RUGGEDISED
Designing smart, resilient cities for all

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Executive summary

One of the first and most important steps for a city to become a Smart City is to assess its state of play in order to get a real and reliable picture of the city as a whole. This is necessary to get a better understanding of what needs to be improved in terms of capacity level and in order to select the set of most suitable smart solutions to be implemented in the identified replication area.
Moreover, the constitution of a Smart City Governing Group is crucial for the success of the planning process. Indeed, what the Fellow Cities have been keeping in mind, during these first 18 months of RUGGEDISED, was that this group is supposed to survive the project and to continue steering and supporting the local Smart Cities activities over time. Therefore, the Smart City Governance groups have been set up and structured taking into account this ambitious goal.
The purpose of this deliverable is to report on the state of play as well as progress done by the Ruggedised Fellow Cities during this first year and a half of the project.
An intermediate assessment of the local progress in the Fellow Cities will be provided at the end of the fourth year of RUGGEDISED within D7.3 “Intermediate Replication Assessment”.
In the coming months an update of D7.1 will be provided with the results of the first evaluation activity in the Fellow Cities.

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1. Introduction

One of the first and most important steps for a city to become a Smart City is to assess its state of play in order to get a real and reliable picture of the city as a whole. This is necessary to get a better understanding of what needs to be improved in terms of capacity level and in order to select the set of most suitable smart solutions to be implemented in the identified replication area.
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The purpose of this deliverable is to report on the state of play as well as progress done by the Ruggedised Fellow Cities during this first year and a half of the project.
The structure of the document is as follows:

- Chapter 2 provides a general overview on WP7, describing the context of the Initial Replication Assessment and outlining the path to be followed during the project.
- Chapter 3, 4 and 5 report the detailed Initial Replication Assessments of Brno, Gdańsk and Parma respectively in terms of general smart city context, city vision, governance structure and first information on future replication activities.
- Finally, Chapter 6 outlines the main findings and conclusions drawn from the assessments provided by the cities

2. Overview on WP7 activities: "Replication to Follower cities and Knowledge transfer"

WP7 aims to guide and support Brno, Gdańsk and Parma in getting ready for the replication of smart solutions inspired by those implemented in the three Lighthouse cities, Rotterdam, Glasgow and Umeå. Concretely, the three Fellow Cities will produce, by the end of the project, a Replication and Investment plan for the deployment of the local smart city projects.
Each Fellow City will determine the formal binding level of these plans (e.g. should they be officially approved by the local authorities or not). The idea is that immediately after the closure of the RUGGEDISED project the Fellow Cities will be ready to become Lighthouse cities by implementing the smart solutions identified and included in the plans.
In order to reach this challenging objective, an intensive process of capacity building and knowledge transfer is carried out according to the following 4 tasks:

- **T7.1: "*Empower the cities through knowledge share and training*"**
  Knowledge transfer is a term used to encompass a broad range of activities to support mutually beneficial collaborations between the societal players taking part in the smart city activities of the Ruggedised cities: authorities, universities, industries and businesses and the civil society.
  Within Ruggedised, the concept of knowledge transfer has been applied making use of different modalities and means of implementation. Fellow Cities are involved in an intensive process of capacity building and knowledge transfer aimed at supplying the competencies for an informed and reliable replication of the smart solutions under development in the Lighthouse Cities.
  As shown in Figure 1, Task 7.1 foresees several opportunities of knowledge transfer between Lighthouse and Fellow cities: 6 Replication Workshops; 3 Study Tours and ad hoc webinars, and conference calls.
  Details and outcomes of this activities are reported in D7.6 (confidential)
  This is a complex task where the interaction between Lighthouse and Fellow cities is foreseen.
- **T7.2: "*Assess the state of play, establish and run the smart city governing groups*"**
  The Replication and Investment Plans, described and presented further in T7.4, play an important role in Ruggedised project and is to be considered the reference documents that the Fellow Cities are committing to and will not substantially modify.
  In order to reach this final milestone, **an initial phase where actors review the state of play and prepare the work is required.**
  Therefore, within this task Brno, Gdańsk and Parma have been undertaking the following route:
  1. Verifying that the smart solutions demonstrated by the Lighthouse Cities were confirmed and check the potential updates whether necessary technical, organisational or temporal changes have been applied.
  2. Assess and update the local state of play regarding the city, and more in details regarding the smart city context: local development and renovation programmes and plans, financing opportunities, synergies with other projects/initiatives as well as key policy and legislation frameworks.
  3. Give an overview on the foresight activities carried out within the first 18 months of the project
  4. Provide a description of the Replication area identified and present (where ready) the list of Smart Solutions that will be replicated in each local context.

  To ensure that the Fellow Cities start off on the right foot the long replication process foreseen by the project, proper forms of governance, called Smart City Governance, have been established in compliance with the local needs and traditions.
  Within this report, a detailed description of all these activities is provided city by city.
  This task involves only Fellow cities.

- **T7.3: "*Deliver a vision and an implementation roadmap with participatory foresight*".** WP7 proposes to utilise a participatory foresight process in order to create shared strategic visions and roadmaps for the organisation of upcoming investments in the energy and mobility sectors. Participatory foresight allows strategic planning and effectively establishes a collaborative forecasting platform that is able to channel the often fragmented energy and intelligence present in our communities to design a concrete way forward. This process will be implemented in each Fellow city and will be steered by the respective Governing Groups that will involve a wider group made up of all the local stakeholders interested and/or relevant for the development of the Smart City. The group of stakeholders will meet at least 7 times according to the path indicated in Figure 1. The first four workshops are

finalised to perform this participatory foresight process in order to deliver the vision and the roadmap, while the last three workshops will involve a smaller group of experts that will define the list of measures to be included in the plan, will present the plan to the wider group of stakeholders for gathering approval and suggestions and will receive the endorsement from the municipality. ***This task involves only Fellow cities.***

- **T7.4: "*Deliver the replication and investment plans*"**. This is the final target of the entire WP. As said, each Fellow city will draft, by the end of the project, the plan with the measures to be implemented to make Brno, Gdańsk and Parma Lighthouse cities. ***This task involves only Fellow cities***.

Figure 1 below shows the roadmap of the activities of WP7.

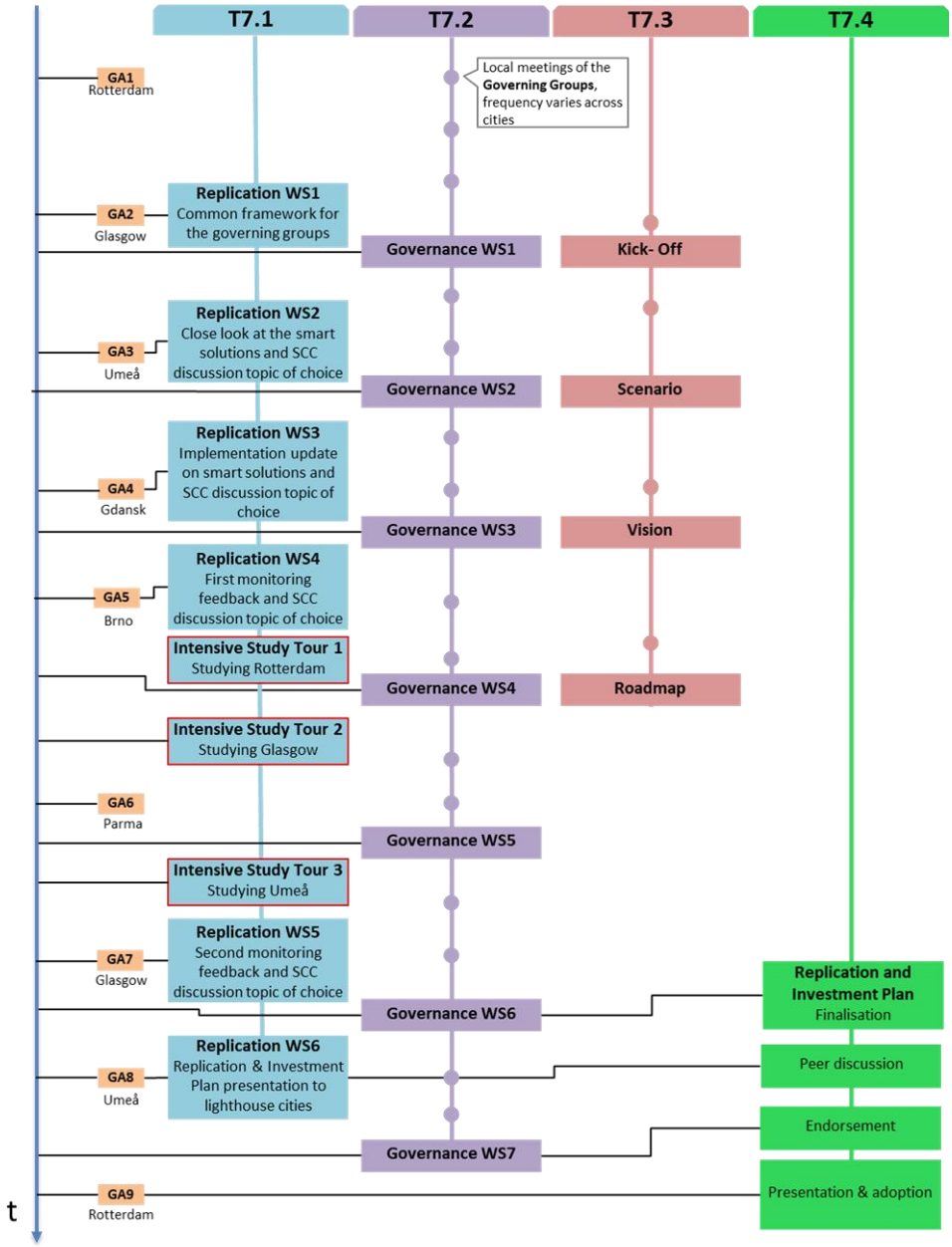


Figure 1: Roadmap of WP7 activities

3. Initial Replication Assessment in BRNO

Brno (377,000 inhabitants) is the second-largest city in the Czech Republic located in the centre of the South Moravian Region. The city has a strategic geographic position within Central Europe with excellent transport accessibility, including an international airport.
City of Brno is modern, dynamic and fast-growing centre of industry, trade, science, information technology, research and innovation with business incubators and centres of excellence in science.
It is also a university centre with more than 70,000 students at 4 universities and 3 university campuses.
The climate is humid continental with cold winters and hot to warm summers.

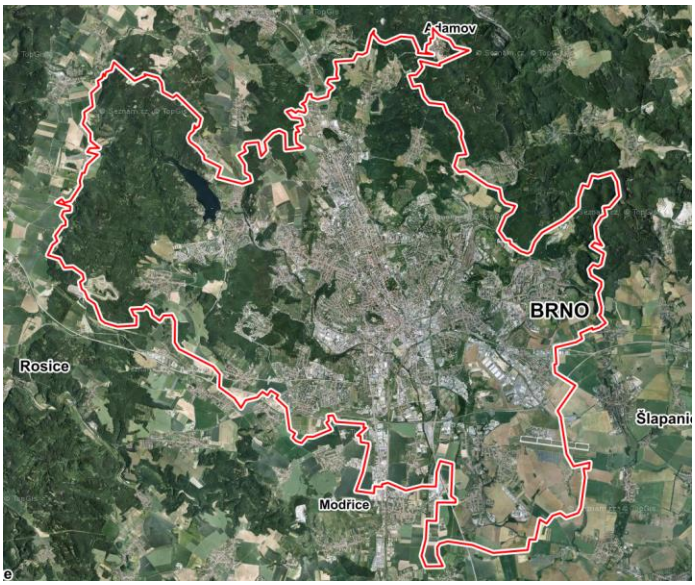


Figure 2: Map of Brno

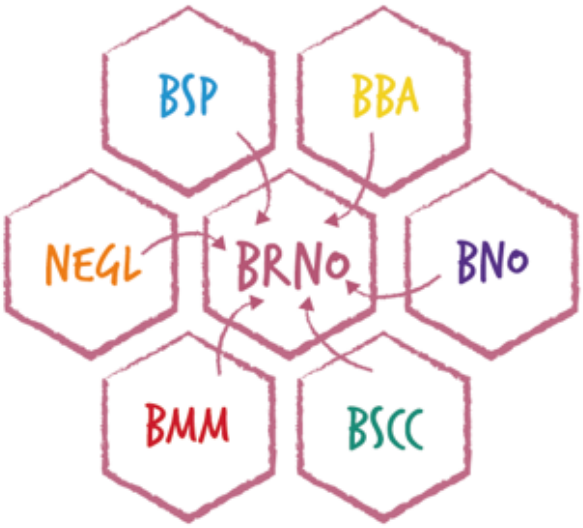
Table 1: Demographic and socioeconomic data of Brno (2017)

Demographic and socio-economic data	
Area (km2)	230,2
Population	379 527
Density (inhabitants/km2)	1649
Average GDP per capita (€)	141 % (EU28 = 100%)
Rate of unemployment (%)	5,0

3.1 Brno before RUGGEDISED

Brno started to work on the Smart City agenda at the end of 2014 when the Smart City Commission was established as advisory body for the Brno City Council. One of the member of the Brno City Council was indicated as responsible for this agenda. Moreover, the City Strategy Office created a position for the Smart City Coordinator of smart city projects.

