and users' training programs have been the approach selected for a healthy lifespan of retrofitting interventions in the Estonian case.



### Smart Home System trainings in Tartu

One of the additional measures besides fully retrofitting Tartu's pilot area apartment buildings is installing **Smart Home Systems in each of the apartments**. It consists of a gateway, a control panel and various sensors/ meters that all exchange data through cable or radio communication. The Smart Home System will be **connected to the Cumulocity cloud city platform** (Tartu's City Information Open Platform; Step 14), exchanging data between various stakeholders (residents, housing associations, city of Tartu, University of Tartu, Tartu Regional Energy Agency), devices and platforms. These data will be the basis for **empowering the consumers**, leading to better decision-making and more energy-efficient behavior. Good data will also help service providers to make better investments and improvements in their value offers.

The Smart Home solution for the pilot area apartments has been a continuous source of discussion at citizen engagement events and information meetings. **Communicating the solution's requirements, functionalities, risks, benefits and privacy issues to the pilot area residents has thus had key importance**, especially as ca. 20% of these residents are 65+ years old, generally more cautious towards new technologies. Tartu's local website that addresses the project activities (<http://tarktartu.ee/eng/>) has also seen many questions asked about the Smart Home solution in the forum. People's concerns have mostly been related to the process of installing the solution, the functionality of the devices, the associated risks (e.g. electromagnetic radiation rate of the devices) and the related health hazards. In order to assist people in adapting to new technologies in their home better, Tartu city together with its partners from the third sector and Smart Home System provider is planning a series of Smart Home Training sessions for the Tartu pilot area residents. The training program starts after the Smart Home System is fully installed in the first houses and is planned to be held based on demand and continuous discussions with the residents. Currently, the program is in its planning phase and is to be launched at the end of 2019.

### The Smart House Ambassador program; innovative users' training after retrofitting works in Tartu

As part of the **social innovation experiment** developed by the University of Tartu, the Tartu partners launched its Smart House Ambassador program in April 2019. The core idea of the experiment is based on the fact that a city is not only smart because of smart solutions but also through smart citizens, who are aware of the benefits and able to make use of the smart devices. In this context, a special **training program was developed** to encourage pilot area residents to learn from each other. So-called ambassadors were qualified in every pilot area building to advice the residents. The ambassadors were trained to help and support their neighbours in various aspects of smart homes and smart city living.

The program consisted of **five trainings**, each focusing on another important smart living area such as home expenses and how to live in a smart apartment; inside climate, ventilation and environmentally friendly interior design solutions; waste, recycling and sustainability; smart home system and the rights of an apartment owner, and green mobility solutions. The eight Ambassadors were awarded with a diploma and practical prizes at the pilot area summer event on 29 May 2019.

The overall feedback to the Smart House Training program was very positive with all participants regarding the trainings as **"useful" or "very useful"**. Many participants were also interested in follow-up trainings which indicate the importance and usefulness of such initiatives.



Figure 31. Smart House Ambassador training program in Tartu (IBS, 2019)



## Step 14. ASSESS. Project evaluation and impact assessment

Once the monitoring period has ended, all data and performance results are collected and analysed. It's time to **assess the project and its impacts**, according to performance indicators generated in Step 11. As an example, in SmartEnCity project, six categories have been identified to assess the project:

- Energy
- Mobility
- Life Cycle Assessment (LCA)
- ICTs
- Social Acceptance
- Citizen Engagement
- Economic Performance

At this step, it is also possible to perform an **Impact Assessment at city level**, up-scaling and contrasting the results with the indicators generated at city level in Step 5. This analysis at city level will be helpful to monitor the fulfilment of strategic city plans and goals (Step 5), quantifying how the project impacts the city.

All generated data can feed the **City Information Open Platform (CIOP)** mentioned in Step 11, where the city can perform analyses for better decision-making as well as sharing the information with the citizens, through different levels of access to this Platform. Through this new city tool, a **CIOP catalogue of potential services** can explore the applicability of the integrated data.

### Step 14. ASSESS Project evaluation and impact assessment

#### We did well or not? Why?

- **Evaluation** according to overall performance of interventions (**step 11** indicators) >
  - Energy assessment; Mobility; LCA; ICT; Social acceptance; Citizen Engagement; Economic performance
    - **Corrective actions**
- **Impact assessment** at city level (**step 5** indicators)

#### City Information Open Platform

- **CIOP in place** for real-time data availability, **decision-making** and transparency
- Project data integration into CIOP
- CIOP catalogue of potential services

### The assessment processes

At this stage, **all interventions are finished and the data from each of them have been gathered** for a significant time period. Now it is time to find out if the actions have reached the expected results and the project goals in terms of energy performance or emissions savings, to calculate the Life Cycle Assessment and the economic impacts and to evaluate the social acceptance, among other parameters.

The process of generating the **assessment** of the implemented actions needs the involvement of different **experts on the different fields** of evaluation for a correct reporting and comparison. It is useful that, for some calculations, the experts are certified on an evaluation methodology (as the International Performance Measurement and Verification Protocol -IPMVP-, for example) to assure the quality of the work.

This assessment must go back to the set of Performance Indicators (KPIs) already defined in Step 11, and using the data collected on the data gathering period to calculate their values. **These results can support an evaluation report**, focusing on all key aspects, **comparing the KPIs values before and after the intervention**. At city level, we can also make a comparison between the current data and the **indicators at city level** defined in Step 5. This comparison between before and after the interventions (PRE vs. POST interventions) will provide a good evaluation measure. It is important to stress that not all indicators are based on data gathered from equipment, but also from the citizens, tenants and the services' users. Data has been gathered, for example, through surveys and needs to be analysed accordingly.

It is clear that a positive assessment supports the interventions developed, in case they have been correctly finished and good evaluation results obtained. But even if the results are not as expected, a correct assessment is still valuable, as it is the **way to ensure better results in future interventions**. The

main challenge at this step is to have a **complete and good quality** set of data. And this means a lot of work in previous stages.

