

SPARCS

D7.1. Business Models and Financing Mechanisms for Wide Uptake of Smart City solutions

01/10/20

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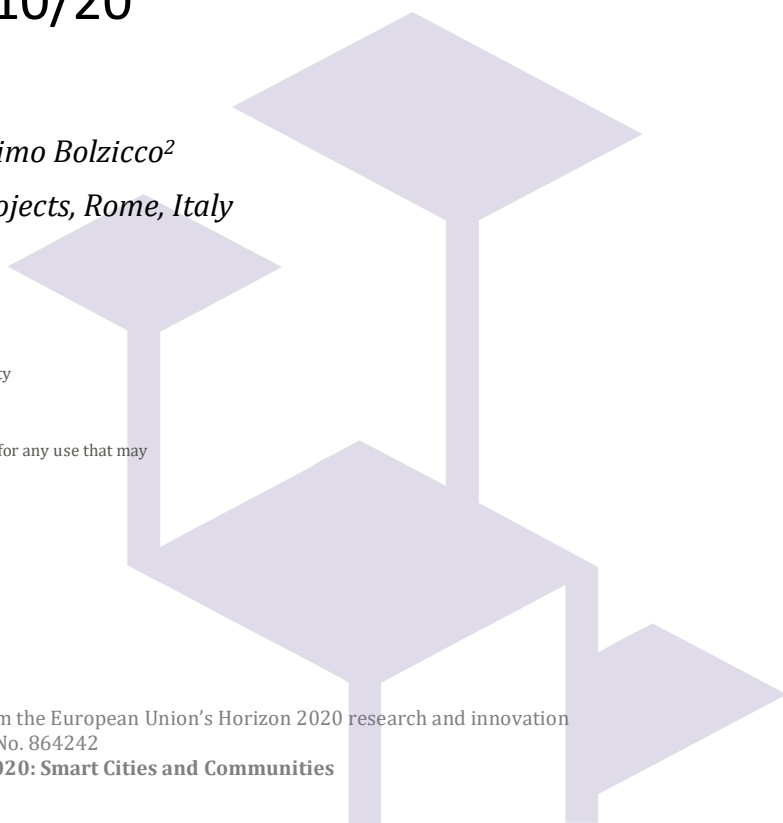
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Description of the related task and the deliverable. Extract from DoA	<p>T7.1 Mapping of business models and financing mechanisms (CiviESCO) M1 – 12</p> <p>The task provides an implementable benchmark, which will be fed in T1.5 towards profiling an innovative, standardized and even customizable Business, Investment, and Risk Model. The starting point is a complete census of the state of the art of business and financing mechanisms already tested and validated in other FP7 and H2020 Smart City projects. In addition, worldwide experiences will be considered related to the already put-in-practice model. In this regard SPARCs market intelligence is focus and settled basically on small/medium size smart city, which is the smart city model exploitable in the European context. The benchmark analysis will include an up-to-date census of financing schemes, instruments and tools validated by three families of financing institutions, such as: - Institutional: European Investment Bank (EIB), Cassa Depositi e Prestiti (CDP), Caisse des Dépôts (CDC), Kreditanstalt für Wiederaufbau (KfW); - Private banking; - Private Equity and Asset Manager. The identified business models, finance & funding instruments and procurement schemes will be analysed in detail and linked to specific interventions in order to assess the extent that they fit today's challenges within smart cities, as they draw up based on the envisaged interventions in the SPARCs lighthouse cities. To this end a value model approach will be followed to evaluate the efficiency of such business models and financing/procurement mechanisms for smart solutions and interventions, enabling the holistic assessment of respective returns in financial, economic, social and environmental terms, thus highlighting the expected high-level benefits for all stakeholders involved in the value chain (per intervention, but also, cumulatively). To this direction, T7.1 will establish direct links and interact with WP5, towards: (i) to properly align use cases (describing in detail the actual interventions in cities and the role of each stakeholder in their implementation) with specific solutions (socio-technical systems enabling the realization of use cases) and (ii) to support the replication planning of the project by identifying and feeding back to WP5 appropriate combinations business models and financing schemes linked to specific interventions to be implemented in Fellow cities involved in the project and beyond. Finally, D7.1 will assess a SPARCs standard architecture Model with three macro areas: Business, Investments, and Risks. In addition, SPARCs implements a customized risk mitigation executive tools at Positive Energy Block/District level, crossing three KPIs: ROI; payback time; DSCR.</p>			



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Dissemination level

PU	Public	X
CO	Confidential, only for members of the consortium (including the Commission Services)	



About SPARCS

Sustainable energy Positive & zero cARbon Communities demonstrates and validates technically and socioeconomically viable and replicable, innovative solutions for rolling out smart, integrated positive energy systems for the transition to a citizen centred zero carbon & resource efficient economy. SPARCS facilitates the participation of buildings to the energy market enabling new services and a virtual power plant concept, creating VirtualPositiveEnergy communities as energy democratic playground (positive energy districts can exchange energy with energy entities located outside the district). Seven cities will demonstrate 100+ actions turning buildings, blocks, and districts into energy prosumers. Impacts span economic growth, improved quality of life, and environmental benefits towards the EC policy framework for climate and energy, the SET plan and UN Sustainable Development goals. SPARCS co-creation brings together citizens, companies, research organizations, city planning and decision making entities, transforming cities to carbon-free inclusive communities. Lighthouse cities Espoo (FI) and Leipzig (DE) implement large demonstrations. Fellow cities Reykjavik (IS), Maia (PT), Lviv (UA), Kifissia (EL) and Kladno (CZ) prepare replication with hands-on feasibility studies. SPARCS identifies bankable actions to accelerate market uptake, pioneers innovative, exploitable governance and business models boosting the transformation processes, joint procurement procedures and citizen engaging mechanisms in an overarching city planning instrument toward the bold City Vision 2050. SPARCS engages 30 partners from 8 EU Member States (FI, DE, PT, CY, EL, BE, CZ, IT) and 2 non-EU countries (UA, IS), representing key stakeholders within the value chain of urban challenges and smart, sustainable cities bringing together three distinct but also overlapping knowledge areas: (i) City Energy Systems, (ii) ICT and Interoperability, (iii) Business Innovation and Market Knowledge.

Partners



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EXECUTIVE SUMMARY



“Those who act first and fastest will also be the ones who grasp the opportunities from the ecological transition. [...] But public finances alone will not be enough. We need to tap into private investment by putting green and sustainable financing at the heart of our investment chain and financial system.”

President Ursula von der Leyen, Political Guidelines, 16 July 2019

WHERE WILL THE MONEY COME FROM?

HOW WILL THE MONEY BE CATCHED?



Embracing the spirit of the European Green Deal aiming to become the world’s first climate-neutral continent by 2050, SPARCs project would act as bridge between that policy directrix and the challenges at the Smart Cities and Communities scenario. SPARCs’ ambition, since the originating phase, was to profile innovative tools in favour of the Main Urban Authorities enabling their toward-climate-neutral transitions. Of course, “where will the money come from” was the looming dilemma. Nevertheless, it has been learnt that the picklock was not even the “where” but “how” the available worldwide-money-mass inflects for funding and financing smart city processes.

Briefly, the overall aim of this work is to structure a benchmark of exploitable business models to be applied at Positive Energy District scale, helping the two lighthouses of Espoo and Leipzig to replicate and scale up the SPARCs large implementation plan. Either the results will be used for drafting the investment plans of the five fellow cities (Reykjavik-IS, Maia-PT, Lviv-UA, Kifissia-EL and Kladno-CZ), given their differences.

As such, the report suggests an already tested and certified methodology able to rate cities implementation plans; thus to establish an innovative funding scheme settled at country base (namely for Finland and Germany) and to provide input for a possible Smart City Fund harmonized at wider scale (not even more country-based) index-linked having as underlying the securitization of cities’ unproductive assets.



The report has been thought to be a preliminary guideline (at M12 compared to M60) able to benchmark the SCC1 exploitable framework in terms of tested business models, checked business plan and funding architectures. Compared to the first intention, two dyscrasia occurred.

From one side, when translating the experiences coming from the SCC1 lighthouses in to models to be applied at Positive Energy District scale, the result has been shattered, but this was barely predictable. As it could be seen in the table 2 of the chapter 2, objectives coming from the topic' requirement had changed according to the SCC1 waves. The first wave of projects was a sum of disaggregated and innovative actions. While the second wave has the holistic approach as a common denominator. SPARCS is in the middle of the third wave, the one of the Positive Energy District. That was endogenic inside the SCC1 global framework: it is SPARCS' challenge.

On the other side, the exogenous dyscrasia is the unpredicted variable given by Covid-19, not in terms of pandemic but in terms of game-changers legacy. Will the climate change and the green economy have a brake? Or, conversely, the after-Covid-19 will be catalyst for them? At the moment, the forecast tends to the second scenario. Overarching the Covid-19 pandemic, a blending attitude is emerging by mixing traditional and classical market finance with venture philanthropy aiming to create new mixed funds including some aspects of the crowdfunding: the rationale is to associate the economic revenues of the social impacts in order to boost the non-cyclic investments and hinder the equity home bias puzzle.



The overall structure of the report discloses two harmonized compendious: a KPIs list with the most relevant one, duly explained and index-linked to the optimal range; a short described basic dictionary dashboard. After a concise introduction about the deliverable and the SPARCS project itself in chapter one, chapters two and three are focused on mapping the business models in SCC1 scenario and at worldwide scale. As such, in chapter two it is shown the methodology adopted. The chapter four is the kernel of the report with three tools: the co-design of SPARCS business model canvas; four adaptable emerging business models; a validated methodology for project financing and bankability evaluation. The fifth chapter is related to an innovative funding scheme customized for the two lighthouses and the possible scalability of the model.



***Qualcosa doveva cambiare perché
tutto restasse come prima***

***Something had to change for
everything to remain the same***

Burt Lancaster acts as don Fabrizio Corbera, Prince of Salina in “Il Gattopardo” movie by Luchino Visconti 1963, based on the novel by Giuseppe Tomasi di Lampedusa 1958



HARMONIZED KPIS ACRONYM LIST

The bankability mismatch, to avoid the credit bottleneck, come with the understanding and respond to the financial project evaluation KPIS, such as:

Rol

Return on Investment, measuring the return on invested capital and therefore the ability to obtain returns on investments, so it indicates the ability to remunerate both risk capital and debt capital; the benchmark for Rol is given by the WACC and it is lower than the **RoE [Return on Equity]**, it does only indicate the ability to remunerate risk capital, despite of Rol]. For SCC1 benchmark purpose, it will consider a value acceptable in the medium-long term. **Range 7-to-16%**.

SRol

Social Return on Investment, it measures non-financial values such as social, economic, and environmental factors; it is useful to quantify the value chain created for the local community. For SCC1 purposes it enables the planning and evaluation quantifying the monetization of the social impact in financial terms. Range to be defined. As such, the SPARCS consortium answers in terms of refined KPIS (see the deliverable D2.2) as well in terms of governance model and urban city planning (see the deliverable D7.3 and D1.9)

PBP

Pay Back Period, a corporate finance indicator to assess the attractiveness of an investment, assessing the recovery of the investment, shorter is best to reach the breakeven, it is useful to determine the cost savings of energy efficiency technology. In that case, for the Prosumers' business plan it fixes. While, for SCC1 purposes rather than PBP is **DPBP [Discounted PBP]** says "how long" it will take to recoup an investment compared to cash flows], when investors use to repaid not only the capital but also the cost of equity, in this case the Equity range should be add to the PBP. Classical Payback: **Range 5-to-20**.

DSCR

Debt Service Coverage Ratio, the most suitable indicator explaining the ability to service debt given a level of income, practically shows operational cash flows able to repay the loan. **Range 1.15-to-1.35%**.

LLCR

Loan Life Coverage Ratio, another fundamental indicator assessing the bankability analysis especially as a guarantee for financing, using the service debt cash flow it explains the sustainability of the service debt coupled with related risks and costs. **Range 1.25-to-1.65%**.

IRR

Internal Rate Return, establishing the profitability of potential investments, showing them the annual growth rate; it should turn the NPV to zero. **Range > cut-off rate**.

WACC

Weighted Average Cost Capital, it fixes good news for investors and a bankability practical tool, it allows investors to establish the cost of capital, by analysing all its components and being fundamental element of the **DCF [Discounted Cash Flow]** estimates the value of an investment based on its future cash flows, practically it figures out the value of an investment



today, based on projections of how much money it will generate in the future, in SCC1 context DCF is useful to estimate the impact of new technologies coupled to the equipment]. **Range 10-to-15%**.

NPV

Net Present Value, it works as a spread between present cash flows, namely inflows/outflows, over a determined timeline; it shows how profitable an investment is. Better than PBP the NPV takes into account the time value of money, and for SCC1 purposes it has less inaccuracy than PBP, but it has some theoretical assumptions hard to achieve; so it could be considered as a preliminary tool for decision makers in the investment prioritization phase, comparing two or more investments having the same scope and lifecycle.



HARMONIZED DICTIONARY DASHBOARD

Bankable

Project or proposal that has sufficient collateral, future cashflow, and high probability of success, to be acceptable to institutional lenders for financing.

Cash Flow

Incomings and outgoings of cash, representing the operating activities of an organization.

Business Plan

Set of documents prepared by the management to summarize its operational and financial objectives for the near future (usually one to three years) and to show how they will be achieved. It serves as a blueprint to guide the firm's policies and strategies and is continually modified as conditions change, and new opportunities and/or threats emerge. When prepared for external audience (lenders, prospective investors) it details the past, present, and forecasted performance of the firm. And usually also contains pro-forma balance sheet, income statement, and cash flow statement, to illustrate how the financing being sought will affect the firm's financial position.

Business Model

Description of means and methods a firm employs to earn the revenue projected in its plans. It views the business as a system and answers the question, "How are we going to make money to survive and grow?"

Securitization

Distribution of default risk by grouping debt obligations (such as mortgages) into a pool, and then selling securities backed by this pool.

Derivative

Contract to buy or sell an asset or exchange cash, based on a specified condition, event, occurrence, or another contract.

EPC

It is a form of 'creative financing' for capital improvement which allows funding energy upgrades from cost reductions. Under an EPC arrangement an external organisation (ESCO) implements a project to deliver energy efficiency, or a renewable energy project, and uses the stream of income from the cost savings, or the renewable energy produced, to repay the costs of the project, including the costs of the investment. Essentially the ESCO will not receive its payment unless the project delivers energy savings as expected.¹

ESCO

It is a company that offers energy services which may include implementing energy-efficiency projects (and also renewable energy projects) and in many case on a turn-key basis.²

SPV

A special purpose vehicle is a subsidiary created by a parent company to isolate financial risk. Its legal status as a separate company makes its obligations secure even if the parent company goes bankrupt.

¹ <https://e3p.jrc.ec.europa.eu/articles/energy-performance-contracting>

² <https://e3p.jrc.ec.europa.eu/articles/energy-performance-contracting>



SICAV

A collective investment scheme, namely an investment company with variable capital, as open-end collective investment schemes, the investor is in principle entitled at all times to request the redemption of his units and payment of the redemption amount in cash. SICAVs are increasingly being cross-border marketed in the EU under the UCITS directive.

Asset-Backed Security

It is an investment security collateralized by a pool of assets, (loans, leases, credit card debt, royalties, or receivables). ABS is similar to an MBS mortgage-backed security, except that the underlying securities are not mortgage-based. For investors, asset-backed securities can be an alternative to corporate debt. ABS is financing schemes, issued against securitization operations, similar to the normal bonds. The procedure for creating an ABS - securitization - is the act by which a company separates a series of receivables from its balance sheet, "packages" them appropriately and sells them on the market, together with the cash flows they generate, through the SPV with the aim of generating liquidity.

