Nantes | Hamburg | Helsinki




Deliverable due date: M12 – November 2017

# D6.3 Baseline assessment & PESTEL Analysis of Rijeka's Initial Replication Plan

# Transition of EU cities towards a new concept of Smart Life and Economy

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731297.

| | |
|---|---|
| Project Acronym | mySMARTLife |
| Project Title | **Transition of EU cities towards a new concept of Smart Life and Economy** |
| Project Duration | 1st December 2016 – 30th November 2021 (60 Months) |
| Deliverable | D6.3 Baseline assessment & PESTEL Analysis of Rijeka's Initial Replication Plan |
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| Due date | M12 30/11/2017 |
| Work Package | WP6 |
| Lead beneficiary | RIJ |
| Contributing beneficiary(ies) | RIJ, NBK, CAR |
| Task description | Subtask 6.1.1: Baseline assessment of follower cities. A baseline assessment of the current situation for each follower city will be performed and therefore the feasibility and adaptation of these preliminary plans will be reviewed. To set up the baseline, a PESTEL (Political, Economic, Social, Technology, Environmental and Legal) analysis will be carried out to determine the uniqueness and the context of each follower city for these initial plans NBK will coordinate this task with the cities and supported by CAR and TEC.<br>For this assessment of the context, each follower will be visited, and key stakeholder interviews prepared and performed. The process will continue iteratively with the active participation of local authorities and identified stakeholders. |

| Date | Version | Author | Comment |
|---|---|---|---|
| 23/05/2017 | 0.1 | Aurélien HENON (NBK) | TOC and questions |
| 9/06/2017 | 0.2 | Aurélien HENON (NBK) | First contribution guideline: one PESTEL analysis on one smart action, preliminary replication plan update and selection of smart action |
| 9/10/2017 | 0.3 | NBK/CAR | Guidelines and place of city level indicators. |
| 15/10/2017 | 0.4 | RIJ | Indicators, city description, PESTEL analysis |
| 25/10/2017 | 0.5 | NBK/CAR | Review of indicators and description |
| 06/11/2017 | 0.6 | RIJ | PESTEL analysis |
| 15/11/2017 | 0.7 | NBK | PESTEL analysis |
| 23/11/2017 | 0.8 | RIJ | PESTEL analysis, conclusions |
| 30/11/2017 | 0.9 | NBK/CAR | Final updates |

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# Abbreviations and Acronyms

| Acronym | Description |
|---|---|
| CCP | Citizen Collaboration Platform |
| CoC | Center of competence |
| CNG buses | Compressed natural gas buses |
| E-buses | Electrical buses |
| EE | Energy efficiency |
| ERDF | European Regional Development Fund |
| ESCO model | Energy Service Company model |
| EUSAIR | EU Strategy for the Adriatic-Ionian region |
| EUSDR | EU for the Danube region |
| HEP d.d. | Croatian national electricity provider |
| HRK | Croatian Kuna, national currency |
| GDP | Gross domestic product |
| GIS | Geographic information system |
| ICT | Information and communication technology |
| IEEE | Institute of Electrical and Electronics Engineers |
| ITI | Integrated territorial investment |
| ITS | Intelligent transport systems |
| MC | Municipal Company |
| mySMARTLife | Transition of EU cities towards a new concept of Smart Life and Economy |
| PR | Public Relations |
| R&D | Research and Development |
| REA Kvarner | Regional Energy Agency Kvarner |
| RES | Renewable energy sources |
| RES | Renewable energy systems |
| ROI | Return on investment |

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|---|---|
| SEAP | Sustainable energy plan action |
| SMEs | Small and medium-sized enterprises |
| SULP | Sustainable urban logistics plan |
| UAR | Urban agglomeration Rijeka |

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# 1. Executive Summary

mySMARTLife project aims at the development of an **Urban Transformation Strategy** to support cities in the definition of transition models, as a suitable path to reach high level of excellence in its development process, addressing the main city challenges and progressing to the **smart people** and **smart economy** concepts. To achieve this ambitious strategy, **Advanced Urban Planning** based on prioritisations of actions are developed for three lighthouse cities and four followers cities. As follower city, Rijeka aims to develop a complete replication plan to be deployed at the end of the project.

On **section three** of this deliverable, a baseline assessment of the current situation for Rijeka is presented. This analysis allows reviewing the feasibility and adaptation of that preliminary replication plan. It also includes an evaluation of the current state and context of the city of Rijeka based on the indicators defined within the evaluation framework developed in the WP5.

This evaluation framework focus on monitoring the evolution of a city towards an even smarter city. The aspects covered in this analysis include the following: general overview, climatic characterisation and geographic positioning and socio-economic, environmental, governance, citizen engagement, city transportation, energy supply and urban infrastructure characterisation.

To establish their own strategy plan, follower cities have studied lighthouses cities solutions and planed how best to implement the successfully demonstrated solutions in their city. In addition, for Rijeka, basis for the writing of the replication plan, which can be found in **section four**, are the local policies and strategies, and the work carried out by Rijeka in the projects derived from participation in networks of intelligent cities. A first version of this plan was already presented on the proposal and several actions were already planned to foster replication.

From the baseline assessment of the current situation and their own strategy plan the city of Rijeka has review the feasibility and adaptation of its preliminary plan. The replication plan has been updated by considering all of these data. This baseline assessment made it possible to select the most relevant smart actions. Six smart actions have been identified as those which should be finally maintained after the analysis of all the proposed actions in this first replication plan. These smart actions, which will be carried out in the next 3 years, are:

1) Smart bus-stations and smart traffic platform (Smart mobility)
2) Smart public lighting
3) Smart metering and Smart meter data management (Smart grids)
4) PV panels: energy storage and sharing (RES integration)
5) Citizen involvement/participation in energy savings
6) Open data GIS & platform

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Finally, in the chapter 5, a PESTEL (Political, Economic, Social, Technology, Environmental and Legal) analysis have been carried out for each selected action to determine the uniqueness and the context of its application.

Some actions have shown great potential for integration where others seemed limited on certain aspects. For these actions whose PESTEL analysis is not entirely favorable, the context and identified difficulties were analyzed by taking inspiration from partner cities. This highlighted some solutions to apply in order to ensure the implementation of these actions. Such solutions have been integrated in the replication plan as intermediate actions.

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# 2. Introduction

## 2.1 Purpose and Target

The objective of this deliverable is to describe the baseline assessment and the PESTEL analysis of Rijeka's Initial Replication Plan and to provide an update of this replication plan. A first part consists to evaluate the current state and context of Rijeka through a city level analysis based on specific smart and cities indicator evaluation. A second part consists to define and analyse the strategic plan of Rijeka according to the main targets of the SEAPs, other relevant urban planning and lighthouse cities strategic plans. Based on the city level analysis and the strategic plan of the city, the action plan is then updated as well as the lists of selected smart actions. A PESTEL Analysis is then performed for selected actions. For actions whose PESTEL analysis is not entirely favourable, the context and identified difficulties would be analyse by taking inspiration from partner cities. This highlighted some solutions to apply in order to ensure the implementation of these actions. Such solutions would be integrated in the replication plan as intermediate actions required to carry out the concerned smart action.

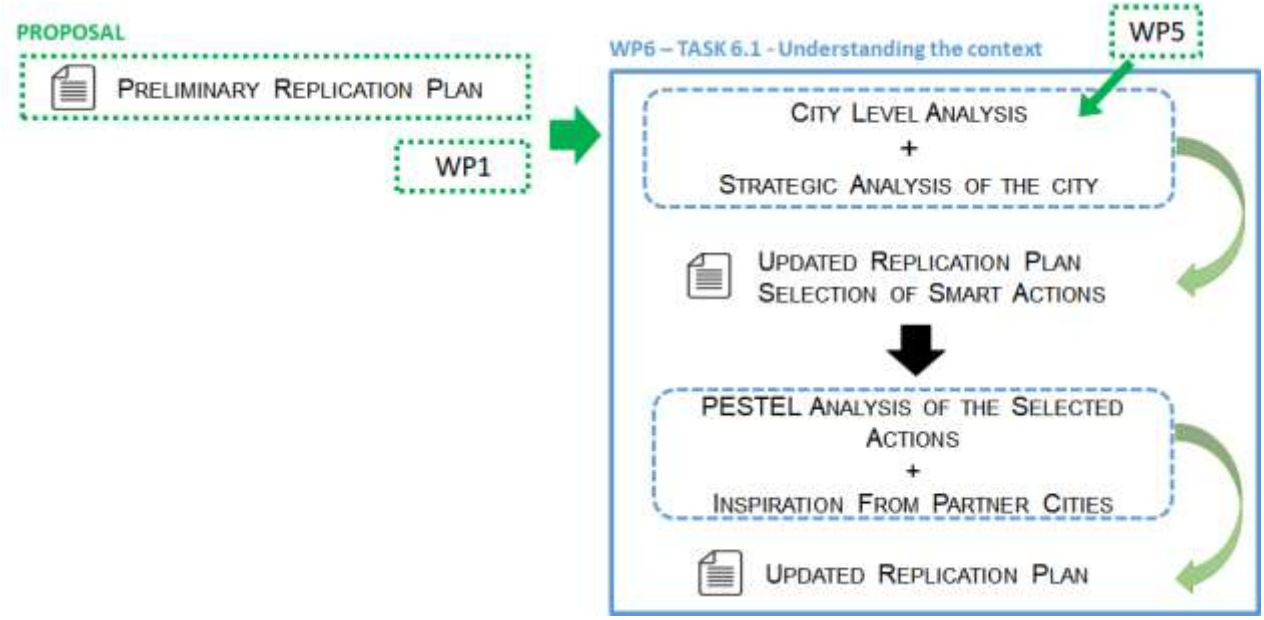


**Figure 1: Several successive steps to update the replication plan**

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## 2.2 Contributions of partners

The following Table 1 depicts the main contributions from participant partners in the development of this deliverable.

**Table 1: Contribution of partners**

| Participant short name | Contributions |
|---|---|
| RIJ | Overall content production and deliverable leading |
| NBK | Overall content reviewing and leading contribution |
| CAR | Overall content reviewing and leading contribution |
| TEC | Reviewing |

From City of Rijeka's part, the deliverable was developed in collaboration of City of Rijeka Departments, Municipal companies, innovation cluster Center of competence (Coc) for Smart Cities, and other institutions and associations. The following associates have been involved:

City of Rijeka: Suzana Belošević Romac, Tina Ragužin, Mirna Hriljac, Iva Ribarić, Tajana Jukić Neznanović, Željko Jurić, Tatjana Perše, Siniša Vugrin, Nenad Lazarić, Danijel Antonić, Kerim Derenčin, Josipa Cvelić.

MC Autotrolej d.o.o.: Franko Ostarčević

MC Čistoća d.o.o.: Marina Babić Brusić

MC Energo d.o.o.: Marin Blečić, Ksenija Mišetić, Marko Križanac, Veljko Đirlić

MC Rijeka plus d.o.o.: Kristina Prijić

MC Rijeka promet d.o.o.: Daniel Frka

MC Vodovod i kanalizacija d.o.o.: Mojca Spinčić

Coc for Smart Cities: Damir Medved

PORIN – Local development agency: Dunja Zagorac Šimac, Mirta Klaričić

CEZAR - Association for EE promotion: Marko Bačić

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## 2.3 Relation to other activities in the project

The following **Figure 2** depicts the main relationship of this deliverable to other activities (or deliverables) developed within the mySMARTLife project and that should be considered along with this document for further understanding of its contents.

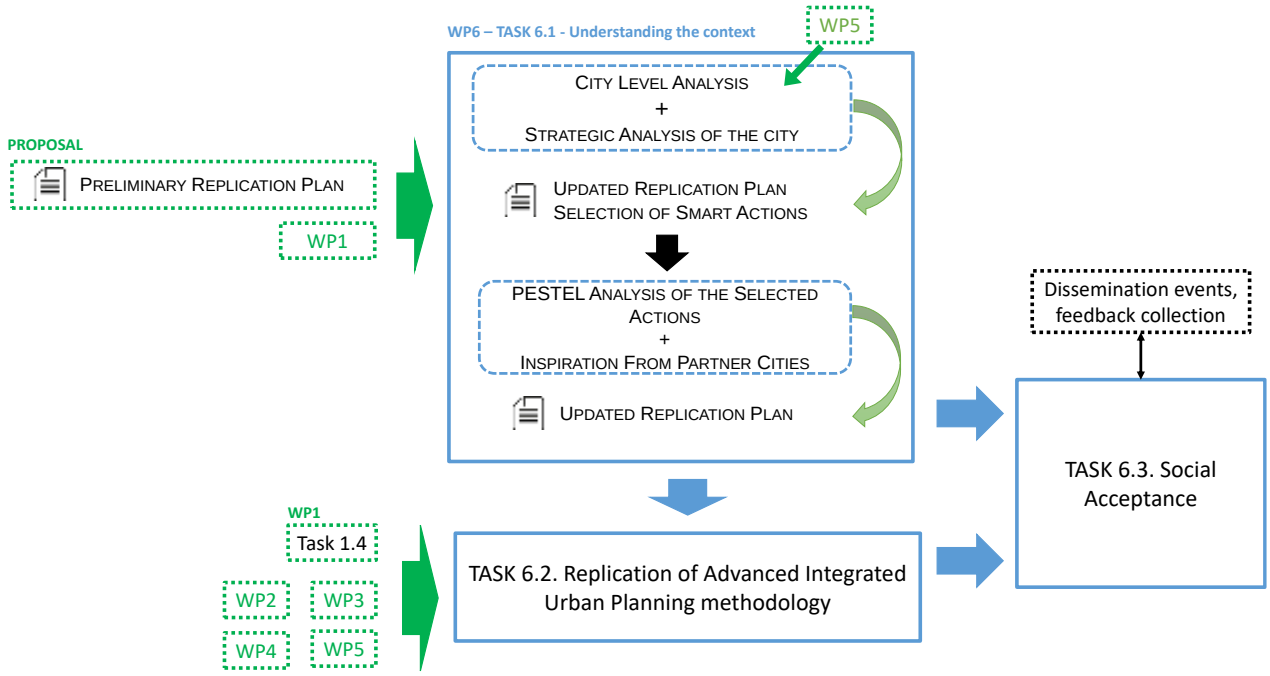


**Figure 2: Relation to others activities in the project**

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# 3. City level analysis

In order to monitor and evaluate the effectiveness of the project actions and interventions, compared to initial situation, initial objectives and expected results, the WP5 of MySmartLife project aims to define an evaluation framework. It will be used for both Lighthouses and Followers cities evaluation. For the Followers cities it will be particularly useful for assessing and understanding the context of each city so that solutions can be chosen and adapted and for delivering adapted replication strategies and plans.

To elaborate this framework, previous work by CITYkeys and SCIS have been considered ([1], [2]). This framework have two fold scope in order to measure and assess the project activities at Smart City Project level and Smart City level considering the five major themes defined by CITYkeys: People, Planet, Prosperity, Governance and Propagation and completed with specific smart city indicators. Starting from the definition of a smart city the indicators for smart cities focus on monitoring the evolution of a city towards an even smarter city.

The characterisation of Rijeka and its supporting data collection, provides the citywide integrated documentation and analysis of the current conditions required to identify the priority action lines as well as their management needs.

Through a range of city descriptors and indicators, information about the existing conditions including some of the key aspects for the sustainable development are collected and shown in a standardised manner: social, economic and environmental aspects. This information is essential to promote actions and management plans for implementing the sustainable urban regeneration model aiming in mySMARTLife project.

The characterisation will follow the approach developed for the evaluation framework developed in WP5. While the overall framework and the full set of indicators will be depicted in WP5 related documents, this report includes a selected list of indicators aiming at covering the city characterisation. These indicators are divided into eight categories:

- General overview, climatic characterisation and geographic positioning
- Socio-economic characterisation
- Environmental characterisation
- Governance characterisation
- Citizen engagement characterisation
- City transportation characterisation
- Energy supply characterisation
- Urban infrastructures characterisation

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Indicators from each category are presented separately on the following paragraphs. Inspired from CITYkeys (D1.4 Indicators for smart city projects and smart cities), the tables of selected city indicators are shown, discussing the application field, the title, the unit, a short description and the indicator evaluation for Rijeka:

- The application field is a common group where various indicators are applicable. Each application field has a dedicated paragraph.
- The title of the city indicator is phrased as evaluating a static situation. A static indicator, assessing the situation at a certain recurrence in time, will allow monitoring over various time periods.
- Important in the choice for the unit of the indicator is the comparability of indicators across a variety of cities differing in size, demography, dominant type of companies/sectors, etc. Here too, absolute values are not suitable. Consequently, most city indicators are defined as '%' or use a Likert scale.
- The description of the indicator are formulated either as a definition or as an interrogative form.

## 3.1 General overview, climatic characterisation and geographic positioning

The City of Rijeka is the capital of the County Primorje-Gorski kotar in Croatia, and the most densely populated city in the region, located in the area of only 44km$^2$. It is a medium sized city developing strong transport connections to the inland from the port, and has a strong student community because of the University of Rijeka providing a wide range of faculties. The University provides education for around 17 thousand students every year.

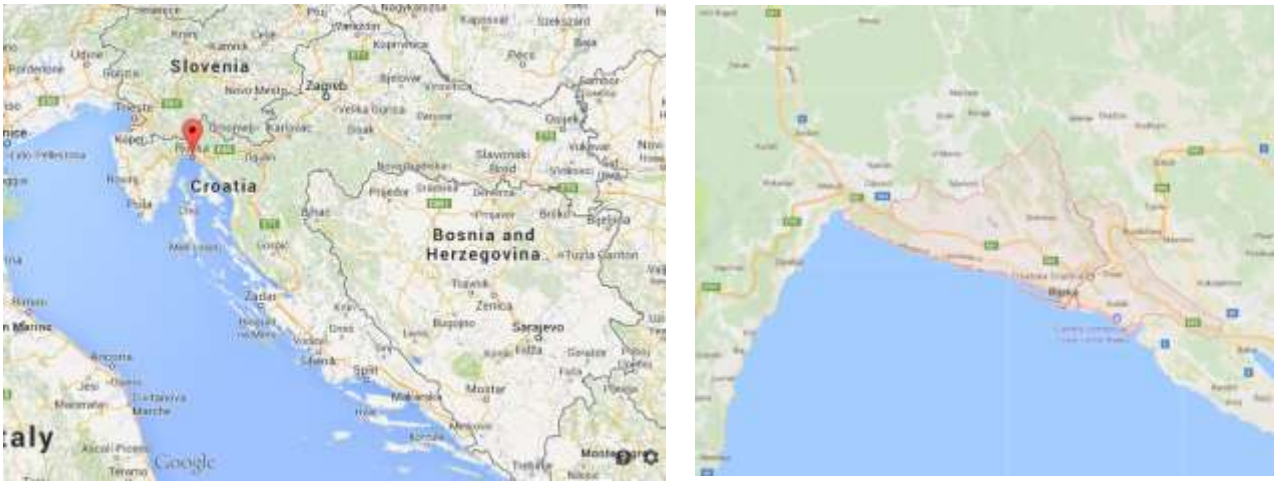


**Figure 3: Rijeka on map (Google maps)**

The City of Rijeka is not a municipality and is located on only 44km$^2$. Because of the administrative boundaries, the city is mostly built for housing, and needs good urban planning for recreational or agricultural purposes. Having joined the Covenant of Mayors, and the Mayors adapt initiative, the City of Rijeka was involved in immense planning to reduce its $CO_2$ emissions. First, by 30% until 2020, and then

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40% until 2030. The City invested in great capacities to determine its energy consumers and biggest $CO_2$ emitters, as well as steps for achieving reduction in its SEAP [3].

Rijeka was for many decades a strong industrial area with many factories in different branches of economy. Nowadays, the industrial part is reduced and the city is increasing its role in tourism, which is a strong economic factor in the County's coastal area. Steps are being taken to increase tourist visits, especially by 2020, when Rijeka will be the European capital of culture. More and more citizens are offering private accommodation, the number of hostels increased in the city, as well as cruiser visits.

The City of Rijeka has a moderate Mediterranean climate with warm summers and moderate winters. Because of its geo-location, it is also subject to humidity and rainfall.

### 3.1.1 City features

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Size** | $km^2$ | Land area of city | 44 |
| **Population** | Inh | Total number of persons inhabiting a city (2011 census) | 128,624 |
| **Population density** | $Inh./km^2$ | Population per unit area in the city | 2,923 |
| **People > 75 years** | % | Population elder than 75 years old (2011 census) | 12,013<br>9% |
| **Average population age** | y | Average of the age of the population (2011 census) | 43.9 |
| **Type of city** | Typology | Typology of the city under study | Urban |

### 3.1.2 Land use

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Land consumption** | nº build/$km^2$ | Measure of land use intensity and urban areas density | 520 |
| | $km^2/km^2$ | Measure of land use intensity and urban areas density | $25km^2/44km^2$ |
| **Balance between residential and no-residential building use** | % | Measure of land use diversity | 12.6% |

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### 3.1.3 $CO_2$ target

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Overall CO2 emission reduction target** | % | Overall CO2 emission reduction target *until 2030. | 40* |

### 3.1.4 Tourism

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Tourism intensity** | nights/100.000 | Number of night for 100.000 inhabitants | 1.14 |

### 3.1.5 Climate

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Climate koppen geiger classification** | Group | The Köppen climate classification scheme divides climates into five main groups (A, B, C, D, E), each having several types and subtypes. Each particular climate type is represented by a two- to four-letter symbol. | Cfb |

## 3.2 Socio economic characterisation

Employment is a severe issue, not only in Rijeka but the Country as whole. For decades the city of Rijeka had been a strong industrial center in the country, but its impact has severely declined. In the post-industrial era of the Rijeka, the city lost thousands of jobs which were part of the strong industry. These types of jobs will not be returning in the future for sure, so other markets need to be developed to keep younger population in the region. The economic performance on the county level however, sets the Primorje-Gorski kotar County on the second place in the Republic of Croatia by GDP, after the capital Zagreb. The City has been putting efforts in developing more incubators and accelerators to increase entrepreneurship. Green economy is one of the requirements set in the SEAP and SEAP revision in 2016, which determined future steps to make the system of green public procurement effective. The first step should be the organisation of workshops on the subject to train public employees in green procurement procedures.

Innovation and investments in R&D became a major focus for the country, especially after joining the European community and gaining access to additional funding. The Republic of Croatia adopted the Smart specialisation strategy on the national level, determining the priority areas which would be subject to funding: health and quality of life, energy and sustainable environment, traffic and mobility, security and

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food and bio-economy. The city of Rijeka runs its own start-up incubator, but new start-ups are not diversely aggregated from other new businesses in the city of Rijeka.