*"If you cannot measure it, you cannot improve it. This 19<sup>th</sup> century statement from Lord Kelvin remains still in full force today. Knowing what's happening, the energy consumption on each moment and system is key to focus the efforts on those points that can better help on improving the energy efficiency and reach an optimal consumption and afterwards to assess where and why the bigger savings or inefficiencies appear. This knowledge drives to a continuous improvement; but be careful to select the correct instruments and indicators to measure the objectives sought."*

Julia Vicente Gómez, Energy sustainability and Efficiency & Smart cities at CARTIF's Energy Division

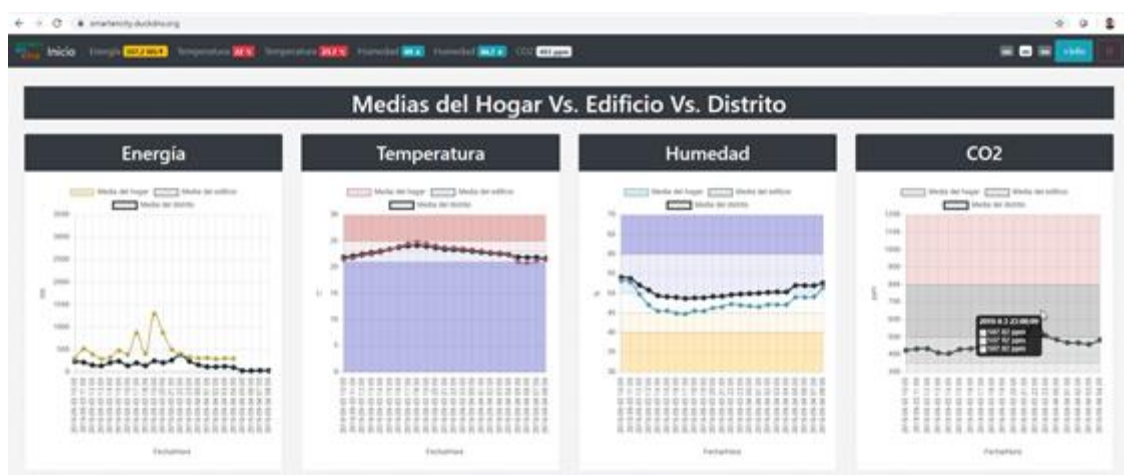


Figure 32. CIOP dashboard comparing dwellings/ building/district energy performances (Mondragón, 2019)

### The City Information Open Platform

The CIOP is an ICT infrastructure that will allow the cities to better manage the services they offer to the citizens. It collects real-time data from the city via sensors and systems, performing continuous data analysis which is crucial for assessment.

In addition to the traditional niche-based assessments, the CIOP will provide the capability to establish cross-sector data evaluations to extract knowledge from the traditional vertical (energy, mobility, traffic, health, waste management, etc.) approach. Furthermore, this tool can be programmed to calculate KPIs from gathered data, supporting the daily work of planners.

The CIOP offers immediate benefits in municipal resource efficiency, improving budget issues and providing environmental benefits. In terms of management, the CIOP offers the city official and up-to-date information to support adequate decisions-making with updated, detailed information. A better relationship with citizens can also be achieved through specific citizen engagement and participatory tools and services.

Both the enabling of participatory governance and the management and interpretation of large amounts of collected data require the development of a robust and scalable ICT infrastructure.

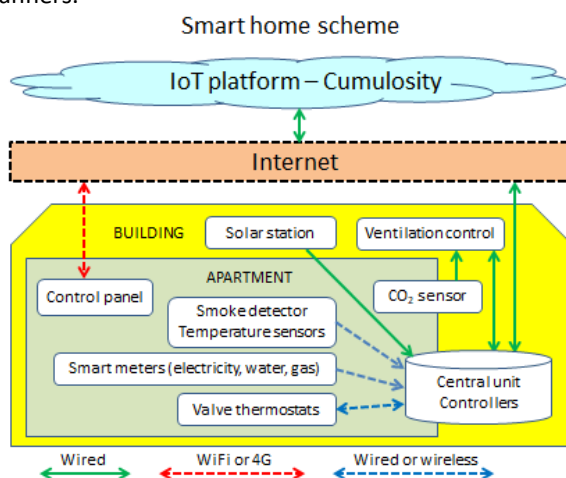


Figure 33. Smart Home Scheme in Tartu Lighthouse project. Connection from building to CIOP "Cumulosity" (Tartu SmartEnCity consortium, 2018)