CDS

It is an ordinary credit derivative mostly used to transfer (swap) the credit risk. For SCC1 purposes, it fixes the loan/lending benchmark's definition for an EE investment. The CDS is a pricing, determined by the issue prize, the recovery rate, the interest rate curve, and the LIBOR curve.

Equity home bias puzzle

A tendency for investors to invest much of their portfolio in domestic equities, ignoring the benefits of diversifying into foreign equities.

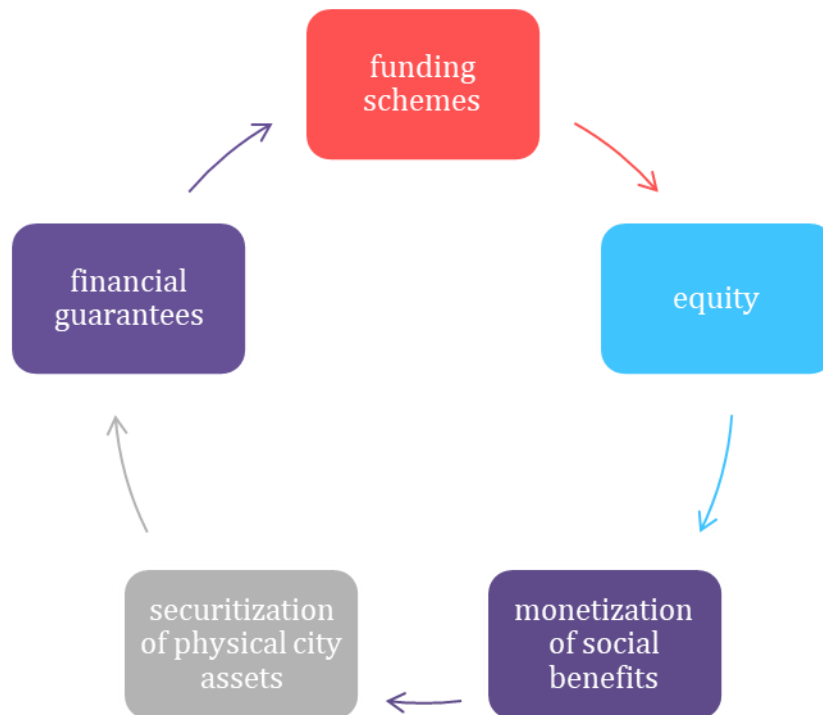


1. INTRODUCTION

“The overall goal of SPARCs is to demonstrate, and validate, the technical and socio-economic viability, and impacts, of scalable, innovative solutions for planning, deploying and rolling out smart and integrated energy systems as an efficient mean for the urban transition into a citizen centred zero carbon ecosystem, enabling a high quality of life. The 7 SPARCs cities will promote the replication of the urban energy transition widely in Europe, by demonstrating the measurable evidence of the benefits of these integrated solutions, on a large scale, for developing blocks of buildings and districts into active energy ecosystems and pioneering business models tailored on interactions between the citizen, building and the urban energy systems”.

It has been merged the financial expectations with the politics one, taking care of the economics, socials, and environmental scopes. Indeed, it has been assumed as mandatory the coding and the assessment of five families of returns in politic, finance, economic, social and environmental terms, thus highlighting the forecast benefits for all stakeholders involved in the smart city value chain along the sustainable green transition process.

Nevertheless, understanding the energy savings account acted as underlying above which build the financial and economic plan of the cities. Being an economic and financial deliverable, the report concentrates on how to match the city administration attitude and commitment with the willingness of the financial players to be involved in the “carbon neutral” change. To provide solutions aiming **to bridge the gap between politics and financial**, we worked on an **innovative funding blending scheme**, able to aggregate:



The result of the deliverable takes into consideration the level of the collaboration among SPARCs project, especially those coming from the lighthouses’ local consortium. For that



purpose, the report contains a methodology to test the economic and technical validation of the city's investment plan.

1.1 Purpose, target group and contribution of the partners

Being a horizontal cross cutting-edge activity, and the theoretical kick-off of the economic and financial items of the whole project, the D7.1 (related to the T7.1) has involved at the beginning a **core team** among the whole consortium, asking them to be aggregator of information.



The two lighthouses have been involved to act from a side as **umbrella**, compare to the cities' needs, and from the other side as **funnel**, when translate the business requirement for their local value chains.

The shared joint agenda was established **web-based** by the Team (the ICT platform). Nevertheless, physical meeting³ has been done at LCs level with the local stakeholders' groups.

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Partner	Contributions
Civi	Edit the deliverable, content planning, allocation of partner responsibilities.
FHG	Mapping Business Models, Checking the content
CVUT	Mapping Business Models
SPI	Mapping Business Models
ESP	Checking the content with local stakeholders
LPZ	Checking the content with local stakeholders
GOPA	Checking the content
KONE	Co-editing the Business Models section
VTT	Coordinator, Quality assessment and final submission to EC

³ To be considered the COVID-19 disease's emergency at EU scale, affected the physical mobility/exchanges, and happened by M6 (March 2020).

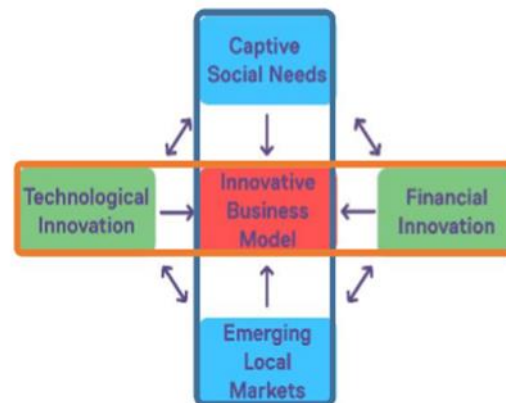


1.2 Baseline

In the proposal ambition “*mastering green city business models*” is considered mandatory to enable “*advanced carbon neutral technological solutions become profitable for Public-Private-Partnership (PPP) investment*”. Theoretically, the baseline should be the creation of a “**city and user centric business models**, specifically tailored for SPARCs solutions, which identify bankable actions for generating a quick market uptake, leading to relevant impacts on an urban area scale”.

As such, in the proposal it has been created a matrix to act as a baseline version when drafting SPARCs Business Model: otherwise the pure design phase, rather than the co-design of a new Canvas draft (see chapter 4.1), was conditional to two couple of innovative drivers:

- the horizontal driver (the new value chain, **orange box**): demonstrating a de-risk platform for innovative cost-effective technologies triggering and capturing available funding
- the vertical driver (the smart city local value chain, **blue box**): analysing the local difference inside the legislation, the weather, the social welfare, the building stock as well as the energy price, the ageing, the behavioural etc. and crossing these local KPIs with the creation of new green jobs and a new green industry (new services and Start-Ups).



What to bear in mind: “SPARCs business ecosystem is focused under the **Main Urban Authority (MUA) umbrella**, in order to **generate and guarantee the local value chain identification/creation, overarching the possible market failure; common in transition period, especially when going beyond the energy dominant model. SPARCs assists MUAs to catalyse the transition, the citizen engagement and the player’s market entry, through Public support and some policy options, by creating innovative governance models**”.

As such, D7.1 will enable as well the D1.9 and D7.3: indeed the methodological approach deployed in D7.1 in terms of due diligence process of the economic and financial assistance to lighthouses cities and PEDs developer will be transformed in a capacity building tool of the MOOC (MS7.1) interactive tool addressed to all the local actors involved in the Smart City legacy’ interventions: lately a **customized due diligence process in the governance model**.

1.3 Relations to other activities

The D7.1 report, direct resume of the T7.1, represent a key process in SPARCs due to its positioning compared to the Gantt. Indeed, it is considered a tool for the two lighthouses when going ahead in rolling their demos, as well the five fellows when starting their replication plan.

Likewise, the task 7.1 has been a collaborative task considering three families of interactions with other tasks.

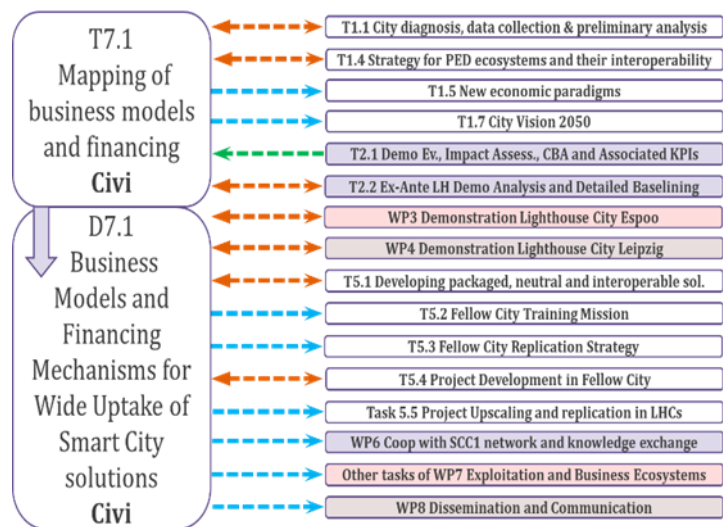


Mainly it has received inputs from the task 2.1 of the work package 2, as regards of the KPIs baseline (green).

Afterward, there was a seamless flow of info exchange (orange) among several tasks.

Ultimately, the deliverable will provide inputs (sky blue), basically as a benchmark tool.

Finally, several deliverables will catch value, such as:



- ▶ D1.7 Scaling up and Replication Guideline @M20
- ▶ D1.9 Urban Transformation: New Economic Paradigms and associated Business Models @M60
- ▶ D1.11 City Vision 2050 @M60
- ▶ D2.5 Holistic Impact Assessment of Demonstration Activities @M36, M48, M60
- ▶ D2.6 Long-term High-level Impact Assessment through Wide Replication of SPARCS @M60
- ▶ D3.7 and D4.7 Replicating the smart city lighthouse learnings in Espoo and Leipzig: technical, social, and economic solutions with validated business plans @M60
- ▶ D5.9, D5.10, D5.11, D5.12, D5.13 Project Development Report Maia, Reykjavik, Kladno, Lviv, Kifissia @M60
- ▶ D5.14 and 5.15 Replication and Upscaling plan Leipzig and Espoo @M60

Task Nr	Type of interaction	What and How is it used?	Responsible partners	Timing
T1.1	Receiving input	Prioritization of Use Cases in the LHCS	FHG - FHG	M6 - M8
T1.4	Receiving input	Use cases for Virtual Power Plants	VTT - FHG	M7 - M9
T2.1	Receiving input	KPIs baseline	VERD - FHG	M8-M10
T1.3	Exchange info	KPIs visualization tool	SUITE5 - FHG	M8-M10
T1.6	Exchange info	Stakeholders identification	SPI - FHG	M8-M10
T2.2	Exchange info	Demos Baseline	SUITE5-FHG	M8-M10
T2.3	Exchange info	Data Repository	SUITE5-FHG	M12-14
WPs 3&4	Exchange info	Identification of opportunities for replication LHs	ESP-LPZ-FHG	M6-M12
WPs 5	Exchange info	Identification of FCs Replication Strategy	FHG- FHG	M9-M12
T7.1	Exchange info	Identification of BMs and financing options	CIVI - FHG	M6 - M8
T1.2	Providing input	Mapping emerging use cases	SPI - FHG	M15
T1.5	Providing input	Mapping emerging business models	CIVI - FHG	M15
T1.7	Providing input	Contributing to City Vision 2050	SPI - FHG	M15
WPs 6&8	Providing input	Storytelling the Packaged Solutions	VTT-GOPA-F	M15
WP7	Providing input	Creating Packaged Solutions	FHG - CIVI	M15



2. IDENTIFYING IN H2020 SCC1 BENCHMARK MODELS

As highlighted in the proposed paper, going beyond the current funding schemes is mandatory. Currently, the emerging U-turn of the capital expectations from the short terms' earnings in to longer is an asset, but not enough when approaching the smart city market. The latter is made up of innovative actions, which are not de-risk activities, and start-ups, mostly undercapitalized companies with too many shortages in the balance sheets. **The banking system is unable to make a sustainability assessment on energy efficiency or a savings figure.**

In addition, in SPARCs the aim is to go beyond the packaging solutions, so far deployed at EIP scale, with the objective to ensure the packaging to be scaled-up and generate stand-alone successful business cases. For that, this report investigates the emerging green economic value chain at city level, compared both to the emerging trends and the city needs (of course bearing in mind the lesson learnt coming from SCC1 lighthouses).

Finally, in the D7.1 contributes at the creation of a tech-based Market place, such as a green techs portfolio, taking care of: performance, funding and ecosystem, especially when the funding gap is coupled with a fragmented innovation ecosystem. It will be baseline of the deliverables D2.7 and D7.7 about the punch-list and the market radar.

The transition from traditional paradigm to Smart cities and communities has not only the potential to improve the overall cities' quality: it can have a stimulation effect on the existing markets as well as on the new business models definition. SPARCs should profile and catch business and governance model definition as well, in line with the Main Urban Authority expectations, the technological asset challenges and the capital requirements. Especially, the business & governance model shall especially be in line with the new SCC1 EC guidelines about the emerging pivotal role of Positive Energy Districts and the captive growing market represented by the Urban Data Platforms.

This methodological approach is translated in an evidence-based Benchmark, being aware that the actual and future drivers of smart cities projects will be enriched by citizens' active engagement and support, allowing the transformation of citizens in new market players, through public support, for boosting the development of demand-driven, user-friendly and locally attuned services. Complementarily, understanding the creditworthiness' key performances index (namely being familiar with the bankability concept) and managing a wide range of funding and financing mechanisms (both conventional and unconventional) are two prerequisites for the mass adoption of these business concepts.

The benchmark baseline has been achieved by triggering around the SCC1 projects already funded by the EC: the SPARCs' ambition is to go beyond the first implemented investment plans and to aid the full completion of the global interventions.

SCC1 projects financed by H2020 Programme include 46 Lighthouse Cities (plus 2 forthcoming), having totally and partially completed their demo projects, and 69 fellow cities (plus 5/6 forthcoming) starting or having completed the technical and economic feasibility studies of their smart city interventions.

The maximization of EC commitment (about 362M€ already invested in the SCC projects, plus 20/25M€ forthcoming) should be an ideal starting point pushing the replication of Lighthouse cities projects as well as boosting the concretization of the fellow cities plans with the translation of those projects into a bankable demand. The 2020 is a key year for the SCC1 ecosystem for bridging the gap.



SCC1	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Grow Smarter											
Remourban											
Triangulum											
Replicate											
Sharing Cities											
Smart en City											
Smarter Together											
My Smart Life											
Ruggedised											
Iris											
Match up											
Stardust											
Making Cities											
+City xChange											
Atelier											
SPARCS											
Pocityf											
coming soon											

2.1 SCC1 Project pipeline portfolio

The methodology adopted mapping the SCC1 project pipeline portfolio was established around a set of KPIs, thus having an experienced consortium in terms of EIP and SCC1 activities.

In addition, and due to the above-mentioned granularity of actions deployed in the lighthouse projects, a list of domains has been created.

As such, the list of KPIs for the value proposition identification was duly explained and each KPI has been matched according to every domain.

		Domanis									
		Governance	Building	District Heating system	Energy Infrastructure	Public lighting	Mobility	Big Data	IoT	P2P Blockchain	Urban Data Platform
KPIs for the value proposition identification											
Underlying Mechanism	understand whether exists assets upon which it is possible to cover against risks not related to finance										
Value proposition	understand the assets offered to customers and the market positioning										
Infrastructure	understand the key actors, the key activities and the key resources										
Funding model	understand the funding sources and if the equity/debt blending composition										
Demand side	understand the customers and the catchment area										
Financial model	understand the operative revenues stream generation										



As an example, when looking at a single project (for example Triangulum) it has been caught a (potential or fully) business case in the e.g. mobility (domain), by investigating the full list of KPIs. The results have been merged in the table below storytelling the business model for each domain and providing the description plus the reference whether it was possible/available. The review of a set of uses cases mapped by CVUT and FHG are listed in the Appendix at the end of the report.

