Roadshow: Build your financial capacity

Empowering urban prosperity: Inspiration for city business models

3rd webinar, 21st of March 2024

Different authors depending on the section.
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1. Introduction

By harnessing digital technology, data analytics, and connectivity, cities can optimize resource use, enhance energy efficiency, reduce emissions, and foster sustainable practices. Smart infrastructure, from energy-efficient buildings to efficient transportation networks, enables local administrations to meet their green goals.

A Smart City empowers local governments to utilize data-driven decision-making, engage citizens through co-creation processes, comprehend financial needs for implementing innovative financing models, nurture a collaborative stakeholders' ecosystem, and include vulnerable groups and deprived areas to align with EU sustainability goals. In this context, financial insights are indispensable within local administrations, playing a vital role in transforming cities into sustainable, green hubs of the future. It represents a wholehearted commitment to the journey towards a climate-neutral Europe by 2050.

Local administrations are crucial for the success of the EU Taxonomy, and the New Green Deal due to their role in implementing green initiatives at the city and regional levels. They require financial skills to secure funds, manage budgets, attract investments, ensure compliance, foster innovation, and drive local economic growth in alignment with the EU's sustainability objectives. Local governments are the bridge between European sustainability policies and tangible projects, making their financial expertise vital for translating these initiatives into actionable, green solutions that benefit both the community and the environment.

1.1. What is Scalable Cities

Scalable Cities is a community of communities. Since 2014, a total of 20 European projects have been funded in which lighthouse cities and fellow cities have committed to developing innovative projects to achieve climate neutrality. The key idea has been to develop innovative energy solutions and business models that can be scaled up and replicated across Europe and lead to measurable results. In this sense, public administrations have been invited to take an active part in the energy transition by taking a proactive role in both designing innovative services and addressing the local market.

Scalable Cities has a Secretariat that supports all these Smart Cities communities to collect and document all the knowledge and experiences developed, as well as to provide support through different services.

Some of the technical solutions developed by the cities that are part of Scalable Cities are the following:

- Computing and cognitive solutions, providing applications or services enabling behavioural changes for citizens.
- Data-Driven business models enable cities or operators to manage energy efficiency better.
- Deployment of charging infrastructure for electric vehicles.
- District heating.
- Electric/hybrid public vehicle purchases.
- Energy management (district/blocks/ buildings/Demand/response) using technologies such as AI, microgrid, blockchain or others.
- Energy storage.
- Frugal solutions: it is an approach that involves using ingenuity to innovate most simply and effectively possible using the least amount of resources.
- Industrial heat production.
- Infrastructure physical and digital.
- Mobility stations.
- New buildings.
- New public transport infrastructures.
- Park & ride facilities.
- Positive Energy Blocks or Positive Energy Districts.
- Private buildings retrofitting.
- Public buildings retrofitting.
- Public lighting.
- Renewable energy production.
- Renewable energy thermal production.
- Vehicle Sharing Platforms (carpooling, sharing).
- Bundling services, please specify which sectors are involved (bundling services means grouping a set of actions in a coherent and global business model. E.g. combining retrofitting with renewables and EV charging stations).
- Others.

1.2. What is the Roadshow: Build your financial capacity?

The Roadshow is a service offered by the Scalable Cities Secretariat to support cities in the field of financial design of projects such as business model, financial schemes and everything that unfolds from it. With this objective, a series of activities will be carried out through which basic and advanced skills on finance will be acquired, to have resources with which to think and design economically sustainable and scalable urban projects to achieve climate neutrality.

This document covers to the content of the third webinar: "Empowering urban prosperity: Inspiration for City Business Models" on 21 March 2024.

1.3. Agenda

Introduction	
10:00 - 10:10	Introduction of Scalable Cities and smart city projects. Paula Ferrando GNE Finance.
Key findings	
10:10 - 10:30	Key findings on the report *"State of the European Smart Cites Mind the Gap: From Piloting to Upscaling".* Damian Wagner Herold, Smart City Expert.
10:30 – 10:45	Key findings on the report: "*Consolidated Analysis of SCC relevant Business Models and Packaged Measures"*. Paula Ferrando, GNE Finance.
Inspiration with different Business Models	
10:45 – 11:00	SPARCS – Business ecosystem modelling for positive energy districts. Yamileth Salas, Bable.
11:00 – 11:20	+CityxChange – Tidal Turbine Energy Power Plant (TTPP) owned by the REC. Vicent Mc Cormack and Gary Brennan, Gkinetic.
11:20 – 11:35	Community Business Models, some good inspiring examples. Paula Ferrando Julià, GNE Finance
Q&A and open discussion	
11:40 – 12:00	Q&A and open discussion.
End of the webinar	

2. Inspirational Webinar: 'Empowering Urban Prosperity: Inspiration for City Business Models'

2.1 Objective of the webinar

The first webinar addressed financial aspects pertinent to designing viable projects. Key milestones in the design and development process of a financeable project were introduced, encompassing the identification of needs, necessary stakeholders, legal considerations, and various technical solutions. Emphasis was placed on essential tools and documents that enhance project viability, including a de-risking tool, financial feasibility plan, business model, ESG metrics, dealing with investors, and more. A table was provided, showcasing minimal financial data to demonstrate the relative financeability of projects, grounded in the understanding that there are no one-size-fits-all solutions; each project requires comprehensive examination. Financial data such as WACC, IRR, NPV, and simple payback period were highlighted, enabling the evaluation of different financing scenarios. Armed with this data, diverse funding possibilities can be assessed, leading to more informed decisions and increasing the likelihood of success when presenting to investors.

The focus of the second webinar was on market analysis, the creation and examination of business models, and an explanation of various metrics (KPIs) applicable for project monitoring. Building a business model does not solely involve understanding and using tools like PESTEL, SWOT, BMC, etc., but rather understanding how these tools contribute to the process. In other words, they aid in critical thinking, decision-making, and fostering value-driven conversations with different stakeholders. While the City Business Canvas, as discussed in the previous webinar, provides a map of actions, actors, communication channels, costs, revenues, social impacts, environmental impacts, etc., all related to a "mission" and with a focus on generating "value" by addressing specific needs, much more is needed for this to materialize. This experience cannot be explained; it must be "lived".

To take a step further and interconnect the various concepts and tools explained earlier, this third webinar is of an inspirational nature.

The objective is to gain firsthand knowledge of diverse business models conceived and executed by cities within the framework of Smart Cities calls financed by the Horizon 2020 programme. These examples illustrate the challenges and lessons learned in creating a supportive ecosystem for the project, in embracing innovative technologies, and highlight the transformations projects undergo during implementation. Furthermore, they demonstrate that calculating financial scenarios aids in understanding and ensuring the viability of the project. On the other hand, Smart Cities seem to encompass everything, yet many interesting developments occur outside this framework. One of the goals is also to look "outside the box" and understand that other narratives and solutions are being applied.

2.2 Content of this document

This document contains information from various sources, all relevant to delve into the different aspects encompassing the design, analysis, and implementation of a business model. To provide a more comprehensive overview, three types of sources are included:

1. Extracts from two reports related to the evaluation and analysis of business models implemented by various Smart Cities projects within the framework of Horizon 2020 (Sections 3 and 4 of this document).
2. Excerpts from several deliverables related to the creation and development of business models, including the generation of a supportive ecosystem for implementation, from two Smart City Projects: SPARCS (2019-2025) and +CityxChange (2019-2014) (Sections 5 and 6 of this document).
3. To go beyond and learn from other experiences, two different kinds of projects are included. One provides a framework to boost new creative processes that give greater consideration to citizens. The other introduces the concept of a "community business model" which have already been implemented or are in the process of being implementing by some European innovation and demonstration projects (Sections 7 and 8).

3. Key findings of the report: 'State of the European Smart Cites – Mind the Gap: From Piloting to Upscaling'

Important note:
The information in this section is directly sourced from the unreleased report titled 'State of the European Smart Cities – Mind the Gap: From Piloting to Upscaling', authored by Smart City and Business Models experts Damian Wagner Herold and Andrea Geyer Schol. The report, completed between 2023 and 2024, is currently undergoing review and is not yet public. Here, we provide general insights without delving into specific case details. The report will be accessible on the Smart City Marketplace website once it has been reviewed and adapted by the European Commission.