### 3.2.1 Employment

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Unemployment rate** | % | Unemployment 2016 | 8.9 |
| **Youth unemployment rate** | % | Youth unemployment 2016 | 5.6 |

### 3.2.2 Equity

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Fuel poverty** | %-points in € | Equity: %-points of gross household income spent on energy bills* No such statistics are made, on the local, nor on the national level | - |
| **Population Dependency Ratio** | #/100 | Economic development = Number of economically dependent persons (net consumers) per 100 economically active persons (net producers) (2016) | 88 |
| **Diversity of housing** | % | Diversity = % social housing of total housing stick | - |

### 3.2.3 Green economy

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Green public procurement** | Qualitative Likert scale | Stimulating eco-innovation | - |

### 3.2.4 Economic performance

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **GDP** | €/cap | Economic performance (2014 – Country level) | 12,765 |
| **Median disposable income** | €/household | Economic wealth: Median disposable annual household income (annual income 2011) | 10,880 |
| **New businesses registered** | #/100,000 | Economic activity, attractiveness (2016) | 869/100,000 |

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### 3.2.5 Innovation

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **New startups** | # | New business (statistic for start-ups is not separately made from businesses) | 869 |
| **Research intensity** | % in euros | Innovation = R&D expenditure as percentage of city's GDP (2013 - National GDP) | 0.81% |

## 3.3 Environmental characterisation

As mentioned before, the City of Rijeka developed its own sustainable energy action plan in 2008, carrying out first comparisons of energy saved and $CO_2$ reduced in 2016. The reference year of 2008 was compared with the results of reduction in the control year 2014, and has shown that the investments and efforts in creating a healthier city, paid off.

The Republic of Croatia has one of the highest clean drinkable water supplies in Europe, and the City of Rijeka is no exception. Located around the river Rječina's canyon, the city uses this resource as the main water supply for the wider area, including the whole Rijeka Agglomeration.

The local Office for public health monitors air pollution on different locations in the city and in the remote area. The devices are located on roads with more traffic load and near industrial facilities. The air quality on these locations shows a good air quality for the citizens of Rijeka and monitors different pollutants and their concentrations in the air. With the INA oil refinery in the coastal area of Mlaka stopping production in the last decade, the air quality was greatly improved [4].

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**Figure 4: Air pollution monitoring on different locations in Rijeka. Screen shot of** [4]

The Republic of Croatia government has been less efficient in adopting EU guidelines for collecting and recycling waste, and adopting the EU waste management standards in general. This caused a delay in developing new centers for waste management or resulted in centers which could have had optimal standards already in use. This is something that will positively change in the following years because of the EU requirements that need to be adopted. A new waste management center has been constructed in the Rijeka Agglomeration but has still to show results in better waste management, while the citizens were given new containers for dividing their solid waste. The waste management services are provided by the municipal company Čistoća d.o.o. which collects waste and transports it to the new waste center Marišćina, managed by the company Ekoplus d.o.o. at the moment, there are multiple locations in the city with "green islands" with containers for dividing household waste, and 2 mobile recycling yards which move around the city on set schedules, where citizens can dispose of non -dangerous waste (e.g. batteries, oils, sprays, hardware components, light bulbs etc.). There are also 2 non-mobile recycling yards for more massive waste and non - dangerous waste described above. Massive metal waste is being managed by the company Metis d.o.o. at their facilities (e.g. iron, cars etc.).

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**Figure 5: County center for waste management Marišćina**

There are more than a few brownfield areas in the Rijeka agglomeration because of the strong industrial history of the area, and also abandoned army facilities. As it is known, the regeneration of brownfield areas is very expensive and starts with studies showing the possible usage of the area after the regeneration. Rijeka is only in the beginning of these activities and has made studies on some areas. Because of the unclear legal status of the properties in regards to ownership, the city has a long way in regenerating these properties. EU funding will help these activities, and brownfield use is one of the thematic areas in operational program Competition and Cohesion for the Republic of Croatia. Because of the administrative border restrain of the city, as mentioned only 44 $km^2$, the city government is more than aware of the need to optimally use every $m^2$.

**Figure 6: Brownfield area: Abandoned refinery Mlaka in Rijeka**

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No statistic has been made about temperature differences resulting from urban heat island effect, but there are differences between the hinterland and the coastal area where the city lies. Only 10 km inland from the city of Rijeka, the morning and night temperature differences are about 2-3 degrees Celsius. But while the city of Rijeka does not have snowfall often, the hinterland of only 10-15 km north of Rijeka has snowfall every year, and Platak, a very popular ski destination is less than 40 km away.

All Croatian cities with over 100,000 residents are required to make a Strategic map of noise to assess the exposure of citizens to noise from different sources and to develop Action plans for noise management. The analysis of noise exposure in Rijeka, and the Action plan have proposed 54 areas for noise management with the objective of noise reduction. For every area, there is a scenario with planned measures for noise management or reduction. For 54 areas, 95 scenarios were developed with a 115 different measures for noise management. To include citizens, consultations were opened on the e-consultations website of the City of Rijeka, were citizens could say if they thought that the measures were adequate for their area, or to propose measures for better protection from noise. The consultations were opened until November 4th 2017, and the propositions and objections of citizens will be taken into account in the development of the report and final version of the Action plan.

**Figure 7. Noise map – City of Rijeka**; *source: http://kartebuke.coin.hr/main.html?map=rijeka*

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### 3.3.1 City environmental impact

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Greenhouse gas emissions per capita** | tonnes $CO_2$/capita | - | 1.77 |
| **Greenhouse gas emissions (tertiary)** | tonnes $CO_2$/year | Buildings for commercial and service activities in 2014. | 68,852.54 |
| **Greenhouse gas emissions (transport)** | tonnes $CO_2$/year | - | 139,702.32 |
| **Greenhouse gas emissions (Residential)** | Mtonnes $CO_2$/year | Greenhouse gas emissions in t CO2 in 2014. | 116,608.11 |
| **Greenhouse gas emissions in buildings, equipment/facilities and Industries** | tonnes $CO_2$/year | | - |
| **Greenhouse gas emissions (Public lighting)** | tonnes $CO_2$/year | - | 2,689.50 |
| **Greenhouse gas emissions (Municipal)** | tonnes $CO_2$/year | All building sectors / 2014 | 197,742.23<br>12,281.57 |
| **Transport greenhouse gas emissions per capita** | tonnes $CO_2$ /(pers.·year) | Measure of the total greenhouse gas emissions per capita due to public and private transport. | 0.72 |
| **Percentage of renewable energy use in public transport** | % | Measure of the use of renewable energy in public transport. | 0 |

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### 3.3.2 Water resources

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Water consumption** | $m^3$/cap/day | Water resources | 0.18 |
| **Water re-used (rain/grey water)** | % of houses | Water resources | 0 |

### 3.3.3 Air pollution

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **NOx emissions** | g/cap | Air pollution<br>(real time measure) | 15.9 g overall |
| **PM2,5 emissions** | g/cap | Air pollution<br>(real time in city district Paveki) | 6.85 µg/m3 |
| **Air quality index** | index | Annual concentration of relevant air pollutants<br>*real time measurement, November 16th 2017 | Data collected separately per pollutant<br><br>9* |

### 3.3.4 Waste

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Recycling rate** | % tonnes | Lower amount of waste. Percentage of city's solid waste that is recycled<br>*Percentage of collected waste for recycling/total waste collected | 20% in volume<br>13% in mass* |
| **Amount of solid waste collected** | tonnes/capita/year | Waste<br>Rijeka agglomeration and surrounding municipalities 2016<br>*approximately, conversion of litres to tonnes (litre density 70) | 3 tonnes/cap/year* |

### 3.3.5 Land consumption

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Brownfield use** | % of km2 | Share of brownfield area that has been redeveloped in the past period as | - |

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| | | | |
|---|---|---|---|
| | | percentage of total brownfield area | |
| **Compactness** | inhabitants or workplaces / $m^2$ | Efficient city plan | n.a. |

### 3.3.6 Food consumption

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Local food production** | % of tonnes | Share of food consumption produced within a radius of 100 km | - |

### 3.3.7 Urban heat island effect

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Urban Heat Island** | °C UHImax | Maximum hourly difference in air temperature within the city compared to the countryside during the summer months | - |

## 3.4 Governance characterisation

The city of Rijeka has attracted a lot of EU funding to provide energy efficiency in buildings, namely adaptations of facades, retrofitting, window joinery replacement etc. The SEAP and SEAP revision set the course for future activities in energy efficiency in the city to ensure planning for these activities and all those ensuring energy and $CO_2$ reduction and optimal use of energy to promote sustainability. The city invested major resources in adaptations on public infrastructure, namely schooling facilities and kindergartens, and continues with such activities.

Activities on mobility have also started but the results will be demonstrated in 2018, when the County traffic Master plan should be developed, as well as the sustainable urban logistics plan – SULP, which will be developed hand in hand with the Master plan.

In development of smart actions that the city wants to enforce, in the city has to follow regulation adopted on the national level, and is not competent to adopt laws on its own right. The decision in force in the city, have to be in accordance with the national legislation. The city of Rijeka has been awarded as a transparent city on multiple occasions. The city provided numerous websites and social media channels for announcements and communication with citizens. The city of Rijeka provides a lot of information for public eye and continuously works on improvements.

The concept of 'smart city' implies the 'smart' solutions in all sectors and the project cannot be implemented by dividing the technical, from the legal or administrative work. It is essential that departments and companies work together on developing new solutions. The city government supports

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the efforts and initiatives that help develop smart solutions for its citizens and has cited innovation as one of the priorities in its Strategy of development.

### 3.4.1 Urban planning

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Existence of plans/programs to promote energy efficient buildings** | Number of plans | Is there any specific plan for promoting energy efficient buildings in the city? | 2 |
| **Existence of plans/programs to promote sustainable mobility** | YES/NO | - | NO |
| | Number of plans | Is there any specific plan for promoting sustainable mobility in the city? | 0 |
| **Existence of regulations for development of energy efficient districts** | Number of regulations | Is there any specific regulation for developing energy efficient districts in the city? | NO |
| **Existence of regulations for development of sustainable mobility** | Number of regulations | Is there any specific regulation for developing sustainable mobility in the city? | NO |
| **Existence of local/national Energy Performance Certificate (EPC)** | YES/NO | Is there any specific EPC for buildings in the city? | YES |
| **Share of Green Public Procurement** | % | Percentage annual procurement using environmental criteria as share of total annual procurement of the city administration | - |
| **Existence of local sustainability plans** | YES/NO | Is there any specific sustainability plan in the city? | YES |
| **Existence of Smart Cities** | YES/NO | Is there any specific Smart Cities strategy in the city? | NO |

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| | | | |
|---|---|---|---|
| **strategies** | | | |
| **Existence of an Agenda 21** | YES/NO | Has the city elaborated an Agenda 21? | YES |
| **Climate resilience strategy** | Likert scale | The extent to which the city has developed and implemented a climate resilient strategy | 2 |
| **Signature and compliance of the Covenant of Mayors** | YES/NO | Has the city signed the Covenant of Mayors? And Is the city complying with it? (both questions need to be answered) | YES to both |
| **Smart city policy** | Qualitative Likert scale | The extent to which the city has a supportive smart city policy | 5 |
| **Preservation of cultural heritage** | Qualitative Likert scale | Identity of place based on its history = the extent to which preservation of cultural heritage of cultural heritage of the city is considered in urban planning (Likert scale 1 – 5; 1=poor; 5=excellent) | 5 |

### 3.4.2 Level of correspondence

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Level of correspondence between local energy codes** | YES/NO | Is there any discrepancy between different local energy codes for buildings? | NO |
| **Level of correspondence with national regulation** | YES/NO | Is there any discrepancy between local codes and national regulation? | NO |
| **Level of correspondence with European legislation** | YES/NO | Is there any discrepancy between local codes and European legislation? | NO |
| **Level of correspondence with international construction** | YES/NO | Is there any discrepancy between local codes and international construction standards? | NO |

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| | | | |
|---|---|---|---|
| **standards** | | | |

### 3.4.3 Online governance data

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Availability of government data** | Qualitative Likert scale | The extent to which government information is published (Likert scale 1 – 5; 1=poor; 5=excellent) | 5 |

### 3.4.4 Quantity of open data

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Open government dataset** | #/100,000 | Quantity of open data sets provided by city's open data portal is currently 106 (sets of open data published http://data.rijeka.hr/) | 8.2/100,000 |

### 3.4.5 Gobernance collaboration

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Cross-departmental integration** | Qualitative Likert scale | The extent to which administrative departments contribute to "Smart City" initiatives and management | 3 |

### 3.4.6 Citizen Participation

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Voter participation** | % | The percentage of people that voted in the last municipal election as share of total population eligible to vote | 37% |

## 3.5 Citizens engagement characterisation

Although there is a major decline in citizen participation on general or local elections, or in the willingness for demonstrations, there is an increase in the participation on online websites and social media. People seem to easily share their opinion when they do not have to sign their name. The City of Rijeka is working on citizen engagement because of the need for citizen participation in the decisions which affect their everyday life. The city is very transparent and all city companies have official websites for checking in on their services and working hours. There are 2 forums where the citizens can report issues to the city services, and place their opinions on improvements. The new website for e-consultations enables citizens

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to participate in the shaping of drafts of future decisions and in that way decide on what is important for them. Around 20% of citizens are high educated, and the city organizes free computer workshops to enable others (especially elder citizens) on how to access online services.


**Figure 8. E-consultations – City web site for on-line engagement**; *source: http://ekonzultacije.rijeka.hr/*

### 3.5.1 Channels of communication

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Number of local associations per capita** | Number of consultations / inhab. | Total number of citizen associations in the city | 0.013 |
| **Number of information contact points for citizens** | Number of information points | Total number of information contact points, related to municipal citizen offices, information about energy efficiency, mobility, environment, etc. | 19 |
| **Number of municipal websites for citizens** | Number of municipal websites | Total number of municipal websites for citizens (citizen participation portal, open data, transparency, etc.) *Number of accesses that have been made into the APIs of the urban platforms | 30* |

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| | | | |
|---|---|---|---|
| **Number of interactive social media initiatives** | Number of social media links | Total number of municipality links in social media channel as Facebook, Twitter, YouTube, etc. | Cca 50 |
| **Number of discussion forums** | Number of forums | Total number of discussion forums dedicated to the citizens | 2 |
| **Access to public amenities** | % | Basic services available close to home = Share of population with access to at least one type of public amenity within 500m | - |
| **Access to commercial amenities** | % | Basic services available close to home = Share of population with access to at least six types of commercial amenities providing goods for daily use within 500m. | - |


**Figure 9. Moja Rijeka (My Rijeka) – City of Rijeka Multimedia portal**; *source:* [http://www.mojarijeka.hr/](http://www.mojarijeka.hr/)

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### 3.5.2 Education level

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Number of high edu degrees per 100,000 population** | n/100,000th | It is an indicator of well-being and development = It is calculated collecting the number of higher degrees divided by one 100 000th of the total population *Census 2011. = 27,000 inhabitants with high education/128,624 inhabitants | 21,022/100,000 |

## 3.6 City transportation characterisation

The City of Rijeka, along with the surrounding municipalities, organises public transportation by buses. The buses used to run on diesel fuel but the company provider, Autotrolej, started procuring exclusively CNG fuelled buses, which are friendlier to the environment. With over 60 thousand private cars registered in Rijeka, there are also taxi services, and a railway connectivity. The city public transportation, transports over 30 million passengers per year and wants to improve its services by including smart solutions on smart bus stations. The city doesn't have a lot of hourly congestion and the system supports around 60 thousand vehicles daily. There have been investments, starting in 2014, in electric filling stations to promote cleaner transportation, but the vehicles themselves are still expensive for the average car owner. 4 filling stations have been installed in the very city so far. The city of Rijeka or the area around it doesn`t have bicycle lanes because of poor urban planning and a geographical location with lots of climbs and narrow streets.

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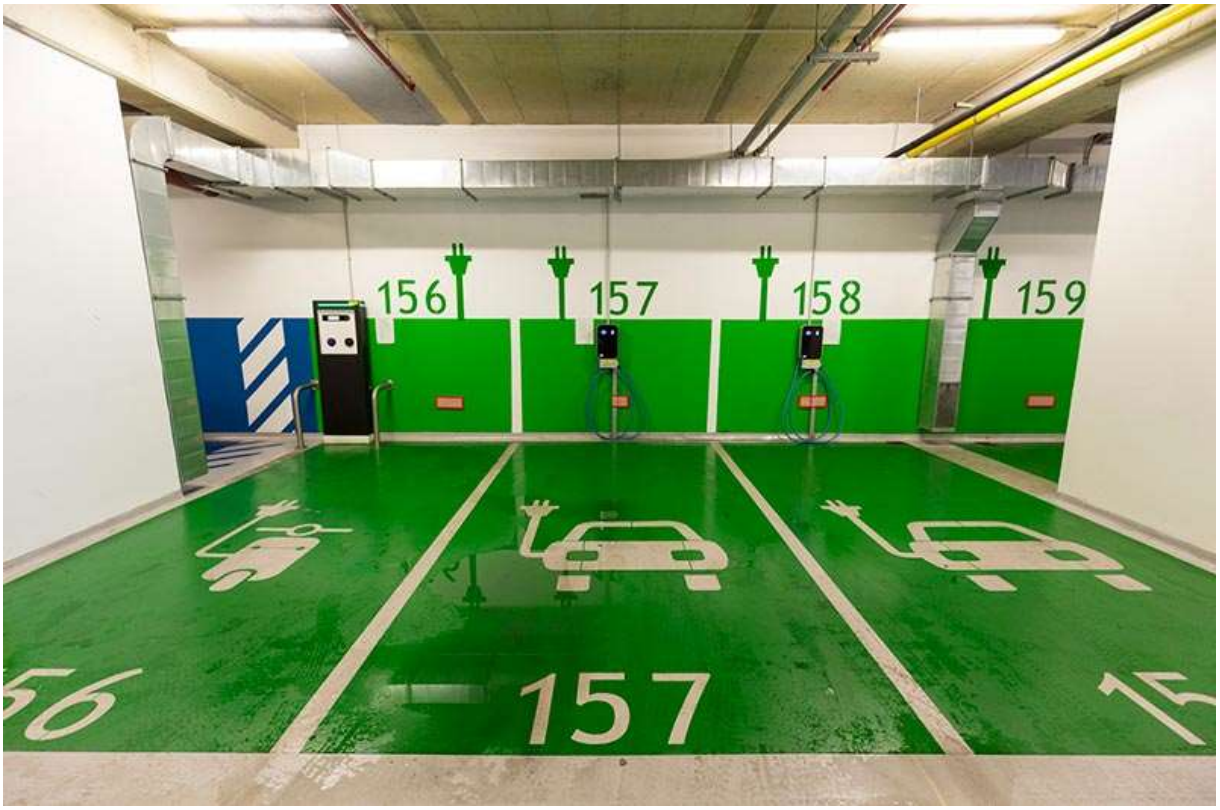


**Figure 10. Electric filling stations in City parking garage Zagrad B**

### 3.6.1 Mobility city profile

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Total number of public transport vehicles** | Number of vehicles | Number of public vehicles that are used for public transport (bus, taxis…) | - 150 buses<br>- 150 taxi licences issued |
| **Number of fossil fuelled four wheels vehicles per capita** | n/ cap | Number of fossil fuelled vehicles (four wheels) of the city divided by type: public and private<br>*2014 vehicles (not divided by fuel type) registered in the County Primorje – Gorski kotar/cap | 0.2/cap* |
| **Vehicle fuel efficiency** | kWh/100km | Total energy consumed for vehicles/total amount of vehicle kilometres completed | Not available |
| **Fuel mix** | % | Percentage of the market share of transport fuel for each type of fuel used | Petrol 54,38%<br>Diesel 44,70% |

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| | | | |
|---|---|---|---|
| | | in given period | LPG 0,92% |
| **Average occupancy** | number of passengers per vehicle | Average of number of passengers per vehicle per trip | 1.6 |
| **Average vehicle speed** | km/h | Average network speed by vehicle (peak/off-peak) | No such statistic available |

### 3.6.2 Sustainable transport

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Number of Electric Vehicles (EV) in the city** | n/100.000 | Number of electric vehicles in the city per 100.000 including private, public and service (taxi and first mile) vehicles including also motobikes | n.a. |
| **Public transport use** | #/cap/year | Annual number of public transport trips per capita<br>*2014 | 31,549.478 total*<br>186/cap/year |
| **Access to public transport** | %of people | Share of population with access to a public transport stop within 500m | No such statistic available |
| **Access to vehicle sharing solutions** | #/100 000 people | Number of vehicles available for sharing per 100.000 inhabitants | Not existing content |
| **Length of bike route network** | km/100000 people | % of bicycle paths and lanes in relation to the length of streets (excluding motorways) | Not existing infrastructure |

### 3.6.3 Transport problems

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Congestion** | % in hours | Increase in overall travel times when compared to free flow situation Uncongested situation) | Not available |
| **Traffic accidents** | #/100.000 people | Number of transportation fatalities per 100 000 population<br>*By September 2017 / County level | 5.4/100,000* |

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### 3.6.4 Charging points

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Total kWh recharged in the EV charging stations.** | kWh | "Number of kWh recharged during a year in the public and private | No such statistic available |
| **Charging points per eVehicle** | % | Percentage of charging points per vehicle | No such statistic available |
| **Total charging points** | # | Total number of charging points | 10 |

## 3.7 Energy supply characterisation

The City of Rijeka started working very actively in the field of energy since joining the Covenant of Mayors initiative in 2009. Statistics and calculations have been made on the consumption of different fuels and energy sources in the city to determine the zero status of consumption. After that, plans for future activities were developed in order to put energy efficiency measures into action and achieve actual reductions and energy efficient systems. The measures were directed on the building, transportation and public lighting system, and provided in SEAP – Sustainable Energy Action Plan. The first revision, with new improvements, was finalized in 2016, comparing the reference year of 2008 and the control year 2014. Primary energy consumption was not covered by the SEAP of the City of Rijeka because such information is covered on the country level, by national electricity provider (HEP d.d.). The emphasis of activities in the future will be on sustainability and renewable energy use, but the effect will certainly depend on funding possibilities.

