Interreg ADRION ADRIATIC-IONIAN
SMILE

Università Iuav di Venezia

DELIVERABLE T1.2.1

MOBILITY SCENARIOS

April 2019

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PART 1: INTRODUCTION AND AIM OF THE REPORT

SMILE (FirSt and last Mile Inter-modal mobiLity in congested urban arEas of Adrion Region) project is focused on first and last mile of mobility in the Adrion Region, where it aims to achieve a real sustainable mobility. This represents an interesting challenge for these variegated urban areas that include costal, inland and bordering cities of different size. In fact, the municipalities involved in the project are capital, middle cities and little cities. Many problems affect them: transport network congestion and related waste time, transport accidents, air pollution and noise. The economic impacts are very large and effective solutions have not yet been found, due to the fact that there is also a problem related to the most appropriate institutional level to face it. For this reason, SMILE tackles the problem from a strategic point of view, involving some multilevel institutions that can be seen as knowledge providers. It involves 12 partners (11 project partners and 1 associated partner). The partnership has been built by involving institutions capable to have an inter-municipal coverage (Regional Agencies), local authorities with implementing capacity, supporting bodies providing consultancy, services and education in field of mobility, an academic-knowledge provider, a strategic planning body. So the Adriatic-Ionian Region municipalities and stakeholders, involved in the project, agreed to work together for the benefit of each country and the whole region. The point of view of the stakeholders and their knowledge of the territorial and transport problems represents a delicate part for the analysis of the current state of mobility. The acquisition of the opinions of the stakeholders and of the identified objectification data will consist of choosing the best strategies to face problems. The novelty and originality of SMILE resides in the elaboration of mobility scenarios and SUMP (Sustainable Urban Mobility Plan) scheme within a transnational context and in the mix of IT solutions that will be tested in order to the main transport issues, to promote intermodal solutions and to make more efficient traffic flows. The transnational approach is needed because it allows a comparison, exchange and share of experiences. In any way, the elaboration of a transnational SUMP-Sustainable Urban Mobility Plan as common cognitive umbrella under which to elaborate local SUMPs mirroring local specific situations. In fact, in the first/last mil, integrated actions are needed to equilibrate modal shift and promote a stronger inter-modality between different sustainable areas.

The report aims to recap the mobility scenarios, developed by PPs, and to provide a complete overview about transport last mile situation in the different pilot areas. Each PP has developed more sustainable mobility scenarios, analysing the results on the basis of the choices made. The “what if model” has allowed the different scenarios to appear, highlighting consequences of business as usual as well as of different measures of change. This is of fundamental importance for the transport planners and the policy makers to better understand the effects of their choices. Moreover, in order to better solve the problems present in the territory, the mobility scenarios have been developed/discussed with the help of the various stakeholders who know the territory well and represent an added value in the search for a sustainable solution. A support in the development of the scenarios was provided by the IUAV University of Venice that has provided some mobility scenarios designed in the MOBILITAS Project, as example and benchmarks to exploit. The resulting mobility scenarios will be the base for the preparation of a Transnational Action Plan.

PART 2: PROJECT PARTNERS

SMILE project involves 12 project partners (of which one is associated) and 7 countries. More precisely, it involves:

- 5 regional agencies/bodies supporting local municipalities in developing transport/mobility policies & plans;
- 5 local authorities that have competences in mobility planning and road maintenance;
- 1 university that, in its role of WP T1 Coordinator, capitalises in SMILE its know-how and experience in supporting partners in designing its mobility scenarios;
- 1 educational/consultancy centre that provide consultancy and service on mobility to several towns;

Table 1 shows the various partners involved in the project.

Table 2.1: Project partners overview

PARTNER N°	ABBREVIATION	NAME	COUNTRY
1	RRC KOPER	Regionalni razvojni center Koper	SLOVENIJA
2	SCV	Šolski center Velenje	SLOVENIJA
3	Ragusa Municipal Consortiom	Libero Consorzio Comunale di Ragusa (già Provincia Regionale di Ragusa)	ITALIA
4	IUAV	Università di venezia	ITALIA
5	ZADRA NOVA	Agencija za razvoj Zadarske županije	HRVATSKA
6	DURA	Razvojna agencija Grada Dubrovnika DURA	HRVATSKA
7	MoH	ΔΗΜΟΣ ΧΕΡΣΟΝΗΣΟΥ	ΕΛΛΑΔΑ (ELLADA)
8	RDA Banat	Regionalni centar za društveno-ekonomski razvoj – Banat doo	SERBIA
9	Tirana	Bashkia Tirane	ALBANIA
10	Agency “PREDA-PD"	Agencija za ekonomski razvoj grada Prijedora “PREDA-PD”	BOSNIA AND HERZEGOVINA
11	Gradiska	Opština Gradiška	BOSNIA AND HERZEGOVINA
12	ASSOCIATED	Ministero delle Infrastrutture e Trasporti	ITALIA

Moreover, also a strategic planning body (Strategic Planning Agency Rimini-IT, promoted by Municipality of Rimini, Province, Chamber of Commerce & many other entities) is involved. This balanced mix of different organizations which joint work should produce expected qualitative results. It owns all the necessary competences to implement the activities planned by SMILE and hence to achieve expected outputs and results.

Below, shows a brief description of the areas in which the scenarios have been developed.

2.1 RRC KOPER

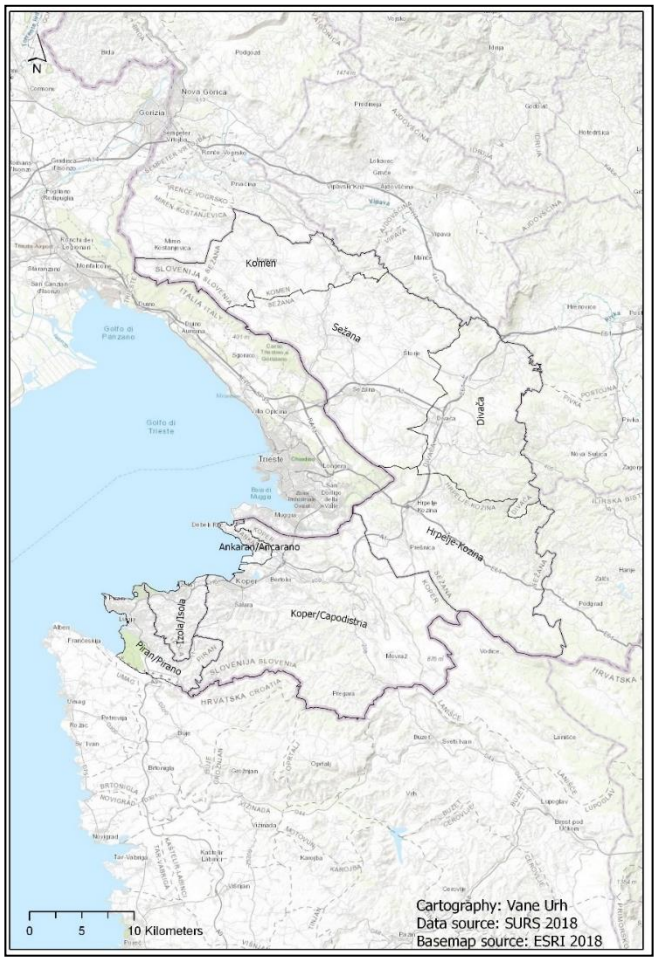


Figure 2.1: Obalno-kraška region

Obalno-kraška statistical region is one of the twelve statistical regions of Slovenia. It comprises the municipalities of Slovenian Istria (Koper/Capodistria, Izola/Isola, Piran/Pirano and Ankaran/Ancarano) and Karst (Divača, Hrpelje-Kozina, Komen, Sežana). Obalno-kraška region has 1,043 km^2 and 113.961 inhabitants (SURS 2018).

Obalno-kraška (Italian *Litorale-Carso*) is a statistical region in southwest Slovenia. It covers the traditional and historical regions of Slovenian Istria and most of the Karst Plateau. The region has a sub-Mediterranean climate and is Slovenia's only statistical region bordering the sea. Its natural features enable development of tourism, transport, and special agricultural products. More than two-thirds of gross value added is generated by services (trade, accommodation, and transport). The region recorded 21 % of all tourist nights in the country in 2016 (RSSO 2018a).

Slovenian Istria fascinates with its unique blend of Roman, Medieval and Venetian influences and the beauty of its nature. Old city cores, picturesque villages and hamlets with their diverse cultural heritage invite you to visit. The Sečovlje Salt Pans are still economically active, producing variety of salt-made products, including wellness and spa services. The Karst with Škocjan Caves and Vilenica cave boasts the most stunning underground worlds on the planet, and is also home to the noble Lipizzaner horse.

As one of the most visited areas by tourists and cargo freight, the area faces many challenges in addressing mobility: the number of arriving guests triples the total number of domestic population in municipalities Piran, and Ankaran, while doubles in Izola, in summer periods. Other municipalities are full of natural and cultural heritage, making them interesting destinations for one day trips. The port of Koper generates large traffic flows compared to other national trip origins. It represents an important line between Adriatic Sea and Central Europe. The port generates traffic with cargo vessels and trucks, while it employs over 1000 inhabitants.

2.2 SCV

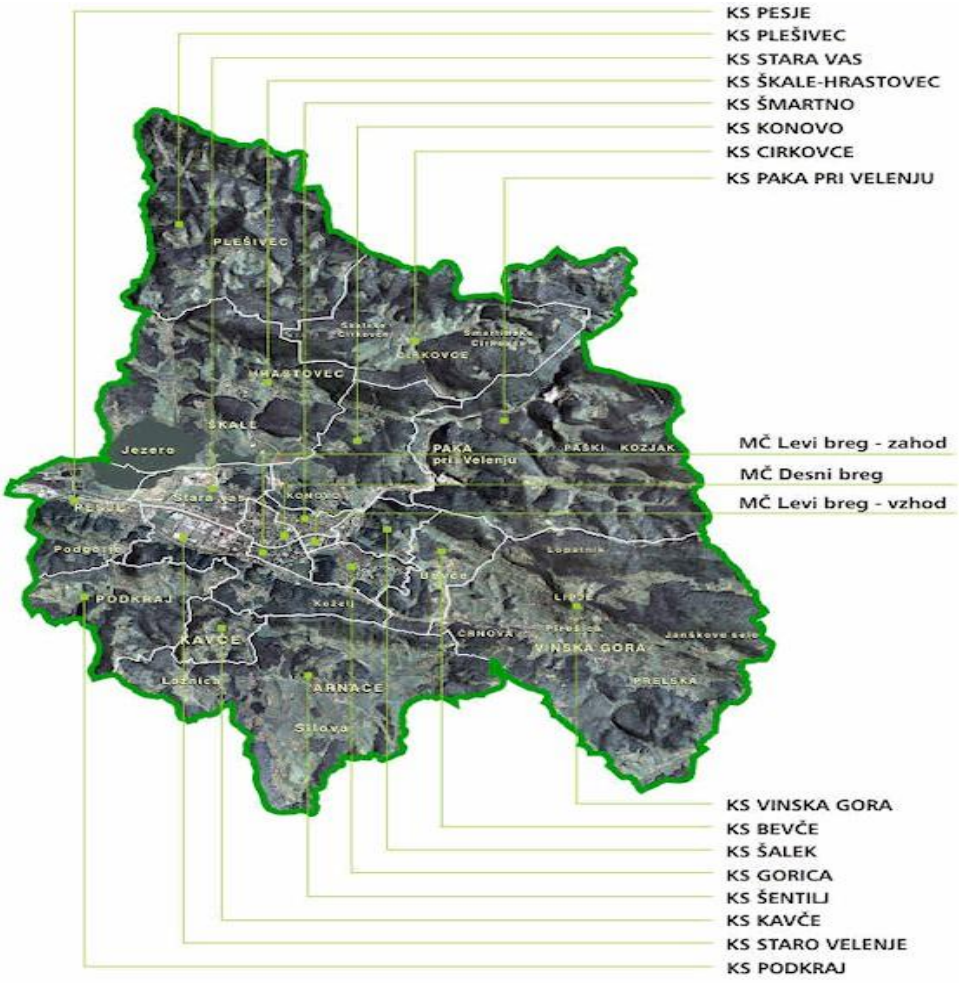


Figure 2.2: Velenje

Study area is combined from rural area and area of city of Velenje, which is a modern city (just over 55 years old), that has quickly developed because of the coal mine (Premogovnik Velenje) which led to development of thermo electric power plant TEŠ (from 1994 in neighbour municipality of Šoštanj) and biggest company in region Gorenje. There are also other successful companies in the area as Skaza, Esotech and in the last years strongly developing support environment for start us.

From consequences of exploitation of coal large artificial lakes formed, which have become an attractive element for touristic development, beside already strong historic background from middle ages and modern history.
The area is divided in smaller districts (Krajevne skupnosti): KS Bevče, KS Cirkovce, KS Gorica, KS Kavče, KS Konovo, KS Paka, KS Pesje, KS Plešivec, KS Podkraj, KS Stara vas, KS Staro Velenje, KS Šalek, KS Šentilj, KS Škale-Hrastovec, KS Šmartno, KS Vinska Gora, MČ Desni breg, MČ Levi breg - zahod, MČ Levi breg – vzhod.

2.3 RAGUSA MUNICIPAL CONSORTIUM

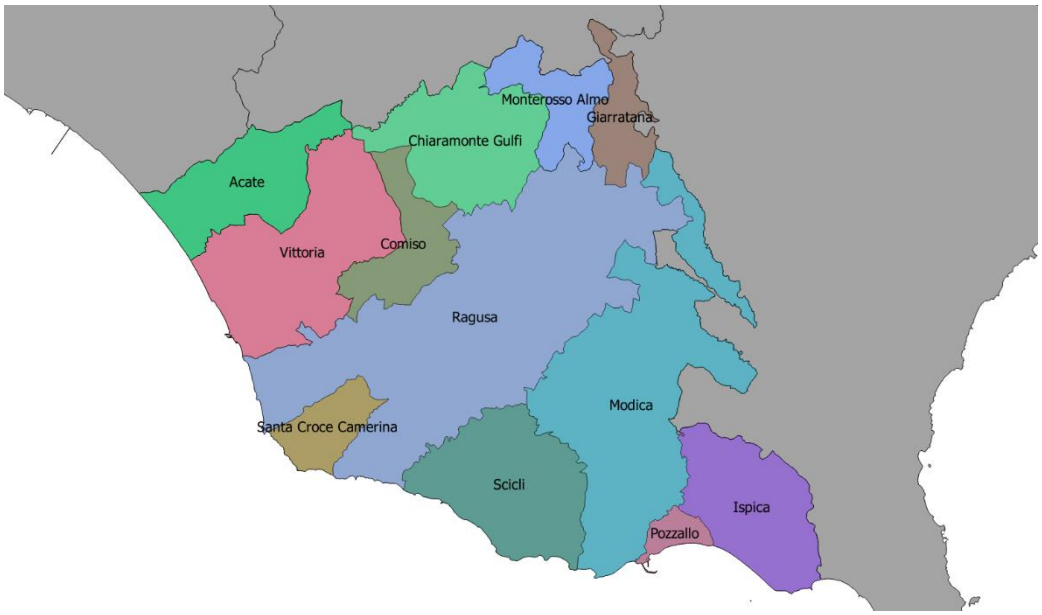


Figure 2.3: Province of Ragusa

The province of Ragusa has an area of 1,614 km² and a population density of about 193 inhabitants per km², including 12 Municipalities.
It borders with the Provices (now Free Municipal Consortia) of Syracuse and Caltanissetta, and with the Metropolitan City of Catania; its southern part overlooks the Mediterranean Sea.
Compared to Metropolitan areas and other congested urban areas of Italy and Sicily, such Province could be considered as a "weak demand area" without very intense traffic zones.
As attractive areas, the cities of Ragusa, Modica and Scicli have been recognized as World Heritage by UNESCO since 2002.
The provincial territory of Ragusa is managed by *Ragusa Free Municipal Consortium*, including the following 12 Municipalities of Southern Sicily with 318,249 inhabitants: Acate, Chiaramonte Gulfi, Comiso, Giarratana, Ispica, Modica, Monterosso Almo, Pozzallo, Ragusa, Santa Croce Camerina, Scicli, Vittoria.

2.4 ZADRA NOVA

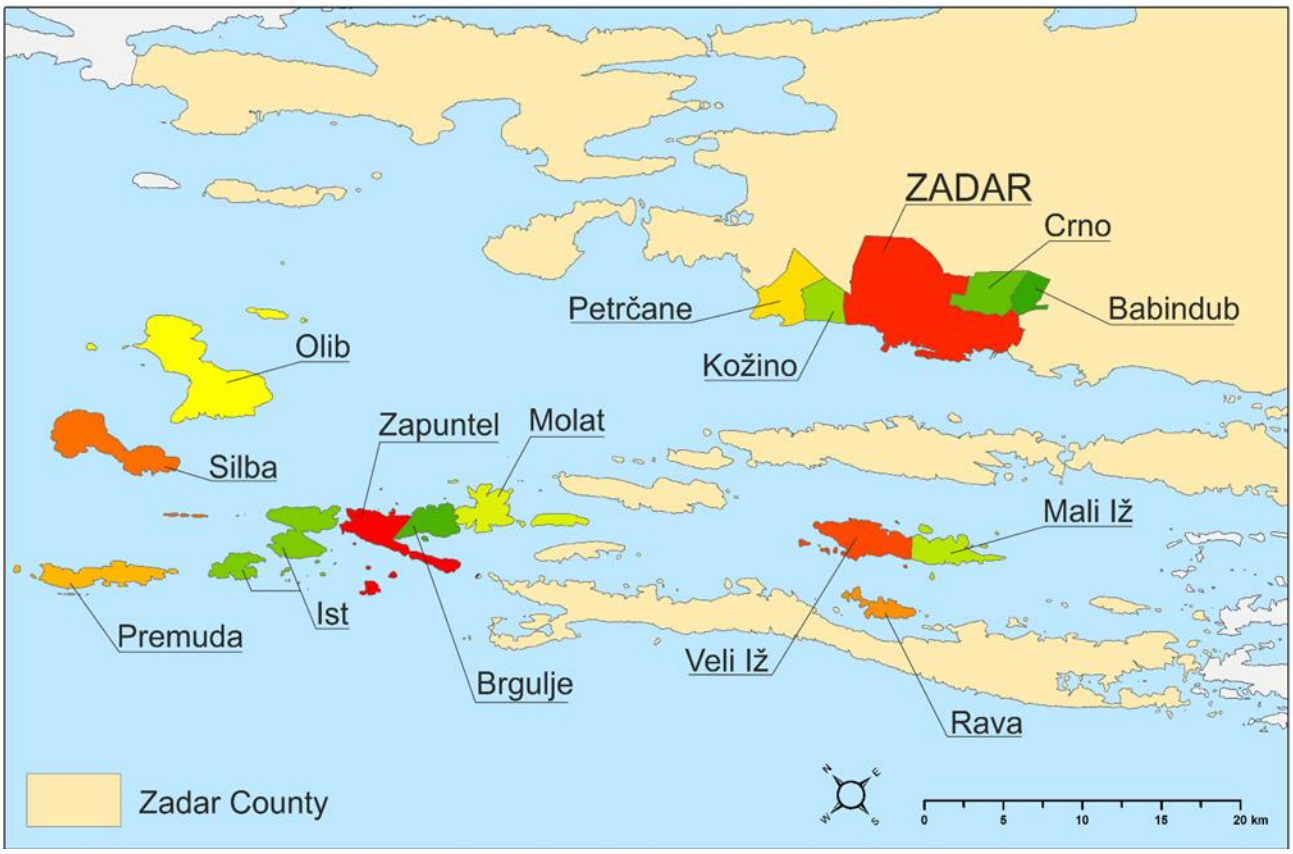


Figure 2.4: Zadar - Source: Croatian Geodetic Survey ì(2017)

Situated on the Adriatic Sea, Zadar is the center of Zadar County and the wider northern Dalmatian region. The City of Zadar is the governing, administrative, functional and economic centre of Zadar regional complex. The complex encompasses a large gravitational area of the City of Zadar that consists of Zadar County and neighboring parts of Lika-Senj County and Šibenik-Knin County. According to the concentration of central-municipal functions and working places Zadar can be characterized as first-order type centre, with more than 120,000 inhabitants gravitating towards it, which should play an important role in promoting the polycentric development of its gravitational area. Today's Zadar region includes the area of Zadar County (170,000 inhabitants) and parts of neighboring counties (160,000 inhabitants), in the central part of the modern Adriatic Croatia as European NUTS 2 region.

The total city area, including the islands, covers 194 km2. Settlement of Zadar, according to the 2011 Census of population, households, and dwellings had 71,471 inhabitants and is divided into 22 spatial units with corresponding officesThe City of Zadar is the administrative and economic center of Zadar County. It is situated on the Adriatic coast. Zadar owes its status as a regional center to its favorable geographic position, three thousand years long urban tradition, developed economy (maritime affairs, transport, tourism, and industry) and transport connections with other parts of the County, and also other parts of the Republic of Croatia. Maritime connections, resulting from maritime exposure and centuries-long maritime tradition of the city position Zadar as one of the most important passenger ports

of the coast, and also as part of the transport corridor linking Central and Eastern Europe with Central and Southern Italy. A good road network in the city and outside connections contribute to the strengthening of maritime and air transport.

The administrative area of the City of Zadar includes Babindub, Crno, Kožino, and Petrčane, as well as the islands of Ist, Iž, Molat, Olib, Premuda, Rava and Silba. The total city area, including the islands, covers 194 km2. Settlement of Zadar, according to the 2011 Census of population, households and dwellings had 71,471 inhabitants and is divided into 22 spatial units with corresponding offices (Arbanasi, Bili Brig, Bokanjac, Brodarica, Crvene kuće, Diklo, Dračevac, Gaženica, Jazine I, Jazine II, Maslina, Novi Bokanjac, Ploča, Plovanija, Poluotok, Puntamika, Ričina, Smiljevac, Stanovi, Vidikovac, Višnjik i Voštarnica).

2.5 DURA

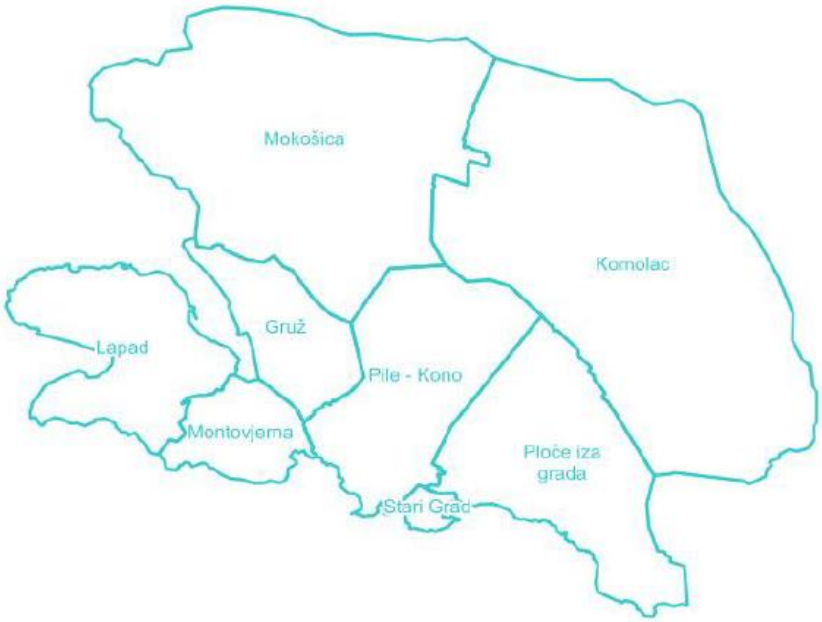


Figure 2.5: Districts of City of Dubrovnik - Source: http://www.up4c.eu/dubrovnik/

Dubrovnik is a tourist destination with well-preserved natural and cultural heritage. The culture, literature, painting, architecture, philosophy, science, music and diplomacy of Dubrovnik are an irresistible part of the cultural heritage of Europe and the whole world. UNESCO has placed Dubrovnik under its special protection. Also, spectacular nature, numerous beaches and a mild Mediterranean climate makes this town the unavoidable destination for all those seeking a vacation combined with exploring history. All these combined effects on the traffic in Dubrovnik, creating overcrowded traffic flows especially during the season.

Inner area in administrative territory of City of Dubrovnik is divided in 8 City Districts: Lapad, Montovjerna, Gruž, Pile-Kono, Povijesna jezgra Grada, Ploče iza Grada, Komolac, Mokošica)

2.6 MoH

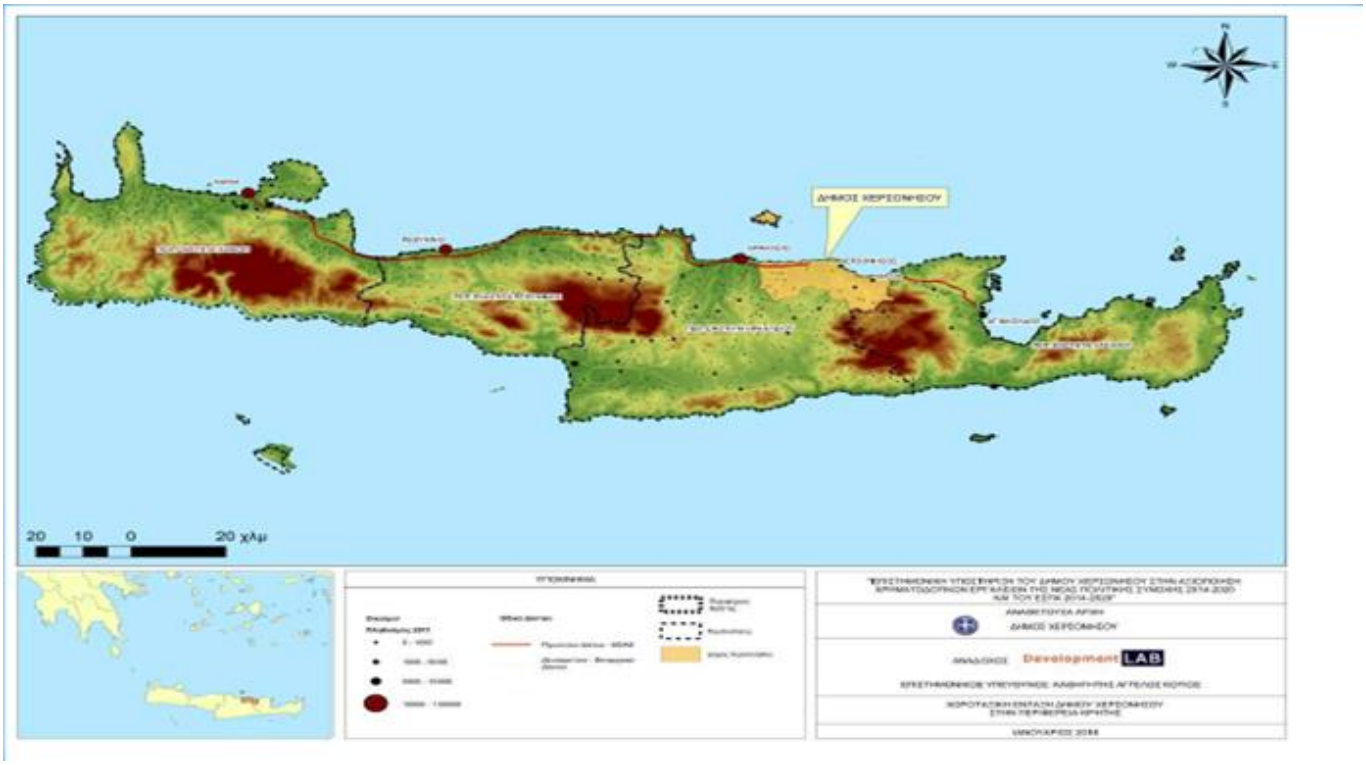


Figure 2.6: Source: Hersonisos - Strategic Plan of Municipality of Hersonisos, Phase A (2015-2019)

The Municipality of Hersonisos extends from the north coastline of central Crete to the imposing mountain chains of Lasithi. It is located a few kilometers away from the international airport "Nikos Kazantzakis" of Heraklion. Within its borders there are settlements with unique characteristics and colors. Hersonisos is known as the most organized tourist destination in Crete. It is also known for its high quality hotels, conference infrastructures and the natural beauty of its coasts.