At the end of 2016 (beginning of RUGGEDISED project), the Smart City governance structure of Brno was rapidly changed. The Smart City Agenda was newly moved under the responsibilities of the Deputy Mayor of the City of Brno who, currently, steers: the City Strategy, ICT and E-Government implementation. Therefore, the Deputy Mayor Office for Smart City agenda was set up; it embodies five departments and more than 60 employees.
The year 2017 started off the unique form of collaboration amongst the main actors of the city: the City Ecosystem. The City Ecosystem is perceived as an ongoing collaboration of all stakeholders in Brno (local, regional and national level). The objective of this collaboration is the long-term development of the city.
The city of Brno is also composed of city districts, municipal companies and organizations. Along with its natural partners from the academic, business and non-profit spheres and active individuals, Brno forms a unique city ecosystem. According to this assumption, the following groups of stakeholders are included in it:



Brno Science Partners
Universities, research and development centers and the Czech Academy of Science

Brno Business Alliance
Self-employed, small and medium sized enterprises, big corporations, investors and chamber of commerce

Brno Non-Governmental Organizations
Non-governmental and non-profit organizations, associations, foundations and endowments

Brno Smart City Community
Active citizens, professionals and expats

Brno Managing Members
Municipality, city districts, political clubs, municipal companies and organizations

National and European Governmental Level
Brno metropolitan area, the South Moravian Region, regional, state and European institutions

Figure 3: Brno City Ecosystem

3.2 Brno smart cities context

- **SUMP**
  The development of the Brno **Sustainable Urban Mobility Plan** begun in August 2014. The Analytical Part, data collection and definition of the baseline, was approved by Brno City Council in July 2015.

  Then, a series of experts and stakeholders workshops were organized in order to gather different points of view and proposals on the Sustainable Mobility vision. The definitive version of the Brno SUMP Vision, focused on improving public transport, walking and cycling, was approved by Brno City Council in December 2015. After this, the preparation of the planning phase started. Currently, a Strategic Environmental Assessment is under development and it is expected to obtain the official final approval in April 2018.

  The whole process was accompanied by public involvement and stakeholders/citizens engagement activities that was partially financed by CH4LLENGE project (Intelligent Energy Europe program).

- **SECAP**
  The City of Brno joined the **Covenant of Mayors** initiative in September 2017. The overarching goal is to improve energy efficiency and reduce CO2 emissions at least by 40% within 2030.
  The Sustainable Energy and Climate Action Plan, is currently under preparation and will be ready by July 2019.

- **International networks:**
  Brno is part of two international networks, namely:

  - **CENTROPE – Building the Central European Region**
    It is a joint initiative aimed at establishing a multinational, competitive and prosperous region in Central Europe encompassing four European countries: Slovakia, Austria, Hungary and Czech Republic. This network was established in 2003.
  - **EUROCITIES**
    A network of 135 large European cities focusing on cooperation in all areas of city administration. Brno has been a member since 1993.

Table 2: Brno Smart City Context

Name	Type	Year	Administrative level	Sector	Set targets	Budget and funding/financing scheme
Brno Sustainable Urban Mobility Plan	*Plan*	*2014-2018*	*local*	*Mobility*	*Modal split:* *56% for public transport* *12% walking* *12% cycling* *20% cars* *A fourfold reduction in greenhouse gas emissions by 2050 compared to 2010 or 1 tonne eq. CO2 per person per year by 2050); decrease in total energy consumption in passenger transport by 20% by 2050)*	*city budget, CIVITAS 2MOVE2 project (Horizon 2020 Program)*
Brno Sustainable Energy and Climate Action Plan	*Plan*	*2017-2019*	*local*	*Energy*	40% *CO2* reduction till 2030	*Approx. 100 000 €* *National program and city budget*

3.3 Building a City Vision

The common goal of the City Ecosystem is to develop a city strategy to 2050 that should be based on the following main pillars:

- **Quality of life**
  It includes a whole range of key topics for the city's residents: safe and affordable housing and good living environment, the opportunity to get a good education, an interesting and satisfying job, to have access to basic services;
- **City administration**
  Effective administration should be clear and intelligible to the city's residents, modern and forthcoming to everyone. It should not burden people, but on the contrary, offer them the opportunity to become part of the local community, engaging in planning and decision-making at a local level:
- **Resources**
  Resources that are available to the city allow for its further development and smooth everyday functioning. Topics from the fields of technical infrastructure, energy management and mobility belong here.

At the beginning of 2017 Brno started working on its Smart City Strategy 2050, with the contribution and participation of the City Ecosystem.

In the first workshop with the city Ecosystem, the discussion was devoted to the **basic conceptualization of this new strategy: #brno2050**. This was done using a world café method and in this way every participant could contribute to the discussion. As a result of this interactive activity, there were suggested more than 50 core values with specific goals and indicators.

One of the goal of the Kick-off Worksop was also to get nomination for the city ambassadors that would represent the City Ecosystem.

Currently, the City Ecosystem is represented by **a board of 6 ambassadors** which nominate the experts in charge to follow a specific part of the strategy. Indeed, **25 guarantors have been chosen as responsible for 25 core values.** Guarantors are (silo) experts: give advice, discuss core values, conflict management.

Details on the Smart City vision are reported in Table 3.

Table 3: Brno Vision Framework

RUGGEDISED VISION FRAMEWORK	
Background	The current vision of the City of Brno until 2050 was approved by the Brno City Assembly as a strategic document at the end of 2017.
Vision Name and objectives	**#brno2050** In 2050, Brno is synonymous for an attractive and sustainable city in the international comparisons. Brnoers appreciate the high quality of life in the city, which offers them the opportunity to work as well as to do business, entertain and relax. It combines the fruits of research and innovation with the economic prosperity of individuals and companies. Urban landscape blend in the surrounding countryside. Brno is a city without barriers and provides a good public space for the Brnoers. Openness and cohesion on the one hand and healthy and resilient environments on the other hand create a home and safe back ground for a half million people. Brnoers are aware of the scarcity and limitations of natural resources, encouraging their efficient use so that the city still has enough water, energy and resources for its development. They want the city to leave the future generations in the same or in a better state. The Brnoers perceive that the city is being managed vigorously, in a modern way and efficiently. Its management and development are based on a cultivated public debate and long-term cooperation of all partners. The city breathes for its inhabitants and they can be proud of their city.
Policy Goals	The vision includes 25 proposed values: what the city should be in 2050 (for example: nature in the city, coherent and respecting city, sustainable and circular city, participatory governance, etc.). These values contain specific and partial goals and concrete indicators. **Example:** Value: **Compact and balanced city** Value description: A compact city is characterized by a continuous built-up area and clear city boundary towards the surrounding countryside. A compact city is the opposite of extending the built-up areas to the outskirts of the city and beyond its boundaries, which is the opposite of the phenomenon called the settlement slurry, which is often observed in satellite villages. In a compact city, transport dependency is ideally reduced. Compact built-up is a prerequisite for increasing social contacts and security of the residents. Contribution to the city: The city will focus on the regeneration of its built-up area, which is not adequately used (e.g. vacant lots and old industrial properties). These spaces will no longer be an environmental and economic burden. The demand for the construction and maintenance of the linear technical and transport infrastructure will be reduced. People will not be forced to deal with long commuting distances. The newly revitalized territories will bring life to previously risky locations in terms of safety and social cohesion. Main goal: Efficient use of spatial reserves within the city incl. brownfield areas Indicator: Share of regenerated brownfield areas on the total area of brownfields in Brno (actual value 0 %, future value by 2050 – 90 %)
Consideration of EU and global goals	The EU and global goals were considered during the analytical phase as one of the key background documents. Proposed values and their objectives therefore follow the objectives of current European initiatives. In some cases, they are even more ambitious.
Focus areas of the Vision	The development of the city has been divided into three areas. Prudent resource management, growing quality of life and effective administration form a framework for Brno's sustainable development in the future – for its attractiveness for the lives of its current residents as well as future generations.

	- **Quality of life** The broadest area is represented by quality of life, which includes a whole range of key topics for the city's residents. These include safe and affordable housing and good living environment, the opportunity to get a good education, an interesting and satisfying job, or to have access to basic services. - **City administration** Effective administration should be clear and intelligible to the city's residents, modern and forthcoming to everyone. It should not burden people, but on the contrary, offer them the opportunity to become part of the local community, engaging in planning and decision-making at a local level. - **Resources** Resources that are available to the city allow for its further development and smooth everyday functioning. Topics from the fields of technical infrastructure, energy management and mobility belong here. As mentioned above, the vision itself consists of 25 values, what the city should be in 2050.
Why and how these areas were selected	The pillars/areas are based on the previously approved Concept of Smart City Brno. Specific values were proposed by members of the City ecosystem. More than 200 experts from universities, companies, non-profit sector, active citizens, representatives of public administration and representatives of political clubs participated in their identification and development. The final processing of the individual values was done by guarantors. The city's representatives in the creation of the vision had only the role of expert consultants and organized dozens of different meetings and discussions that led to the final design of the City of Brno's vision to 2050.
Temporal scale of the Vision	The new Strategy consists of three parts. The first is a vision until 2050 currently under preparation. The most important values and goals for the long-term development of the city have been defined. It will be followed by the setting of specific priorities and topics that Brno should sort out by 2028. For the nearest time frame – until 2020, the first action plan that will include individual activities and projects will be set up. For long-term vision planning, the 2050 horizon seems to be the most appropriate. At the same time, this horizon is the same with other strategic plans, whether at regional, state or European level.
Spatial Scale of the Vision	For the city and surrounding metropolitan area (defined for ITI by functional relations – e.g. commuting to work, for school and services, accessibility by car and public transport).
RUGGEDISED VISION PROCESS	
Summary of the process (steps and timing)	Creating the vision of the city of Brno until 2050 was a first major task in co-operation with the City Ecosystem. Its first meeting was held in March 2017. Many meetings, workshops, discussions, questionnaires were organized since that date. Here is a list of important milestones/meetings that took place since the beginning of the cooperation (March 2017) until the approval of the vision (December 2017): • City ecosystem kick-off meeting (22.3.2017) • workshops for the inner (city and its organization) and the external City ecosystem • Meeting of ambassadors and nomination of guarantors • Draft of values, goals and indicators by guarantors • 1st round of public commenting (via webpage www.brno2050.cz) • Incorporating comments by guarantors • Presentations for Brno City Municipality and ambassadors

	• Workshop „Scenarios for #brno2050“ • 2nd round of public commenting • Public debate in 6 city districts • 2nd meeting of the City Ecosystem • Incorporating comments by guarantors • Final version of VISION 2050 in Committees, City Council • Assembly (12.12.2017)
Promoter and key partners	The numerous debates on the future of Brno that the Strategic planning department launched in spring 2017, enabled collaboration and gradually favoured the achievement of consensus among a number of partners. The city of Brno, usually perceived only as a political representation or office, is also composed of city districts, municipal companies and organisations. Therefore, partners from universities, scientific research centres, companies, non-profit organisations and active individuals in particular, are part of a unique city ecosystem and all of them participates in the preparation of the Strategy. The resulting Strategy will not be a strategy of the office, but a strategy of the city of Brno as such and of all its citizens.
Method	**Combination of Explorative and Normative** It was a combination where a desirable status for the future was proposed with a respect to analysing existing development trends and megatrends. This assessment was mainly carried out during the workshop "Scenarios for #brno 2050"
Tools	Various methods were used to get relevant outputs while working with the public, namely: - Literature review; - SWOT analysis - Surveys/questionnaires - Experts/citizens workshops For example, to assess the impact of megatrends and trends on the possible development of the city, the participatory foresight method was used during this workshop. On the other hand, to collect comments from the widest spectrum of the public a web platform for the 2050 strategy was used.
RUGGEDISED VISION INITIAL ASSESSMENT	
Main barriers encountered in setting the Vision process	Political instability
Main opportunities	The main opportunity is to use the widest range of relevant people and their knowledge in creating a vision.
Skills to be enhanced within the city departments	Better coordination and exchange of information on their own development activities.