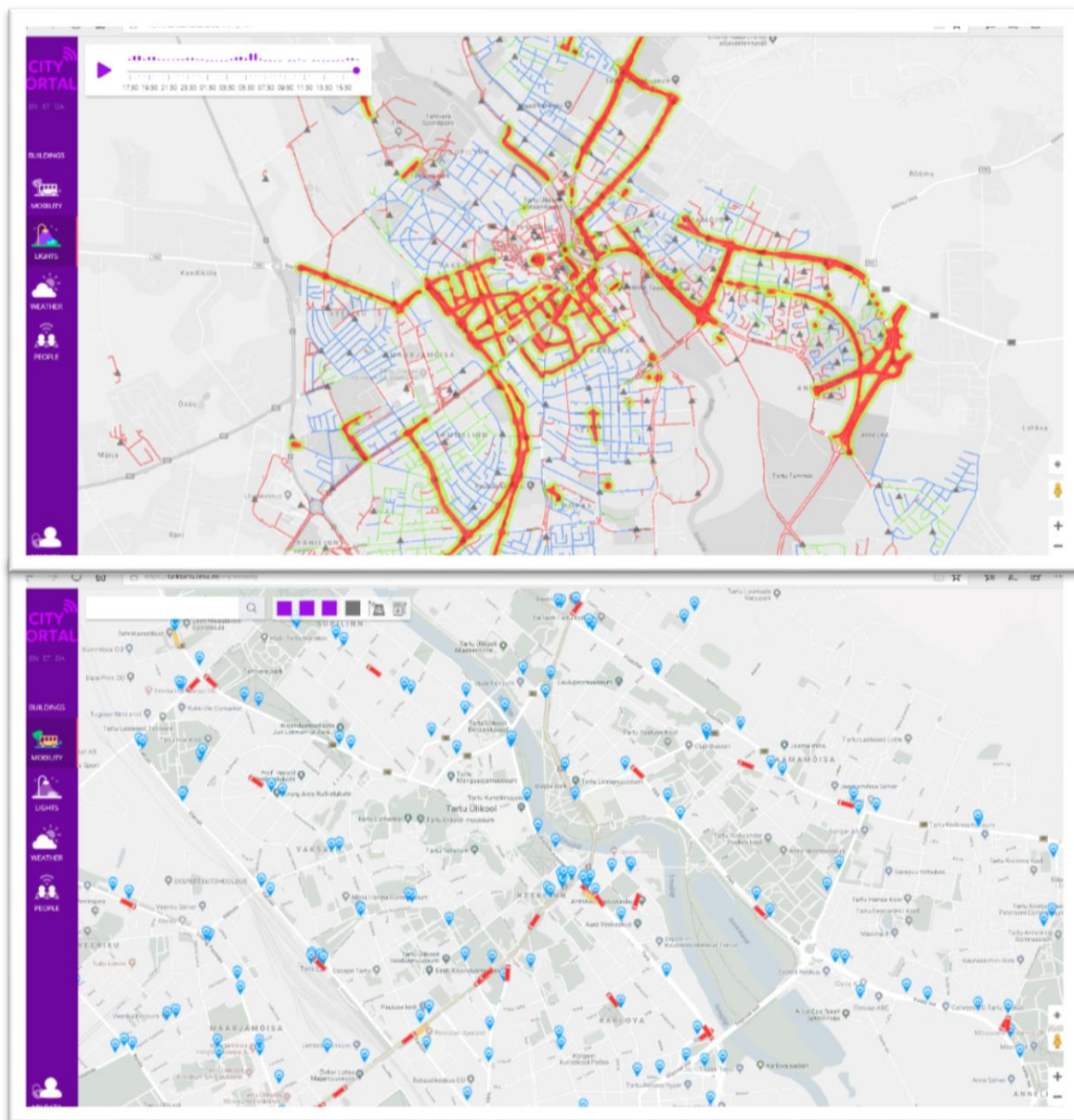


Figure 34. Tartu City Information Open Platform. Real time lighting (A) and mobility (B).  
<https://tarktatu.telia.ee/en/lights>





## Step 15. VALIDATE. Project review; main learnings and reflections

Finally, after assessing and planning a healthy lifespan for interventions, the project has come to its end. It is time to reflect and perform a **project review**. This review will check if the project objectives stated in Steps 7 and 10 have been fulfilled. For instance, SmartEnCity **project objectives** were split into four categories: **Technical, Environmental, Social, and Economic objectives**.

For a comprehensive review, general and specific **feedback from key stakeholders** can reveal critical factors, successful ones as well as barriers. Main groups to be asked are:

- Citizens & end-users
- Practitioners and experts
- City administration
- Market stakeholders
- Academia

With all this information, after assessment on Step 14 and project review, the Local Partnership towards the SZCC will be able to check and **validate if the interventions were aligned with the Strategic Plan & Action Plan at city level** (Step 5), and to what extent they are successful, exploitable or replicable. *What was successful? What might have been done better?* From this reflection, **key barriers, success factors**, regulatory inputs and **potential exploitable results** can be extracted for future projects in the city.

### Step 15. VALIDATE Project review; main learnings and reflections

#### Project review

- **Project objectives** fulfilment (check **Step 7**)
  - Technical
  - Environmental
  - Social
  - Economic
- **General feedback**
  - Citizens & end-users;
  - Practitioners; City
  - Administration; Market;
  - Academia

*What was successful?  
What might have been  
done better?*

- **Strategy validation and Strategic Plan & Action Plan alignment (Step 5)**
- Main learnings, barriers and **key success factors**
- Reflections
- Regulatory inputs
- Potential exploitable results

### Share and contrast your outcomes and experiences in the SmartEnCity Network!

The SmartEnCity Network consists of **small and medium-sized European cities committed to developing and implementing new smart zero carbon solutions**. All Network members are willing to share their efforts and best practice experiences with each other, derived from concrete actions.

Many small and medium-sized cities across Europe have already developed a Sustainable Energy Action Plan (SEAP). The SmartEnCity Network helps to inspire and support these cities to take specific actions to successful implementation. The SmartEnCity Network works to enable committed cities to become smarter and more energy efficient based on **an integrated approach for mobility, energy and ICT infrastructure**. We share our experiences, knowledge, challenges and best practices and believe in open innovation and co-creation.

Europe has many small and medium-sized cities, which can and should establish ambitious policies, initiate actions and engage citizens and local networks even better than the capital cities, which usually are in the spotlight. Because **“you do not have to be a capital city to make a major difference!”**

### Help transition Europe’s cities and communities – and benefit as a front runner

We invite cities, urban planners and associated experts across Europe to join our effort to co-create Smart Zero Carbon Cities. We are committed to sharing our ambitions, results and best practice learnings based on an integrated action-oriented approach with strong citizen participation. **Our vision is to enable Europe’s small and medium-sized cities to become fast growing Smart Zero Carbon Cities.**

We offer the cities honest and proven experiences, inspirational cases, integrated approach insights, tools and learnings from the three SmartEnCity Lighthouse projects, our followers and the Network.

We are already more than 50 cities on board! You can **JOIN SmartEnCity Network** and find more information at <http://smartencitynetwork.eu/registration.aspx>





## Step 16. UP-SCALE. Upscaling & next steps

The final step of this third stage explores the **replication potential** of the process and its implemented SZCC solutions. This is done through **local up-scaling strategies** for the city, considering urban labs for replication in other areas of the city (CES Model on Step 9), and through **exploitation paths** for local partners (business models, incubators, accelerators, partnerships, etc.).

The connection to European sources such as the **SCC1 solutions** portfolio and **SCIS** can always be helpful for further city connections and inspiration.