Mass tourism, beautiful beaches and the rich nightlife only constitute one side of the coin "Hersonisos". Its other side, which is less acknowledged, includes the pristine mainland, where many historical monuments and landscapes of exceptional beauty await to be discovered.

The natural routes in the Municipality of Hersonisos also offer a journey through time, to the rich history of a blessed place. From its southern extremity, the mountainous "Kera" at the edge of the Lasithi plateau, until its northern border, the portside with the Roman and Byzantine antiquities, the wider region of Hersonisos will award visitors with beautiful images, forgotten flavors and the traditional Cretan hospitality. Visitors may enjoy the organized tourist installations of the north and also escape by taking cultural tours and walks in forgotten ancient paths and in the villages of "Lagkada". There are activities for every taste: for sport lovers: (golf, sea sports, mountain bike etc) for children (playgrounds, animal farms), for the lovers of gastronomy and wine from a wide selection of high-quality restaurants.

Hersonisos constitutes a complex urban and inter-urban environment. It is a polycentric municipality served by an extended bus network linking all key municipal units and major settlements, however with limited daily routes and punctuality, as well as a low service level in all terms. Being a major tourist

destination, there are also several private tourist bus operators supporting the needs of visitors. There is no special provision for cyclists while pedestrian zones are limited in the city centers and are occasionally expanded for the summer period (seasonal road closures). Commuters use mostly their private cars or motorcycles; however, several hotel owners provide special transportation for their employees between April and October.

The access to the area takes place from the Northern Road Axis of Crete (BOAK - E75) which is passing through the Municipality of Hersonisos. The Old National Road of Aghios Nikolaos-Heraklion is also a short distance from the coastal part of the Municipality, while the Kasteli - Hersonisos Provincial Road connects the coastal part of Hersonisos with the mainland of the Municipality, leading to the higher altitude areas.

2.7 RDA BANAT

Figure 2.7: Zrenjanin

The city of Zrenjanin is located in the north-east of the Republic of Serbia, in the center of the Serbian part of Banat, part of the Autonomous Province of Vojvodina. The area of the City extends to 1,327 km^2, which is slightly more than 6.1% of the surface area of the statistical region of Vojvodina, and the second is by surface in the Republic of Serbia.

Zrenjanin is located on the western edge of the Banat, at the place where the channeled river Begej flows into the former trough of the Tisa river. The city lies at an altitude of 80 m, and in the city area the altitude ranges from 77m to 97m.

Zrenjanin is 75 kilometers away from Belgrade, about 50 kilometers from Novi Sad, and about 60 kilometers from the European Union (the state border with Romania), which makes its position an extremely important transit center and a potential resource in the north - south and east - west direction.

The area of the city consists of 23 settlements: Aradac, Banatski Despotovac, Belo Blato, Botos, Centa, Ecka, Elemir, Farkazdin, Jankov Most, Klek, Knicanin, Lazarevo, Lukicevo, Lukino Selo, Melenci, Mihajlovo, Orlovat, Perlez, Stajicevo, Taras, Tomasevac, Zlatica and Zrenjanin.

2.8 AGENCY "PREDA-PD"

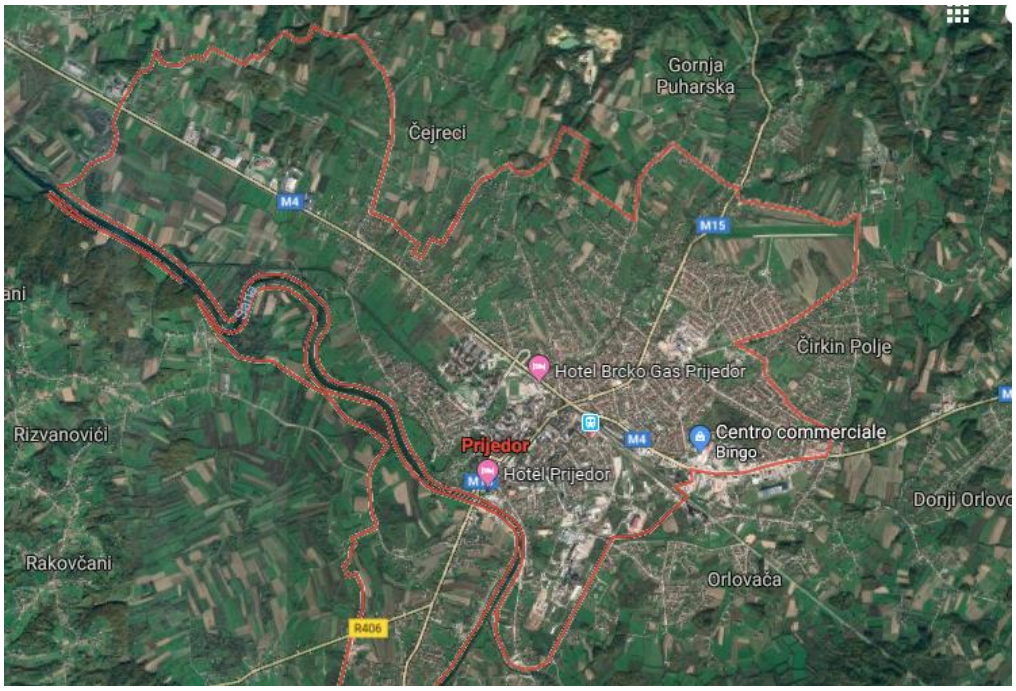


Figure 2.8: Prijedor - Source: Google Maps

Prijedor is a city located in the north western part of Bosnia and Herzegovina, Republic of Srpska entity. The geographical position of the city and the fact that it is located on the banks of the Sana River, and at the foot of Kozara Mountain, creates opportunities for developing different type of tourism. Prijedor is 280km far away from Sarajevo, the capital city of Bosnia and Herzegovina, 134km far away from Zagreb, the capital city of Croatia and 346km far away from Belgrade, the capital city of Serbia. The geographical location of the city close to Europian Union and major European capitals makes it an important industrial and commercial centre at the national level. All these advantages are recognized by many foreign companies who decided to start their plant in city of Prijedor in order to develop their business and to employ many people from entire Prijedor region and some of them are Arcelor Mittal, Kolektor, Calzedonia and many others.

Traditionally, Prijedor is an industrial area that based its economic development on exploitation of natural resources of iron ore, gypsum, clay, quartz sand and wood. Important mineral - raw material complex, wood mass as well as fertile land enabled the development of mining, agriculture, wood and metal industry. By richness of raw materials that metal processing activity is based on (iron ore), the City of Prijedor is amongst the richest areas in Republic of Srpska and Bosnia and Herzegovina. According to the indicators, economic development of the city of Prijedor for the latest 10 years period the largest share of employment and income from local companies and entrepreneurs realize in the manufacturing industries

such as mining, wood processing, metal processing, food processing, textile, etc. City of Prijedor has a huge number of tourist potentials that enable development of different types of tourism starting with Kozara mountain with National park Mrakovica, the Sana river, numerous picnic areas and places settled for tourist stay.

2.9 GRADISKA

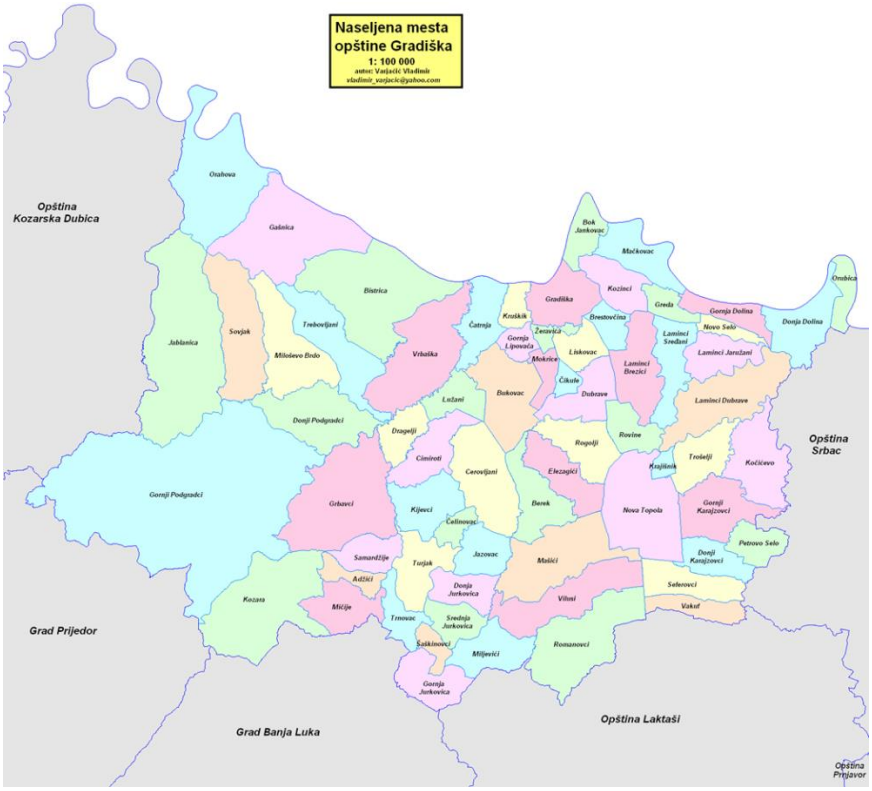


Figure 2.9: Gradiška -Source: author: Varjačić Vladimir cartography base: Republička uprava za geodetske i imovinsko-pravne poslove Republike Srpske

The municipality of Gradiška contains one of the most important border crossings in BiH, the border with Croatia – and consequently the European Union. On average 4000 vehicles, out of which 300 freight vehicles, pass through this border crossing each day. Considering that the border crossing is located in the center of the urban area of the Municipality, the frequent traffic jams (the jams can often be up to 5 km long) on the border can paralyse traffic flow in the Municipality. Highway Banja Luka – Gradiška was finalized in 2011 and a new bridge and border crossing into Croatia are planned, reducing the traffic flows through the centre of Municipality of Gradiška. The highway connects to the major regional highway Belgrade – Zagreb, resulting in very favourable transportation conditions for Gradiška.
The municipality is divided into 56 local communities and the most populated, apart from the urban area of Gradiška, are Nova Topola, Laminici Brezicani and Donji Podgraci.

PART 3: DESCRIPTION OF ACTIVITY T1.2

The WP2 is coordinated by Università IUAV di Venezia and consists of the following main actions implemented in each PP area. According to the application form of the project, the reference activities for this report are T.1.1 and T1.2.

T1.1 – Common transnational template, data collection and elaboration: This activity includes the data collection and elaboration of the territory-transport System. To collect these data, capitalising the methodologies developed in MOBILITAS project, IUAV has designed a questionnaire that give project partners the opportunity to analyse the state of their territory-transport system and to identify the issues and the peculiarities. Finally, a transnational report provides a portrait of the different urban and rural areas involved in the SMILE project and a comparison between them.

T1.2 – Elaboration of the transnational action plan (including mobility scenarios): The elaboration of the Transnational action plan focuses on how to design sustainable mobility scenarios taking into account the variegated urban and rural areas involved, the different mobility scenarios depicted at local/regional level and the stakeholders' point of view and knowledge. This document will represent the main knowledge base for developing a transnational SUMP concept, implement IT solutions, and prepare new policies for future sustainable mobility.

Activity T1.2 includes 2 deliverables:

- Deliverable T1.2.1 – *Mobility scenarios*: a transnational report that show the different local mobility scenarios singled out and designed by PPs. Each territorial PP will design some different sustainable mobility scenarios to enable policy makers and stakeholders to better understand effects of their choices;
- Deliverable T1.2.2 – *Transnational action plan for Sustainable Mobility Scenarios Design*: The elaboration of the Transnational action plan focuses on how to design sustainable mobility scenarios taking into account the variegated urban and rural areas involved, the different mobility scenarios depicted at local/regional level.

This report refers to the deliverable T1.2.1, which is composed by scenarios developed by nine project partners and whose content is presented in the next section 4.

PART 4: MOBILITY SCENARIOS ELABORATED BY PPs

This section is the core of the deliverable T1.2.1. It shows different scenarios for each pilot area, as developed by Project Partners on the basis of a common template that was provided by WPL at the beginning of the WP activities. Such template includes the minimum information required to make scenarios understandable. However, the final responsibility of the contents for each scenario is left to each PP, also according to the data availability and to the budget at disposal for performing such activity.

4.1 RRC KOPER

Scenarios are used as a tool to think over current framework of policy instruments and prepare better basis for strategy elaboration. Strategies are actions that are open to local, regional and national authorities. The actions are part of a wider context, consisting of given conditions (political, economic, demographical, technological…) that will apply in the urban and rural areas at each future point in time. To the extent that these conditions are taken as wholly exogenous, they are called *a scenario*. However, some conditions might be influenced by political action in long-term sense (Järvi and others 2003).

Major factors that are usually considered in scenarios by Järvi and others 2003 are:

- population change,
- household information,
- economic growth and employment,
- national policy, and policies of neighbouring areas,
- car ownership rates,
- vehicle technology changes,
- introduction of new technology like e-work.

The most important we consider in the region are demographic and economic variables, and policies managed by legislation, what consequently influences on travel demand. The national policy influences penetration rate of new technologies and fuel taxes. The vehicle technology influences air pollution and energy consumption (Järvi and others 2003).

The scenarios involve predictions about development of interrelated factors in consistent way. National forecasts from the Transport Development Strategy in the Republic of Slovenia 2030 do not primarily focus on elaboration of scenarios, but rather mention them in the sense of demography, motorisation rate, and climate change. The Strategy identifies that sustainable transportation modes are important more than ever, therefore the focus of development is on active and more sustainable transportation modes. The Strategy thus includes 29 measures for railways, 37 for roads, 22 for public passenger transport and sustainable mobility, 14 for water transport (maritime and inland waterways) and 6 measures for aviation. Coastal-Karst region is mentioned as one of six gravity zones of traffic in the country, specifically because of cargo traffic between Koper and Ljubljana, and personal traffic between

inland and coastal areas, and Croatia. The region is included in 70 measures, 2 directly and 18 indirectly for railways, 1 directly and 16 indirectly for roads, 16 indirectly for public passenger transport, 5 directly and 8 indirectly for water transport, and 1 directly and 3 indirectly for aviation.

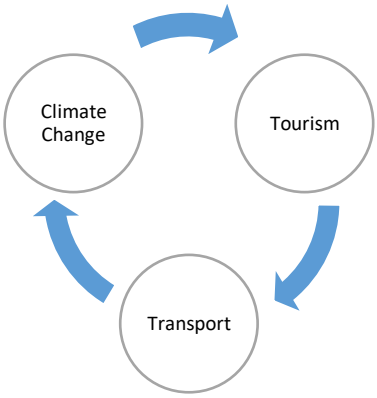
The scenarios are prepared with extrapolation of most intense policy changes in land use planning towards "what-if" model and will be discussed with stakeholders during preparation of a SUMP in the selected area. We are using a descriptive method, with capitalisation of results from scenarios prepared in CHESTNUT and MOBILITAS projects. Values are based on assessments as no other data sources or methods are currently available. The scenarios represent part of an analytical phase in the process of SUMP preparation. They will serve as a tool to assess the context of different strategies, not only the do minimum strategy. The scenarios will not be parallel of objectives, but rather a mechanism to predict impacts of different measures (Järvi and others 2003).

4.1.1 PROJECT MOBILITAS SCENARIOS

In project MOBILITAS the goal for RDC Koper was to develop a strategy for tourism flows, which is focused on the mobility of tourists and visitors, and will be inclined to the four adopted sustainable urban mobility plans of municipalities. Before preparation of the Strategy, the partners had to prepare well understanding of the area, and adopt scenarios prepared by project partner from IUAV. IUAV prepared three scenarios for every project partner in project consortium (Cavallaro, Irranca Galati and Nocera 2018), including scenarios for the regional area of RDC Koper.

Area of scenario elaboration for RDC Koper was Coastal-Karst region (NUTS 3), with all eight municipalities included (LAU 2). Scenarios were prepared with support of different tools (TopDAd, HBEFA, INFRAS …).

The methodology elaborated by IUAV Università di Venezia within project MOBILITAS develops different mobility scenarios in order to enable policy makers and stakeholders better understanding the effects of different choices on environmental quality of destinations. The final aim of this European project is increasing the capacity to use existing low carbon transport systems and multimodal connections to improve the living environment in high-density coastal destinations.



Cavallaro, Irranca Galati and Nocera 2018 calculated using developed methodology that … *The total emissions produced by tourists in Coastal-Karst Region if nothing changes, will be 3.34 ktCO₂. Anyway, a decrement of about 50% is possible in the optimistic scenario (1.53 ktCO₂)* … Calculated variables are derived from selected indicators that were acquired from the questionnaire and are based on mathematical calculations of energy consumption and emissions of greenhouse gases. The selected indicators suggest strong orientation to traffic flows that result in tourism sector, and overall population of the region.

In the framework of MOBILITAS project, scenarios were developed through a three-step approach, which can be summarised as follows:

- quantification of future tourism demand,
- definition of transport-related implications,
- consequences in terms of CO_2 emissions.

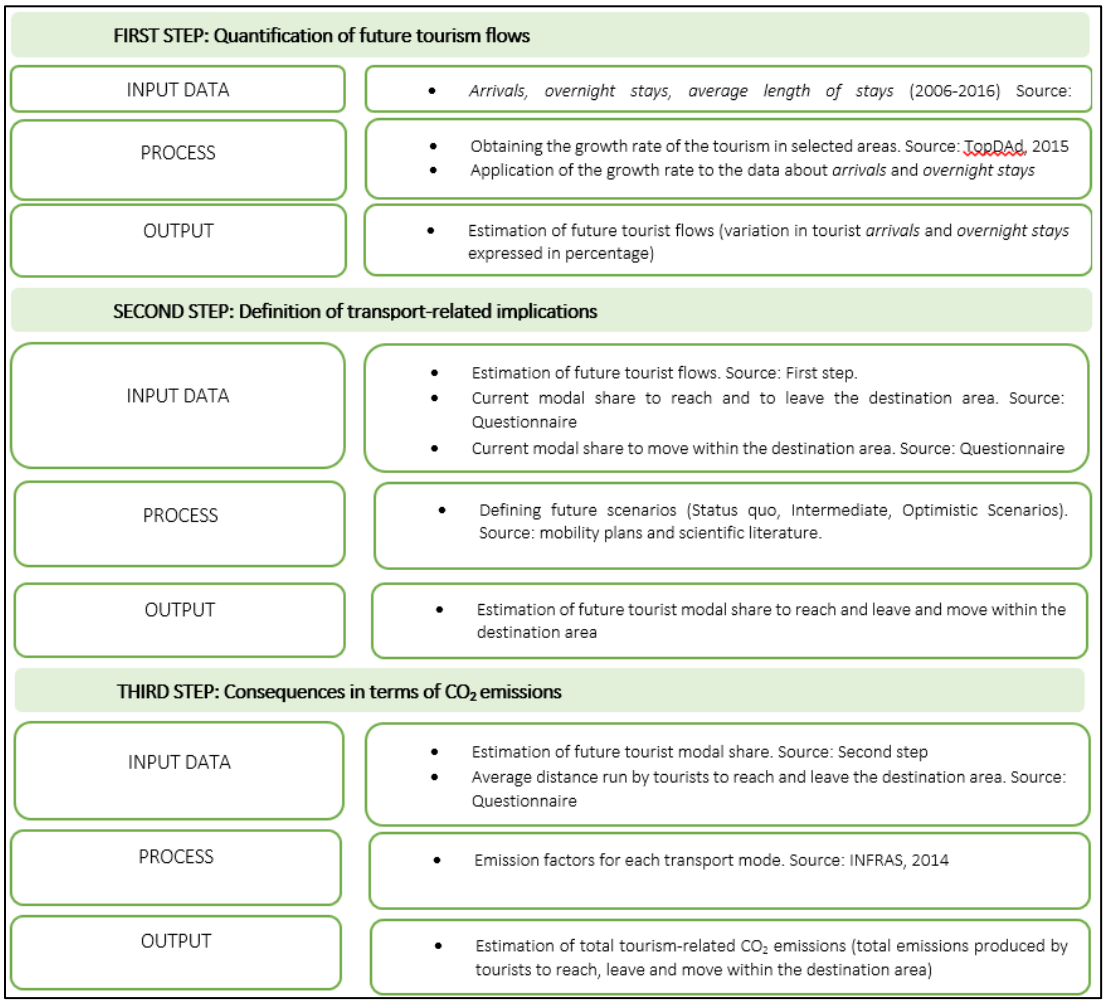


Figure 4.1: Summary of the scenario method applied in the framework of MOBILITAS (Source: Cavallaro, Irranca Galati and Nocera 2018).

Scenario methodology from MOBILITAS project is explained below (by Cavallaro, Irranca Galati and Nocera 2018): "*To this aim, the model developed by the European project TopDAd - Tool-Supported Policy Development Interactive Tool for regional adaptation - allows to obtain the future growth rate of the tourism (expressed in %), according to climate change impacts (TopDAd; http://www.topdad.eu). ToPDAd develops a tool set to assess the economic effects of climate change on beach tourism during the summer season (May-October) and alpine skiing during the winter season (November-April). It also maps potential changes in overnight stays within the summer and winter season respectively, as well as changes in tourist flows, including shifts between regions, time and activities (Lockers et al., 2015). ToPDAd works with*

scenarios, combining the Representative Concentration Pathways (RCPs) RCP2.6, RCP4.5 and RCP8.5 with Shared Socio-economic Pathways (SSPs) as developed by IIASA (2012) and the EU roadmaps for Energy and Transport. The model takes into account three different RCPs, representing three global warming scenarios, but in this report only the first two of them are considered, since the third one is considered not realistic:

1) *A worst-case scenario (RCP8.5) with rapidly developing global warming, also beyond 2100, resulting in an average global temperature rise of about 4°C compared to 1990.*
2) *A middle scenario (RCP4.5) global warming is developing at a more moderate pace, resulting in a rise of about 2°C by 2100.*
3) *A lowest scenario (RCP2.6) envisages a very rapid reduction in global GHG emissions.*

SSPs are built on the basis of qualitative and quantitative indicators, such as the level of international cooperation, market freedom and regional equality as well as the development of GDP, population and demographic statistics (e.g. age, education and rate of urbanization). Five alternative SSPs (Table 2) are developed by TopDAd model. For our purposes, two of them – SSP4 and SSP5 - are combined with the two above-mentioned scenarios RCP8.5 and RCP4.5.

Table 4.1 Description of the five alternative SSPs proposed by the TopDAd model. Source: IIASA (2012)

SSP	*Description*
SSP1 *Sustainability*	*This pathway represents a world making relatively good progress towards sustainability. Efforts are made to achieve global development goals as well as reduce energy and resource intensity and dependency on fossil fuels, and the Millennium Development Goals are achieved within the next decade or two. Inequality both between countries and within economies is decreased as low-income areas develop rapidly. Technologic development is also rapid. Economies are globalized and open but strict environmental protection policies are implemented.*
SSP2 *Middle of the road/Current trends continue*	*Current socio-economic trajectories are assumed to continue. Some progress towards global development is achieved. Some low-income countries manage to make relatively good progress, but many are also stuck with low-level development. The power of global institutions remains very limited and global economy is only partially open. Still most of the economies are politically stable, and the gap between high- and low-income countries slowly closes.*
SSP3 *Fragmentation/Fragmented world*	*This pathway represents the greatest challenges for both adaptation and mitigation. The world is fragmented into a few pockets of moderate wealth, areas of extreme wealth and many countries struggling to maintain standards of living for their strongly growing populations. World trade and international co-operation are severely restricted. Policies are oriented towards security instead of sustainable development, and the world is failing to achieve global development goals.*
SSP4 *Inequality/Unequal world/Divided world*	*In this pathway, wealth is distributed very unequally both across and within countries. A small global elite produces most of the GHG emissions while the poorer population remains vulnerable to the impacts of climate change. Global institutions work well for the rich elite but provide little support for the development of the poor masses. However, mitigation challenges are low, due to limited overall economic activity and the capabilities of the wealthy players to invest in low-carbon development.*
SSP5 *Conventional development / Conventional development first*	*In this pathway, conventional fossil-fuel dominated development is the solution to social and economic problems. This enables rapid economic growth across the world and helps in adapting to the impacts of climate change; this solution is largely incompatible with ambitious emission mitigation targets.*

The percentages obtained from the TopDAd model are applied to the current values of overnight stays provided by the partners through the questionnaire (Audit Report, Deliverable 3.2.1). Then, the arrivals are obtained by dividing the overnight stays by the average length of stays of the tourist in the pilot area. The outputs of this phase are different figures showing the percentages and the quantity variations in a specific destination area, during summer season, in the period between years 2015 and 2050, with values provided at 5-year intervals."