3.4 Brno Smart City Governance

As it was mentioned above, the Office of Deputy’s Mayor is responsible for the Smart City agenda in Brno and includes five departments. These departments suggest individual projects to be assessed by the Smart City Commission which consists of City Councillors and independent experts. The Smart City Commission recommends selected projects for City Council to approve.

External partners are engaged for cooperating with the City Ecosystem, which serves as an advisory board for specific projects and the overall development of the city as well.

Brno created a working group to achieve a successful implementation of RUGGEDISED project. Members of the working group are from different department of the Deputy's Mayor Office and they are led by the project manager of RUGGEDISED project.

A Steering Committee has been established thanks to RUGGEDISED. It is made up of City Councillors, members of Six Research Centre, and independent experts. The Steering Committee defines the direction of project development, decides on the substantive project issues and fulfils a control function.

The city of Brno aims also to share its experience and transfer the knowledge gained with other cities and in this regard, already involved some cities from the South Moravian region and has currently invited them to become part of the project's City Interest Group.

3.5 Replication Area

The City of Brno intends to build the Smart District of Špitálka: a 2.4-hectare area, owned by Teplárny Brno a.s. (heating company) in the central part of the city.
The existing manufacturing facilities situated in the adjoining areas along Plynárenská, Špitálka and Radlas Streets are being currently converted.
Moreover, a project for the revitalization of the Ponávka Stream along Plynárenská Street, adjacent to the entrance to a heating plant site, has been prepared. The complex, or rather its western part, circumscribed by the streets of Koliště, Cejl, Tkalcovská, the Svitava River and a railway line, is intended for the construction of a smart district, which is expected to include a mix of different uses with a well-balanced share of opportunities for housing, work, service and recreation. The technological solutions that best respond to the local needs will be chosen, whether in the field of sustainable urban transport or integrated energy systems.
The Future Smart district Špitálka is located right next to the city centre (Figure 4).

Figure 4: Future Smart City District- location

The red line in Figure 5 shows the size of the area which will become the future smart district Špitálka.

Figure 5: Smart City district area

The whole heating plant area is reported in the figure below (Figure 6).

Figure 6: Heating Plant area

The Central heating plant Špitálka was built in 1930 and was one of the first modern heating city system in Central Europe. Nowadays, part of the Špitálka district with monumental cooling tower is unused. This area is very close to the city center in industrial part of Brno. Next to the Špitálka there are some factories, old railway and National theatre. The whole heating plant area has 68 975 m2 and 24 177 m2 of it will become a smart district. This complex of buildings is owned by company that belongs to the City of Brno.

Modern district for modern people

The area will be transformed and smart block of buildings will be built. They will be mostly used for housing and services but also as a recreation centre with outdoor and sport activities etc. Creating such a significant urban element almost in the city centre will also generate new job opportunities for individuals as well as for companies and start-ups.

New technological trend will be brought to model not only architectural aspect of this district but also modern society with people who are living focused on a genuine sense of community. By using shared facilities and spaces for meetings and co-working people will find a more convenient and fulfilling lifestyle.

Next Steps

Before that, Špitálka will be temporally used for several activities and events. Local manager will take care of the area and will arrange events and workshops for people; facilitate meetings and negotiate with stakeholders, land owners and policy providers to agree on the future of Špitálka. The City's chief architect's office will provide and manage the first international urban contest that will bring a solution for the urban interface of the area.

The actual master plan for the city does not include the renovation of the new smart district Špitálka. Thus, it will be changed in order to start the construction works in 2021. It will be announced an international and technical competition for the proposed architectural design of the district. The results of the competition will produce a complete plan (final Replication Plan) for the smart district Špitálka.

Figure 7: the Cooling Tower

3.6 Lighthouse solutions to be replicated in Brno

Brno in cooperation with a RUGGEDISED partner – SIX Research Centre - are currently working on expert analysis aimed at evaluating benefits and risks of the implementation of technological solutions in the local environment. Six Research Centre coordinates the analysis in collaboration with researchers and other experts from different universities and research centres.

The findings of the analysis will summarize all Lighthouse cities' smart solutions - technological solutions that will help to build sustainable and ecological cities. Thus the city of Brno will be able to decide which smart solutions can be implemented and which ones are compatible with local environment.

The finalization of analysis is planned at the end of April 2018. Outputs of this work will be discussed by politicians who will decide which smart solutions will be implemented in the replication area.

Currently Brno is interested in the following smart solutions under development in the Three Lighthouse cities:

Table 4: Smart Solutions under analysis in Brno

Lighthouse City	Smart Solutions
Rotterdam	R6: Smart Charging Parking Lots
	R8: Energy Management System
	R9: 3-D City operations model
	R11: Efficient and intelligent street lighting
Glasgow	G1: Heat and cold exchange. Connection of buildings to a district heating network
	G2: Battery storage to support the integration of electricity generated by PV and wind turbines, discharge to EV chargers, and act as grid balancing mechanism
	G4: Optimisation of the integration of near-site RES, potentially liked into battery storage
	G6: Intelligent LED street lights with integrated EV charging functionality, wireless communications network, and air pollution monitors
	G7: Smart open data Decision Platform/central management system
Umeå	U4: Intelligent building control and end user involvement
	U6: E-charging Hub & charging infrastructure

The final list of smart solutions to be replicated in Brno will be included in the Intermediate Replication Assessment Report.

3.7 Other relevant smart solutions, not included in the Replication Plan - Brno

BRNO ID

The objective of the project is to provide services to citizens in an electronic form and communicate with them. The project started with the implementation of electronic season tickets for public transport and the creation of an e-shop related thereto. Since the spring of 2017, payment of the fee for municipal waste has also been implemented in the e-shop. Recently, a Tourist Card module has been launched. The e-shop also allowed voting in the city's participatory budget. Currently they are working on interconnection in the area of access to sports facilities. Over a longer horizon, an information module is also planned, as well as capturing of cultural services (offers from contributory organizations) and other areas.

All the individual services can share the e-shop payment channels and also entirely share the identification carrier of the acquired services. The carrier is any contactless bank card that a user can link with his or her account via the e-shop by him- or herself and use the carrier immediately. This significantly saves costs (by using existing technology that is universal and internationally compatible).

SMART CITY VOUCHERS

The latest technological trends are currently being dealt with by a number of new companies; however, the city must create conditions for their application. It is precisely the city-invested companies that should create the conditions and platforms for the application of smart solutions. Often though, unlike in the private sphere, they do not have sufficient capacities to monitor and implement new technological trends. It is therefore a rather demanding job to prepare a project in the area of Smart City and correctly define the requirements for the initiation of a public procurement procedure. In order to overcome these barriers, they want to use Brno's research institutions, which could help municipal companies in their choice of optimum technological solutions.

The project focuses on cooperation between municipal companies and the Brno's research institutions in the professional and the strategic preparation of the introduction of new technological solutions. It will provide municipal companies with objective information for their decision-making on public procurement, thus enabling an optimum technological solution to be put into operation. Cooperation based on the Smart City Voucher will lead to a detailed specification of the needs and opportunities of municipal companies and to the establishment of further (long-term) cooperation with specific Brno-based research institutions that deal with the given set of issues. The pilot run has the objective of launching cooperation between the academic sphere and the municipal companies, and it is supposed to continue later even „without a voucher". The cooperation will lead to increased efficiency, cost-effectiveness and usefulness of the requested smart solutions. For both stakeholders, the cooperation will mean working on real and local challenges in harmony with the Brno Smart City Concept („the city as a laboratory of solutions").

BRNO IoT TEST BED

In the Brno Smart City Concept, a city laboratory was described as a space that serves for testing. The space will be used to test combinations of sensor solutions. This test-bed will include the area of the Brno Exhibition Centre, the adjacent roadways and the residential neighbourhood. The test-bed can serve research purposes to explore the optimum use of smart solutions. Individual manufacturers can also research the modularity of sensor solutions in combination with competitive solutions. The space will allow for all known sensor solution data transfer options. Stationary and mobile sensors can be combined here.

WIRELESS TRAM

The city of Brno is characterized by its high proportion of tram and trolleybus transport, which has a positive impact on the environment. A disadvantage of these solutions is the large number of pillars, wires and cablings that compromise the attractiveness of the city's historic centre. New trams would not be purchased, but the vehicles currently in operation would be fitted with new technology (batteries, control, power recuperation, etc.) based on a feasibility study and prototype tests.

The objective is to enable the development of a tram that would use a battery-powered drive on some stretches of its route in order to facilitate its passage through the historic centre without the overhead traction line and also ensure safe transport in emergency situations (frost, etc.).

HYPERLOOP

Hyperloop is a revolutionary transport solution introduced by Elon Musk; it appears to be a new developmental stage of mass passenger transport for the future. It is attractive due to its speed, positive energy balance and not creating barriers on the hyperloop track. Reducing transport times and on-demand transport would mean a revolution in the internal transport function of cities and would interconnect European cities into wider regions. The development of this technology may support the emergence of new innovations that can find their application in related industries as well.

The primary objective is to get the entire potential of the city (the academic and business sectors) involved in development around Hyperloop technology. The City of Brno is participating along with the South Moravian Region in a feasibility study of the Vienna-Bratislava-Brno-Prague route. This study should provide the first realistic expert estimates of the difficulty, demand for the service and optimum routing on the European continent. Involvement of research and development capacities present in the region will facilitate access to data and make the conducting of the study more efficient.

CUBESAT

Space research, which is on the agenda of the European ESA agency, has a direct impact on solutions adopted on Earth. The dispatching of a nanosatellite can help develop a broad range of solutions being offered to cities. Accurate measurements, imaging and proportions of green areas; all can be cheaper in the long run if they are carried out from orbital level compared to aerial photography or imaging done by drones. Also, for research and development organizations in Brno, the dispatching of a Brno nanosatellite may be an interesting opportunity.

Main objectives are to assess the options of nanosatellite use for research purposes in the city and to create a feasibility study, including its service lifetime and necessary costs of the implementation of the project.

3.8 Integration and Long-Term Sustainability of the Smart Solutions

To be defined in Intermediate Replication Assessment Report.

4. Initial Replication Assessment in Gdańsk

Gdańsk is a district city and the capital of Pomeranian Voivodeship located on the Baltic coast in the region of Zulawy (an alluvial lowland of the Vistula River) and Kaszuby Lakeland. Together with **Gdynia** (268 thousand citizens) and **Sopot** (almost 40 thousand inhabitants), Gdańsk forms the **Tricity metropolis** with total population of approximately **750 thousand citizens**. Apart from the role of Gdańsk in the Tricity metropolis, Gdańsk is **major city of the Gdańsk Agglomeration**. Other cities included in the agglomeration are: Gdynia, Hel, Jastarnia, Kartuzy, Pruszcz Gdański, Reda, Rumia, Tczew, Sopot, Wejherowo, Zukowo. More than **1.25 million citizens** living on the area of 3,719 km2 inhabit the entire agglomeration.