	Business Model	Description	Reference
Domain	Governance		
	Building		
	District Heating system		
	Energy Infrastructure		
	Mobility		
	Big Data		
	IoT		
	P2P - Blockchain		
	Urban Data Platform		

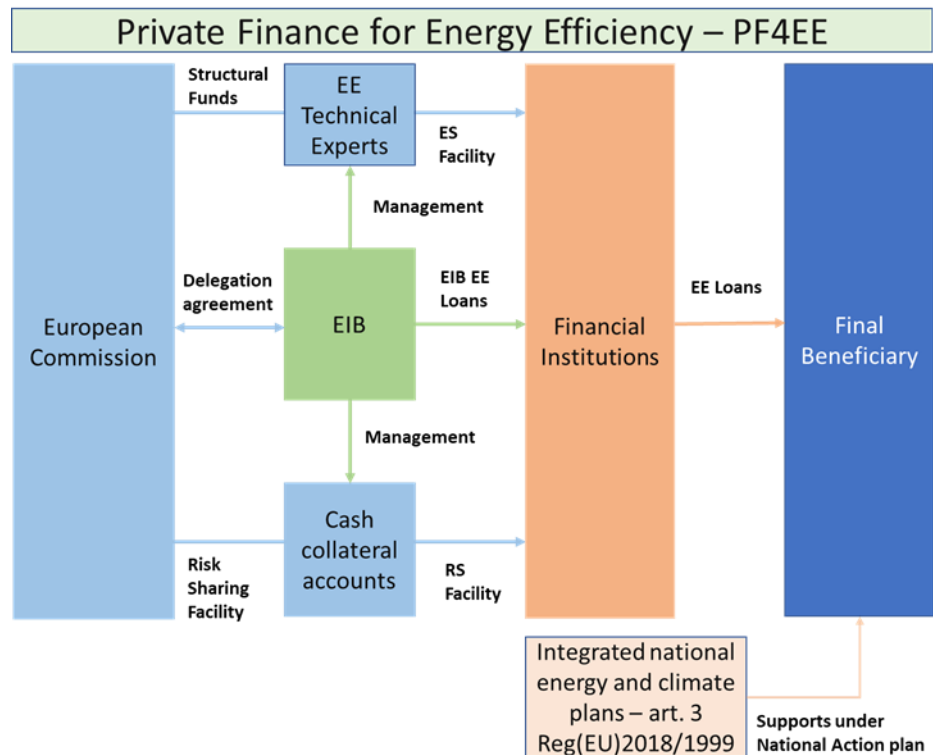
SCC1 Project	Mapped by	Ref.	Timing	Related Expected Impact
Grow Smarter	FHG	SCC-2014	01/01/2015 31/12/2019	Projects by wide-scale deployment of innovative replicable and integrated solutions in energy, transport and ICT, are expected to trigger large scale economic investments with the repayment of implementation costs in acceptable timelines (to facilitate the bankability of the projects). Means of verification: validation of attractive business plans for potential large-scale replication.
Remourban	CIVI	SCC-2014	01/01/2015 31/12/2019	
Triangulum	FHG	SCC-2014	01/02/2015 31/01/2020	
Sharing Cities	FHG	SCC-2015	01/01/2016 31/12/2020	
Replicate	CIVI	SCC-2015	01/02/2016 31/01/2021	
Smarter Together	FHG	SCC-2015	01/02/2016 31/01/2021	
SmartEnCity	CIVI	SCC-2015	01/02/2016 31/07/2021	
Ruggedised	CVUT	SCC-2016	01/11/2016 31/10/2021	
mySmartLife	SPI	SCC-2016	01/12/2016 30/11/2021	
Iris	NEW	SCC-2017	01/10/2017 30/09/2022	
MAThUP	CVUT	SCC-2017	01/10/2017 30/09/2022	Means of verification: development of innovative Business Models able to demonstrate technical and financial risks are low enough for large scale investments in other EU cities with similar characteristics.
Stardust	CIVI	SCC-2017	01/10/2017 30/09/2022	
CityxChange	CIVI	SCC1-2018	01/11/2018 31/10/2023	
Making-City	CVUT	SCC1-2018	01/12/2018 30/11/2023	By integrated innovative solutions for Positive Energy Blocks (2018)/Districts (2019 and 2020) each project will develops feasible solutions in terms of technical, financial, social, environmental and legal, to be replicated and gradually scaled up to city level.
SPARCS	Not relevant self-assess.	SCC1-2019	01/10/2019 30/09/2024	
Atelier	Not relevant too early	SCC1-2019	01/11/2019 31/10/2024	
Poctyf	Not relevant too early	SCC1-2019	01/10/2019 30/09/2024	
...coming soon	Still to be granted	SCC1-2020	01/10/2020 30/09/2025	Means of verification: delivery of effective business models for sustainable solutions.
...coming soon	Still to be granted	SCC1-2020	01/10/2020 30/09/2025	



3. FINANCIAL STRUCTURES BY THE EIB FOR ENERGY EFFICIENCY AND SELF-PRODUCTION PROJECTS IN POSITIVE ENERGY DISTRICTS WITH THE SUPPORT OF INSTRUMENTS CO-FINANCED – FOCUS ON ESCO

The purpose of the financial scheme is to incentivize commercial banks and other EIB intermediaries to develop the Energy Efficiency (EE) sector as a separate business segment.

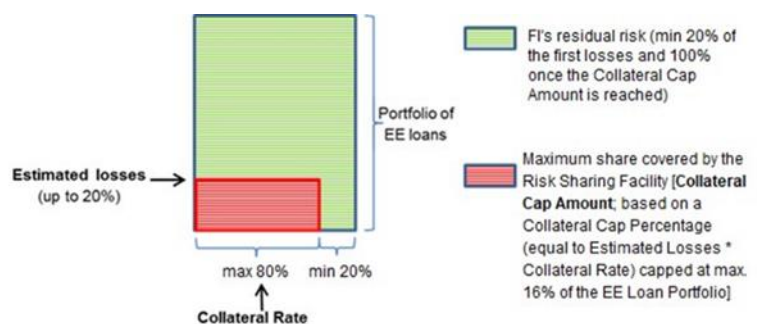
There could be a possible use by cities for the development of their carbon neutral investment plan through the aggregation of homogeneous investment operations. The PF4EE supports EE investments aimed at the purposes of the energy accounts and strategic plans of the Member States and provides 3 products:



Long-term EIB loan (PF4EE Energy Efficiency Loan) max € 5 million per transaction, with pre-amortization to be defined.

Technical training and advice to financial intermediaries (PF4EE expert Support Facility).

Loss coverage of up to 80% of individual loans up to the established threshold of maximum total portfolio loss (PF4EE Risk Sharing Facility).



Financial institutions could apply to EIB before the 30th September 2022, the EIB indicative amount available to be allocated to Financial Intermediaries for PF4EE RSF operations is EUR 21.5m, out of which, EUR 5m could be allocated in an acceptable tradable currency.⁴

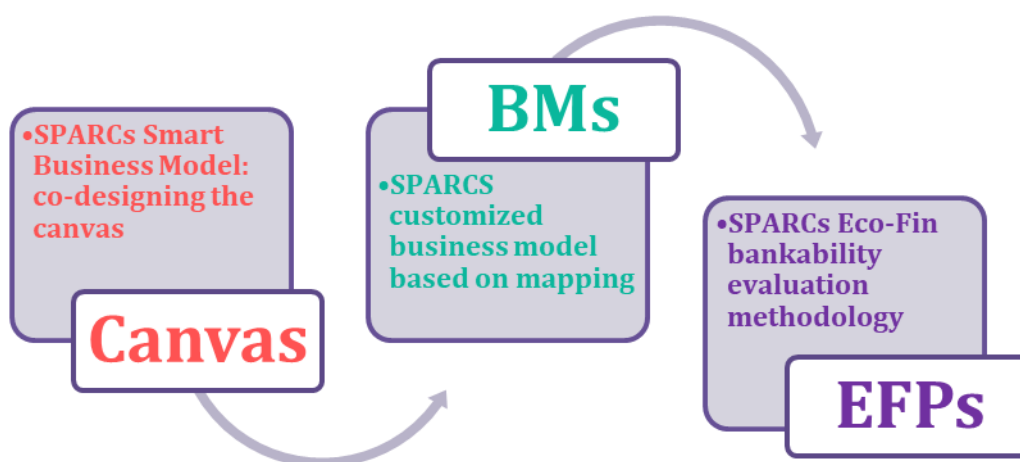
Facilitate the access to long-term finance for public counterparties and for the development of EE projects and to support EE programs of the Member States is possible through "limited / non-recourse" and/or "off-balance" structures where possible.

⁴ <https://www.eib.org/attachments/pf4ee-3rd-request-for-proposals-to-select-fis.pdf>



4. SPARCS BENCHMARKING ON POSITIVE ENERGY DISTRICT

The approach in SPARCs was led by determining how at Lighthouse programme business models and business planning could coexist. That to give back to business planning its losing status, due to the importance undertaken by the business model. Looking at the SCC1 topic indications in terms of means of verifications, it has been passed from "the facilitation of the **project bankability** by the validation of **attractive business plans for potential large-scale replication**" to "the development of **innovative Business Models** able to demonstrate technical and financial risks are low enough for large scale investments in other EU cities with similar characteristics" till "**the delivery of effective business models for sustainable solutions**". This chapter proposes three exploitable tools:



4.1 SPARCs Smart Business Modelling: A Canvas co-design proposal

As stated in the beginning of this report, business model "views the business as a system." Often represented through visual business model canvases, business model can be described as a holistic and easy concept showing how an organisation creates, delivers, and captures value. Business model consists of set of elements and their relations that are important for an organisation in order to run the business (Osterwalder & Pigneur, 2010).

In different business model canvases, presented in literature, these elements cover most often at least product / service offering and customer relationships and value proposition for target customers; company's management infrastructure including for instance distribution channels and partner networks, and financial aspects such as pricing mechanism and revenue model (Osterwalder, Pigneur & Tucci, 2005).

Whereas business plan provides possibly a more analytical and detailed way of approaching an organisation's future actions, business model illustrates the core concept of how business is structured. Main elements, presented in most of the business models, are shortly summarised below.

Offering, value proposition and customers

To create a business model, an organisation must have a clear offer what to provide for its customers. Value proposition may vary for different types of customers. Value proposition should state what a customer gets and what separates the offer from other competitors in the market. Additionally, business model should present how a customer relationship is managed. In other words, who are the specific customers, how they are reached, and in what ways a

company aims to maintain the customer relationship. Furthermore, value proposition can be examined from several stakeholders' point of view (Osterwalder, Pigneur & Tucci, 2005).

Management infrastructure

In order the customer to buy or use the offering, whether it is service or a product, business should clarify how and with whom the offering is produced. In addition to intangible and tangible resources that may be needed, distribution channels and partner network is often described in a business model (Osterwalder, Pigneur & Tucci, 2005).

Financial aspects

Financial aspects in the business model present the numeric infrastructure behind the offering and in what ways the revenue is gained. Different revenue models, such as subscription based, leasing and renting or pay-as-you-go, summarise how the value is finally captured back to the organisation (Osterwalder, Pigneur & Tucci, 2005).

In SPARCs, developing user and city centric business models, should happen in tight collaboration between different stakeholders. Business models should not only be illustrations how an organisation makes the most profit but also how social and environmental values are delivered to a surrounding community.

Co-designing business models in SPARCs

Today, business models are often connected to business model innovation where an iterative process adopting methods from design, is utilized. Business model innovation can be a highly collaborative process involving users and customers (Gassmann, Frankenberger & Csik, 2019). During the process, different business model canvases can be used as a tool to explain and communicate the business for different stakeholders involved (Osterwalder & Pigneur, 2010).

City and its communities are complex structures formed by several different actors. Thus, creating new smart city innovations supporting sustainable lifestyle, does not happen in one organisation but rather requires an ecosystem around. Many existing business models are valuable for communicating a single organisation's business but less useful to present complex business relations in an ecosystem (Weiller & Neely, 2013).

Just like an ecosystem, "smartness" in business models is not driven and defined by a single element, such as smart technology, but rather a combination of various effecting factors. In order to research and develop business models that provide both social, environmental and economic value for all stakeholders and surrounding communities involved, SPARCs will pilot ways to study and co-create business models together with city representatives, companies and citizens.

Co-creative approach to business models, will create a unique viewpoint addressing the opportunities and challenges that lay in innovative business models for sustainable solutions. Co-creation, concretely taking place under the **SPARCS T3.8**, will be conducted through workshops aiming to study, how co-creation can also function as a method to reveal innovative and creative business model suggestions in order to achieve sustainable transition

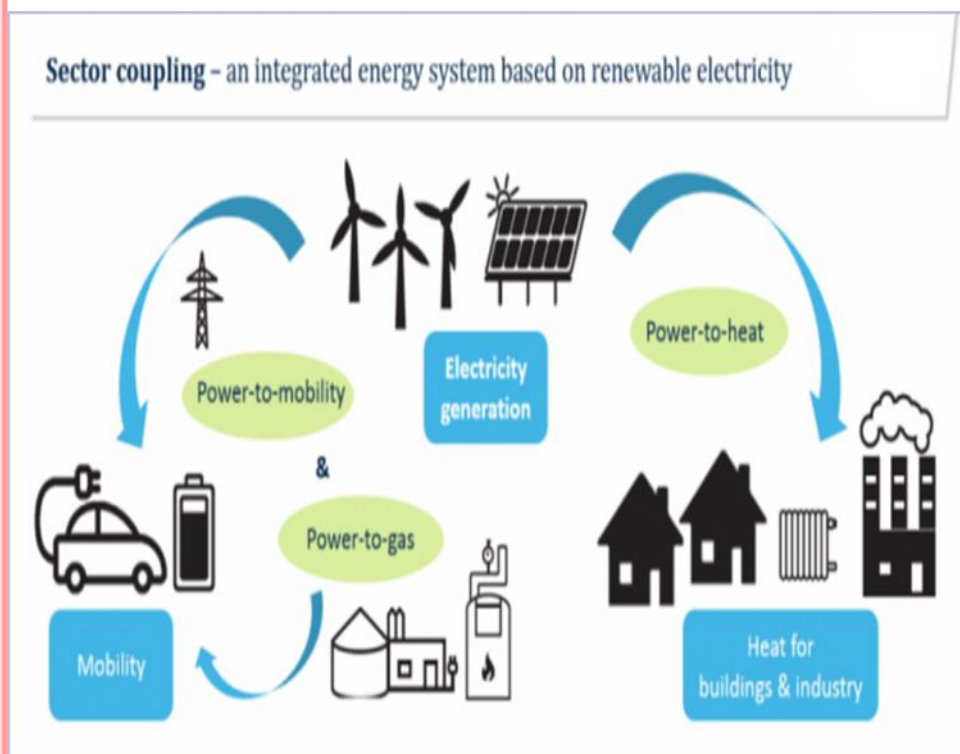


4.2 Four customized Business Models impacts

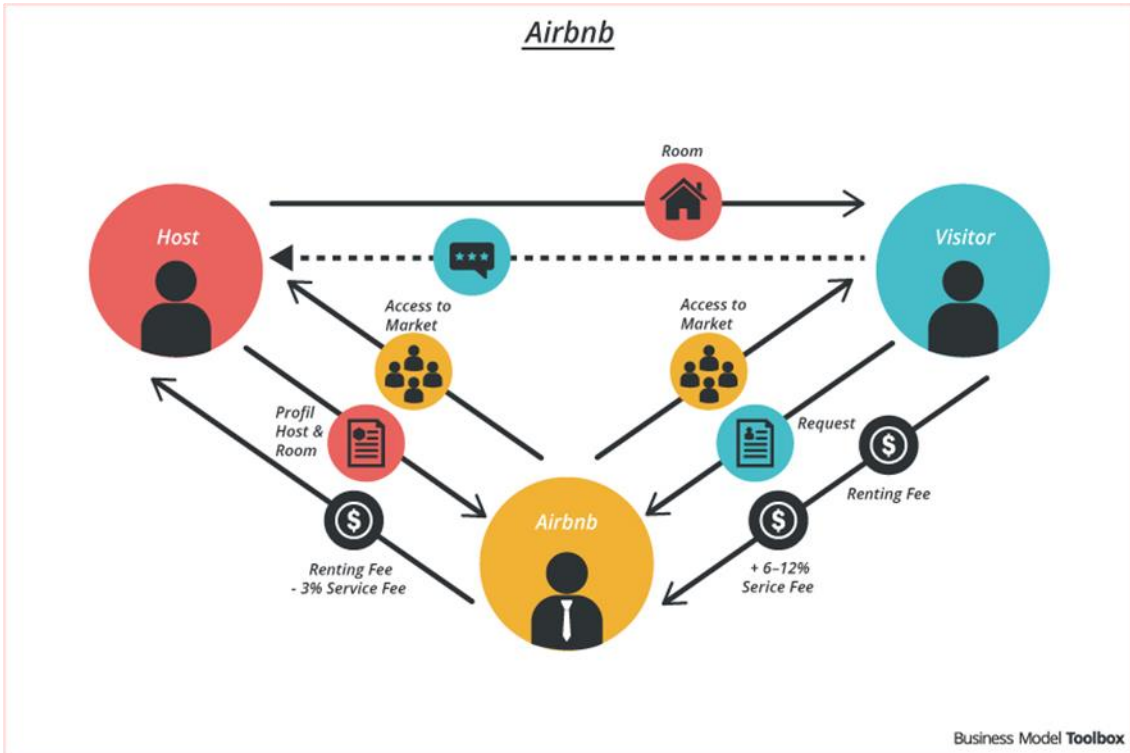
This section focuses four emerging business models adaptable to SPARCs projects, according to the disruptive technologies that could have a positive impact on the economic growth of the public-private local value chain, by enabling environment and fostering long-run innovation.