Cities4ZERO strategy will end with a **final workshop steered by the local taskforce (LP towards the SZCC)**, reflecting on next steps and future interventions. The thematic **working groups** set in Stage A for city diagnosis and envisioning processes can provide valuable input. This workshop ensures the **iteration** of the whole process depending on city needs:

1. If the **Strategic Plan and Action Plan** are still considered valid after this process, and if an update is not necessary, the city can pick and **develop new Key Projects, coming back to Step 7** (7. PRIORITIZE), selected from the project list published in the Action Plan (Step 5).
2. In case the **Strategic Plan and/or Action Plan** are considered to be partially obsolete, where an update is appropriate for a better projects' focus, the city can come **back to Step 4** (4. ENVISION) and update its strategic planning process for a reconsidered planning umbrella (IUP and Action Plan).

This **continuous iteration** will readjust the focus of city projects and strategies towards the final SZCC goal.

### Step 16. UP-SCALE Upscaling & next steps

#### Up-scaling strategies for the city. SZCC solutions

- Urban Labs
- Locally tested solutions and SCC1 solutions portfolio: business models and innovative solutions to be exploited by local partners: incubators, accelerators, partnerships, etc
- CES Model
- Connection to SCIS (Smart Cities Information System)

#### Next steps, future interventions

- Local Partnership for SZCC final workshop

#### ITERATIVE PROCESS:

- Back to Design Stage (Step 7) for new interventions
- Back to Strategic Stage (Step 4) for a strategic planning update

### Lessons learned & tips from Stage C

- **Control the awarded companies to fulfil their schedules and requirements** as planned, and to gather from them the monitoring equipment they install and the **required data** for control and verification (Step 12).
- Bear in mind to engage **communication experts to train end-users**, since a language too technical can lead to misunderstandings (Step 13).
- Be careful on **data gathering stages** as they are key to obtaining a qualitative result when assessing the interventions to be performed (Step 14).
- **Rely on experts** (internal or external), ideally certified, that can generate independent quality reports (Step 14).
- **Learn from results**, no matter how good or bad they are, as they are **always useful** (Step 14 and 15).
- Take into consideration the **feedback from your citizens & end-users**, as they are the final target group of all interventions. Their input will be very valuable for readjusting projects and strategies (Step 15).
- **Promote replicating** what fits and what is working in one neighbourhood, up-scaling the solution to nearby or similar neighbourhoods, districts or even the whole city. Involve local businesses and associations in the up-scaling process (Step 16).
- The most innovative aspects should be supported by experts in all phases on Strategy Planning, Design and Implementation & Maintenance.
- Make sure to conduct a final workshop for next steps and future interventions. This will **ensure a shared reflection towards the iteration of the whole process, updating your strategies and developing new projects** towards city decarbonisation (Step 16).

## Intervention & Assessment Stage wrap-up

### C. INTERVENTION & ASSESSMENT STAGE PROJECT & CITY LEVEL



Figure 35. Cities4ZERO. Intervention & Assessment stage overview (Urrutia, 2019)

## CONCLUSIONS & LESSONS LEARNED

An effective **urban transformation towards cities' decarbonization** requires a thorough analysis on the local context to propose the most suitable ad-hoc plans and interventions for each specific environment. However, all municipalities that were part of this research were facing **common challenges and solutions in this urban transition**. That is why the authors of this strategy were able to identify key common barriers and success factors of those processes to produce this document.

### Cities4ZERO; main take-aways of the strategy

This strategy has already a compact and summarising format, touching briefly upon many steps that could be further described in more depth. The interest here is bundling all those sequential concepts into one package; one process that gives cities an overview to act towards urban decarbonisation. Accordingly, the strategy Cities4ZERO could be taken as a conclusions' package of an extensive work, fed by several years of experiences in SmartEnCity project. Nevertheless, some additional concluding remarks are presented below:

- **Local governments are uniquely positioned to enable urban decarbonisation**, according to their various capacities: as planners and regulators, as facilitators of finance, as role models and advocates, and as large consumers of energy and providers of infrastructure and services<sup>14</sup>. If they are stably committed, the rate of potential success is high for next decades.
- **City-visioning and strategic planning** processes are crucial in the decarbonisation process. Cities must have a collaborative framework to envision their future and plan their way towards it.
- **Local and external conditions** affecting to the city (regional, national, European and global challenges) should be analysed, to ensure strategies and interventions are well aligned and can take advantage of both perspectives.
- **Integrated planning** implies the commitment of different stakeholders, and the consideration of all dimensions of a problem (social, environmental, technological and economic parameters), in order to determine the most appropriate solutions. Integrated planning also addresses the **need of coordination** with other local strategies, initiatives, projects, departments, (...), to avoid foreseen barriers as well as to leverage potential synergies in the local context.
- **Citizens** are observers and protagonist at the same time. Training, dissemination and awareness are necessary to be more likely to succeed. Demonstration projects of a certain scale are a good showcase to interact with end customers and see the acceptability of the solutions.
- **Information and communication technologies** (ICT) will have a fundamental role in the transmission and processing of city's information, but also in allowing and facilitating the lives of citizens and businesses through advanced services.
- A rigorous **assessment** process is key to measure progress towards city goals. *We cannot improve what we don't measure.*
- The **regulatory framework** at all levels (local, regional, national, European) must enable the city to be agile in the decarbonisation process.
- **The city must iterate and reformulate its strategic approach towards decarbonisation** according to the changing situation of the city. This virtuous cycle will bring decarbonisation closer and closer.

## **Key Factors towards cities' decarbonization**

In addition, this research has concluded the existence of five **key factors for accelerating an urban transformation process towards cities' decarbonisation**<sup>13</sup>, all of them looking for a more effective integration of energy planning into urban transformation and planning processes:

### **1. The method, the strategy.**

*The Conference of COP24 Parties "reiterates its invitation to Parties to communicate, by 2020, mid-century, long-term low greenhouse gas emission development strategies in accordance (...) of the Paris Agreement"*

*Katowice COP24 Parties, 2018*

This strategy intends to guide those cities who want to **steer a strategic municipal process towards decarbonisation in the mid-long term**. A step-by-step strategy is key to have an overview of the procedure as well as the specific requirements of such an ambitious transition. *A city-vision, a plan, key projects.*

### **2. Local people.**

*"The new strategic discourse needs to emphasize **the process than the content, the actors** more than the structures separating of the planning and operational elements of the process"*

*P. M. Williams, 2002*

**Local stakeholders are key** in this process, since they will be the ones who are going to implement the initiatives leading towards decarbonisation; **they need to be engaged from the beginning** to achieve a successful implementation.