Figure 8: Gdańsk's map

Table 5: Demographic and socioeconomic data of Gdańsk

Demographic and socio-economic data	
Area (km2)	261.96
Population	463,754
Density (inhabitants/km2)	1,770
Average GDP per capita (€)	15,900
Rate of unemployment (%)	2.9

4.1 Gdańsk before Ruggedised

In 2004 Gdańsk City Council adopted "Development Strategy 2015" (resolution no. XXXIII/1011/04). The aim of the prepared strategy was to determine the directions of changes in the city, meeting the expectations of residents. The provisions of the strategy were to serve the conscious and competent control of the processes taking place in Gdańsk with the optimal use of its assets and resources. The main directions of the City's development were recognized in the document: improvement of the quality of life of inhabitants, development of civil society, economic development, including the development of maritime economy and logistics, strengthening the role of Gdańsk as a cultural center and integration of the Gdańsk Metropolis.
Updated Operational Programs (aligned with 2015 strategy) covered five thematic areas:

- **Time for Gdańsk** (economic development of the city through culture, sport and tourism, Gdańsk-led investment activities),

- **Gdańsk - My City** (program emphasizing coherent identification, both for social and civil movement, education, health, social activity and social integration),
- **Gdańsk - I Live Here** (measures to improve the living conditions of Gdańsk residents, including the use of communal property, free access to high-quality communal services, living in a healthy environment while maintaining protection and security for residents),
- **Mobile Gdańsk** (activities leading to the construction of a new mobility services in urban area, creating a high quality public space in Gdansk and a sustainable, effective and secure public transport system),
- **Innovative Gdańsk** (activities related to increasing cohesion and social opportunities through innovation, policy of creating a knowledge-based economy and a knowledge society, setting directions creation of an innovative information infrastructure, or networks of cooperation between the economic sphere and the research and development sphere).

One of the key results of 2015 strategy was the development of tools for better understanding processes taking place in the city. For example, Tristar ITS system helps the city to gather a lot of information on the city itself, its infrastructures and events taking place. Open data initiatives in the city hall and its units, like Public Transport Authority, make possible a better cooperation with external stakeholders and allow the transformation of the city towards a more accessible and friendly one.
Further, in the course of the execution of 2015 strategy, the city management put strong emphasis on environment protection and actions like decreasing air pollution, water retention, increasing energy efficiency of buildings. There are refund programs for changing coal heating for central or gas heating, as well as plans for thermos-modernization of city buildings, like schools. Zoning plans reserve places for development of solar and wind energy installations. Public transport, including development of tram network, is another important area of action.
Last but not least, in 2015 policy of openness was created, which made ground for open data initiatives in the city. Among others, currently data on public spending, public information, city economy and transport data are released for free use outside the city hall.
To summarize, in result of 2015 strategy, Gdańsk secured capability and resources to continue its transformation toward a smart city. As a next step, in a wide cooperation with the research community, NGOs, residents and other stakeholders, the **Gdańsk 2030+ Strategy** was created and adopted by the City Council in Resolution no. LVII/1327/14 from 25th September 2014. It was the first of its kind document in Poland developed in consultation with citizens. In order to execute strategic objectives of Gdańsk 2030+, on 17th December 2015 the City Council adopted Gdańsk Operational Programmes 2023 (resolution no. XVII/514/15).
For Gdańsk and the whole metropolis, developing a smart city concept is an opportunity to improve the functioning of the whole area by way of effective, economic and ecological management. This will be reflected in the efficiency of, amongst others, public services, mobility, energy and dialogue with the inhabitants. This assumption fits into the sustainable development policy of the European Union, and is a chance to change the city's face as one which is friendlier to its users.
Key challenges identified for Gdansk to be addressed in Ruggedised project cover improving innovation and organizational capacity through:

- orchestration of scattered innovation activities and projects, including innovations in the field of ICT, transport, energy, and built environment;
- establishing platform for internal cooperation and synchronization of actions within the city hall and municipal companies;
- sourcing innovative solutions, technologies and expert knowledge from research organizations and industry both domestic and foreign;
- preparation of long-term urban innovation agenda, which will set out clear innovation roadmap for future research and innovation activities.

4.2 Gdańsk smart cities context

- **Open Gdańsk**
  In 2015 Gdansk adopted "Manifesto of Openness", an internal policy to commit to the use of new technologies to promote transparent and accountable exercises of public functions, inspire and involve citizens in the affairs of the city and support the construction of civil society, and to stimulate entrepreneurship and create conditions for the development of new business initiatives. In result of the project, Gdansk consequently shares the data

collected by the city for the citizens and use new technologies to support transparency of governance. The policy accounts for gradual release of new public data sets, published in the open and structured formats allowing their reprocessing.

- **Tristar**
  Tristar is an Intelligent Transportation System installed in entire Tricity agglomeration, i.e. in Gdansk, Gdynia and Sopot. The overall budget of the project is 40 million EUR. The project goal is to deploy a system of traffic management and control based on the signalling infrastructure and ICT technologies. Within Tristar System several subsystems were deployed: functional subsystems in traffic control with priorities for public transport vehicles and detect incidents, traffic measurements, video surveillance, meteorological surveillance, signs and variable message signs, parking information, information for drivers, security management (red light crossing monitoring, speeding registration, identification of vehicles), public transport management (dynamic passenger information, cooperation with the traffic control system), traffic planning. Tristar covers more than 150 intersections in Gdansk, Gdynia and Sopot.

- **GdańskLAB**
  In 2015 Gdansk City Hall launched an internal initiative to integrate the existing silo architecture and facilitate information exchange and knowledge generation processes. GdanskLAB is supposed to analyze and improve internal processes, catalyze the change in the organization, share know-how, keep pace with the digital world, engage the staff and encourage cross-department cooperation and knowledge generation.

- **SUMP**
  SUMP (Sustainable Urban Mobility Plan) is a comprehensive document of strategic importance, developed and implemented by the city authorities and entities involved in the implementation of transport policy. It is a tool facilitating planning, taking into account the broader context of the city's functioning and the long-term perspective. One of the basic features that distinguishes sustainable urban mobility plans is the large scope of social participation, much wider than the traditionally perceived social consultations. This means the necessity to identify the most important stakeholders on the supply and demand side of the transport market and to involve them in the process of preparing the plan from the very beginning. Main goal of SUMP in Gdańsk is improving access of residents to high-quality sustainable mobility. It includes participation of residents in planning and managing transportation issues in Gdańsk. The is related to Tristar ITS and urban open-data (Open Gdansk) initiatives.

- **Low Emission Economy Plan (LEEP)**
  Low-emission economy plan for the Gdańsk-Gdynia-Sopot Metropolitan Area involves 31 municipalities of GOM and is supposed to contribute to achieving the goals set in the EU climate and energy package until 2020 through reduction of greenhouse gas emissions, increasing the share of energy from renewable sources, reduction of final energy consumption. The latter is to be achieved by increasing energy efficiency. LEEP shall improve air quality in areas where exceedances or concentration levels of substances in the air were observed. Main actions include further development of central heating network, thermo-modernization of municipal buildings, improving efficiency of city lighting, and development of low emission public transport.

- **Strategy Gdańsk 2030+**
  Strategy Gdańsk 2030+ is a key strategic document setting out priorities of Gdańsk development by 2030. In order to meet the needs of residents, both current and future, the document outlines directions that will strengthen Gdansk's social, economic and cultural potential. It is expected to provide the basis for shaping of processes taking place in the city and strengthens the development impulses of the Gdańsk metropolis and the whole Pomerania region. Priorities are organized in four pillars: education and social activity, innovative economy and transport, friendly urban space, culture and identity, health and sport. In particular, the strategy is focused on energy efficiency and decreasing emissions, improvement of public mobility services, etc

- **Operational Program**

The Operational Programs are used to implement the Gdańsk Development Strategy 2030+. They present tasks and activities leading to the implementation of the adopted objectives, indicate potential sources of their financing and ways to assess the achieved effects. While the Strategy sets directions for long-term development, the Operational Programs focus on a closer time horizon – by 2023. This is due to the programming period of the European Union funds 2014-2020 and the process and date of accounting for projects co-financed from EU funds. There are 9 areas covered by the operational plans: education, public health and sport, social integration and civic activity, culture and free time, innovation and entrepreneurship, Investment attractiveness, infrastructure, mobility and transport, and public space.

Table 6: Gdańsk Smart City Context

Name	Type	Year	Administrative level	Reference sector	Set targets	Budget and funding/financing scheme
Open Gdańsk	Project	2015	Local	ICT	Opening city data-sets to the public in accordance with standards and open-data principles	Funded from city budget, ~10-15K eur/year
Tristar	Project	2008	Regional	ICT, Mobility	Optimization of urban traffic, opening of mobility data-sets, improving public transportation management	City + EU funding, 40M EUR
GdańskLAB	Project	2015	Local	ICT, Mobility	Platform to exchange information and generate innovations in a cross-departmental process	Funded by city budget
SUMP	Plan	2017	Local	Mobility	Improving access to sustainable urban mobility	Funded by city budget and EU funding
Low Emission Economy Plan (LEEP)	Plan	2015	Local	Energy	Achieving targets set out by the EU 2020 climate policy	Funded by city budget
Strategy Gdańsk 2030+	Strategy	2015	Local	Energy, Mobility, ICT	Strategic priorities for 2030	Funded by city budget
Operational Programs	Strategy implementation	2015	Local	Energy, Mobility, ICT	Define operational measures to implement 2030+ strategy	Funded by city budget

4.3 Building a City Vision

As said, **Gdańsk 2030+ Strategy** was elaborated in cooperation with the research community, NGOs, citizens and all key stakeholders that were involved in the process.
Within the Foresight process undertaken in the Ruggedised project, an update of this strategy and an extension beyond 2030 will be done.

Details on the vision framework adopted by Gdansk are reported in the table below. It must be noted that it is still an ongoing process and many information are not yet available. An updated version will be provided within the Intermediate Replication Assessment.

Table 7: Gdańsk Vision Framework

RUGGEDISED VISION FRAMEWORK	
Background	The background document on which the new vision, developed within Ruggedised, will be based on is the **Gdańsk 2030+ Strategy**
Vision Name and objectives	**Urban Innovation Agenda** As an outcome of foresight and strategic planning process, UIA will outline a roadmap of Research & Development & Innovation activities that are required by the city of Gdansk to meet mid-term and long-term objectives set out in Gdansk development strategy and beyond. UIA is supposed to inform stakeholders (research and industry) about R&D&I priorities and coordinate R&D&I activities across departments and internal innovation projects.
Policy Goals	Not available at this stage
Consideration of EU and global goals	Planned, not aligned yet.
Focus areas of the Vision	ICT, mobility, energy
Why and how these areas were selected	These are the domains covered by Ruggedised project, however experts and stakeholders from other domains are also invited to the foresight process. Insights from other domains will be integrated in Ruggedised approach and/or forwarded to other working groups and departments at the city hall.
Temporal scale of the Vision	The already adopted Strategy **(Gdańsk 2030+ Strategy)** covers the development of the city up to 2030. Ruggedised results will be used to update and extend existing strategic approach up to **2050**.
Spatial Scale of the Vision	The Vision is applied to the city of Gdansk and it is not extended to the neighbourhood or regional level.
RUGGEDISED VISION PROCESS	
Summary of the process (steps and timing)	Vision and strategy development process are in line with the methodology proposed in Ruggedised: scenario development, visioning, road mapping and preparation of operational programmes (Replication and Investment Plan)
Promoter and key partners	The initiative was undertaken by the Smart City Governance Group. The operational work was carried out by the Core Team (see the following paragraph). The stakeholders involved are from academia, research, industry, business, municipal companies, public administration, and NGOs
Method	**Combination of Explorative and Normative** ▪ STEER (STEEP) analysis – horizon scanning activity, determining factors relevant for urban development, ▪ expert panels – involvement of experts (research, NGO, government) to jointly generate knowledge and recommendations, ▪ relevance trees – decomposition of high-level objective into several possible action-maps leading to set out result, ▪ patent analysis – IPR state of the art screening to identify trending technologies relevant for R&D&I activities, ▪ Delphi – communication and heuristics technique to generate knowledge based on individually working experts,

	▪ Roadmappig – setting out priorities for mid-term development.
Tools	Various methods were used to get relevant outputs, namely: - Literature review; - SWOT analysis - Surveys/questionnaires - Experts/citizens workshops - Interviews
RUGGEDISED VISION INITIAL ASSESSMENT	
Main barriers encountered in setting the Vision process	Coordination of investment process across departments and municipal companies
Main opportunities	• high awareness regarding metropolitan level challenges – actors representing local governments in the metropolitan area begin to cooperate in order to address local issues in larger perspective (e.g. Gdansk-Gdynia-Sopot Metropolitan Area association or Integrated Territorial Investment Funds) • strong involvement of stakeholders
Skills to be enhanced within the city departments	• know how in technological issues • organization of procurement process

4.4 Gdańsk Smart City Governance

Gdańsk Smart City Governance Structure consists of four entities:

- **Core Team** – responsible for operational activities, including Ruggedised project;
- **Stakeholders' Group** – representatives of city departments, municipal companies, local and regional industry and business, academic and research organizations, and NGOs; the group is responsible for the generation of knowledge and inputs to road-mapping and operational programming process
- **Experts' Group** – municipal department heads and academic experts responsible for review and analysis of stakeholders' input as well as for elaboration of operational programmes;
- **Decision Group** – comprising of the vice-president and high ranking public administration officers, as well as city council representatives, responsible for approval and adoption of strategic documents and operational plans

The results of the First Foresight Forum (November 2017) in Gdańsk (STEER factors and preliminary vision) is currently being analysed and reviewed by the Experts' Group. In May 2018 results of the analysis should be delivered to Decision Group for approval.