3.1. What is this report about?

This report is the outcome of a contract initiated by Scalable Cities in 2023, following a "call for expert". The primary objective of the report, titled 'State of the European Smart Cities – Mind the Gap: From Piloting to Upscaling', was to identify, understand, and showcase potential business cases and financing schemes, with a particular focus on Positive Energy Districts (PEDs). The assessment placed additional emphasis on comprehending the value and service chains, challenges, requirements, and potential avenues for upscaling and commercialization. The report outlines twelve "lighthouse cases" selected alongside the PED value-chain, emphasizing the importance of smart city prototyping, implementation, and opportunities for upscaling potential products and services:

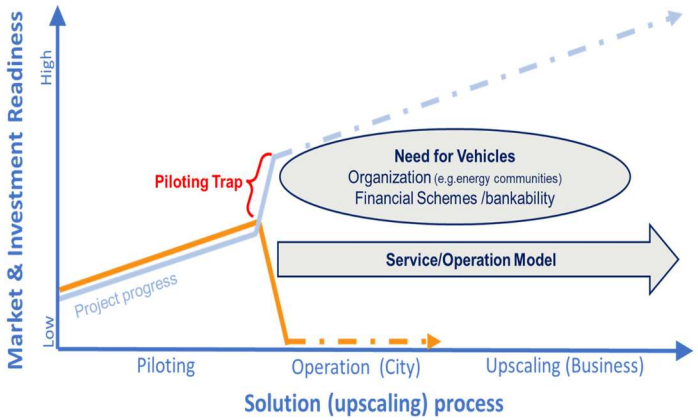
Title	Description in a nutshell	Project, city & owner
1. Smart energy management and infrastructure (heat)	Smart infrastructure and management in private buildings using smart valves and applications for (end) users.	**SPARCS 2019-2025** Leipzig, DE partner: CENERO Energy GmbH
2. Financial Risk Sharing Model	Financial scheme to reducing risk for investors or building and neighbourhood measures.	**+CityxChange 2018-2023** Trondheim, NO partner: Officinae Verdi Spa
3. V2G EV charging network	Smart charging infrastructure integrating rooftop PV and load management.	**IRIS 2017-2023** Utrecht, NL Partner: LomboXnet
4. Smart infrastructure, energy management and local trading platform	Smart infrastructure/microgrid and management and local trading platform linking PED and national energy market.	**Atelier 2019-2024** Amsterdam, NL partner: Banlieu BV
5. E-Bus Charging System full Service Model	Full-service model for public e-bus charging including infrastructure, software, maintenance.	**SPARCS 2020-2025** Espoo, FI partner: Plugit Finland Oy
6. PED Energy Management tool box and AI based optimization	Smart Infrastructure and management including AI-based prediction and optimization and energy community for renewable energy (RE)self-consumption.	RESPONSE 2020-2025 Dijon, FR partner: EDF France
7. Heat as a service model including storage in buildings	RE generation within student village from heat pump upcycling district cooling flows, thermal storage, and smart energy management development of a full-service model.	**RESPONSE 2020-2025** Turku, FI partner: Turku Student Village Foundation

8. Open Urban data platform and service marketplace	City provides a data platform and portal (BIM & 3D models, real-time data) and marketplace for urban data services and applications offered by providers; city sets and enforces governance framework.	**Ruggedised 2016-2022** Rotterdam, NL partner: FutureInsight
9. Urban Digital Innovation Executive Leadership Programme	The training program, managed by a university, introduces the building blocks for successful digitalization and innovation strategies for communities, cities, and regions.	**Ruggedised 2016-2022** Rotterdam, NL partner: Erasmus University Rotterdam
10. 2nd Life Battery Storage	Refurbished batteries from heavy-duty vehicles (buses) get assembled into electric storage units in buildings and smart energy system integrates local RE.	**IRIS 2017-2023** Gothenburg, SE partner: Volvo Buses
11. Floating River Turbine	Hydroelectric floating river turbine generates power at low flow speeds, eligible with environmental regulation.	**CityxChange 2019-2024** Limerick, IE partner: GKinetic Energy
12. Crowd-funded solar plant	The City of Valencia financed a solar plant for self-consumption on a city-owned building with crowdfunding from citizens.	**Match-up 2017-2023** Valencia, ES

3.2. Key findings of the report

The report underscores that the essence of a "smart" positive energy district lies in its customization to a city's specific framework conditions, local fabric, and stakeholder needs. This requires a meticulous process comprising various solutions rather than relying on an off-the-shelf product. A crucial step encountered by the report was to identify the basic elements and subsequently highlight the importance of connectivity and interoperability within the district, achieved, for example, through the application of AI-based management systems, urban data platforms, and service and operation models.

The assessment conducted by the report revealed that cities often prioritize operational aspects, such as financing and value creation, over considerations of business models, market readiness, and profits. The report highlights the identified piloting gap as one of the major challenges for lighthouse and smart city projects, noting that making the transition from the pilot phase to a consolidated and replicable project is a significant hurdle. Through the below graph, the authors illustrate how pilot projects either encounter market and implementation failures or necessitate the consolidation of financial and organizational vehicles to achieve replicable and scalable solutions.



Bridging the piloting trap requires financial vehicles, organisation such as energy communities and operation and service models that connect the dots.

The report highlights seven key aspects that require attention to understand the current status of the evaluated business models. The aim is to foster collective reflection and advance the implementation of urban solutions that enable the scaling of positive energy districts:

1) **Mind the piloting cap**: Cities focus on value creation and operations rather than on profits and business models.

2) Smart energy districts are not a product that you can buy, it is a (learning) **process that needs to be built**!

3) The interoperability of solutions and products requires **service and operation models**.

4) Cities may moderate **local innovation eco-systems and collaborations** and should set the right innovation frameworks.

5) **Lost in translation**: Cities need to **build and transfer (financial) expertise**, capacity and find a common language with businesses and investors.

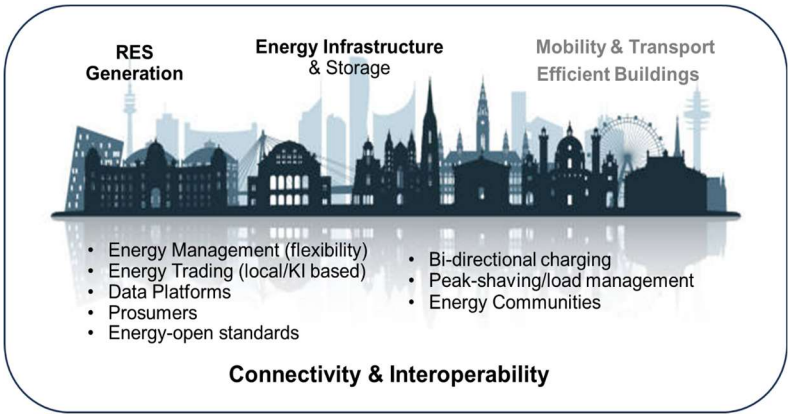
6) The identified lighthouse cases have created a **significant impact for cities & reduced the risk for business** but lack impact on commercialisation.

7) Connecting the dots: **Financial and organisational vehicles** are needed to reach market and investment readiness and to upscale activities.

3.3. Some interesting conclusions of the report

The report emphasizes that a positive energy district (PED) involves diverse stakeholders, including citizens residing in the district and individuals visiting for work, education, recreation, and other activities. Nevertheless, there are fundamental components common to every PED, consisting of both infrastructure and intelligence.

One important principle of a PED is to generate and consume energy within the neighbourhood itself as much as possible. Therefore, energy infrastructure and intelligent interconnection play crucial roles. The core elements of a PED encompass infrastructure and intelligence, with a primary focus on energy generation, storage, efficient buildings, mobility, and, notably, connectivity and interoperability.



The report assesses the fundamental principles that a PED solution must contain and highlights a total of six conclusions based on the 13 lighthouse cases studied. Here is a brief summary; more detailed information can be found in the report once it is published.

1. An apparent need exists for the development of interconnected service models, along with the creation of vehicles to operate and finance them effectively.
2. Successful "lighthouse cases" are paving the way for others to follow.
3. There is a clear necessity for mutual exchange between cities and private sector to facilitate further upscaling, knowledge transfer, and replication of successful models.
4. Strengthening the connection with the EU Mission on climate neutral and smart cities' and leveraging its platform and instruments are crucial for maintaining the momentum developed in the lighthouse projects.
5. Explore and implement financial schemes that not only cover investments but also contribute to research, development, and innovation (R&D&I) ventures to drive ongoing innovation.
6. Provide opportunities for citizens to establish financial assets, fostering engagement from those interested in the development of their cities and willing to invest in these initiatives.

4. Key findings of the report: 'Consolidated Analysis of SCC relevant Business Models and Packaged Measures'

Important note: *This subsection is extracted from the report titled "Consolidated Analysis of SCC Relevant Business Models and Packaged Measures," prepared by GNE Finance (P. Ferrando, E. Menendez and V. Cabal) for the European Commission under the Scalable Cities Service. Please note that this work is still in progress and is subject to review by the project officer and the Commission.*

4.1. What is this report about?

In the realm of Smart City Communities (SCC), the 'Consolidated Analysis of SCC Relevant Business Models and Packaged Measures' report undertakes a comprehensive exploration of two business models identified for each of the following five smart city projects: SmartEnCity, Rugeddised, mySMARTLife, MatchUP, and IRIS. The central focus of this analysis is to unravel the intricacies of these models, shedding light on their accomplishments, challenges, key learnings, successes, and avenues for improvement.