### **3. Tools.**

*"Tools can contribute to a broader scope, more comprehensive assessments, and better legitimacy of the energy planning"*

*J. Ivner, 2009*

If we don't have a clear picture of our **local energy system**, we won't be able to plan a **feasible path towards decarbonisation**, we won't thus be able to **generate alternative scenarios for the future**. Modelling tools are crucial to generate and monitor those plans.

### **4. Action.**

*"It is important to propose initiatives without delay and in line with the Joint Declaration of the three institutions on the European Union (...), to allow for a swift energy transition on the ground. (...) **the focus now turns to implementation**"*

*European Commission, 2017*

After planning, it is time to act! We won't overcome the current *carbon lock-in* if we don't transform our cities; **interventions that must have an impact** on emissions and an inspiring domino effect on the implementation areas.

### **5. Cities' collaboration.**

*"Transnational city-networks are mobilizing cities in the global fight against climate change (...). City-networks help build capacity to measure, report, verify emissions reductions."*

*D. J. Gordon and C. A. Johnson, 2018*

**Knowledge and experiences sharing through cities' networks** has proved to accelerate urban decarbonisation processes; inspiration from peers, discussion of barriers and solutions, common seminars, joint procurement processes, one voice against other interests, contrast and expertise, etc.

## ANNEXES

### 1. RESOURCES

#### STEP 1: ENGAGE

- [Institutional Transformation and Planning](#) (Alexander, 2005)
- [The Quintuple Helix innovation model: global warming as a challenge and driver for innovation](#) (Carayannis et al, 2012)
- Energy Cities (European Association of local authorities in energy transition) <https://energy-cities.eu/>
- EERA [European Energy Research Alliance Join Programme Smart Cities](#)

#### STEP 2: ANALYSE

- City characterization template and indicators – SmartEnCity D2.4/ Section 6
- Vitoria-Gasteiz City Characterization – [SmartEnCity D3.1/ Section 5](#)
- Tartu City Characterization – [SmartEnCity D4.1/ Section 5](#)
- Sonderborg City Characterization – [SmartEnCity/ D5.1 Section 5](#)
- [Smart Zero Carbon City Readiness Level study](#)<sup>7</sup>

#### STEP 3: DIAGNOSE

- [Article on Sonderborg's stakeholder engagement](#)
- [SWOT Analysis and PEST Analysis – When to Use Them](#)
- SWOT tool. Sinfonia project - <http://sinfonia.eurac.edu/swot/>
- SmartEnCity D8.4
- City characterization template and indicators – SmartEnCity D2.4/ Section 6
- *From Carbon Calculators to Energy System Analysis in Cities*<sup>15</sup> - <https://doi.org/10.3390/en12122307>
- Vitoria-Gasteiz City Characterization – [SmartEnCity D3.1/ Section 6](#)
- Tartu City Characterization – [SmartEnCity D4.1/ Section 6](#)
- Sonderborg City Characterization – [SmartEnCity/ D5.1 Section 6](#)
- Cities' Engagement Workshops – [Tartu](#) – [Sonderborg](#) – [Asenovgrad](#) – [Lecce](#)

#### STEP 4: ENVISION

- [The making of a smart city: best practices across Europe](#)
- [Article about Tartu's scenario building workshops and process](#)
- [Article about Sonderborg's scenario building workshops and process](#)
- [Article about Lecce's scenario building workshops and process](#)
- [Article about Asenovgrad's scenario building workshop and process](#)
- SmartEnCity D8.4
- WEBINAR. [Facilitating Energy Transition at city level](#)
- [Stakeholder engagement in the Integrated Energy Planning phases](#)

#### STEP 5: PLAN <sup>CITY LEVEL</sup> / STEP 6: INTEGRATE

- Sonderborg Roadmap2025; [https://smartencity.eu/media/roadmap2025\\_eng.pdf](https://smartencity.eu/media/roadmap2025_eng.pdf)
- [Donostia – San Sebastian Smart Plan](#) – STEEP project
- [Tartu Energy 2030+ - towards a SECAP development](#)
- WEBINAR: [Strategic Energy Planning in countries and cities](#)
- EnergyPLAN tool for energy system analysis. Software and training. <https://www.energyplan.eu/>
- Energy Balance Tool; <https://smartencity.eu/outcomes/tools/>
- City impact evaluation procedures/ SmartEnCity [D7.4](#)



- [SCIS Key performance indicators guide](#)
- CITYKEYS – [Smart City KPIs and related methodology](#)

## STEP 7: PRIORITIZE

- QGIS. A free open source Geographic Information System: <https://www.qgis.org/en/site/>
- Vitoria-Gasteiz prioritization process – [SmartEnCity D3.1/](#) Section 6

## STEP 8: FRAME

- SmartKalea case in Donostia – San Sebastian: <http://www.fomentosansebastian.eus/smartkalea/en/>
- Review of regulatory gaps and recommendations to facilitate city transformation processes/ [SmartEnCity project D2.1](#)
- Recommendations on standards in urban transformation and Smart Cities/ SmartEnCity project D2.2
- New business models, procurement schemes and financing mechanism for Smart City projects/ [SmartEnCity project D2.3](#)
- [The making of a smart city: policy recommendations](#)

## STEP 9: AGREE

- Citizen Engagement Strategy and deployment plan/ [SmartEnCity D2.6](#)
- Integrated Management models for large scale Smart City transformation projects/ [SmartEnCity D2.5](#)
- International Association for Public Participation <https://www.iap2.org/mpage/Home>
- [Report on the participatory citizens dialogue](#)

## STEP 10: DESIGN

- Smart Cities Information Systems <https://smartcities-infosystem.eu/>
  - Projects, Technologies, Experiences, Materials
- Software recommendation for planners:
  - [EnergyPLAN](#) (regional/ national framework) – System Illustrative tool
  - [QGIS](#) (georeferenced data) – Geographical Information System tool
  - [REVIT](#) – Building Information Modelling tool
  - [EnergyPlus e+](#) - Building Energy Simulation tool