### 3.7.1 City energy profile

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Final energy consumption per capita** | MWh/capita | - | - |
| **Final energy consumption** | TWh/year | / 2014*COPERT IV model | 0.53 |

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| | | | |
|---|---|---|---|
| **(Transport)** | | | |
| **Final energy consumption (Buildings, equipments/facilities and Industries)** | TWh/year | / 2014 | - |
| **Final energy consumption (Municipal)** | TWh/year | / 2014 | 0.038 |
| **Final energy consumption (Tertiary)** | TWh/year | / 2014 | 0.18 |
| **Final energy consumption (Residential)** | TWh/year | / 2014 | 48,64 |
| **Final energy consumption (Public lighting)** | TWh/year | / 2014 | 0.00815 |
| **Final energy consumption (Industry)** | TWh/year | - | - |
| **Final energy consumption (electricity)** | TWh/year | National level 2014 | 112,8 |
| **Final energy consumption (Heat/Cold)** | TWh/year | / 2014 | - |
| **Final energy consumption (Fossil fuels)** | TWh/year | / 2014 | 83,895 |
| **Total buildings energy consumption per year** | GWh/inhab.year | Residential consumption in the city for heating and electricity uses / 2014 | 6.32 |
| **Primary energy consumption** | GWh of PE/year | Gross inland consumption of the city excluding non-energy uses *National level: / 2015 | 17,600 |

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| | | | |
|---|---|---|---|
| **in the city per year** | | | |
| **Primary energy consumption per capita** | MWh/capita | - | n.a. |
| **Primary energy consumption (Transport)** | TWh/year | - | n.a. |
| **Primary energy consumption (Buildings, equipments/facilities and Industries)** | TWh/year | - | n.a. |
| **Primary energy consumption (Municipal)** | TWh/year | - | n.a. |
| **Primary energy consumption (Tertiary)** | TWh/year | - | n.a. |
| **Primary energy consumption (Residential)** | TWh/year | - | n.a. |
| **Primary energy consumption (Public lighting)** | TWh/year | - | n.a. |
| **Primary energy consumption (Industry)** | TWh/year | - | n.a. |
| **Primary energy** | TWh/year | *National level / 2015 | 17.51* |

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| | | | |
|---|---|---|---|
| **consumption (electricity)** | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

### 3.7.2 Renewable energy

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Final energy consumption (Renewables)** | TWh/year | - | - |
| **Share of local energy production to overall final energy consumption** | % | - | - |
| **Renewable electricity generated within the city** | % | The percentage of electric energy derived from renewable sources, as a share of the city's total energy consumption | - |
| **Non-RES Heat/ Cold production** | TWh/year | *National level 2014 | 2* |
| **RES Heat/Cold production** | TWh/year | - | - |
| **Renewable energy per carrier** | GWh/RES_supplier | Energy that each renewable systems provides to the city | 0.016 |
| **Percentage of renewable energy** | % | Amount of energy coming from the renewable sources<br>*National level / 2015 | 37.82%* |
| **Green electricity** | % | The percentage of green electricity purchased, as a share of the city's total | - |

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| | | | |
|---|---|---|---|
| **purchased** | | electricity consumption | |

### 3.7.3 Energy mismatch

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Maximum Hourly Deficit (MHDx)** | kWh | Energy mismatch: The maximum yearly value of how much the hourly local electricity demand overrides the local renewable electricity supply during one single hour | n.a. |

### 3.7.4 Energy monitoring

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Smart energy meters** | % of buildings | This indicator is the percentage of smart meters coverage on the energy distribution network; it could be distinguished for electric and methane or heat networks.<br>*City owned buildings (gas, electricity, water) | 16* |

### 3.7.5 Potential of retrofitting

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Refurbished buildings improving energy performance** | % of refurbished buildings | Number of buildings subject to refurbishment improving their energy profile above the EPBD (Energy Performance of Buildings Directive) requirements | 0.04%*<br>+4 buildings in progress |

### 3.7.6 Energy Systems

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Number of connections to a district heating network** | % of buildings | Number of houses connected to a district heating network of the city | 53.2% |

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## 3.8 Urban infrastructure characterisation

There is significant work to be done on the existing infrastructure so that it could be used for smart solutions. The upgrades have already started when speaking of the public lighting system. New luminaires are being installed to optimize energy use and be a better lighting source than the obsolete system. Bus stations will be adapted with smart solutions which will enable a better transport system. The waste management system is being upgraded as described above, and the parking system is a test bed for pilot projects which bring new improvements. Every smart solution which has to be integrated in the existing infrastructure has a certain financial weight to it, and is being carefully planned and developed. WiFi is accessible for everyone in the City of Rijeka center and it has been enabled by the city. Internet has become regarded as a necessity for work and leisure, so good connectivity and speed have become a requirement, so that checking e.g. parking availability, congestion, can be checked in real time. Rijeka is following that direction.

### 3.8.1 Lighting management

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Lighting system connected** | YES/NO | Is there an automated lighting management system in the city? | NO |

### 3.8.2 Lighting management

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Waste management system** | YES/NO | Is there an automated waste management system in the city? | NO |

### 3.8.3 Traffic management

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Traffic management system** | YES/NO | Is there an automated traffic management system in the city? | YES |
| **Parking management system** | YES/NO | Is there an automated parking management system in the city? | YES |

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| | | | |
|---|---|---|---|
| **Public bicycles management system** | YES/NO | Is there an automated public bicycles management system in the city? | NO |
| **Public transport management system** | YES/NO | Is there an automated public transport management system in the city? | YES |
| **Number of public transport stops with real time info** | % | Number of public transport stops with real time information. ICT applied to public transport needs accuracy and territorial coverage | 2 |


**Figure 11. Parking management system: no. of free parking spaces in City-owned parking lots and garages;** *source: https://www.rijeka-plus.hr/*

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### 3.8.4 Liveability of neighbourhoods

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Use of groundfloors** | $m^2$ | Liveability of neighbourhoods | n.a. |

### 3.8.5 Green spaces

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Green and blue space** | $m^2$ | Nature and recreation possibilities | - |

### 3.8.6 Communication infrastructure

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Access to public free WiFi** | % | Attractiveness, accessibility of online services | 3% |
| **Access to high speed internet** | % | ensure good city connectivity and the provision of efficient digital infrastructures | 11.63% |
| **Number of phone connections per 100,000 inh** | Connections/ 100.000 hab. | Total number of cell phone connections in the city in relation to the population of the city | 105,000 |
| **Number of Internet connections per 100,000 inh** | Connections/ 100 000 hab. | Total number of internet connections in the city in relation to the population of the city | 59,000 |

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**Figure 12. Three Free Wi-Fi zones in Rijeka: Center, swimming pool complex Kantrida and University Campus Trsat;** *source: https://www.rijeka.hr/servisne-informacije/free-wi-fi-rijeka/*

### 3.8.7 Urban Platform

| Indicator title | Units | Description of the indicator | RIJEKA |
|---|---|---|---|
| **Cybersecurity** | Qualitative Likert scale | Data protection, security of ICT systems | 3 |
| **Data privacy** | Qualitative Likert scale | The level of cybersecurity of the cities' systems | 3 |
| **Number of data publishers** | # | Number of data publishers that publish data into the existing urban platform<br>*(1) City of Rijeka (iURBAN), (2) Autotrolej (buses), (3) Rijekaplus (parking), (4) Rijeka promet (traffic load) | 4* |
| **Number of sensors/devices connected**** | # | Number of IoT sensors/devices from any field that are connected in the current urban platform<br>*150 measure devices (iURBAN)<br>160 buses and 20 induction loops | Cca. 350* |
| **Number of services** | # | Number of available services in the current urban platform | 2* |

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| | | | |
|---|---|---|---|
| **deployed** | | *Bus movement, parking | |
| **Number of available Open APIs** | # | Number of available APIs in the current urban platform<br>*Parking lots | 1* |
| **Number of available Open Data sources** | # | Number of available Open Data sources in the current urban platform<br>*The open Data portal contains app. a 100 resources but not all urban | Cca. 20* |
| **Number of accesses to the urban platform APIs** | # | Number of accesses that have been made into the APIs of the urban platforms | No such statistic available |

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# 4. Applying strategic analysis

## 4.1 Replication plan update

Associated with document Ref. Ares (2016)5909815 - 13/10/2016

### 4.1.1 Main targets of the SEAPs or other relevant urban planning

Regarding SEAP the City of Rijeka has undertaken a responsible commitment to base the city's energy sustainable development on principles of energy efficiency, sustainable building and use of renewable energy sources and is therefore taking the following actions:

- Continuously implementing programmes and projects promoting energy efficiency and the use of renewable energy in buildings owned by the City;
- Encouraging programmes and projects aiming to reduce fuel consumption and improve the quality of urban transport;
- Implementing measures, projects and programmes to improve the energy efficiency of public lighting in the territory of the City;
- Planning the City's development according to principles of sustainable energy and environmental sustainability;
- Promoting continuous information and educational activities and campaigns about ways to increase energy efficiency and reduce CO2 emissions, to raise the citizens' awareness about the need to save energy in their daily life and work;
- Supporting programmes and initiatives promoted by natural and legal persons to increase the use of renewable energy;
- Promoting local energy production.

Looking more broadly, the strategic vision of the City of Rijeka is based on the following aspirations:

- Jobs and a competitive economy supported by close connections with the City Administration and the University
- Reliable and modern utility infrastructure that includes a wide application of ecological energy sources and up-to-date technologies
- Comprehensive social policy and investments aimed at enhancing the quality of everyday life, thus achieving security and satisfaction among all generations

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### 4.1.2 Which actions and solutions (technical and non-technical) that are going to be implemented in mySMARTLife project are already in the city planning for a near future?

**Building and Districts:**

- Smart lighting

The following investments are planned for the period 2018-2020: installation of new public lighting in the street A.K. Miočića, reconstruction of public lighting in the street Nova cesta, and reconstruction and installation of public lighting in the street Liburnijska. The investments are planned in the amount of over 3.5 million HRK.

- PV, Solar Thermal

Installation of photovoltaic panels on the MC Čistoća (waste management) garage which will enable water heating for the company facilities is expected in the period 2017-2019, as well as the installation of photovoltaic panels on the roof structure of the future facility for waste separation with the aim of producing energy for the company's needs.

- Retrofitting projects – public & residential buildings

According to the City EE Action plan [5], 17 public buildings will be reconstructed in various extent. The planned activities in the period of the next 2 years include ETICS (External Thermal Insulation Composite System) façade systems, heat insulation, replacing window joinery, installation of systems for remote reading of energy consumption, biomass boilers and many others, in order to improve EE of the buildings.

Retrofitting of residential buildings (private ownership) is co-financed from the national Fund for the Environmental Protection and Energy Efficiency. The dynamics of reconstructions and buildings involved depended on the owner(s) decision to take part in the public call. The last call ended on 31st January 2017, with total of 596 eligible projects proposals, worth over 1 billion HRK, and co-financed with 560 million HRK grants [6] (national level data) until 2020.

**City Infrastructure**

- Optimisation of the heating network

The phase I of the reconstruction of the heating system in the City of Rijeka, started in 2015. Phase I consists of building a new energy plant on Trsat (part of town), reconstruction of 6.5 km of heating lines and 20 heating sub-stations. All project documentation is prepared and 1.5 km of heating lines have been restored. The rest of activities in phase I will be carried out in the next 2 years (starting in 2017 and will end in 2019).

- Smart metering & Smart Meter data management

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Smart meters that monitor water, electricity, gas and heat consumption were installed on 26 buildings owned by the city of Rijeka. For private households, smart meters were installed in 8 homes as part of the EU project FIESTA (Families Intelligent Energy Saving Targeted Action) [7]. At this moment there is no possibility to install more meters in private households because of private ownership.

**Mobility**

- Replacement of diesel bus fleet by CNG-fuelled vehicles

In the past years, the city of Rijeka has started to replace its diesel bus fleet by CNG-fuelled vehicles and the plan is to procure 52 more buses, mainly on CNG, and several more on diesel fuel because of the geographical position of some locations in the functional urban area that are not fitted for CNG buses. 4 public electric stations were installed in the city, as well as some privately owned (e.g. on gas stations) which enable free charging of vehicles. The city utility companies procured several field vehicles which run on gas or electricity for daily city maintenance activities, and the older fleet will continuously be replaced with more eco-friendly vehicles. 2 smart bus station were installed (as pilots), and it is planned to equip every bus station of the public transportation system with IT displays with notification on bus arrivals.

**Non-Technical Actions:**

- Citizens' participation for energy efficiency; Evaluation of the participation processes

Since 2011, the City of Rijeka with its partners (MC Energo d.o.o., Cezar Association, and Regional Energy Agency (REA) Kvarner organizes 'Rijeka Energy week' as part of the Sustainable energy week. Around 30 workshops are organized every year for citizens and experts with the aim of informing about the advantages of sustainable energy development by using renewable energy sources, energy effective and clean technologies and stimulation of development and application of renewable energy in the county Primorje – Gorski kotar.

**ICTs:**

- Open data platform

The open data platform is being developed by the City of Rijeka Information Technology Department. There are currently a 106 sets of data published on the platform, and the plan is to develop the platform even more, and to publish more sets of data which the citizens consider a necessity, useful and interesting.

### 4.1.3 Which actions from the set of actions that are going to be implemented in mySMARTLife project are closer to the city interests, so could be replicated in the future?

**Building and Districts:**

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- Smart lighting; PV, Solar Thermal; Retrofitting projects – public & residential buildings

The City of Rijeka has been very active in retrofitting public buildings in the last period, but has also supported national programs for subsidies which enabled new facades, window joinery and roof retrofitting in the past. The private buildings mostly rely on national programs (Fund for the Environmental Protection and Energy Efficiency) for retrofitting for larger investments, so the city is interested in the renovation of multi owner buildings and how to accelerate it.

**City Infrastructure**

- Smart metering & Smart Meter data management; Optimisation of the heating network

Solar energy and biomass boilers have already been planned for public buildings and the optimization of the district heating network and it is interesting to learn from the experiences of Hamburg including energy storage solutions on building and district level.

**Mobility**

- e-public transportation system (e-buses and smart stations)

E-buses will not be an option soon considering the plan to use mostly CNG fuelled public transportation in the future, but field utility vehicles have started being changed by e-vehicles for city maintenance. Smart stations are interesting for the city of Rijeka, with 2 pilots already in place, to see how the new technologies could improve urban co-existence.

**Non-Technical Actions**

- Citizens' participation for energy efficiency; Evaluation of the participation processes

The City of Rijeka is interested in learning more on citizen's participation in energy efficiency, and sharing their experience from the Energy week.

**ICTs:**

- Open data platform

Evaluation of participation processes, urban platform, community on the move, Hamburg Cloud (Open Data, Citizen Topics).

### 4.1.4 How will the financing be of selected actions? Other programmes are envisaged like ESIF or ERDF funds?

All mentioned actions are to some extent also Investment priorities in the Croatian Operational programme Competitiveness and Cohesion 2014-2020.

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The programme allocates funds mostly from the ERDF. Some projects will be funded in connection to the Rijeka Agglomeration which will finance activities with the ITI mechanism – Integrated Territorial Investments (i.e. procurement of new buses, installation of IT equipment on bus stations). Further development of Open Data and GIS platform is planned to be co-financed from the city budget.

#### 4.1.5 Which stakeholders (local, regional or national) are close/engaged to the city to support the city transformation?

- City of Rijeka
- Primorsko-goranska County
- Local Utility Providers (specified for every smart action)
- National Utility Providers (specified according to smart action)
- REA Kvarner (Regional Energy Agency)
- CEZAR - Association for EE promotion
- PORIN – Local development agency
- Innovation Cluster - Center of competence for the Smart Cities – Coc Smart Cities
- NGOs/Citizens

## 4.2 Selection of smart actions

The preliminary replication plan is adjusted with the city objectives and strategic documents (e.g. The Development Strategy of the City of Rijeka 2014-2020, SEAP). The actions and solutions from the preliminary replication plan were selected, and the list of smart actions for the PESTEL analysis has been reduced. Altogether 6 smart actions were recognized as those which should be finally maintained (Table 2). These actions are listed below and are detailed in the following PESTEL analysis sub-sections:

In the field of **MOBILITY:**

- Smart Action 1 – to Implement smart bus-stations and smart traffic platform

In the field of **CITY INFRASTRUCTURE:**

- Smart Action 2 – to develop smart public lighting system
- Smart Action 3 – to implement a smart metering and its smart meter data management system
- Smart Action 4 – to implement urban RES integration with solar panels (PV and thermal) technology into the city-owned buildings: energy storage and sharing

In the field of **NON-TECHNICAL ACTIONS:**

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- Smart Action 5 – to actively engage citizen involvement/participation into the projects related to energy efficiency and energy savings and to evaluate that actions.

In the field of **URBAN PLATFORM AND ICT DEVELOPMENTS**

- Smart Action 6 – to develop an open data GIS platform

This doesn't include 3 actions that had been preliminary listed. These discarded actions and reasons for elimination are provided in the following overview:

In the field of **DISTRICT & BUILDING**: Retrofitting projects – public and residential building

Action plan on energy efficiency for the City of Rijeka (2017-2019) envisions the reconstruction of 17 public buildings. In general, the project contains following actions: ETICS façade system, heat insulation for the roof, window joinery, installation of thermostatic valves, modernisation of the lighting system, and system for remote reading of energy consumption etc. (detailed specifications of reconstructions for every building are provided in the Action plan). Since this actions are already in the implementation stage, all previous analysis have been completed. There is no need to conduct additional analysis for the action already in the implementation stage, and set as a priority in the urban development.

The retrofitting and renovation of private residential buildings rely on national funding programs (Fund for the Environmental Protection and Energy Efficiency) as mentioned before, and cannot be managed by the City, only promoted and encouraged. These actions also depend on the financial abilities of the homeowners. So, the retrofitting of the residential buildings in private ownership is the matter of national policy and residences' decision. Moreover, the last call for co-financing residential retrofitting projects, as already noted, ended on 31st January 2017. Since the City of Rijeka has no competences in this mechanism, except of promoting it, the feasibility of the respective smart action could not be a part of local policy scope. In that regard, the results of the PESTEL analysis could not contribute to the smart action prioritising, because City of Rijeka, as a local authority, has no influence on the country level acts and measures. Limited City budget does not allow co-financing the retrofitting of the residential buildings from local public funds.

In the field of **MOBILITY**: E-buses implementation

The objective is to continue with the replacement of diesel-fueled public transportation vehicles (buses) with CNG-fueled buses. Overall 30 CNG buses were in use by 2017, and 10 new CNG buses were procured. The process of replacement of fossil-fuelled buses with the CNG-fuelled has already started and will continue in the future. At this time the procurement of electric vehicles at City level is planned for Municipality companies for waste, water, heating and traffic management. The decision of the authorities on public transport in the city of Rijeka is to, for now, continue with replacing the old bus fleet with more eco-friendly buses that run on CNG, and to keep several buses on diesel because of the land configuration. E-vehicles and hybrids are encouraged by the city government and free charging is

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provided for owners on several charging stations, as well as free parking on the city managed parking lots. As the city started building the infrastructure for CNG buses a few years ago and is still developing it, there are no plans to discard the work achieved and replace it with new infrastructure.

In the field of **CITY INFRASTRUCTURE**: Optimization of the heating network

The optimization of the heating network, recognized as one of the city level top-priorities, has started in 2017. It consists of building a new energy plant, reconstruction of 6.5 km of heating lines and 20 heating sub-stations. All project documentation is prepared and 1.5 km of heating lines have been restored. The rest of activities will be carried out in the next 3 years. This action is already planned by phases and the 1st stage already started. Holder of the EE heating network project is MC Energo d.o.o.

As for the cooling network, there is no existing infrastructure for supporting such activities, neither on local nor on national level.

**Table 2: Selection of smart actions**

| DISTRICT/BUILDING | CITY INFRASTRUCTURES | MOBILITY | NON-TECHNICAL ACTIONS |
|---|---|---|---|
| Domotics & Smart Controls | Smart Grids | Electric Vehicles | Policy Improvements |
| | Smart metering and Smart meter data management | Smart bus-stations and smart traffic platform | |
| Building Integrated RES | District Heating | Charging Stations | Inovative Businesses |
| | | | |
| Storage | Public Lighting | Demand mgt: eV ⇔ Grid | Urban Planning |
| | Smart lighting | | |
| Retrofitting | Urban RES | Urban Freight (Logistics) | Citizens' Engagement |
| | PV panels: energy storage and sharing | | Citizen involvement/participation in energy savings |
| New Buildings | Thermal Storage | Multi Modality | Staff Exchange |
| | | | |

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| | |
|---|---|
| Electrical Storage  | I.T.S  |
| | |

| URBAN PLATFORM AND ICT DEVELOPMENTS | |
|---|---|
|  Urban Platform | -  IoT |
| Open data & GIS platform | |

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# 5. PESTEL analysis

## 5.1 Methodology

The purpose of this document is to update the replication plan. It is therefore necessary to analyze the selected actions in an urban context. Thus, one objective is to identify the opportunities and the barriers to the implementation of these actions. This will make it possible to study the feasibility of their implementation, but also to give priority to actions with a favorable context and to raise the barriers for other actions. The actions with a difficult context can then be compared with similar actions set up in partner cities and solutions can be sought to overcome the identified barriers. Use of PESTEL tool in the earliest stage, can be done to meet these objectives.

The objective of the PESTEL analysis is to evaluate the feasibility of each smart action considering the different Political, Economic, Social, Technological, Legal and Environmental implications for each. It consists to assess the strategic viability of the different actions based on a series of questions. The methodology, and specifically these questions come from the STEEP deliverable "D2.3 Guidelines for prioritising interventions" [8] which aims to provide a set of guidelines and principles that can be applied in any city for prioritising interventions regarding energy efficiency.


**Figure 5: PESTEL Analysis**

In order to evaluate actions regarding each fields it is required to provide evidence regarding the success of this particular intervention to give this a 'score'. On this Project, as on the STEEP Project, 5 level score

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is used represented with a specific color. Performance of a given action is rated from 'exemplary' to 'best practice', 'good practice', 'minimum standard' and finally the 'sub-standard'. The higher the environment (incentives or lack of barrier) is favorable to the development of the solution the higher will be the score. In some cases it may be difficult to understand the question this way, then answer considering that: if the solution and the environment go both towards the same positive direction, then the score is high. The objective of this score is not to assess the performance of the city in overcoming the barriers, but a score to help the decisions about implementing or not a new action and also to prioritise these actions.


**Figure 6: Scoring method inspired from STEEP D2.3**

When all selected actions would have been evaluated with PESTEL analysis it would be then possible to prioritise some specific actions. To overcome identified barriers, solutions will be sought from partner's cities. Such inspired solutions will be then added to the replication plan.