Within this examination, a crucial theme emerges - the delicate balance between fostering robust private partnerships and cultivating solutions with a profound social impact. This nuanced exploration delves into how these communities navigate the landscape, preserving the core values of public administration while ensuring scalability and sustainability.

The analytical framework of the report is constructed around three key parameters: I. City model canvas; II. Financial data analysis; and a III. Spider graph integrated analysis.

Smart city project	Business model case 1	Business model case 2
SmartENCity (2016-2022)	Biomass district heating system in Victoria-Gasteiz, Spain.	Retrofitting and Smart home solution in Tartu, Estonia.
Ruggedised (2016-2022)	Urban data platform in Rotterdam.	Urban Digital Innovation Executive Leadership Programme.
mySMARTLife (2016-2022)	Electric power tenant supply.	Smart lighting - Engie
MatchUP (2017-2023)	Socialized solar photovoltaic plant – "Las Naves brillen" – in Valencia, Spain.	Tenant electricity model in Dresden, Germany.
IRIS (2017-2023)	2nd life battery storage in Gothenburg, Sweden.	V2G EV charging network in Utrecht, The Netherlands.

4.2. Key findings of the report

1. Diverse business approaches:
Smart City Communities (SCCs) showcase varied business models, with some prioritizing strong private partnerships, while others focus on solutions with significant social impact, often sidelining financial considerations towards public administration. Despite similarities in technical solutions, the

diversity in business strategies becomes a key distinguishing factor among these forward-thinking communities.

2. The importance of the theoretical framework when creating business models:
The theoretical underpinnings chosen by SCCs play a pivotal role in shaping their respective business models. For instance, mySMARTLife introduces the concept of "coopetition", amalgamating competition and cooperation, resulting in the development of profitable public-private models. Meanwhile, MatchUP interprets revenues as social impact within an administrative context, giving rise to a distinctive Community/Social Business Model.

3. Success through Private Partnerships:
The cases of IRIS and SmartEnCity must be highlighted, as they have successfully developed robust economic models through strategic private collaborations. The nuances in their development approaches, whether through procurement processes, lease agreements (as seen in district heating and cooling in SmartEnCity), or direct engagement with energy service operators (as exemplified by second life batteries in IRIS), contribute to the depth of their success stories.

4. Social impact as core development driver:
Rugeddised and MatchUP stand out for prioritizing solutions with substantial social impact, highlighting the pivotal role of local administrations in balancing economic development with tangible improvements in the quality of life for citizens. Rugeddised, through its urban data platform, sparks essential debates on data ownership, positioning the administration as a critical referee in the evolving landscape.

5. Sustainability lessons learned:
While SCCs strive to implement integrated sustainability-related measures, a lack of ESG metrics data is identified in the analysed models. This does not imply that such data does not exist but rather that it is not accessible in the studied documents and/or has not been made available. This limitation hinders a comprehensive analysis of the impact of various projects, emphasizing the importance of enhancing data availability for future evaluations.

6. Scalability challenges:
Acknowledging the challenges associated with scaling socially impactful projects, the emphasis lies in preserving the essence of public administration in initiatives seeking growth. Innovations in technology (exemplified by UDP and Rugeddised) or alternative funding models like Crowdfunding and MatchUP distinguish projects striving for scalability. Mature technologies implemented in collaboration with financially sound companies (such as Smart Lighting in partnership with Engie in MySMARTLife) are in a more favourable position to ensure the economic viability of their business models.

7. Lack of solid financial data:
Addressing the pervasive challenge of acquiring comprehensive financial data for economic analysis within SCCs, the report emphasizes the need for comprehensive financial data. While some SCCs, like MySMARTLife, provide economic scenario studies, the overall lack of financial data shifts the analysis towards formal aspects and implementation details, rather than offering a nuanced understanding of financial robustness and viability of these projects.

4.3. Some interesting conclusions of the report

1. Holistic urban solutions:
Initially focused on discrete city aspects like energy efficiency, building renovations, mobility, energy production, and citizen participation, Smart City Communities (SCCs) now embrace positive clean energy districts. This shift, from individual buildings to neighbourhoods, demands comprehensive financial schemes to address the complexity of aggregated projects, necessitating clarity, conciseness, and appeal in administrative documentation.

2. Synergizing people-public-private partnership:
Models based on public-private collaboration, as exemplified by initiatives like IRIS and SmartEnCity, have proven to be highly efficient and effective. On the other hand, MatchUP's experimentation with project socialization, funded through crowdfunding, successfully engages the citizens in energy transition projects. The concept of synergizing people-public-private partnership projects can integrate these two business model ideas. Regardless, it is imperative to explore additional channels for securing funding from both citizens and the private sector, aiming to collaboratively create and participate in urban energy transition projects.

3. Renewed financial approaches:
The complexity of positive clean energy districts necessitates a revamp of financial approaches. Innovative financing structures must align with aggregated project intricacies, fostering collaboration among diverse stakeholders. This is crucial for effective implementation and long-term sustainability in the evolving landscape of smart city initiatives.

4. Administrative empowerment for investment appeal:
Administrations play a crucial role in attracting private investment. Clear, concise, and attractive documentation is imperative. Empowering administrations with the tools and knowledge to present projects in an appealing manner becomes a strategic imperative for successful private engagement.

5. Creativity and imagination in business models to capture value
The circular economy of materials, the establishment of citizen labs and start-up incubators, and the implementation of courses on innovation and the development of new digital skills can contribute to the creation of an urban ecosystem focused on developing innovative business models to support the energy transition.

6. Mature technology: Moving beyond pilot thinking
While some experiences may still be considered as pilots, the ten years of Smart City Community (SCC) projects within the Horizon 2020 programme have provided a list of mature technologies that should be implemented, transitioning from the pilot concept to a viable scaled model.

5. Some Smart City Business Models

5.1. Ecosystem and effective business models: SPARCS

Ecosystem approach

Important note:
This subsection is derived from sections 1.2 'Analytical Framework: Overall Logic', 2.1 'Types of Stakeholder Engagement', and 2.2 'Towards Successful Engagement' in the deliverable D7.3 on 'Governance Models for Sustainable Smart City Business Ecosystems (2022)', authored by A. Giordano, A. Garlatti, P. Fedele, S. Iacuzzi1, M. Mason, A. Cassisi, M. Fuccaro, M. Bolzicco, M. Di Gallo, all from CiviESCo. The document is available on the official SPARCS website. (https://sparcs.info/en/deliverables/d7-03-governance-models-for-sustainable-smart-city-business-ecosystems/). To facilitate readability and comprehension of the main ideas, the content has been rewritten.
The deliverable D7.3 contains additional sections with more information as well as case studies of the two SPARCS lighthouse cities: Leipzig and Espoo.

The way organizations are structured, especially their formal or institutional design, plays a crucial role in influencing decisions and behaviours. It provides a framework for actors to make choices and sets the "rules of the game", determining who participates and making certain options easier. Many studies on stakeholder engagement focus on how organizational arrangements impact its outcomes.

SPARCS conducts an analysis that focuses on three key aspects of organizational arrangements: accessibility, formalization, and coordination devices.

- **Accessibility:** This refers to how stakeholders can access the decision-making process. Most literature considers two arrangements essential for interactive design.
- **Formalization:** This is a key aspect of organizational design, determining to what extent the process, outputs, and overall functioning of interactive practices are predefined by formal rules and procedures.
- **Coordination devices:** The study adopts a framework classifying various coordination devices suggested by Bouckaert et al. (2010). These devices can centre around structural solutions, such as a unit or position, or management systems, like a planning system.

Additionally, the deliverable explores stakeholder engagement during different phases of the policy cycle, distinguishing between four situations: Co-commissioning, co-design, co-delivery, and co-assessment.

Types of stakeholder engagement

Stakeholder engagement comes in various forms, with the classification depending on both the participation contexts and the purpose of the process. Consequently, there is no single universal typology or definition applicable to stakeholder engagement, leading to the development of numerous taxonomies over the years.

Another outcome of the stakeholder engagement process is 'social learning,' highly valued by participants and expressed in various ways, such as empowerment, social intelligence, self-

fulfilment, and a sense of belonging to a shared undertaking. Stagl (2006) offers a typology of social learning associated with the participation process, including cognitive learning (mainly informational), mutual understanding (appreciating others' values through justifications), trust and respect in group-building, and learning about societal needs and the institutional changes needed to address them.

SPARCS proposes a table that links the stakeholder engagement objective, description, and the methodology or tool that can be used to achieve the objective:

Purpose	Description	Methods
Exploration	People learn more about themselves, their community or an issue and perhaps come up with some innovative ideas	World Café, Open Space, Socrates Café, Bohm Dialogue etc.
Conflict Transformation	Poor relations or a specific conflict among individuals or groups is tackled	Sustained Dialogue, Mediation, compassionate listening etc.
Decision Making	A decision or policy is impacted, and public knowledge of an issue is improved	Citizens Jury, Deliberative Polling, consensus conference etc.
Collaborative Action	People tackle complex problems and take responsibility for the solutions that they come up with	Study Circles, Appreciative Inquiry, future Search etc.