4.5 Replication Area

The projects included in the replication plan will be implemented in **Gdańsk Śródmieście ("Downtown")** district which is the traditional area of Gdańsk, where the old town is located.
The quarter covers 5.65 km^2 and is populated by 29,630 inhabitants with a population density of approximately 5,244 persons per square kilometre.

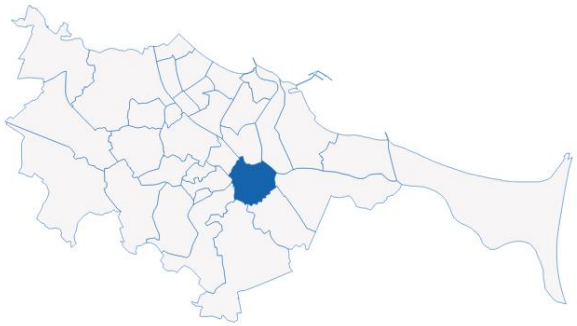


Figure 9: Gdańsk Śródmieście and other city districts

Figure 10: Location of Gdańsk Śródmieście district

4.6 Lighthouse solutions to be replicated in Gdańsk

Gdansk has already identified the set of smart solutions to be replicated in **Gdańsk Śródmieście**. The whole list is reported in the table below:

Table 8: Gdansk Smart Solutions to be replicated

Gdansk Smart Solutions	LHs Smart Solutions
GDA1: RES-ready urban energy management system	R8: Energy Management System
GDA2: Advanced energy management and integration system for public school building	U: Geothermal heating/cooling storage and exchange
GDA3: Refurbishment, modernization, and ICT for buildings in Lastadia street	R1: Geothermal heat/cold storage and heat pumps
GDA4: Innovations in water utilities: generic solution for waste-heat recovery; system for energy-optimization of water infrastructure	G1: Heat and cold exchange. Connection of buildings to a district heating network
	R2: Thermal energy from waste streams
	R4: Thermal energy out of asphaltic pavement
GDA5: EV recharging points	R6: Smart Charging Parking Lot
	G5: EV Charging hub in city centre car park
	U6 E-charging Hub & charging infrastructure
GDA6: Geographic Information System for heat, electricity, and water network	R9: 3-D City operations model
GDA7: Open-data standards for energy consumption monitoring in public buildings	U8: Smart Open Data City Decision Platform (U8)
	G7: Smart open data Decision Platform/central management system

In the following tables (Table 9; Table 16) details on the Smart Solutions above indicated are provided. Not all the information is available at this stage.

Table 9: Business model canvas for the Smart solutions included in the Replication Plan - Gdańsk

Smart Solution	Key Partnership	Key Activities	Key Resources	Value Proposition	User Relationships	Key End Users
GDA1: RES-ready urban energy management system	SMEs (ICT sector), PICTEC	Deployment of RES-ready solution that enables (a) energy consumption monitoring and profiling; (b) cost control; (c) controlling of RES energy production and its effectiveness, (d) integration of CPSs (cyber-physical systems), telemetry, and telematics. System provides monitoring features with regard to RES-energy production and storage.	expertise on IoT architectures, smart technologies offered by local industry	CO2 reduction, reduced energy costs	promotion of RES, offering interfaces for energy-data exchange with other parties	citizens of Gdańsk, city authorities and city departments, ICT sector (application/system developers)
GDA2: Advanced energy management and integration system for public school building	EDF, GPEC, Schneider-Electric, SMEs	*Stage 1* - Refurbishment and thermo-modernization of a public school building. *Stage 2* - implementation of BEMS (building	EDF and Schneider-Electric solutions	CO2 reduction, reduced energy costs	demonstration of RES-focused technology to increase the uptake of similar solutions in public buildings	public education system, citizens, pupils, teaching staff

		energy management system), employment of RES, energy-storage, electricity-grid integration, ICT platform to integrate CPSs in energy domain. Project will involve SME sector focused on the integration of RES with building-heating systems, smart HVAC solutions adjusted to building exploitation profiles, including air-ionization technologies.				
GDA3: Refurbishment, modernization, and ICT for buildings in Lastadia street	GPEC, GDMEL	*Stage 1* - Refurbishment and construction works in Lastadia street buildings including connection with urban heating network and installation of energy-efficient	GPEC heating technology, GDMEL expertise	CO2 reduction, reduced energy costs	demonstration of state-of-the-art solution in smart building domain, promotion of RES for wider uptake of proposed technological solutions	citizens (Downtown inhabitants), industry, public administration

		elevators with energy-recovery mechanisms. *Stage 2* - Deployment of smart building technologies, including energy management system and building automation; advanced integration with RES, energy-storage and energy-grid integration.				
GDA4: (A) generic solution for waste-heat recovery (B) system for energy-optimization of water infrastructure	GIWK	TBD	TBD	TBD	TBD	TBD
GDA5: EV recharging points	Energa	Deployment of 10 FEV recharging points in Gdańsk Downtown area. The project includes ICT integration and	low-cost charging devices available on the market	CO2 reduction	raising proactive attitude of citizens towards low-carbon economy; education of citizens regarding of e-scooters and e-	citizens (FEV users), public administration

		tools for the management of EV recharging points as well as employment of Renewable Energy Sources and complementary energy-storage solutions. One of the objectives is to offer public electric scooters and bicycles that will be charged with the use of EV charging stations.			bikes; wider uptake of EV mobility	
GDA6: Geographic Information System for heat, electricity, and water network	Energa, GPEC, GIWK, SMEs (ICT sector)	Implementation of digital maps and GIS technology for heat, electricity, and water networks together with decision-support and planning tools. It is planned that the energy-related geospatial information will be provided to Gdańsk open-data platform.	ICT department staff, already existing urban GIS datasets	access to geospatial information for business, citizens, administration; decision and planning support	training programmes and organizational changes to use GIS for evidence-based decision making in city departments	citizens, municipal departments, municipal companies, business
GDA7: Open-data standards for	SMEs (ICT sector), research	Exposure of public energy-related data-	ICT department staff, expertise of	access to wide range of public	communication activities to reach	citizens, public administration, ICT

energy consumption monitoring in public buildings	and technology organizations	sets with the use of ACCUS platform as a gateway to integrate energy systems and provide data to CKAN open-data platform.	PICTEC, ACCUS platform, CKAN portal	data for monitoring; growth of smart city services	stakeholders: citizens and businesses that will exploit the data	sector

Table 10: Investment plan - Gdańsk

Smart Solution	Estimated Cost	Funding Source and Scheme	Funding Timeline	Link with other existing initiatives
GDA1: RES-ready urban energy management system	TBD	Gdańsk is considering two options: (A) system will be purchased in PPP model; (B) project will be funded by Gdańsk municipal funds, EU funds	TBD	
GDA2: Advanced energy management and integration system for public school building	0.8 million EUR	Interreg Baltic Sea Region 2014-2020 (PV), public-private partnership (EDF, Schneider-Electric), Integrated Territorial Investments (ZIT = 60%), own investment (Gdańsk)	up to 2021 (refurbishment); beyond 2021 (ICT, integration, RES)	
GDA3: Refurbishment, modernization, and ICT for buildings in Lastadia street	10 million EUR	Integrated Territorial Investments (ZIT) and Gdańsk Drainage (GDMEL)	up to 2020 (refurbishment and construction); beyond 2021 (ICT, integration, RES)	
GDA4: **(A) generic solution for waste-heat recovery** **(B) system for energy-optimization of water infrastructure**	TBD	Gdańsk Water and Sewers Infrastructure (GIWK), TBD	TBD	
GDA5: FEV recharging points	TBD	municipal companies, EU-funds, Gdańsk municipality	2020+	
GDA6: Geographic Information	4–5 million	municipal companies, EU-funds, Gdańsk municipality	2020+	

System for heat, electricity, and water network	EUR			
GDA7: Open data standards for energy consumption monitoring in public buildings	TBD	municipal companies, EU-funds, Gdańsk municipality	2020+	

Table 11: Replication Roadmap - Gdańsk

Smart Solution	Design	Procurement	Deployment	Other Phases
GDA1: RES-ready urban energy management system	2019-2020	2020-2021	2022+	N/A
GDA2: Advanced energy management and integration system for public school building	2018 (refurbishment and construction works); 2020 (ICT-RES innovations)	2019 (refurbishment and construction works); 2021 (ICT-RES innovations)	2020 (refurbishment and construction works); 2022+ (ICT-RES innovations)	N/A
GDA3: Refurbishment, modernization, and ICT for buildings in Lastadia street	2016 (refurbishment and construction works); 2020 (ICT-RES innovations)	2017 (refurbishment and construction works); 2021 (ICT-RES innovations)	2018-2019 (refurbishment and construction works); 2022+ (ICT-RES innovations)	N/A
GDA4: **(A) generic solution for waste-heat recovery** **(B) system for energy-optimization of water infrastructure**	2020	2021	2022+	N/A
GDA5: FEV recharging points	2020	2021	2022+	N/A
GDA6: Geographic Information System for heat, electricity, and water network	2020	2021	2022+	N/A
GDA7: Open data standards for energy consumption monitoring in public buildings	2020	2021	2022+	N/A

4.7 Other relevant smart solutions, not included in the Replication Plan - Gdańsk

Table 12: Other relevant smart solutions in Gdansk

Sector	Activity	Description
ICT	ACCUS platform	1. Participation in the FP7/ARTEMIS research and development project in order to provide end-user requirements for ACCUS smart city operating system. 2. Involvement in subsequent R&D project to mature existing technology. 3. Deployment of ACCUS ICP platform to integrate urban systems (ACCUS platform is dedicated as integration and coordination middleware for distributed and evolving cyber-physical systems and IoT solutions).
ICT	Open data standards	1. Development of CKAN platform as a place to gather and publish city data. 2. Access to open data for citizens and businesses to stimulate growth of bottom-up city smart services and ICT tools. 3. Every city spending published daily on a website. 4. All requests for public information and replies published on website. 5. New standards for public procurements – new IT solutions for the city should fulfil openness standards.
ICT	Cooperation with hacktivists	1. Support for the Code of Poland initiative – encouraging the use of city open data to create applications for improving quality of life in the city. 2. Applications for monitoring traffic, real-time bus timetables were created, other are currently under development.
ICT	City application for better use of city resources	1. Gdańsk has already created two applications. Bank of trees – residents can pinpoint on a Google map where new trees should be planted. Wyrzuc.to (ThrowIt Away) – real time data on garbage collection. 2. New applications, improvements for it are under development, like an online survey to show where new benches should be placed.
Mobility	System of cycle routes (STeR)	1. Document which went through an extended process of public consultations (640 amendments were proposed). 2. Development of bike routes, bicycle parkings and better intra-district conections. Traffic-calmed zones and legal obligation for building bicycle parkings at each new investment.
Mobility	The Bike Audit	1. Based on the BYPAD methodology. 2. First such a document in Poland and a background for Gdańsk's action since 2010.
Mobility	Tristar	1. Tristar is an Intelligent Transportation System installed in entire Tricity agglomeration, i.e. in Gdańsk, Gdynia and Sopot. 2. Project was a part of *Gdańsk 2015 Development Strategy*. 3. Tristar project implements the Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport.

4.8 Integration and Long-Term Sustainability of the Smart Solutions

The programming period in Gdańsk ends in 2023. Beyond that date new operational programmes will be defined in order to implement the general strategy of the city by 2030 (*Gdańsk 2030 Plus Development Strategy*). To that end Gdańsk will involve "smart city governance group" in the work on the operational programmes to in order to guarantee that the policy of Gdańsk with regard to ICT-mobility-energy policy will not be altered and will be continuously implemented beyond 2023.