Table 4.2 The main steps to get the variation rates referred to arrivals and overnight stays. The variables highlighted in green have been considered in this report

TopDAd model		
Variable	*Alternatives*	*Description*
Select a case study or assessment:	*Beach oriented summer tourism in Europe*	*Rise of average summer temperatures and long term implications for summertime tourism – spatial and seasonal redistributions---*
	Artic shipping in Northern Europe	*Retreat of Arctic sea ice cover – implications for international logistics in Europe and beyond.*
	Energy production in Northern Europe	*Larger intra- & inter-seasonal variability in power generation based on runoff, solar insolation and winds - implications for hydro, solar and wind power generation as well as the second order impacts in the rest of the power system.*
	Flooding in London	*Extreme weather events leading to flooding cause damage to a wide variety of infrastructure and production capacity in cities. Such damage can result in significant direct and indirect economic effects, which in turn can be reduced through allocation of resources to adaptation.*
	Nuclear Energy production in France	*Protracted drought has lowered water levels and raised temperatures in rivers France, Germany and Benelux thereby seriously limiting cooling water availability. Despite maximum use of inter-regional transmission capacity it curtails electricity supply in various regions, while demand has risen due to a heat wave.*
	Weather Extremes and Urban Traffic -Economic Impacts	*Larger intra- & inter-seasonal variations in weather, incl. extremes – higher frequencies of unfavourable conditions (e.g. heavy rain)*
	Winter Tourism in Europe	*Decreasing reliability of winter snow cover in Alpine and Nordic ski tourist areas – common and different effects.*
	Health Impacts Assessment in Europe	*Health impact under RCP8.5-SSP5 scenario combination*
	Long-term Integrated Impact Assessment in Europe	*Macro-economic projections under different RCP/SSP combinations*
	Medium-term Integrated Impact Assessment in Europe	*Macro-economic projections under different RCP/SSP combinations*
Select the tourist adaptation strategy:	*Tourists change destination and month in the season*	*Tourists stick to the holiday type (beach tourism), but change time and/or destination, e.g. postpone their beach holidays to the shoulder season or change to regions with better climate;*
	Tourists change destination of holiday:	*Tourists stick to the holiday type (beach tourism), but change destination, e.g. change to regions with a better climate;*
	Monthly distribution of overnight stays – tourists change destination and month in the season	*Tourists stick to the holiday type (beach tourism), but change time and/or destination, e.g. postpone their beach holidays to the shoulder season or change to regions with a better climate*
	Monthly distribution of overnight stays – tourists change destination of holidays	*Tourists stick to the holiday type (beach tourism), but change destination, e.g. change to regions with a better climate*
Select the region	*select region from the list*	*Interface element that allows the selection of a specific (geographical) area. Two hierarchical levels can be displayed, which eases the selection in case of detailed level areas, reducing the amount of areas by first selecting a higher level region.*
Select the area	*select area from the list*	
Select time period	*select years from 2010 to 2085*	*5-year resolution*
Select the destination adaptation strategy:	*No-adaptation*	*No region adapts to climate change*
	Partly successful adaptation	*Regions with a mean monthly heat index of more than 29 adapt by taking actions that protect tourists from or help tourists to manage heat stress. We assume that adaptation is only partly successful and the increase of temperatures has now negative effects on the attractiveness of a region.*
	Successful adaptation	*Regions with a mean monthly heat index of more than 29 adapt by taking actions that protect tourists from or help tourists to manage heat stress. We assume that in this case increasing temperatures have no negative effects on the attractiveness of a region.*
Scenarios	*RCP4.5/SSP4*	*See Table 2*
	RCP8.5/SSP5	*See Table 2*

Key findings for the Coastal-Karst region by Cavallaro, Irranca Galati and Nocera 2018 are:

- Coastal-Karst Region is expected to gain arrivals and overnight stays due to climate change in the scenario RCP4.5/SSP4, while it is expected to lose new arrivals and overnight stays in the scenario RCP 8.5/SSP5;

- In both cases, the variation in tourist arrivals is modest: by 2050, +0.57 % in RCP4.5/SSP4; by 2035, -0.57 % in RCP 4.5/SSP4;
- Compared to the status quo scenario, in 2035, the intermediate and optimistic ones generate, respectively, -31 % and -53 % of total CO_2 emissions;
- A successful adaptation strategy in the RCP 4.5/SSP4 is expected to gain less tourists than the no-adaptation strategy;
- Similarly, a successful adaptation strategy in the RCP 8.5/SSP5 is expected to lose more tourists than the no-adaptation strategy in years 2015-2050.

4.1.2 PROJECT CHESTNUT SCENARIOS

In project CHESTNUT the goal for RDC Koper was to develop a draft of SUMP for FUA, which tests new methodology for preparation of mentioned transportation plan. Area of SUMP elaboration, and consequently scenario preparation, were five municipalities within a region, all LAU 2 units. Scenarios were part of the analytical phase and understanding status quo of mobility within the FUA. Lead partner for the activity with scenarios was Vienna University of Technology (VUT), which also proposed methodological guidelines of how to prepare scenarios – in the end each project partner had to prepare them by themselves.

In the case of Koper-Izola-Piran conurbation FUA, the scenarios were elaborated with support of a tool *Urban Transport Roadmaps*, which provides online tool to help:

- explore and identify transport policy measures,
- quantify impacts of transportation to environment and economy, and
- consider an implementation pathway for the policy scenario.

In RDC Koper we developed four test scenarios: business-as-usual, national pricing on all roads, fostering active transport modes, and making public transport more attractive. The scenarios were described qualitative and quantitative according to results obtained from the *Urban Transport Roadmaps* tool (See Appendix 1). Demographic projections show that the number of population will continue to rise (currently by around 0,5 % per year). This region is one of three regions in Slovenia (out of 12 in total) which holds a prediction of population increase. The age structure will change significantly in favour of older inhabitants. Current ageing trends will continue and it is predicted that the proportion of old people will increase from 18 % in 2014 to 28 % by 2050, hence to around 23 % by 2030.

4.1.3 SCENARIOS

Scenarios prepared for SMILE project will help to identify alternative futures in mobility and stimulate discussions between various stakeholders of what kind of mobility is possible in the region. Outcomes of discussions will be a vision, goals and list of possible instruments that predict impacts and prepare possible strategies of following the favourite scenario.

The scenarios in MOBILITAS project were projected using quantitative data and models for the area of the region, while in SMILE we present qualitative data for the same territory, but they will not base on data from the tourism sector. Scenarios will be limited to land use and regional (urban) development interaction. Land use policy was chosen as the framework for analysis because it enables a direct comparison between transportation outcomes of land use policy decisions, and it was not a topic of

discussion during CHESTNUT and MOBILITAS projects. Additionally, land use planning on regional level in Slovenia is a new policy measure, which will have to be implemented in the following years by legislation; we would like to test how transportation measures can be implemented through land use planning. We will use different data available on the portal of Statistical Office Republic of Slovenia, and The Surveying and Mapping Authority of the Republic of Slovenia, mostly related to population, workplaces, workers, trip distances, land use, modal split and number of trips. Indicators that currently do not exist, but would prove useful in the scenarios, will be – where possible – assessed, and proposed to be collected in the future.

Future development of influences is unpredictable and faces unknown conditions such as economic situation, demographic conditions, mobility needs, available energy sources and costs, climate change, global warfare, politics and scarcity. New types of ride sharing platforms are expected to reach the market, while teleworking is increasing – these will all have consequences on regional development and on region's transportation system. Each deserves further explanation, hence, that would be off the intended path. Until there is better understanding of regional mobility on NUTS 3 level in general, predictions would be too speculative to draw purposeful outcomes given the data and resource available.

In order to make aware of future regional mobility, scenarios are prepared for the year 2030 – which is the same period as recently proposed planning framework of regional development and land use planning. All three scenarios assume the same number of jobs and inhabitants, but change in distribution of population according to settlement patterns that are predicted as:

- Mixed Suburban and Urban;
- Mostly Urban and
- Mostly Suburban.

Absolute value for density of population in the region is 108 inhabitants per square kilometre, while the national average is 100. Currently the most densely populated areas are settlements of Piran, Izola, Lucija, and Koper. Estimations show that 4,8 % of the region area is urbanised, what represents approximately 50 km^2. Current mobility is car-oriented with friendly conditions for driving and parking. Public transport does not represent an efficient competitor against personal traffic; the share of users is low compared to users of personal cars. It is mostly used by pupils and elderly who can not drive on their own. Cycling and walking are popular mostly inside the urban centres, but not outside these areas. Traffic flows of active mobility on inter-urban level is mostly generated by tourism and recreation. Dispersed population pattern represents a challenge for efficient organisation of traffic, as mobility is mostly perceived from the point of view of a car and was not strategically addressed as in the recent years.

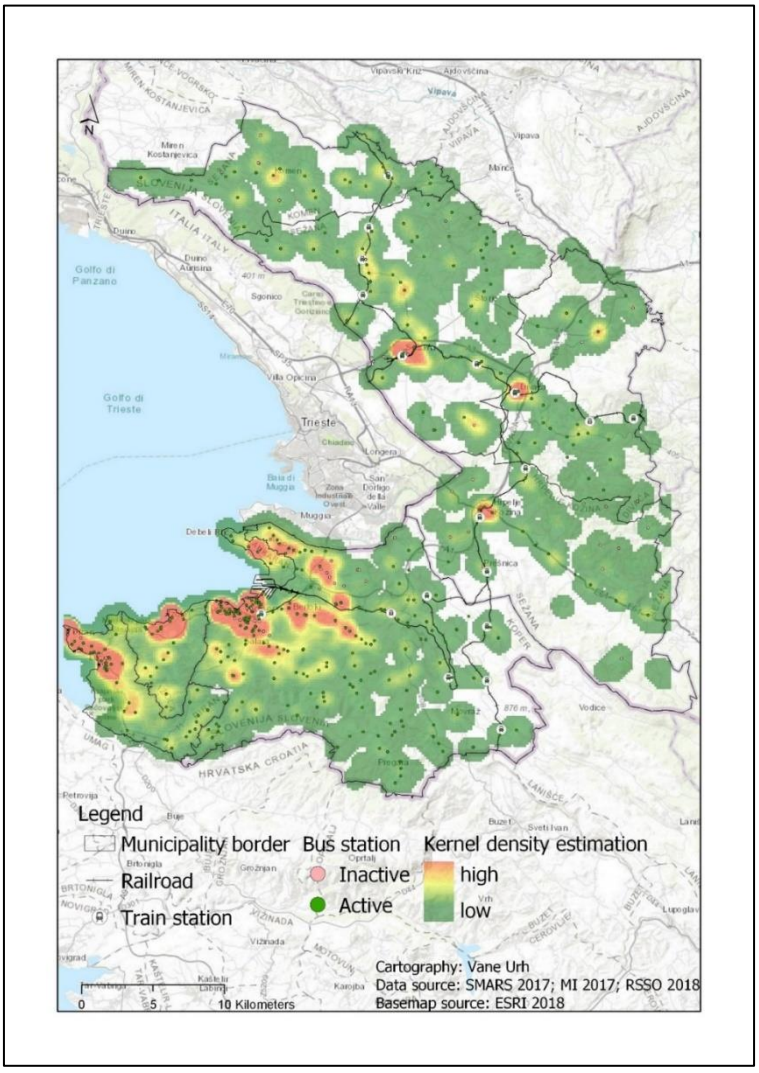


Figure 4.2: Density of population in the region in 2018.

Traffic infrastructure and services do not offer the best alternatives to personal traffic, something that is being addressed through adopted municipal SUMPs. Four municipalities, namely Koper, Izola, Piran, and Sežana have started to implement measures for integrated transportation planning in 2017. Mobility pattern in present form represents a threat to good quality of living in urban and Mediterranean environments, for people and for nature. Extensive land use for transportation infrastructure, and car-oriented environment, currently make it questionable to reach some objectives of Sustainable Development Goals 2030 on local level, especially those related to health, air quality, traffic safety, and energy consumption. Modal split is acquired from a national survey of mobility in 2016, where data was collected on a regional scale. Data for all municipalities are therefore the same: 0,4 % commute by railway, 2,4 % by bus, 77,2 % by car (from those 10 % as co-drivers), 2,4 % by bicycle, and 17,5 % by foot as pedestrians. Due to dispersedly populated areas in Slovenia, we could assess that share of commuters by car is higher in smaller suburban settlements; densely populated urban centres make more trips by

foot, bicycle or public transport. Only a few SUMPs on municipal level in Slovenia have used the methodology to acquire latest modal share of their inhabitants (Pretnar 2016).

Thematic focuses of municipal SUMPs are walking, cycling, public transportation, rational use of personal cars, and integrated transportation planning. It is expected that measures will be with the support of SUMP documents implemented within the outlined timeframe, but some delays or unrealised projects can be expected. This is primarily due to the fact that municipalities lack of own funding that would be directly used for proposed measures, and measures were developed in a participatory way. Active communication with the national authorities and Ministries will be necessary in the future as well.

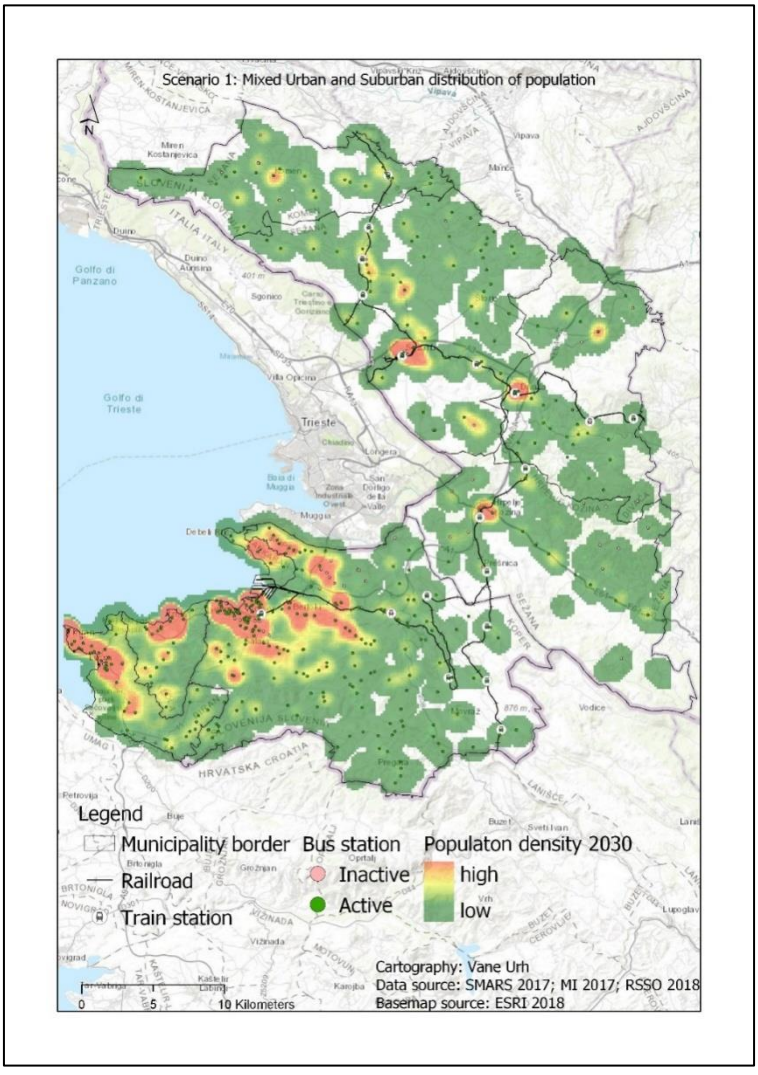


Figure 4.3: Population density and distribution in urban and suburban development.

Population density is expected to remain at the same level, with approximately 110 inhabitants per km^2. Newly developed area is assessed to be 15 km^2, and the current trend of urbanisation and

suburbanisation is continued. Decils with higher number of population in 500 m grids increase in their values. Some municipal strategic spatial documents adopted by municipalities support this pattern as the official one. Growth is accumulated in a mix of suburban development on the boundaries balanced with reurbanisation measures and infill of the urban cores. Services of general interest and jobs are centered in urban and suburban environment, while suburban areas develop better conditions for quality of life. Rural and border areas maintain low level of population density, mostly limited to primary activities and tourism offer.

Urban and suburban areas will implement measures that make walking and cycling more user-friendly and reorganise space that the environment encourages less frequent use of car. Urban areas will increase its accessibility by foot, bicycles, and public transport, while new parking policy is introduced. Movement in urban areas can be car-free, but access is retained mostly for short-term arrivals and handicapped people. Modal split changes significantly in favour of active transportation modes. Suburban areas are better connected with urban centres by public transportation (buses), what means more trips can be done by public transport and by foot or bicycle. Urban and suburban areas remain connected and form complementary ecosystem with shared functions of working places and settlement of population.

Car- and bike-sharing schemes are introduced on regional level and are connecting main origin and destination locations throughout the region.

Railway infrastructure and services are improved. New train stations are established, while population is more densely concentrated along the railway. Accessibility between Koper and its suburban areas is made easier with development of “light rail” system which is expanded throughout the whole coastal area in Slovenia. Municipalities in the Karst area of the region are more efficiently connected by rail with more frequent departures and arrivals. Easy access to mobility-impaired and cyclists is established. Share of traveling by railway in modal split of inhabitants rises to 5 %.

Deterioration of traffic infrastructure in selected rural and border areas will continue with small, but necessary investments, while new public service (call-a-ride) is introduced and covers access to 100 % of population in the region.

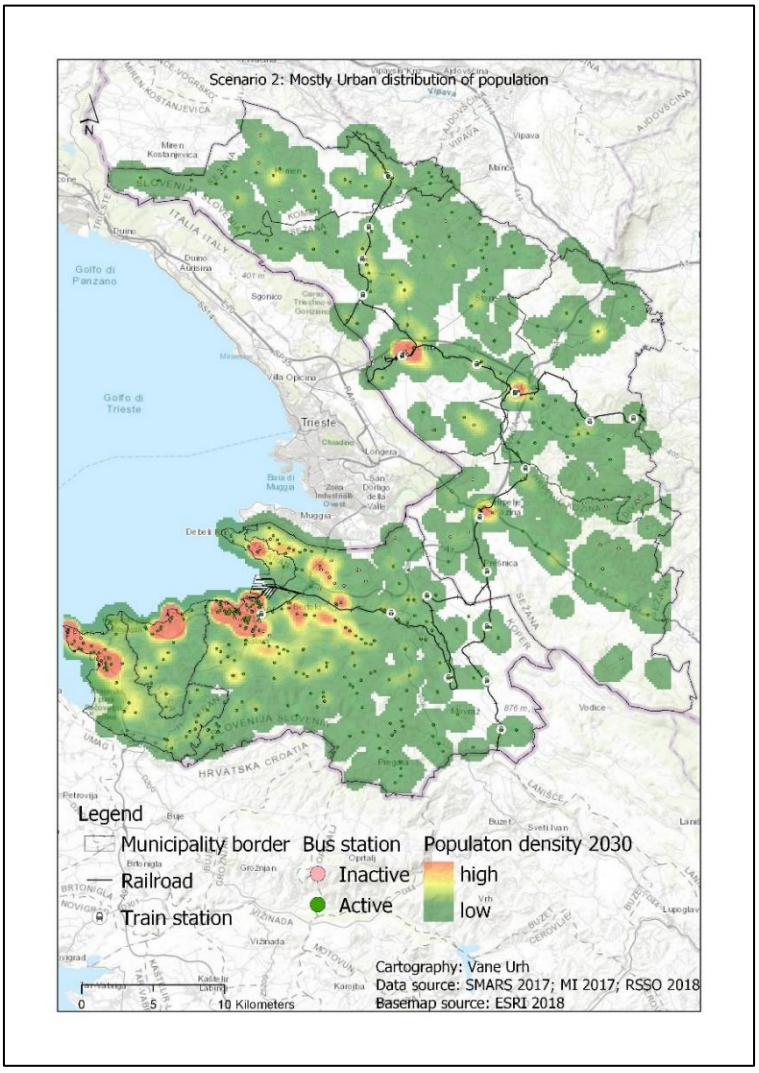


Figure 4.4: Population density and distribution in urban development.

In the urban scenario, we represent a vision where more inhabitants move towards urban cores of cities and enhance the possibility of having smaller distances towards public services and working places. Current "urban" suburban centres offer services and jobs what enables more independent lifestyle for inhabitants and creation of new urban centres. Eight km^2 of new areas are built, while the density of population rises to 140 inhabitants/km^2. Certain areas towards boundaries of the region maintain small number of inhabitants due to lifestyle and activities related to farming and other primary activities.

Investment options are focused in high-density areas and support better connection of the regional conurbation in Ankaran-Koper-Izola-Piran. Areas with higher density of population have options to travel by all modes of transportation, while selected intercity bus connections are reorganised physically or have their time tables rearranged. Urban public transportation operates more frequently and serves as efficient alternative mode to personal cars. It is implemented additionally in the municipalities of Izola and Sežana. Motorisation rate decreases as household errands can be satisfied without an extra family car. In the urban scenario the modal split of inhabitants is increased in favour of walking, cycling and

public transportation use. Private car remains as the main mode to travel to touristic sights or recreational areas in the hinterland areas, but less trips are done by it. Bike- and car-sharing scheme is introduced on the edges of urban cores, while cargo and passenger transport is strictly limited with low emission or traffic-limited zones. Urban centres are expanded towards current suburbanised areas and traffic calming areas are extended.

Suburban and hinterland areas become less densely populated as the population moves towards the urban centres, but they remain connected by a public paratransit service.

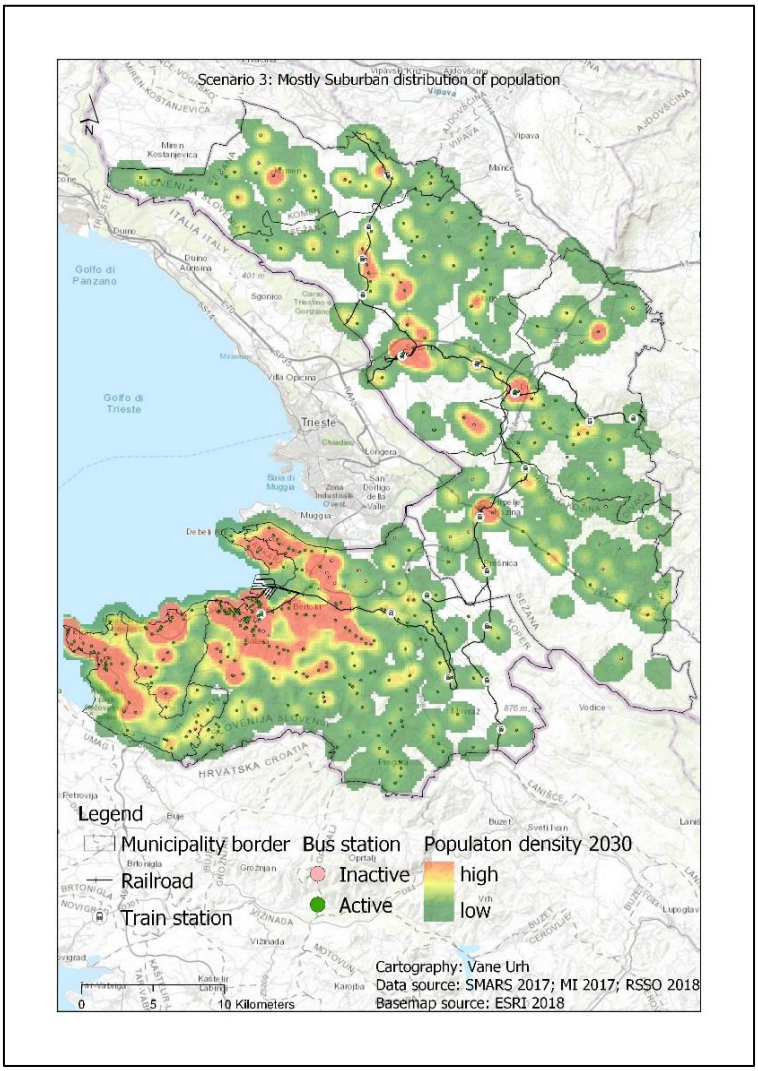


Figure 4.5: Population distribution in suburban development.

Suburban scenario bases on historic development of settlement in Coastal-Karst region. Growth is focused on outlined areas and is traditionally populated less densely. The urban cores keep approximately the same level of population, but the infill is less visible. Suburban areas gain more built areas (approximately 20 km^2), and density decreases to 105 inhabitants/km^2.

Suburban areas gain more built land, and sparse population pattern is continued. Residential areas and working places are located outside urban cores, what means more traffic is generated by personal cars, as the public transportation or alternative modes cannot compete against it. Development of suburban areas mean that some public services will be decentralised and located towards new population centres, mostly closer to current origins of employees. "Do-nothing" scenario in this case means expansion of housing and traffic infrastructure and higher costs for these purposes, while alternative mobility is neglected. Traffic flows between suburban centres remain on the same level as today, bus transportation stagnates, while there is smaller increase of travels by rail as the services are improved, because cargo transportation is shifted to the new railway track between Koper and Divača. Bicycle tracks connect main population centres, especially in the lowland areas. Walking decreases as the distances become longer, and urban population is moved towards the suburban areas and hinterland settlements.

Planning for mobility in suburban areas enhances a pack of services concept and segments markets and users in order to be efficient. Supply and demand must be planned and assessed in close collaboration with local population, in order to tailor services efficiently. Organisation of public transport is difficult because it is competing in space where parking is abundant and lower land value than in the urban zones.

New services of bike- and car-sharing schemes are introduced, while paratransit service is established on a regional level.

Public transportation is focused on connecting suburban areas with smaller infill towards the urban cores. Urban cores become places for tourists and travellers, while economic activities are located at the edges of historic centres. Karst areas continue to remain sparsely populated what results in extensive use of personal traffic, as the density of population in some areas remain at low level.

4.1.4 CONCLUSION

In 2016 the inhabitants of the region used in average 62 minutes per day to travel, which is the shortest travel time in any Slovenian region. 93 % of trips started and ended in the same region, also making it the region in Slovenia with the highest share.

Missing data that are identified as relevant for understanding modal split and mobility pattern in the region are: average daily distance travelled by car and other modes, accessibility to working places (time travelled by car or public transport), level of satisfaction with public transport facilities …

Scenarios will represent basis to understanding the connection between land use measures and transportation features in the region. As some municipalities have already adopted SUMPs (and they currently cover 85 % of regional population), a step forward to a regional approach will be necessary, as the national legislation accepted also a new measure in spatial planning – the regional spatial plan.

Transportation sector represents approximately 30 % of energy consumption and CO_2 emissions in the region, along with high share of active population employed in the same sector. With the advantage of strategic location come great benefits, but also great responsibility in terms of ensuring good quality of living for all inhabitants and visitors. Current environment is built keenly to personal cars, while public transportation is poorly developed and does not represent an efficient mode of transport, even for

elderly, who are unable to drive by themselves. In some areas the paratransit service is operating, but is based on voluntary activity of younger people and is not organised as real public service.

Mobility scenarios presented are different to the ones developed in MOBILITAS and CHESTNUT projects, and focus on spatial trends of population and working places movement. When future activities for SUMP elaboration will happen, it will be necessary to understand elaborated quantitative and qualitative scenarios, along with the spatial demand and supply of services in the region. Another important note is that the population is ageing what means more mobility impaired and handicapped inhabitants. If active transportation modes will not prevail, we might face greater costs in medical care as well.

4.2 SCV

4.2.1 INTRODUCTION

One of the main objectives of SMILE project is to learn and prepare Future Mobility Scenarios of the Municipality Velenje (hereinafter: Velenje or the MOV). What cities needs in mobility is a new culture, where more passengers adopt higher share of active modes of transport. More space is dedicated to pedestrians and cyclists, while public transportation infrastructure and services are improved and expanded. Multimodal choices offer convenient, safe, and efficient movement in space, while new types of circular and sharing economies are accessible to population and visitors. The role of test scenarios in the context of sustainable urban mobility planning is to encourage wide range of the stakeholders to discuss the future mobility of the area concerned. Scenario is a tool to help authorities, transport service providers, citizens, experts, companies, schools and other stakeholders to openly discuss the future of mobility and relevant policy in the region. These test scenarios are to stimulate the discussion, and are not meant to be mobility or transport policies itself for the future.