Table 4 - NCDD engagement streams framework

Towards successful engagement

Based on SPARCS' experience and insights, nine principles guide effective public engagement, emphasizing best practices that can shape and support meaningful engagement:

- Makes a positive impact on participants, decisions, and policy.
- Ensures transparency in the information provided to participants, reporting of their views, and the channels through which their input influences policymaking.
- Upholds integrity and openness.
- Tailors the engagement to specific circumstances, aiming to meet objectives and the needs of participants and decision-makers.
- Involves the right number and type of people.
- Treats participants with respect and values their contributions.
- Prioritizes participants' discussions, learning, and feedback.
  Undergoes regular review and evaluation to enhance practices.
  Keeps participants informed throughout the process.

Effective business models for sustainable solutions

Important note: *This subsection is derived from sections 6.1 'Introduction', 6.2 'Challenge of significance to SPARCS Cities: Developing and finding financially viable business models for the projects', and 6.2.1 'Solution developed in SPARCS: the SPARCS Business Model Canvas Template', in the deliverable D6.6 'Recommendations on cross-cutting issues' (2023), drafted by Zarrin Fatima, Mia Ala-Juusela, Mikaela Ranta, Mari Hukkalainen (VTT), Aristotelis Ntafalias (MOH), Marielisa Padilla, Niklas Effenberger, Pelumi Akinmade, Uta Pollmer (FHG), Yamileth Salas, Gretel Schaj (BABLE), Julia Schließauf, Nadja Riedel (LPZ), Hendrik Kondziella (ULEI), Simon Albrecht (LSW), Michal Kuzmic (CVUT), Kleopatra Kalampoka, Artemis Giavasoglou (KFS), Giorgos Papadopoulos (SUITE5), Carolina Goncalves (Adeporto), Daniel Albuquerque (EDP CNET), Nino Gomes, Minoo Doost (SPI), Jani Tartia, Joni Mäkinen, Mia Kaurila (ESP), Marta Moreira (Maia), Yurii Poliansky (LCE), Sergij Soltys, Maksym Terletsky (Lviv), Sylva Lam (REK), David Skorna*

(KLD). You can download the complete deliverable on the official website (https://sparcs.info/en/deliverables/d6-6-recommendations-on-cross-cutting-issues/).
To facilitate readability and comprehension of the main ideas, the content has been rewritten.

Timeus et al. (2020) defines the 'smart city business model' as how a city government organizes its services to create and deliver economically viable, socially inclusive, and environmentally sustainable value for its citizens.

In SPARCS, a key objective is to identify, analyse, and adopt innovative and effective business models. This allows the developed tools and solutions to be scaled up to the city level and replicated in Fellow Cities and other European and worldwide cities.

The graph below illustrates the project development process designed within SPARCS:

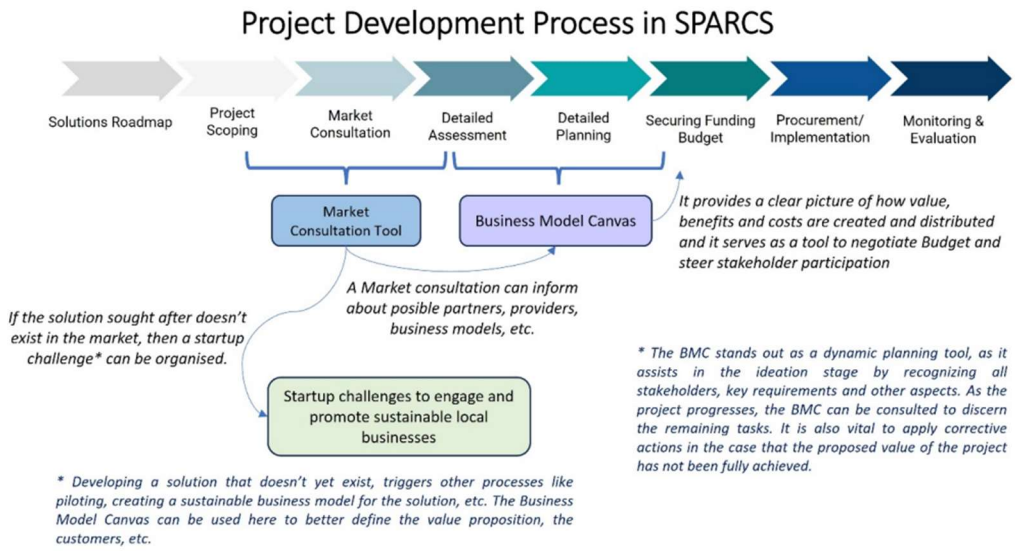


Figure 7: Connection of the three SPARCS challenges regarding Business Models as described in the following sections

Developing and finding financially viable business models for the projects

Cities strive to identify financing methods that balance economic benefits with social needs in smart city solutions. Effective business models are crucial to overcome challenges and ensure the financial viability of initiatives, avoiding prioritizing large-business goals over social goals.

City council managers encounter challenges in smart city project implementation, including the need for a transparent local framework, careful consideration of non-financial impacts, and complex stakeholder identification.

The business model canvas in SPARCS is designed for organizations seeking insights into how a positive energy district solution can create, deliver, and capture value. The primary targets within SPARCS include cities, municipal authorities, product suppliers, service providers, investors, and companies owning or developing smart city solutions.

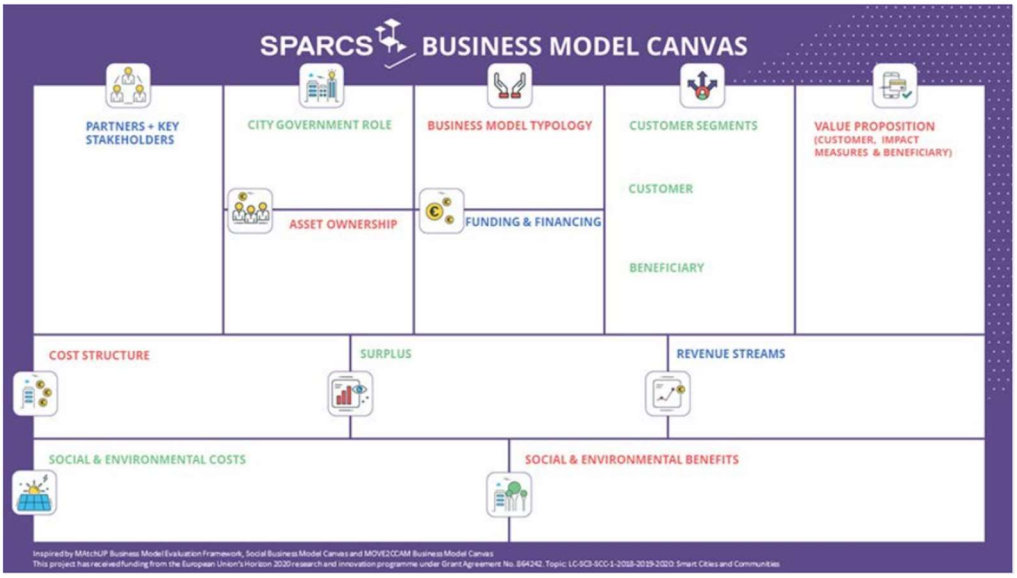


Figure 8: SPARCS Business Model Canvas (BABLE Smart Cities, 2023)

The segments that add differential value to the SPARCS business model canvas are: (1) Customer segment, (2) Surplus segment, (3) Social & Environmental costs, and (4) Social & Environmental benefits. These four segments give a better approach to how this framework could assist city council managers and use cases owners in outlining the ways they can generate and provide public value via their smart city initiatives and have better acceptance and participation by citizens, which is also considered one of the bottlenecks at the time of implementation.

SPARCS Canvas Segments	Explanation
City Government role	Control over city actions: Design/Management/Performance, collaboration, finance, policy, taxes, citizen engagement.
Asset Ownership	Indication of actors owning assets: companies (physical and intangible) and governments (infrastructure, lands, buildings).
Business Model Typology	Main typologies supporting actions: Public own/operate, EPC, PPP, Concession, Crowdfunding, Outcome-based Contracting.
Value proposition (Customer, Impact Measures, and Beneficiary)	Real value for citizens, city-users, local government, and stakeholders.
Funding/Financing	Determination, identification, and measurement of resources needed for project execution.
Cost Structure	Capital and Operational expenses for long-term assets and business operations.
Revenue Streams	Identification and measurement of income sources for the action bundle.
Social & Environmental Costs	Non-financial detriments: social (mental health, privacy) and environmental (energy, waste, biodiversity).
Social & Environmental Benefits	Non-financial benefits: social (job creation, inclusion) and environmental (efficiency, sustainability).
Partners and Key Stakeholders	Key stakeholders influencing project success, excluding customers and beneficiaries.
Target users/Customer Segments (Customer and Beneficiary)	Description of key target users or customers and beneficiaries for the product or service.
Surplus (Reinvested in other services for the citizens)	Reinvestment of profits to support or benefit communities, e.g., educational workshops.