The assumption of the proposal is that the dynamicity of the local ecosystem is a resultant by a city market, shaped and created together for citizens by both the urban authority and the private sector: **the ticket enables the high-risk investments.**

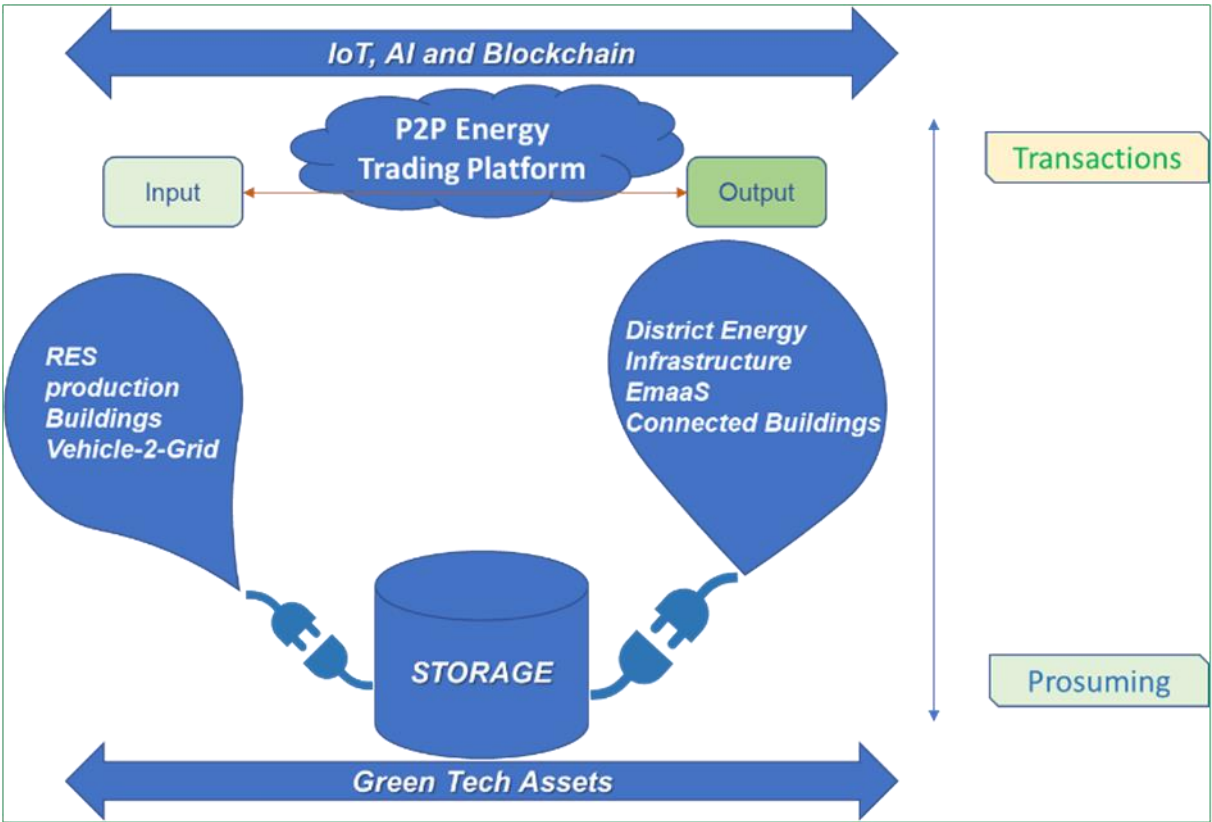
Furthermore, the creation of new services having a **long-lasting effect** for the project interventions and **able to generate revenues**, in the sector coupling was another underlying assumption. **By the digitalization asset**, the sector coupling enable in the smart city ecosystem a many-sided range of **emerging business cases** such as:
Power-to-Gas,
Power-to-heat/cold,
Power-to-Mobility



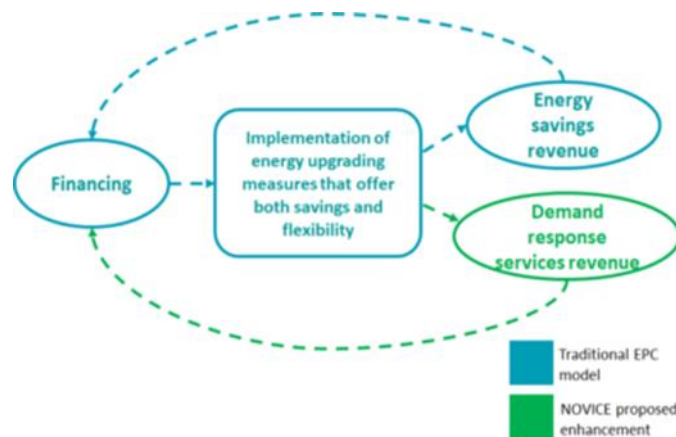
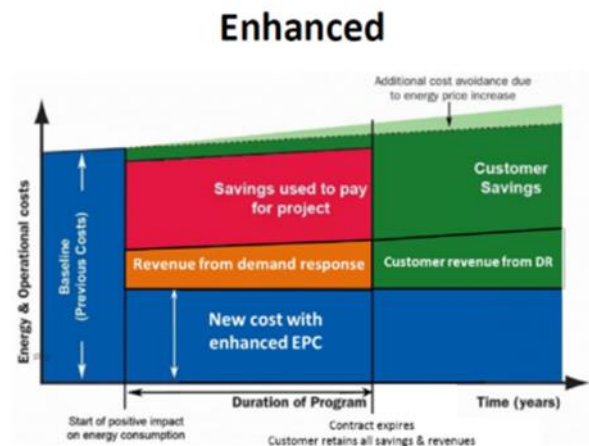
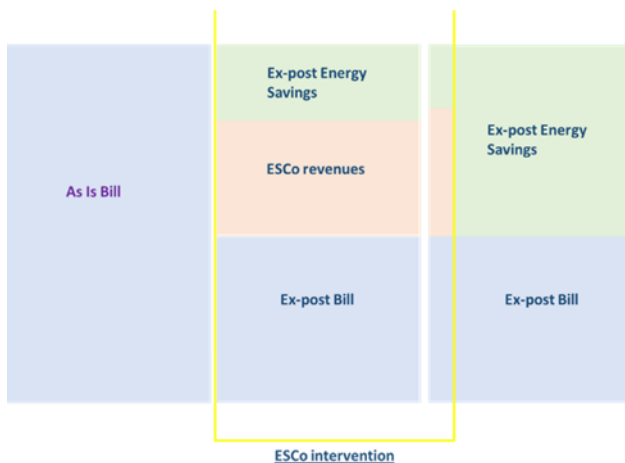
The Main Urban Authority could create a **city tech-based Market place** – a one stop shop for the local hype innovation -, such as a **green techs portfolio**, establishing a **pre-commercial procurement platform**, protecting the big data generated pursuant to GDPR and use it for city’s digital twinning purposes, leveraging a small amount of revenues coming from the **rationalization of the fragmented local innovation ecosystem**. Similarly, to the AirBNB Business Model, **hosts are local MSMEs or public companies** such multi utilities, **visitors are tech-provider**, while the **Main Urban Authority acts as the artificial intelligence platform**. At dealing, city earns a small percentage from the MSMEs for the platform O&M, and a bigger one from the tech provider. The system will also ensure the respect of the European Directive on combatting **late payments in commercial transactions** by ensuring a seamless cash flow for the public administration.



The proposed case runs around the development of a **full positive energy district** together with the principle of the **local renewable energy community (even Virtual)**. A business case derived for PEDs from the emerging P2P BM as described by IRENA "P2P electricity trading is a BM, based on an interconnected platform, that serves as an online marketplace where consumers and producers "meet" to trade electricity directly, without the need for an intermediary, also known as the "Uber" or "Airbnb" of energy, as it is a platform that allows local distributed energy generators to sell their electricity at the desired price to consumers willing to pay that price". For PED, the boundaries are one of the main features as well as the presence (and the ownership) of the Storage facility that has the advantage to enable the energy balance and the flexibility. Despite of the P2P platform designed by IRENA the presence of a **centralized player** (on behalf of the Main Urban Authority, an aggregator, a DSO or a TSO) is fundamental; it could also act as the **financial counterpart** and generate for the **prosumers an energy wallet** (as deploy a **energy-related-cryptocoin**).



ESCOs develop energy efficiency both in the public and private sectors with a logical and effective approach that we can summarize as follows: consistent collection of data on energy consumption, analysis of the same and proposal of interventions with the related time schedule (**Energy Audit**); functional technical solutions for achieving the goals of reducing consumption expressed in the energy audit; **economic sustainability**. The technical solutions identified to favour improvements must be economically sustainable. We believe that simultaneous innovation in the energy, communication and transport sectors has historically resulted in increased productivity levels to support growth. Both, **traditional and enhanced model (leveraging the Flexibility and demand-response)**, represent a **new widespread economic model** is taking shape that reverses the pyramid of energy and information distribution, as such the space has been created to apply a sort of **territorial "Keynesian" income multiplier** that takes into account both the economic and the socio-cultural effect. From this point of view, the efficiency enhancements in the public sector reach the goal of involving the communities and demonstrating the goodness that they can have if applied on a large scale also to the private sector.



4.3 Project Financing and Bankability evaluation: Business Planning through Business Modelling

When clarifying the business model and just before the funding architecture instalment, it could be milestone to draft an Economic Feasibility Project which defines, among a set of solutions, **those with the best cost-benefit ratio for the collectively compared to pre-determined specific needs to be satisfied and the services to be provided**. The following tool has been created after the coming into force in Italy of the New Public Procurement Code in 2016, while the mean is a **certified project financing software** deployed by Bocconi University of Milan together with CiviESCO.

In SPARCs it has been introduced in order to verify the feasibility of the PED and it includes all the investigations and studies necessary for the definition of several aspects, as well as graphic schemes for identifying the dimensional, volumetric, typological, functional and technological characteristics of the works to be carried out and the related economic estimates, including the choice of possible division into functional lots/units.

The latter, due to the complexity of a PED deployment, is a relevant field specially to figure out the economic aspect in the initial phase of the project deployment. As such, the concept of beneficial costs incorporates some extent the Cost-Benefit Analysis, an analysis recognized by the International Financial Community for the evaluation of interventions of major public works.

Finally, the choice of the possible division of the Project into functional lots among the activities of the feasibility project is a practice currently underused, nevertheless it is **strategically fundamental for optimally evaluating the capability of a project to self-finance and therefore by reducing the investment coverage to a minimum**. Thus, to enable the predictive analysis of investments and the reliability of the economic and financial assumptions in order to guarantee the public and private partnership and of all the subjects participating in the initiative.

Guarantees are:

- a. Data displayed are clearly shown in the Indicators report, where the numerators and denominators with which they were obtained are indicated, not only at annual but also at monthly base.
- b. Calculation algorithms are certified, specifically each is reproduced in the software exactly according to the formula indicated; the variables in use are explained as well how they bind each other; each of them has been tested on a large sample of cases.
- c. Program outputs are structured according to financial conventional international standards.
- d. Program inputs could not be altered when already processed.

The rationale is a preventive assessment of the economic and financial sustainability of an initiative and the subsequent co-design of the funding scheme bridging the financial gap.

As such, the bankability concept is enlarged meaning a project capable of generating, in the executive operational phase, sufficient cash flows to repay the debt contracted for its realization and remunerate the risk capital; the process allows a project to be evaluated by the financial community as an independent entity, compared to the promoter, for its ability to generate cash flows (**it stands alone**).

1 - Main Information		
Operating Management		Value
Revenues		2.093.752
Dismissal		0
Expenses		-764.315
CapEx		-3.919.884
Major Maintenance		0
Financial Expenses		0
Taxes		-132.292
Total Previous Debt		0
Outstanding - NOT Depreciable		1
Financing		% Value
Self-financing	2,001	129.787
LSGG	49,225	3.192.124
Equity	2,313	150.000
Senior	7,644	495.723
Bridge Loan	25,517	1.654.747
VAT Loan	13,298	862.374
NWC Loan	0,000	0
Sh. Loan	0,000	0
Profits & Losses		Value
EBITDA		1.329.437
EBIT		564.327
EBT		459.512
Net Profit		327.220
Dividends		327.220

2 - Eco. Fin. Equilibrium		
Time Assumptions		Date
Work Start		01/08/2019
Operation Start		01/10/2021
Repayment Start		01/10/2021
Senior Debt Real Deadline		31/07/2034
Senior Debt Required Deadline		31/07/2034
Operation End		31/07/2034
Cash		Date Value
Total Before Dividends		466.459
Total		141.239
Annual floor	31/08/2021	0
Annual cap	30/11/2033	167.772

3 - Return	
NPV	
NPV Operation before Taxes ^(NMF+FT)	381.598
NPV Operation after Taxes ^(NMF+FT)	238.617
NPV Equity before Taxes ^(E)	198.326
NPV Equity after Taxes ^(E)	117.236
PBP	
PBP Operation before Taxes ^(NMF+FT)	28/02/2029
PBP Operation after Taxes ^(NMF+FT)	30/09/2030
PBP Equity before Taxes ^(E)	30/11/2024
PBP Equity after Taxes ^(E)	30/04/2027
IRR	
IRR Operation before Taxes ^(NMF+FT)	8,664
IRR to Operation after Taxes ^(NMF+FT)	6,379
WACC ^{standard}	2,296
IRR Equity before Taxes ^(E)	50,079
IRR Equity after Taxes ^(E)	23,534
Cost of Equity	7,860
Growth Rate (%)	NC

4 - Bankability		
DSCR		Value
Average		1,684
Annual floor	31/12/2021	0,809
Senior DSCR		Value
Average		4,166
Annual floor	31/12/2033	1,793
LLCR		Value
Average		1,952
Annual floor	31/12/2021	1,404
Senior LLCR		Value
Average		2,163
Annual floor	31/12/2032	1,937

Legend

WACC = Weighted Average Cost of Capital: weighted average between cost of equity and cost of debt after taxes.
 Formula: $(\text{Cost of Equity} \cdot \text{Equity} / (\text{Debt} + \text{Equity})) + ((\text{Interest Rate} \cdot (1 - \text{Taxes})) \cdot \text{Debt} / (\text{Debt} + \text{Equity}))$

Cost of Equity = Sum of risk-free rate and factor between equity market risk premium and beta index.
 Formula: $\text{Risk Free Rate} + (\text{Index } \beta \cdot \text{Equity Market Risk Premium})$

EQ = Equity
 E+SL = Equity + Shareholder Loan
 NMF+FT = Not Main Facilities + Figurative Taxes
 CFC+AT = Capitalized Financial Charges + Actual Taxes

PBP = Pay Back Period
 TV = Terminal Value
 EV = Enterprise Value



Due to that approach, the process determines:

1. Funding need of the intervention
2. Debt repayment (financial sustainability)
3. Return on risk capital at market returns
4. Risk profile
5. Implementation Gantt and project size.