## STEP 11: PLAN <sup>PROJECT LEVEL</sup>

- KPIs review, selection and definition/ SmartEnCity [D7.1](#) and [D7.2](#)
- Evaluation protocols/ SmartEnCity [D7.3](#)
- Monitoring program/ SmartEnCity [D7.6](#), [D7.7](#) and [D7.8](#)
- [Best Practice Example Monitoring Report](#) – NEXT project
- Data collection approach and data management/ SmartEnCity [D7.9](#)
- CIOP: Designing guide and tool catalogue [D6.5](#)
- CIOP: Data Model Architecture Implementation [D6.3](#)
- CIOP: Interoperability Mechanisms [D6.4](#)

## STEP 12: INTERVENE

- Lighthouse interventions follow-up/ <https://smartencity.eu/>
- Integrated planning reports/ SmartEnCity [D3.4](#), [D4.4](#) and [D5.4](#)
  - SCIS Smart Cities Information System <https://smartcities-infosystem.eu/>
  - SCC1 projects; integrated interventions in cities.
    - SmartEnCity <https://smartencity.eu/>
    - GrowSmarter <http://www.grow-smarter.eu/home/>
    - RemoUrban <http://www.remourban.eu/>
    - Triangulum <http://www.triangulum-project.eu/>

- Replicate <https://replicate-project.eu/>
- SharingCities <http://www.sharingcities.eu/>
- SmarterTogether <https://www.smarter-together.eu/>
- mySMARTLife <https://www.mysmartlife.eu/mysmartlife/>
- Ruggedised <https://ruggedised.eu/home/>
- +CityxChange <https://cityxchange.eu/>
- MakingCity <http://makingcity.eu/>
- Stardust <http://stardustproject.eu/>
- MatchUP <http://www.matchup-project.eu/>
- IRIS <https://www.irissmartcities.eu/>
- Sectorial strategies
  - Energy – [Hotmaps project](#) / [PlanHeat project](#)
  - Retrofitting - [ZenN project](#) - Nearly Zero Energy Neighbourhoods
  - Mobility – [SUMP 2.0 guidelines are currently being updated 2019/2020](#)
  - ICTs – [Urbana Platforms Management Framework \(EIP\)](#)
  - Green Infrastructures – [Oppla – EU Repository of Nature-Based Solutions](#)
  - Waste – [UrbanWaste - Urban strategies for Waste Management](#)
  - Water – [Urban water atlas for Europe; Urban Water Management](#)
  - Citizen Engagement – [MySmartLife – Key stakeholders’ engagement in urban transformation](#)

### STEP 13: ENSURE

- Tartu smart home system <https://smartencity.eu/about/solutions/smart-home-solution-tartu/>
- Social Innovation in smart-citizens training program [https://smartencity.eu/news/detail/?rx\\_call=184](https://smartencity.eu/news/detail/?rx_call=184)
- Smart House Ambassadors awards in Tartu [https://smartencity.eu/news/detail/?rx\\_call=196](https://smartencity.eu/news/detail/?rx_call=196)

### STEP 14: ASSESS

- KPIs review, selection and definition/ SmartEnCity [D7.1](#) and [D7.2](#)
- Evaluation protocols/ SmartEnCity [D7.3](#)
- City impact evaluation / SmartEnCity [D7.4](#)
- Monitoring program/ SmartEnCity [D7.6](#), [D7.7](#) and [D7.8](#)
- Data collection and monitoring summary/ SmartEnCity [D7.9](#) and [D7.12](#)
- Assessment of overall performances; final evaluation document/ SmartEnCity [D7.13](#)
- Evaluation certification IPMVP
- [Retrofitted apartments in Lighthouse City Vitoria-Gasteiz are ready for monitoring](#)
- Tartu City Information Open Platform <https://tarktatu.telia.ee/en/>

### STEP 15: VALIDATE

- SmartEnCity Network - <http://smartencitynetwork.eu/>
- [Why may replication \(not\) be happening - Recommendations on EU R&I and regulatory policies](#) (SCIS)

### STEP 16: UP-SCALE

- [Estonian Smart City Club](#)
- [The making of a smart city: replication and scale-up of innovation in Europe](#)
- [European Energy Award – Acting locally for the climate](#)

### SmartEnCity Webinars <https://smartencity.eu/outcomes/webinars/>

- W1. Strategic Energy Planning in countries & cities
- W2. Facilitating energy transition at city level
- W3. Citizen Engagement in energy transition
- W4. Energy retrofitting of buildings
- W5. Low-carbon mobility

## 2. KEY POINTS AND TOOLS OF EACH STAGE

### Strategic Stage key points:

	Step 1 ENGAGE	Step 2 ANALYSE	Step 3 DIAGNOSE	Step 4 ENVISION	Step 5 PLAN <sup>CITY</sup>	Step 6 INTEGRATE
<b>Inputs</b>	<ul style="list-style-type: none"> <li>Stakeholder mapping</li> <li>Institutional analysis</li> </ul>	<ul style="list-style-type: none"> <li>Desk research (plans/ strategies, etc.)</li> <li>Interviews &amp; surveys</li> </ul>	<ul style="list-style-type: none"> <li>Stakeholder mapping;</li> <li>Critical topics &amp; city trends</li> </ul>	<ul style="list-style-type: none"> <li>Strategic question</li> <li>SWOT analysis</li> <li>Working groups</li> </ul>	<ul style="list-style-type: none"> <li>City vision</li> <li>SWOT analysis</li> <li>City Characterization</li> <li>Key stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>Strategic &amp; Action Plan</li> <li>Key Projects</li> <li>Municipality knowledge: Institutional, legal &amp; budgetary</li> </ul>
<b>Outputs</b>	<ul style="list-style-type: none"> <li>Local taskforce: LP towards SZCC</li> </ul>	<ul style="list-style-type: none"> <li>City Characterization</li> <li>CO<sub>2</sub> Emissions baseline</li> </ul>	<ul style="list-style-type: none"> <li>SWOT analysis</li> <li>Thematic working groups</li> </ul>	<ul style="list-style-type: none"> <li>Future city scenarios</li> <li>City vision</li> </ul>	<ul style="list-style-type: none"> <li>Strategic &amp; Action Plan; Key Projects</li> <li>Stakeholders commitment</li> <li>Indicators at city level: baseline</li> </ul>	<ul style="list-style-type: none"> <li>Municipality support &amp; engagement on Key Projects</li> </ul>