## 5.2 PESTEL analysis for Smart action 1: Smart bus-stations and smart traffic platform

### 5.2.1 Short description

This action aims to build a smart bus-station network for public transport supported with innovative systems for integrated traffic management in the urban area. The central information system for traffic management will collect, process and make accessible all available information related to the public transport system.

Objectives of the smart action are to:

- Improve passenger information system by providing static and dynamic (real-time) information on public transport (i.e. bus location, time of arrival)
- Enable the future development of intelligent urban mobility in the city of Rijeka
- Implement energy efficiency measures in public transport upon monitoring and coordinating traffic actions, in order to reduce greenhouse gases emissions in the city area.

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### 5.2.2 Political Factors

Stakeholders involved for the operational implementation of the smart-action

The actors of the implementation of this action are mainly involved in the city and urban transport network management:

- City of Rijeka
- MC Autotrolej d.o.o. - Municipal Company for Public transport
- MC Rijeka promet d.d. – Municipal company for management of city road network
- Center of Competence (CoC) for Smart Cities – Innovation Cluster
- Smart Ri d.o.o. – City of Rijeka-owned company for management and strategic development, founded to manage the CoC for Smart Cities
- NGOs

⇨ This large number of **stakeholders** is representative of the openness of the local government to the innovative solutions. This item can be then evaluated as optimum with a **score of 5 out of 5.**

Existing political support for the implementation of the smart-action

The City of Rijeka is a founder and owner of Smart RI d.o.o. Company, which purpose is to manage 3-helix innovation cluster for Smart Cities. The CoC for Smart Cities connects industry and business entities, research institutions and local authorities into partnership committed to specific projects regarding smart city concept.

At broader level, county and national policies cannot be seen as obstacles in providing any of smart actions, especially when it may represent a flagship initiative. On the contrary, the national policy (i.e. Ministry of Economy) is generating an enabling environment for innovations at local level by co-financing the projects through different R&D-related programs. Both City- and County long-term development strategies are relying on (among others) knowledge, new technologies and innovation.

⇨ The **future proofing** is based on a strong strategy of knowledge and innovation. Such strategy is representative of best practice to the implementation of the smart-action and is evaluated with a score of **4 out of 5.**

Importance rate

Whereas the public passenger transport considers to be one of the utilities which demands continuous improvement in planning and adopting to users' variable needs, it is reasonable to expect that introduction of 'smartness' in public transport will be in the top of the citizens' interests, as well as supported by civil NGOs. Yet, in domestic socio-economic situation where more basic needs are remain unsolved,

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upgrading of the transport system may challenge political opponents, as well as part of the citizens, to question smart investments or disapprove their immediate application. This issue is close to the Social element in PESTEL, and has been more closely elaborated in that part of analyses.

⇨ Because of this delicate context with a ranking in the priorities, the **importance rate** of policy can be considered as moderate, which tends to put a score of **3 out of 5.** To overcome such barrier to the implementation of this action, a solution is to improve the public relations policy and political dialog.

### 5.2.3 Economic Factors

Current and short-term economic context (5 to 10 years) relating to the implementation of the smart-action.

Smart bus-stations, as a part of larger set of smart traffic actions, could be co-financed under the program of Ministry of Economy for Centers of competences development support. Minor part of financing would come from a private (business/industry) sector, e.g. from the CoC for Smart Cities actors involved in specific project.

The sources of private capital financing smart public transport actions are mainly owned by CoC members from regular business or retained earnings.

The reason why industries are interested to invest, even smaller amounts of their own capital, in smart-but-public solutions, is the fact that they are representing a whole new market with an unfailing potential. Being the first providers of smart solutions in urban area, and also developers and researchers in the national ground, set the position of Coc members for future projects and actions in wider region, or beyond that. It is also additional reference for being involved in other EU or transnational projects in which the experts from smart industry fields are needed.

⇨ Such economic perspective is propitious for a new market for Smart City solutions. It is representative of best practice to the implementation of the smart-action and is evaluated with a score of **4 out of 5.**

Private financing mechanisms identified for the implementation of the smart-action

CoC for the Smart Cities, established in Rijeka in 2015, consist of 20 member. 2 of them are large international companies, while rest (10) are SMEs. They all belong to ICT sector and have successful and profitable businesses.

As mentioned before, in order to explain the economy cycle, part of financing for particular smart actions in public transport would be from private sources, i.e. partners' regular business or retained earnings. In specific cases (mostly considering minor enterprises), source of self-financing could be bank loans.

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⇨ The encouraged use of the funding offered by EU funds and programmes is a good opportunity for private businesses to develop and to implement smart solutions, in case of healthy business situation. The private financing is evaluated with a score of **3 out of 5.**

Local impact resulting from the implementation of the smart-action (startup creation, city employee…)

Building a smart public transport solutions (bus-stations and platform) has a huge local impact in every manner. Regarding local economy, there is several possible benefits that may occur while planning and implementing this smart issue:

- Business improvement of local SMEs participating in CoC for Smart Cities actions.
- Increasing of public transport efficiency may affect to higher population mobility (residents and tourists) and better personal time management. Those circumstances may lead to increased consumption of goods and services inside the urban area.
- The smart traffic platform, as an open platform to be constantly upgraded, could be enhanced in the future with new applications or functions. Ones established smart solutions may stimulate new ideas to be applied, especially those coming from the fresh and flexible local sources (start-ups, micro businesses, free lancers…).

The system will allow the development of solutions for sharing resources, infrastructure and property (public-private collaboration model) based on *Sharing Economy* principles.

⇨ Such system will allow a smart specialisation and mobility. Such local impact is representative of best practice to the implementation of the smart-action and is evaluated with a score of **4 out of 5**.

### 5.2.4 Social Factors

Impact of the implementation of the smart-action in healthy lifestyles and wellbeing

Smart bus-stations and supporting platform will enable optimisation of public transport system, leading to decrease emissions of greenhouse gases generated by public vehicles.

In long-term perspective, this action along with related actions managing urban traffic system, may produce alternative public or public-private transport solutions within *Sharing Economy* practices.

Also, depending on range of the containing features smart bus-stations will be able to provide to its users (citizens, tourists), it is reasonable to believe that the quality of life in the urban area will be taken forward.

⇨ Such smart-action will improve everyday life of the community. Regarding the social community item it can be then evaluated as optimum with a score of **5 out of 5.**

Impact of the implementation of the smart-action in equality promotion

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The smart bus-station network and supporting platform (passenger information system) addresses the users of public transport, regardless of their age, abilities, education, or habits. It this manner it makes no difference between the users. This action is focused to maximize the comfort of public transport usage, and by collecting and analysing gathered information – to make it more efficient.

However, the users of public transportation have unequal level of skills or preferences to innovative technologies and solutions, and by that some of them may refuse to consume new technology. Also, many of elder citizens or those with the lower living standard will not be in position to use smart options delivered on smart-devices (such as smart phones or tablets). In that regard, the smart bus-stations need to be designed to allow as wide range of information and services as possible on-site. Moreover, the promotion and accessible education (e.g. open workshops, volunteers, info-flyers) have to be in the back-up of action planning and implementation.

⇨ Regarding the equality of the smart bus-station network and supporting platform but in return the unequal level of skills or preferences for the handling of such technological platform, equality can be evaluated as medium with a score of **3 out of 5.** To create the 'Smart users', systematic education and communication must be provided or/and initiated by the local government.

Other impact of the implementation of the smart-action

A national social and economic situation is still very affected by the recent recession which lasted longer than in majority of European countries. One of the many negative effects resulting is defeatism and pessimism of population, and distrust in Government at all levels. This atmosphere may cause lack of citizens' support for smart projects focused on wide range of population, and rise suspicions of project transparency. In another words – even the end-users' needs for optimisation of the public transportation may exist, the public opinion could get against it because some of the social and economic priorities (not necessary in the local government jurisdiction) are not satisfying (e.g. unemployment rate, poor entrepreneurship environment, high taxes, basic local infrastructural object still unrealized, etc.). This issue could only be solved by constant and profound PR policy.

⇨ This public disapproval makes the **public opinion** as a worst case to implement this smart action and is evaluated with a score of **1 out of 5**. To overcome such barrier solutions are to :

- Improve the Citizen collaboration system
- Establish new communication channels
- Ensure two-way communication flow
- Empower Local Community Councils

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### 5.2.5 Technological Factors

Technologies currently deployed and linked to the smart-action

At the present time, there is no technology embedded in public transport bus stations, in the city of Rijeka. The information for passengers are displayed on the stations' billboards, and can't be found at every bus station of public transportation network. Static information are provided at web site of City Company for Public transport – MC Autotrolej d.o.o. 2 pilot smart bus stations are built in the city center in October 2017. They will serve as guidelines for the future investments in the smart public transport infrastructure.

⇨ Except for the 2 smart bus stations now in the pilot stage, there is no other technology solutions installed as a part of public transport system, resulting with a score of **2 out of 5**.

Synergy resulting from the implementation of the smart-action: Study of the possibilities of replacement or change.

The smart bus stations are single entry points where all the information regarding public transport can be provided to citizens and tourists. The type of the provided content does not need to stay only in the field of public transport, but also the other content regarding city data could be provided by this interface. Also, interactive working mode is one of the possible capabilities that could enhance public transportation system, make it 'smarter' and more contributing to community.

⇨ Smart bus station may become an info points for tourists and residents. Open IT solutions allows upgrading and adapting to new demands, so the rating is **4 out of 5**.

Effectiveness of the smart-action on the market ("market-proof")

Improving public transport with smart bus station system is not the latest urban innovation. Many cases from Europe approved this step in the process of urban transformation.

⇨ Smart public transport system is building block of the smart city transformation. Every urban ecosystem needs to adopt it in order to make this transition, which is why the score is **5 out of 5**.

### 5.2.6 Environment Factors

Impact of the smart-action on air quality, noise and GHG emission standard

Background output from smart bus stations network implementation is optimisation of the urban traffic system. By collecting and analysing data from public bus transport, the system could be modified to work in more efficient way. This optimisation could certainly reduce the level of GHG and noise. Also, in case of full functionality and reliable system, the citizens may decide to replace personal vehicles with the public transport, or to shorten their everyday routes.

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⇨ In the field of public transport the main factor that impacts on air quality is the fuel used by the public transport vehicles. Since the CNG-fuelled buses won't be replaced with the e-buses in the near future (partly because of hilly landscape not suitable for e-buses), the improvements can be done by reducing or optimizing the transport routes, as result from the monitoring and coordinating traffic actions. In addition, using cars could be reduced in favour of using buses. This action impact is scored **4 out of 5.**

Impact of the smart-action on energy consumption

Besides the positive effects that optimisation of public transport system may generate by building of smart bus stations, it is reasonable to expect lower bus-fuel consumption (CNG, diesel). Solar smart bus stations (as an optional solution) could label this project as fully energy sustainable.

⇨ The fuel consumption savings are direct implication of the public transport system optimisation. Within existing CNG-based fleet, this is consider to be the best way to achieve lower level of energy consumption. In addition, smart bus stations could have zero energy consumption. According to that, the score is **5 out of 5**.

### 5.2.7 Legal Factors

International and national standards

The Croatian transport system is relevant for the macro-regional strategic established through the Macro-regional Strategy of the EU for the Danube region (EUSDR), the EU Strategy for the Adriatic-Ionian region (EUSAIR) and the thematic pillar "Connecting the region (transport and energy)". The Republic of Croatia adopted the Strategy for Smart Specialisation for the Republic of Croatia 2016-2020 and the corresponding Action plan identifying 5 thematic priority areas, one of them being Traffic and mobility, with the horizontal themes KET and ICT. Intelligent transport systems (ITS) integrate telecommunications, electronics and information technologies with traffic engineering to plan, develop and manage transport systems [9].

The development of ITS was increased when the Republic of Croatia joined the EU, because of the need to harmonize the national legislation with the European (e.g. Directive 2010/40 which prioritizes norms and standards such as optimal use of traffic, road and travel information, continuity of traffic and freight management, apps for road safety, connecting vehicles with traffic infrastructure implemented in the Law on roads NN 84/11, 22/13, 54/13, 148/13, 92/14.) The thematic priority is further developed in the Strategy of transport development for the Republic of Croatia 2014-2030 citing specific priorities for investments and development in the country, and the basis of the Sustainable energy action plan of the City of Rijeka, following with specific goals to be achieved by 2030. in the field of energy consumption, reduction of $CO_2$ and the connection between energy and environment and the city's, or functional urban area's traffic and transport. This also for the wider area surrounding the city of Rijeka, not covering the whole County of

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Primorsko-goranska which Rijeka is a part of, but the Rijeka Agglomeration of 10 municipalities with 320 km of roads between them [10].

The plan of the Strategy of the Rijeka Urban Agglomeration, in further development of the priority Transport, was to highlight the need for upgrading bus stations with ICT equipment and to then develop more innovative solutions in public transport infrastructure [11].

Financing these goals through the ITI mechanism should help tackle the 3 key factors slowing the innovations development: tax system, lack of primary and secondary phases of financing and business environment.

⇨ Legal framework not only allows, but also encourages the smart transport initiatives. Strategies, Action plans and other measures stimulate all stakeholders to be engaged in joint activities related to public transportation improvement. It implies a financing and collaboration models for planning and implementing smart solutions in field of public transport. It represent a good basis to score this element with **5 out of 5**.

Need for new legal frameworks and policies. Study of the local authority power/competence for the smart-action implementation

In accordance to the Law on Energy Efficiency (NN 127/14), all counties and big cities (>10.000 citizens) in the Republic of Croatia are obliged to enact the 3-years Action Plans on Energy Efficiency and Energy Consumption. The City of Rijeka is classified as big city with a number of inhabitants more than 128.000, and so is obligated to develop the Action plans every 3 years. The recent Plan is made for the period 2017 – 2019, and (among other topics) is containing an overview of the measures related to EE of city transport. City of Rijeka Action plan on EE is a short/mid-term tool, harmonized with EE strategies on national and local level, which allows selection and rational planning of upcoming actions in compliance with local level priorities.

All above mentioned strategic and operative documents ensure and encourage implementation of smart solutions in public transport. At this moment Master plan of Northern Adriatic Region transport development is being prepared. The Masterplan will stand as strategic pillar for all future projects in the field of transport, and will enhance the possibility of EU funding. Even the specific topics of the Masterplan are not yet revealed, it is expected that the inclusive measures support smart solutions in urban transport system, and have the ability to be synergized within.

Another legal/ethical aspect of smart bus station system is coming from everyday use in their micro locations. Building of smart bus stations as public good, accessible to everyone, brings also the risk of devastation from irresponsible individuals, which may cause significant material damage to the community. Although the legal measures for devastating of City property exists, the perpetrator could remain unknown. By embedding the security surveillance system into the smart bus stations this problem

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could be prevented, but it also reveals the ethical issues (monitoring and control, freedom of movement...). Also, this magnifies the amount of investments and may impact on economic cycle length.

⇨ Direct influence of local authorities on urban transport system development enables adopting of new and specific solutions tailored by environmental and community demands. In the field of privacy protection national regulations must be adopted. Considering that, the score is **4 out of 5**.

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### 5.2.8 Synthesis of the PESTEL analysis

**Table 3: PESTEL summary and score for Smart bus-stations and smart traffic platform**

| PESTEL Analysis | | Main barriers and opportunities | Score |
|---|---|---|---|
| **Political** | Stakeholders | Openness of the local government to the innovative solutions | 5 |
| | Future proofing | Strategic development based on knowledge and innovation | 4 |
| | Importance rate | Ranking of priorities | 3 |
| **Economic** | Local impact | Smart specialisation and Mobility | 4 |
| | Financing | Encouraged use of the funding opportunities offered by EU funds and programmes | 3 |
| | Perspective | New market for Smart City solutions | 4 |
| **Social** | Equality | Creating the 'Smart users' | 3 |
| | Community | Improving everyday life | 5 |
| | Public opinion | Public disapproval | 1 |
| **Technological** | Currently deployed technology | No existing IT solutions – 2 pilot smart stations | 2 |
| | Synergies | New solutions and improvements | 4 |
| | Future proofing | Contributing Smart City transformation | 5 |
| **Environmental** | Pollution reduction | Traffic system optimisation | 4 |
| | Energy consumption | Energy Sustainability | 5 |
| **Legal** | Existing framework | Smart specialisation strategy S3 | 5 |
| | Power and scale | City 3yr Action Plan on EE | 4 |

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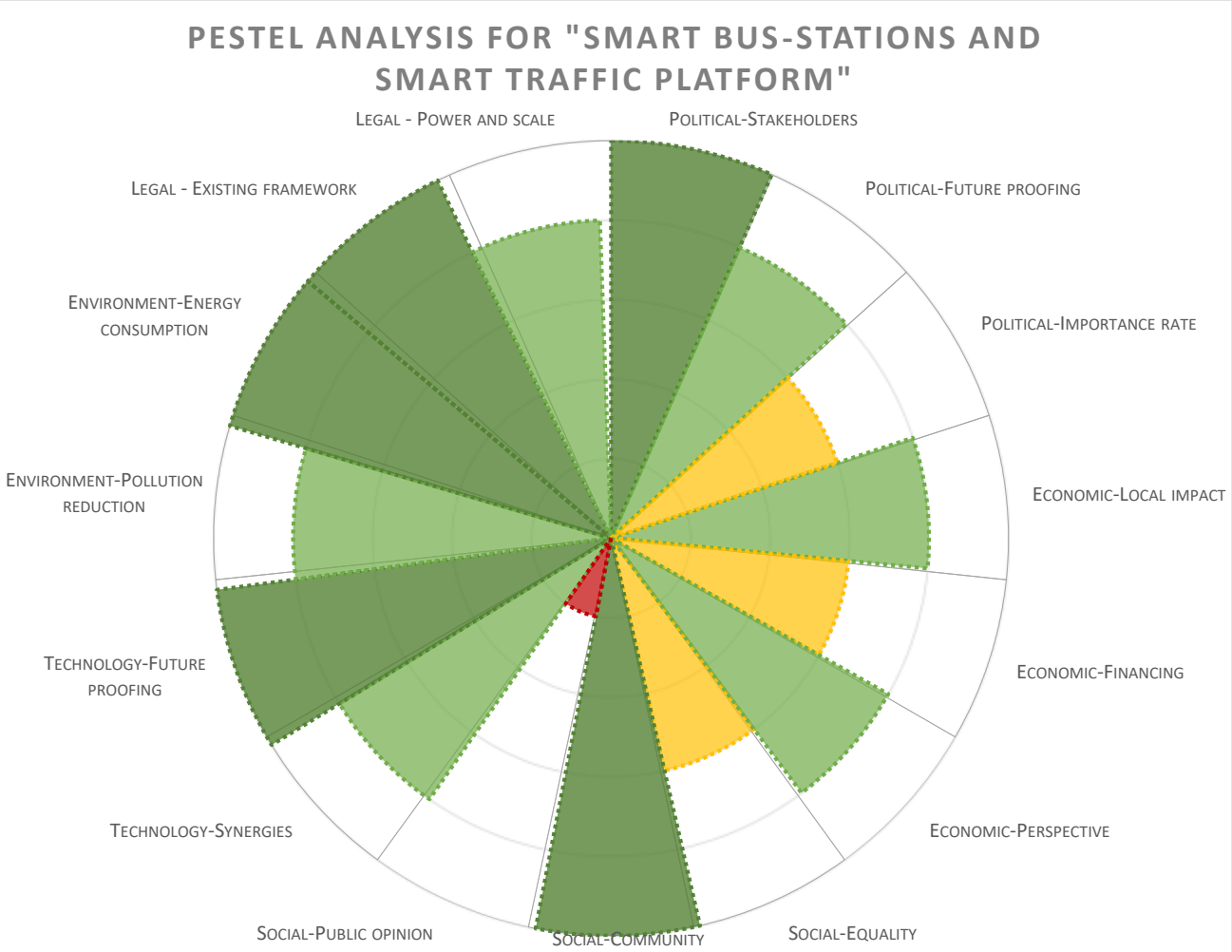


**Figure 7: Synthesis of PESTEL analysis for Smart bus-stations and smart traffic platform**

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**Table 4: Solutions to overcome barriers**

| PESTEL Analysis | | Main barriers | Solutions to overcome barriers |
|---|---|---|---|
| **Political** | Stakeholders | - | - |
| | Future proofing | - | - |
| | Importance rate | Ranking of priorities | Public Relations policy improvement and political dialog |
| **Economic** | Local impact | - | - |
| | Financing | - | - |
| | Perspective | - | - |
| **Social** | Equality | Creating the 'Smart users' | Systematic education and communication provided or/and initiated by the local government |
| | Community | - | - |
| | Public opinion | Public disapproval | Improvement of Citizen collaboration system<br>Establishment of new communication channels<br>Ensuring the two-way communication flow<br>Empowerment of Local Community Councils |
| **Technological** | Current Technology | No existing IT | Proceeding with pilot projects |
| | Synergies | - | - |
| | Future proofing | - | - |
| **Environmental** | Pollution reduction | - | - |
| | Energy consumption | - | - |
| **Legal** | Existing framework | - | - |
| | Power and scale | - | - |

## 5.3 PESTEL analysis for Smart action 2: Smart Public Lighting

### 5.3.1 Short description

The smart lighting system presumes the possibility of remote control and management (lighting/turning off/strength regulation) of every particular lamp in the system. Also, smart lighting can be upgraded by adding additional sensors (temperature, humidity…) which could then be used by other systems for increasing the quality of living for all citizens.

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For the Rijeka public lighting system it would mean replacing all existing lamps (app.15.500) with new LED lamps which have the above mentioned possibilities. The available technologies of the smart public lighting systems mostly use wireless GPRS technology.

Smart public lighting opens possibilities such as:

- Advanced management
- Immediate detection of failure
- Simple turning off of parts of the infrastructure in need
- Regulation of strength according to now/planned needs
- Upgrades of the system with new sensors

The results of smart lighting are:

- Significant reduction in electricity consumption because of regulation strength effectiveness
- Significant reduction in maintenance costs
- Reduction of light pollution
- Reduction of CO2 emission.