As a whole, the process allows also the **Main Urban Authority** to carry out a **due diligence process**; indeed the main output is a **synthetic dashboard** which shows the result of the operational management, the financial coverage sources and the income statement, the global economic and financial Balance, **plus the Indexes of Profitability and Bankability**.

Finally, the entire process has a complete and reliable evaluation also considering the context in which it is integrated. Context means the market (sector) and the country of reference. That means, together with the specific risks of the project (**the so-called "Idiosyncratic Risks"**) mentioned above, the project also considers the risks of the market system and the country system that affect the project (**the so-called "Systemic Risks "**).

As such, to correctly evaluate these "Systemic Risks", the international finance models provide for the discounting of the global project and operator cash flows respectively to the "**WACC**" (Weighted Average Cost of Capital) and **KE** (Cost of Equity) rates.

Going the extra mile, the excel matrix of the software related to the project data inputs will be fine-tuned in the D7.3 also according to the work done in D2.2 and related to the Impact Investing strategy. Namely, in SPARCS **the monetization of the hidden/multiple/social benefits will be a project Key Exploutable Result.**



5. FUNDING SCHEME FOR ESPOO AND LEIPZIG

The starting assumption is a resultant coming from financial and bank background:

- A. A deep analysis of **“what if”** an Urban Authority, even a non-institutional aggregator of project developments, **collects funds before** starting the implementation phase (time 0), it discloses an **higher cost of the “funding product”** due to the static time required to start-up the process and the amortization.
- B. On the other end, the operational requirement leveraging money for Positive Energy District implementation is referred to the **“as is”** of the **energy consumption** compared to record in the balance sheet the subsequent **energy savings** during the OpEx phase.

The optimal solution seems to be a **two-steps funding process**:

- 1. At the beginning, **attracting funds during** the implementation phase by short/medium-term financial products, through the credit channels (both traditional and unconventional).
- 2. Later, when the amortization period starts, it could be possible to **securitize the EPC** contract by long-term financial products. This is possible considering PEDs as energy-centric projects.

Phase 0: the cost of funding

Crowdfunding lending/equity or other similar financial product (UCITS, SICAV or SIF platform, green bonds, etc.) for clustered interventions in “progress of work” mode for the portion not covered by private equity or public funds. Financial instrument with EIF guarantee also intended for retail (medium - low GDR, maximum duration 5 years also in amortizing).

Cost of funding estimate

Assumption of a benchmark starting from the assumption that the portion covered by the EIF guarantee or similar, regardless of whether equity or lending or loan, should be priced considering the cost of the national debt for the same duration + a spread and the weighted rate with the portion not covered as a guarantee by type of financial instrument.

Pricing of the cost of funding, part covered by public guarantee starting from the value of the cost of the public debt (based on Bloomberg data of 5 November 2019) of the respective states of belonging:

As for Finland

EUR Finland Sovereign Index													
1y	-0.66	2y	-0.65	3y	-0.61	4y	-0.55	5y	-0.51	10y	-0.09	30y	0.438

As for Germany

1) Money Rates		Interbanc		EURIBOR Fix		EUR LIBOR		Euro Swap		OBL/BUND			
O/N DEPO	-0.500	O/N	-0.46250	1M	-0.4430	1M	-0.51257	1A	-0.3594	-0.3522	1A	-0.60	+0.01
O/N LEND	0.250	T/N	-0.46750	3m	-0.3990	2M	-0.46457	2A	-0.3559	-0.3529	2A	-0.64	+0.01
1 sett	0.000	1M	-0.47500	6m	-0.3480	3m	-0.44129	3A	-0.3270	-0.3217	3A	-0.67	+0.01
Repo 3M	0.000	3m	-0.44250	1A	-0.2810	6m	-0.40871	4A	-0.2832	-0.2791	4A	-0.65	+0.01
2) Titoli Stato		6m	-0.39750			1A	-0.30929	5A	-0.2303	-0.2259	5A	-0.59	+0.02
2A	-0.640	9M	-0.36250					6A	-0.1696	-0.1653	6A	-0.56	+0.02
5A	-0.536	1A	-0.36000					7A	-0.1035	-0.1008	7A	-0.52	+0.02
10A	-0.325							8A	-0.0371	-0.0337	8A	-0.47	+0.02
30Y	0.222	1x4	-0.4050					9A	0.0315	0.0335	9A	-0.40	+0.02
Spot FX		3x6	-0.4100					10A	0.0980	0.0980	10A	-0.33	+0.03
€/GBP	0.8635	6x9	-0.4260					20A	0.4913	0.4990	20A	-0.02	+0.03
€/USD	1.1137	9x12	-0.4370					30Y	0.5330	0.5390	30Y	0.22	+0.03
€/JPY	121.1580	1x7	-0.3380										
BuBills		3x9	-0.3480										
1mo	-0.605	6x12	-0.3580										
2do	-0.626	12x18	-0.3630										
		18x24	-0.3300										



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 Topic: LC-SC3-SCC-1-2018-2019-2020: Smart Cities and Communities

As for CDS GOVI 10ys

The 2019 AFME Capital Market Union survey indicates that in 2018 at European level the cost of debt was estimated at around 2% compared to an average equity cost of 8%.

Below a rough estimation (based on Bloomberg data of 5 November 2019) of what the cost of funding could be.

Zona Euro		Matrice spread intermercato Statali														
Scad	10 anni	Spread														
Regione	Rnd	AT	BE	CY	EF	FI	FR	DE	GR	IE	IT	LV	LT	NL	PT	SK
Austria	-.148		-5.7	-68.2	-9.6	-1.8	-7.7	+23.2	-151.4	-16.9	-133.3	-24.2	-41.5	+9.0	-48.8	-17.3
Belgio	-.091	+5.7		-62.5	-3.9	+3.9	-2.0	+28.9	-145.7	-11.2	-127.6	-18.5	-35.8	+14.7	-43.1	-11.6
Cipro	.534	+68.2	+62.5		+58.6	+66.4	+60.5	+91.4	-83.2	+51.3	-65.1	+44.0	+26.7	+77.2	+19.4	+50.9
EFSF	-.052	+9.6	+3.9	-58.6		+7.8	+1.9	+32.8	-141.8	-7.3	-123.7	-14.6	-31.9	+18.6	-39.2	-7.7
Finlandia	-.130	+1.8	-3.9	-66.4	-7.8		-5.9	+25.0	-149.6	-15.1	-131.5	-22.4	-39.7	+10.8	-47.0	-15.5
Francia	-.071	+7.7	+2.0	-60.5	-1.9	+5.9		+30.9	-143.7	-9.2	-125.6	-16.5	-33.8	+16.7	-41.1	-9.6
Germania	-.380	-23.2	-28.9	-91.4	-32.8	-25.0	-30.9		-174.6	-40.1	-156.5	-47.4	-64.7	-14.2	-72.0	-40.5
Grecia	1.366	+151.4	+145.7	+83.2	+141.8	+149.6	+143.7	+174.6		+134.5	+18.1	+127.2	+109.9	+160.4	+102.6	+134.1
Irlanda	.021	+16.9	+11.2	-51.3	+7.3	+15.1	+9.2	+40.1	-134.5		-116.4	-7.3	-24.6	+25.9	-31.9	-4
Italia	1.185	+133.3	+127.6	+65.1	+123.7	+131.5	+125.6	+156.5	-18.1	+116.4		+109.1	+91.8	+142.3	+84.5	+116.0
Lettonia	.094	+24.2	+18.5	-44.0	+14.6	+22.4	+16.5	+47.4	-127.2	+7.3	-109.1		-17.3	+33.2	-24.6	+6.9
Lituania	.267	+41.5	+35.8	-26.7	+31.9	+39.7	+33.8	+64.7	-109.9	+24.6	-91.8	+17.3		+50.5	-7.3	+24.2
Paesi Bassi	-.238	-9.0	-14.7	-77.2	-18.6	-10.8	-16.7	+14.2	-160.4	-25.9	-142.3	-33.2	-50.5		-57.8	-26.3
Portogallo	.340	+48.8	+43.1	-19.4	+39.2	+47.0	+41.1	+72.0	-102.6	+31.9	-84.5	+24.6	+7.3	+57.8		+31.5
Slovacchia	-.025	+17.3	+11.6	-50.9	+7.7	+15.5	+9.6	+40.5	-134.1	+4	-116.0	-6.9	-24.2	+26.3	-31.5	
Slovenia	.071	+21.9	+16.2	-46.3	+12.3	+20.1	+14.2	+45.1	-129.5	+5.0	-111.4	-2.3	-19.6	+30.9	-26.9	+4.6
Spagna	.387	+53.5	+47.8	-14.7	+43.9	+51.7	+45.8	+76.7	-97.9	+36.6	-79.8	+29.3	+12.0	+62.5	+4.7	+36.2

% of Guaranteed landing on government bond yield for equal maturity (10 years)

Titolo di stato	Rendimento	Spread (ipotesi di studio)	Costo del debito	Costo stimato strutturazione prodotto annuo		Total expense ratio stimato	
				Min (ipotesi)	Max (ipotesi)	Min (ipotesi)	Max (ipotesi)
Germania	0,098	0,750	0,848	0,1	0,5	0,948	1,348
Finlandia	0,090	1,000	1,090	0,1	0,5	1,190	1,590

% of Equity with EIF guarantees 40%

Titolo di stato	Costo medio equity garantito da FEI	Costo medio equity europeo	Costo dell'equity	Costo stimato strutturazione prodotto annuo		Total expense ratio stimato	
				Min (ipotesi)	Max (ipotesi)	Min (ipotesi)	Max (ipotesi)
Germania	0,339	4,800	5,139	0,1	0,5	5,239	5,639
Finlandia	0,436	4,800	5,236	0,1	0,5	5,336	5,736

The costs have been estimated on a SICAV basis for a value of 30 million euros considering the project amounts, the costs of structuring and managing the financial product will likely drop.

By reaching the large capital market, in the case of a loan financial product, the functional amounts to optimize the cost of the fund should not be less than 200 Million of €.

Phase 1: The structure of the EPC and the ESA contracts

As read from the Fi Compass document on "European Structural and Investment Funds and Energy Performance Contracting - Stimulating investments in energy efficiency" and from that "How to finance energy renovation of residential buildings: Review of current and emerging financing instruments in the EU" the schematic description of two emerging contractual trends shows which can be applied to the case of SPARCs and more generally to the financial construction of Positive Energy District.

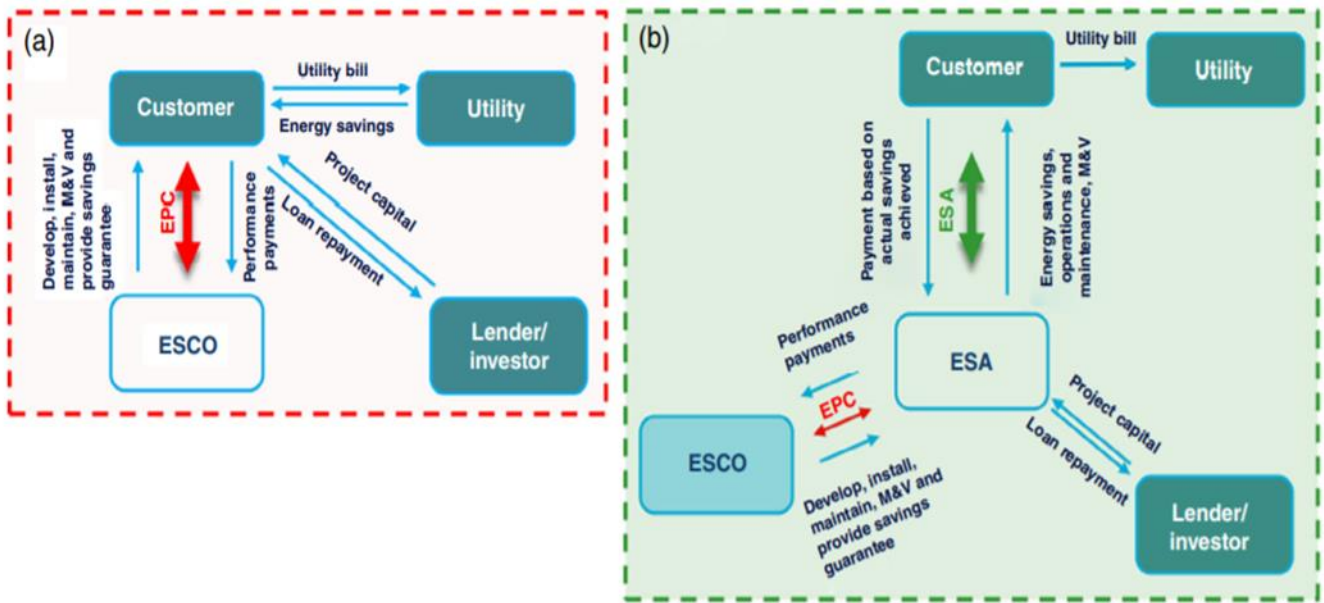
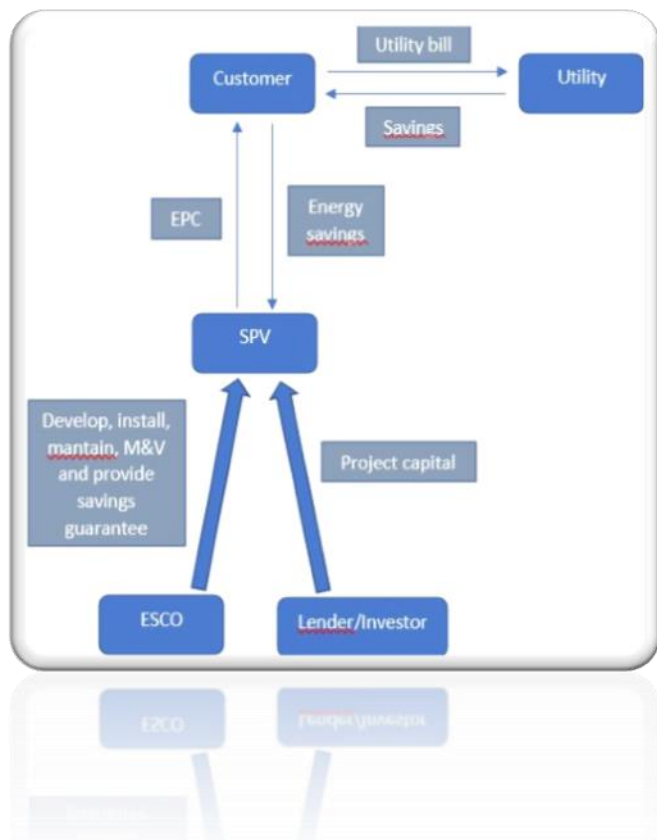