5. Initial Replication Assessment in Parma

Parma is located in the Emilia-Romagna region, halfway between Milan and Bologna. Because of its continental climate, seasons are moderate; the average temperature in January is 0.9°C and in August 24°C.
It is a vital town rich in history, art and culture, and it is the seat of the oldest Italian university. The academic research teams excel in various fields, including food, agriculture, biotechnologies, innovative medications, experimental medicine, law, economics and arts. Amongst its most important discoveries there is the "mirror neurons" by the Department of Neuroscience. Moreover, research and Innovation in the Intelligent Transport Systems led to the development of the first intelligent autonomous vehicles.
Parma is the capital of the so-called "Food Valley": the city specializes in the food sector and the local food industry consists of handicraft firms, small enterprises and big industries. Since 2004 Parma has been home to the European Food Safety Authority (EFSA). It is the EU's leading authority for risk assessment regarding food and food safety.
In addition to this, in 2016, Parma has been designated as UNESCO Creative City of Gastronomy and , more recently, in 2018, Parma has been designated as 2020 Italian capital city of Culture.

Figure 11: Emilia Romagna Region and Parma's map

Table 13: Demographic and socioeconomic data of Parma

Demographic and socio-economic data	
Area (km2)	260,8
Population	194.884
Density (inhabitants/km2)	747,83
Average GDP per capita (€)	28.336
Rate of unemployment (%)	7,5

5.1 Parma before RUGGEDISED

Before the start of Ruggedised, the goals of Parma's city government were already in line with the Smart City concept, namely: to make the city more attractive, more sustainable, more inclusive and more balanced for the citizens who live, work and visit the town.
Indeed, the key words chosen by the local administration were (and are):

- SHARE experiences, information, and projects, as well as responsibility among citizens, stakeholders and other institutions for the decisions that will affect the life of Parma's citizens in the coming years;
- strengthen the IDENTITY of Parma as a capital city for good food, culture and music; make the city more attractive for its citizens, tourists, and businesses;
- focus on VALUES in terms of ethics, social responsibility and quality of services for people and companies.

Making Parma a stronger and more united community was already on the top of the list. Therefore, the involvement of businesses, multi-utility companies, and public transport stakeholders was considered essential to achieve these goals.
Hence, already since the end of 2013 the City of Parma set up an inter-sectorial working group from four areas (energy, urban planning, mobility, ICT), working on integrating urban policies with the aim of making Parma a smart city.

The process has become stronger after the approval of the RUGGEDISED project: in the new city governance structure there's a common horizontal goal called "Future city area – Smart City".

5.2 Parma smart cities context

In a report called **Smart City Index**, developed by Ernst and Young, 116 major Italian cities have been analysed using more than 470 indicators. The goal is to measure the level of smartness of Italian cities. The survey assesses the cities' capacity of promoting the development of smart networks and infrastructures, measuring their ability to innovate and offer quality services to their citizens. In the report published in 2016, Parma ranked fifth among all Italian cities.
In the following sections, the most relevant projects, plans and strategy developed in Parma are listed and shortly described. Details are reported in Table 14.

- **SEAP**

The SEAP of Parma was presented in 2014. In 2015 it was ranked the best Italian SEAP (A+COM, Italian Climate Alliance). The main goal is to reduce CO_2 emissions of about 21%. In 2017 a first monitoring survey was carried out: it showed that the 99% of the actions has started.

- **SUMP**

The SUMP of Parma was approved in 2016. The main goals are to:

- reduce private car use and allow people to move in a more efficient, sustainable and safe way.
- re-design the public transport network in order to cope with actual user expectations in terms of efficiency, quality and fast access to information.
- develop inter-modality and interconnection with different urban transfer systems (bike and car sharing, electric mobility, carpooling).
- improve environmental quality by reducing noise and air pollution and by recovering urban spaces.
- reduce transport costs, energy consumption and waste of resources.

The Municipality of Parma is member of CIVITAS and a former Deputy Mayor was also a member of the Political Advisory Committee (PAC).
Every year Parma organizes the European Mobility Week in the city.

- **SECAP**

Starting from SEAP and SUMP the Municipality will sign the Sustainable Energy and Climate Action Plan soon. The main goals are:

- MITIGATION: decarbonisation process;
- ADAPTATION to climate changes;
- SECURE AND SUSTAINABLE ENERGY: Increase energy efficiency and energy from RES.

- **SIMPLA**

SIMPLA projects supports local authorities in harmonising their SEAPs and SUMPs. The project targets small and medium-sized municipalities with a population between 50.000 and 350.000 inhabitants proposing a four-step approach to foster harmonised planning.
Parma, with all the other cities involved, will develop harmonised SEAPs and SUMPs making them greener and smarter. Joint planning maximises synergies, triggers considerable environmental benefits and paves the way to decongestion, increased energy efficiency and better quality of life for citizens.

- **INFINITE SOLUTIONS**

Infinite Solutions is a EU project funded by the IEE program. Within this project it has been developed a soft loan financing scheme and set up an agreement with a local Private Bank, Cariparma – Credit Agricole: the main objective

of the Municipality of Parma was to create a funding instrument that allows providing low-interest loans to private housing owners (unsecured loan), in order to increase energy efficiency and the use of green energies.

- **EFFICITY**

EFFICITY is a project co-financed by the Emilia Romagna region. The main goal is to develop a platform to optimize management and design of energy grids for urban districts and public and/or commercial buildings. This is made in order to predict energy profiles, optimize management and control of energy plants and networks, and to optimize the design or to improve existing plants and networks.

- **DIGITAL AGENDA**

Emilia-Romagna's Digital Agenda (ADER) is the main program for the Emilia-Romagna Region and the local authorities to promote the territorial development of the information society: it sets the ambitious goal of reaching a 100% digital Emilia-Romagna in 2025. The Agenda translates the rights of digital citizenship into concrete action axes: infrastructures, data and services, skills and communities, indicating priorities for intervention for each axis.

- **FREIGHT TAILS**

The Freight Tails Action Planning Network, part of the URBACT programme, aims to address the challenges posed by rapidly increasing freight movements, within the context of all urban logistics. This project will develop tailored freight management policies using the URBACT Integrated Action Planning methodology to pro-actively support the functioning of different growing cities, whilst reducing the carbon emissions associated with urban freight transport, and stimulating the low carbon urban freight sector.

- **AWAIR**

AWAIR is the acronym of EnvironmentAl integrated, multilevel knoWledge and approaches to counteract critical AIR pollution events, improving vulnerable citizens quality of life in Central Europe Functional Urban Areas. The project is funded by the INTERREG program and aims at improving the environmental management capacity in central Europe through the promotion and adoption of agreed measures and strategies. It will define a common transnational protocol for mitigation and the management of adaptation actions in functional urban areas. Specific monitoring of the effectiveness of actions at each functional urban area are also foreseen. AWAIR also aims at promoting innovative preventive approaches by introducing new indicators (e.g. ultrafine particles, black carbon) and including air quality forecasting systems.

- **ZERO WASTE STRATEGY**

Parma has a *zero-waste strategy***:** in 2016 Parma ranked the second place for recycling, among Italian cities with more than 100.000 people, with a share of 73%. At the end of 2017 the share increased to 77%. Moreover, Parma has a district heating network served by energy produced from waste: 800 buildings are connected to this district heating network.

- **SIMON**

SIMON is a demonstration oriented project funded by the European Commission. The project, ended in 2017, involved four large scale pilots in Madrid, Lisbon, Parma and Reading and focussed on the promotion of the independent living and societal participation of mobility impaired people in the context of public parking areas and multiple transport modes, through the adoption of specific navigation information and access-rights management solutions.
SIMON proposed a mobile application to support impaired citizens in the use of public and private transport modes. This application not only included specific information and navigation functionalities, but also made use of e-id mechanisms to propose coordinated tariff policies and reduce fraud.

Table 14: Parma Smart City Context

Name	Type	Year	Administrative level	Reference sector	Set targets	Budget and funding/financing scheme
SEAP	Plan	2014	local	Energy Mobility	-21,6% CO_2 reduction	Public fund Private financing
SUMP	Plan	2017-2030	local	Mobility	e.g. • +208% bike sharing • +136% cycling path • +1264% e-charging points • etc	Public fund Municipal fund
SECAP	Plan	2018 2030	local	Energy Mobility Climate change	• - 40% GHG emissions; • 27% of the energy needs RES; +27% energy efficiency;	Public fund Private financing
SIMPLA	Plan	2017 - 2019	national	Energy Mobility	Harmonize SEAP and SUMP	EU funds
INFINITE SOLUTIONS	IEE Project	2014-2017	EU	Energy	Soft loan scheme for house energy refurbishment	138.298 € (103.724 € co-financed by EU)
EFFICITY	ERDF	2017 - 2019	regional	Energy	Efficient energy systems for smart urban district	27.000 € (co-financed 18.900 €)
DIGITAL AGENDA	Plan	2015-2019	Regional	ICT	territorial development of the information society	Regional funds
FREIGHT TAILS	EU Project		EU	Mobility	Freight management policies in urban areas	66.418 € (56.455 € co-financed by EU)
AWAIR	EU Project	2017	EU	Environment	Improve air quality in urban areas	EU funds (266.934 €)
Zero waste	Plan		local	Environment	Improve recycling system and share	
SIMON	EU Project	2014 -2016	EU	Mobility	asSIsted MobIlity for Older aNd impaired users	263.975,00 €

5.3 Building a City Vision

RUGGEDISED VISION FRAMEWORK	
Background	The numerous sustainable and smart initiatives, actions and projects undertaken by Parma in the last years (listed in the previous paragraph) constitute the background for drafting the new vision to be developed thanks to Ruggedised activities.
Vision Name and objectives	**PARMA FUTURO SMART**

	Imagining the future is the first step to achieve it and Parma Futuro Smart is the construction of a vision, a smart city idea. It is a political strategy tool of the Municipality of Parma to support decisions by governments and companies in an appropriate time to understand and respond to changes. Imagining the future allows to: - highlight the relationships and consequences of political choices in the medium-long term from 15 to 35 years - Include the weakest and least represented interests in the political debate - Increase cooperation and policy coherence (sectors, departments) - Identify political choices and options; - Understand opportunities and mitigate risks
Policy Goals	The overarching objectives identified by Parma Futuro Smart are: - Improve quality of citizens life - Reduce air pollution - Increase production and use of renewable energies - Improve a sustainable mobility system - Create synergies between all urban actors (city administration, universities, schools, industries, social services) to imagine and implement smart initiatives The process will take into account the objectives and targets established within the SUMP and SEAP of Parma
Consideration of EU and global goals	In the development of the vision, Parma is taking into account both the Sustainable Development Goals (SDGs) as well as the objectives of the Covenant of Mayors
Focus areas of the Vision	- Energy and environment, Grid and Infrastructure - Mobility and transport - People and society - Economy and innovation
Why and how these areas were selected	This selection was done considering the smart areas identified by the UN (SDGs), the European Commission and ANCI (National association of Italian municipalities).
Temporal scale of the Vision	The time horizon of Parma vision is set to 2030 in order to be aligned with other City's strategies and plans.
Spatial Scale of the Vision	The Vision is applied to the city of Parma and it is not extended to the neighbourhood or regional level.
RUGGEDISED VISION PROCESS	
Summary of the process (steps and timing)	The vision and strategy development process are in line with the methodology proposed in Ruggedised. The specific work phases will foresee the participation of several local actors/stakeholders and include: - Proposals for Ideas for Parma Smart City- kick off Forum: *The Kick Off forum in Parma took place 30th November 2017, when the City launched the participatory process called Parma Futuro Smart.* - Elaboration of thematic scenarios (*held in April 2018- results under development*) - Definition of a shared view on 4 Smart themes - Action Plan and Smart Investments - Experimentation of Smart pilot projects in various parts of the city of Parma with various integrated solutions
Promoter and key partners	Thanks to the help of facilitators and the Ruggedised Core Team, the City started the process. The stakeholders involved in the process at City level cover all the key sectors and interests in the city:

	- Academy/research: energy, environment, food and drugs, machine vision algorithms, mobility - Business sector: automotive, buildings, cosmetics, food, health care, IT, public lighting, public transport, e-commerce solutions - Co-working lab - Municipal Subsidiary companies: Energy, Mobility - Municipal employees: city planning, energy, EU office, environment, IT, management, mobility, public works, - Press - Start up: diagnostics, fashion industry, mobility, Unmanned Vehicle Systems (pilotless aircraft), 3D print - Students from a secondary school - Utility: Energy, Environment, Waste, ICT During the kick-off workshop, 6 key smart initiatives were presented by five important company in the industry, academic and mobility sector: Barilla, Dallara, Docomo Digital smart services, Davines, Lepida, Vislab. During the "Vision workshop" 8 ambassadors (2 for each thematic areas) opened the discussion by presenting trends and insights in the different thematic areas.
Method	**Combination of Explorative and Normative** The kick off offered the opportunity to map the different SMART initiatives currently on-going in Parma and build a network of interested participants in creating the vision of PARMA FUTURO SMART. The vision workshop started with the presentation of the most important trends that will affect the future of Parma and participants were asked to rank them by importance and uncertainty. Against this background, four working group were set to imagine two scenarios (Business as Usual and best) for each thematic field. Next steps will involve 1) creating a common vision 2) devising pathways and actions to reach it.
Tools	Various methods were used to get relevant outputs, namely: - Ideas brainstorming - Word café -kick off meeting; - Trends analysis – desk research; - Trends ranking – vision workshops; - Scenarios/stories building – vision workshops - Communication and networking – interactive web-site, 1 leaflet, 2 reports
RUGGEDISED VISION INITIAL ASSESSMENT	
Main barriers encountered in setting the Vision process	The main barriers identified is the integration of RUGGEDISED activities within the daily activities of the Municipality and the mapping and engagement of the key stakeholders.
Main opportunities	To coordinate all the ongoing activities and a new layout in city's departments with a new horizontal goal - Future city Area towards smart city issues.
Skills to be enhanced within the city departments	Technological innovation applied on daily municipal activities and a better knowledge on grids and IT infrastructure.

5.4 Parma Smart City Governance

The Municipality of Parma, assisted by ISINNOVA, coordinates the project with regular exchanges with local stakeholders working or interested in smart city topics. The aim is to find solutions to existing problems to make the city more sustainable, to develop a smart strategy and to push local businesses.

Parma aims also to achieve the following objectives:

- LA silos break down: coordinate the different departments involved;
- Integrate different strategies at municipal level;
- Coordination at city level of smart city projects (outside of the Municipality);
- RUGGEDISED project as an engine for the smart city topics at city level;
- Smart city topics to be highlighted to the public opinion;
- SEAP and SUMP goals;
- Help the city to improve the sustainability: e.g. reducing air pollution.

Parma set up the Smart City Governance by grouping the key persons to be involved in the process of becoming a Smart City. The governance' structure includes:

- Project Manager: partner of the RUGGEDISED project, creating and maintaining linkages between project and local activities
- Smart City Leaders: one more institutional and the other more operative, working both at the project at local level;
- Decision Group: made up by the Mayor, 3 Deputies, the General Director and the University (this last involved because a part of the replication area identified is the University campus)
- Core Team: Operative steering group made up of project partners (Municipality of Parma, Infomobility and ISINNOVA) as well as all other departments of the municipality and the University: Energy and Seismic Division; Sustainability policies Sector; IT Sector; Management Division (EU Office); UNIPR;
- Expert Group: a series of expert will be involved both in the local workshops and in the development of the Replication and Investment plan. This group includes: Parma Energy Agency; Mobility Manager, Logistic Expert; Smart Waste Experts; ITCity; Communication Division; Urban Planning; Civil Protection; Local Police.

5.5 Replication Area

More than one Replication area have been identified: some actions will be replicated at City level, while others in the University Campus, which is the scientific centre of the University of Parma. It covers an area of about 77 hectares located in the south of the city, with several buildings for teaching and scientific research.
The heated volume is about 300.000 m^3 and every day more than 7.000 people live, study and work there. The Campus energy consumptions are mainly due to building heating and cooling, domestic hot water, indoor and outdoor lighting. All buildings are currently served by a district heating/cooling system, which is connected to a thermal power plant (based on methane gas boilers), and by cooling machines for air conditioning.

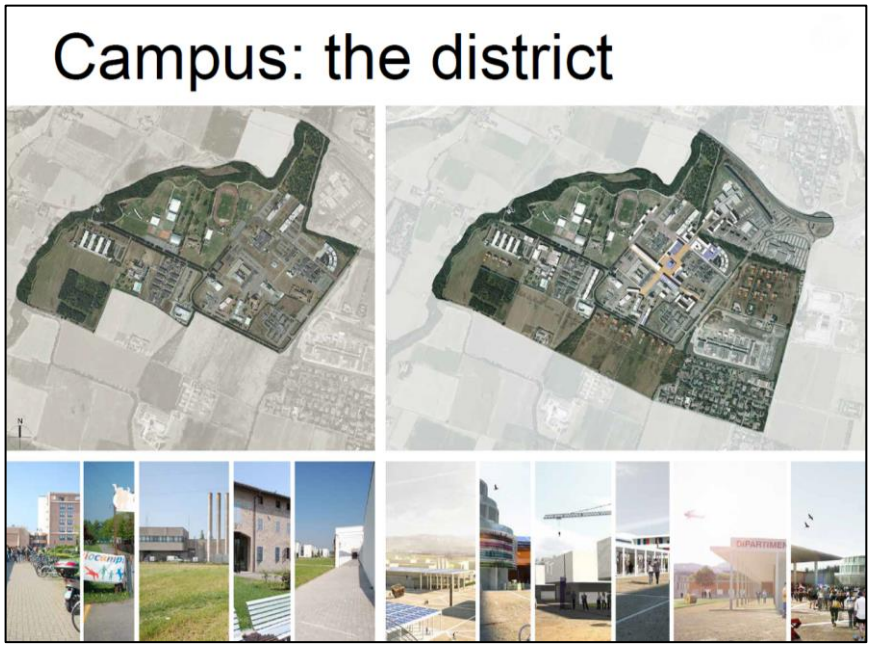


Figure 12: Parma University Campus

5.6 Lighthouse solutions to be replicated in Parma

Starting from the solutions provided by the Lighthouse cities, the City of Parma is going to implement several actions, as described below. These actions could change during the process, also considering that in Parma there were local election in 2017 and also the new Dean of the University of Parma was elected in the same year 2017.

Table 15: Parma Smart Solutions to be replicated

Gdansk Smart Solutions	LHs Smart Solutions
P1: New CHCP plant for district heating connection	G1: Heat and cold exchange. Connection of buildings to a district heating network
P2: Energy management system	R8: Energy Management System
	R13: Smart Waste Management
P3: Solar PV and supply of energy to EV charging infrastructure	G5: EV Charging hub in city centre car park
P4: Intelligent building control	U4: Intelligent building control and end user involvement
P5: Local Public Transport	R7: Optimising the E-bus fleet of RET
P6: Mobility Planning	U6: E-charging Hub & charging infrastructure
	G5: EV Charging hub in city centre car park
P7: Smart Waste Management	R13: Smart Waste Management
P8: Creation of a query based geo-spatial Data Based Decision Platform	R9: 3-D City operations model
	G7: Smart open data Decision Platform/central management system
	U8: Smart Open Data City Decision Platform
P9: Smart Open Data City Decision platform	R9: 3-D City operations model
	G7: Smart open data Decision Platform/central management system
	U8: Smart Open Data City Decision Platform
P10: Smart public lighting	G6: Intelligent LED street lights with integrated EV charging functionality, wireless communications network, and air pollution monitors
	G8: Implementation of demand-side management technology in street lighting
	R11- Efficient and intelligent street lighting

A short description of each smart solution of Parma is provided below.

- **P1: New CHCP plant for district heating connection**

New plants for distributed energy generation will be implemented in the thermal power station serving the district heating and cooling of the University Campus: in order to optimize heating loads, a thermal storage will be also implemented. In 2020 a public procurement will be adopted.

- **P2: Energy management system**

Energy demand and supply information of buildings will be provided by using smart meters and the BIM-model. These data together with the introduction of the energy management system will ensure an efficient energy-exchange between the assets. In every building of the University of Parma located at the Campus, an energy management system will be implemented, in order to measure temperature, pressure, energy flows. At the moment, the Municipality is working on the EFFICITY project, which is strictly linked to these topics.

- **P3: Solar PV and supply of energy to EV charging infrastructure**

In the University Campus a 700 kWp plant have been installed, as well as EV chargers. The idea is to evaluate the possibility of using the surplus electric energy from PV systems to serve storage batteries to EV chargers.

- **P4: Intelligent building control**

In some buildings of the University of Parma, an intelligent control system for the internal climate will be installed: a continuous monitoring system will allow the optimization of the indoor climate depending on the weather and uses, and then energy consumptions will be reduced. To incentivize users to save energy, digital real-time information, statistics on climate impact and suggestions to put the homes in “saving mode” will be showed to the end users. At the moment, the Municipality is working on the EFFICITY project, which is strictly linked to these topics.

- **P5: Local Public Transport**

The solutions involves the implementation and renewal of the management software of two services, called "Prontobus" (a bus service ‘on demand’) and the school bus service called "Happy Bus": both are operated by the local LPT company (TEP). Information about traffic and mobility will be collected in order to optimize services. Expected results are an increase of users to 60.000 (Prontobus) and 1.600 (Happy Bus).
Moreover, the local public transport company is working on a EU project called LOW-CARB, financed by the INTERREG program: the aim is to serve one specific urban bus line (number 8) with e-buses. In the last station of this line very fast e-charging points (plug in) will be installed and could be used also by cars. This last station could become a very important intermodal exchange point.
Today, the city has 5 lines served by trolleybuses: the LPT company is also working on optimizing the bus fleet, in order to implement 85 new and low emissions buses (under evaluation, but they could be 7 electric/bimodal and 78 natural gas vehicles/e-buses).

- **P6: Mobility Planning**

In order to optimize mobility aspects in Parma, several activities are foreseen. The first one is to develop a new smart control unit to manage urban traffic in order to monitor traffic flows through data from mobile companies, pilot projects with Start-ups, cameras and existing detection loops, to send information on variable message boards, to allow a real-time traffic lights diagnostic and to improve traffic control cameras and electronic access control gates in restricted areas or bus reserved lanes.
This will help to plan a sustainable mobility strategy, also towards e-mobility. An e-mobility plan is foreseen in order to realize additional hubs for e-vehicle charging suitable for car sharing, bike sharing, electric cars, electric bikes powered by RES. These e-charging hubs will be super-fast and placed at special spots, developing business cases for concentrated deployment of EV chargers, connecting the charging hubs to RES and battery storages.

- **P7: Smart Waste Management**

The Municipality has been working a lot on waste strategies in the last years: a 77% share of recycling has been achieved. Now, the City is going to work on different aspects trough different actions with the aim to further improve what is already existing.
In the last 4 years the amount of not recyclable waste produced by every user has been measured with the help of an RFID system, both on the trash bins and the trash bags, read by the antenna on the garbage truck. That lead to a correct fee for the users. Regarding the aspect of plastic bottles and tin cans, compact containers for the collection

of empty plastic bottles and empty tin cans are used also as Wi-Fi point. The collectors have been used since last year, and their number is growing at city level. The use of this machines helps to reduce the littering and the amount of total waste in the street waste bin.
In order to improve the waste management, a first action will consist of a monitoring system of the filling degree and collection vehicles'route optimization. This solution will be applied on the collection of the glass banks in the Campus and in the nearby district (80 glass banks) as a pilot phase and could be extended to the whole city (1.300 glass banks).
Moreover, in order to support the door to door waste collection system, the Municipality is going to provide some Smart Mini Eco station. These structures are equipped with nozzles for different types of waste (plastic, aluminum and tetra pak packaging) and can be electronically opened with the health card associated to the user. The goal is to make the recycling system more flexible and at the same time to provide some smart services.
All stations are equipped with surveillance systems in order to avoid improper abandonment of waste and vandalism. These systems are not only fixed collection points but structures with integrated functions that involve aspects related to culture, promotion of the territory and also safety (Figure 13).