### 5.3.2 Political Factors

Stakeholders involved for the operational implementation of the smart-action

- City of Rijeka;
- Energo d.o.o. – Public provider of thermal energy, gas and public lighting
- HEP ELEKTRA – Croatian national provider of electricity, Rijeka subsidiary
- REA Kvarner (Regional Energy Agency)
- CEZAR - Association for EE promotion
- NGOs/Citizens

⇨ This large number of **stakeholders** is representative of the existing political support. This item can be then evaluated as optimum with a score of **5 out of 5.**

Existing political support for the implementation of the smart-action

The city of Rijeka supports all activities connected to the promotion of new technologies which contribute to the reduction of energy costs and greenhouse-effect gas. The confirmation of politic support can be found in the fact that the city of Rijeka is one of the signatories of the Covenant of Mayors Initiative and

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has specific activities planned in the Rijeka SEAP (Sustainable Energy Action Plan), such as: 1) replacement of old luminaires with ones that are energy efficient and environmentally adequate; 2) management of the intensity of public lighting. Smart public lighting is connected to both measures.

We believe that no group has reasons to criticize the proposed action considering that the action contributes to the reduction of light pollution, the reduction of energy consumption and greenhouse-effect gas, and with the better visual identity of the city, it will be a success for all stakeholders.

⇨ The activities for smart public lighting for the near future are planned and revised by the Rijeka SEAP and the Energy Action Plan developed by the City and competent authorities so this item can be evaluated with a score of **4 out of 5**.

### 5.3.3 Economic Factors

Current and short-term economic context (5 to 10 years) relating to the implementation of the smart-action.

It is difficult to precisely define the economic activity cycle, since it depends on many factors, such as:

- Type of installed equipment,
- Equipment features and possibilities for upgrade
- Proposed quantity of luminaires to be installed
- Location, in the sense of replacing outdated lighting bodies with new, or, will the existing bodies be upgraded and in which ratio

From the above mentioned, it is evident that without specific information it is impossible to give a precise answer, but what can be determined are the estimated percentages and periods for the return of the investment. If for instance, the existing public lighting is reconstructed with the new led technology that has the possibility of reducing energy in late hours of the evening, the return of the investment can be expected in 8-14 years. This assessment includes savings in electricity and maintenance during the lifespan of the equipment. If on the other hand, the same lamps are used but with integrated smart management, the period for the return of the investment will be 5 years shorter. Today, already there is an economic justification for converting to LED light sources the outdated parts of public infrastructure. If a potential investor should decide for a smart lighting network, they would depend on additional co-financing. At the moment, the possibilities of co-financing investments in public lighting are limited. In the past, the situation was more favorable, because of the then existing national program for public lighting by the Fund for environmental protection and energy efficiency. The option for co-financing available now, are by the ESCO model or PPP (public-private partnership). Also, there is always the possibility that the national program will be started again and enable new investments. Co-financing can also be gained by

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some of the EU programs. This type of financing, in principle, has the highest rate of co-financing, but ensuring financing is very difficult because of the competition.

⇨ From this point of view, it is not possible to predict exact ROI period for Smart lighting action. According to approximations and professional experience, the evaluation is on the level of good practice, **3 out of 5**.

Local impact resulting from the implementation of the smart-action (startup creation, city employee…

The prerequisite, and the advice of expert with these types of investments is that the equipment procured is produced by renowned manufacturers. This benefits the suppliers of the equipment and promotes their competitiveness. With all said, the recommendation is that the system is 'open' for integration of additional elements of public lighting (that don't have to be of the same manufacturer) such as: traffic counters, air pollution sensors, wireless networks etc. This all opens the possibilities for local businesses to develop and place new, or improve existing products.

⇨ The local economy may provide a small number of manufacturer specialised in the lighting industry. However, better opportunities to benefit have IT-oriented and engineering SMEs. The impact can be rated as good practice, **3 out of 5**.

Private financing mechanisms identified for the implementation of the smart-action

ESCO models of financing mean co-financing through private mechanisms. Also, public-private partnership is a form of a private mechanism of financing. Experiences have shown that these models are more accepted by smaller local governments or bigger ones that are reconstructing only part of their infrastructure. The reason for this situation are the conditions of the ESCO model, still not precisely determined, or the long and complicated preparation of documentation (in the PPP). Also there are certain misgivings with the local governments because both models mean long term contractual commitments.

⇨ Insufficiently defined ESCO model with positions not suitable or perspective for both – private investors and local authorities makes this financing mechanism scored with **2 out of 5**.

### 5.3.4 Social Factors

Impact of the implementation of the smart-action in equality promotion

This action guarantees complete gender equality because it is carried out in public places which are equally available to all citizens regardless of age, gender or other differences.

⇨ Because this action does not generate any kind of inequality, the score is **5 out of 5**.

Impact of the implementation of the smart-action in healthy lifestyles and wellbeing

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This activity positively affects the increase in security and the improvement of the quality of life of the local community in several aspects. With the realisation of smart lighting we can effect: traffic safety because of the better illumination of streets which results in a reduced number of traffic accidents; the increase of safety of citizens from petty thefts and night attacks, the reduction of light pollution in night which ensures better sleep, a more normal biorhythm of birds inhabiting the city; the reduction of greenhouse and other harmful gas emissions in the atmosphere, which affects positively the local community's health, and the global reduction of man's influence on climate change.

⇨ Every aspect of smart public lighting is positively affecting on health and wellbeing. However, this impact isn't high like in other fields (transport, building), and is contributing only in the dark part of the day. That is why we scored this impact with **4 out of 5.**

### 5.3.5 Technological Factors

Technologies currently deployed and linked to the smart-action

Currently, the city of Rijeka is mostly illuminated by high pressure sodium lamps. The city of Rijeka has in the past years, intensively worked on replacing outdated light bodies with energy inefficient harmful high pressure mercury lams, and this type of lighting can seldom be found (in less than 2% of total light bodies). Rijeka also has a certain number of lamps which use the reduction of energy in late hours to save electricity and reduce light pollution and the greenhouse gas emission. Regarding the newest technologies, to this day there are 200 light bodies with LED technology installed in Rijeka. Also, there is an active pilot project with 22 LED lamps which have the possibility of wireless management and monitoring (smart lighting).

⇨ The existing public lighting system has no smart solutions integrated, except partly in the municipalities in Rijeka surrounding area (project STOPCO2), as a pilot actions. The recent installation of 22 LED lamps allows smart upgrades. For that reason the rating is **2 out of 5**.

Synergy resulting from the implementation of the smart-action: Study of the possibilities of replacement or change.

We are certain that this action will not disable other actions aimed at energy efficiency, on the contrary, it is considered that a good example will encourage new actions. The realisation of smart lighting in Rijeka encourages that the surrounding local governments adapt this modern concept as well. With the classic replicable actions, this project can encourage other activities from different sectors such as traffic, IT or ecology. Some examples of the actions which could be started:

- Development/installation of new sensors and applications of the existing infrastructure of public lighting

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- Sinergy with smart traffic routing regarding traffic density (according to data from traffic counters on public lighting poles)
- Actions for procuring eco vehicles
- Actions for renewable energy use
- Actions for control and prevention of air pollution from traffic, etc.

⇨ As can be seen, with the installation of smart lighting which has an open possibility for installing different sensors, a synergic effect can be achieved of several sectors, bigger than the sum of particular actions, so it is scored with **5 out of 5**.

Effectiveness of the smart-action on the market ("market-proof")

Smart lighting already exists as a concept, and has been tested through some minor and major pilot activities in the Rijeka area as well. Here we can mention pilot projects in municipalities Kostrena, Čavle and Viškovo (project STOPCO2) and the pilot project in Mihanovićeva street in Rijeka. Based on the available data, it can be concluded that the smart lighting can be implemented on many ways and of different manufacturers, which provides differences in possibilities, technology, price and upgrade options. All still have in common a high price compared to LED lighting (without smart possibilities) which prolongs the period for returning the investment. However, one has to have in mind that the value of smart lighting lies in ensuring a whole line of direct savings which are difficult to quantify (e.g. maintenance and repair when out of order). Also, smart lighting encourages the development of additional functions and applications which can contribute to energy savings, while classic LED lighting cannot.

⇨ With the pilots still in progress, the public lighting provider gain valuable information on how the smart lighting system can be constructed. The more experience – the more effective future lighting system could became. On the other hand, the expensiveness of the equipment is for sure a limiting factor. The score is, according to this, 4 out of 5.

### 5.3.6 Environment Factors

Impact of the smart-action on air quality, noise and GHG emission standard

Through the answers above, it was already mentioned that this action directly and positively affects the reduction of electricity consumption, and along with that, on global increase in air quality (less energy produced in thermo-energy plants). This action also has an effect on the reduction of light pollution – the influence of lighting on a person's biorhythm is decreased, and the animal and plant life in urban surroundings. The action marginally contributes to noise reduction considering the new LED lamps use electric drivers, compared to electromagnetic which irritate citizens in vicinity.

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⇨ With positive implications on GHG emission, this action brings improvements regarding another type of pollution, present in every urban area – a light pollution. For contributing on two pollutions types with the same action, this impact is scored with **5 out of 5**.

Impact of the smart-action on energy consumption

This action directly contributes to the reduced energy consumption of electric energy because it entails a more effective technology than the existing (more light from the source with a smaller consumption of energy), and indirectly considering maintenance which is quicker and less resource and energy consuming.

⇨ Both technology and maintenance of smart lighting system contribute to the savings in energy consumption. This is the optimum case, and so it is scored with **5 out of 5**.

### 5.3.7 Legal Factors

International and national standards

The Republic of Croatia has a Law on protection of light pollution from January 1st 2012, and the Law on energy efficiency from November 5th 2014. This law commits us to maintain and reconstruct public lighting in a way that reduces energy consumption, and in the same time, it is in compliance with the Law on the protection against light pollution. Also, when reconstructing public lighting systems, European (Croatian) provisions on illumination of roads for vehicles and pedestrians must be respected: EN13201.

⇨ The legal framework contains directions on how to manage public lighting systems in general. Within existing regulation we may consider this as the best practice, so it can be evaluated with **4 out of 5**.

Need for new legal frameworks and policies. Study of the local authority power/competence for the smart-action implementation

There is a need to define all the necessary sub-law acts and regulations which are noted in the Law on the protection against light pollution, which are not adopted to this day. Local governments in the Republic of Croatia have the authority and are responsible for managing the public lighting system in accordance with the above mentioned laws. Besides encouraging the competent ministries to take action, local governments have no competency to create their own regional laws or policies. So, the local governments have a limited influence on the resolution of the needs to adopt regulations according to the Law on the protection against light pollution.

⇨ In the practical level there is a need for additional regulations that will direct local governments more specifically, in particular regarding the anti-pollution actions. However, this legislation could not be adopted by the local authorities, so the score is **1 out of 5**.

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### 5.3.8 Synthesis of the PESTEL analysis

**Table 5: PESTEL summary and score for Smart Public Lighting**

| PESTEL Analysis | | Main barriers and opportunities | Score |
|---|---|---|---|
| **Political** | Stakeholders | Existing political support | 5 |
| | Future proofing | SEAP and Action plans on EE | 4 |
| **Economic** | Current economic context | ROI approximation<br>Lack of national co-financing programs | 3 |
| | Local impact | Product development – IT sector boosting | 3 |
| | Financing | ESCO model - PPP mechanism | 2 |
| **Social** | Equality | Public availableness | 5 |
| | Community | Safety and Security | 4 |
| **Technological** | Currently deployed technology | No smart solutions – pilots in progress | 2 |
| | Synergies | Encouraging new actions | 5 |
| | Future proofing | Testing within the pilots | 4 |
| **Environmental** | Pollution reduction | Direct and indirect impact | 5 |
| | Energy consumption | Technology efficiency | 5 |
| **Legal** | Existing framework | Legal acts compatibility | 4 |
| | Power and Scale | Regulation on light pollution | 1 |

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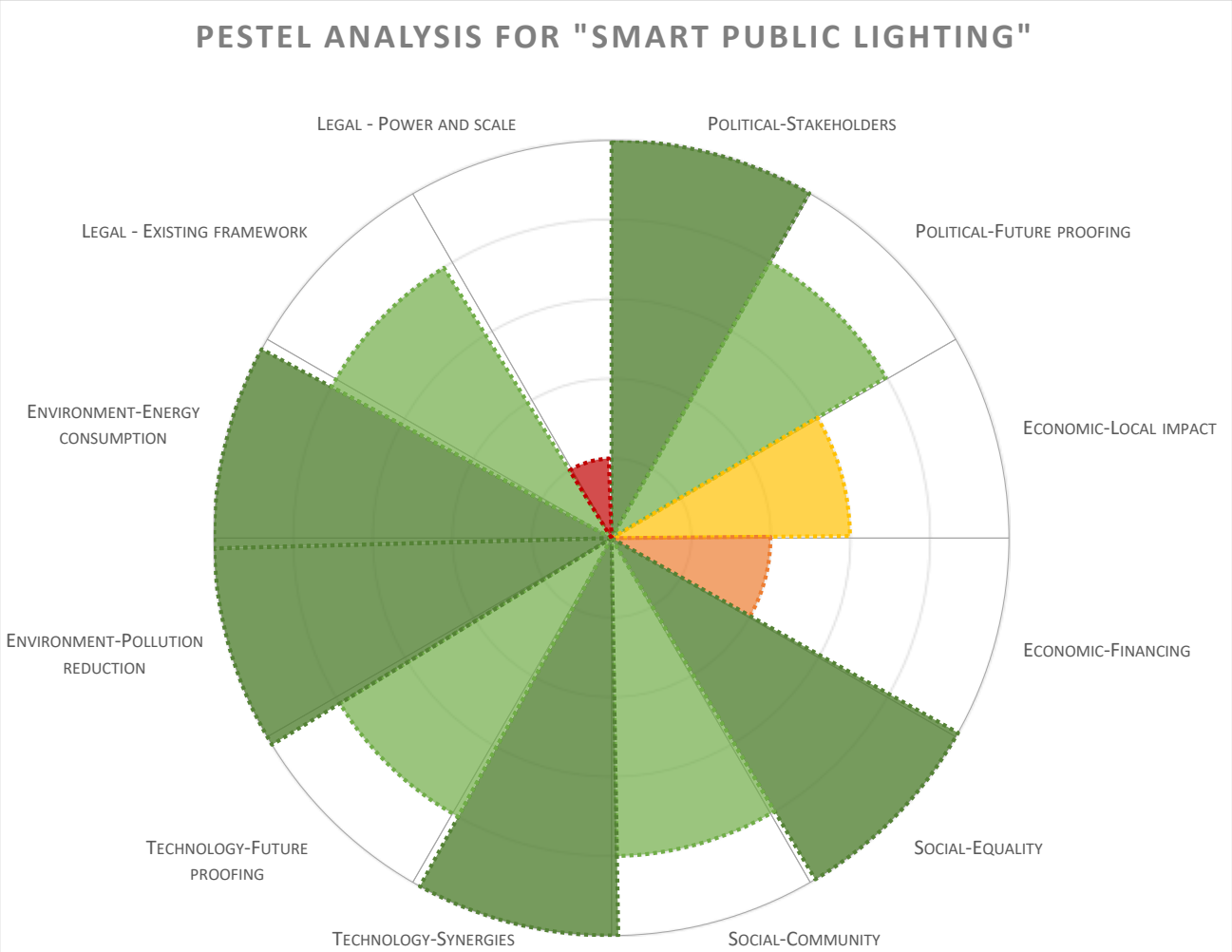


**Figure 8: Synthesis of PESTEL analysis for Smart Public Lighting**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731297.

**Table 6: Solutions to overcome barriers**

| PESTEL Analysis | | Main barriers | Solutions to overcome barriers |
|---|---|---|---|
| **Political** | Stakeholders | - | - |
| | Future proofing | - | - |
| **Economic** | Current economic context | ROI approximation<br>Lack of national co-financing programs | Studies based on existing pilot projects and external (same-size urban area) experiences<br>Relying on EU and international funds |
| | Local impact | Product development and improvement | Establishment and/or focused strategy of:<br>Business Accelerator<br>Creative Industry Incubator<br>Supporting policies for local manufacturers |
| | Financing | ESCO model - PPP mechanism | (Co-) financing from alternative sources:<br>Preparing high-potential project proposals<br>Step-by-step replacement of the existing lighting system |
| **Social** | Equality | - | - |
| | Community | - | - |
| **Technological** | Currently deployed technology | No smart solutions – pilots in progress | More pilots implementation<br>External practice and experiences<br>Installation of equipment that supports smart technology |
| | Synergies | - | - |
| | Future proofing | - | - |
| **Environmental** | Pollution reduction | - | - |
| | Energy consumption | - | - |
| **Legal** | Existing framework | - | - |
| | Power and Scale | Regulation on light pollution | The local authorities could provide opinions and recommendations on the regulation concerned, but can't speed up the process of act adoption |

## 5.4 PESTEL analysis for Smart action 3: Smart metering & Smart Meter data management

### 5.4.1 Short description

The installation of smart meters in the City of Rijeka – owned public buildings, including:

- Schools and kindergartens
- Sports, cultural and healthcare facilities

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- Municipal companies' buildings
- Administrative and local self-government buildings

The estimated number of building for smart meters installation is cca. 150.

Smart metering system is monitoring several parameters, depending of the object purpose: electricity consumption, gas consumption, electricity production (when PV/solar-thermal are installed), gas distribution (gas stations), thermal energy consumption, thermal energy production (heating plants), water consumption, and heating oil consumption.

### 5.4.2 Political Factors

Stakeholders involved for the operational implementation of the smart-action

- City of Rijeka
- HEP ELEKTRA – Croatian national provider of electricity, Rijeka subsidiary
- MC Energo d.o.o. – Public provider of thermal energy, gas and public lighting
- NGOs/Citizens

⇨ The involvement of the local public authority, national electricity provider, the competent municipal company, NGOs and the further education and inclusion of citizens can be evaluated with a score of **4 out of 5**.

Existing political support for the implementation of the smart-action

Political support exists in every smart venture planned to be undertaken in the City of Rijeka. Smart actions are a part of larger concept 'Rijeka Smart city' that encourages projects which make the city smarter, simultaneously improving citizens' life in various modalities. Since the smart meters are potential energy savers, this action will cut City costs for electricity for a particular amount. In perspective of budget savings, it is very likely to presume that strong political support will not omit. However, the project financing has to be combined from internal and external sources (city budget and EU funds). If opposite, the project may partially loose its political support.

During the recent EU project iURBAN (FP7, 10/2013-09/2016) [12], in which City of Rijeka took part as a partner, 26 buildings owned by the City of Rijeka and municipal company Energo d.o.o. were equipped with smart meters.

⇨ Because the political support depends on the financing of the project, it is expected that the support will be high as long as there are possibilities available for financing, so the political support can be valued with a score **4 out of 5**.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731297.

### 5.4.3 Economic Factors

Current and short-term economic context (5 to 10 years) relating to the implementation of the smart-action.

Smart meters in public buildings will help to reduce the public expenses for the electricity. A ROI analyses has to be conducted for revealing a precise capital return period. The smart meters, besides the savings, may indicate on issues not identified by now, which will need new approaches (in energy management, organisation system etc.). In the long-term, smart meters will contribute not only to city/municipal cost reduction, but also on (positive) impact on the environment. Moreover, unspent/saved funds after ROI may be redirected in other priority fields, depending on different polices of every city institution involved.

⇨ It may be inferred that the ROI isn't the main criterion that will determine prioritising of this action. The monitoring of energy consumption and resources are more important issues in order to provide insight into consumption dynamics, in relation to savings and environmental protection. This may be concerned as the good practice, and scored with **3 out of 5**.

Local impact resulting from the implementation of the smart-action (startup creation, city employee…

Depending on who will be provider of smart meter devices and software, and who will be responsible for system maintenance, the procurement of the equipment, its installation and further support may result in direct or indirect engagement of local industry (e.g. SME subcontractors). In more broadly way, public building supply may initiate and/or enhance usage and installation of the smart meters in other sectors – residential, tertiary and industry.

⇨ There is certainly a market opportunity for equipment manufacturers and maintenance, but a greater impact will be enabled when smart meters are installed on a bigger number of buildings, so the score is **3 out of 5**.

Private financing mechanisms identified for the implementation of the smart-action

At this point, a private financing mechanisms are not the option for sustainable actions in public sector. The project financing can be provided, as mentioned above, by combining internal and external sources (City of Rijeka and EU programmes).

⇨ As said above, private financing is not an option in the public sector, so this item can be evaluated with a score **2 out of 5**.

### 5.4.4 Social Factors

Impact of the implementation of the smart-action in equality promotion

Considering wide range of potential consumers, Smart meter system is equitable: the electricity is charged upon actual consumption.

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On the other side, the purchase of the system devices and maintenance causes initial investments, and that may result with difficulties (similar price will be charged to equal units with diverse level of income). In the City-owned buildings perspective, those gaps can be overcame by on-time planning, while in the private sector it will depend on smart system provider, payment options and subsidy policy.

⇨ Citizens who have the highest energy consumption are usually the ones who are dependable on subsidies of national programs and bodies so the progress is slower. The score can be valued with **3 out of 5**.

Impact of the implementation of the smart-action in healthy lifestyles and wellbeing

Smart meters are part of smart life concept, and one more path to make citizen become 'smarter'. They certainly promote sustainable, rational and healthier life, in relation to themselves and to nature and community. By this action, the City of Rijeka may establish a flag-ship concept that can be followed by others (individuals, institutions, organisations, business or cities).

⇨ Further promotion of the savings and reduction of emissions which provide a healthier environment will continue by the City of Rijeka, and has already produced good results in the citizen`s conscience and behaviour, so it can be evaluated with a score of **4 out of 5**.

### 5.4.5 Technological Factors

Technologies currently deployed and linked to the smart-action

In the past 3 years a new remote metering system has been installed in 26 buildings. All the buildings are public and fit diverse usage profiles (administrative, schools, sports, etc.). Each building has its own central unit that collects readings from energy and water meters based on 1-minute reading interval, and once in every 15 minutes, transmits readings via GSM network towards Rijeka Data centre. The equipment is certified according to valid European standards and norms for measurement and telecommunication equipment. All the devices in this system have "CE" markings and fully comply with the actual EN norms (e.g. EN 60950- 1:2006/A1:2010, EN 13757-3, EN 13757-4, etc.).

Software solutions have been implemented in the Data centre owned by City of Rijeka.

Buildings by type: 2 administrative centres (City of Rijeka), 2 cultural centres, 5 schools, 4 sport centres, 3 kindergartens, 8 heating plants, 1 gas station, 1 public lighting.

Current software solutions can be used and upgraded for a full monitoring system.

⇨ In total, 26 buildings in public ownership (City of Rijeka and MC Energo d.o.o.) have installed smart meter systems, with an ability to be embedded in wider monitoring system. The amount of buildings included in the existing system isn't high enough to reveal more significant outcomes, but it represents a good ground for further extensions. Taking this into account, the evaluation is **4 of the 5**.