FIGURE 3 Schematic diagram illustrating the underlying principles of (a) EPC and (b) ESA models (Economidou & Bertoldi, 2014)

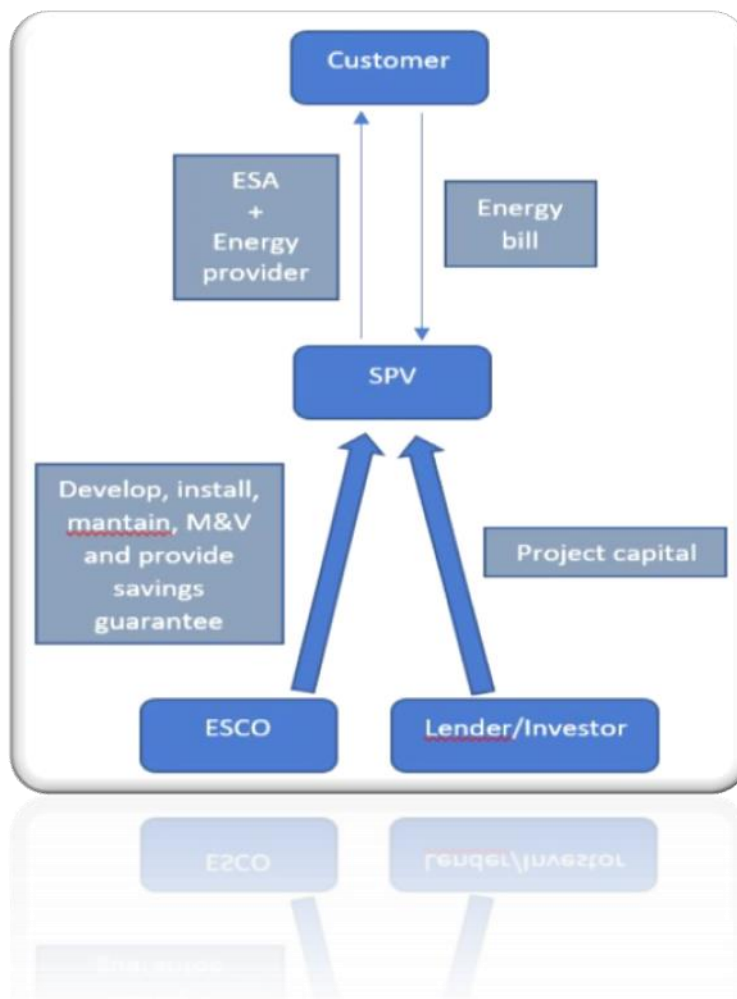
Theoretically both are correct but, nevertheless based on the financial world’s sentiment these could have **not a fully applicability at large scale dimension**, while they fit within small scale transactions, especially with those dedicated to SME’s or Private individuals. Briefly, in both solutions (a and b on the above table) the OPEX, which is charged to ESCO, is divided from the CAPEX (Lender or Investor) and the customer pays back both (OPEX and CAPEX) by saving on energy costs or by paying as for the pre-intervention energy supply, possibly funding the gap coming from the share of the works not generate energy savings with their own funds (particularly in the ESA case).

Alongside and below, there is a fine-tuning proposal of the above mentioned ESCo’s operational both for EPC and ESA contract schemes. The single agreement with an SPV reduces the complexity and the fragmentation of the scheme. In the ESA scheme, the SPV is also the energy provider.



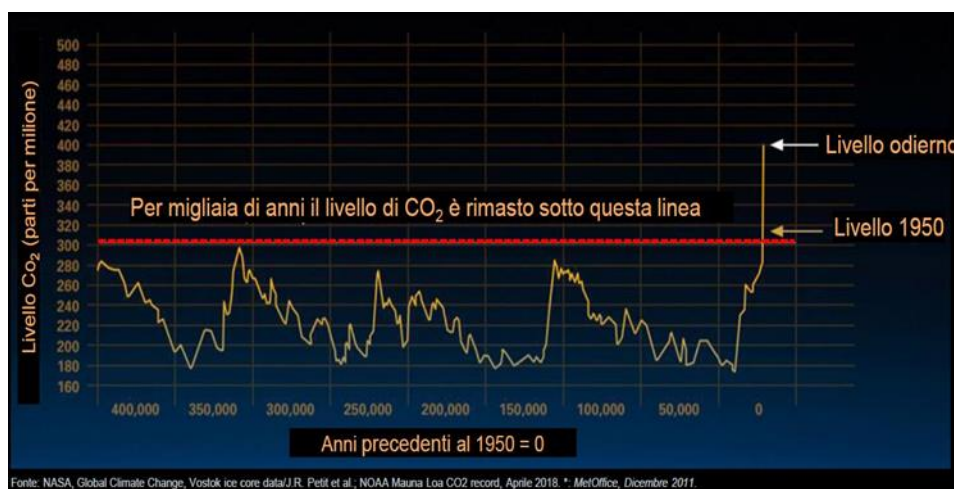
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The sentiment of professional investors on the difference between an Epc and an Esa contracting scheme is slight; briefly the EPC measures and guarantees a high degree of efficiency with the aim of repaying the investments in amortization with savings while the ESA provides the same services by repaying the investments through the supply of energy and possibly by integrating the share not related to energy saving. The other way around several formulas of EPC scheme replicates many of the best practices applied on structured financial products (namely first in, first out, shared saving) and which could be tested for a PED investment strategy or carbon neutral city strategy in favour of a Main Urban Authority as an issuer.



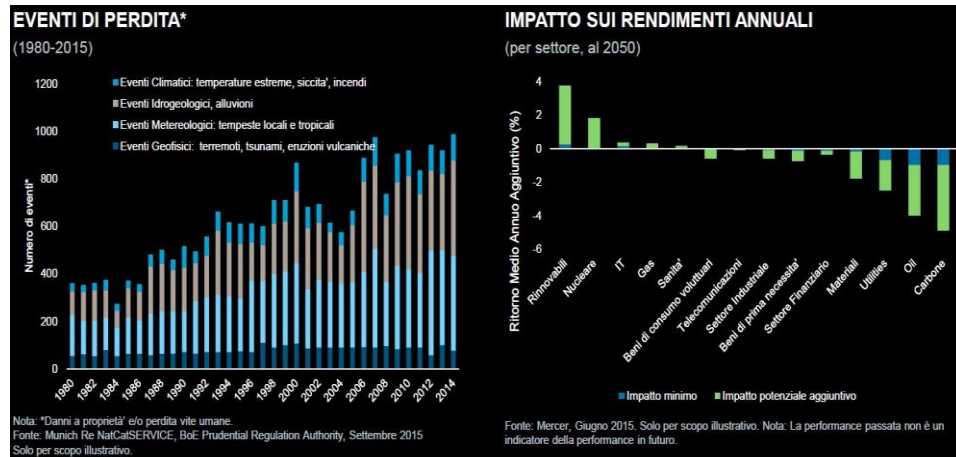
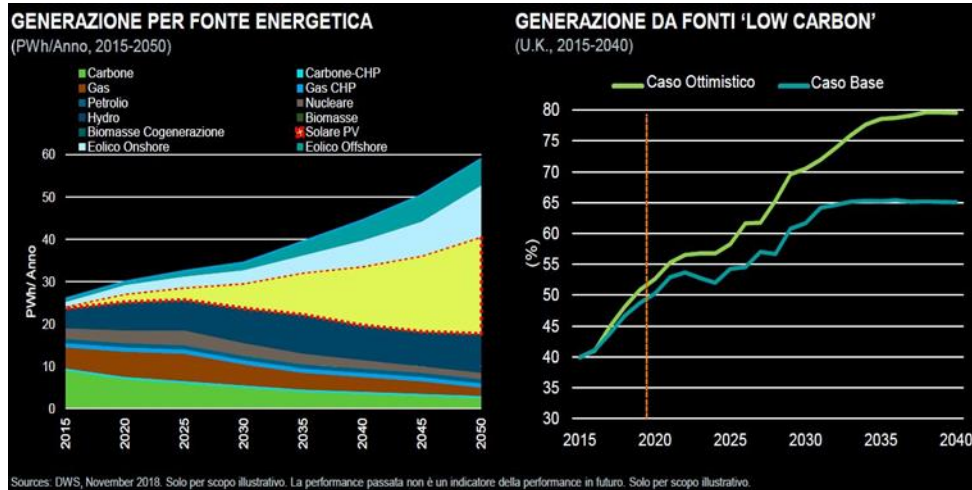
The following funding proposition enables the **CAPEX as a senior debt** and the **OPEX as a junior debt**: as such, it gives the opportunity to the Main Urban Authority to **have guarantees on the senior debt** by EIF/EIB with a **lower cost of funding** and to manage (or to have a implementing party) the junior debt, which is together more risky even more profitable than the forecasted.

The leading assumption, optimizing the creation of the economic and financial plan of the interventions, is that the **various financing and facilitation schemes** (non-repayable rewards, debt, and equity financing) **should be attributable solely to an SPV**. Two other concepts should be recalled:



- The possibility of setting up energy communities that can help make implementation works and investment plans more captive and less expensive.

- The Grid parity, which can not only compare the cost of the kWh of production (such as "direct" costs) but should take into account the negative impacts ("indirect" costs) of the GhG emissions linked to the traditional energy production.



The three slides above are quoted from Gianluca Minella/DWS, Director, Infrastructure Strategy & Research showed during the public event "Megatrends and innovation: how finance and economy will change" Udine, September 19th, 2019⁵

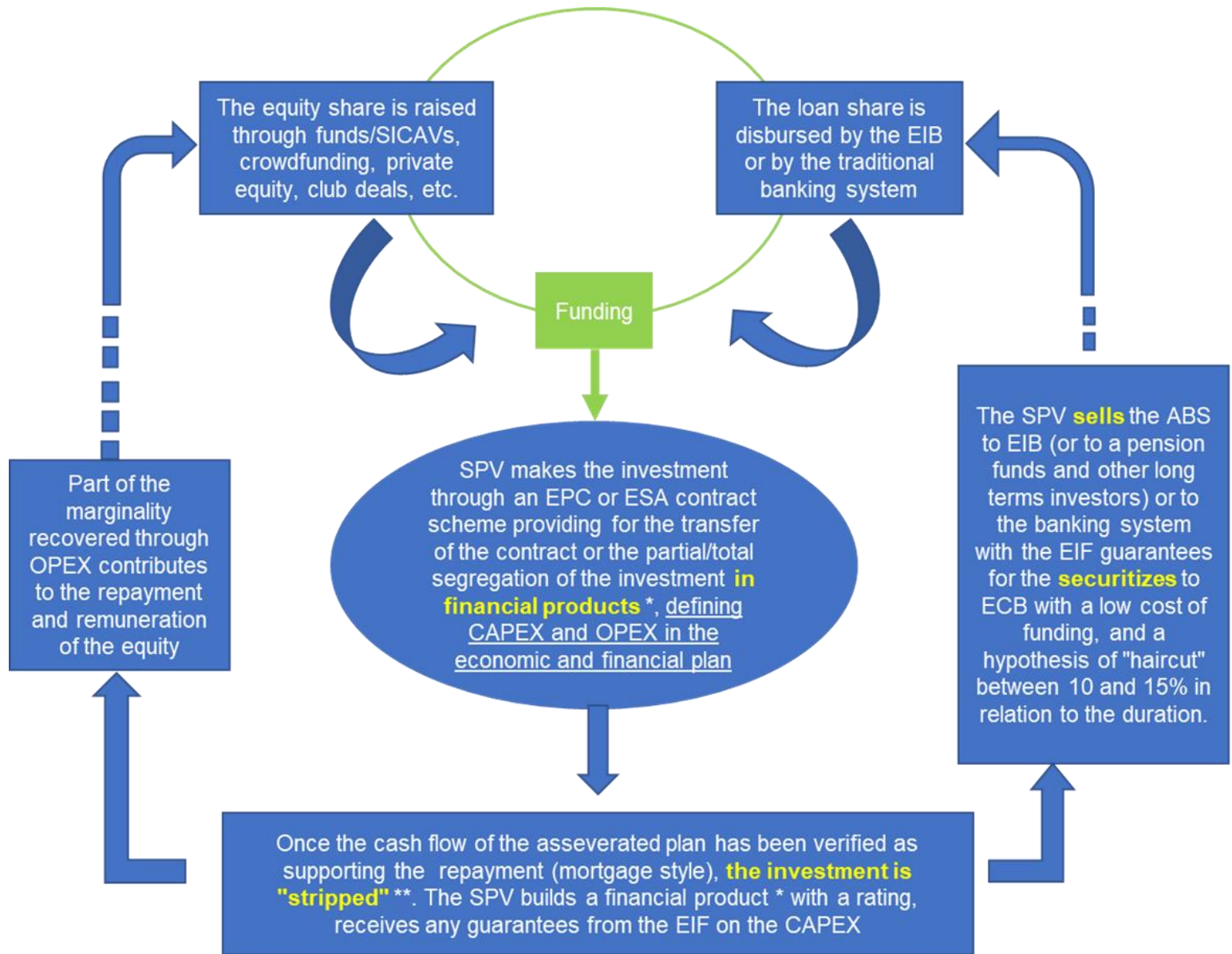
⁵ https://www.civiesco.it/_it/news/Megatrend_e_innovazione/17



Phase 2: Investment disposal strategy

* In the considered hypothesis it **would be a bond**

** The CAPEX flow from EPC used as collateral of the ABS (Asset-Backed Security) security if considered senior can be sold to institutional investors (funds, banks, KW, possibly EIF or ECB) even or with one "extremely low" discount on the price. In case it is purchased by banks to finance itself with the ECB, it may have an additional "haircut" (including the devaluation on the price) of around 15%. Any junior issues in a proportion of 80/20% (credit enhancement of 20%) could be theoretically sold to investors specialized in higher risks and yields securities.



CONCLUSIONS

This public report has been combined the concept of sustainable and innovative finance through the principles of Impact Investing. The creation of innovative turnkey funding scheme, the preliminary draft of six possible business models to deploy in the SPARCs' context, and the city's capacity building tool in terms of bankability evaluation of the pipeline of energy efficiency projects will allow the proposal to be a package solution for LCs and FCs to attract substantial investments (with a floating ratio between public/private investments).

The COVID-19 pandemic has sanctioned the high likelihood of "green swan" events but on the other hand as highlighted the necessity to foresee risks, those related to climate change primarily. Risk and scenario evaluations will help the Main Urban Authorities in understanding the longer-term challenges facing by their cities. A due diligence process could enable the bankability and the consistency of their resilience strategies in front of the investors.

As such, the challenge that embraces the SPARCs in terms of innovative financing is to unlock the so-called non-cyclical investments in energy efficiency projects. Nonetheless, the specific objective of the D7.1 is also to certify the proposed methodology in bankable terms, to accompany the Lighthouse municipalities in the process of requesting finance (loan, equity, blending) from transnational public institutional investors (European Investment Bank and Council of Europe Development Bank). Institutional investors with long-term objectives (pension funds or similar) and who adopt ESG (Environmental, Social and Governance) and PRI (Principle for Responsible Investment) criteria in the choice of investments will also be involved, considering the EIB Taxonomy. **The Financial Leverage must be contained to prevent it from undermining the non-cyclical nature of the investment**

Finally, the public report's proposal aims to exploit a part of the real estate assets of the municipalities, the public under-capacitated real estate asset, to test a replicable process model via PED replication. In that sense the European added value in terms of scalability and deployment of Key Exploitable Results is a milestone.