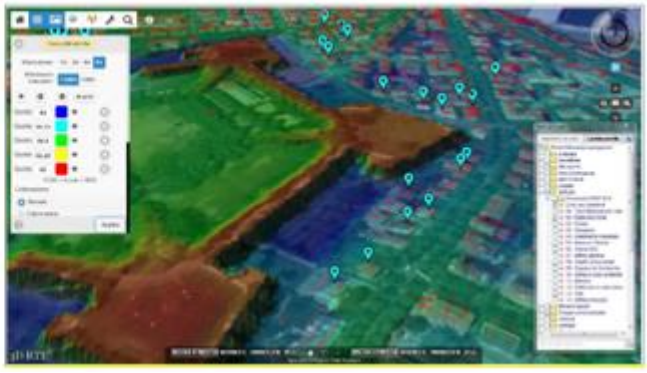
Figure 13: Smart Mini Eco Stations (rendering)

- **P8: Creation of a query based geo-spatial Data Based Decision Platform**

An integrated system of data monitoring and analysis will be assembled and configured from multiple systems: this will produce multiple analyses and "accommodate" all modelling calculations. Moreover, it will provide users with a decision support tool for environment & energy planning and control. The system will be set up so that it can be used for future developments of different types of data, and it can integrate new functional modules of the mobility-environment system of Parma.

3D RTE Parma Information Management

The Civil Protection Department of the Municipality of Parma has developed a geo-cartographic software for planning, managing emergencies and for supporting decisions during critical phases. This SW is linked to the Geographic Information System (GIS) of the Municipality, and uses a GPS system and a digital modelling. It contains different kind of data, ranging from existing infrastructures to old people served by the municipal social services.
The geo-cartographic core is the basis on which a whole series of services and functionalities can be implemented. The purpose is to share all the information already held by the Municipality, that now stand in different departments. Moreover, this will ensure the full operation in terms of better knowledge, integration and protection: this will improve the management and planning of the City and its resilience during critical events.
Also through unmanned aerial vehicle (Start up), the idea is to implement it with new data (e.g. buildings, new infrastructures, 3D ground modeling etc..) and with simulators of fire or flood propagation.



- **P9: Smart Open Data City Decision platform**

The solution will complement P8, by integrating collected data from other areas such as buildings, mobile devices and other "objects" that communicate with the territory.
The Municipality of Parma has already started creating an open data platform: the open data project is currently in a preliminary phase.
The ultimate goal is to respond to the needs of citizens, associations and local businesses, making available several kinds of information.
The Open Data project of the Municipality of Parma is part of a national strategy called Digital Agenda.
This Open Data platform could be then integrated, by creating a specific IT infrastructure dedicated to sharing a 3D RTE geo-cartographic scenario with citizens. Through a simple free software every citizen will be able to view all the territorial information the institution will open, also creating an app dedicated to that.

- **P10: Smart public lighting**

In December 2017 the refurbishment plan of the public lighting network of the city of Parma was approved.
The urban lighting redevelopment plan involves a radical modernization of the City network, replacing the old systems with new LED ones, enabling a smart management, installing new surveillance and traffic control cameras and new sensors.
Among a total of 36.613 lighting points, approximately 24 thousand new LED lighting systems will be installed and the network will be extended by 3.5 km.
The project will end in 2035, with a total investment of 29 M€ (EPC contract signed by the Municipality).
At the end of the first phase of the project, it will be possible to:

- reduce pollution by 65%, from an average annual consumption of about 21 million kWh to around 7 million (equivalent to 4,670 tons of CO_2);
- reduce energy costs for public lighting, with an annual saving on the energy bill of around 2.6 mln €;
- reduce light pollution;
- integrate new smart city systems, such as intelligent cameras in order to increase urban security and improve a sustainable mobility, new sensors to monitor the environment (e.g. hydrometric sensors for underpass structures) and enable Wi-Fi connection.

Table 16: Business model canvas for the Smart solutions included in the Replication Plan - Parma

Smart Solution	Key Partnership	Key Activities	Key Resources	Value Proposition	User Relationships	Key End Users
P1: New CHCP plant for district heating connection	University of Parma, Campus heat management company	Business model, public procurement,	Technical office, energy department	New efficient plant, CO_2 reduction	Information, formation to students and citizens	Students, all citizens
P2: Energy management system	University of Parma	Implementation of a monitoring system	Sensors, dedicated system	Knowledge, awareness, CO_2 reduction	Information, formation to students and technical office, heat management company	Technical office, Students, all citizens
P3: Solar PV and supply of energy to EV charging infrastructure	University of Parma	Implementation of a storage system, business model	E storage system	Pilot project on an e-storage system that could be replicated in other parts of the city	Knowledge, awareness	all citizens
P4: Intelligent building control	University of Parma	Implementation of a monitoring system	Sensors, dedicated system	Knowledge, awareness, CO_2 reduction	Information, formation to students and technical office, heat management company	Students, all citizens
P5: Local Public Transport	TEP, start up, private companies	Business model, LPT e-mobility plan	New buses, dedicated SW, infrastructure	Better LPT services, CO_2 reduction	Knowledge, awareness	all citizens
P6: Mobility Planning	Enel, IREN, private companies	Traffic monitor, mobility plan, e-mobility plan	dedicated SW, infrastructure	Sustainable mobility, CO_2 reduction	Knowledge, awareness	all citizens
P7: Smart Waste Management	IREN Spa, Begeo srl	RFID Tracked Bins, Collect PVC bottles and tin cans, Recycle	RFID Chip, reader, Smart interaction with user, Wi-Fi, Smart card, reader, infrared sensor	Great increase in recycling, awareness, Complete the door-to-door waste harvest	Information, formation and details, Prize for each use, Free to use, 24 hours per day, in public parking spots	all Citizens, tourists
P8: *Creation of a query based geo-*	ItCity, Pangea s.r.l – Lepida, University of Parma	Implementation of the "Scenario" Parma information	Dedicated computer infrastructure,	Better control of the territory, advanced capacity	Knowledge is awareness, a citizen who knows his	All Citizens

spatial Data Based Decision Platform		management. Improvement of the quality/resolution of data. Development of applications dedicated to the information or the alerting of the population. Sharing of data with citizens	drones and topographical tools, development of dedicated software. The sectors mainly involved are: civil protection, public works, Territorial Information System (S.I.T).	of analysis of possible problems, quicker and more efficient rescue interventions, greater sharing and participation in the management of the city, greater resilience to disasters.	territory, lives it consciously and, if needed, knows how to cope with the risks. The system foresees, in addition to the sharing from the geo-cartographic data, an important data collection section (mail and mobile of individual citizens, companies, schools, sensitive structures, etc...) to facilitate a quick and certain contact in case of danger or Important communications from the authorities.	
P9: Smart Open Data City Decision platform	Lepida Spa, ItCity Spa	Collect datasets from different internal resources, Standardize datasets, Publish dataset on Open Data Portal, Publish datasets from external resources	Data Owner in every office of the municipality	To give a web platform where to find different data to collect and to link: this will help to take more targeted decisions	Citizens can propose data or topics to be added at the portal	Every Citizen Research and educational system, Industry
P10: Smart public lighting	Gemmo Spa, City Green Light srl	Replacing old systems with LED, installing sensors	Lampposts, sensors, dedicated computer infratructure	4,670 tons of CO_2 reduction, annual savings of 2.6 mln €, new smart city systems to be implemented	Knowledge, awareness	every Citizen

Table 17: Investment plan - Parma

Smart Solution	Estimated Cost	Funding Source and Scheme	Funding Timeline (Date of funding availability)	Link with other existing initiatives
P1	1.5 M€	Public, Private, PP, ERDF	2020	
P2	150 k€	Public, Private, PP, ERDF	2019	EFFICITY
P3	1 M€	Public, Private, PP, ERDF	2019	
P4	250 k€	Public, Private, PP, ERDF	2019	EFFICITY
P5	34 M€	Public, Private, PP, ERDF	2019	LOW-CARB
P6	300 k€	Public, Private, PP, ERDF	2019	
P7	400 k€	Public	2018-2020	
P8	85 k€	Public, European founds	2019-2022	Data Warehouse Municipality of Parma
P9	65 €	Public	2021	
P10	29 M€	Municipal funds	2017-2035	New traffic control unit, data platform

Table 18: Replication Roadmap -Parma

Smart Solution	Design	Procurement	Deployment	Other Phases
P1	2019	2020		
P2	2019	2020		
P3	2020	2021		
P4	2019	2020		
P5	2019	2020		
P6	2019	2020		
P7	2018	ongoing	10 years	
P8	2019	2020		
P9	2020	2021		
P10	EPC contract	Done in 2017	The contract will end in 2035	2019 end of replacing systems

5.7 Other relevant smart solutions, not included in the Replication Plan - Parma

Beyond the replication of the smart solutions described above, Parma is going to implement, during the five years period of the project, many other relevant solutions which are preliminary to the development of the Replication Plan. These solutions involve: **refurbishment of building blocks; expansion of the district heating network, harmonizing SUMP and SEAP goals**.

5.8 Integration and Long-Term Sustainability of the Smart Solutions

The RUGGEDISED smart solutions that the City of Parma will adopt aim at creating a smart district with an integrated management of energy efficiency, sustainable mobility and ICT. The package of smart solutions has been selected to meet the ambition of Parma to become a smart city in a few years. The guiding principles in setting this package have been: the feasibility of the solutions in the local context of Parma, the up-scaling potential of solutions in other city districts and the integration of the solutions to overcome the usual sectorial approach. The replication plan will enhance the integration between energy efficiency, renewable energies, energy storage, monitoring consumptions, sustainable mobility and data flows. The solutions can be connected to existing or already planned projects and integrated into the city's existing plans and in plans that are being revised or prepared (SEAP, SUMP, SECAP, etc.), which will support their sustainability.

6. Conclusions

This report shows the progress of local activities in Brno, Gdansk and Parma in the first 18 months of the project. From this first assessment it can be seen that **all three Fellow Cities of RUGGEDISED are at a very advanced stage in the pathway to become Smart Cities.**

Smart City Governance

They all established **effective local governance groups** that show a **strong commitment** in carrying on and **steering smart city's activities and initiatives**. In all cases, they have been set up and structured in such a way as to **survive the numerous political elections** and succession of several local governments (this will be verified later during the next years of the project).

Long Term Vision & Participatory Foresight Process

Concerning the **long-term strategy and planning**, all Fellow cities have just started a participatory foresight process aimed at defining a medium-long term vision. Within this path, all relevant city stakeholders as well as citizens are invited to provide their ideas on how they imagine their city in the future. All their thoughts and expectations are important for the **definition of the vision** and the subsequent **roadmap of concrete actions** to be included in the **Replication and Investment Plan** that this intensive process will produce.

In this regard, **Brno** is in a more advanced stage, so, in a way, it **is leading and inspiring Gdansk and Parma in their next steps**. Anyhow, these latter **are not far behind** and have just completed both their second local workshops on scenarios, while Brno has just held the third (the reports of the local workshops will be provided in D7.5, to be due by M53).

Replication Activities

As for the actual **replication activities** of Lighthouse Smart Solutions, again the three cities are in different stages at the moment: **Brno** has just pinpointed the solutions of interest that the Lighthouses are developing but has not yet defined what the actions to be taken will be in detail; for now, the **district where the smart solutions will be applied has been identified**. **Gdansk and Parma** have **already identified a list of solutions to replicate as well as the implementation sites.** The smart solutions here reported will be further discussed and deepened before being included in their Replication and Investment Plans.

As mentioned in Chapter 2 (and further detailed in D7.6 "Report from the technical workshops"), the continuous discussion and exchange of expertise and knowhow in specific topics with the Smart Solutions' responsibles of the Lighthouse Cities (made possible thanks to the Replication Workshops held during the General Assemblies) constitute a great opportunity for Fellow Cities.

Indeed, thanks to this process Brno, Gdansk and Parma have been enriching their knowledge on both technical and non-technical themes related to specific smart solutions. This set of activities is crucial for acquiring knowledge resulting from good practices and, at the same time, for consciously dealing with the potential barriers that could be encountered and learning from the failures, identifying the best way to avoid them.

An intermediate assessment of the local progress in the Fellow Cities will be provided at the end of the fourth year of RUGGEDISED within D7.3 "Intermediate Replication Assessment".

In the coming months an update of D7.1 will be provided with the results of the first evaluation activity in the Fellow Cities.

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