5.2. Business model for an innovative technical solution: +CityxChange

Important note*:*

The following sections from the D4.15 'Limerick Energy Investment Models White Paper' (2023) were used in this support document: Section 3 'Methodology and Approach for Business Modeling'; section 4 'Energy Assets in Limerick "virtual" PEB'; subsection 4.1 'Tidal Turbine Energy Power Plant (TTPP)'; and Appendix B.
Deliverable 4.15 was authored by Vincenzo Cimini, Filippo Giglio, Roberta Casapietra, Giuseppe Martino, Valentina Scavelli (OV), with contributions from Gearoid Kerin, Pat Stephens (LCCC), Mladen Antolic, Stephen Wright, Arthur Trousseau (MPOWER), Dudley Stewart (MPOWER), Gary Brennan, Vincent McCormack (GKinetic), Lorenzo De Donatis (IESRD). This document can be found on the official +CityxChange page (https://cityxchange.eu/knowledge-base/d4-15-limerick-energy-investment-models-white-paper/).
To facilitate readability and comprehension of the main ideas, the content has been rewritten.

Methodology and approach for business modelling

The +CityxChange approach, methodology, and efforts on sustainable investments are detailed in the report D2.4 'Report on the bankability of the demonstrated innovations' (Cimini, Giglio, Carbonari, 2019). The basic concepts of bankability include being acceptable to a bank, having a high profit potential, ensuring acceptable cash flows, and having a high probability of long-term viability and success. These concepts are applied in the frameworks and solutions of PEB and local energy markets. The development of integrated investment models and new value chains is derived from these principles, as illustrated in the following figure:

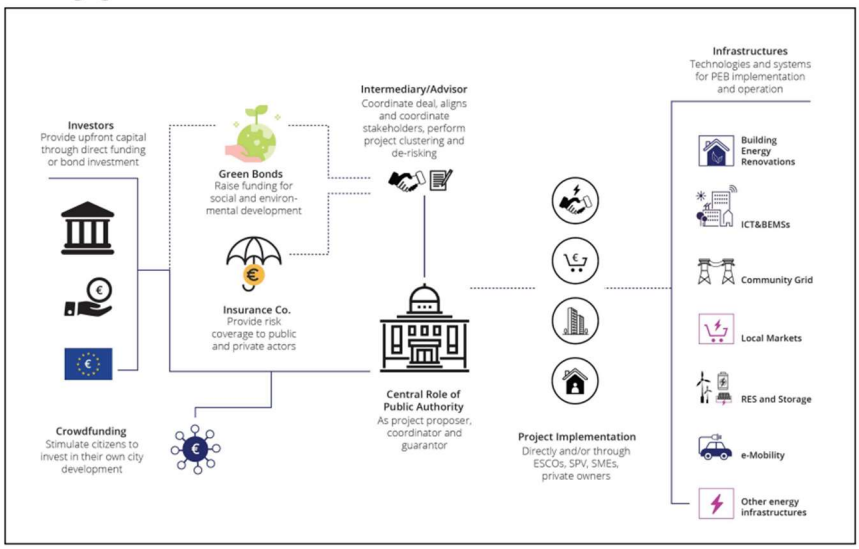


Figure 3.1: Generic Integrated Investment model for implementation and operation of PEBs and Local Energy Markets. Source: +CityxChange report D2.4 - Report on the bankability of the demonstrated innovations (Cimini, Giglio, Carbonari, 2019)

The business concepts, models, and investments in this work are specifically designed for positive energy blocks (PEB), with the potential for scalability to PEDs at district level. The methodology and approach used in the +CityxChange project for developing business models began with the "traditional" standardized business model canvas. This canvas serves as a strategic management template for creating and documenting business models, focusing on how an organization creates, delivers, and captures value. In essence, the business model canvas aims to not only maximize economic and financial profits but also to minimize the environmental and social impacts of planned interventions, aligning with the goals of the +CityxChange project.

Limerick "virtual" PEB

The demonstration district in Limerick covers 23 city blocks and spans an area of 353,000 m2, including the Georgian District and parts of the river north of the city centre where a tidal turbine power plant is planned.

Initially focused on the local PEB, it evolved into a virtual distributed positive energy block (DPEB), exploring connections with distributed generation sources across a much broader area than originally envisioned.

The "virtual" PEB consists of local and remote distributed energy assets used to meet local demand:

- The community grid is expected to cover the entire PEB's demand for optimal energy resource utilization and self-sustainability, minimizing transmission costs.
- Common local assets include solar panels on PEB buildings, primarily for self-consumption.
- Surplus energy is stored in battery banks or converted to heat and stored in boilers for heating. Battery-stored energy can be shared between PEB buildings through enerXchange trading.
- **The tidal turbine**, initially intended as the main local energy source, became a remote distributed generation source due to an updated location relatively far away.
- Another remote generation source is a PV plant, contributing energy to the virtual DPEB as needed.

Tidal turbine energy power plant (TTPP)

As a successful example within the +CityxChange project, we will delve into the case of the turbine. This case is noteworthy due to its technological innovation, a process of adaptation and changes, a robust approach to its business model, and a detailed study of financial scenarios. Despite all the obstacles in the process, it has ultimately been successfully installed and has become a remote component in the conception of Limerick's positive energy block (PEB)

Business case & investment solutions

The Tidal Turbine generated an investment of €853,600 for its second-phase installation, which was secured by external private investors and/or other equity financing. Private investment was linked to and dependent on energy costs, revenues, financial risks, payback period (PBP), return on investment (ROI), and other relevant key performance indicators (KPIs).

The tidal turbine investment was planned to contribute to the implementation of the PEB, create new jobs, foster citizens' engagement, and produce cleaner energy. The small-scale +CityxChange demo project presented a significant opportunity for the Limerick community and served as an initial practice to boost large-scale opportunities in the long term.

During the initial phase, the partnership involved in designing and developing the business model shared and exchanged information regarding technical aspects, energy production, investment costs, technological specifics, environmental impacts, and potential CO_2 reductions. The work was undertaken with the aim of designing and implementing the "best" business models for Tidal Turbine implementation to contribute to PEB creation. This was followed by an analysis of potential asset ownership and possible financial solutions.

Business and investment models for the TTPP were supported by an analysis of costs and revenues, with a focus on potential financial solutions. The business model canvas for TTPP owned by the Renewable Energy Communities (REC) synthesized how the TTPP could capture value from energy production and self-consumption for the REC and the entire PEB.

Business model canvas for TTPP owned by the REC

Business Model Canvas for TTPP owned by the REC

7.Key partners & ownership 7.1 +CxC project partners	**5. Key Activities** 5.1 Cost & Benefits analysis calculation	**1. Value Propositions** 1.1 RES technology & green produced energy	**4. Customer Relationships** 4.1 Long terms partnership (Contractual medium term,	**2. Customer Segments** 2.1 CEC (Citizen Energy Community)

Business Model Canvas for TTPP owned by the REC

7.Key partners & ownership 7.1 +CxC project partners 7.2 REC (Renewable Energy Community) 100% (Recent government requires that community energy projects are 100% owned by the REC). 7.3 LCCC	**5. Key Activities** 5.1 Cost & Benefits analysis calculation 5.2 Loan & borrow money for the investment 5.3 EE services (other services, broader scope, they can offer other service regulatory speaking) 5.4 Electricity trading **6. Key Resources** 6.1 Technical & financial know-how	**1. Value Propositions** 1.1 RES technology & green produced energy 1.2 Successful Energy Project, minimum enegy production: Tidal Power converts more or less 30% of kinetic energy into electricity 1.3 35% powered by TTPP (clean energy) (+CxC project) 1.4 Minimize technology risks, management & related manteinance costs 1.5 Support the energy transition through local market for energy and flexibility which generate value for local stakeholders 1.6 REC sells directly energy	**4. Customer Relationships** 4.1 Long terms partnership (Contractual medium term, 5 - 20 years) 4.1 Co-creation & co-development: REC & developer 4.3 Engagement with citizens 4.4 Engagement with policy makers, at local and national level **3. Channels** 3.1 Special events 3.2 Social & official tools 3.3 Direct marketing & storytelling, to deliver 3.4 Trading platform	**2. Customer Segments** 2.1 CEC (Citizen Energy Community) 2.2 Local Energy Market 2.3 Building owners 2.4 EV users
9. Cost Structure- 9.1 O&M costs 9.2 Technology & prototype/demonstrator development 9.3 Engage communities			**8. Revenue Streams** 8.1 Self consumption 8.2 PEB Innovative Benefits (i.e from Local Trading) 8.3 SEAI (Sustainable Energy Agency of Ireland) Grants 8.4 Project development rights 8.5 EU fundings 8.6 Concultancy & business model innnovation (license and best practice fee) 8.7 Rapid charge cars	