A model based on the measurement of social impacts in terms of income statement that can intercept the needs of projects with positive effects on the territory (in social, environmental and energy terms) expressed by the financial community (green economy). In this regard, the presence of an asset underlying the investment, such as a set of properties coupled with an infrastructure for the efficiency/production of renewable energy, is a factor of interest for private investors.

The systematic use of EPC (Energy Performance Contracting) which fix the floor beyond which savings become a revenue for the user, performed by the involvement of 3PF (third party financing) in the form of ESCo (Energy Service Companies), is pivotal in the proposed architecture and in relation to the monetization process of energetically virtuous behaviours.



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Positive Energy District, Local Renewable Energy Community, Energy Trading Platform

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APPENDICES

Business model inventarisation (BY FHG)

H2020 projects on Smart cities:

- Triangulum
- Growsmarter
- Smarter together

		Business Model	Description	Reference
Domain	Building			
			"The solution consists of a virtual power plant which connects local photo-voltaic production, heat pumps and batteries. A charging station for electric vehicles is also be integrated into the system. It lowers the demand for external energy by increasing energy self sufficiency of buildings.	
	Virtual Power Plant in Mülheim			
			Under the GrowSmarter project, the City of Stockholm has implemented energy retrofitting actions for the 6 tertiary buildings owned by Stockholmshem. In this retrofitting, external insulation is added to the whole building envelope in an ambitious manner and new windows and balcony doors have been installed with the best possible U-values for the project. This way there is control over incoming air. The only air intake is under the windows right behind the radiators to warm the air up before it continues into the apartment. The air exits by exhaust ventilation and the heat is recovered by a heat pump on the roof.	
	Energy efficient refurbishment of tertiary residential buildings in Valla Torg, Stockholm			
			To improve energy efficiency of existing residential buildings by 70% as part of EU Horizon 2020 GrowSmarter Project, renovation measures were undertaken. This includes building envelope insulation, high efficient windows, staircase lighting, elevator and heating system.	
	Smart building shell refurbishment in Cologne			
			The City of Stockholm has implemented energy retrofitting actions in 2 tertiary buildings: a cultural central and an official complex	
	Energy efficient refurbishment of tertiary buildings by the City of Stockholm			

	Energy efficient refurbishment of a residential building - Brf Årstakrönet		Under the GrowSmarter project, this measure focusses on energy efficient refurbishment of a residential building from 2007: Brf Årstakrönet, with 56 private condominiums.	
	Hubgrade Energy saving centre		A remote energy saving center called Hubgrade was set up in the three buildings in Stockholm which were refurbished under the grow smarter project. The measure aims at reducing energy bill by taking proactive measures based on 24/7 monitoring.	
	Stand alone Smart Street Lighting in Stockholm		Under the Smart Lighting measure of the Grow Smarter project, the goal is to demonstrate and test three different technologies for smart street lighting: remote, self-controlled and sensor-controlled LED lighting.	
	Construction Consolidation Centre in Stockholm		Construction materials make up 30-40 % of goods moved around modern cities. A centralised logistics depot in Stockholm, using alternative fuel vehicles, can help cut emissions from freight transport drastically.	
	Energy efficient refurbishment of tertiary buildings by Barcelona Municipality		Barcelona Municipality has retrofitted two old textile factories, lately abandoned or used as a warehouse.	
	Energy efficient refurbishment of the building - Educative centre Escola Sert		Gas Natural Fenosa has implemented energy refurbishment of an Educative center Escola Sert. The aim is to validate the technical and economic feasibility of adding renewable energy generation to a tertiary building in the form of building integrated	
	Energy efficient refurbishment of the building - Hotel H10 Catedral		Under the GrowSmarter project, Gas Natural Fenosa has implemented energy refurbishment of three buildings with very different uses , and one of them is a hotel H10 Catedral.	
	Energy efficient refurbishment of residential buildings by Naturgy		Naturgy has implemented retrofitting actions with the aim of lowering the energy consumption of buildings in nearly 20,000 m2 of residential floor in Barcelona: Canyelles, Ter, Lope de Vega and Melon District.	



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	Energy efficient refurbishment of a residential building - Passeig Santa Coloma		Barcelona Municipality has promoted the energy refurbishment of a social housing building in Passeig Santa Coloma with 207 dwellings and over 14,000 m2.	
	Building Energy Management System: Resource Advisor		The Software Platform called 'Resource Advisor' developed by Schneider Electric enables the follow-up of Key Performance Indicators (KPIs) for the evaluation of the impact of energy retrofitting works in a building.	
	Smart energy and self-sufficient block		The smart energy and self-sufficient block aims to reduce electric consumption in tertiary buildings through renewable energy, especially photovoltaic.	
	Smart meter information analysis and actuators		In Barcelona, Endesa deployed an innovative "Data Hub", named Multiservice Concentrator (MSC), allocated in the secondary substation with the aim to serve as a data node, collecting and managing city data.	
	Refurbishment of a Municipal Housing Estate in Vienna (Social Housing Lorystraße 54-60)		The project Lorystraße 54-60 is a medium-size housing block with 95 flats, completed in 1966 and owned by 'Wiener Wohnen' the city-owned social housing operator.	
	Refurbishment of a Rental Social Housing in Vienna		The project 'Hauffgasse 37-47', completed in 1987, is a large housing block with 485 flats. It is supplied by a micro-district-heating-grid and currently fired with natural gas. The objectives were mainly focusing on the reduction of energy demand and the integration of renewable energy sources.	
	Renovation of semi-attached homes of housing association using Woonconnect tool		The Use Case aims to involve tenants in the process of renovating and maintaining homes owned by the social housing association Woonbedrijf.	
	Smart and Intelligent Street Kiosk		By placing high-tech city beacons, Eindhoven presents revolutionary, multifunctional and interactive information system. The city beacons replace the old (advertising) information displays giving residents, visitors and entrepreneurs access to number of digital and interactive, basic functionalities	

	Smart control of individual rooms in existing buildings		With the aim of reducing energy consumption by 20% in the existing office buildings in Strijp-S, an innovative concept has been developed to optimise energy consumption while maintaining user comfort.	
	Energy Optimisations in Buildings		The Building Benchmark Assessment is used to identify buildings where energy optimization measures can be implemented and is based on a set of benchmarks developed over time.	
	Photovoltaic installation on post 2000 building		The system is an integral part of the ambition to become grid independent on a campus housing 1 large academic building, an energy centre, a multi-storey car park and accommodation for 900 university students.	
	Smart control of individual floors in existing buildings		Predictive control algorithm was used to independently control floors in a Strijp-S office building.	
	Renovation of semi-attached homes of privately owned houses using woonconnect tool		The digital tool WoonConnect is used for the renovation choice in this project, allowing the home owners to see their energy use linked to their day-to-day behaviour and improve their homes.	
	Renovation of semi-attached homes of privately owned apartments using woonconnect tool		To achieve energy consumption improvement in the whole area, the consortium also addressed other apartment owners present in the area Eckart	
	Energy Infrastructure			
	Open District Heating for Sustainable Heat Recovery		This Open District Heating aims to recover waste heat to the existing DH network by developing an innovative business model for plug and play heat pumps and contracts where the DH provider buys waste heat from local sources like data centres and supermarkets.	
	Smart local thermal districts		Within the GrowSmarter project."Smart local thermal districts" is part of the building refurbishment in Ca l'Alie, which combines on-site electricity generation (PVs) with the local existing DHC network, reducing the	



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			consumption of fossil primary energy for heating and cooling production.	
	Virtual energy advisor by Barcelona municipality		The Virtual Energy Advisor is being developed within the Barcelona Municipality project 'Take charge of your energy' with the aim to reduce household electricity consumption by encouraging behavioural changes amongst tenants.	
	Stochastic model of appliance energy consumption		An electricity demand model based on stochastic approach has been developed by IREC using statistical data from Spain (Time Use Data Surveys).The aim is to influence consumer decisions to improve the their appliances' energy labels.	
	Home energy management system (HEMS) by Gas Natural Fenosa		Home Energy Management Systems (HEMS) are installed in all residential buildings selected to be refurbished by Naturgy in Barcelona. It aims to inform tenants on how to optimize their consumption and reduce their energy bills, by providing information on real-time electricity and	
	Sustainable Energy Supply by Soil Sanitation		SANERGY is a low-cost system which aims at purifying soil in combination with extracting energy from groundwater using heat pumps in the Strijp-S district in Eindhoven.	
	Demand Side Response (DSR) Control for Student Accomodation		The use case aims to deliver strategic load curtailment in student accomodations via existing BEMS.	
	Demand Side Response Control for Office Block (Academic Building)		The Use case aims at delivering strategic load curtailment in academic buildings via existing BEMS.	
	Smart Lighting in Strijp-S - Eindhoven		The project involved equipping light poles with multi-colour LEDs allowing interactive control of individual lights. This enables a variety of services such as: guiding people through different lighting, seasonal lighting programs for increased comfort, safety control via sound sensors.	
	Fibre Optic Infrastructure (Backbone project)		Strijp-S is built as a smart data driven area and hence, needed a strong data backbone. 500km of Fibre Optic(Backbone) cables have been installed in ducts in the Strijp-	

			S district (68 acres) for improving connectivity in the area. The Fibre Optic network acts as a Backbone for data related service.	
	Energy storage assets		Energy storage system with Li-Ion batteries which provides bi-directional flexibility. It is aimed for dynamic cycling.	
	Smart City Central Energy Controller		A Virtual Power Plant energy management platform, providing the capability to city stakeholders to actively manage Distributed Energy Resource (generation, storage and load) from a single platform.	
	Demand Side Response Control for Public buildings		The Use case aims at delivering strategic load curtailment in public buildings via existing BEMS.	
	Micro-grid management system		Microgrid management controller, designed to integrate disparate energy assets throughout single stakeholders to deliver improved energy performance within the areas of cost, CO2, flatten peak and effective use of low carbon generation.	
	Unidirectional functional lighting in Eckart		Unidirectional functional lighting has been installed on a walking path at a pond in Eckart. The special type of lights only shine towards the path and not on the pond to not disturb the local fauna.10 of the 30 poles are equipped with sensors that dim the light according to the usage of the path.	
	Switching from steam based heating systems powered by biomass		Steam pipes were changed to district heating based on water as energy transmitter. The power is supplied via a biomass power plant owned by the municipality.	
	Mobility			
	Mobility Station in Mülheim		The Mobility stations in Mülheim provide commuters and residents of the busy district with a location, where they can easily find various alternative transport options. The aim is to encourage behavioral change from using cars towards more active modes of transport like walking and cycling.	
	Vehicle Sharing Service in Mülheim		With the aim of enabling road users to travel their routes using the environmentally-friendly transport	



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			network and to rely less on their own car, the car sharing facility in Mülheim offers a range of different vehicles. This includes e-cars, e-bikes and also normal cars for long distance.	
	Multifunctional Mobility Ticket in Cologne		A multi functional mobility app and ticket is launched in Cologne providing users of public transport the access to use shared cars, (e)-bikes, buses, trams etc. with one ticket. It is an enhancement of the existing subscription ticket enabling the travelers to also use the shared mobility services.	
	E-Charging Station with remote control in Mülheim		The solution aims to promote the replacement of fossil fueled vehicles by facilitating use of EVs. The charging infrastructure enables the tenants to charge their EVs. It is implemented in collaboration with various shared E-mobility providers rendering the use of a private car unnecessary.	
	Traffic control system for passenger vehicles		Smart management of traffic signal lights can reduce congestion and make traffic flow more smoothly in cities.	
	Smart traffic signals synchronized to prioritize cleaner vehicles		Traffic lights equipped with signal priority systems give environmentally sound trucks a green light faster than others, reducing their travel time. This works as an incentive for cleaner vehicles.	
	Green parking index in combination with car sharing pool with EV		The Green parking index in Stockholm is designed to encourage alternative forms of transport, thus reducing the demand for the private parking places which must be provided when building new and renovating old housing in Stockholm.	
	Normal charging infrastructure for electric vehicles		Electric Vehicles increase in share of car sales and charging infrastructure is important to facilitate the transition to an improved vehicle fleet in cities. In Stockholm five to ten normal charging stations have installed to satisfy citizen needs.	
	Fast charging infrastructure for electric vehicles		In Stockholm, a fast charging station within the GrowSmarter project is established by Fortum at the parking facility by McDonald's	

			restaurant. Fast charging stations could provide electric vehicles with fully charged batteries in less than 30 minutes.	
	To enable alternative fuelled heavy vehicles to get a larger share of the market, the City of Stockholm has installed 10 new refuelling stations providing alternative fuels – biogas, ED 95, HVO and RME for heavy duty vehicles.		Renewable refuelling stations for heavy duty vehicles	
	Travel demand management and smart guiding to alternative fuel stations		A smart phone application is developed to follow up and influence changes in travel behaviour to a healthier and environmentally friendly travel.	
	Communal service boxes for sustainable deliveries		Smarter deliveries cut traffic generated by shopping and provide better information on delivery times, while the use of cleaner vehicles will help to reduce local emissions and noise.	
	Developing charging infrastructure to promote e-mobility in Barcelona		Endesa Energía has implemented five fast charging stations in Barcelona with the aim of promoting clean transport in the city.	
	Vehicle to X (V2X) Charging for Electric Vehicles		In Barcelona, an innovative form of Vehicle-to-X (V2X) charging for Electric Vehicles has been implemented. This can increase the renewable energy penetration, energy storage, grid flexibility and facilitate energy management optimization.	
	Smart taxi stand system in Barcelona		The Smart Taxi Pilot in the city of Barcelona makes it possible to provide taxi drivers and taxi clients with real time information about taxi availability at each taxi stand through a mobile app.	
	E-Car Sharing in social housing BWSG-Hauffgasse		E-Car sharing in the social neighbourhood is an innovative approach in the issue of e-mobility in social housing, contributing not only to the environmental goals but also to the community building as a strong societal element.	



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	E-Logistics at Siemens in Vienna-Simmering		E-logistics are an important element in modern on-site plant management contributing to a substantial CO2 reduction. Employees's involvement contributes to the acceptable and sustainable innovation dynamics in the plant, increasing its overall competitiveness.	
	E-Bike Sharing for the District		A first E-Bike terminal was opened in April 2018 at the central cemetery of Vienna. A second terminal is at the mobility point. 12 E-Bikes and a Cargo-Bike are in operation. The E-Bikes are available via the SIMBike App or through a chip card offered at the spot. Sycube developed the whole system.	
	Multimodal Mobility Stations		'Mobility stations' make environment-friendly urban travel possible and offer sharing alternatives to buying one's own vehicle. Eight multi-modal mobility stations were built in the project area, two of which also include Shared District Boxes. Additionally, the stations offer free wifi.	
	Shared District Boxes		Munich is testing two "Shared District Boxes" located in the proximity of mobility stations. These boxes make delivery, shopping and sharing services possible on a 24/7 basis. Each box features compartments at different temperatures (cooling, refrigerated or at a constant ambient temperature).	
	Electric Assist Cargo Bikes (Pedelecs) for goods delivery in Manchester		The aim is to promote the sustainable alternatives for local deliveries using electric Assist cargo bikes. The Municipality offers the use of 4 bikes leased from a fleet of different bikes owned by Manchester	
	Smart Charging for Electric Vehicles in Eindhoven		In order to promote use of Electric Vehicles and better manage the charging infrastructure, a smart charging system was developed. 6 Type-2 AC chargers installed in Strijp-S with two charging point. Peak load management system/charging management system is included in the project.	