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Synergy resulting from the implementation of the smart-action: Study of the possibilities of replacement or change.

Smart metering system is an open system that allows other interventions and upgrades, and supporting the similar goals, i.e. smart consumption of energy.

⇨ The deployed system allows upgrades and connecting to other readings to give a more comprehensive status of information on consumption so this item can be evaluated with a score **5 out of 5.**

Effectiveness of the smart-action on the market ("market-proof")

Smart metering is considered to be the recent smart solution for energy consumption, with a broad application possibilities. It is an efficient tool that enables savings, but also challenges the end-users to act in smart and organised way.

⇨ It is a question of the time period in which smart meters will cover more buildings, including private ones but the efficiency of consumption reduction achieved will be a sure direction in the near future, so this item can be scored with **4 out of 5**.

### 5.4.6 Environment Factors

Impact of the smart-action on air quality, noise and GHG emission standard

The smart meters system has positive impact on the environment, including air and GHG emission (noise=neutral). Using it on conscious and proper way, the system can reduce the consumption, and by that lower the GHG emissions, as well as improve air quality.

⇨ The systems deployed so far shows a positive impact on pollution reduction and can be evaluated with a score **5 out of 5**.

Impact of the smart-action on energy consumption

Usage of the smart meters can reduce energy consumption, by:

- Accepting new behaviour standards regarding electricity consumption (remote control of electricity system)
- Revealing discrepancies in everyday consumption which can be removed or neutralized by management intervention.

⇨ The system provides monitoring of energy consumption and can considerably affect consumer behaviour and detect bigger consumers, the only variable is the consumers behaviour, so this can be valued with a score **4 out of 5**.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731297.

### 5.4.7 Legal Factors

International and national standards

Legal environment on national level in regard of smart metering has been changed during recent years. At this point there is no legal obligations for smart metering system implementation in public (or any other) buildings. Also, there is no subsidy program that supports/refunds smart metering system implementation.

This legal framework is not aligned with the Croatian Smart Specialisation Strategy (S3) in the extent they should be, considering defined S3 - thematic priority area 'Energy and sustainable environment' and its particular research, development and innovation activities, such as smart metering.

⇨ There is no legal obligation or incentive for installation of smart metering, so this item can be evaluated as **1 out of 5**.

Need for new legal frameworks and policies. Study of the local authority power/competence for the smart-action implementation

Since the legal framework for regulation of smart metering system does not exist, apparently there is a need for adoption of new set of rules that will stimulate or obligate (at least) public institutions for implementation. Local authorities do not have a competence to make regulations on this issue, neither purposeful budgets for stimulate smart metering users.

⇨ There is no legal framework for regulations directly applying to smart metering, but there is a need for framework and benefits for those which install such devices and achieve reductions, so the score is **1 out of 5**.

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### 5.4.8 Synthesis of the PESTEL analysis

**Table 7: PESTEL summary and score for Smart metering & Smart Meter data management**

| PESTEL Analysis | | Main barriers and opportunities | Score |
|---|---|---|---|
| **Political** | Stakeholders | Existing political support | 4 |
| | Future proofing | Support on cost-saving initiatives | 4 |
| **Economic** | Current economic context | ROI vs. energy management improvement | 3 |
| | Local impact | IT equipment and services providers | 3 |
| | Financing | EU programmes funds dependence | 2 |
| **Social** | Equality | Investments vs. consumption | 3 |
| | Community | Smart life concept | 4 |
| **Technological** | Currently deployed technology | Smart solution existing in selected objects | 4 |
| | Synergies | Open system | 5 |
| | Future proofing | End-users = Smart users | 4 |
| **Environmental** | Pollution reduction | Positive impact | 5 |
| | Energy consumption | Impact on consumer behavior or processes | 4 |
| **Legal** | Existing Framework | Lack of regulations | 1 |
| | Power and scale | Stimulation mechanism | 1 |

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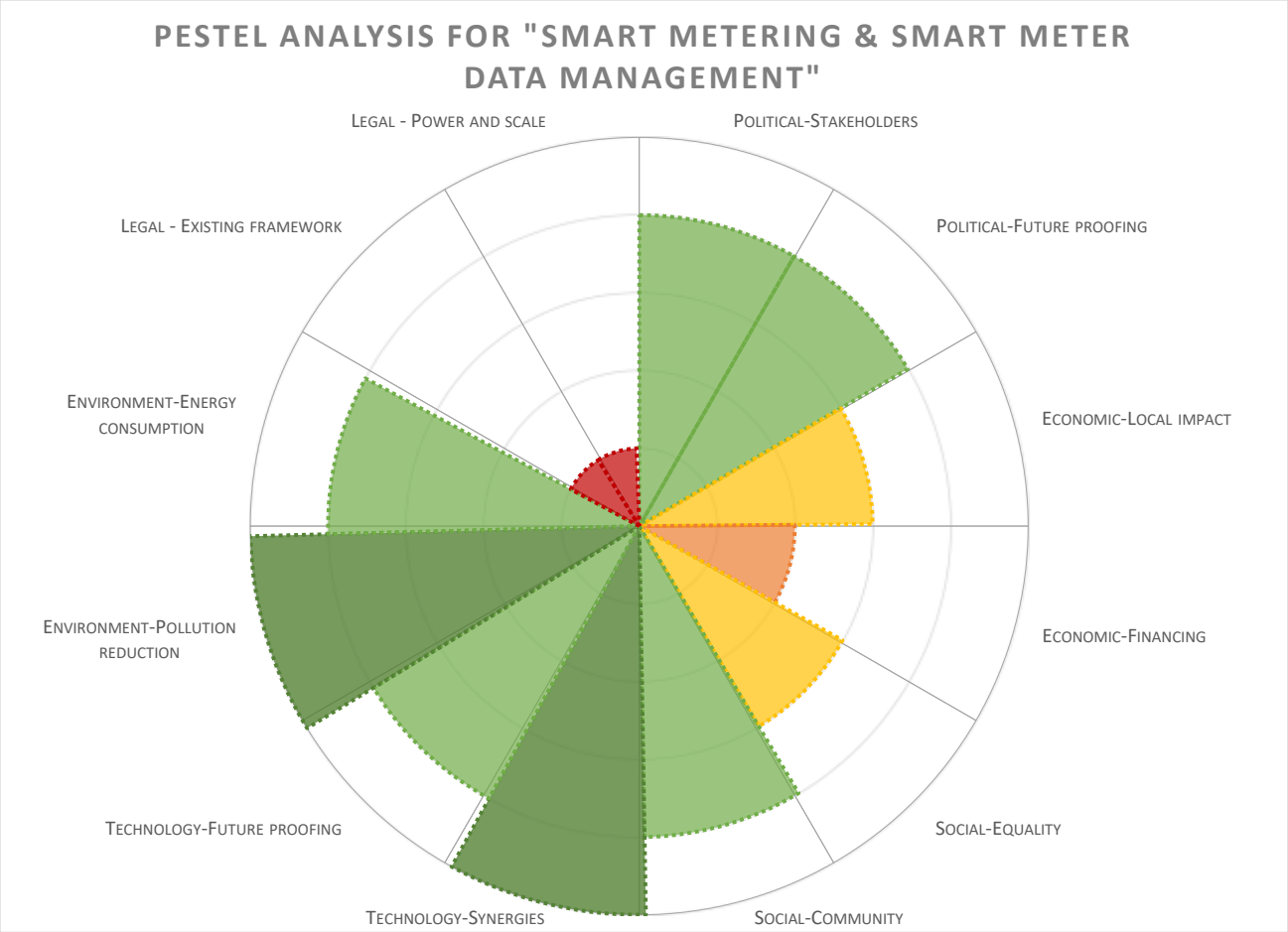


**Figure 9: Synthesis of PESTEL analysis for Smart metering & Smart Meter data management**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731297.

**Table 8: Solutions to overcome barriers**

| PESTEL Analysis | | Main barriers | Solutions to overcome barriers |
|---|---|---|---|
| **Political** | Stakeholders | - | - |
| | Future proofing | - | - |
| **Economic** | Current economic context | ROI vs. energy management improvement | Implementation of energy management new measures to ensure on-time savings and reduce ROI period |
| | Local impact | IT equipment and services providers | Main barriers linked with financial and legal issues. |
| | Financing | EU programmes funds dependence | Step-by-step implementation |
| **Social** | Equality | Investments vs. consumption | On-time planning |
| | Community | - | - |
| **Technological** | Currently deployed technology | - | - |
| | Synergies | - | - |
| | Future proofing | - | - |
| **Environmental** | Pollution reduction | - | - |
| | Energy consumption | - | - |
| **Legal** | Existing Framework | Lack of regulations | The local authorities could provide opinions and recommendations on the regulation concerned, but can't speed up the process of act adoption |
| | Power and scale | Stimulation mechanism | The local budget does not allow the subsidy program for private purposes, but smart meter systems are included in every new facility or renovated building in City ownership. |

## 5.5 PESTEL analysis for Smart action 4: RES integration - PV panels: energy storage and sharing

### 5.5.1 Short description

This smart-action consists to implement an energy sharing concept joining neighbouring buildings in sharing electricity generated by PV panels.

### 5.5.2 Political Factors

Stakeholders involved for the operational implementation of the smart-action

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- City of Rijeka
- HEP d.d. – Croatian national provider of electricity,
- HEP ELEKTRA Rijeka subsidiary
- HERA – Croatian Regulatory Energy Agency
- HROTE – Croatian Energy Market Operator [13]
- Energo d.o.o. – Public provider of thermal energy, gas and public lighting
- REA Kvarner
- NGOs/Citizens

⇨ The mutual collaboration from completed projects by the public stakeholders, and which will continue on new planned actions can be evaluated with a score **4 out of 5.**

Existing political support for the implementation of the smart-action

In the City development strategy for period 2014-2020, one of the three main objectives is to develop a competitive economy based on knowledge-based society and use of new technologies. As a forming part of that strategic goal, a specific project is defined, in relation to citizen participation in energy savings

*Encouraging and co-financing energy efficiency programmes (…)* including installation of **photo voltaic panels** for electricity generation and the construction of cogeneration plants.

The City of Rijeka set an example by installing PV panels on the roof of the city government building in 2009., to promote the use of electricity from alternative sources and thus so, to reduce gas pollution. The city continued with the practice when installing PV plants on 6 of its buildings in 2013.

⇨ The citizens' inclusion is limited because investments depend on national subsidies, so this item can be evaluated with **3 out of 5**.

National policy

On the national level the production of the solar energy, and consequently installation of equipment and plants, is now stagnating. The reason is national RES policy. The only national electricity provider HEP d.d. is purchasing RES produced energy from eligible producers in private or public ownership. National action plan (NAP) for RES [14] has limited quotes for solar-produced energy purchase, and, according to available data [13], by the end of 2016 those quotes are fully achieved, leaving no space for further investments in the solar systems (except for the own purposes).

⇨ Limitation on energy, produced by solar plants, is 52 MW in total, on national level. There are 1,222 eligible producers country-wide (97 / 4.02 MW in Primorsko-Goranska County) , with no possibility for

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others to join. Since incentives or subsidy programs are not available any more, and the ROI for installation is too long for majority of prospective providers, further investments are in serious decline. It represents the minimum standard, so the score is **2 out of 5**.

### 5.5.3 Economic Factors

Current and short-term economic context (5 to 10 years) relating to the implementation of the smart-action.

The above mentioned actions were set to return the investment in 9 and 6 years, respectfully. Also taken into account was the national regulation, concretely, the Law on Energy, providing registered eligible producers (privileged manufacturers) to sell the energy produced back into the grid of the national electricity provider on stimulating prices. The difficulties identified in the investment were the long process of registration as a manufacturer, expensive technology and the long period for returning the investment. The electricity produced can be used for own purposes but it's not usually stored in batteries, which, for private consumers, are very expensive. The installation does not, and cannot replace the electricity connection by the market provider. If installed for the use of neighbouring buildings, the cost would be divided among investors and easier to undertake. The exact cycle cannot be anticipated at this point, because the cost of the investment depends on many factors (type of equipment, number of panels, converter, battery etc.).

⇨ The investment cannot replace the electricity connection by the national provider and it depends on many factor noted above, and there are no supporting mechanisms at this time so this item can be evaluated with a score **1 out of 5**.

Local impact resulting from the implementation of the smart-action (startup creation, city employee…)

This impact cannot be anticipated at this point, but a higher demand on photovoltaic panels would require more experts for installation, maintenance and sales.

⇨ The action would create some job opportunities, but the amount depends on political and legal factors, so the evaluation score is **2 out of 5.**

Private financing mechanisms identified for the implementation of the smart-action

The financing would be provided by private citizens or companies, and, possibly supported by co-financing. The first investments in photo voltaic panels were supported by co-financing by the Fund for environmental protection and energy efficiency.

⇨ The installation on private houses and buildings depends on private financing, and on the possibilities of co-financing by the Fund for environmental protection so the score is **2 out of 5**.

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### 5.5.4 Social Factors

Impact of the implementation of the smart-action in equality promotion

Equality is not greatly promoted by this action since, the system itself represents a great investment cost and not all citizens would be able to participate in such an action and create benefits for themselves, so the starting point would not be equally accessible for all citizens.

⇨ This action is not accessible to citizens with lower income as to other, so the score is **2 out of 5**.

Impact of the implementation of the smart-action in healthy lifestyles and wellbeing

This action does promote a healthier lifestyle and the wellbeing in general. Once the investment returns, the users have financial benefits in electricity bills and with the use of electricity from alternative sources, there is considerate reduction in harmful gas emissions into the environment, thus creating a healthier surrounding.

⇨ The action promotes a healthier lifestyle and promotes sustainability and lower energy bills but does contribute to health in some extent, so this item can be evaluated with **3 out of 5**.

### 5.5.5 Technological Factors

Technologies currently deployed and linked to the smart-action

From the year 2011-2013, with the project Solar energy in the city of Rijeka, the city installed 6 PV solar plants on educational building with the power of 80 kW. The program was co-financed by the above mentioned Fund for environmental protection and energy efficiency by 36%. The project installed 36 to 114 modules, respectfully, with up to 10 - 30 MWh of power produced annually.

⇨ Some of the technologies currently deployed already show a need for upgrade or a different technology to be installed, but in all cases demonstrate reductions, so this can be valued with **3 out 5**.

Synergy resulting from the implementation of the smart-action: Study of the possibilities of replacement or change.

The PV panels should be popularized and more used by private buildings and households to decrease emissions of gas into the environment. Since the systems in use, convert solar energy for the end user as an addition to the electricity connection by the electricity provider, the further step would be to invest in storage batteries which could distribute power upon neighbouring need.

⇨ The system can be upgraded with the installation of storage batteries but is an expensive investment so this item can be evaluated with **3 out of 5**.

Effectiveness of the smart-action on the market ("market-proof")

The action has not yet been carried out in full or tested for private buildings.

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⇨ If this action would become wider spread in more homes it would open up bigger market opportunities and competitive products, since solar charging products are very popular on the market now, score **4 out of 5**.

### 5.5.6 Environment Factors

Impact of the smart-action on air quality, noise and GHG emission standard

Production of electricity by PV solar plants improves air quality since there are no greenhouse gas emissions in the production cycle or in the distribution between buildings, and does not contribute to air pollution.

⇨ This action has a positive effect on air quality but would be better if more panels were installed, so the evaluation score is **4 out of 5**.

Impact of the smart-action on energy consumption

The estimation should be adapted when the number of installed solar plants increases, but the estimations for the 6 solar plants described above is 87,58 MWh of heat energy saved and 28,90 tCO2 reduced.

⇨ This action provides direct savings on energy bills because of the reduced need for electricity and should, installed in a bigger number, produce bigger reductions, so this item can be evaluated with a score **4 out of 5**.

### 5.5.7 Legal Factors

International and national standards

There are national laws and regulations covering environmental protection, air quality, and land, water and coast protection. The most important of them being the Law on environmental protection (80/13, 153/13, 78/15), the Law on air protection (130/11, 47/14, 61/17) and the Law on energy efficiency (127/14) etc. All regulations and directives deriving from EU legislature have been translated and implemented in the national Croatian legislature. In addition to the competent state Ministry for environmental protection, there is an Agency for environmental protection which, with other indicators, monitors greenhouse gas emissions and aggregates data into the National registry. The trends for environmental protection translated into national legislature are followed with the local action plans for energy and sustainability.

⇨ The national legislature is harmonized with the relevant EU legislature but does not provide the framework to enable a sharing system yet, the score is therefore **3 out of 5**.

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Need for new legal frameworks and policies. Study of the local authority power/competence for the smart-action implementation

The local authority has no competence for adopting legislature concerning energy efficiency since it is in the competence of the national government. However, the local authority can give suggestions and opinions in creating these policies. There is no legal framework at this point which would allow the concept of energy sharing between buildings, and it would not only imply changes on regulation regarding environmental issues, but also the laws concerning ownership of property. Changes in legislature will be required and the concept of energy sharing introduced to positive regulations.

⇨ The local government does not have the possibility to adopt legislature, only to participate in the process and give proposals, so the item can be evaluated with **2 out of 5**.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731297.

### 5.5.8 Synthesis of the PESTEL analysis

**Table 9: PESTEL summary and score for RES integration - PV panels: energy storage and sharing**

| PESTEL Analysis | | Main barriers and opportunities | Score |
|---|---|---|---|
| **Political** | Stakeholders | Mutual collaboration | 4 |
| | Future proofing | Renewable energy sources with citizens inclusion | 3 |
| | National policy | Limitations on solar energy production | 2 |
| **Economic** | Current economic context | Expensive technology and long period of ROI | 1 |
| | Local impact | Job opportunities | 2 |
| | Financing | Investment costs with no supporting mechanism at this time | 2 |
| **Social** | Equality | Inaccessible to the citizens with lower income | 2 |
| | Community | Improvement in quality of living | 3 |
| **Technological** | Currently deployed technology | Need for upgrade or different technology implementation<br>Immanent reductions | 3 |
| | Synergies | Expensive storage batteries, but possibilities to system upgrading | 3 |
| | Future proofing | To enable a market for storage batteries and increase the use of PV panels by sharing energy | 4 |
| **Environmental** | Pollution reduction | Influence on pollution reduction in case of a greater share of the community participation | 4 |
| | Energy consumption | PV panels already in use show a direct reduction in energy consumption | 4 |
| **Legal** | Existing framework | Implemented EU legislature | 3 |
| | Power and Scale | Adopting legislature is in the competence of the national government | 2 |

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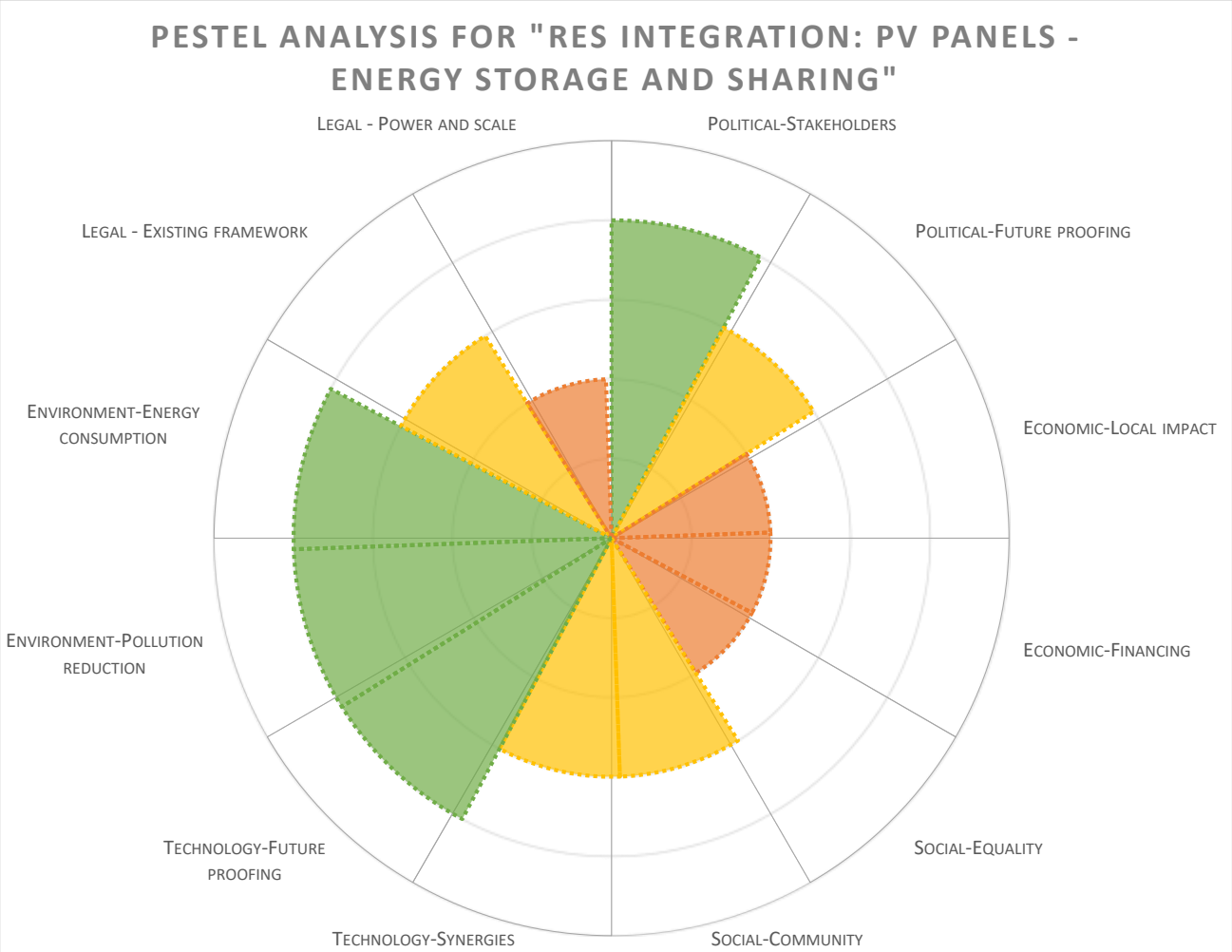


**Figure 10: Synthesis of PESTEL analysis for RES integration - PV panels: energy storage and sharing**

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**Table 10: Solutions to overcome barriers**

| PESTEL Analysis | | Main barriers | Solutions to overcome barriers |
|---|---|---|---|
| **Political** | Stakeholders | - | - |
| | Future proofing | Renewable energy sources with citizens inclusion | Advocate for subsidies and framework for joint investments |
| | National policy | Limitations on solar energy production | Increasing of the quotas in accordance to technical possibilities and economic justification which is in the central government competence;<br>Advocate for subsidies and joint investments |
| **Economic** | Local impact | Job opportunities | Demand increase: need for change in political and legal framework |
| | Financing | High investment cost | Advocate for subsidies and framework for joint investments |
| **Social** | Equality | Equality depends on citizens' income | Advocate for subsidies and framework for joint investments |
| | Community | - | - |
| **Technological** | Currently deployed technology | Need for upgrade or different technology implementation | Implementation of recent and more suitable technology in public buildings;<br>Local authority assistance on promoting of new technologies (e.g. events, digital platforms) |
| | Synergies | Expensive storage batteries | Need for legal framework on energy sharing systems -> cost-benefit analysis of the sharing model -> If economically acceptable find the financing sources: Subsidies, EU funds, Crowdsourcing |
| | Future proofing | - | - |
| **Environmental** | Pollution reduction | - | - |
| | Energy consumption | - | - |
| **Legal** | Existing framework | Implemented EU legislature | Advocate for a legal framework to enable a sharing system |
| | Power and Scale | Adopting legislature is in the competence of the national government | The local authority does not have the competency to adopt laws,<br>but to propose changes and provide opinions |

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## 5.6 PESTEL analysis for Smart action 5: Citizen involvement/participation in energy savings

### 5.6.1 Short description

This smart-action consists to:

- Establish the Citizen Collaboration Platform (CCP) with Energy savings module/layer for individuals or subjects who are willing to be involved
- Compile the questionnaire to explore citizens everyday habits related to particular fields, at home and at working place: use of electrical devices, use of other resources (water, heat, cooling), waste disposal, transportation etc.
- Collect general data from involving individuals about building performances (heating and cooling system, façade, window joinery etc.)
- Collect data about real (energy and resources) consumption from utility providers.
- Analyse of collected data, generating of relevant indicators, feedback on proposals or actions to be taken by users in order to gain better results on energy savings
- Educate and recommend actions: list of measures and possibilities that could improve EE in domestic or business environment.