4.2.2 BACKGROUND_HISTORY AND NEW VELENJE

Velenje had a status of a market town until the twentieth century. It came into existence in the Middle Ages and was mentioned for the first time in the thirteenth century, although it has been inhabited since the new Stone Age. Until the nineteenth century, the settlement was mostly a trade and supply centre with few administrative functions. Its intensive development began together with the arising citizenry and industrialization. More intensive urbanization began not earlier than in the 1950s with building of the new Velenje, which became the youngest city in the then Yugoslavia with its official inauguration on the 20th September 1959. The new image occurred due to the development of the Velenje coal mining. They had to build new dwellings for about 20.000 inhabitants, which was a great challenge for the town planners, as they had to design an entirely new town. The idea was to build 'a city in a park' — the miners work all day down the earth, so when they come out they should live in a green and open city. The city of Velenje is, with its modern architecture, different from other Slovenian cities. Without an old city centre, without dense streets, open and green it sets its own standards, quite unusual for other cities. It has a lot of independently standing buildings, extensive lawns, large pedestrian areas, flat roofs and many other differences. There are many important buildings put up around the central part: the town hall, the hotel, the art centre, a former direction of the coalmine, the bank, the shops and other city infrastructures. The town got its basic appearance by Slovenian architects at the end of the 1950s when the modern was the prevailing architectural style. Because of the coal-mining three lakes in the broad city area came into existence. City of Velenje and the coalmine company has done a lot of work to revitalize the degraded area. The process is still going on. By these lakes lies the Tourist recreational centre Jezero. The lake area still has many tourism related potentials waiting to be exploited.

Today Velenje is one of the strongest economic poles in Slovenia, with highly developed coal-mining, metal industry and many other branches of economy and services. The Gorenje Group - household appliances producer employs almost a third of all labour in the valley, and the company itself is the biggest and the most important economic enterprise and exporter in Slovenia. At the same time, the number of small, highly specialized enterprises has been increasing and in the last decade, Velenje is becoming an important cultural and educational centre.

Velenje is located in the eastern part of the Šaleška valley at an altitude of 396 meters, covering the area of 83,5 sq km. In the central part of the municipality runs the river Paka. The whole part of the Šaleška dolina valley is urbanized. The city is the fifth largest city in Slovenia by population and it had developed and expanded during the last 50 years among settlements and villages Škale, Stara vas, Staro Velenje, Šalek and Šmartno. Velenje forms functional conurbation in the spatial and economic terms with the neighboring municipality of Šoštanj, together with over 40 000 inhabitants. Terrain characteristics: mostly flat terrain in the city of Velenje with hilly terrain on the outskirts of the city.

Velenje is relatively young city. Number of live births (2009) was higher than the number of deaths. Natural increase per 1,000 inhabitants in the municipality was thus positive for the year 2009 amounted to 4,4 (in Slovenia, 1.5). The number of those who have emigrated from municipality was higher than the number of those who have immigrated into it. Net migration per 1000 inhabitants in the municipality was therefore negative, it was -0.6. Sum of natural increase and net migration per 1000 inhabitants in the municipality was positive - 1.9 (in Slovenia, 10.9). The average age of residents is 40.0 years and thus lower the average age of people in Slovenia (41.3 years) (data from: 30.6.2009). Among residents of Municipality of Velenje, the number of the youngest 0-14 years is greater than the number of the oldest - aged 65 years or more. On 100 residents, aged 0-14 years, comes 89 residents, aged 65 years or more.

Pinch points of the road network where traffic jams regularly occur are during every work days in core city caused by majority of working places in whole region. In Velenje there is Velenje Lake, which is popular place for number of events during the whole year (mainly sports), attracting daily commuters from other regions and also foreigners. During summer there is peak flow, since there is located Velenje beach, which is attracting every year more visitors, mainly regional inhabitants and others from whole Slovenia, while number of foreigners is increasing. Beside that there are also some significant traditional events (example Pippi Longstocking festival as the biggest children festival in Slovenia every September). Beside that also:

•High school center Velenje – In 2016 there was 1655 students, attending different programs of high school, and 214 employees. 23% students are commuting from other Municipalities in FUA, which is the biggest share of commuters. Shopping center

•Velenjka – it is the largest shopping center in upper Savinjska-Šaleška region and gets numbers of commuters from other FUAs municipalities.

•Lakes of Velenje – located in Velenje is popular place for numerus of events during the whole year (mainly sports), attracting daily commuters from region, from other regions and foreigners. During summer, there is peak flow, since there is located Velenje beach, which is attracting every year more visitors, mainly regional inhabitants and others from whole Slovenia, but numbers of foreigners are increasing.

•Spa center Topolšica – Located in neighbor municipality Šoštanj, is attracting numbers of foreign visitors annually, and also daily commuters within the region

Traffic calming area is in Velenje, since almost whole center is closed for traffic. This is the result of building city in concept of garden city in 60's, with loads of green surfaces and good accessible basic

services. In core city there is also recreational center at Velenje lakes with leisure infrastructure (walking paths, benches, outdoor gym, etc.).

The most popular tourist attractions are the Coal Mining Museum of Slovenia, Velenje lake side, the Museum at Velenje castle, World's highest Tito's statue and the new modern architecture city center and promenade.

4.2.3 TRANSPORT DEMAND

City of Velenje is having free public transport, free bike-share system, train and two electric charging stations. There is no highway, tram or subway. Velenje has 13km of cycling paths and a lot of surfaces of pedestrian zones. Velenje is not connected to highway or having subway, tram and waterway. Main problem of public transport in the region is, that it is rather not satisfying and it is not being used as alternative to personal cars. Schedules are uncoordinated, resulting that buses are not suitable for everyday commuters.

The statistics about modal split at national level are collected by Ministry for infrastructure of Slovenia in document Transport development strategy in the Republic of Slovenia (2014). In passenger transport the use of private vehicles prevails; 8% of journeys are taken by public passenger transport, 5% by bicycle and 18% walking. More journeys in Slovenia are taken by private vehicle, since Slovenia has a lower level of urbanization and there are no major cities; however, there are many small, fragmented and dispersed rural settlements. More journeys by private vehicle are undertaken in small settlements, and fewer journeys in large settlements. Data for Velenje is collected and it is quite similar to data at national level:

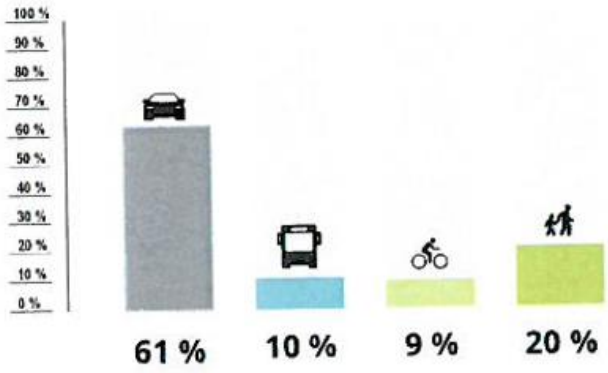


Figure 4.6: Modal split in Velenje

In Velenje physical and socio-geographic factors, are pointing to the great potential of Velenje as a cycling town. Slopes in Velenje are appropriate for development of cycling. More than half of Velenje has an appropriate slope, i.e. between 0° and 5°. The Šalek Valley in which Velenje is located has a moderate continental climate, and its characteristic climatic conditions allow for cycling throughout the entire year – even in the winter, if one wears proper clothing. The socio-geographic factors – characteristics of the population, morphological structure of the town and employment structure – suggest that Velenje is a suitable place for cycling. There are no unfavorable parts of core city for cycling since it is located in a valley, but after trying to reach other parts of municipality, which are located at higher altitudes, normal city bike is not enough anymore. This is the opportunity for developing some updating of city bikes to e-

bikes or at least for promotion of them as they are gaining importance in cycling industry. On the other hand this is also opportunity for developing cycling and recreational tourism, since surrounding of core city is more rural in comparison to industrialized and urban Velenje.

Cycling network in Velenje consists out of 13 km cycling lanes, from which all of those are separated from car traffic. But that information does not reflect the real situation of cycling infrastructure, where the mayor problem is missing connection and cyclists are forced to use either car streets or sidewalks for pedestrians. Among bicycle paths and lanes, there are also recreational paths at Velenje lakes showed on a picture from brochure prepared for visitors in Tourist information center, there are paths mainly purposed for recreation (cycling, walking, jogging and in winter cross-country skiing) in length of 11350 m. There are also other cycling and walking paths at rural parts of municipality, but the data is not available.

Figure 4.7: Recreational paths in the area of Šalek valley lakes

There is also a core city network map available – blue lines are representing city cycling network, green lines are for recreational paths all the dotted lines are for planned cycling and recreational paths. Red dots are representing employing centers, orange are shopping centers and blue are schools.

From map it is easy to see that whole city of Velenje is accessible by bike. The concept of the cycling network is good, but cycling paths are not interconnected and the network is incomplete, even dangerous in certain sections. Another weakness of the network is the lack of signs and direction boards and inadequate maps for potential cyclists. On a national level, there is a legislative framework that allows designing of cycling paths against one-way direction on one-way roads, but in core city there is no any. Parking conditions for cyclists are also not in favor for them.

Figure 4.8: Core city network map: Core city network map. Source: SUMP of Velenje, 2017

The research for preparing the local SUMP showed that there is no any bigger parking place for cyclists in the surrounding of railway or bus station in core city, which means that multimodality is hard to be encouraged. However, at main bus station there is a station for bike share, so it is easy to get a bike and continue a trip after arriving with bus.

In general, there is lack of parking spots for bikes in whole city. In front of public institutions there are usually present, but majority of those are inappropriate. For the case of neighborhoods (in Velenje there are parts with block neighborhoods with high population density) the parking's are present. There is no regulation about bicycle parking on the building code. Some of the buildings are having special places for bikes as bicycle sheds. Those places are not safe since there are lots of people living and everyone is having a key, so the bikes can get easily stolen. Beside bicycle sheds there are some bike parking usual also in front of buildings, but those are also inappropriate and not safe. A lot of people are storing their bikes in their cellars, but that is not in favor of using bike for every day, because it can take them a lot of time to take the bike out every day. As already stated, in core city, Velenje there is free bicycle sharing scheme with 12 stations and it is connected to municipality of Šoštanj with five more stations. Traffic accidents of cyclists in whole upper Savinja region in period from 2010 and 2016 are showed on a map (dots) from webpage http://nesrece.avp-rs.si/.

Figure 4.9: Cyclists accidents in whole upper Savinja region in 6 years period

In that period there was no death victim. It can be seen that most of the accidents are happening in municipality of Velenje and in general it can be stated that the most dangerous spots are outside centers and probably most of those cyclists were there for recreation causes. That means that missing of safe infrastructure is mainly in smaller settlements. The research made for preparing SUMP of Velenje showed, that in last years the number of accidents of cyclists is growing, which is a result of growing the importance of a bike in everyday use.

Local interests' groups in core city were quite successful in the past regarding ecological issues, since the municipality is primarily industrial center. That could be a good prospect for new generations, since cycling advocacy is also environmental-friendly advocacy. There are some local initiatives for development of urban cycling, but are not very active, which can be explained with lack of motivation, since groups are not numerous.

Figure 4.10: Map of locations of bike rental system (also in Šoštanj)

The main pedestrian zones in core city are in center which is closed for traffic. Outside of strict center there are also safe pavements that are serving pedestrians for walking to reach all the neighborhoods, companies, shopping centers, etc. There are still missing some tree avenues which would make shade for warmer seasons and some urban furniture which would make all the walkable distances even more enjoyable. At some pavements outside of strict center is missing lightening which would make night walk safer.

The railway in Velenje exist, but is not efficient, as there are no enough stops and infrastructure is quite old. Railway services are provided by national railway company, which is not investing a lot in infrastructure in general. Trains from Velenje ride only to Celje. During working days there are 12 trains at different hours available, in general every one hour and during peak hours there are three available, every 40 minutes. During weekends the situation is worse, since on Saturday there are only three trains available (between 5:30 and 14:15) and on Sundays there is no train available. Trains are actually not serving a lot of people. There is no exact number (or GIS data) of people living or business located in 500 m buffer zone from train station, but it can be told that share would be high. In proximity of station there is company Gorenje, the biggest one in region (approximately 4.000

employees), but there is no block neighborhood with really high population density. Caused by proximity of Gorenje, there is also freight-only rail track, which is serving only the company.

Velenje is having free public transport LOKALC, free bike-share system BICY, train and two electric charging stations. Free public bus is managed by Municipality of Velenje in collaboration with private company Nomago, and prior that company Izletnik. Main problem of public transport is that it is rather not satisfying and it is not being used as alternative to personal cars. Schedules are uncoordinated, resulting that buses are not suitable for everyday commuters.

The road-based public transport is a combination of circular and radial characteristics. In Velenje there is central bus station, which is serving also as central transfer point within region, but it has to be mentioned, that there is no many buses and it serves to students mainly, which are using school busses, and other disadvantaged social groups. By adopting local SUMP in municipality of Velenje there are also measures listed which are prioritizing the usage road-based of public transport. According to the survey 34% of interviewees are employees, who are followed by secondary school students and students with 29% and pensioners with 18% of all users. 40% of interviewees are using LOKALC to travel to work, 41% of users are travelling to school.

Figure 4.11: City bus "LOKALC" is free of charge in Velenje

4.2.4 SUSTAINABLE URBAN MOBILITY PLAN FOR VELENJE; LEGISLATION; SUPORTING DOCUMENTS

At national level Ministry of infrastructure in collaboration with Urban Planning Institute of the Republic of Slovenia published Guidelines for preparation of SUMPs in 2012. Those guidelines had to be followed as the same Ministry of infrastructure published an open call for municipality SUMPs in 2015, and Ministry for environment and spatial planning published an open call in 2017 for implementation of some measurements from prepared SUMPs. The interest in mobility themed topics is increasing which is result of European incentives and is reflecting to lower levels – mainly to municipalities.

The main issues that Municipality is dealing with is written in Sustainable Urban Mobility Plan (SUMP), which has identified that today's Velenje is burdened with dense motor traffic, which further increases

the needs of road infrastructure and endangers the weaker road users, while still facing low public transport infrastructure (PPP), disorder and the danger of cycling routes and footpaths.

The modern Municipality of Velenje will, as a regional hub, promote and introduce various forms of sustainable mobility in the future. It will strive for the accessibility of all inhabitants, daily migrants from settlements and hamlets of the entire Šaleška valley and other visitors, while it will behave with attractive public spaces and efficient connections in the municipality and the region.

In the area of transport development, the key linking role between the present and the present situation will be in the area of transport development in the field of transport development (SUMP), which the Municipality of Velenje jointly developed between 2016 and 2017 together with experts and with the help of the public and is one of the main novelties of the new design. Traditional traffic planning has given priority to **speed and efficiency** in decision-making on important projects in the municipality until recently, while **transparency and the inclusion of key stakeholder groups have been lost**. In addition, **the road infrastructure** and focus on **cars** were the **main focus of the discussion**.

The modern approach, for which we have decided and successfully obtained grants, is not only the preparation and adoption of the strategic transport document of the Velenje Municipality, but also the beginning of **the long-term process of creating a sustainable transport system**, where construction is only the last step in solving the challenges of transport. The current planning practice is being upgraded with a **thorough analysis of the situation**, the vision of transport development, **strategic goals and pillars**, which comprehensively include the areas of long-term action, such as **sustainable planning, walking, biking, public passenger transport and motor transport**.

The decision for sustainable mobility is thus a decision for green Velenje, which will maintain the balance between social equity, the quality of the living environment and the success of economic development. We have adopted a common challenge.

In the analysis of the traffic situation, it was found that, despite the progress made in recent years, Velenje is faced with a number of strategic challenges that are directly or indirectly related to transport.

Demographic image is negative

- Concern is the negative migration balance, especially the highly educated population, mostly due to economic conditions and high unemployment, especially among young people.
- In terms of traffic, there are problematic trends in terms of extending travel distances, whose overcoming, in the absence of competitive public passenger transport, is primarily due to car transport.
- On the one hand suburbanization occurs, since the number of inhabitants in the neighboring town of Velenje, where there was a seven percent decline in the number of inhabitants between 2008 and 2016, is increasing in neighboring places (e.g. Podkraj, Podgorje, Lipje, Bevče).
- On the other hand, the share of labor migration to other municipalities is increasing, as it increased from 22% to 32% between 2005 and 2015. Similarly, the motorization rate, which rose by 10 percent during the same period, is still growing, but still 477 cars per thousand inhabitants remains well below the Slovenian average.

The impact of transport links on the economy

- Current state of transport links has a very negative impact on the development of the local and regional economy.
- In the absence of fast and safe transport links, there is a serious risk that due to inadequate traffic connections and, consequently, lower competitiveness, some production programs will migrate to more logically better connected areas.
- Inadequate traffic connections also adversely affect the attractiveness of the site from the perspective of potential investors. The road connection to Arja vas is inadequate and dangerous, the railway system is uncompetitive, slow and outdated.
- While there is a general economic downturn, tourism is a positive trend, and good accessibility and mobility play an important role in this, and these positive changes will only be strengthened.
-

The quality of life can be further improved

- The Municipality of Velenje marks an attractive living environment. In terms of environmental quality, the efforts made for environmental rehabilitation and a sustainable investment policy yield good results. The quality of the environment has improved significantly since, among all the major cities in Slovenia where PM10 particulate matter concentrations are measured, Velenje has at least the exceedances of the daily concentration limit in the year and its values are well below the permissible limit.
- Nevertheless, the leading polluters are passenger and freight transport, which is almost entirely through the city of Velenje. Road transport is also the biggest problem in terms of noise, as it reduces the quality of life.
- Traveling habits, excessively tied to personal cars, are one of the elements of an increasingly sedentary lifestyle that contributes to a greater risk of the occurrence of various diseases. Thus, in the municipality, almost 27 percent of children are over-eating, which exceeds the Slovenian average.
- On the other hand, the physical activity of children in Velenje is also worse than the Slovenian average. The use of more sustainable forms of mobility plays a major role in improving public health both through increased physical activity and by reducing the external negative impacts of transport.
- Traffic safety has improved considerably over the past 15 years, but there are several accidents involving cyclists, but the number of accidents involving pedestrians remains at about 15 years ago. The safety of pedestrians and cyclists is thus one of the key challenges of an integrated transport strategy.

The car is to much a choice of mobility

- Trends of rising travel distances and motorization rates, as well as the lack of competitiveness of public passenger transport, have led to the use of a car in most of the years studied.
- The free city bus Lokalc provides a good connection to public passenger transport in the urban area, but there is a lot of optimization options that would make transport more user-friendly and more environmentally friendly.
- Intercity traffic is relatively satisfactory in the narrower area, but connections with major centers such as Celje, Maribor and Ljubljana are unsatisfactory.
- Similarly, rail links are characterized by long travel times and low frequencies.
- Due to favorable geographical features, cycling is an ideal form of mobility at shorter distances in the municipality, which is also supported by the automated bike rental system BICY, but the main

limiting factor for the faster development of cycling in everyday life is the deficient, sometimes hazardous cycling infrastructure that prevents fast and safe urban cycling.
- The conditions for walking have improved considerably, as is shown by the satisfaction of citizens with the regulation of pedestrian surfaces, but pedestrians are often too often in a subordinate position in terms of infrastructure planning. There is a great deal of potential for adjusting the infrastructure to people with reduced mobility.

Traffic planning is not comprehensive

- In the field of sustainable transport planning, the municipality has made great progress in recent years, so it is not surprising that we were ranked first in the study of Cipra (2011) in the light of efforts to move towards sustainable mobility.
- Nevertheless, traffic planning in the municipality is still too often subordinate to passenger cars, despite the sustainable guidelines in key strategic documents.
- Traffic planning is poorly integrated with other sectors at the municipal level as well as with the remaining entities in the field of space exploration. This is particularly true of spatial policy, in which the opportunities for promoting sustainable mobility are not exploited. We are still not aware of the importance of transport to improve public health and quality of life and the resulting impacts on the development of the municipality.

Municipality of Velenje is also having several strategic documents adopted, which are including principles of sustainable development and are somehow connected to sustainable mobility:

- Vision and strategy of Velenje till 2025 (2008)
- Long-term spatial plan of municipality of Velenje (2010)
- Strategy of age-friendly guidelines and activities in the Municipality of Velenje until 2020 (2013)
- Sustainable urban strategy till 2025(2015)
- Program of sustainable development – Local agenda 21 (2012)
- Municipality program of protecting the environment 2016-2020 (2015)
- The program for improving the life of disabled people in MO Velenje for the period 2014-2017 (2014)
- THE Sustainable Urban Mobility Plans OF THE VELENJE MUNICIPALITY, 2017
- PROJECT SMARTCOMMUTING: https://www.interreg-central.eu/Content.Node/SMART-COMMUTING.html
- PROJECT CHESTNUT: http://www.interreg-danube.eu/approved-projects/chestnut

Main document = SUMP for Velenje (2017) is targeting five main pillars of developing – establishing of strategically holistic approach to transport planning, promoting walking as mean of transport, exploitation of good conditions for cycling, developing of attractive public transport and changing of behavior of car drivers. Beside strictly SUMP themed documents there are also documents connected with traffic policies in different ways:

- Resolution about traffic policy of Republic of Slovenia (2006), adopted by the Government of Slovenia
- A law about spatial planning, adopted by the Government of Slovenia
- Strategy of traffic development in Slovenia (2015), adopted by the Government of Slovenia
- A law about transfers in road traffic (2006) - Government of Slovenia

- Decree on concessions for the provision of public utility services for the implementation of public transport (2004) - Government of Slovenia
- The concept of the national bicycle network in the Republic of Slovenia (2005) – Ministry of infrastructure

4.2.5 DIRECTIONS, VISION FOR VELENJE

The vision for Velenje in 2035 is: "Velenje as a regional hub promotes and introduces various forms of sustainable mobility. It is accessible to all with attractive public spaces and efficient connections in the municipality and the region".

As a result of the possible improvements of sustainable mobility there are 5 pillars on which we would want to develop our action plan for more sustainable developed mobility. In addition to the goals, each pillar also has measures to achieve the set goals. The measures have been carefully selected so that they are in line with the strategic and operational objectives to be socially beneficial, sustainable, feasible and financially efficient. The strategic 5 pillars of an integrated transport strategy in the future are described in table below.

Table 4.3: 5 pillars of an integrated transport strategy of Velenje in the future

SUSTAINABLE PLANNING	WALKING	CYCLING	PUBLIC TRANSPORT	MOTORCYCLE TRAFFIC
Establishment of integrated traffic planning	Introduction of walking as an important way of overcoming distances	Creation of conditions for exploitation of cycling possibilities	Development of attractive public passenger transport	Change of habits of users of motorized traffic

Exploitation of the geographical characteristics of the municipality for walking and cycling

The geographical features of the municipality, related to relief, climate, population density and short distances, enable most of the short paths to be made on foot or by bicycle. The opportunity is primarily to improve the safety and comfort of footpaths and bicycle connections, which would allow for quick overcoming distances. For this, it would make sense to upgrade the successes of recent years in improving infrastructure, slowing down traffic, closing down the motorway center, parking policies and renovating public spaces and markets. We also recognize great opportunities in walking and cycling as a tourist and recreational offer and planned remote biking connections.

Optimization of public passenger transport

The public free city bus LOKALC uses more and more residents, which gives us additional impetus for improving transport in the wider urban area. The possibilities are mainly in the optimization of lines and schedules, the upgrade of the information system and the system for issuing tickets, the expansion of the service and the fleet, and the improvement of the business model. There is also a great opportunity to better integrate forms of public passenger transport and other transport modes with them.

The third Slovenian development axis (3. Razvojna os)

Construction of the third development axis will link regional centers of international, national and regional importance, increase the competitiveness of the area, improve economic and institutional links and, ultimately, traffic safety. The third development axis will have direct impacts on the quality of life in the city by reducing the burden on the environment with traffic discharges and noise by moving the transit traffic currently taking place near the city center in Velenje.

Rational use of funds for transport

In the last decades, we devoted a lot of funds to motor transport, which, understandably, led to a focus on and dependence on automotive transport. We see the opportunity in the change of planning advantages, which would give more emphasis to sustainable forms of mobility.

Access to European funds and knowledge

Velenje is already actively involved in EU projects in the field of sustainable mobility (e.g. BICY, GUTS, CHESTNUT, SMART COMM), but we want to make even more active use of the opportunities for access to the resources, knowledge, information and experience available from the European Commission. Adoption of the strategy will further increase these opportunities.

Cooperation with others

We want to take advantage of the possibilities of regional cooperation, especially with the municipality of Šoštanj and other neighboring areas and other stakeholders in the area of public passenger transport and remote bicycle connections.

Mayor goals

In municipality of Velenje, according to local SUMP, adopted in 2017, there are two mayor goals for increasing the usage and accessibility of public transport:

- With different measurements increasing the usage of public transport there (till year 2022 20% increase of passengers in city and inter-city busses, till year 2022 10% increase of passengers of railways and till 2022 30% increasing of number of journeys with public transport).
- With different measurements improve of quality of public transport in general (till 2022 increasing of frequency of busses and optimization of routes, establishment of integrated ticket till 2019 and till 2022 adjusting whole public transport scheme to motion and sensory impediment persons).

4.2.6 MOBILITY SCENARIOS OF FUTURE DEVELOPMENT

The role of test scenarios in the context of sustainable urban mobility planning is to encourage wide range of the stakeholders to discuss the future mobility of the area concerned. Scenario is a tool to help authorities, transport service providers, citizens, experts, companies, schools and other stakeholders to openly discuss the future of mobility and relevant policy in the region.

These test scenarios are to stimulate the discussion, and are not meant to be mobility or transport policies itself for the future. Overreaching goals are:

- Healthy city;

- Environmentally safe, spatially attractive city;
- Cooperative city.

Following test scenarios were chosen for Velenje transport development:

1. *Optimization of public passenger transport*
2. *Conclusion of the network of city cycling routes and the construction of other cycling infrastructure and the construction of regional cycling links*
3. *Sustainable optimization of the arrangements for dormant traffic*

4.2.7 MOBILITY SCENARIO 1 - OPTIMIZATION OF PUBLIC PASSENGER TRANSPORT

Free city public transport (bus Lokalc)

- 5 lines, 43 stations
- 35.000 passengers per month
- Saving 2.000.000 tons of CO_2annually
- A specially-fitted bus runs the yellow route and is also disabled-friendly.

Figure 4.12: Lokalc

Table 4.4: OPTIMIZATION OF PUBLIC PASSENGER TRANSPORT

Objectives of the measure	Indicators
Improve the economy of the Lokalc service	Reducing the burden on the budget
Optimize timetables and routes	Increased passenger satisfaction with timetables and lines;
Upgrade the information system for informing passengers	Number of users of the external display application;
Improve rolling stock by introducing buses with more environmentally-friendly drive aggregates	Number of eco-buses
Increase the number of users of the service	Number of users

MOBILITY SCENARIO 1- IMPROVEMENTS

- Making public transport more attractive
- Public transport covers 70% of the city population and workplaces/schools by 2025 within 300m of stations/stops.
- High frequency of the service and longer service hours is provided.
- Introduction of integrated ticket system for all types of public transport (bus, tram, railway).
- Increase of the share of PT in modal split for 25 % by 2023.
-Reduction of CO2 and PM10 emissions caused by PT by 20 % by 2023.
-Reduction of CO2 and PM10 emissions caused by personal transport by 20 % by 2023.