	Parking Management System		With the vision of transforming the parking policy from normative numbers, a more demand driven optimum solution was developed using ICT technologies to improve the user experience. The system is aimed at increasing the occupancy of parking lots.	
	Leasing electric vans for estate management		To reduce carbon footprint and improve air quality, 7 diesel vans from the university estate management team of University of Manchester were replaced with new electric leasing vans. The vans are used for delivering mail and operational services.	
	Corporate Electric Car Sharing for University		The aim was to reduce staff using their own cars for university business and to increase the use of EVs at the MMU. Two 30kW Nissan electric cars were purchased and two additional charging points installed. The sharing scheme is managed by a third party enterprise through an online booking system.	
	Station bound district car sharing		With the aim to improve the sharing of green mobility solutions, 3-5 sharing cars are operated by several contractors in Strijp-S, Eindhoven.	
	Single base bike sharing		A mixture of ebikes and normal bikes is offered in a station bound bike sharing system located at one of the entrances of Strijp S.	
	Big Data			
	Smart Home Systems for Tenants in Mülheim		The SmartHome app allows tenants to turn off all electrical appliances and lights at any time and from anywhere. This can be done easily at home or on the move. In combination with smart plugs (Smart Meter), tenants can keep track of the current energy consumption of any connected devices.	
	Big Data Visualization for Cologne		A Big Data Management Application, called Urban Cockpit has been implemented in the city of Cologne to provide a fast and easy overview of the data stored in the Urban Data Platform. It includes data from traffic management systems , energy providers and other such companies.	



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	Waste collection statistics for individual households		Collecting waste statistics is one sub-solution under the Smart Waste Management measure of Grow Smarter project. It is able to provide feedback to end users on their waste segregation habit.	
	Barcelona's big data integration solution		Barcelona's big data integration solution aims at developing a semantic model that reflects and connects three domains of interest: mobility, energy, and integrated infrastructures.	
	Open Source Database		The use of database is essential in all modern project management. The essential question is hence whether the data collecting and processing changes in the implementation process are open source or the solution is vendor locked. Smarter Together Vienna chose an open source solution based on FIWARE.	
	Smart Data Platform & Data Gatekeeper		The City of Munich has built a Platform to collect and handle all generated smart city data accordingly. In a concept named "Data Gatekeeper" all elements that are important for a city are discussed- including data privacy aspect, data classification & anonymization, use case building and data model	
	Public Sound Sensor Safety Project		The Public Sound Sensor Safety Project consists of sound sensors in the public space that are attached to the smart light poles in the area. This enables to detect specific sounds such as fighting and sound levels in bars or cafes in the main bar street in Eindhoven.	
	Data-Enabled Innovation Challenges		The goal is to encourage data enabled solutions i.e. solutions which make use of the data available by organising events such as hackathons. Grass root approach adopted to identify citizen challenges, giving participants a guideline on which challenges they could possibly solve using the data.	
	Data Curation Service		The data curation service offers access to data generated by the Manchester mobility and energy modules (hosted on the OSISoft platform) and other related datasets. This service will enable actors within the Corridor to create	

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			economic, social and environmental value from Triangulum project data.	
	IoT			
	Active House smart home solution		The Active House smart home solution is an intelligent system with a state of the art graphical user interface. This energy tool raises awareness among tenants on energy consumption from areas including electricity, hot water and apartment heating and encourages them to reduce their consumption.	
	Streetlights as wifi-to-grid connectors and electrical chargers		In Stockholm the smart connected city adds sensors to existing fibre-optic network and connects to an Internet of Things (IOT) open data platform to produce real-time information for traffic emissions reduction and manage all aspects of city life and operations.	
	P2P - Blockchain			
	Urban Data Platform			
	Automated waste collecting system		Within the Grow Smarter project in Stockholm, an automated waste collection system has been implemented in an existing neighborhood. The goal is to enable a cost efficient and smart waste solution for residential areas.	
	Optical sorting system for smart waste collection		Within the Grow Smarter project, optical sorting technologies have been combined with a smart waste collection system to increase waste recycling rates in multi-family residential areas.	
	The Smart Tower is a smart solution that provides enhanced wireless access networks. The aim is to support the growing demand of mobile connectivity in the city for broadband mobile			



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	connections, IoT services, etc.			
	Remote controlled LED Street Lighting		Under the Smart Lighting measure of the Grow Smarter project, the goal is to demonstrate and test three different technologies for smart street lighting: remote, self-controlled and sensor-controlled LED lighting. In this Use Case the focus is on a remote controlled system connected to a CMS.	
	Microdistribution of freight in Barcelona		Last mile delivery of goods is a new approach to reducing congestion, lowering emissions and diminishing delivery times in dense urban areas.	
	SIMmobile-Mobile Urban Living Lab in Vienna-Simmering		The SIMmobile is the key outreach, participation and co-creation lab of the Smarter Together project in Vienna.	
	Munich SmartCity App		The Munich SmartCity app is an example of how to make an existing offer smarter – within the Smarter Together project the Munich app became the Munich SmartCity app by adding additional smart services as well as a more user-friendly design.	
	Smart Data: Intelligent Lamp Posts in Munich		Intelligent lamp posts were installed to trial sensors for smart data collection in Munich. Additionally, the lamp posts can provide free wifi access (M-WLAN). The lamp posts are used as "urban labs" to test digital services and their benefits.	
	Eindhoven Open Data Portal		With the goal of making data more accessible and useful, the open data portal of the City of Eindhoven was built. It helps to upload, share, use, analyze and visualize public data sets. The platform is highly user friendly and has very low barrier to use.	
	Data Visualization Platform		The visualisation platform allows for the viewing of data from various sources in different “canvases,” such as virtual reality, augmented reality, 360 degree video or traditional 2D.	
	Public Wi-Fi		The goal of the use case is to provide open free Wi-Fi to inhabitants and visitors of Strijp-S.	
	Smart interactive floorlight for walking and running in Eckart		To encourage walkers, joggers and runners interactive lights are	

			embedded in a footway around two ponds in Eckart.	
	Camera based crowd management in the Eindhoven city center		Several cameras were installed on the main bar street in Eindhoven (Stratumseind) with the aim of better crowd control.	
	Sensor based citizen initiative for environmental monitoring		The initiative aimed at collecting environmental data to monitor air quality focussed on particulate matter.	

KPIs for the value proposition identification	
Value proposition	understand the assets offered to customers and the market positioning
Infrastructure	understand the key actors, the key activities and the key resources
Funding model	understand the funding sources and if the equity/debt blending composition
Demand side	understand the customers and the catchment area
Financial model	understand the operative revenues stream generation



Ruggedised (By CVUT)

		Business Model	Description	Reference
Domain	Governance			
				-
	Building			
	District Heating system			
	Geothermal heat/cold storage and heat pumps (Rotterdam)	A heat/cold grid is built in a new district with a storage system underground and heat pumps in each buildings. The diversity of buildings enable to reduce the peak load in heat/cold and reduce the overall size of the infrastructure. The operational costs are consequently reduced and the owners have a reduced total cost of ownership.	Individual pumps and condenser are installed in every building producing heat over the day independently of the needs. The waste heat is stored underground in the grid and disposable for other buildings connected. There is one storage for heat and one for cold enabling a trade over the seasons when the cold is most needed in summer and heat in the winter and the production is the reverse.	https://ruggedised.eu/fileadmin/repository/Factsheets/Ruggedised-factsheet-R1-Rotterdam.pdf



D7.1 Business Models and Financing Mechanisms for Wide Uptake of Smart City solutions

Thermal energy from waste streams (Rotterdam)	A heat exchanger enables to collect heat from sewage waters and also from surface waters of ponds and lakes (independantly) especially in the summer. This heat can be directly used or stored in the heat/cold grid (see above).	The two heat exchangers collect the heat from incoming sewage water before they are sent to the pumping station, or from local ponds and lakes after depolluting this water. This system is used in completion to the geothermal heat/cold storage grid and is less relevant without it.	https://ruggedised.eu/fileadmin/repository/Factsheets/Ruggedised-factsheet-R2-R3-Rotterdam.pdf
Pavement heat/cold collection (Rotterdam)	A layer of tubes in the concrete enables to collect heat in the summer, cold in the winter, or distribute heat in the winter to prevent freezing.	The heated concrete in the summer (60°C) contains tubes in the asphalt layer enabling heat collection. The heat can be used or stored in the thermal grid. In the winter the same solutions can be used to heat up the pavement in some places to prevent freezing (parking, walkways..). As the city owns the pavement and installs this solution, the profit goes into the reduction of the total cost of ownership for citizens.	https://ruggedised.eu/fileadmin/repository/Factsheets/Ruggedised-factsheet-R4-Rotterdam.pdf
Energy Infrastructure			
Intelligent LED light with EV charging (Glasgow)	The LED lighting program also includes in some columns a smart EV-charging station that minimizes the amount of public space used and provides an easy access to charging stations for citizens. The charging	The charging stations funded by Transport Scotland are connected to the network which can transmit control signals and data, and is used to examine the demand-side management potential of EV assets. The business case also aims at considering owners' remuneration for	https://ruggedised.eu/fileadmin/repository/Factsheets/Ruggedised-factsheet-G6.pdf

		stations are also connected to the wireless network which transmits data to the data platform for decision makers.	using EV battery charge in case of demand-side event.	
	Smart Waste Management (Rotterdam)	This solution's objective is to lower the energy consumption of waste collection vehicles by monitoring their degree of filling and optimising the route of the collection trucks. Similar projects have been done in other cities, but the scale (6,540 containers) and the connection to a 3-D city model makes this solution quite innovative.	Sensors in all waste containers send data to the data platform which contains a 3D model of the city. The centralised management system will create dynamical optimized routes for waste collectors. The waste collection will represent 25% less driven distance in the end and a reduced need for equipment.	https://ruggedised.eu/fileadmin/repository/Factsheets/Ruggedised-factsheet-R13-Rotterdam.pdf
	Public lighting			
	Intelligent LED light with EV charging (Glasgow)	A LED lighting program with wireless network enables sending data gathered on the LED lights to the data decision platform.	The street LED lights are connected to a wireless network which can transmit data and control signals. The decision platform of the city can thus examine the demand-side management of street lights along with the EV assets connected to the charging station.	https://ruggedised.eu/fileadmin/repository/Factsheets/Ruggedised-factsheet-G6.pdf



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	Mobility		
	Green Parking (Umea)	<p>This solution is a business model whose purpose is to reduce the need for car parking spaces in a specific residential area. With this model we can reduce the amount of parking, gather the majority of parking spaces in co-usage parking facilities and at the same time get financing for 'Mobility Management' for residents in the area. This solution will create behaviour changes that reduce the need for owning a car and instead use other types of mobility in daily life.</p>	<p>The land owner building a new house do not build a parking place with the help of the business model, so that Upab (municipal parking service) takes the responsibility to accomodate parking in the area. The owners are encouraged with reduction on parking standards to use alternative transports, the owners pay share into mobility management fund which encourages behavioral change. This type of agreement is available for area where the restriction of parking space for mobility management would be effective, and where owner could live without a car.</p>
			<p>https://ruggedised.eu/fileadmin/repository/Factsheets/Ruggedised-factsheet-U7-Umea.pdf</p>
	Big Data		

	IoT		
	P2P - Blockchai n		
	Urban Data Platform		



D7.1 Business Models and Financing Mechanisms for Wide Uptake of Smart City solutions

Intelligent lights with EV

		Energy Infrastructure	Public lighting	Mobility	Urban Data Platform	Questions
KPIs for the value proposition identification						
Underlying Mechanism	understand whether assets exist upon which it is possible to cover against risks not related to finance		City lighting infrastructure			Is it retrofit or new?
Value proposition	understand the assets offered to customers and		LED street lights with wireless network	EV charging station integrated thus reducing the public space used and providing easy	Wireless communication transmitting data and control signals to feed the Data Based Decision Platform.	What are the gains for using the data from the charging stations and the lights ?

	the market positioning			access charging stations.		
Infrastructure	understand the key actors, the key activities and the key resources	Municipality of Glasgow; EV charging station, accessibility to the electrical network for higher demand than classical lighting. Demand-side analysis for using EV assets as part of electrical infrastructure.	Municipality of Glasgow; Basic LED lights, lights close to the road to implement charging station		Municipality of Glasgow; Air quality sensors, wireless communication. Data Decision Platform.	
Funding model	understand the funding sources and if the equity/debt blending composition	EV charging stations funded by Transport Scotland	Street lighting funded through European Regional Development Fund		Horizon 2020 fund to develop the intelligence to examine the demand-side management potential	How is the investment in EV charging station returned ?



D7.1 Business Models and Financing Mechanisms for Wide Uptake of Smart City solutions

Demand side	unders tand the custom ers and the catchm ent area		City needs for street lights	EV owners, that do not have access to private charging stations	Electrical distribution intelligence from city platform, demand side management	
Financial model	unders tand the operati ve revenu es stream generat ion	Savings using LED, distribution intelligence to reduce costs	Savings using LED	Using EV assets for peak load (business case not implemented)	Distribution intelligence to reduce costs	Are EV owners paying for the charge ? Who are they paying ?

Geothermal heat and storage pump

		District Heating system	Energy Infrastructure	Questions
KPIs for the value proposition identification				

Underlying Mechanism	underst and whether assets exist upon which it is possible to cover against risks not related to finance	Newly built DH low temperature network.		Is it all newly build?
Value proposition	underst and the assets offered to custome rs and the market position ing	Local heat/cold exchange and maximise use of wastewater heat with geothermal storage. Connection of all buildings in a grid for lower peak load with diversity of use. Green energy.	Reducing size of heating infrastructure by connecting to the grid	Is there any EE measure involved in buildings? Specific system or choice by homeowners? Is it possible to trade surplus of heat/cold on building level (if there is any surplus)?



D7.1 Business Models and Financing Mechanisms for Wide Uptake of Smart City solutions

Infrastructure	understand the key actors, the key activities and the key resources	Buildings owners (large buildings), Municipality, Grid operator. Eneco (energy supplier/distribution company) Build a low temperature grid to connect the buildings, and add heat pumps to each buildings. No existing heating infrastructure to implement it up-front.		
Funding model	understand the funding sources and if the equity/debt blending composition	No details on funding		Who invests (grid, heat pumps/condensers), what instruments, equity/debt, share of project money, any payback period
Demand side	understand the customers and the catchment area	New districts with diversity of buildings and possibility to connect majority of them. End users are the residents with reduced TCO and the grid operator.		

Financial model	underst and the operativ e revenue s stream generati on	Reduction of peak load -> reduction of infrastructure size --> investment cost and operating cost.		Estimated savings
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Flexible Green Parking

		Governance	Building	Mobility	Urban Data Platform	Questions
KPIs for the value proposition identification						
Underlying Mechanism	understand whether assets exist upon which it is possible to cover against risks not related to finance	N/A	N/A	N/A	N/A	
Value proposition	understand the assets offered to customers and the market positioning	Business model reducing need of car parking spaces in residential areas	40% reduction of the applicable parking standard for owners.	Mobility management fund to encourage behavioral change		



D7.1 Business Models and Financing Mechanisms for Wide Uptake of Smart City solutions

Infrastructure	understand the key actors, the key activities and the key resources	Upab (municipal parking company), Umea Kommun, Akademiska Hus. Mobility Management fund by owners. Need for a place where less cars and parkings would be effective and fewer people would own a car	New property with car parking not within the property area, municipal parking company responsible for accommodation	Behavioral change among residents in the area with mobility management. Need close services for the area (businesses, schools and healthcare center) to tackle everyday need for car transport		
Funding model	understand the funding sources and if the equity/debt blending composition	Financial sum from owners to "Mobility Management Fund"				Any subsidy by municipality? How is the Mobility Management Fund used?
Demand side	understand the customers and the catchment area		New owners, building residential areas in a neighborhood close to commodities and schools etc.			What are their motivations? How to prevent owners to build in-house parking slot?

Financial model	understand the operative revenues stream generation		Owner 40% reduction in standard parking, no need for in-house parking slot	Gain in overall parking place. Use of public transport and reduction of traffic costs		Any incentive for buyers of property?
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