FEATURES

1. GKIN's role as advisory: the expected relationship between the REC and GKIN is that GKIN will not have any ownership of the REC, but rather will act in an advisory role to the REC, assist with planning and permitting and lead the supply, installation, commissioning, operations and maintenance of the turbines for the REC)
2. The REC will have to raise €853,600 to cover the supply and installation costs for the remaining 12 turbines. The 3 units from the demonstrator will have a residual value of €145,624 by the end of the project which GKIN will donate as in-kind
3. Change of number and size of turbines: from '180kWh tidal power plant' to 3 + 12 x 12kW turbine units. Higher external financing (partly REC) is for full deployment of 180knw. This finance os out of the risk. REC full set-up for December 2021
4. The energy scope of the work remains the same and GKIN is committed to supplying the originally agreed 630,720kWh/yr of energy as per the original DoA, pending funding for the full deployment, funded by the REC. The generation capacity of 630,720kWhrs per year could yield a retail price of 20 cent per unit at today's prices (prices are predicted to rise rapidly over the next few years). If the generation is used to rapid charge cars it could yield 25 - 35 cents per kW. In these conditions revenue over a twenty year lifespan can easily exceed €2.6 Million for the REC
5. With economies of scale (especially with grid connection costs), the Community Led Projects (REC) need to be around the 4MW size to be competitive; most of the other projects are at the max 5MW threshold
6. The overall cost increase means that the required external fin. increases from€ 750.714 (as per DoA by Gkin, now raised by the REC by € 102.886,00 to € 853.600,00 which the REC is now expected to cover and secure
7. MPower is also working on a business plan for CHP installation in the PEB to close the energy gap. (c) Battery storage to be used to make sure connections are below the 11kW threshold for REC. (d) Energy from demonstration turbines may be used to charge eVs. (e) Apply for funding under the Climate Action Fund
8. OV is developing an Evaluation Method for TTPP (for RES): net present value (NPV), internal rate of return (IRR). Social discount rates and ESG impacts. Weighted Average Cost of Capital (WACC)

Investment solutions for TTPP owned by the REC

In Annex 1 of this document, the study of the different financial scenarios explored by the project is outlined. It involves four scenarios with varying financial schemes.

6. Community/Collaborative Business Model

Definition:
A community or collaborative business model is a strategic approach where businesses, individuals, or entities collaborate and contribute collectively towards a shared goal, often fostering community engagement and co-creation.

Process:
1. **Identifying community needs:** Understanding the needs of the community or stakeholders.
2. **Engaging stakeholders:** Involving diverse participants in collaborative efforts.
3. **Shared decision-making:** Collaboratively making decisions to achieve common objectives.
4. **Resource sharing:** Utilizing shared resources, skills, and expertise for mutual benefit.
5. **Continuous feedback:** Encouraging ongoing communication and feedback loops within the community.

Relevance to Smart Cities:
In the context of Smart Cities, a Community/Collaborative Business Model is vital for:
- **Inclusive Innovation:** Involving citizens and businesses in co-creating smart solutions.
- **Resource Optimization:** Maximizing the use of shared resources for sustainable urban development.
- **Enhanced Quality of Life:** Tailoring smart initiatives to community needs for improved well-being.

Integration into Business Models:
The community/collaborative business model becomes a core aspect of a business model, shaping how organizations interact with stakeholders and emphasizing shared value creation.

Impact on Smart City Projects:
1. **Inclusive development:** Ensures diverse perspectives are considered in planning and implementation.
2. **Sustainable practices:** Promotes resource efficiency through shared infrastructure and services.
3. **Citizen-centric solutions:** Facilitates the creation of smart solutions aligned with community preferences.

Advantages and Disadvantages:

Advantages	Disadvantages
- Diverse Expertise	- Potential for conflicts of interest
- Community Empowerment	- Challenges in decision-making consensus
- Enhanced Innovation	- Initial coordination efforts may be high
- Shared Costs and Risks	- Requires effective communication

European Regulatory Framework:
The community/collaborative business model aligns with European principles of collaborative governance and citizen engagement, as highlighted in various policies such as the EU's Digital Agenda and Horizon 2020 programme. These frameworks encourage partnerships and collaborations for sustainable and citizen-centric urban development.

Some interesting projects that are applying this concept:

Syn.ikia

- Is an EU-funded project aiming at developing sustainable neighbourhoods with surplus renewable energy across Europe.
- They are working on the theoretical and practical development of a community business model, focusing on 5 key strategies: share, shine, shave, safe, and scale.
- More information: https://www.synikia.eu/

oPEN Lab

- Is an EU-funded project leading the transition to Positive Energy Neighbourhoods (PENs) in Tartu (Estonia), Pamplona (Spain) and Genk (Belgium).
- Positive energy neighbourhoods (PENs) go beyond simply combining individual positive energy buildings. By integrating buildings and neighbourhood infrastructure, they create a dynamic interacting with energy, mobility and industry.
- More information: https://openlab-project.eu/

Vilawatt Project

- Vilawatt's backbone is the public-private-citizen partnership (PPCP). Vilawatt was an Urban Innovative Action project made up of 9 partners (public and private) coordinated by the municipality of Viladecans, Spain.
- VILAWATT creation aimed to drive forward the energy transition in the Catalan city of Viladecans. The project set up a public-private-citizen partnership (PPCP), as the main governance structure to manage 4 key services: 100% renewable energy supply; fast renovation of private buildings; consulting services and learning communities (energy audits & contract optimisation, training and empowerment in energy culture, financing options); and efficiency incentives via the Vilawatt local currency.
- More information: https://shape-affordablehousing.eu/vilawatt-project/

CrAFt, Creating Actionable Futures

- CrAFT is an EU-funded project for cities to become climate-neutral, beautiful and inclusive.
- CrAFt's commitment to cities and communities extends beyond the pursuit of climate neutrality. They see cities and communities as living, breathing entities that prioritise the well-being of their inhabitants and the health of our planet. This holistic perspective guides our experiments, dialogues and research, ensuring that our cities are not only environmentally responsible, but also socially and economically vibrant.
- Their approach involves radical collaboration, i.e. collaboration across disciplines, sectors and cultures, emphasising active stakeholder engagement through workshops and consultations. This ensures broad-based support and ownership, creating a participatory environment for shaping the urban landscape collaboratively. Incorporating artistic, cultural, and creative sectors into climate-change strategies, inspires active participation and new viewpoints. The collaborative effort values the insights of both professionals and inhabitants, recognising inhabitants as experts in their daily lives.
- More information: https://craft-cities.eu/

Watteco Company

- MISSION: Watteco aims to facilitate a participatory energy transition by assisting local communities in embracing renewable energy collaboratively, engaging citizens in the process. The company has introduced a virtual platform designed to streamline collective financing for renewable projects, offer rewards to investors based on generated energy, and foster local trade through a virtual currency.

- VISION: Watteco envisions itself as a catalyst for a paradigm shift in the energy sector. Recognizing that the transition to renewables entails economic, social, and cultural transformations, the company aspires to contribute to this paradigm shift. Watteco seeks to promote the establishment of local energy communities empowered to reshape neighbourhoods, towns, and cities towards a more sustainable future.
- More information: https://www.watteco.cat/

Annex 1

Business case & investment solutions of the tidal turbine energy power plant (TTPP)

allowed for this. LCCC is working on potential PV sites solutions to compensate for the Tidal Turbine energy GAP and in addition to being a mitigation and corrective measure, the integrated system could facilitate the attraction of potential investors like an ESCO (Energy Service Company).