4.2.8 MOBILITY SCENARIO 2- CONCLUSION OF THE NETWORK OF CITY CYCLING ROUTES AND THE CONSTRUCTION OF OTHER CYCLING INFRASTRUCTURE AND THE CONSTRUCTION OF REGIONAL CYCLING LINKS

Table 4.5: CONCLUSION OF THE NETWORK OF CITY CYCLING ROUTES AND THE CONSTRUCTION OF OTHER CYCLING INFRASTRUCTURE AND THE CONSTRUCTION OF REGIONAL CYCLING LINKS

Objectives of the measure	Indicators
Increase the share of cycling in urban transport	Number of daily riders
Enable the conditions for completing the city cycling route network	Number of completed sections of city cycling routes
Enabling conditions to improve other urban cycling infrastructure	Number of users of the external display application;
To contribute to the fulfillment of conditions for the implementation of regional cycling links	Number of regional bicycle connections; Number of accompanying cycling facilities
Increase the number of users of the service	

Conclusion of the network of city cycling routes

Figure 4.13: Existing cycling network in the city

Figure 4.14: Planning new connections

Enabling conditions to improve other urban cycling infrastructure

- The extension of BICY system (free of charge automated city bike sharing system)

- Expansion:

>From 77 bikes, 16 stations, 125 bike docks (in Velenje and Šoštanj) to 140 bikes, 32 stations, 220 docks (connecting with other neighbouring cities)

- Introduction of an electrical bike rental system:

>Introduction of electrical bikes to be implemented within the system

- Additional: canopies/roofs above the bicycle station; awards for users; improved APPs; BICY promotors in the city

Figure 4.15: BICY system

Figure 4.16: Map of rental points

- Parking places for bicycles with canopies

In front of all primary schools, kindergartens, library, gallery, cultural centre, Red Hall, youth centre, music school, health centre, railway station, bus station), other public buildings (villa Bianca, UE, CSD, Standard, MIC, post office), a canopy above the stands in front of the municipality

- Implementation of Cycle counters (4)
- Placement of Direction boards (information boards)
- Urban equipment: tube filling points (2), wheelbase poles (2), high-pitched refuse baskets, benches and other custom-made urban equipment according to the designer's proposal, planting.

Construction of Regional bicycle connections

Figure 4.17: Connecting Velenje – Šoštanj – Šmartno ob Paki – Mozirje

MOBILITY SCENARIO 2 – IMPROVEMENTS

- Increase of the share of cycling in modal split for 30 % by 2023.
- Improvement of the accessibility of recreational and tourist locations by sustainable modes for 10% by 2023.
- Reduction of CO2 and PM10 emissions caused by personal transport by 25 % by 2023

4.2.9 MOBILITY SCENARIO 3 - SUSTAINABLE OPTIMIZATION OF THE ARRANGEMENTS FOR DORMANT TRAFFIC

Table 4.6: SUSTAINABLE OPTIMIZATION OF THE ARRANGEMENTS FOR DORMANT TRAFFIC

Objectives of the measure	Indicators
Enable conditions for the execution of P + R parking lots	Number of P + R parking lots
Reform the policy of dormant transport to promote more environmentally friendly passenger transport	Introduction of free parking for electric and other "ecological" vehicles
Reform the policy of traffic calming measures to promote more environmentally friendly passenger transport	Number of traffic calming measures Number of charging points for electric vehicles
Providing parking options for transit freight vehicles	Number of restrained rest areas for freight vehicles
Providing the possibility of parking tourist buses	Number of parking lots for tourist buses

Construction of Park and Ride (P+R parking lots) in the vicinity of Velenje lake side area

Figure 4.18: Park and Ride (source: Bayern 2009)

Reducing road capacity for cars in congested city parts

This case study involved the closure of the section of the main street in Velenje to traffic as part of an integrated response to traffic congestion and urban decline.

Reducing road capacity for cars in congested city area can represent a sustainable, efficient planning solution. In addition, once freed from domination by car traffic, reclaimed urban spaces can become accessible, vibrant 'living' places.

Figure 4.19: Vibrant 'living' places (Source: 'Public spaces, public life', 1996, Jan Gehl and Lars Gemzøe)

As the streets and squares in the city centre have been pedestrianized and improved, the area has become more attractive yet also less accessible for the motorist. The city authority has adopted an integrated traffic management strategy for the city centre:

• limiting the number of parking spaces (charges for on-street parking are relatively high);

• reducing the number of lanes on several main routes into the city and using the space for bus and cycle lanes instead;

• restricting through traffic;

• while developing the suburban train, bus and bicycle networks.

In the city centre, 80 % of all journeys are made on foot, and 14 % by bicycle. Car traffic in the city core has been reduced and congestion is not a problem. The key to the success of these inner city transformations was undoubtedly the gradual way these rather drastic changes were made. This incremental approach has given residents time to adapt, to change from driving and parking their cars to walking, using bicycles and public transport.

Source: 'Public spaces, public life', 1996, Jan Gehl and Lars Gemzøe, The Danish Architectural Press and the Royal Danish Academy of Fine Arts School of Architecture Publishers. 'New city spaces', 2001, Jan Gehl and Lars Gemzøe, The Danish Architectural Press.

Figure 4.20: Before (left) and after (right) pedestrian prioritization

MOBILITY SCENARIO 3- IMPROVEMENTS

Prior to the road reallocation scheme approximately 7 000 vehicles per day drove through the main street. Now there is no car traffic. Traffic flow in streets adjacent to the square has risen from 1 000 to 3 500 vehicles per day, while in other streets there has been no change in traffic flows. Some of the traffic has 'evaporated', more trips in the city centre are now made on foot.

4.2.10 GOALS AND MEASURES

Overarching goals are basis for development of mobility scenarios in Velenje. Three relevant interests were taken into consideration while defining overarching goals. With a list of goals we set up a guidelines for the development of measures and also a basis for evaluation of the scenarios implementation.

The list of measures:

- Integrated public transport
- Building of displays at the PT stations

- Improvements on the railway system
- Bike sharing system
- Improvements of the existing cycling infrastructure
- Building of local and regional cycling network
- Introduction of traffic calming measures
- Building of new sidewalks and walking paths
- Improvements on the infrastructure for handicapped
- Building of charging stations for e-bikes
- Introduction of alternative fuel buses for PT
- Building of charging stations for e-cars
- Introduction of e-bikes in bike sharing systems
- Introduction of car sharing service
- Introduction of carpooling service
- Establishing parking policies in order to support sustainable mobility
- Improvements in parking controlling system
- Planting trees along the walking paths, sidewalks and in the pedestrian zones
- Introduction of cycling friendly urban furniture
- Building of local walking networks and establishing safe school ways
- Introduction of shared space
- Building of safe level crossing on railway
- Designing and setting of unique graphic communication for general public - promotional materials
- Distribution of promotion materials
- Awareness raising events for general public
- Awareness raising events for decision makers
- Establishing alternatives for freight traffic - dedicated parking facilities, time and mass restrictions, distribution centers etc.
- Improving the conditions for PT - new lines, busses, bus stations, information etc.

Overarching goals are:

OG 1: IMPROVING ACCESSIBILITY TO THE CITY AND WITHIN THE CITY FOR ALL (Optimization of public passenger transport)

OG 2: INFRASTRUCTURAL TRANSFORMATION IN FOR FUTURE MOBILITY (Conclusion of the network of city cycling routes and the construction of other cycling infrastructure and the construction of regional cycling links)

OG 3: REDUCING CAR DEPENDENCE AND IMPROVING THE CONDITIONS FOR TRANSPORT SHARING, PUBLIC TRANSPORT AND MULTIMODALITY (Sustainable optimization of the arrangements for dormant traffic Improving accessibility to the region and within the region, for all social groups)

4.2.11 MEASURES

Each measure for overarching goal is set as follows:

Table 4.7: Measures OG1

OG 1: Improving accessibility to the city and within the city for all		
Target	Indicator	Measure
Increase of the share of PT in modal split for 30 % by 2023	The share of PT in modal split	Integrated public transport Building of displays at the PT stations Improvements on the railway system
Increase of the share of cycling in modal split for 30 % by 2023	The share of cycling in modal split Number of eliminated critical points within existing cycling network Improvements of the existing cycling infrastructure Number of improved cycling lanes within existing cycling network The length of new cycling lanes [m]	Bike sharing system Improvements of the existing cycling infrastructure Building of local and regional cycling network
Decrease of traffic jams for 25% by 2023	Time lost in traffic jams Number of traffic jams	Integrated public transport
Decrease of the number of traffic accidents for 25% by 2023	Number of traffic calming measures Number of traffic accidents	Introduction of traffic calming measures

Table 4.8: Measures OG2

OG 2: Infrastructural transformation in for future mobility		
Target	Indicator	Measure
Increase of e-mobility and other alternative fuel vehicles by 25% by 2023 and the de-crease of standard vehicles by 25 % by 2023	Number of e-bikes Number of e-buses and other alternative fuel buses Number of e-charging stations Number of standard vehicles	Building of charging stations for e-bikes Introduction of alternative fuel buses for PT Building of charging stations for e-cars Introduction of e-bikes in bike sharing systems
Increase of the number of alternative PT transport services by 30% in by 2023	Number of alternative PT transportation services	Introduction of alternative fuel buses for PT

Table 4.9: Measures OG3

OG 3: Reducing car dependence and improving the conditions for transport sharing, public transport and multimodality.		
Target	Indicator	Measure
Increase of the number of car sharing service for 10% by 2023	Number of car sharing services	Introduction of car sharing service
Increase of the number of car pooling services for 10% by 2023	Number of carpooling services	Introduction of car pooling service
Increase of the share of PT in modal split for 30% by 2023	The share of PT in modal split	Integrated public transport (integrated ticket for different means of PT)
Set up parking management by introducing 5 parking policies by 2023	Number of new established parking policies	Building P&R at the entrance of Velenje (lake side area) Establishing parking policies in order to support sustainable mobility Improvements in parking controlling system
Increasing the share of cycling in modal split for 30% by 2023	The share of cycling in modal split Number of eliminated critical points within existing cycling network Number of improved cycling lanes within existing cycling network The length of new cycling lanes [m]	Improvements on the existing cycling network Building of local and regional cycling network

4.3 RAGUSA MUNICIPAL CONSORTIUM

The next pages and Appendix 2 report the following three development scenarios with horizon to 2030:

- Scenario 1 – Business-as-usual;
- Scenario 2 – Implementation of alternative measures by local authorities;
- Scenario 3 – Increasing of energy and fuel costs.

The first one is the **"base scenario"** describing the **current trend** according to the ongoing interventions which are already programmed and/or implemented, that mainly affects:

- the extension of Catania-Siracusa highway up to Ragusa (TEN-T road managed by external Consortium of Regional Authority), in order to create an East-West faster connection between the main town and the other urban centers of the provinces;
- progressive weakening of the local railway network managed by National company, because of the low local transport demand;
- the promotion of bike tourism through soft measures and with a limited extension of bike lanes only in the urban areas.

The **second scenario** analyzes the effects of **endogenous policies** on the local mobility development, by considering the implementation of possible measures that some Local Authorities are discussing (but not still adopting). The scenario affects mainly:

- the further improvement of local road networks to connect the future highway to the rest of minor towns and to the main intermodal terminals (Comiso airport and Pozzallo port);
- the strong improvement of electric transport policies, by building a spread public EVSE network to recharge the vehicles;
- the introduction of local car sharing, as alternative sharing transport services, in order to tackle the weak demand for public transport services;
- the introduction of *park-and-ride systems* in order to reduce urban traffic congestion, with free parking areas near to bus stations placed on the outskirts of a city, where the commuters and drivers can leave their cars and travel to the city center on public bus services.

The **third scenario** analyzes the effects of **exogenous policies** on the local mobility development, by considering the implementation of some external measures that some National and Regional Authorities could consider in the next years. The scenario affects mainly:

- the increasing of energy cost (both for electricity and fuels) because of a global world growth energy demand and lower fossil energy sources (mainly oil and carbon);
- the implementation of low carbon policies promoting renewable energy sources.

The baseline for each development scenario starts from 2015, which is the most recent year with almost completed data. The years 2016-2018 have not been used because of the lack of some data.

For a correct interpretation of results it is important to highlight that, according to the SUMP process and ELTIS guidelines, the following development scenarios aim to help the policymakers and stakeholders to assess independently the consequences of current trends, measures already programmed, and new policy choices. Therefore the development scenarios have not to represent the future policy goals, target or strategies of the SUMP, but only the foreseen trends on the basis of different alternative policies.

4.3.1 SCENARIO 0: Business As Usual

This scenario assumes continuation of the current transport policies over the next 15 years starting from the baseline, which is established on 2015. It means that points of view about main topics of international organizations like air pollution levels as well as energy and transport policies will not change up to the long term horizon stablished for 2030. Therefore, the Business as usual scenario foresees the continuation of the existing measures starting on the baseline year, such as:

- the extension of Catania-Siracusa highway up to Ragusa (TEN-T road managed by external Consortium of Regional Authority), in order to create an East-West faster connection between the main town and the other urban centers of the provinces;
- progressive weakening of the local railway network managed by National company, because of the low local transport demand;
- the promotion of bike tourism through soft measures and with a limited extension of bike lanes only in the urban areas.

The scenario considers the current features of the analyzed territory on the basis of data collected during the activity T1.1, by including:

- a stagnation of demographic growth rate of 0% per year;
- the maintenance of the low sprawl level of urban centers of the provinces;
- the maintenance of the local road network system connecting middle and small towns and a lack of extended public transport on railroad.

So that, the mode split will improves the private transport by road where the rate of trips by cars will increase up to 60,74% and forces a reduction of pedestrian displacements.

How will the demographic structure of your area and the core city in it be in your planning horizon around 2025 to 2030? (Number of population, age structure, etc).

On the basis of the data collected during the Activity T1.1, the number of population of the Province of Ragusa increased up to 2013 at 1% per year.

In 2015, there was 318.983 inhabitants and, on the basis of the last 5 years analyzed, it is estimated that the growth rate will be like 0,5% per year until 2030.

Over the 2030 year, it is possible to foresee a decreasing of the population, since between 2007 and 2015 the average age of permanent residents increased up to 1.5 years, and the senior index passed from 114,8 to 130,9.

The over 65 population will grow up in the next years, so that the active population ant the related transport demand gradually will be minor in the coming years.

The travel distance per trip on 2030 should be the same than 2015.

Which types of transport technology will have been diffused or will disappear in your area in your planning horizon around 2025 to 2030?

This scenario considers a slow technical progress for the next years until 2030 with special reference to vehicles and related supply infrastructures/equipment, without R&D investments at local level. If no Alternative Fuel Infrastructure will be developed in the coming years at local level, on 2030 the yearly growth rate of alternative fueled private car fleet is estimated equal to 8,5% for the hybrid electric vehicles, and almost 0 % for battery electric vehicles and fuel cell vehicles.

As regard Light-Duty Vehicles (i.e. light commercial vehicles that are limited to a gross vehicle weight of up to 3,500 kg), the hybrid and battery electric fleet used for mid-distance delivery will have a yearly growth rate equal to 0%.

Instead the hybrid and battery electric LDV fleet used for city logistic from urban platforms will have a yearly growth rate equal to 1,6%.

Finally, the increasing of alternatively fueled bus fleet is estimated with a yearly growth rate equal to 12,5% for CNG, 6,1% for hybrid electric, 0,3% for battery electric technology.

Therefore, as regard the alternatively fueled car vehicles, the scenario foresees on 2030 a share of 28,46%of hybrid electric car, 0,88 % of battery electric car, 0,09% of fuel cells car.

With reference to the rate of alternatively fueled bus vehicles, the scenario foresees on 2030 a share of 12,45% of CNG bus, 6,1% of hybrid electric bus and 0,45% of battery electric bus. Given the above, on 2030 the vehicle-km rate affecting the conventionally fueled cars (gasoline and diesel) will registers a decrease equal to -27,9% compared to 2015.

At mean time the number of accidents will register a reduction with a number per 100.000 inhabitants should decrease from 6,16 on 2015 to 5,65 on 2030.

How will the share of transport mode change in your core city and area? Will there be higher share of journey with cars or less? Will it increase or decrease the share of public transport? Will there be more cyclists and walkers, or less?

Compared to the baseline year, the share of transport mode will not change significantly on 2030 also on the basis of the low growth of the population and the limited urban sprawl of the Municipalities of Ragusa Province.

Following the current transport plans, in the province area there will not be a tram or metro network and the main mean of transport will be always the car that will register a light increasing from 59,62% in 2015 to 60,74% in 2030.

At meantime, if the current local and regional policies will confirm the low improvement of public transport services on the province, the bus share will decrease up to 16.54%.

The other means like bus or bike will remain almost on the same level.

Which part of your future prediction is not in line with upper-level transport policy (of region, country and EU)?

In the last years it was promoted the use of more environmental friendly and sustainable means of transport to decrease the car use.

The current local policies does not to promote the national and EU sustainable mobility strategies and, overall, on the improvement of public transport because the local low population density make the Province a "weak-demand areas". Therefore the cost-benefit analyses for the improvement of railway networks and tram solution do not allow to plan investment on rail mode.

Moreover, it is not considered any kind of raising activity to increase awareness about climate change and sustainable energy issues.

In particular, the measures to develop a local alternative fuel infrastructure are too much limited to develop an electric transport supply and subsequent demand.

Is the overall situation improving the living quality of your area?

Despite a slow technical progress for the next years until 2030, the trend of pollutant emission factors by transport mode is anyway considered equal to -4% per year for PM polluting emissions factors; -2% per year for CO polluting emissions factors; -4% per year for NOx polluting emission factors and -1,5% per year for VOC polluting emission factors. It is expected to reach in 2030 the 292.947,993 tonnes per year of CO2 emissions (-12,9% compared to 2015); 20,848 tonnes per year of PM emissions (-56,8% compared to 2015); 775,878 tonnes per year of CO emissions (-34,9% compared to 2015); 374,379 tonnes per year of NOx emissions (-63,9% compared to 2015) and 183,146 tonnes per year of VOC emissions (-37,7% compared to 2015). For more details refer to table 10 and Appendix 2.

What are the effects on particular demographic groups, such as children, elderly, low-income group, foreigners and migrants, students, mobility-impaired people, etc.?

Considering the constant population density of the area without an extension of urbanized areas, the business-as-usual scenario does not register particular variations in living conditions for the weak groups of population.

The overall situation of this scenario does not offer any particular policy to improve living conditions of weak groups of population like children (decreasing on 2030), elderly or mobility-impaired people and does not intervene in mobility policies to develop an efficient network for commuters, students or tourists.

In this framework, there are not created new opportunities related to additional options like health and free time activities.

Probably, the group of population that will be penalized in such scenario is represented by the over 65 group, that will increase up to 2030 with subsequent demand of home care for the elderly.

The poor families will be penalized for an increasing of transport expenditures per year due to the lack of alternative to the private transport.

Relatively to the average distance travelled per trip within the city, as internal mobility, it is estimated as ratio between total passenger-km and total passenger trips, predicting an almost constant value from 2015 to 2030.

How will the transport-related cost paid by each end user change? How will the transport-related cost paid by your municipalities or regional government change?

There will be a difference between the individual expenditure for transport, that will increase about 0,05% per year from 2015 to 2030, and the expenditures for transport by public administrations, that will be remain constant. However, the transport revenues of public administrations will decrease about -1,87% between 2015 and 2030. For more details refer to table 10 and Appendix 2.

Will the overall change lead to increase or decrease of transport-related energy consumption in your area?

Assuming a slow technical progress for the next years until 2030, the decreasing of car average fuel consumption trend is considered about -0,6 / -0,7% per years for gasoline, diesel, CNG and LPG fuel supply; about -0,2% per year for alternatively fueled vehicles. Although the use of car will be increased in 2030, the diffusion of the alternatively-fueled vehicles will cut down the transport-related energy consumption.

Will the overall change lead to increase or decrease of transport-related CO2 emission in your area?

This scenario predicts a decrease of CO2 equivalent emissions about 13%, passing from 336.245,351 tonnes per year in 2015 to 292.947,993 tonnes per year in 2030. For more details refer to table 10 and Appendix 2.

4.3.2 SCENARIO 1: Implementation of alternative measures by local authorities

This scenario add endogenous factors to the current transport policies over the next 15 years starting from the baseline, which is established on 2015.

In particular the scenario introduce some local policies on the mobility development, by considering the implementation of possible measures that some Local Authorities are discussing (but not still adopting).

Generally, the scenario consider an expansion of local road network involving a realization of park and ride systems to be integrated with the public transport services of the Province of Ragusa.

Moreover the scenario considers the diffusion of charging stations for EVs (Electric Vehicles) available everywhere in area by 2030 according to the Directive 2014/94/EU and the local National measures improving the alternative fuels.

The second scenario confirms anyway the existing measures already reported in the previous Business-as-usual scenario, such as:

- the extension of Catania-Siracusa highway up to Ragusa (TEN-T road managed by external Consortium of Regional Authority), in order to create an East-West faster connection between the main town and the other urban centers of the provinces;
- progressive weakening of the local railway network managed by National company, because of the low local transport demand;
- the promotion of bike tourism through soft measures and with a limited extension of bike lanes only in the urban areas.
- Moreover, such development scenario includes since the years 2018-2019 the implementation of following complementary local measures affecting:
- the further improvement of local road networks to connect the future highway to the rest of minor towns and to the main intermodal terminals (Comiso airport and Pozzallo port);
- the strong improvement of electric transport policies in all the towns of the province, by building a spread public EVSE network to recharge the vehicles;
- the introduction of local car sharing, as alternative sharing transport services, in order to tackle the weak demand for public transport services;
- introduction of incentives to buy and use low carbon vehicles;
- the introduction of park-and-ride systems in order to reduce urban traffic congestion, with free parking areas near to bus stations placed on the outskirts of a city, where the commuters and drivers can leave their cars and travel to the city center on public bus services.

The scenario considers the current features of the analyzed territory on the basis of data collected during the activity T1.1, by including:

- a stagnation of demographic growth rate of 0% per year;
- the maintenance of the low sprawl level of urban centers of the provinces;
- the improvement of the local road network system connecting middle and small towns and a lack of extended public transport on railroad.
- the development of a wide network of Electric Vehicle Supply Equipment covering all the
- Municipalities of the province.

So that in this framework the scenario predicts a strong reduction of vehicles-km car conventional vehicles and of CO2 emissions thanks to the introduction of innovative mobility technologies.

How will the demographic structure of your area and the core city in it be in your planning horizon around 2025 to 2030? (Number of population, age structure, etc).

The second Scenario reports the same development of demographic structure predicted in the Business-as- usual Scenario, considering the data collected and processed in the survey. On the basis of the data collected during the Activity T1.1, the number of population of the Province of Ragusa increased up to 2013 at 1% per year. In 2015, there was 318.983 inhabitants and, on the basis of the last 5 years analyzed, it is estimated that the growth rate will be like 0,5% per year until 2030. Over the 2030 year, it is possible to foresee a decreasing of the population, since between 2007 and 2015 the average age of permanent residents increased up to 1.5 years, and the senior index passed from 114,8to 130,9.

The over 65 population will grow up in the next years, so that the active population ant the related transport demand gradually will be minor in the coming years. The travel distance per trip on 2030 should be almost the same than 2015

Which types of transport technology will have been diffused or will disappear in your area in your planning horizon around 2025 to 2030?

Compared to the previous Scenario, the second one considers a **fast technical progress** for the next years until 2030 with special reference to vehicles and related supply infrastructures/equipment, with **R&D investments at local level** to improve the urban facilities.

If a new network of Alternative Fuel Infrastructure will be developed in the coming years at local level, on 2030 the yearly growth rate of alternative fueled private car fleet is estimated equal to 15% for the hybrid electric vehicles, 25% for battery electric vehicles and 4% for fuel cell vehicles.

As regard Light-Duty Vehicles (i.e. light commercial vehicles that are limited to a gross vehicle weight of up to 3,500 kg), the hybrid and battery electric fleet used for mid-distance delivery will have a yearly growth rate equal to 26%.

Instead the hybrid and battery electric LDV fleet used for city logistic from urban platforms will have a yearly growth rate equal to 33%.

Finally, since the scenario does not introduce specific measures on public transport services, as well as for the business-as-usual scenario, the increasing of bus innovative vehicle fleet is estimated with a yearly growth rate equal to 12,5% for CNG, 6,1% for hybrid electric, 0,3% for battery electric technology.

Therefore, compared to the previous prediction, as regard the alternatively fueled car vehicles, the scenario foresees on 2030 a share of **18,62% for hybrid electric cars** (respect to 28,46% of previous Scenario 1), of **26,5% for battery electric cars** (respect to 0,88% of previous Scenario 1), and of **3,99% for fuel cells cars** (respect to 0,09% of previous Scenario 1).

Instead, with reference to the rate of alternatively fueled bus vehicles, without specific policies on this field, the scenario foresees on 2030 a share of 12,45% of CNG bus, 6,1% of hybrid electric bus and 0,45% of battery electric bus.

Given the above, the vehicle-km rate affecting the **conventionally fuelled cars** will registers **a decrease equal to -49,1%** compared to 2015.

At mean time the number of accidents will register a reduction with a number per 100.000 inhabitants passing from 6,16 on 2015 to 5,63 on 2030.

How will the share of transport mode change in your core city and area? Will there be higher share of journey with cars or less? Will it increase or decrease the share of public transport? Will there be more cyclists and walkers, or less?

This scenario introduces the car sharing as further mode of transport. Compared to the baseline year, the share of transport mode will not change significantly on 2030 also on the basis of the low growth of the population and the limited urban sprawl of the Municipalities of Ragusa Province. If it will be confirmed

the current public transport plans, in the province area there will not be a tram or metro network and the main mean of transport will be always the car. Anyway, the Scenario register in this case a light decreasing from 59,62% in 2015 to 59,27% in 2030.

At meantime, if the current local policies will introduce a sharing mobility services integrating the low level of traditional public transport services, the bus share will decrease up to 16.14% (against 16.92% on 2015) but will be supported by 1,95% of car sharing rate. The other means like motorbikes or bike will remain almost on the same level.

Which part of your future prediction is not in line with upper-level transport policy (of region, country and EU)?

The aims predicted in this scenario are in line with the national and EU sustainable mobility policies and it is expected to reduce air pollution improving living conditions. In the last years it was promoted the use of more environmental friendly and sustainable means of transport to decrease the car use. The complementary local policies will promote the national and EU sustainable mobility strategies and, overall, the car-sharing as solution to integrate the public transport in “weak-demand areas”. The scenario will improve the electric transport pursuant the Directive 2014/94/EU. Therefore, the measures to develop a local alternative fuel infrastructure aim to develop an electric transport supply and subsequent demand in all the cities of the province

Is the overall situation improving the living quality of your area?