### 5.6.2 Political Factors

Stakeholders involved for the operational implementation of the smart-action

- City of Rijeka
- Primorsko-goranska County
- CoC for Smart Cities
- REA Kvarner
- CEZAR - Association for EE promotion
- MC Energo d.o.o. – Public provider of thermal energy, gas and public lighting
- MC Vodovod i kanalizacija d.o.o. – Municipal company for water supply, drainage and waste water disposal
- HEP ELEKTRA – Croatian national provider of electricity, Rijeka subsidiary
- Faculty of Engineering Rijeka
- NGOs/Citizens

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⇨ The public stakeholders and NGOs have an active collaboration but the participation of private citizens is still being developed so this item can be evaluated with a score **3 out of 5**.

Existing political support for the implementation of the smart-action

City of Rijeka was one of the partners at EU project FIESTA - Families Intelligent Energy Saving Targeted Action (CIP - IEE - Intelligent Energy Europe; 10/2014 – 09/2017). Altogether 160 families from Rijeka are involved in the project, with a goal to make the influence on their energy consumption behavior, as well as decisions to buy more energy efficient home appliances. From that reference, City of Rijeka and Municipal companies have an interest to continue citizens involving process that would result with energy savings.

City of Rijeka Information Technology Department carries out the activities relating to planning, projecting, developing and establishing IT systems, the City's websites and two-way communication systems, as well as citizen on-line services within the development of e-Government. This department cooperates with organisations, institutions and other City departments when preparing and implementing projects dedicated to the development and application of new technologies in business process management and in the promotion of new approaches for communicating with citizens, business and scientific communities (eGovernment, eDemocracy, eInclusion). The service cooperates and coordinates the implementation of national and European strategic guidelines tied to the implementation of the 'Digital Agenda for Europe'.

⇨ The City of Rijeka is actively developing new channels for citizen participation, such as e-Consultations [15], so this item can be evaluated with **4 out of 5**.

### 5.6.3 Economic Factors

Current and short-term economic context (5 to 10 years) relating to the implementation of the smart-action.

Monitoring and analysing of citizens' behaviour, decisions and actions on energy use in the long-term period may result with an expertise revealing extent of impact on energy savings. To identify economic feasibility of the project, an overall ROI study has to be conducted, taking all factors, estimations and calculations into account: the financial, human, material and other resources for IT platform development, regular maintenance and costs, and the benefits resulting from such digital participation: financial savings (EE improvements), value of information, directives for future transformation etc. In general, digital inclusion of citizens on energy savings can't be observed mainly through fast ROI period, even the long-term results must imply economic principles (e.g. optimisation, efficiency, stability). The main citizen collaboration platform (CCP) value/output, which covers wide range of variable perspectives, is information.

⇨ The main value of the citizen collaboration platform is obtaining opinions and information, and there is a need for higher level participation of citizens, so the score is **3 out of 5**.

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Local impact resulting from the implementation of the smart-action (startup creation, city employee…)

The impact that EE engagement function of CCP would have on local economy subjects in general can be rated as low or moderate. The platform that collects citizens' or businesses data on behaviour of energy use, or hard data on living or working spaces could eventually suggest replication of this actions if some savings are wanted to be achieved. There is no solid connection between citizen engagement in energy savings (as a part of collaboration platform) and creation of new jobs.

⇨ There is no direct connection between citizen engagement in energy savings and job creation, so the score is evaluated with **1 out of 5**.

Private financing mechanisms identified for the implementation of the smart-action

The development of urban platform is not predicted to be financed by private funding. It can be realized within EU programmes or, before mentioned, under the program of Ministry of Economy for Centers of competences development support, where minor part of financing would come from a private (business/industry) sector, e.g. from the CoC for Smart Cities actors involved.

⇨ Financing depends on EU programmes, and a minor part comes from private financing so the evaluation score is **3 out of 5**.

### 5.6.4 Social Factors

Impact of the implementation of the smart-action in equality promotion

The action tends to embrace as much larger and various target of citizens as possible, regardless of their age, education, gender or other social or personal characteristics. In that manner the action can be marked as equal to all participants. Still, the participation depends of how familiar the citizens are regarding the usage of digital tools. Another factor which could affect the responsiveness of the action is the level of citizen engagement (willing to be involved into the urban ecosystem processes). Social climate, as well as individual priorities and attitudes may also have an impact that could lower the feedback rate (according to Eurobarometer, HIO - Hendal Index of Optimism and World happiness report, Croatian results are moderate, but with negative trend in the future).

External factor that can cause poor or moderate response rate is insufficient promotion of the action, so the duty of the City is to communicate this action in the proper way, ensuring that the information reaches general public in order to gather as many participants as possible.

⇨ Response of the citizens depends on their digital skills. Part of population could refuse to participate due to pessimism, distrust, or privacy issues. This impact is evaluated with **2 out of 5**.

Impact of the implementation of the smart-action in healthy lifestyles and wellbeing

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The action is aimed on energy savings by direct involvement of its consumers (families, businesses, citizens). However, it is primarily concerned to the families and individuals involved (or willing to be involved). The results and conclusions from the analysis could be used as directions aimed for general city population (non-involved citizens), so the impact of the collaboration would be multiplied. In general, this action presents the initiative that promotes wellbeing in many aspects (savings, pollution reduction, ecosystem balance), but it primarily addresses the citizens and individuals that want to be engaged in the collaboration process.

⇨ The action promotes wellbeing on multiple levels, from savings, pollution reduction, and ecosystem balance and can be valued at a score of **5 out of 5**.

### 5.6.5 Technological Factors

Currently deployed technologies

At this moment, smart urban platform, which may host the collaboration and analyse the collected data (including digital engagement on energy savings), does not exist. The City of Rijeka has an Open Data Platform (http://data.rijeka.hr/) [16], but it contains static sets on information available to general public. It contributes to the transparency of local authorities but doesn't ensure mutual communication (collaboration).

Planned CCP is based on Liferay Portal Community Edition. Liferay Portal is a free and open source enterprise portal software product. Distributed under the GNU Lesser General Public License and optional commercial license, Liferay was declared 'Best Open Source Portal' by InfoWorld in 2007. It is primarily used to power corporate intranets and extranets. Additional integrations are done with Map Server (Open Source development environment for building spatially enabled Internet applications). The software builds upon other popular Open Source or freeware systems like Shapelib, FreeType, Proj.4, libTIFF, Perl and others, to bring mapping capabilities to collaboration platform.

⇨ With no smart urban platform existing, but with projections already in place, the score is **2 out of 5**.

Synergy resulting from the implementation of the smart-action: Study of the possibilities of replacement or change.

Smart urban platform has unlimited capabilities regarding expanding its performances. The only limitation is related to the data sources that could provide indicators in the real time. In this perspective, a feasibility study needs to encompass selection of data sets that could be embedded in the platform, and also explore those which can't be provided, for various reasons (e.g. legal, technical or organisational limitations). For example, in this specific action, the valuable data would be the level of electricity consumption (on daily or monthly basis). Since the electricity provider (see stakeholders list: HEP ELEKTRA) operates on the national level, and is not under the local government jurisdiction, there is no

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guaranties (from this point of view) that this data would be provided or measured in order to back-up this action.

⇨ The collaboration system is open for changes and improvements, limited by data sources only. Key stakeholder (national electricity provider – responsible for electricity consumption monitoring) is not under the local government custody, but the collaboration with City and its MCs was already performed in other projects and activities. Taking it all into account, the rating is **4 out of 5**.

Effectiveness of the smart-action on the market ("market-proof")

Initial trials confirm that CCP has potential to significantly improve interaction between interested parties, primarily by assuring feedback to citizens posting comments and suggestions, and to provide them with the appropriate statistical analysis and trend predictions that are micro located in their neighbourhood. This 'local' approach is widely accepted and will be further developed. The action wasn't tested at domestic market, so there is no insurance on how efficient the results could be. We can rely on external market experiences, but also take into account specifics of local community (i.e. technical: internet connections, mobile connections, use of internet, digital inclusion).

⇨ Rely on external experiences and anticipation of local specifics could slightly improve the effectiveness, but yet we are not able to predict the CCP performance in EE, so the rating is **2 out of 5.**

### 5.6.6 Environment Factors

Respect to air quality, noise and GHG emission standard?

Engaging citizens in energy savings may reduce the air pollution, especially in the field of transport. To achieve significant improvements, collaboration of high proportion of citizens is necessary. Besides the action taken regarding energy savings, the citizens can also identify the sources of pollution in their local communities. This is particularly referring to noise pollutants.

⇨ Citizen collaboration is an instant indicator on what is going wrong in the community. Citizen is also an inevitable actor who can change the situation. The range of changes depends of how many citizens will collaborate, so the score is **4 out of 5**.

Impact of the smart-action on energy consumption

Primary objective of this action is to reduce energy consumption and to rationalize energy use in everyday life.

⇨ With a general standpoint that citizen behaviour could make a difference in energy consumption, the rating is **5 out of 5.** The only thing questionable is – to which extent?

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### 5.6.7 Legal Factors

International and national standards

To participate in the smart action and engage themselves in energy savings, the citizens will need to sign in with their personal data. In the participation process they will be asked to provide additional information about their living, family status, property, habits etc. This represents a great amount of personal information that have to managed in accordance to Law on Personal Data Protection (NN 103/03, 118/06, 41/08, 130/11, 106/12), Law on Information Security (NN 79/07), and Law on Electronic Communications (NN 73/08, 90/11, 133/12, 80/13, 71/14, 72/17). This legislative reflects the EU regulations in the respective fields.

⇨ Good legal framework ensures personal privacy. The score is **5 out of 5**.

Need for new legal frameworks and policies. Study of the local authority power/competence for the smart-action implementation

At the present point of view, there is no need for new regulations regarding development of urban collaboration platform.

⇨ Existing legislative provides solid background for CCP development. The rating is 5 out of 5.

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### 5.6.8 Synthesis of the PESTEL analysis

**Table 11: PESTEL summary and score for Citizen involvement/participation in energy savings**

| PESTEL Analysis | | Main barriers and opportunities | Score |
|---|---|---|---|
| **Political** | Stakeholders | Collaboration level with national stakeholders | 3 |
| | Future proofing | Process of eDemocracy and eInclusion | 4 |
| **Economic** | Current economic context | The long-term results must imply economic principles | 3 |
| | Local impact | Job creation | 1 |
| | Financing | EU programmmes dependence | 3 |
| **Social** | Equality | Responsive rate | 2 |
| | Community | Wellbeing and prosperity | 5 |
| **Technological** | Currently deployed technology | No smart urban platform existing | 2 |
| | Synergies | Countless solutions in performance, but limited data sources | 4 |
| | Future proofing | Specifics of local community (unknown external factor) | 2 |
| **Environmental** | Pollution reduction | Positive impact | 4 |
| | Energy consumption | Positive impact (individual level primarily) | 5 |
| **Legal** | Existing Framework | Personal data and security | 5 |
| | Power and Scale | No need at presence | 5 |

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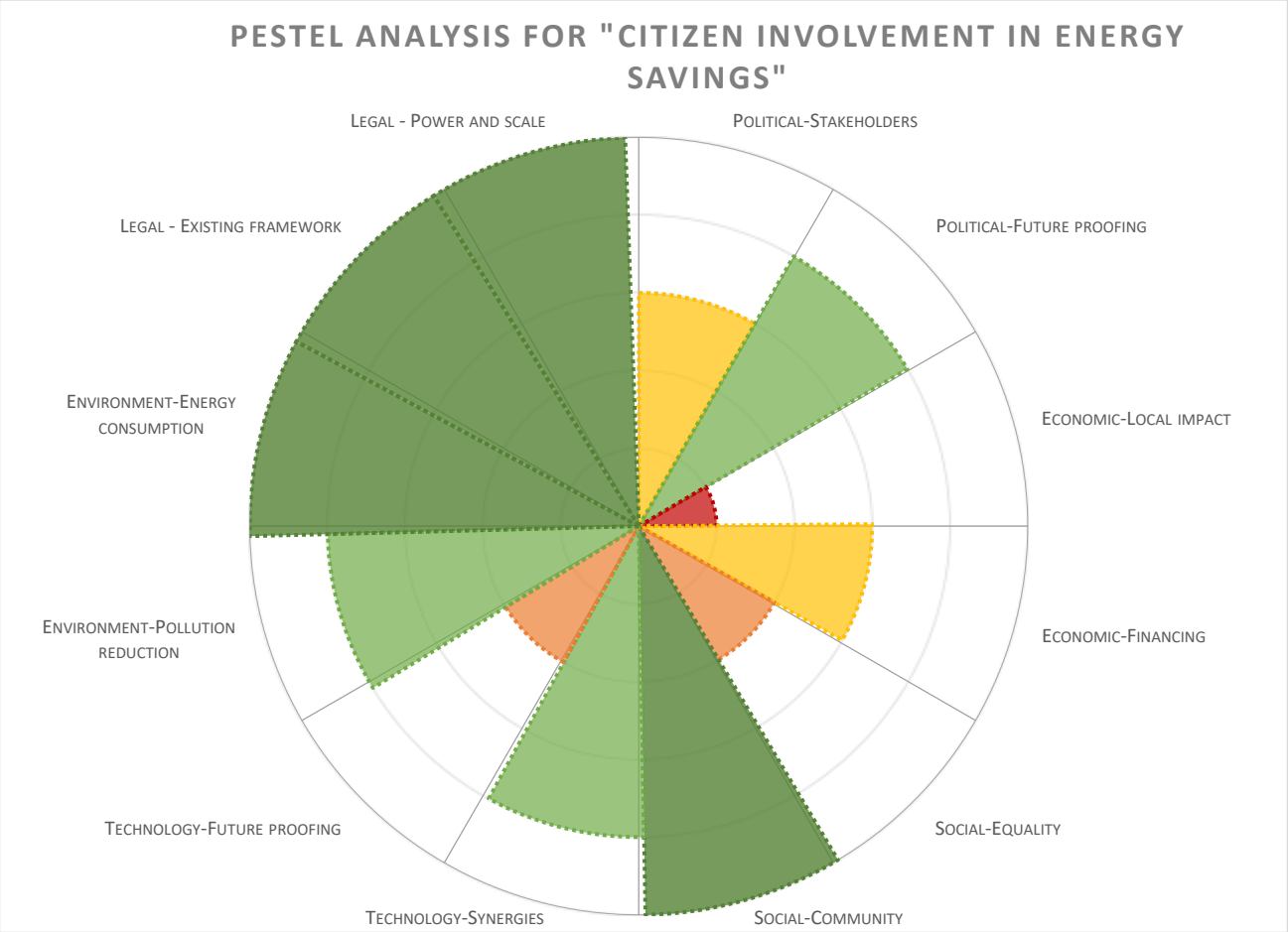


**Figure 11: Synthesis of PESTEL analysis for Citizen involvement/participation in energy savings**

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**Table 12: Solutions to overcome barriers**

| PESTEL Analysis | | Main barriers | Solutions to overcome barriers |
|---|---|---|---|
| **Political** | Stakeholders | Relations to national providers | Official agreements |
| | Future proofing | - | - |
| **Economic** | Current economic context | Effectiveness of action in energy savings | Set of specific measures in clearly defined timeframe |
| | Local impact | Job creation | Secondary/derived information may indicate market demands |
| | Financing | EU programmmes dependence | Partnership in EU and domestic collaborations/projects |
| **Social** | Equality | Responsive rate | Reward system |
| | Community | - | - |
| **Technological** | Currently deployed technology | No smart urban platform existing | Developing of the CCP by citizen demands, city profile and best practices from similar urban areas |
| | Synergies | - | - |
| | Future proofing | Specifics of local community | Pilot project and testing on target groups |
| **Environmental** | Pollution reduction | - | - |
| | Energy consumption | - | - |
| **Legal** | Existing Framework | - | - |
| | Power and Scale | - | - |

## 5.7 PESTEL analysis for Smart action 6: Open data & GIS platform

### 5.7.1 Short description

GIS lets users visualize, question, analyse, interpret and understand data to reveal relationships, patterns and trends.

By releasing GIS data to the public via Open Data Portal, the City provides a platform for innovation powered by data and developers, private-sector workers and activists can use data and leverage it in the new ways. Open data creates opportunities for increased transparency and broader use of data. Additionally, once a community receives access to the data, they can use that information on related open data sites or applications. With open data, the city is also increasing its reach to various stakeholders within the community.

### 5.7.2 Political Factors

Stakeholders involved for the operational implementation of the smart-action

- City of Rijeka

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- Primorsko-goranska County
- MC Energo d.o.o. – Public provider of thermal energy, gas and public lighting
- Vodovod i kanalizacija d.o.o. – Municipal company for water supply, drainage and waste water disposal
- Rijeka plus d.o.o. – City car parks management
- KD Autotrolej d.o.o. - Municipal company for Public transport
- Rijeka promet d.d. – Municipal company for management of city road network
- Čistoća d.o.o. – Municipal company for waste disposal and green areas maintenance
- Kozala d.o.o. – Graveyards maintenance
- HEP ELEKTRA – Croatian national provider of electricity, Rijeka subsidiary
- Ministry of internal affairs – County police department
- Center of competence for Smart cities – Innovation cluster
- NGOs/Citizens
- Other stakeholders from government, industry, R&D or civil sector

⇨ It is very challenging to bring so many stakeholders into collaborative action. However, it is reasonable to believe that it will present a good and promising practice, so the score is **3 out of 5**.

Existing political support for the implementation of the smart-action

One of the main objectives in 'The Development Strategy of the City of Rijeka 2014-2020' is developing a competitive economy based on knowledge-based society and use of new technologies. The objective is completely consistent with Digital agenda for Europe initiative.

In regards, both Country- and City-policies are containing ICT related topics in their priority areas, considering them as one of the flywheels of economic growth and prosperity.

Primorsko-goranska County (in the official document 'The Development strategy of Primorsko-goranska County 2016-2020') states that 'key economic activities are: development of transport, energetics, tourism, processing industries, and ICT industries.

City of Rijeka derived its strategic goal by relying economic development on new technologies, creative industries, and ICT city infrastructure.

City of Rijeka is also a member of international association addressing ICT and digital technologies Mayor Cities of Europe – IT users group.

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The main role in the establishing process of GIS platform has City of Rijeka Information and Technology Department. It carries out the activities relating to planning, projecting, developing and establishing IT systems, geo-information systems (GIS), integrating alphanumeric and graphic data, the City's websites and two-way communication systems, as well as citizen on-line services within the development of e-Government. The problem that is reasonable to expect is the gathering of all information from significant amount of sources, from different authority levels (horizontal and vertical), and their compiling into unique map with real-time dynamics.

⇨ Working together to complete a 'toolbox for smart cities', i.e. Open Data and GIS platform, requires cooperation with different authority levels. This initiative may present an example of best practice on following the City- and County strategic goals, so can be scored with **4 out of 5**.

### 5.7.3 Economic Factors

Current and short-term economic context (5 to 10 years) relating to the implementation of the smart-action.

Open data & GIS platform is made to be persistent tool with constant upgrade and adaptation with new solutions, and aligned with needs of all stakeholders, including business and citizens. Maintenance and management of open data and GIS platform demands permanent investments from eligible sources: City budget, national funds and EU programmes.

⇨ Compared to other cities in Croatia, city of Rijeka with existing Open Data platform is an example of the good practice. The score is, within national standards, **3 out of 5**.

Local impact resulting from the implementation of the smart-action (startup creation, city employee…)

There are many benefits for all different parties in urban ecosystem on micro- and macro- economic level, and probably the most significant is accessibility of information, as basis for decision making process in business (starting, expansion, diversification) and on City level (indicators, priorities, challenges). For example, open data portal may provide city-owned real estate inventory, including available spaces for new businesses. Within other integrated information (price, costs, surroundings, density, citizens' demands…), entrepreneur would be able to lower the risk by anticipating facts provided by open data GIS.

⇨ Open Data and GIS platform provides an economic profile of the urban area, which may support decision making process in industry/business sector. The impact can be evaluated with **4 out of 5**.

Private financing mechanisms identified for the implementation of the smart-action

At the presence, there is no private financing mechanisms to rely on in developing of city-owned platform. The financing models are primarily correlated with limited City budget.

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⇨ With no private resources to be included directly into the development of public tools, the score is **2 out of 5**. There is an option of collaboration with IT companies within EU and national programs.

### 5.7.4 Social Factors

Impact of the implementation of the smart-action in equality promotion

Elder population and other citizens who have poor ICT literacy may have difficulties with using Open Data and GIS platform. To overcome this, and many other issues on the way in digital society, the education workshops could be performed, managed and sourced by City authorities. In fact, ICT education, especially among elder people, is common practice in the city of Rijeka, where pensioners are well organised into very active citizens' associations.