Business case & Investment solutions

Background

The Tidal Turbine generates an investment of the 2nd Phase installation to be secured by external private investors and/or other Equity financing equal to € 853.600 Private investment is related and dependent on costs of energy & revenues, financial risks, Payback Back Period (PBP), Return On Investment (ROI) and other appropriate KPIs. The Tidal Turbine investment has been planned to contribute to PEB implementation, to create new jobs, to foster citizens' engagement and produce cleaner energy. The small scale +CxC demo project is a great opportunity for the Limerick community and it's a starting practice to boost large scale opportunities in the long-term. The work done by OV, in cooperation with Gkin and MPower, consisted in different steps and actions.
During the first part, the partnership involved in the Business Model design and development has shared and exchanged information in terms of technical issues, energy produced, investment costs and technological specifics, environmental impacts and potential CO_2 reductions. The work has been developed with the aim to design and implement the "best" Business Models for Tidal Turbine implementation to contribute to PEB creation. This has been followed by an analysis on potential ownership of the asset and possible financial solutions. Business and Investment models for TTPP have been supported by an analysis of costs and revenues with emphasis on possible financial solutions. The "Business Model Canvas for TTPP owned by the REC (Appendix B to this Deliverable) synthesises how the TTPP could capture value from energy production and self-consumption for the REC and the entire PEB. The BM canvas is a starting strategy for developing the "best" Business Model to be competitive in the energy market. Among the numerous activities of technical assistance, OV has also suggested and supported LCCC and Gkin in an open call during the Reporting period and already closed on the SEAI scheme: RESS 2 that finances energy production. The terms were that the investment should have been minimum 500 kW so additional PV may be required (a potential solution to evaluate). The feed in tariff was the most used formula in the EU for RES while Governments realise that a support it's necessary for a period of years. The Renewable Energy Support Scheme (RESS) is an auction based feed in tariff, with two distinct categories; a general category, for generation over 5MW and a community category, for generation between 500 kW to 5 MW. Participation in the community category was restricted to Renewable Energy Communities (RECs). The Governance was characterised by REC 100% ownership of the renewable energy generation asset. Structuring the ownership of the Tidal turbine as a REC will allow more options for both grid connections and route-to-market, with the expectation that REC generation less than 500 kW will be facilitated in due course. The latest RESS auction (RESS 2) resulted in a € 116.41 per MWh strike rate for the Community Led section.

Work done, planned & achieved results

As mentioned above, the first part of work consisted in a collection of info data on investment, operational and maintenance costs, energy production and related revenue calculations.

Limerick TTPP experience shows how social, financial, permission barriers and factors influence the investment's success. To overcome barriers and before taking a decision on investment, investors must perceive and understand related risks and evaluate potential investment solutions.
Moreover, investment decisions are strongly influenced by the increasing energy price and interest rate. The analysis has assessed the potential problems associated with construction and management and OV has evaluated the project from the investor's perspective and how all these factors could impact on the return of the investment.

Due to difficulties and problems already described, the project foresees two phases for installation and implementation:

1. 36 kW installed during the project and co-financed by the Grant Agreement (GA)
2. 144 kW to be installed after the project's end (TO BE SECURED BY EXTERNAL INVESTMENTS).

Phase 1 and Phase 2 have different financial and economics features, in particular:

Phase 1: the 36 kW TT is expected to be connected to the Grid via the Thomond Weir building. At the beginning of the project, before establishing the REC, it was assumed that the tidal turbine owners would serve directly LCCC (which owns the Thomond Weir building), with some energy being directly consumed & some exported to the Grid. Phase 1 is temporary, with a two-year duration only.

Phase 2: during this phase the "real" TT Business Model is deployed. After the REC establishment the energy produced will be wholly self-consumed by the Community. It is expected that the REC will seek and obtain capital Grant support, such as the Climate Action Fund[26] in the order of 50% to progress to Phase 2. A "route-to-market" for Small Scale Renewable Energy generators (50kW to 500kW) is currently being developed by the Department of the Environment, Climate and Communications of the Irish Government in response to Action 108 of the Climate Action Plan 2021[27].

The key parameters proposed in the consultation process for REC participation (where the REC is not associated with a demand site & is under 1 MW) in the Small Scale Generation Scheme SSG are:

- all projects installing an eligible renewable electricity generation technology up to 1 MW will be eligible for SSG support. This is in line with the recent Communication from the Commission[28], which allows for exemptions from a competitive bidding process in the allocation of aid to all renewable electricity projects up to 1 MW capacity.
- to be eligible for SSG support, such projects must be able to demonstrate planning approval/exemption and grid connection offer
- Subject to compliance with state aid rules, community-specific support similar to those offered under the SEAI RESS Community Enabling Framework will be available to RECs participating in the SSG.

[26] https://www.gov.ie/en/publication/de5d3-climate-action-fund/#further-information
[27] https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/
[28] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022XC0218(03)&from=EN

The Tidal Turbine Business Case identifies a series of Scenarios with different options and Investment solutions.
For all Scenarios have been calculated investment costs, economic and financial costs, revenues from energy production, cash flows, debt duration payment and instalment.
In all identified Scenarios we have simulated financial solutions to cover the CAPEX with different loans and/or other financial solutions. For all Business Case-Scenarios we consider a 20 years life-span.

The analysis measures and tests the bankability of the investment for the Tidal Turbine in each Scenario. Investment results are tangible and available for Public Bodies and local authorities, potential investors, REC and all citizens.
For Investment solutions, dialogue and negotiations with shareholders and banks are needed to provide Equity and Debt.
The TT Business Case foresees that the possible Legal Form to own the TT is the REC with the opportunity of the members to become shareholders of the investment by acquiring shares, with rights to access to any information, to take part in the assemblies and vote. Possible investment solutions for the Tidal Turbine could be a mix of supporting schemes with Equity-Grants, bank loans and/or soft loans[29] with different durations.

The investment solution for the missing part to be secured equal to € 853.600 could be managed by the REC. OV has developed the following Business Cases-Scenarios for the Tidal Turbine with related investment solutions.

The first option is described in **Scenario 1** which calculates potential benefits arising from electricity revenues based on an energy price of € 0,145 kWh for both Phase 1 (Equipment installation 36 kW) and Phase 2 (Equipment Installation 144 kW) as shown in the following table:

- Annual energy production: 630 MWh
- Energy cost (2018)[30]: 0,145 €/kWh
- Revenues: € 91,454.40

Table 4 1: Tidal Turbine Energy production & revenues

Demonstrator Installation (Revised Proposal) - INPUTS Data & Production						
Energy Production	RES Production		REC or PEB Self-consumption	Exported production	FIT revenues	Revenues from savings
TTPP	Installed KW	Annual production (kWh)	(kWh)	(kWh)	(euro)	€ savings
Equipment Phase 1	36	126,144.00	126,144.00	0	0.00	18,290.90
Equipment Phase 2	144	504,576.00	504,576.00	0	0.00	73,163.50
Total	180,00	630,720.00	630,720.00	0	€ 0.00	€ 91,454.40

[29] A soft loan is a loan with no interest or a below-market rate of interest. https://www.investopedia.com/terms/s/softloan.asp
[30] SEAI (Sustainable Energy Agency of Ireland) Report https://www.seai.ie/publications/Domestic-Fuel-Cost-Comparison.pdf

ENERGY TARIFFS	
Revenue per kWh (€/kWh)	€ 0,145
FIT (feed in tariff)*	€ 0,00
Selling price	€ 0,145

Table 4 1.1: energy prices (OV re-elaboration)

Scenario 1: Investment solutions

OV has provided potential financial-investment solutions for the amount-value of € 853,600.

Scenario 1 has positive and bankable cash flows. Total amount to be secured is 50% of total (€ 426,800). The remaining part is financed by Debt with a cost (interest rate) of 6,5%. Payback Period for the Debt is 10,3 years.

Table 4.2 below shows the Payback Period for Scenario 1, including Operations and Maintenance costs, related Operating Profit and Depreciation with an energy price of 0,145 €/kWh:

Table 4.2: Tidal Turbine Simple Cost Benefit Analysis - Scenario 1

TTPP - Investment-cost & profit analysis Scenario 1	
COSTS	
Total Investment costs €	€ 853,600.00
50% of the investment (to be secured)	€ 426,800.00
50% by GRANT	€ 426,800.00
A. Depreciation	€ 19,206.00
B. Operations & maintenance Costs	€ 20,743.00
C. Other costs (insurance, etc.)	€ 10,000.00
BENEFITS	
D. Total electricity savings/revenues (€ 0,145/kWh)	€ 91,455.00
Operating profit [€/yr][31] (D-A-B-C)	€ 41,505.00
Payback Period (Yr) on 50%	10,3
Payback Period (Yr) on Total Investment	20,6
Return on Investment	4,86 %

They have been simulated by OV, in cooperation with LCCC, based on the following energy prices:

Scenario 2: 0,21 €/kWh (Year 2019)
Scenario 3: 0,277 €/kWh (AVERAGE VALUE = Year 2018/2022)

[31] https://www.investopedia.com/ask/answers/031015/what-difference-between-gross-profit-operating-profit-and-net-income.asp

Scenario 4: 0,42[32] €/kWh (October 2022 - energy price)

Scenario 2: Investment solutions

Here below the Table 4.3 synthesises main values and KPIs for Scenario 2 with an energy price of 0,210 €/kWh:

Table 4.3: Tidal Turbine Simple Cost Benefit Analysis - Scenario 2

TTPP - Investment-cost & profit analysis Scenario 2	
COSTS	
Total Investment costs €	€ 853,600.00
100% of the investment (to be secured)	€ 853,600.00
A. Depreciation	€ 19,206.00
B. Operations & maintenance Costs	€ 20,743.50
C. Other costs (insurance, etc.)	€ 10,000.00
BENEFITS	
D. Total electricity savings/revenues	€ 132,451.20
Operating profit [€/yr]	€ 82,501.70
Payback Period (Yr) on 50%	6
Payback Period (Yr) on Total Investment	11
Return on Investment	9,67 %

Next table illustrates a financial scheme that could be provided-used for the investment:

Table 4.4: Financial scheme Scenario 2

Cost of funding (%)	Equity/Debt	TT Scenario 2	
		Scenario - Solution 2	
		Total investment	€ 853,600.00
-	Equity	Grant (EU, National, Regional)	-
6,5%	Debt	Green Bank Loan	100%

Total investment for Phase 2 Business Case - Solution 2 is € 853,600.00 financed at 100% by a Green Bank Loan.