Compared to the other ones, this Scenario report the lowest air pollutant levels and best benefit for the local population affecting the air quality and, subsequently, the living quality of the overall area. Assuming a fast technical progress for the next years until 2030, the trend of pollutant emission factors by transport mode is considered equal to -9% per year for PM polluting emissions factors; -4% per year for CO polluting emissions factors; -8% per year for NOx polluting emission factors and -3,5% per year for VOC polluting emission factors. It is expected to reach in 2030 the 222.926,454 tonnes per year of CO2 emissions (-33,7% compared to 2015); 7,364 tonnes per year of PM emissions (-84,7% compared to 2015); 374,970 tonnes per year of CO emissions (-68,5% compared to 2015); 158,624 tonnes per year of NOx emissions (-84,7% compared to 2015) and 112,240 tonnes per year of VOC emissions (-38,2% compared to 2015). For more details refer to table 10 and Appendix 2.

What are the effects on particular demographic groups, such as children, elderly, low-income group, foreigners and migrants, students, mobility-impaired people, etc.?

Despite the constant population density of the area without an extension of urbanized areas, the scenario registers some positive variations in living conditions for the weak groups of population. The policies introduced in this scenario try to offer some elements that improve urban policies, such as the expansion of road network or the creation of free parking slots in peripheral areas to leave private cars and use public transport services. However, despite the investments and purpose to develop an efficient mobility network for commuters, students or tourists, the policies do not reach the goal to shift the modal split towards the bus. Probably the failure of this goal could be due to the weak transport demand in the area and the low population density that do not allow to have a cost/benefit rate in this kind of investments.

Anyway, the low-income groups will be advantaged by the opportunity of car-sharing in order to reduce the yearly cost of transportation. Moreover, the Scenario predicts an improvement of the safety in the road transport with a reduction of accidents and fatalities with positive impact of all the population that is permanent resident in peripheral areas and in smaller urban centers of the province. Generally, the strong reduction of air pollutant in this scenario will have positive advantage for the health of all the weak groups of population. Probably, also in this scenario the group of population that will be penalized is represented by the over 65 group, that will increase up to 2030 with subsequent demand of home care for the elderly. Relatively to the average distance travelled per trip within the city, as internal mobility, it is estimated as ratio between total passenger-km and total passenger trips, predicting an almost constant value from 2015 to 2030.

How will the transport-related cost paid by each end user change? How will the transport-related cost paid by your municipalities or regional government change?

As reported in the previous section, there will be a positive impact on the individual expenditure for transport, that will decrease about -2,6% between 2015 and 2030. Instead, the expenditures for transport by public administrations will increase of 1,6% in 2030 after a peack of costs in the first years of the implementation of the starting investments. Anyway, the implemented policies will have a positive impact on transport revenues of public administrations that will increase of about 13,9%, by reducing the negative results of the net financial ratio for public administrations. As final results, the implemented policies of such scenario will reduce the overall transport social monetary costs up to -12,5% between 2015 and 2030. For more details refer to table 10 and Appendix 2.

Will the overall change lead to increase or decrease of transport-related energy consumption in your area?

Assuming a fast technical progress for the next years until 2030, the decreasing of car average fuel consumption trend is considered about -2,6 / -3,0% per years for gasoline, diesel, CNG and LPG fuel supply; about -0,9% per year for other alternatively fueled vehicles. Although the use of car will increase in2030, but less that in the business-as-usual scenario. In this case the growth of the motorization rate will be due to the diffusion of the alternatively-fuelled vehicles that will cut down the transport-related conventional energy consumption

Will the overall change lead to increase or decrease of transport-related CO 2 emission in your area?

This scenario predicts a decrease of CO2 equivalent emissions about -33,7%, passing from 336.245,351 tonnes per year in 2015 to222.926,454 tonnes per year in 2030. To this end, such scenario reaches the best results compared to the other ones. Moreover, the scenario considers a fast technical progress for the next years until 2030 with special reference to vehicles and related supply infrastructures/equipment, such as Electric Vehicle Supply Equipment (EVSE). So that it is predicted an increasing of the rate of electricity generated by Renewable Energy Source (RES) and improvement of smart green policies connected to the development of infrastructures and facilities for Smart Cities and Smart Roads following the current transport plans and policies at European and national level as well as the implementation of Directive 2014/94/EU. For more details refer to table 10 and Appendix 2.

4.3.3 SCENARIO 2: Increasing of energy and fuel costs

This scenario add exogenous factors to the current transport policies over the next 15 years starting from the baseline, which is established on 2015.

In particular the scenario introduce some external policies implemented by National Authorities following an hypothetical energy crisis due to the evolution of global market, in order to analyze the possible local impacts on the mobility system of the province.

The Scenario consider an increase of crude oil price, that will be double in 2030 respect to 2015 (as well as appended in previous historical periods), and a subsequent general growth of energy cost due to the growth of the demand at National and global level.

The scenario predict an improvement of transition policies for sustainable development and renewable energies in order to counteract the energy crisis.

In this framework, it is predicted a strong reduction of vehicles-km by car conventional vehicles and a gradual introduction of low carbon vehicles (CNG, LNG, Hybrid electric, BEVs and fuel cells).

Also in this case the scenario considers the diffusion of charging stations for EVs (Electric Vehicles) available everywhere in area by 2030 according to the Directive 2014/94/EU and the local National measures improving the alternative fuels, but without a coordination with local policies.

The second scenario confirms anyway the existing measures already reported in the previous Business-as-usual scenario, such as:

- the extension of Catania-Siracusa highway up to Ragusa (TEN-T road managed by external Consortium of Regional Authority), in order to create an East-West faster connection between the main town and the other urban centers of the provinces;
- progressive weakening of the local railway network managed by National company, because of the low local transport demand;
- the promotion of bike tourism through soft measures and with a limited extension of bike lanes only in the urban areas.
- Moreover, such development scenario includes since the years 2018-2019 the implementation of following external policies and exogenous conditions affecting:
- the increasing of energy cost (both for electricity and fuels) because of a global world growth energy demand and lower fossil energy sources (mainly oil and carbon);
- an improvement of electric transport policies, by building a spread public EVSE network to recharge the vehicles only in the towns with more than 30.000 inhabitants;
- the implementation of low carbon policies promoting renewable energy sources, green taxations/fuel duties, and incentives to install local plant for the distributed energy generation.

The scenario considers the current features of the analyzed territory on the basis of data collected during the activity T1.1, by including:

- a stagnation of demographic growth rate of 0% per year;
- the maintenance of the low sprawl level of urban centers of the provinces;

- the maintenance of the local road network system connecting middle and small towns and a lack of extended public transport on railroad.
- the development of a wide network of Electric Vehicle Supply Equipment covering all the Municipalities of the province.

So that in this framework the scenario predicts a strong reduction of vehicles-km car conventional vehicles and of CO2 emissions thanks to the introduction of innovative mobility technologies.

How will the demographic structure of your area and the core city in it be in your planning horizon around 2025 to 2030? (Number of population, age structure, etc.)

The third Scenario reports the same development of demographic structure predicted in the Business-as-usual Scenario, considering the data collected and processed in the survey.

On the basis of the data collected during the Activity T1.1, the number of population of the Province of Ragusa increased up to 2013 at 1% per year. In 2015, there was 318.983 inhabitants and, on the basis of the last 5 years analyzed, it is estimated that the growth rate will be like 0,5% per year until 2030. Over the 2030 year, it is possible to foresee a decreasing of the population, since between 2007 and 2015 the average age of permanent residents increased up to 1.5 years, and the senior index passed from 114,8 to 130,9. The over 65 population will grow up in the next years, so that the active population ant the related transport demand gradually will be minor in the coming years. The travel distance per trip on 2030 should be almost the same than 2015.

Which types of transport technology will have been diffused or will disappear in your area in your planning horizon around 2025 to 2030?

Also the previous Scenario, the second one considers a fast technical progress for the next years until 2030 with special reference to vehicles and related supply infrastructures/equipment.

The scenario predicts also investments at national level to improve technology on transportation, the energy storage capacity and green taxation measures (higher fuel duties, and car ownership taxation).

As well as for the scenario 2, if a new network of Alternative Fuel Infrastructure will be developed in the coming years at local level, on 2030 the yearly growth rate of alternative fueled private car fleet is estimated equal to 15% for the hybrid electric vehicles, 25% for battery electric vehicles and 4% for fuel cell vehicles.

As regard Light-Duty Vehicles (i.e. light commercial vehicles that are limited to a gross vehicle weight of up to 3,500 kg), the hybrid and battery electric fleet used for mid-distance delivery will have a yearly growth rate equal to 26%.

Instead the hybrid and battery electric LDV fleet used for city logistic from urban platforms will have a yearly growth rate equal to 33%.

Finally, since the scenario does not introduce specific measures on public transport services, as well as for the business-as-usual scenario and scenario 2, the increasing of bus innovative vehicle fleet is estimated with a yearly growth rate equal to 12,5% for CNG, 6,1% for hybrid electric, 0,3% for battery electric technology.

Therefore, compared to the previous prediction, as regard the alternatively fueled car vehicles, the scenario foresees on 2030 a share of 15,30% for hybrid electric cars (respect to 28,46% of previous Scenario 1), of 24,07% for battery electric cars (respect to 0,88% of previous Scenario 1), and of 3,99% for fuel cells cars (respect to 0,09% of previous Scenario 1).

Instead, as well as for the previous scenario, with reference to the rate of alternatively fueled bus vehicles, without specific policies on this field, the scenario foresees on 2030 a share of 12,45% of CNG bus, 6,1% of hybrid electric bus and 0,45% of battery electric bus.

Given the above, the vehicle-km rate affecting the conventionally fuelled cars will registers a decrease equal to -43,2% compared to 2015.

At mean time the number of accidents will register a reduction with a number per 100.000 inhabitants passing from 6,16 on 2015 to 5,28 on 2030 (the lowest value between the compared scenarios.

How will the share of transport mode change in your core city and area? Will there be higher share of journey with cars or less? Will it increase or decrease the share of public transport? Will there be more cyclists and walkers, or less?

Compared to the baseline year, the share of transport mode will confirm the trip behaviors on 2030 also on the basis of the low growth of the population and the limited urban sprawl of the Municipalities of Ragusa Province. If it will be confirmed the current public transport plans, in the province area there will not be a tram or metro network and the main mean of transport will be always the car. Anyway, the Scenario register in this case a light increasing from 59,62% in 2015 to 60,74% in 2030. At meantime, considering the constant low level of traditional public transport services, the bus share will decrease up to 16.54% (against 16.92% on 2015). The other means like bus or motorbike register a small decrease contrary to the bicycle that registers an increase. It is predicted a decrease of pedestrian (19,60% in 2015 and 18,80% in 2030).

Which part of your future prediction is not in line with upper-level transport policy (of region, country and EU)?

The aims predicted in this scenario are in line with the national and EU sustainable mobility policies and it is expected to reduce air pollution improving living conditions.

In the last years it was promoted the use of more environmental friendly and sustainable means of transport to decrease the car use.

The scenario will improve the electric transport pursuant the Directive 2014/94/EU, despite the increasing of energy costs that should be counteracted by improving of renewable energy sources.

Therefore, the measures to develop a local alternative fuel infrastructure aim to develop an electric transport supply and subsequent demand in all the cities of the province.

Is the overall situation improving the living quality of your area?

Compared to the other ones, this Scenario reports a minor reduction of air pollutant levels and lower benefit for the local population affecting the air quality and, subsequently, the living quality of the overall

area. The minor impact is due to the lack of coordination of policies with public transport measures and a low integration of energy policies with mobility policies. Anyway, for the increasing of energy costs, it is expected to reach in 2030 the 319.739,512 tonnes per year of CO2 emissions (-4,9% compared to 2015); 28,136 tonnes per year of PM emissions (-41,6% compared to 2015); 851,429 tonnes per year of CO emissions (-28,5% compared to 2015); 529,604 tonnes per year of NOx emissions (-49,1% compared to 2015) and 208.846 tonnes per year of VOC emissions (-0,3% compared to 2015). For more details refer to table 10 and Appendix 2.

What are the effects on particular demographic groups, such as children, elderly, low-income group, foreigners and migrants, students, mobility-impaired people, etc?

Considering the constant low population density of the area without an extension of urbanized areas, the scenario does not register particular positive variations in living conditions for the weak groups of population and does not intervene in mobility policies to develop an efficient network for commuters, students or tourists.

In this framework, there are not created new opportunities related to additional options like health and free time activities, because the policies introduced in this scenario do not try to offer some elements that improve urban policies.

Probably, the group of population that will be penalized in such scenario is represented by the over 65 group, that will increase up to 2030 with subsequent demand of home care for the elderly.

The poor families will be penalized for an increasing of transport expenditures per year due to the lack of alternative to the private transport.

Anyway, the Scenario predicts an improvement of the safety in the road transport with a reduction of accidents and fatalities with positive impact of all the population that is permanent resident in peripheral areas and in smaller urban centers of the province.

Generally, the little reduction of air pollutant in this scenario will have positive advantage for the health of all the weak groups of population.

Probably, also in this scenario the group of population that will be penalized is represented by the over 65 group, that will increase up to 2030 with subsequent demand of home care for the elderly.

As regards the average distance travelled per trip within the city, as internal mobility, it is estimated as ratio between total passenger-km and total passenger trips, predicting an almost constant value from 2015 to 2030. So, it will not involve variations in living conditions for the weak population.

How will the transport-related cost paid by each end user change? How will the transport-related cost paid by your municipalities or regional government change?

Considering the higher energy costs predicted in the following scenario, there will be a negative impact on the individual expenditure for transport, that will increase up to 15,6% between 2015 and 2030. At the same time, the expenditures for transport by public administrations will increase of 0,01%from 2015 to 2030. On the contrary, transport revenues of public administrations will decrease of about -8,5%. Instead, the expenditures for transport by public administrations will increase only of 0,01% in 2030, since there

will be no specific investments. Anyway, the lack of implemented policies will have a negative impact on transport revenues of public administrations that will decrease of about -8,5%. Finally, the implemented policies of such scenario will reduce the overall transport social monetary costs up to 6% between 2015 and 2030. For more details refer to table 10 and Appendix 2.

Will the overall change lead to increase or decrease of transport-related energy consumption in your area?

Assuming a fast technical progress for the next years until 2030 due to the energy transition policies, the decreasing of car average fuel consumption trend is considered about -2,6 / -3,0% per years for gasoline, diesel, CNG and LPG fuel supply; about -0,9% per year for alternatively fueled vehicles. Although the use of car will not change in 2030, the diffusion of the alternatively-fueled vehicles will cut down the transport-related conventional energy consumption but it will not to increase the use of public transport.

Will the overall change lead to increase or decrease of transport-related CO 2 emission in your area?

This scenario predicts a decrease of CO2 equivalent emissions about -4,9%, passing from 336.245,351 tonnes per year in 2015 to 319.739,512 tonnes per year in 2030. To this end, such scenario reaches the lowest results compared to the other ones. Moreover, the scenario considers a fast technical progress for the next years until 2030 with special reference to vehicles and related supply infrastructures/equipment, such as Electric Vehicle Supply Equipment (EVSE). So that it is predicted an increasing of the rate of electricity generated by Renewable Energy Source (RES) and improvement of smart green policies connected to the development of infrastructures and facilities for Smart Cities and Smart Roads following the current transport plans and policies at European and national level as well as the implementation of Directive 2014/94/EU. For more details refer to Appendix 2.

Table 4.10 Different impacts of choices

Indicator	Baseline (2015)	SCENARIO 1 (2030) Business as usual	SCENARIO 2 (2030) Implementation of alternative measures	SCENARIO 3 (2030) Increasing of energy and fuel costs
Motorisation rate (car/1000 inhab.)	651	680,96	679,49	**680,96**
Mode split (%)	Pedestrian 19,60% Bicycle 0,48% Motorbike 3,38% Car 59,62% Bus 16,92% Car sharing 0%	Pedestrian 18,80% Bicycle 0,56% Motorbike 3,36% Car 60,74% Bus 16,54% Car sharing 0%	Pedestrian 18,70% Bicycle 0,58% Motorbike 3,36% Car 59,27% Bus 16,14% Car sharing 1,95%	**Pedestrian 18,80% Bicycle 0,56% Motorbike 3,36% Car 60,74% Bus 16,54% Car sharing 0%**
Travel distance per trip (km)	4,24	4,25	4,23	**4,25**
Average car speed in peak hours (km/h)	45	43,69	43,96	**43,69**
Average bus speed in peak hours (km/h)	18	17,79	17,83	**17,79**
Vehicles-km by car conventional vehicles	1.015,29	731,96	517,24	**577,12**

Rate of alternatively fuelled car vehicles	Hybrid electric 1% Battery electric 0% Fuel cells 0%	Hybrid electric 28,46% Battery electric 0,88% Fuel cells 0,09%	Hybrid electric 18,62% Battery electric 26,50% Fuel cells 3,99%	**Hybrid electric 15,30% Battery electric 25,07% Fuel cells 3,99%**
Rate of alternatively fuelled bus vehicles	CNG 12% Hybrid electric 0,10% Battery electric 0%	CNG 12,45% Hybrid electric 6,1% Battery electric 0,45%	CNG 12,45% Hybrid electric 6,1% Battery electric 0,45%	**CNG 12,45% Hybrid electric 6,1% Battery electric 0,45%**
CO_2 emissions per year (tonnes)	336.245,351	292.947,993	222.926,454	**319.739,512**
PM emissions per year (tonnes)	48,225	20,848	7,364	**28,136**
CO emissions per year (tonnes)	1.191,407	775,878	374,970	**851,429**
NOx emissions per year (tonnes)	1.039,478	374,379	158,624	**529,604**
VOC emissions per year (tonnes)	293,944	183,146	112,240	**208,846**
Total Accidents by severity (individuals)	Fatality 19,63 Serious 436,13	Fatality 18,04 Serious 402,23	Fatality 17,96 Serious 400,13	**Fatality 16,83 Serious 375,05**
Fatalities per 100,000 inhabitants	6,16	5,65	5,63	**5,28**
Transport expenditure per individual per year (1000EUR/year)	1,092	1,100	1,064	**1,262**
Transport expenditure of public administration (1000EUR/year)	141.941,499	141.941,499	144.197,375	**141.961,499**
Revenues of public administration (1000 Euro/year)	38.188,90	37.474,28	43.490,48	**34.948,178**
Transport social monetary costs (1000 Euro/year)	238.419,24	220.697,38	208.625,51	**253.002,235**
Net financial result for public administration (million Euro)	-1.184	-1.184	-1.106	**-1.184**

4.4 ZADRA NOVA

4.4.1 SCENARIO 0: Business As Usual

Hypotheses

FUA Zadar will continue current transport/mobility policy until 2025; EU, National and Regional Policies will not change until 2025. SUMP and ITS implementation will provide better mobility conditions for different users. Common vision for the entire FUA Zadar identifies priorities such as development of cycling network, better coordination of public transport, modernization of infrastructure and implementation of smart and innovative transport solutions.

Strategies and measures

No new measures for supporting sustainable mobility are foreseen.

Short, medium and long results

Until 2025 all transport modes will remain the same as today with more emphasis on the usage of clean vehicles and fuels. FUA Zadar in accordance with EU and National legislation will support the use of electric cars. Overall change will lead to decrease of transport-related CO_2 emission in FUA Zadar. At the moment government policy encourages reduction of CO_2 emission by extra taxing cars with higher CO_2 emission.

Table 4.11 Different impacts of choices

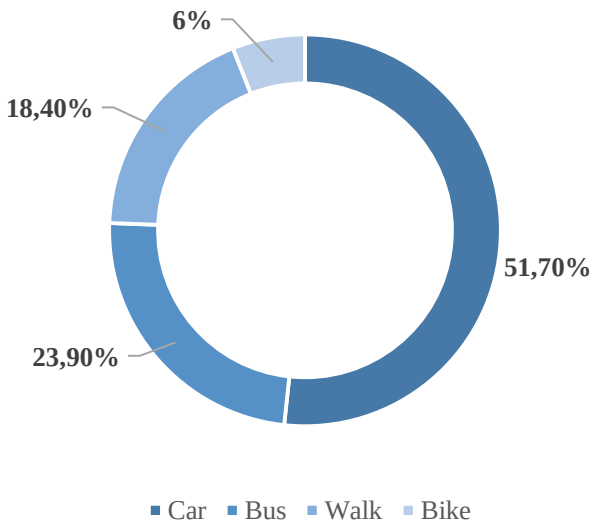
Indicator		Baseline	**Buisnes as usual**	Fostering "active" transport modes (walking and cycling)	Eu Policy prohibite private car ownership by 2045
Modal split	Car	51,70%	**54%**	45%	20%
	Bus	23,90%	**24,20%**	27,30%	37,60%
	Walking	18,40%	**17,30%**	20%	28%
	Bike	6%	**4,50%**	8%	14%
Achieve CO2-free city	Number of cars	367,7 cars/1000 inhabitant	**452,3 cars/1000 inhabitant**	331,4 cars/1000 inhabitant	150 cars/1000 inhabitant
Personal activity	number of population walking	18,40%	**17,30%**	20%	28%
	number of population cycling	6%	**4,50%**	8%	14%
	Length of cycling paths	14,86 km	**17 km**	150 km	200 km
Achieve transport intermodality	Increase the number of population using public transport	23,90%	**24,20%**	27,30%	37,60%

4.4.2 SCENARIO 1: Fostering “active” transport modes (walking and cycling)

Fostering “active” transport modes (walking and cycling) is in line with all upper-level transport policies; regional/national/EU. In all the mentioned official documents needs of an individual are in the centre of their focus with special emphasis on increasing the share of walking and cycling. There is a plan for turning historic Zadar city centre into shared pedestrian zone since majority of tourist attractions, but also public and governmental services/offices are located there.

Hypotheses

Modal distribution: surveying is the basis for traffic planning, providing insight into the current state of the traffic, and data indicating the necessary reconstructions, building new traffic directions, or other measures to improve existing and future traffic. Data collection is needed due to traffic and urban planning, due to the planning of the future traffic network or the design of a junction, for possible reconstruction of the existing traffic network and construction of new traffic routes, and for taking certain steps in terms of improving mobility.



Graph 4.1 Modal distribution

Satisfaction with bike lanes:

Graph 4.1 Satisfaction level

Public transport problems: by conducting field research, users of public transport have mentioned problems that arise when using a bus as a means of transport. Some of the problems are:

- Lack of bus lines
- Low frequency of buses
- Inadequate precision and accuracy
- Lack of suburban lines
- Unorganized timetable
- Slight connectivity of lines with different neighbourhoods
- Failure to follow timetable

Number of cars per 1.000 inhabitant:

Year	2014	2015	2016
n° cars/1000 inhabitant	349.5	358.3	367.7

Strategies and measures

The most important changes will be done in the core city, especially on the Zadar peninsula which will be turned into shared space or pedestrian zone. According to proposed documentation around 200 km of cycling lanes will be implemented in Zadar FUA until 2025. Road network in all settlements in Zadar FUA will be modified and new routes will be implemented for each mode of transport. Since the only provider for public transport in Zadar FUA is bus company only bus routes need to be adjusted. Parts of the Zadar city centre will be closed to motorized vehicles and above ground parking. Priority will be given to pedestrians. Only residential traffic, services, emergency vehicles, and loading/unloading vehicles under special circumstances will be allowed into these areas.

- Promotion of sustainable mobility and healthy lifestyle through educational activities. Through Sustainable Mobility Workshops (brochures, posters, online marketing campaigns) promote the habits of sustainable mobility among students and citizens and promote the benefits of using public transport, cycling and hiking in relation to car use. The importance of this measure is to raise awareness of a healthier way of life and promote the importance of sustainable mobility that has an impact on the overall transport system of the city and contributes to a "healthier city" for all citizens.
- Moving the parking lot to the suburbs and to the shores of the city. Moving the parking lot to the suburbs and to the shores of the city reduces the traffic pressure on the city road network and increases the level of service of road roads. Just by moving the parking lot to the suburbs and the shores of the city, conditions are created for the introduction of the park & ride system. This system can in itself reduce the daily turnover of passenger cars and increase the use of public transport, and hence the expansion of the public transport system. There is also the possibility of introducing an integrated passenger transport system and increasing the level of intermodality.
- Improving the infrastructure of sidewalks in accordance with European and national standards. It is necessary to focus on increasing pedestrian traffic in order to promote sustainable mobility. The network of sidewalks is crucial in order to increase the mobility and availability of city areas and public transport systems. It is also very important in terms of security standards that the development of the new infrastructure is aligned with the latest available standards (construction of a platform for people with special needs, pedestrian infrastructure width, rest, greenery providing shade, ...). In order to further encourage the hiking of citizens, it is necessary to build a sufficient number of seating areas along the pedestrian paths. This measure also includes the construction of pedestrians and overheads on loaded roads, including county and state roads, where there is a safety risk for pedestrian traffic participants.
- Extend real-time displays on public transport stations. In the public transport system, it is of utmost importance to increase passenger information so that public transport becomes easier to use. Every public transport user must provide accurate information in real time and in an easy way to maximize the ease of use of public transport. By extending the necessary "totem" information to all public transport attitudes to provide information on the arrival of public transport vehicles to real-time views, developing web portals and mobile web applications for easy and quick travel planning using public transport services, passengers, reducing the number of unsatisfied public transport users and reducing the number of dissatisfied users with the availability of information. Indirect influence has on increasing the share of public transport in total modal distribution.
- Install a ticket machine. New ticketing channels are to be implemented throughout the public transport network system. New sales channels will improve the availability of tickets and offer a simplified and "user friendly" system for all types of passengers (regular passengers, tourists and the like).
- Implementation of e-ticket (digitalisation). An electronic ticket or e-card indicates travel documents, i.e. a purchase receipt directly to the carrier or to an authorized agent - a travel agent, either on a web site or online. The term e-card also signifies any form of booking of a place for a travel or a valid ticket and / or replaces a classic paper ticket. The traveller receives a

confirmation, which can be printed, and which contains the number of e-tickets, as well as the number / booking confirmation.

- Implementation of the Shared space zone. Although strict separation of traffic would significantly increase traffic safety and increase mobility, especially pedestrians and cyclists, it is sometimes simply impossible to perform due to spatial constraints or seasonal demand. In this context, quiet zones, as well as a shared space zone in the old parts of cities, smaller places or tourist centers can be the optimal solution, especially if their regulation changes over time, or adapt to the actual needs of the local population and tourists.

Short, medium and long results

Until 2025 all transport modes probably will remain the same as today with more emphasis on the usage of clean vehicles and fuels. FUA Zadar in accordance with EU and National strategic documents will support the use of e-bikes.

Due to improvements in public transport and the cycling network there will be fewer journeys with car. The share of public transport will increase. New shipping lines will be introduced between islands. Number of pedestrians and cyclists will increase.

If all the priorities listed in the description of this scenario will be implemented the quality of life will improve. This all will lead to air quality improvements, noise reduction and positive health effects. The transport-related energy consumption will decrease if more people will walk or cycle. Overall change will lead to decrease of transport-related CO2 emissions in FUA Zadar.