The Open Data and GIS platform has to be adapted to be simply used by disabled persons (i.e. blind and partially-sighted persons). In general, implementing Open Data and GIS platform implies equality, by providing all available information to all users, regardless their personal characteristics.

⇨ For certain citizen groups the platform could be less useful than to the others, in particular elder people and disabled persons. With making it more user-friendly and proceeding with digital inclusion these differences could be prevailed, so the rating is **3 out of 5**.

Impact of the implementation of the smart-action in healthy lifestyles and wellbeing

The main attribute of GIS platform is data transparency. It enables insight in great amount of data, indicators, analysis and information to be available to all interested parties. Especial accent is on public data and analysis, which can provide accurate maps and information about various layers of urban life. In that manner the community will be aware of advantages and disadvantages of their micro locations, local institutional networks, environment etc.

⇨ The transparency of the public data and their availability to all community members make this impact scored with **5 out of 5**.

Ethical issues

The main ethical issues derive from the invasion of person's privacy. Therefor the mobile application user should be able to read and choose whether he/she is willing to accept the terms of use of the application and comply with sharing a specified set of private information and the location itself.

⇨ The concern of privacy invasion may reduce the efficiency of the action. The platform could be less in use from the citizens, so the rating is **2 out of 5**.

### 5.7.5 Technological Factors

Technologies currently deployed and linked to the smart-action

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The GIS of the City of Rijeka is managed by the IT Department. The GIS data is stored on proprietary servers in an Oracle database. The users within the Organisation use free GIS Viewers or professional GIS editing tools (Hexagon GeoMedia) for the viewing, editing and analysis of data. Some of the data is provided to public via City web maps (city map, urbanistic planning) and some of the data is provided in open data formats on the Open Data Portal of the City of Rijeka. The citizens and stakeholders have the possibility to request specific data by filling in the Request for access to information that can be found on the City portal.

The GIS data covers a wide range of data: technical map (streets, addresses, buildings, administrative boundaries...), urbanistic plans, cadastral data, Orto photo imagery, points of interest, bus lines etc.

When publishing open data City of Rijeka uses open source formats recommended by the national Open Data Portal (data.gov.hr): shapefile, GeoJSON, IndoorGML, GML, KML and WMS/WFS. Web services and maps are published with open source software: GeoServer and OpenLayers.

⇨ With technology already in use, and platforms in the development stage, the score is **4 out of 5**, (in comparison with the other Croatian cities).

Synergy resulting from the implementation of the smart-action: Study of the possibilities of replacement or change.

With the growing activity of the open source community and development of better and faster open source GIS solutions, the plan is to test those solutions and implement those that prove efficient for our scope of activities and needs.

⇨ Growing of the open source community allows the possibility to improve and enhance existing tools and contents. The evaluation is **4 out of 5**.

Effectiveness of the smart-action on the market ("market-proof")

There is large list of benefits that proofs efficiency of Open Data and GIS platform for the urban stakeholders, especially for decision makers at local authority-, industry/business-, and science & research- level. The premise is: integrated data and information have the ability to be capitalized in decision making process, improving efficiency, cost savings, time and resources management, revenues and cross-sector collaboration. It is all applicable even on the individual level, where single users could also benefit from citizen participation and have more distinctive access to local government representatives.

⇨ With the growing tendency to rely on open source solutions and achieve savings, this action is fitting into new patterns of economy, and can be scored with **4 out of 5**.

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### 5.7.6 Environment Factors

Impact of the smart-action on air quality, noise and GHG emission standard

There is no direct connection between Open Data and GIS platform and GHG or noise reduction, but they have an ability to indicate critical sites or points within the city.

⇨ We consider prevention as important as an action itself, so the rating is **4 out of 5**.

Impact of the smart-action on energy consumption

Among all other indicators, open data GIS platform will provide environmental conditions of urban area: noise map, air, water and soil pollution, amounts of waste, energy consumption, etc. Based on the respective analysis, the competent authorities and institutions would be early warned about changes that could impact on environmental balance.

⇨ Integrated monitoring of the city indicators may reveal imbalances, so the focused actions can be undertaken. The evaluation of this impact is **4 out of 5**.

### 5.7.7 Legal Factors

International and national standards

The legal background is based on two main issues: privacy and security. The Article 37 of the Constitution of the Republic of Croatia states:

Everyone shall be guaranteed the safety and secrecy of personal data. Without consent from the person concerned, personal data may be collected, processed and used only under conditions specified by law. Protection of data and supervision of the work of information systems in the Republic shall be regulated by law. The use of personal data contrary to the purpose of their collection shall be prohibited.

Personal data protection and supervision over collecting, processing and use of personal data in the Republic of Croatia is regulated by the Law on personal data protection (NN 103/03, 118/06 and 41/08, 130/11; consolidated text: OG 106/12).

As a Member State of the Council of Europe, the Republic of Croatia has accepted provisions of the Convention 108 (Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data). Furthermore, right to access to information is regulated by the Right to Information Access Law (NN 25/13). The Act also lays down the principles of right to access, exemptions from right to access and process for exercise and protection of right to information access. The aim of the Act is to enable and ensure information to natural and legal persons through the openness and availability of public authority actions, pursuant to the legislation.

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The Information Security Law (NN 79/07) establishes the term information security, information security measures and standards, fields of information security, and competent authorities responsible for the adoption, implementation, and supervision of information security measures and standards.

The Law on Electronic Communications (NN 73/08, 90/11, 133/12, 80/13) regulates the field of electronic communications, including the use of electronic communications networks and the provision of electronic communications services, the provision of universal services and the protection of rights of users of services, construction, installation, maintenance and use of electronic communications infrastructure and associated facilities, competition conditions and rights and obligations of participants in the market of electronic communications networks and services, addressing, numbering and management of the radio frequency spectrum, digital broadcasting, data protection and security in electronic communications and the performance of inspection and expert supervision and control in electronic communications, as well as the establishment of a national regulatory authority for electronic communications and postal services and its organisation, scope and competence, including the decision-making procedure and resolution of disputes concerning electronic communications.

Republic of Croatia has very detailed security measures set forth in the Regulation on the Procedure for Storage and Special Measures Relating to the Technical Protection of Special Categories of Personal Data (NN 103/03). This Regulation lays down measures, tools and conditions for the storage, safety and protection and for the transfer of special categories of personal data and the corresponding data filing systems; measures for the maintenance and control of correct functioning of the computer and telecommunication equipment and of the software of the system for the maintenance ('system') of filing systems containing special categories of personal data; provision of working premises for such equipment; persons authorized for the implementation of anticipated measures, and persons competent for the supervision of their implementation.

⇨ Sufficient legal framework ensures satisfying level of security and privacy to both sides – providers and users, so can be evaluated with **4 out of 5**.

Need for new legal frameworks and policies. Study of the local authority power/competence for the smart-action implementation

At the presence, there is no need for new legal frameworks and policies. The local authority, primarily the IT Department of the City of Rijeka, with the data regularly provided by other Departments and stakeholders, has the competence for the implementation of the legal framework and policies.

⇨ The existing regulations are easily implemented by IT Department of the City of Rijeka, with no need at the moment for additional legal directives. The score is **4 out of 5**.

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### 5.7.8 Synthesis of the PESTEL analysis

**Table 13: PESTEL summary and score for Open data and GIS platform**

| PESTEL Analysis | | Main barriers and opportunities | Score |
|---|---|---|---|
| **Political** | Stakeholders | Cross-sector collaboration | 3 |
| | Future proofing | Toolbox for smart city | 4 |
| **Economic** | Current economic content | Alignment with needs of business and citizens | 3 |
| | Local impact | Market risk reduction | 4 |
| | Financing | Limited City budget | 2 |
| **Social** | Equality | Fitting to all users' profiles | 3 |
| | Community | Transparency | 5 |
| | Ethical issues | Privacy invasion | 2 |
| **Technological** | Currently deployed technology | Platforms in the development stage | 4 |
| | Synergies | Growing of the open source community | 4 |
| | Future proofing | Shifting more on towards open source solutions | 4 |
| **Environmental** | Pollution reduction | Prevention | 4 |
| | Energy consumption | Monitoring and indicating imbalances | 4 |
| **Legal** | Existing framework | Well-designed legal environment | 4 |
| | Power and Scale | No need for additional regulations | 4 |

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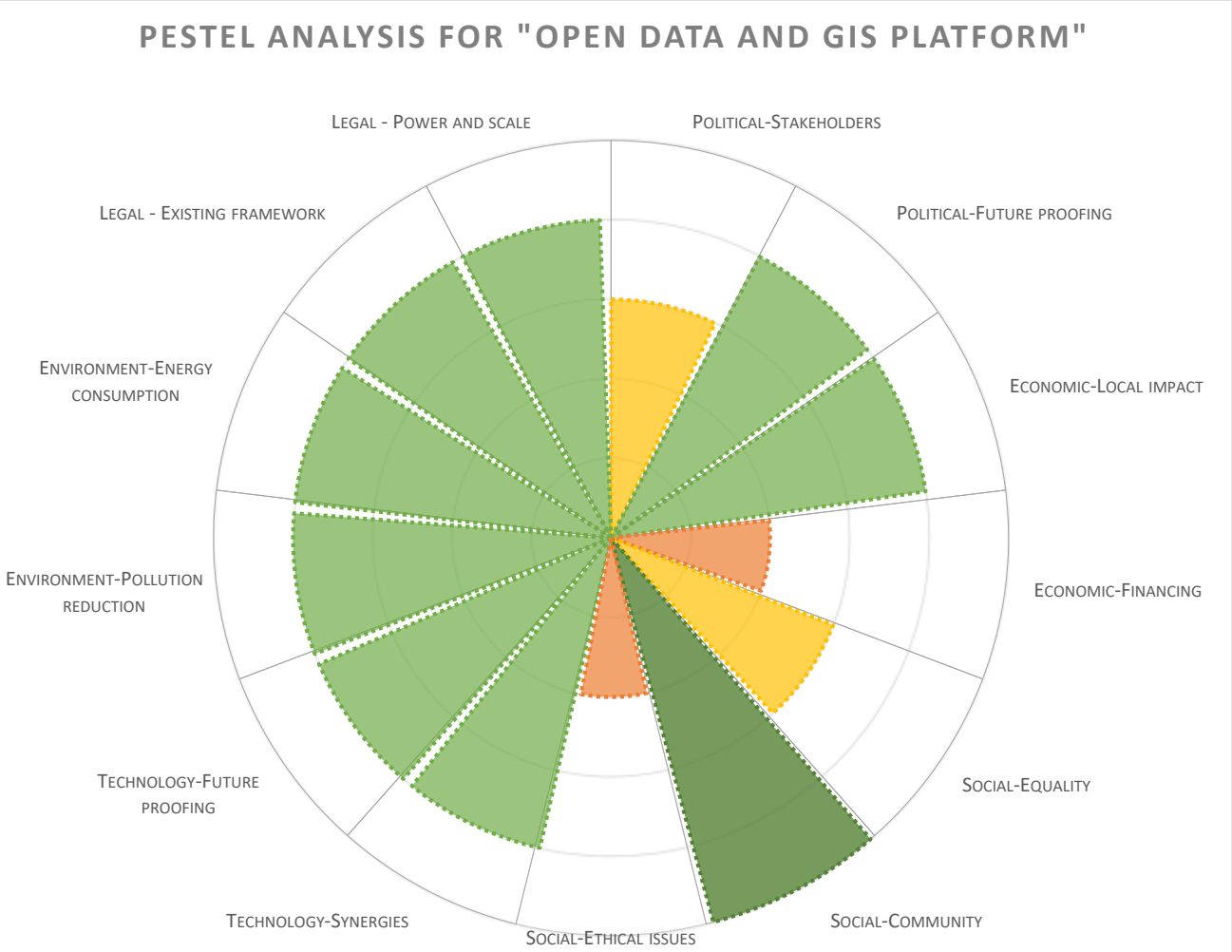


**Figure 12: Synthesis of PESTEL analysis for Open data and GIS platform**

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**Table 14: Solutions to overcome barriers**

| PESTEL Analysis | | Main barriers | Solutions to overcome barriers |
|---|---|---|---|
| **Political** | Stakeholders | Relations with 'outsiders' (not under the City of Rijeka authority, e.g. national level institutions and companies) | Official agreements |
| | Future proofing | Gathering of information | Protocols, procedures, Internal regulations |
| **Economic** | Current economic content | Alignment with needs of business and citizens | Research on stakeholders demands and interests<br>Providing data in accordance to the results of research |
| | Local impact | Acceptance of tool among SME community, Start-ups and Entrepreneurs | Promotional efforts |
| | Financing | Limited City budget, no PPP mechanisms identified | EU funds, National development funds |
| **Social** | Equality | Unequal digital literacy of end-users | Digital inclusion |
| | Community | - | - |
| | Ethical issues | Personal privacy invasion | Accepting the terms of use during sign-in process |
| **Technological** | Currently deployed technology | - | - |
| | Synergies | - | - |
| | Future proofing | - | - |
| **Environmental** | Pollution reduction | - | - |
| | Energy consumption | - | - |
| **Legal** | Existing framework | - | - |
| | Power and Scale | - | - |

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# 6. Conclusions

In this Deliverable, the City of Rijeka, a follower city in the mySMARTlife project, provided a solid ground for taking new initiatives which may contribute to the city transformation, a process that already started in Rijeka. After the deep analysis carried out during the development of this deliverable, the City of Rijeka has summarized in the following table its strengths and weaknesses.

**Table 15: Strengths and weaknesses of Rijeka**

| **STRENGTHS** |
|---|
| **Urban Agglomeration Rijeka (UAR)** is consisted of 4 cities (Rijeka, Kastav, Kraljevica and Opatija) and 6 municipalities (Čavle, Klana, Kostrena, Lovran, Mošćenićka Draga and Viškovo) with unique mission: sustainable economy development and maintaining of urban areas quality. UAR was set up by a decision of the Ministry of Regional Development and EU funds, and is going to benefit from the integrated territorial investment (ITI) mechanism in the Republic of Croatia. |
| **Above-average level of development:**<br>Rate of highly educated citizens (25,9%) is significantly higher than national rate (16,4%) (source: Croatian Bureau of Statistics, www.dzs.hr**).**<br>GDP (County level) per capita higher then national GDP p/c, index=126,4 (data from 2013) (source: Croatian Bureau of Statistics, www.dzs.hr**).** |
| **Rijeka - European Capital of Culture 2020**: City of Rijeka was elected for European Capital of Culture for year 2020. Actions and initiatives, planed and provided by the city- and county-owned company Rijeka 2020 d.o.o., responsible for project implementation, will have a significant influence on urban ecosystem transformation. |
| **Local budget transparency**: City of Rijeka has the highest rank of budget transparency level based on the number of key budget documents published on its official websites. Budget transparency enables citizens to obtain complete, accurate, timely and understandable budget information. This analysis are annually conducted by the National Institute of Public Finance, from year 2013. City of Rijeka was ranked 5/5 in every year since. |
| **Free Wireless Internet Access**: the free wireless Internet signal covers the downtown area and main sports, historical, cultural and educational facilities. Overall, there are 95 access points in total, and the maximum number of users who can simultaneously use free Internet access is 5.400. The signal strength in the coverage zone is up to 50 dB, which makes this network the highest quality Wi-Fi zone in Croatia. The speed of the wireless Internet access is up to 100 Mbits. The project makes use of Wi-Fi (Wireless Fidelity) technology, i.e. wireless computer network based on IEEE 802.11 specifications that prescribe standards of wireless communication. |

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| |
|---|
| **Level of SMEs**: Over 99% of local business are small enterprises with up to 50 employees. Due to the fact that in the local area a very small number of large companies exist, this points out that the small enterprises have to be initiators of the economy development. |
| **Sport infrastructure**: In the recent years several facilities were built with primarily sports purpose: the pool complex, sport hall and the stadium. |
| **New University capacities**: University campus with Science and Technology Park Step Ri, with new, planned expands in the near future, tends to be the centre of higher education and research in wider region. |
| **Public transport:** Good connections within the city and with nearby cities and municipalities facilitate intensive daily migrations. In addition, 42/173 vehicles are using CNG fuel. |
| **City real-estate property:** City of Rijeka owns numerous of real-estate units, including residential and commercial spaces. However, some of them remain still unused. |
| **Participation in European projects and membership in international associations.** |
| The City of Rijeka's weaknesses can be seen in the following bullets: |
| **WEAKNESSES** |
| **Ageing population:** The most represented age group are inhabitants from 55-59 years (8,38%) following by age group from 50-54 (7,97%), and 60-64 (7,63%), which indicates significant share of older population in total population structure. |
| **High population density:** Rijeka is the third-largest city in Croatia and one with the highest population density (2.923/km$^2$). Surrounded by neighboring cities and municipalities, city has a poor possibilities to spread inside its administrative borders. That causes spatial limitations in urban planning and development. |
| **Public infrastructure:** Constant investments in municipal infrastructure as well as in ICT infrastructure are required, especially in the field of production and distribution of thermal energy (heating system). Some of the needful, but intense investments, can't be implemented by city itself, due to the city budget limitations. |
| **Unused business capacities:** Partially as the consequence of the global crisis, large shopping mall appearance and other reasons (e.g. public regulations and administration), many smaller businesses in the center of the city were not profitable and got closed. Also, former factories that closed during the period of transition are still unused. |
| **Gap between knowledge and local economy:** Even though in the past years some progress has been made, the bridges between industry and knowledge are still insufficient. The new models of networking are still required. |
| **Fossil fuels dependence:** Entire public heating system is based on fossil fuels usage. Renewable energy producing points are still rare, and mostly related to solar and photovoltaic panels. |

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**Lack of monitoring:** There is no central monitoring system that could collect, analyze and provide all city data. Some of the indicators are not accessible; some of them can be hardly found in many different sources, or just be provided on national, not on local, level.

Before the compiling list of indicators the City of Rijeka working team was aware of all the difficulties that will come towards in collecting process: there is no single monitoring point, no centralised system for collecting, analysing, storing and delivering city indicators or KPIs, no unified study which provides all data that define urban area. By developing one of the selected smart actions – Open Data GIS platform, this fact could be changed, and boost the city of Rijeka one step closer to the smart city concept. This action, as well as digital Citizen Engagement in the energy savings and Smart bus stations and traffic platform, tends to 'train' current end-users to accept virtual possibilities and become smart users with skills and habits that fit into the future landscape, but also actively participate in its shaping. The smart user is presumption of smart life and smart economy, and starting principle for designing of smart culture.

The actions which are directly aimed to improve environmental features are aligned with the second mySMARTlife objective - Making cities more environmentally friendly. Those actions, in the first place, are Smart bus station and smart traffic platform, Smart lighting, Smart metering, and PV panels use in energy sharing and storage. Their common ground is their energy consumption and pollution impact reduction.

PESTEL analysis stressed out (in cases of Smart bus stations, Citizen Engagement, Open Data GIS platform and especially PV panels) that the process of citizens' inclusion could face difficulties, even when they aim to e-democracy (involving citizens in decision making process). The reason is different level of digital literacy or fear of new technologies, along with privacy and security issues, defeatism and pessimism.

The duty of local authorities is to facilitate conditions for plain inclusions of critical target groups (e.g. elder citizens). As for the average age of citizen in the city of Rijeka is 44 years, this has to be considered systematically and embedded in social policy of every smart action taken. City has already made the efforts in engaging elder population into digital era, and actions like workshops and educations will take place in the future.

In case of PV panels the main obstacle for smooth inclusion is absence of legal framework and regulations, as well as supporting measures like subsidy programs. The last program took place in 2014 when City of Rijeka in collaboration with the Environmental Protection and Energy Efficiency Fund provided 80,000 € of funds for installation of the renewable energy technology (max. 2.000 €/household system).

As already mentioned in the analysis, one of the problems occurred during the pilot projects (that tackle smart solutions) is social climate. Partly because of recent global crises which affect Croatia longer than other parts of Europe, partly because of general political and economic situation at local and national

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level, people are prone to observe things in very negative manner, even the action taken are apolitical and intended to contribute city population prosperity. This may be the obstacle for smooth implementation, but it can't be the reason for not taking action at all. It is the challenge that local government has to face, and try to resolve by refined public relations policy and more intensive communication.

In abstract, no matter how 'much' equality and wellbeing the action implies in its essence, the society is complex, unpredictable and living system which requires interdisciplinary approach, and first of all – efficient legal framework. In that way only the city could count on the most important stakeholder for urban development and transformation – the citizen.

PESTEL analysis for the City of Rijeka was performed in collaboration of City Departments (CD of Entrepreneurship, IT department, City Office, CD of Development, Urban Planning, Ecology and Land Management, Utility Services Department), Municipal companies (Energo d.o.o. – Public provider of thermal energy, gas and public lighting, Vodovod i kanalizacija d.o.o. – Municipal company for water supply, drainage and waste water disposal, Rijeka plus d.o.o. – City car parks management, KD Autotrolej d.o.o. - Municipal company for Public transport, Rijeka promet d.d. – Municipal company for management of city road network, Čistoća d.o.o. – Municipal company for waste disposal and green areas maintenance), and Center of competence for Smart cities – Innovation cluster.

The results of the analysis can be summarized in the following points:

- In general, strong political support for all selected smart actions exists, but there is no financial background to implement all of them in full range in the next 5 years.
- City IT Department and CoC for Smart cities aim to overcome technological gaps. There is no serious technological issue that could hinder selected smart activities.
- Social climate could be the obstacle for some of the actions because of its possible influence on political decisions.
- Legal environment is created on the national level. The local impact on regulations adoption is low, but could be improved within existing legal frame by use of tools and measures of local policy.
- All the selected actions have (direct or indirect) positive impact on urban ecosystem and environment.

There is no unified and unambiguous position about which actions are the most or least important, which are the most relevant or which are the priorities. In the most cases the financial perspective is the crucial factor that determines actions' feasibility or implementation scale. Due to the City budget limitations, other financial mechanisms has to be taken into consideration (EU funds and PPP). This requires additional proactivity of the City units: efforts in organisation/management, time and human resources. Also, if the

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action is not covered by the existing legal framework, like in case of the action "PV panels: energy storage and sharing", the action could not be implemented.

City of Rijeka will continue with endeavour to become a national exemplar for smart city transformation and will seek for the solutions to gain such a label. In that perspective the PESTEL analysis unveils the first layer of action context, while the next steps should reveal more detailed profile of every action.

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