[32] SEAI (Sustainable Energy Agency of Ireland) Report https://www.seai.ie/publications/Domestic-Fuel-Cost-Comparison.pdf

The Green Bank Loan is a Loan from a Bank and/or a financial Institution, for example in Ireland are available also Climate Action Loan Fund[33], to finance green projects that have a repayment schedule on a fixed or variable interest rate. The Loan repayment foresees a fixed instalment-rata which considers the capital share and the interest rate. The instalment is repaid with revenues from energy production (for deeper analysis check the Tool Annexed file on the website named: +CxC D4.15_Annex 2_Limerick_Tidal Turbine_Business Model).

Investment value is covered 100% by Debt and it's bankable with 10 years loan duration. Annual revenues/savings are € 132,451.20 (0,21 €/kWh energy price). Investment provides positive financial and economic results, cash-flows become positive at year 11.

Next table summarises main figures for a 100% Bank Loan solution:

Table 4.5: TT Business Case Scenario 2

Green Bank Loan - Financial Model Scenario 2		
Capital cost to be funded		€ 853,600.00
Grant 0%		€ -
Loan cover		100%
Total Funding		€ 853,600.00
Cost of Funding		€ 417,716.41
Years of loan	Loan payment	Interest rate
10	€ 85,360	6,5 %
Total payments (10 yr)		€ 1,271,316.41
Cost of Energy		0,21 €/kWh

Scenario 2, with an energy price of 0,21 €/kWh, has already demonstrated the Tidal Turbine Investment is Bankable, consequently, all next considered Scenarios 3 and 4, with a further increasing energy price €/kWh, are more convenient.

In fact, compared to Scenario 2, Scenario 3 has a 28% higher price and Scenario 4 is 100% higher than Scenario 2.

[33] https://www.clanncredo.ie/mi-loans-climate-action-loan-fund#bottom

Table 4.6: Energy price

	Energy Price [€/kWh]	Based on
Scenario 1	0,145	Year 2018
Scenario 2	0,21	Year 2019
Scenario 3	0,277	AVERAGE PRICE = Year 2018/2022
Scenario 4	0,42	CURRENT- October 2022 - energy price

Scenario 3: Investment solutions

Here below Table 4.7 synthesises main values and KPIs for Scenario 3 with an energy price of 0,277 €/kWh:

Table 4.7: Tidal Turbine Simple Cost Benefit Analysis - Scenario 3

TTPP - Investment-cost & profit analysis Scenario 3	
COSTS	
Total Investment costs €	€ 853,600.00
50% of the investment (to be secured)	€ 426,800.00
50% by GRANT	€ 426,800.00
A. Depreciation	€ 19,206.00
B. Operations & maintenance Costs	€ 20,743.50
C. Other costs (insurance, etc.)	€ 10,000.00
BENEFITS	
D. Total electricity savings/revenues	€ 143,488.80
Operating profit [€/yr]	€ 93,539.30
Payback Period (Yr) on 50%	4,6
Payback Period (Yr) on Total Investment	9,1
Return on Investment	10,96 %

Next table illustrates a financial scheme that could be provided-used for the investment.

Table 4.8: Financial scheme Scenario 3

Cost of funding (%)	Equity/Debt	TT Scenario 3	
		Scenario-Solution 3	
		Total investment	€853.600,00
-	Equity	Grant (EU, National, Regional)	-
6,5 %	Debt	Green Bank Loan	100%

Investment of € 853,600 is financed 100% by Debt (Green Bank Loan), with an interest rate of 6,5%[34] and a 10 years loan duration. Annual revenues/savings are € 143,488.80 (0,277 €/kWh energy price).

Investment provides positive financial and economic results and additional cash-flows completely repay the Debt.

Next table summarises main figures for the investment solution with 100% Bank Loan:

Table 4.9: TT Business Case Scenario 3

Green Bank Loan - Financial Model Scenario 3		
Capital cost to be funded		€ 853,600
Grant 50%		€ -
Loan cover		100%
Total Funding		€ 853,600
Cost of Funding		€ 305.162
Years of loan	Loan payment	Interest rate
10	€ 85,360	6,5 %
Total payments (10 yr)		€ 1,158,762
Cost of Energy		0,277 €/kWh

Scenario 4: Investment solutions

Here below the table 4.10 shows main values and KPIs for Scenario 4 with an energy price of 0,42 €/kWh:

[34] https://personalbanking.bankofireland.com/borrow/loans/green-home-improvement-loan/rates/#:~:text=Variable%20rate%20of%206.50%25%20Annual,variable%20rate%20of%206.5%25%20APR.

Table 4.10: Tidal Turbine Simple Cost Benefit Analysis - Scenario 4

TTPP - Investment-cost & profit analysis Scenario 4	
COSTS	
Total Investment costs €	€ 853,600.00
50% of the investment (to be secured)	€ 426,800.00
50% by GRANT	€ 426,800.00
A. Depreciation	€ 21,340.00
Depreciation 90%	€ 19,206.00
B. Operations & maintenance Costs	€ 20,743.50
C. Other costs (insurance, etc.)	€ 10,000.00
BENEFITS	
D. Total electricity savings/revenues	€ 233,366.40
Operating profit [€/yr]	€ 181,282.90
Payback Period (Yr) on 50%	2
Payback Period (Yr) on Total Investment	5
Return on Investment	21,24 %

Scenario 4 represents an improved Business Scenario-Solution in terms of revenues compared to Scenarios 3 and 2.

In particular, Scenario 4 revenues are twice as high as Scenario 2 with the same costs. For this reason cash-flows strongly improve in Scenario 4 and allow to repay the Debt in half time compared to Scenario 2.

The REC self-consumption Business Model

Table 4.11: The REC self-consumption Business Model

Owner/Leader	Project stage/Investment	Financial schemes Options	Value proposition
REC 100%	Implementation & physical construction	Green Bank loan	Energy self-consumption
		Grant (ERDF) & Climate Action Programs	
	Energy production	ESCO	
		Climate Action programs	

There is an interesting regulation in Ireland, coming from the Clean Energy Package, which allows the REC to charge electricity down the road; it could be in a separate generator than their own property and use it for themselves, it could be a form of "clever accounting" but at the moment is in a planning phase and in next years it will be possible to see how it evolves. What we expect now it's an increase in energy prices in the next future from 20 to 40 cents and probably more).
In case the REC will use further charges-devices like the DuoS there will be additional-operational costs, and we simulate a Business model where the energy price is reduced by 0,05 cents (0, 14 € - 0,05 € , 0,31 – 0,05 € and 0,43 € – 0,05).

The REC scenario is the following:

- Eight players (LCCC is not included) with LCCC acting as a facilitator to enable the REC. (LCCC is the landlord for the REC and there will be too many conflicts of interest in being part.)
- Installation of 38 cable substations.

The Community Grid hasn't taken up and this is a project failure. At the same time, the REC establishment is a tangible positive result.
OV analysis and investment solutions include PEB 1 and Tidal Turbine which covers part of energy buildings demand because in the Georgian District there are huge buildings like Gardens International.
The analysis considers the scaling up of the model from five to 25 buildings (3 PEBs).

4.2 Micro CHP Energy Power Plant: future option

The Feasibility Study on Micro CHP Energy Power Plant has been designed and developed by MPower as a potential option to cover possible risks of local energy generation. MPOWER has assessed and scoped some locations to find areas where the CHP could effectively be installed and its energy production used.
That is how after global environmental and political considerations, we saw at that time an opportunity that would align as much as possible with the original targets of the project by considering the implementation of micro-CHP plants. The process for the CHP scoping and implementation is described in D4.12 Community Grid Implementation Guide, section 2.3.
The proposal by MPOWER as regards the potential for the project of a micro CHP plant installation was explained to the consortium as a solution to be examined. The biggest barriers in CHP's validation and implementation would rely on the gas network which is not fully considered renewable at the moment even though there is a national trend to supply it with biogas, on issues regarding location for installation within the dense urban area or the historic buildings under heritage protection, issues around civil works to connect buildings, a process to convince building owners, insurance, noise, ownership and operation, and general scenarios with a detailed deployment plan addressing these issues.
For a complete insight, it would have been necessary to create a proper feasibility study, for which the necessary budget and justification was not followed up, so it was eventually