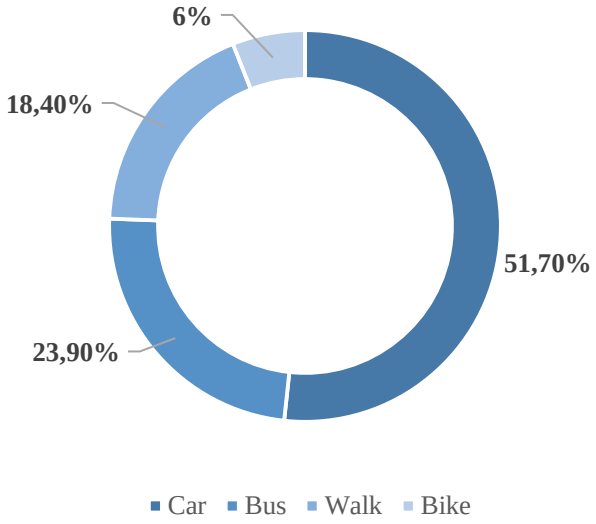
Table 4.12 Different impacts of choices

Indicator		Baseline	Buisnes as usual	**Fostering "active" transport modes (walking and cycling)**	Eu Policy prohibite private car ownership by 2045
Modal split	Car	51,70%	54%	**45%**	20%
	Bus	23,90%	24,20%	**27,30%**	37,60%
	Walking	18,40%	17,30%	**20%**	28%
	Bike	6%	4,50%	**8%**	14%
Achieve CO2-free city	Number of cars	367,7 cars/1000 inhabitant	452,3 cars/1000 inhabitant	**331,4 cars/1000 inhabitant**	150 cars/1000 inhabitant
Personal activity	number of population walking	18,40%	17,30%	**20%**	28%
	number of population cycling	6%	4,50%	**8%**	14%
	Length of cycling paths	14,86 km	17 km	**150 km**	200 km
Achieve transport intermodality	Increase the number of population using public transport	23,90%	24,20%	**27,30%**	37,60%

4.4.3 SCENARIO 2: EU Policy prohibit private car ownership by 2045

Hypotheses

Modal distribution: Surveying is the basis for traffic planning, providing insight into the current state of the traffic, and data indicating the necessary reconstructions, building new traffic directions, or other measures to improve existing and future traffic. Data collection is needed due to traffic and urban planning, due to the planning of the future traffic network or the design of a junction, for possible reconstruction of the existing traffic network and construction of new traffic routes, and for taking certain steps in terms of improving mobility.



Graph 4.3 Modal distribution

Satisfaction with bike lanes:

Graph 4.4 Satisfaction level

Public transport problems: by conducting field research, users of public transport have mentioned problems that arise when using a bus as a means of transport. Some of the problems are:

- Lack of bus lines
- Low frequency of buses
- Inadequate precision and accuracy
- Lack of suburban lines
- Unorganized timetable
- Slight connectivity of lines with different neighbourhoods

- Failure to follow timetable

Number of cars per 1.000 inhabitant:

Year	2014	2015	2016
n°cars/1000 inhabitant	349.5	358.3	367.7

Strategies and measures

EU decides to prohibit private car ownership until 2025, with 20-year transition period. According to proposed documentation any type of cars will be allowed to be owned by companies, but not allowed by private person. Car-sharing scheme will be introduced in all parts of Zadar FUA. Number of cars on the roads will decrease significantly. Population will cycle, walk and use public transport more. Children will go to school only by school buses, cycle or on foot.

- *Implementing a carsharing system*. Carsharing system is the public car system integrated into the public transport system. The introduction of the system is carried out in order to increase the mobility within the city in a sustainable and environmentally acceptable manner. The system can be established as a city-based company or can be given a concession for it. This measure will result in reduced number of vehicles within the city, increasing population mobility, respecting ecological acceptance and sustainability, and reducing the number of unsatisfied citizens by offering public transport.

- *Establishment of the Park & Ride system.* The Park & Ride system represents the expansion of the public transport system in rural and suburban areas. The construction of a parking lot is practiced outside the city centre, where a suitable location would be where there is already a necessary infrastructure of one of the sustainable modes of transport (mainly for this type of travel use rail integration sites). People can use their own car to the nearest integration site to keep their journey via sustainable modes of transportation. Using the P & R model will increase the use of public transport and reduce car traffic in city centres by building a car park at the outskirts of the city. In the long run, this will lead to a greater modal share of public transport, which is directly linked to the number of cars on the city streets. This system can reduce the daily turnover of passenger cars and increase the use of public transport. By reducing the number of cars in the streets, the system will reduce CO2 emissions, increase the efficiency of the traffic system and the accessibility of all urban areas.

- *Introduction of fleets of electric buses.* Purchase of public transport vehicles to propulsion alternative / combined energy sources (the main objective of the European Union's transport policy is the reduction of the environmental impact of the Transport System). Implementation of a larger number of vehicles is needed - the modernization of the public transport fleet in order to

increase energy efficiency and use environmentally friendly vehicles. The measure has a direct impact on reducing the negative impacts of transport on the environment, improving perception and raising public awareness about the benefits of using public transport, and contributing to a "healthier city" while indirectly having an impact on improving the efficiency and sustainability of the transport sector and reducing the number of unsatisfied public transport users.

- *Moving the parking lot to the suburbs and to the edge of the city.* Moving the parking lot to the suburbs and to the edge of the city reduces the traffic pressure on the city road network and increases the level of service of road roads. Just by moving the parking lot to the suburbs and the edge of the city, conditions are created for the introduction of the park & ride system. This system can reduce the daily turnover of passenger cars and increase the use of public transport, and hence the expansion of the public transport system. There is also the possibility of introducing an integrated passenger transport system and increasing the level of intermodality.

- *Encouraging taxi fleet transfer to hybrid / electric vehicles.* Provision of public transport vehicles to propulsion alternative / combined energy sources (the main objective of the European Union's transport policy is to reduce the impact of the Transport System on the environment). It is necessary to implement more vehicles - modernizing the taxi fleet to increase energy efficiency and use environmentally friendly vehicles and energy sources.

Short, medium and long results

There will be fewer trips with cars while the share of cycling, walking and usage of public transport will increase. Since car-sharing is still not introduced in Zadar FUA implementation of such model would be very difficult. People think of their car as very valuable personal property and are used to moving from one place to another by car. Car gives them sense of freedom; they are independent and plan their activities according to their wishes. This allows them maximum freedom and even if they are aware of traffic jams in the summer or during rush hours they usually choose car over cycling, walking or public transport.
If all the priorities of this scenario will be implemented the quality of live will improve. This all will lead to air quality improvements, noise reduction and positive health effects. Fewer cars on the street mean fewer traffic accidents and safer streets for all.
The transport-related energy consumption will decrease if more people will use cars less.
Overall change will lead to decrease of transport-related CO2 emission in FUA Zadar.

Table 4.13 Different impacts of choices

Indicator		Baseline	Buisnes as usual	Fostering "active" transport modes (walking and cycling)	**Eu Policy prohibite private car ownership by 2045**
Modal split	Car	51,70%	54%	45%	**20%**
	Bus	23,90%	24,20%	27,30%	**37,60%**
	Walking	18,40%	17,30%	20%	**28%**
	Bike	6%	4,50%	8%	**14%**
Achieve CO2-free city	Number of cars	367,7 cars/1000 inhabitant	452,3 cars/1000 inhabitant	331,4 cars/1000 inhabitant	**150 cars/1000 inhabitant**
Personal activity	number of population walking	18,40%	17,30%	20%	**28%**
	number of population cycling	6%	4,50%	8%	**14%**
	Length of cycling paths	14,86 km	17 km	150 km	**200 km**
Achieve transport intermodality	Increase the number of population using public transport	23,90%	24,20%	27,30%	**37,60%**

4.5 DURA

4.5.1 SCENARIO 0: Business As Usual

This scenario assumes continuation of the current transport policy in the next 20 years. This means that in FUA Dubrovnik travel habits are centred around car use.

Hypotheses

According to the current modal schedule, based on the research is expected to increase the number of unsatisfied users by public transport services, the number of private vehicles will grow and will in turn arrive to the increasingly congestion.

Strategies and measures

No new measures for supporting sustainable mobility are foreseen.

Short, medium and long results

Use of public transport continues to be minimal and the service remains uncompetitive compared to car use. Walking remains important on the local level but cycling does not build on it its potential. Regional, national and EU policies do not change.

Table 4.14 Different impacts of choices

Indicator		Baseline	Business as usual	Fostering public transport modes (park n ride + public transport)	Smart mobility
Modal split	Car	42,10%	**45,30%**	30%	32,00%
	Bus	13,30%	**14%**	16%	15,00%
	Walking	31,30%	**28%**	32,80%	32%
	Bycicle	20%	**12,70%**	21,50%	21,00%
Improving the sustainability of the transport system within the urban center	Number of PM10 and the NO2limits	4 days exceeding the PM10 limits; 235 hours exceeding the NO2 limits	**6 days exceeding the PM10 limits; 250 hours exceeding the NO2 limits**	2 days exceeding the PM10 limits;150 hours exceeding the NO2 limits	3 days exceeding the PM10 limits; 185 hours exceeding the NO2 limits
regulation and organization of traffic flows	number of vechiles in city of Dubrovnik in peak hour (08-09)	25000 v/h	**25800 v/h**	21975 v/h	22475 v/h
improvement of road public transport	unsatisfied public transport users	50%	**54%**	10%	15%
Increasing passenger information	unsatisfied public transport users with passenger information	80%	**80%**	30%	5%
Increase access to public transport information to tourists	number of tourists who considered that information is not at a satisfactory level	50%	**60%**	15%	0%

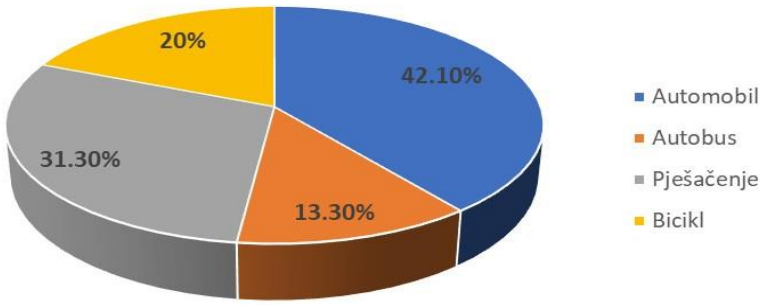
4.5.2 SCENARIO 1: Fostering public transport modes (park n ride + public transport)

In this scenario, public parking lots on the edge of the city are being introduced, which would be linked to public transport. Parts of the city center of Dubrovnik will be closed for motor vehicles. Priority will be given to public transport vehicles and pedestrians. Moving the parking lot to the suburbs and to the edges of the city reduces the traffic pressure on the city road network and increases the level of service of road roads. By moving the parking lot to the suburbs and the edges of the city, the conditions for the introduction of the park n ride system are being created. This system can in itself reduce the daily turnover of passenger cars and increase the use of public transport, and hence the expansion of the public transport system. There is also the possibility of introducing an integrated passenger transport system and increasing the level of intermodality.

Only residential housing, services, prices and loading / unloading vehicles will be permitted in closed areas under special circumstances. The Park & Ride system represents the expansion of the public transport system in rural and suburban areas. The construction of a parking lot is practiced outside the city center, where a suitable location would already be where the infrastructure needed is one of the sustainable modes of transport. Using the P & R model will increase the use of public transport and reduce car traffic in city centers by building a car park at the outskirts of the city. In the long run, this will lead to a greater modal share of public transport, which is directly linked to the number of cars on the city streets. This system can reduce the daily turnover of passenger cars and increase the use of public transport. By reducing the number of cars in the streets, the system will reduce CO2 emissions, increase the efficiency of the traffic system and the accessibility of all urban areas. Before the system is set up, it is necessary to make a parking lot study.

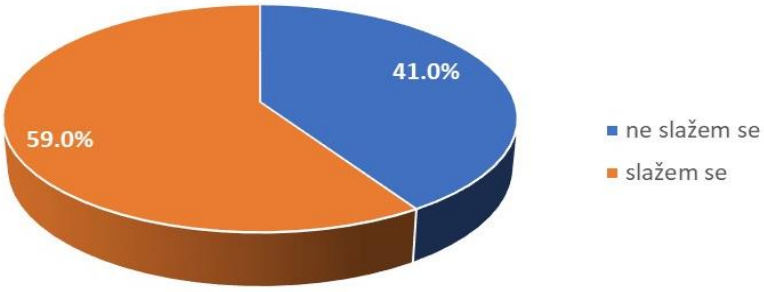
Hypotheses

- *Modal distribution (mobility survey).* Surveying is the basis for traffic planning, providing insight into the current state of the traffic, and data indicating the necessary reconstructions, building new traffic directions, or other measures to improve existing and future traffic. Data collection is needed due to traffic and urban planning, due to the planning of the future traffic network or the design of a junction, for possible reconstruction of the existing traffic network and construction of new traffic routes, and for taking certain steps in terms of improving mobility. The modal distribution shown in the graph below refers to the use of sustainable modes of transport every day compared to the car. As can be seen, the proportion of those who walk every day is 31.3%, the city bus uses 13.3%, while the bicycle uses 20% of the respondents. According to this indicator, the value of using sustainable modes of transport needs to be increased. By 2025, it is necessary to increase the percentage of walking from 31.3% to 40%, the use of the city bus from 13.3% to 25%, and the share of bicycle usage from 20% to 30% compared to 2017.



Graph 4.5 Modal distribution

o Influence of traffic on the environment. The negative impact of traffic on the environment is very large. The unfavourable impact of traffic on the environment results in pollution of air, water and soil, noise and vibration, and negative overall environmental impact. Traffic occupies green areas, vital parts of space in overcrowded areas and causes visual degradation of natural and urban space. Since the harmful impact of traffic on the environment is so harmful the impact of traffic on human health. According to the data shown in the graph below, approximately 60% of respondents agree that road traffic has a negative impact on quality on their lives. Also, more than 50% of respondents believe that their regular mobility habits have a negative impact on the environment.



Graph 4.6 Percentage of respondents that believe that their regular mobility habits have a negative impact on the environment

- *Dissatisfied users of public transport.* The quality of transport services is the totality of the characteristics and characteristics of the transport infrastructure, traffic superstructures and the conditions of cargo (cargo, material goods), people and energy, depending on their ability to meet the explicit or expected (assumed) requirements and needs of their users. The quality of a traffic service is the totality of the characteristics of the transport service and the operations related to the carriage of goods, passengers (people) and communications, depending on their ability to meet the explicit or expected (assumed) requirements and needs of their users. Quality of service is the dominant objective of providing transport services. Observed from the point of view of transport, in logistical terms, the quality of transport services can vary in several ways:
- by the timetable and frequency of the operation,

- the speed of operations and the number of views,
- by the characteristics of the vehicle, especially in terms of comfort and capacity,
- by tariff structure tariff,
- by additional services in the vehicle.

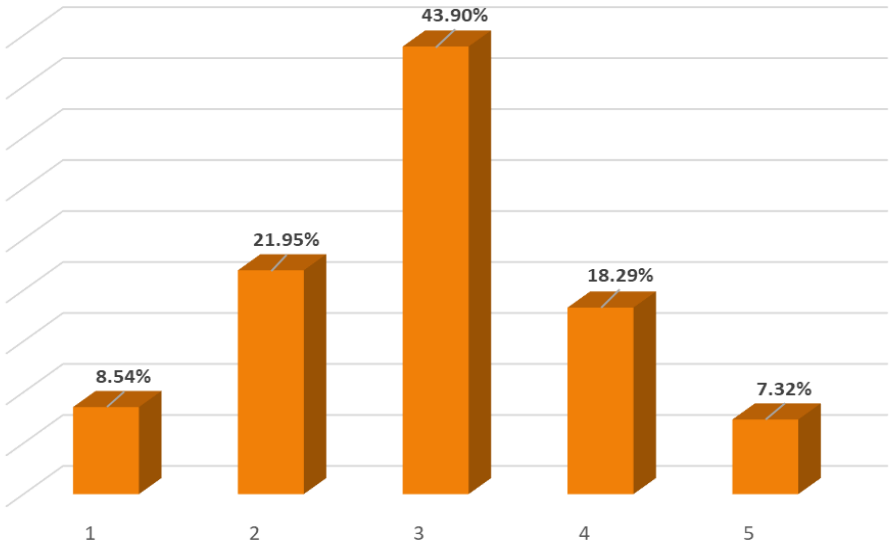
The characteristics of the services that are important to the user - the traveller are:

- frequency,
- accuracy and regularity,
- Travel speed,
- the service station's distance,
- price,
- service hours (first and last departure),
- Service on weekends,
- Vehicle coverage on the line and between the two points (shown as the capacity utilization coefficient at peak times).

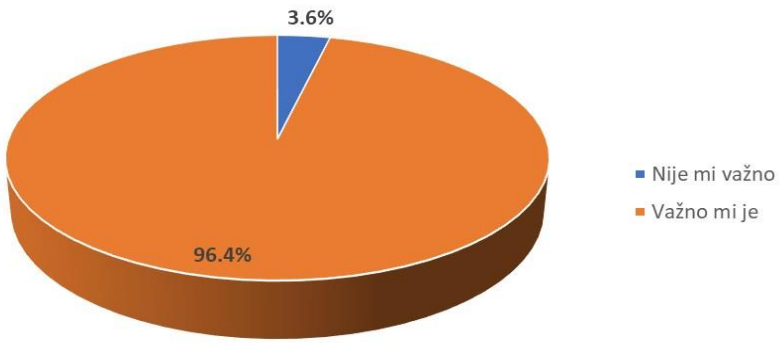
Public transport services quality indicators include:

- Speed of transport,
- Economical transport,
- Other indicators (frequency, regularity and accuracy of transport, transport capacity, passenger safety, etc.)

According to previous survey and field research, the graph below shows the number of dissatisfied users by public transport in the City of Dubrovnik. Approximately 30% of respondents are not satisfied with the offer of public transport in the City of Dubrovnik, while about 44% of respondents said it was a good offer of public transport in the city of Dubrovnik. About 25% of respondents stated that public transport is very good or excellent. Also, more than 96% of respondents said it was important for them to have a high quality public transport offer in the city of Dubrovnik. According to this indicator, it is necessary to reduce the number of unsatisfied public transport users by 50% by 2025.



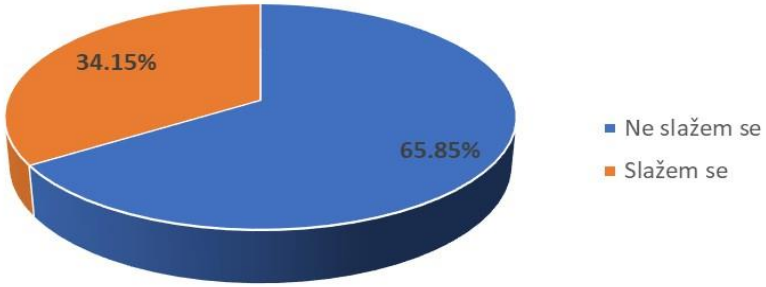
Graph 4.7 Satisfaction with the offer of public transport in the City of Dubrovnik



Graph 4.8 Importance of quality public transport services in the area of your city

- *Dissatisfaction with public transport accessibility.* The criterion of quality is basically the criterion of commitment to the use of public transportation means of transport. The higher the quality of certain criteria, the higher the quality of the service, and the greater the overall commitment to the use of public transport services. Quality criteria are not of the same importance for all public transport users. One group of passengers can state the importance of the criteria, but there is no choice between public transportation and public transport vehicles. The second group of passengers has the option to choose, and they represent a significant indicator of the state of the traffic system and the quality of the service. One of the criteria is accessibility to public transport. An accessibility approach would be the availability of a public transport system involving passengers related to other modes of transport. Accessibility could still be divided into:
- External communication (with pedestrians, bikers, taxi drivers, car drivers)
- Internal (entrance / exit, internal movement, transfer in other ways of public transport of passengers),
- Availability of maps (procurement within the network, procurement outside the network).

According to the survey conducted earlier and field surveys, around 65% of respondents considered that public transport stops were not properly linked to the pedestrian path. It can be said that accessibility is not at a satisfactory level and that there are room for improvement in this direction. According to this indicator, it is necessary to reduce the number of unsatisfied public transport accessibility by 50% by 2025.



Graph 4.9 Quality connection of hiking trails with public transport stops

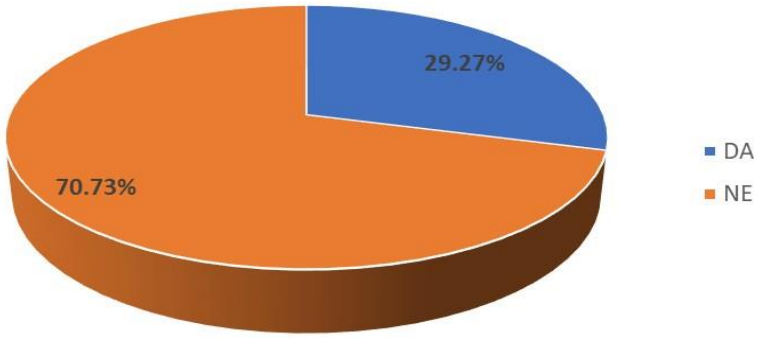
- *Raising awareness of the benefits of using public transport*. Public transport is a transportation that, at the same conditions, is accessible to all users of transport services. The benefits of public transport can be seen both towards the individual (traveler) and the community. Benefits of public transport for passengers:
- greater security than when transporting personal vehicles;
- lower transport costs;
- positively affect the health of passengers;
- greater physical activity of passengers;
- eliminates stress;
- More free time (by using public transport, we can learn, read ...).

Benefits of Public Transport for the Community:

- gives citizens more mobility and more freedom;
- Reduces traffic jams;
- considerably reduces fuel and energy consumption;
- affects the reduction of air pollution.

These advantages need to be brought closer to users and citizens through various seminars, promotions and the habit of using public transport. How many citizens are undecided in the benefits and benefit of public transport that can largely be of benefit to every user shows also a survey conducted earlier that about 70% of the respondents were not familiar with Integrated Passenger Transport (IPP). Integrated Passenger Transport (IPT), a new local public transport system where all public transport vehicles (trains, buses, trams, boats ...) are integrated into a common passenger transport system in a particular region. For all public transport lines (trains, buses, trams, boats...), a common map is valid throughout the region. The system usually uses the tactical timetable, ie departures from each point of view are at regular intervals (eg every 10, 20, 30, 60 minutes, etc.) and there are a large number of common stops (multimodal terminals) stopping different types public transport (train, bus, tram, boat ...) and it is easy to

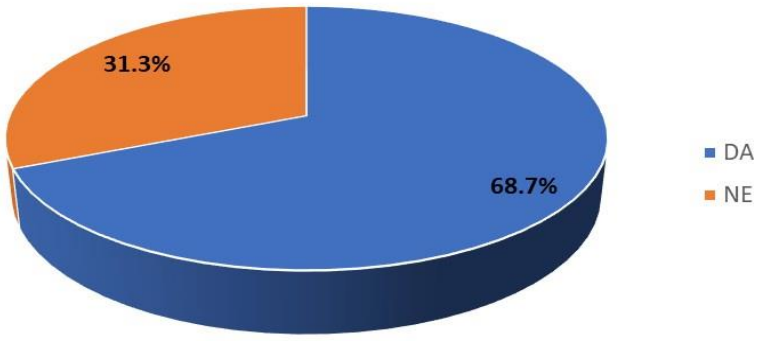
make quick breaks. The train rows in the system are aligned and allow for a quick resumption of travel after the transfer. The vertex of the system consists of track systems (trains, trams ...) due to its ecological, energy and infrastructure advantages. Other public transport vehicles (buses) serve as tracking systems and thus use their great advantages over short distances. According to the above indicators, it is necessary to increase public awareness of the benefits of using public transport by 60% by 2025.



Graph 4.10 Knowing the concept of Integrated Passenger Transport

- *Lack of carsharing system and public bicycle system.* Carsharing system is the public car system integrated into the public transport system. The system allows the car to be accessible to all drivers with a driver's license, without the need for a personal vehicle. This directly affects citizens' mobility and the quality of life. Likewise, carsharing appears as a good option for households that own one, and only occasionally need to use more cars. In such a case, buying a new car is an additional unnecessary expense, and the problem can be solved by using carsharing. Since there is currently no car sharing system in Dubrovnik, it is necessary to implement or increase the number of car sharing systems by 1 through 2020. As for the public bicycle system, it is a complement to the public transport system. Bicycles in this system are available to everyone throughout the day and the user can leave a bicycle on any of the terminals in the coverage area. One of the fundamental goals of introducing a public bicycle system is to change the current structure of mobility to the benefit of public transport.

The public bicycle system was not implemented in the City of Dubrovnik. Due to the safety and morphological characteristics of the road within the City, a security problem is set in the implementation of this measure, so it could determine the pilot area where a certain number of bicycles would be introduced in the foreseeable future to be supplemented by public transport. According to the survey conducted, 68.7% of respondents were familiar with the concept of the Public Bicycle System, while about 25% of respondents stated that they would use the Public Bicycle System if they existed in the area of Dubrovnik.



Graph 4.11 Knowing the concept of the Public Bicycle System

Strategies and measures

Selecting a measure is a process of determining mobility and transportation measures that are most appropriate and cost-effective for achieving the vision and goals of a sustainable urban mobility plan and solving the identified local problems. Only well-chosen measures will define the achievement of goals. They always take "packs" to compute potential synergies. An individual measure has limited impact while a package of measures can take synergies and strengthen each other. The goal of this step is to identify the opportunities for appropriate measures and their integration as well as to gain an overview of the various options that contribute to vision and goals. The choice of measures does not only affect efficiency, but also economy.

- *Establishment of the Park & Ride system.* The Park & Ride system represents the expansion of the public transport system in rural and suburban areas. The construction of a parking lot is practiced outside the city center, where a suitable location would be where there is already a necessary infrastructure of one of the sustainable modes of transport (mainly for this type of travel use rail integration sites). People can use their own car to the nearest integration site to keep their journey via sustainable modes of transportation. Using the P & R model will increase the use of public transport and reduce car traffic in city centers by building a car park at the outskirts of the city. In the long run, this will lead to a greater modal share of public transport, which is directly linked to the number of cars on the city streets. This system can reduce the daily turnover of passenger cars and increase the use of public transport. By reducing the number of cars in the streets, the system will reduce CO2 emissions, increase the efficiency of the traffic system and the accessibility of all urban areas.

Figure 4.21 Park & Ride system

Responsibility: City Administration (Directives), Carriers (Implementation) Costs: 30.000 € (it is necessary to equip the created sites)

Source of financing: Local budget, stakeholders

- *Implementing a carsharing system.* Carsharing system is the public car system integrated into the public transport system. The introduction of the system is carried out in order to increase the mobility within the city in a sustainable and environmentally acceptable manner. The system can be established as a city- based company or can be given a concession for it. This measure will result in reduced number of vehicles within the city, increasing population mobility, respecting ecological acceptance and sustainability, and reducing the number of unsatisfied citizens by offering public transport. It will indirectly influence the reduction of the impact of transport on the environment, improve the efficiency and sustainability of the transport sector, and improve traffic safety and security and contribute to a "healthier city".