### Design Stage key points:

	Step 7 PRIORITIZE	Step 8 FRAME	Step 9 AGREE	Step 10 DESIGN	Step 11 PLAN <sup>PROJECT</sup>
<b>Inputs</b>	<ul style="list-style-type: none"> <li>City diagnosis &amp; spatial analysis</li> <li>Municipal budget &amp; urban plan</li> <li>Key projects of Strategic &amp; Action Plan</li> </ul>	<ul style="list-style-type: none"> <li>City characterization</li> <li>Pre-intervention project</li> <li>Budget</li> <li>Financing sources mapping</li> </ul>	<ul style="list-style-type: none"> <li>Pre-intervention project and area</li> <li>Governance model</li> <li>Socio-economic knowledge and dynamics of the district</li> </ul>	<ul style="list-style-type: none"> <li>Pre-intervention project</li> <li>Design team</li> <li>Project program &amp; requirements</li> </ul>	<ul style="list-style-type: none"> <li>Project design</li> <li>Budget</li> <li>Responsible stakeholders</li> <li>Timeline</li> </ul>
<b>Outputs</b>	<ul style="list-style-type: none"> <li>Intervention area</li> <li>Key Projects selected</li> <li>Pre-intervention project</li> </ul>	<ul style="list-style-type: none"> <li>City transformation framework</li> <li>Financing mechanisms</li> <li>Business models</li> <li>Project viability</li> </ul>	<ul style="list-style-type: none"> <li>Integrated Management Plan and follow-up committees</li> <li>Citizen Engagement Strategy</li> </ul>	<ul style="list-style-type: none"> <li>Project design</li> <li>Solutions &amp; technologies selection</li> </ul>	<ul style="list-style-type: none"> <li>Implementation plan</li> <li>Quality management</li> <li>Risk management</li> <li>Project indicator system</li> <li>Tendering process</li> </ul>

### Intervention & Assessment Stage key points:

	Step 12 INTERVENE	Step 13 ENSURE	Step 14 ASSESS	Step 15 VALIDATE	Step 16 UP-SCALE
<b>Inputs</b>	<ul style="list-style-type: none"> <li>Project design</li> <li>Implementation Plan</li> </ul>	<ul style="list-style-type: none"> <li>Interventions deployed</li> <li>Monitoring equipment</li> <li>Project Design materials</li> </ul>	<ul style="list-style-type: none"> <li>Evaluation Plan</li> <li>Monitoring data</li> <li>Indicators at city level: baseline</li> </ul>	<ul style="list-style-type: none"> <li>Evaluation report</li> <li>Impact assessment</li> <li>Stakeholders' feedback</li> <li>Strategic &amp; Action Plan</li> </ul>	<ul style="list-style-type: none"> <li>Evaluation report</li> <li>Impact assessment</li> <li>Strategic &amp; Action Plan</li> <li>Feedback</li> <li>Project review</li> </ul>
<b>Outputs</b>	<ul style="list-style-type: none"> <li>Interventions deployed</li> <li>Monitoring equipment deployed</li> </ul>	<ul style="list-style-type: none"> <li>Maintenance Plans</li> <li>Users' training</li> </ul>	<ul style="list-style-type: none"> <li>Evaluation report</li> <li>Impact assessment</li> <li>City Information Open Platform</li> </ul>	<ul style="list-style-type: none"> <li>Feedback for future interventions</li> <li>Project &amp; strategy validation</li> <li>Key Success Factors</li> </ul>	<ul style="list-style-type: none"> <li>Up-scaling strategy</li> <li>Replication and exploitation input</li> <li>Overview to start new projects (Step 7) or update city vision &amp; plans (Step 5)</li> </ul>







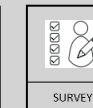

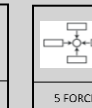






- TOOLS/ METHODOLOGIES suggested for each STEP -															
	 TREND WATCHING	 LEGISLATION	 STAKEHOLDERS MAPPING	 DELPHI	 INTERVIEWS	 FOCUS GROUP	 SURVEY	 SWOT	 5 FORCES	 SCENARIOS	 CO-CREATION	 ROADMAP	 CANVAS	 RISK MATRIX	 DIGITAL TWINS
A. STRATEGIC STAGE	2	2, 6	1	3	2	3, 4	2	3	3	4	4, 5	5			
B. DESIGN STAGE						9					9, 10	7	8, 11	11	10
C. INTERVENTION AND ASSESSMENT STAGE		13				16					12, 13, 15, 16	16	16		12, 13

Figure 36. Tools and methodologies suggested for each step of Cities4ZERO strategy (Murguiondo, 2019)

### 3. CITY CHECK-UP ASSESSMENT TOOL

30/10/2019

City Check-up Assessment

## City Check-up Assessment

Please take a few minutes to fill out our survey.

Your feedback is really important as it can improve our Integrated Energy Planning concept and you can find inspiration for creative new ideas including feedback from our SmartEnCity experts. The form should take no longer than 10 minutes to complete! Thank you in advance for your collaboration. We really appreciate your time!

SmartEnCity Team

\*Required

smar+  
en  
ci+y

network

*Skip to question 1.*

## Engage

This section delves on governance of energy & decarbonization topic in your municipality

1. **Does your city have a coordination group dealing with the energy & decarbonization topic?** \*

*Mark only one oval.*

☐ Yes

☐ No

2. **Who are the key stakeholders of this group?** \*

*Tick all that apply.*

☐ Local Authority

☐ Politicians

☐ Technicians

☐ Industry

☐ Academia

☐ Citizenship

☐ NGOs

☐ Financial Institutions

☐ Not applicable

3. **Is this core group constant over time or temporary?** \*

*Tick all that apply.*

☐ Constant

☐ Temporary

☐ Not applicable

<https://docs.google.com/forms/d/1mWqDbN16iOOcWkVcRS8zRimylWnFVYYxUeu6Ik/edit>

1/7



**4. What is this group focussing on? \****Mark only one oval.*

- ☐ Built Environment
- ☐ Mobility
- ☐ Energy Supply (Heating and Cooling)
- ☐ Energy Supply (Electricity)
- ☐ Citizen Engagement
- ☐ ICT
- ☐ Waste
- ☐ Not applicable
- ☐ Other: \_\_\_\_\_

**5. Please give a general description of how the group is financed \****Tick all that apply.*

- ☐ Fully financed by municipality
- ☐ National/ Regional funding
- ☐ EU funding
- ☐ Public-private
- ☐ Not applicable
- ☐ Other: \_\_\_\_\_

**Analyse and Diagnose**

This section delves on city analyses, diagnoses, baseline studies, etc. performed in your city within the energy & decarbonization topic

**6. Have you done a city analysis and diagnosis in connection with the energy & decarbonization topic? \****Mark only one oval.*

- ☐ Yes
- ☐ No

**7. If yes, when have you done this analysis and diagnosis?***Mark only one oval.*

- ☐ Before 2010
- ☐ 2010 - 2015
- ☐ 2015 - 2018
- ☐ 2019

**8. What kind of data did you use to perform this analysis and diagnosis? \****Tick all that apply.*

	Reports	Indicators/ KPIs	Georeferenced (GIS)	Other	Not relevant	Metered data
Socio-economic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Business and financial	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Urban environment and quality of life	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sectorial strategies: energy, built environment, mobility, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Existing policies, and regulations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**9. If you have used other kind of data, please specify**


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**10. Which city sectors did you include in the analysis and diagnosis? \****Tick all that apply.*

- ☐ Urban Planning  
☐ Energy  
☐ Mobility  
☐ Built Environment  
☐ Green Infrastructures  
☐ Citizen Engagement  
☐ Not relevant  
☐ Other: \_\_\_\_\_

**11. Which methods did you use to perform a city diagnosis? \****Tick all that apply.*

- ☐ SWOT  
☐ Delphi  
☐ Brainstorm  
☐ Not Relevant  
☐ Other: \_\_\_\_\_

**Envision**

This section delves on the procedures to develop a city vision towards decarbonization

**12. Do you have a long-term vision in the energy & decarbonization topic? \****Mark only one oval.*

- ☐ Yes  
☐ We are currently developing one  
☐ No, but we are considering so  
☐ No

**13. Have you generated potential energy & decarbonization city scenarios? \****Mark only one oval.*

- ☐ Yes  
☐ No  
☐ Don't know

**14. If the answer was yes, how do you use them further in your process?**

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**15. Is the development of a vision a participatory process? \****Mark only one oval.*

- ☐ Yes  
☐ No  
☐ Partly  
☐ Not applicable

**16. What kind of stakeholders are involved? \****Tick all that apply.*

- ☐ Politicians  
☐ Public administration technicians  
☐ Industrial partners  
☐ Experts/ researchers  
☐ NGOs  
☐ Citizens  
☐ Other: 

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**17. Do you set working groups on the main topics within your energy & decarbonization scenarios processes? \****Mark only one oval.*

- ☐ Yes  
☐ No  
☐ Partly

**18. Do you collaborate with other cities regarding energy & decarbonization ambitions? \****Mark only one oval.*

- ☐ Yes, on a national level  
☐ Yes, on an international level  
☐ No

**19. Do you belong to a cities' network on the topic with knowledge-sharing purposes? \****Tick all that apply.*

- ☐ Yes, to a national network  
☐ Yes, to an international network  
☐ No

## Plan (City Level)

This section delves on the decarbonization plan, as a structuring and guiding document towards city decarbonization

20. **Does your city have a strategic plan on energy & decarbonization topic? \***

*Mark only one oval.*

- ☐ Yes  
☐ We are currently developing one  
☐ No, but we are considering so  
☐ No

21. **Are there allocated resources for the actions identified in that plan? \***

*Mark only one oval.*

- ☐ Yes  
☐ No  
☐ Partly

22. **Does your plan include tangible targets? (e.g.: m<sup>2</sup>, %, CO<sub>2</sub>, KPIs, deadlines?) \***

*Tick all that apply.*

- ☐ 1 (not tangible at all)  
☐ 2 (rather not tangible)  
☐ 3 (more or less tangible)  
☐ 4 (rather tangible)  
☐ 5 (tangible)

23. **Are your tangible targets connected to your city vision? \***

*Mark only one oval.*

- ☐ Yes  
☐ No

## Integrate

This last section delves on the integration of the outcomes of the decarbonization plan into Municipal Planning

24. **Is there a procedure to integrate the outcomes of your energy & decarbonization plan into Municipal Planning? \***

*Mark only one oval.*

- ☐ Yes  
☐ No  
☐ Somewhat

25. If yes, how do you integrate those outcomes? (land-use, legal viability, municipal competences, acknowledgement by other municipal departments, etc.)

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26. Who is in charge of integrating the energy & decarbonisation plan into the Municipal Planning?

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27. What are the biggest challenges or barriers for the municipality in developing and/or implementing the energy and decarbonisation plan? (e.g. the lack of quantified objectives, or clear adaptation policy goals and targets at a national or local level; fragmented, limited or non-existent adaptation actions; the lack of a proper assessment of the resources and capacity needed to deliver adaptation at the local level.)

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### Inspiration

Where did you get your inspiration....

28. Have you received inspiration for your city energy plans and/or actions from the following sources?

*Tick all that apply.*

- ☐ SmartEnCity.eu <<http://SmartEnCity.eu>> website
- ☐ Smartencitynetwork.eu <<http://smartencitynetwork.eu>> website
- ☐ SmartEnCity project workshops
- ☐ Other: \_\_\_\_\_

### Contact information

29. Name \*

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30. Type of your Organisation you are working for

*Mark only one oval.*

- ☐ Municipality
- ☐ Company
- ☐ University / Research Organisation
- ☐ Other: \_\_\_\_\_



31. Name of your Organisation \*

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32. What is your current job title/position?  
(\*Please specify if you are working in a municipality and/or local government)

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33. Email address \*

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34. Would you like to receive feedback based on your answers from the SmartEnCity project experts? \*

*Mark only one oval.*

☐ Yes

☐ No

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