Figure 4.22 Carsharing system

Responsibility: City Administration (Directives and Infrastructure), Private Resellers (Implementation)

Costs: 440,000 € (220,000 per system)

Source of financing: Local Budget, Private Brokers

o Introduction of fleets of electric buses. Purchase of public transport vehicles to propulsion alternative / combined energy sources (the main objective of the European Union's transport policy is the reduction of the environmental impact of the Transport System). Implementation of a larger number of vehicles is needed - the modernization of the public transport fleet in order to increase energy efficiency and use environmentally friendly vehicles. The measure has a direct impact on reducing the negative impacts of transport on the environment, improving perception and raising public awareness about the benefits of using public transport, and contributing to a "healthier city" while indirectly having an impact on improving the efficiency and sustainability of the transport sector and reducing the number of unsatisfied public transport users.

Figure 4.23 Electric bus (Barcelona)

Responsibility: City Administration (includes a directive in the next concession contest), public transport operators (purchase of electric vehicles)

Costs: 3.500.000 €

Source of financing: Carriers

- *Integrated public transport organization: Implementation of the Customs Union of Shipping.* The introduction of a common tariff system enables the use of all modes of transport included in the IPP system (rail, bus, car sharing system, public bicycle systems etc ...) with a common tariff and a transport ticket. The common tariff system makes it easy to use public transport, increasing its popularity, resulting in reduced car usage, and thus reducing traffic burdens. The measure has a direct impact on improving the efficiency and sustainability of the transport sector as well as improving accessibility, increasing public transport share in modal distribution, reducing the number of disadvantaged public transport users and increasing intermodality, while indirectly reducing vehicle exhaust emissions, improving perception and raising awareness of the advantages of using public transport, raising the efficiency and functionality of the transport system in the tourist season and the quality of public transport services. All these effects contribute to a "healthier city".

Figure 4.24 An example of ticketing and integrated system (Barcelona)

Responsibility: City Administration, County, City and Municipal Administration, Public Transport Operators

- *Improve parking management rates.* Managing parking fees should be aligned with the actual needs and locations where parking needs are needed. The parking price should therefore be

separately regulated in the individual areas and parts of the city where the parking lots are located. Thus, the cost of parking in the city center should differ from that used to park the city streets, which would thus encourage users to use the park & ride system if this system existed. This measure has a direct impact on improving the efficiency of the transport sector, since it has the effect of driving down the use of the car. Indirectly reduces the harmful impact of traffic on the environment, reduces the possibility of traffic accidents and contributes to a "healthier city".

Responsibility: City Administration Costs: 200,000 €

Source of financing: Local budget

- *Moving the parking lot to the suburbs and to the edge of the city.* Moving the parking lot to the suburbs and to the edge of the city reduces the traffic pressure on the city road network and increases the level of service of road roads. Just by moving the parking lot to the suburbs and the edge of the city, conditions are created for the introduction of the park &ride system. This system can in itself reduce the daily turnover of passenger cars and increase the use of public transport, and hence the expansion of the public transport system. There is also the possibility of introducing an integrated passenger transport system and increasing the level of intermodality. The measure has a direct impact on improving the efficiency of the transport sector, changing the distribution of passenger traffic in favor of public transport compared to the road while it has an indirect impact on the reduction of harmful exhaust gases and contributes to raising awareness of a "healthier city".

Responsibility: City Administration (Planning) Costs: 30.000 €

Source of financing: Local budget, EU funds

Short, medium and long results

Different impacts of choices

Short, medium and long results

The gradual implementation of measures in this scenario will have a modal share change, where the number of public transport users will increase. Gradually the total number of vehicles will fall, and the number of particles PM10 and NO2will be reduced. Also, the number of dissatisfied users will fall by public transport.

Table 4.15 Different impacts of choices

Indicator		Baseline	Buisnes as usual	Fostering public transport modes (park n ride + public transport)	Smart mobility
Modal split	Car	42,10%	45,30%	**30%**	32,00%
	Bus	13,30%	14%	**16%**	15,00%
	Walking	31,30%	28%	**32,80%**	32%

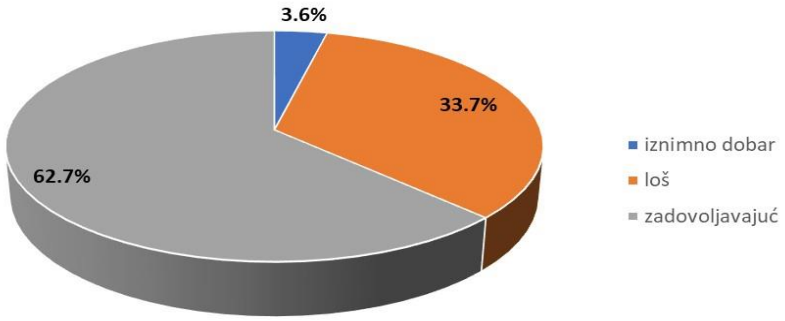
	Bicycle	20%	12,70%	**21,50%**	21,00%
Improving the sustainability of the transport system within the urban center	Number of PM10 and the NO2limits	4 days exceeding the PM10 limits; 235 hours exceeding the NO2 limits	6 days exceeding the PM10 limits; 250 hours exceeding the NO2 limits	**2 days exceeding the PM10 limits;150 hours exceeding the NO2 limits**	3 days exceeding the PM10 limits; 185 hours exceeding the NO2 limits
regulation and organization of traffic flows	number of vehicles in city of Dubrovnik in peak hour (08-09)	25000 v/h	25800 v/h	**21975 v/h**	22475 v/h
improvement of road public transport	unsatisfied public transport users	50%	54%	**10%**	15%
Increasing passenger information	unsatisfied public transport users with passenger information	80%	80%	**30%**	5%
Increase access to public transport information to tourists	number of tourists who considered that information is not at a satisfactory level	50%	60%	**15%**	0%

4.5.3 SCENARIO 2: Smart Mobility

Hypotheses

- *Availability of information.* It is very important that the public transport system is tailored to users. In this context, there are several aspects:
- Frequencies of service, arrival time and departure time, as well as driving pricing for certain directions must be easily accessible, clearly presented and up-to-date;
- Real-time information must be available to passengers on the road as well as on the means of
- transport. Passengers should receive current information on the actual times of departure, arrival and occupancy of the first and the next vehicle;
- Details of previous reservations should be clearly presented.

Graph 4.12 Motivation for frequent use of public transport

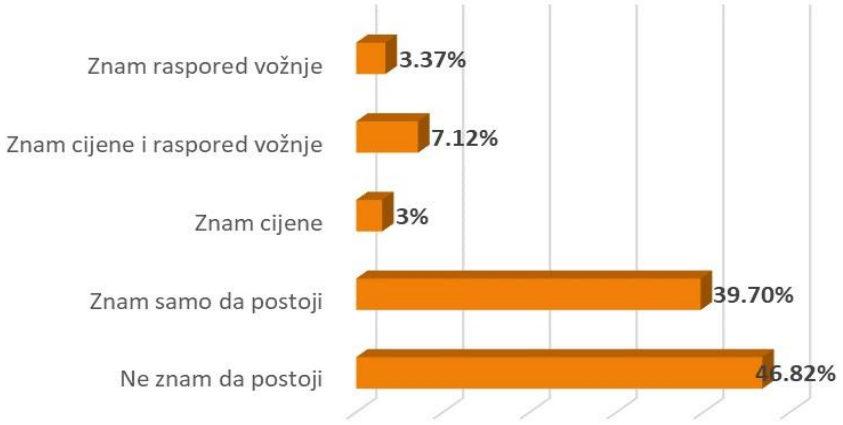


Graph 4.13 Information system for passengers in public transport

According to the survey conducted earlier and on field research, about 20% of respondents would be more motivated to use public transport more widely if information was available. Also, about 33% of respondents believe that there is a bad public information system. According to this indicator, it is necessary to increase the availability of information for all public transport users by 50% by 2025.

- *Number of tourists who consider that public transport information is not at a satisfactory level.* Since public transport is accessible to all users of transport services under the same conditions, it also applies to tourists visiting Dubrovnik and who are in the summer season the main

beneficiaries of the same. It is very important that the public transport system is tailored to users because accurate real-time information (service frequency, arrival and departure time, price, reservation etc.) achieves the desired public transport feature that contributes to competitiveness compared to other modes transportation. If it is to increase public transport competitiveness, it is essential that the service is at a satisfactory level that will attract more customers. According to the survey conducted in the past and field research (LairA project), about 50% of tourists are not familiar with the existence of liner bus services, while only 7% of tourists are familiar with the travel schedule and ticket prices. According to this indicator, it is necessary to reduce the number of dissatisfied tourists by 50% by 2025.



Graph 4.14 Number of tourists with information on public transport

Strategies and measures

- *Initiating ITS and prioritizing public transport.* ITS solutions on major roads will help manage high traffic and load levels to reduce congestion and traffic accidents. Real-time information can be provided to traffic control centers and users. Traffic management, control systems and infrastructure include intelligent vehicle monitoring, adaptive traffic control, accident management and information system for passengers, motorways and state roads, to ensure integrated operations. Also, for a faster public transport service that will make the passengers more attractive, priority should be given to the priority of public transport vehicles at intersections. This means that the traffic light system should be integrated with the GPS device in the buses. When the bus reaches the intersection, the traffic light automatically sets the green light from the bus route. These measures have a direct impact on improving the efficiency and sustainability of the transport sector, reducing negative environmental impacts, increasing safety and contributing to a "healthier city".

Figure 4.25 An example of an ITS system

Figure 4.26 Traffic Priority Sensor

Responsibility: City Administration (planning, tender for construction works)

- *Mobility as a Service (MaaS) (Connecting existing mobility applications (Smart parking, Libertas app, Dubrovnik eye, Dubrovnik airport, Dubrovnik Map and walks)) and creating new opportunities*- The concept of "MaaS" is the central idea of transport change. It is generally perceived as a vision of mobility in which the journey occurs through a combination of public, private, and common modes of transport. Mobility as a service is a combination of public and private transport services within a specific regional environment that provides holistic, optimized passenger-oriented options to enable the ultimate journey that the user pays as the sole cost and which aims at achieving the key public equality goals. The measure would have a direct impact on increasing passenger information and reducing the number of unsatisfied public transport users. Indirectly, it would have had an impact on achieving a "healthier city".

Responsibility: City, county and state administration (promoting partnerships between public transporters)

Costs: Depends on the type of integration

Source of funding: Local budget, public private partnerships

- *Smart parking*. Smart Parking is a system that monitors the availability of parking spaces and outdoor parking with the help of sensors embedded in the ground. Parking sensors detect the state and present it via an interactive mobile map application. The system is based on magnetic field technology and detects vehicles by measuring changes in the Earth's magnetic field caused by static vehicles or vehicles on the move. Smart Parking is easy and convenient to integrate into existing IT systems, such as car parks or parking systems. It also easily integrates into a full-fledged Cloud management environment. Direct access will be made to increasing passenger information and reducing traffic burden. The impact of the traffic on the environment will be indirectly reduced and the efficiency and sustainability of the transport system will be improved.

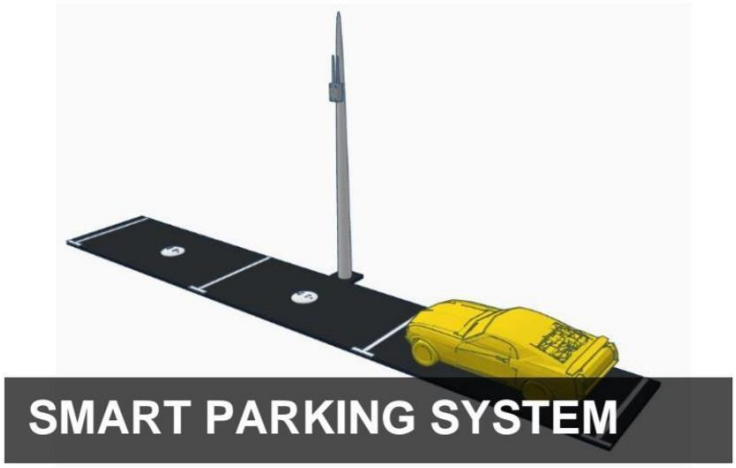


Figure 4.27 Illustration of Smart Parking Solutions

Responsibility: City Administration (directives) Costs: 275.000 € (about 50 per parking place)

Source of financing: Local budget, EU funds

- *Increase number of smart streets.* A smart street is just one of the segments of the smart city development. The existing infrastructure and information that the city has to be upgraded to new ideas. Using advanced technologies, citizens are provided with a free internet service, effectively managing the lighting level and parking spaces. Also, without spending additional resources, you can manage the city in a smart way. The measure has a direct impact on increasing the share of hikes in overall modal distribution and increasing the availability of information for citizens. Indirectly contributes to improving the efficiency and sustainability of the transport sector and to the promotion of traffic safety and security and contributes to a "healthier city".

Responsibility: City Administration (planning and tendering for construction works) Costs: 400,000 € (200,000 for one street)

Source of funding: Local Budget, Private Operators

Short, medium and long results

The gradual implementation of measures in this scenario will have a modal share change, where the number of public transport users will increase. Gradually the total number of vehicles will fall, and the number of particles PM10 and NO2 will be reduced. Also, the number of dissatisfied users will fall by public transport.

Table 4.16 Different impacts of choices

Indicator		Baseline	Business as usual	Fostering public transport modes (park n ride + public transport)	Smart mobility
Modal split	Car	42,10%	45,30%	30%	**32,00%**
	Bus	13,30%	14%	16%	**15,00%**
	Walking	31,30%	28%	32,80%	**32%**
	Bicycle	20%	12,70%	21,50%	**21,00%**
Improving the sustainability of the transport system within the urban center	Number of PM10 and the NO2limits	4 days exceeding the PM10 limits; 235 hours exceeding the NO2 limits	6 days exceeding the PM10 limits; 250 hours exceeding the NO2 limits	2 days exceeding the PM10 limits;150 hours exceeding the NO2 limits	**3 days exceeding the PM10 limits; 185 hours exceeding the NO2 limits**
regulation and organization of traffic flows	number of vehicles in city of Dubrovnik in peak hour (08-09)	25000 v/h	25800 v/h	21975 v/h	**22475 v/h**
improvement of road public transport	unsatisfied public transport users	50%	54%	10%	**15%**
Increasing passenger information	unsatisfied public transport users with passenger information	80%	80%	30%	**5%**
Increase access to public transport information to tourists	number of tourists who considered that information is not at a satisfactory level	50%	60%	15%	**0%**

4.6 MoH

4.6.1 SCENARIO 0: Business-as-usual

This scenario assumes continuation of the current transport policy in the next 10-11 years and refers to the Business-as-usual situation. This means that in Hersonisos commuting habits and behaviours will remain car- centric as they currently are. No new measures for supporting sustainable mobility are foreseen, but only the continuation of the few existing ones such as information and awareness raising and some road safety measures, focusing mostly on traditional transport planning. Use of public transport continues to be minimal (9,37%[1]) and serving territorial routes through linear distribution. Public transport links the different settlements with the main neighbouring cities. Walking and cycling continue to be considered as a leisure activity without specialized infrastructure (i.e. bike lanes etc). Regional policies do not change. National and EU policies do change, hence the introduction of Electric Vehicles (EVs) and other alternatively fuelled vehicles in the Greek cities as well as other environmental related actions impact slightly emission levels in Hersonisos.

Figure 4.28 Scenario 1

The assessment of consequences is based on scientific projections arising from the current planning documents of the municipality assisted by the online tool for SUMP scenario planning Urban Roadmaps Tool and the Health Economic Assessment Tool – HEAT, as well as the EVIDENCE Project Report REGARDING economic benefits and assessment of implementation timeframe. Baseline data are defined at the DATASET Tool of the SMILE Project as presented through the WP2 - Activity T1.1: Common Transnational template, data collection and elaboration – Deliverable T1.1.1: Common transnational template. The planning horizon refers to 2030 and projections refer to 11year planning from 2019 to 2030.

- How will the demographic structure of your FUA and the core city in it be in your planning horizon around 2025 to 2030? (No of population, age structure, etc.)

The population of MoH is currently estimated at 26,717 inhabitants (2011 census). Demographic projections for the Municipality show that the number of population will continue to rise (close to 10% in

[1]Modal share data refer to 2019 levels, as provided also to the T.1.1.1 Deliverable

a decade from 2020 to 2030). The overall region's statistics show a clear population increase according to the national data (+12% in the decade 2001-2011, see 5.1 section of Deliverable T1.1.1)[2]. This is directly related to economic activity and especially to tourism development as Crete – especially its northern part where Hersonisos is located- continues to rise as a European touristic destination, providing motives for young people to work and live there. The age structure is also expected to change in favour of younger people (under the age of 50)[3].

- Which types of transport technology will have been diffused or will disappear in your FUA in your planning horizon around 2025 to 2030?

In this baseline scenario, MoH is not introducing any innovative transport technology for both public transport and private car fleets. No Information Communication Technology (ICT) tools are implemented regarding shared vehicles, nor mobility management techniques or any other tools to enhance mobility.

The main technology that is expected to evolve in Hersonisos is an uptake of green and more specifically hybrid electric vehicles, following the national uptake of such vehicles. Their share for personal cars if following the national standards is expected to increase for 5.85% (from 2.64% to 8.49%) showing the way to which local mobility policies need to move[4]. Following this trend, public transport vehicles are also expected to increase the use of Compressed Natural Gas- CNG (0.12% to 0.45%) technologies and expand the use of hybrid electric (1.60 to 6.00%) and battery electric (0.12% to 0.45%) vehicles for serving local needs.

- How will the share of transport mode change in your core city and FUA? Will there be higher share of journey with cars or less? Will it increase or decrease the share of public transport? Will there be more cyclists and walkers, or less?

Bearing in mind the initial parameters of the Business-as-usual scenario, no new measures are implemented until 2030 hence urban mobility attributes mostly remain the same.

The share of transport modes will be almost similar to the baseline situation without significant changes. Based on the projections of the UTR tool for Hersonisos, car use will increase for almost 1%, while the use of public transport is expected to be slightly less. The use of motorbikes will remain the same and the use of bikes will still be used in a limited scale. The latter ones will remain to be considered useful for leisure activities but not practical enough as an everyday commuting mode of transport. Pedestrians will be slightly less in percentage than they are today, following the national trend in no sustainable mobility strategies are implemented.

Consequently, no significant changes (behavioural or in city infrastructure) are expected to take place in terms of transport mode change and private cars will remain the protagonists of the local transportation.

[2]Data deriving from the local Operation Plan referring to the planning horizon of 2020 and 2030.
[3]Data deriving from the local Operation Plan referring to the planning horizon of 2020 and 2030.
[4]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.

- Which part of your future prediction is not in line with upper-level transport policy (of region, country and EU)?

The Greek and EU policies introduce the use of more environmentally friendly and sustainable means of transport for people and goods while at the same time set goals and activities for the decrease of car use. Sustainable Urban Mobility planning is being institutionalized in Greece. Therefore, this scenario **does not comply** with these policies, as it continues the existing trends of car reliance. Mobility standards of the area remain the same and the very limited awareness raising activities (planned and future) are not considered enough to bring any kind of real change. Moreover, this scenario, is also not expected to fulfil the road safety goals as the number of accidents and fatalities will **not** decrease in line with them.

- Is the overall situation improving the living quality of your FUA?

Some aspects can certainly improve quality of life. For example, due to the technological improvements and uptake of green vehicles (mentioned above), air quality is expected to improve (decrease PM, CO, NOx, VOC emissions) and noise emissions will also decrease. Road safety is not expected to improve significantly due to the small increase of car use and the small decrease of public transport, which has an impact on the living quality. In this framework and based on the planned road upgrades, cars and buses speeds will be slightly smaller and fatal or serious accidents are expected to be slightly less. Financially, transport expenditure per individual or household will slightly decrease[5].

- What are the effects on particular demographic groups, such as children, elderly, low-income group, foreigners and migrants, students, mobility-impaired people, etc.?

This scenario assumes the continuation of the current transport policy in the next 11 years and refers to the Business-as-usual situation, hence vulnerable road users will continue to be obstructed. The most negative effects are expected to be more visible for people who are not able to drive either because of age, income, health or purely personal reasons. These groups may account for half of population; hence their social inclusion will be compromised due to limited mobility. Basic public transport will remain at the current levels and in spite or slight improvements in vehicles used in order to be more environmentally friendly, **limited new opportunities will be offered for mobility options** "out of the box/out of the schedule", which is deteriorating especially for those who live in the outskirts of the cities or in rural areas of the Municipality. In this framework, additional options for accessing health, education, sports, shopping, services, leisure, etc. will be difficultly offered.

In the urban areas, walking and cycling could represent an important transport mode, particularly for young people, though no significant investments are taking place to this direction for this scenario. Mobility- impaired people will also face difficulties in all forms of mobility as no relevant measures are programmed.

[5]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.

- How will the transport-related cost paid by each end user change? How will the transport-related cost paid by your municipalities or regional government change?

Individual expenditure for transport will slightly decrease in spite of the increase in car use and at the same time, the expenditures for transport by public administrations will be slightly less[6]; On the contrary, the transport revenues of public administration are expected to be increased. Transport social monetary costs will increase compared to the current situation.

- Will the overall change will lead to increase or decrease of transport-related energy consumption in your FUA?

In spite of the projected increase in car use, this scenario predicts lower transport-related energy consumption, as the introduction of alternatively-fuelled vehicles alters the energy consumption patterns.

- Will the overall change will lead to increase or decrease of transport-related CO2 emission in your FUA?

Due to the slight increase of car use and the fact that other means of sustainable transport will not expand, this scenario predicts an increase of 0.12% regarding CO2 emissions.

4.6.2 SCENARIO 1: Conservative solution- Enhancing mobility management and developing Low Emission Zones (LEZs)

This is a conservative approach on scenario building for Hersonisos. Assessing Hersonisos' municipal area in 10-11 years from now reveals **updated mobility management policies** such as few protected areas in the most important centralities (i.e. Hersonisos, Malia, Stalida, Anopoli). The **same bus network** serves the area and **no new walking or cycling infrastructure** is in place. Similarly to the Business as Usual Scenario, regional policies do not change, however the Greek national and EU policies do change in terms of electromobility introduction and the use of alternatively fuelled vehicles.

Implemented policies and measures include;

- the introduction of Information Communication Technology (ICT) tools to control access regulations in key entrances of the selected centralities
- the introduction of Information Communication Technology (ICT) tools to control illegal parking close to several destinations,
- new delivery and servicing plans for freight logistics,
- reorganization of 5 key public transport and taxi stops to enhance service levels and improve accessibility,
- three Low emission zones (LEZs) are implemented to cease conventionally fuelled vehicles from entering the central areas of Hersonisos, Malia and Stalida,

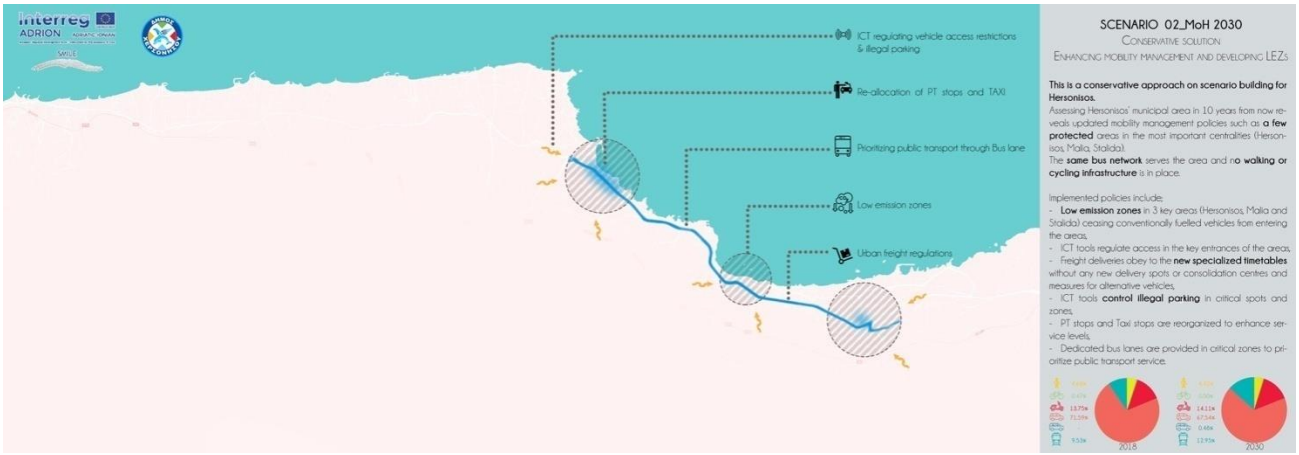
[6]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.

- Buses are prioritized through specialized bus lanes without altering their service route or timetables and frequency.
- Slight introduction of car sharing services with no supplementary measures.

The above measures are expected to be fully implemented in 10 years' time in order to show a protected environment for the central areas of Hersonisos, Malia and Stalida. However only light changes are apparent in the long-term as there are no robust mobility management measures, nor new infrastructure for pedestrians, cyclists and public transport users.

The overall expected results show small changes in modal split which is the key indicator for altering commuting habits in the area. The denser areas (Hersonisos, Malia and Stalida) are protected from extensive car presence through ICT tools (see map for location) and are characterized as Low Emission Zones, allowing all EVs and alternatively fuelled cars to enter with no restrictions, even providing policies for free parking and circulation. Walking and cycling facilities remain scattered hence commuting habits are not expected to change in the overall municipal territory. The above measures were selected as the first conservative approach to building a common SUMP.

Figure 4.29 Scenario 2



- How will the demographic structure of your FUA and the core city in it be in your planning horizon around 2025 to 2030? (No of population, age structure, etc.)

The population of MoH is currently estimated at 26,717 inhabitants (2011 census). Demographic projections for the Municipality show that the number of population will continue to rise (close to 10% in a decade from 2020 to 2030). The overall region's statistics show a clear population increase according to the national data (+12% in the decade 2001-2011, see 5.1 section of Deliverable T1.1.1) . This is directly related to economic activity and especially to tourism development as Crete – especially its northern part where Hersonisos is located - continues to rise as a European touristic destination, providing motives for young people to work and live there. The age structure is also expected to change in favour of younger people (under the age of 50) .

- Which types of transport technology will have been diffused or will disappear in your FUA in your planning horizon around 2025 to 2030?

Through this scenario, Hersonisos is introduced to ICT tools for access control. Diesel and gasoline cars will be slightly decreased due to the uptake of EVs. The key technology that is expected to evolve in the area is an uptake of green and alternatively fuelled vehicles including electric ones. Their share for personal car vehicles is expected to increase for 5.85% (from 2.64% in the baseline to 8.49%) showing the evolvement of the industry in the local market. Following this trend, public transport vehicles will also slightly increase the use of Compressed Natural Gas- CNG by 0,33% (from 0.12% to 0.45%) and expand the use of hybrid electric for 4,40% (1.60 to 6.00%) while also the battery electric vehicles will increase their share by 0,33% (0.12% to 0.45%). Such results will only be visible in the long term implementation (2030) as the EV penetration in the local market is extremely slow. As stated earlier, transport technologies that are expected to be well introduced in the area are related to Information Communication Technology (ICT) tools in order to assist in access regulation control for the three main centralities of Hersonisos, Malia and Stalida.

- How will the share of transport mode change in your core city and FUA? Will there be higher share of journey with cars or less? Will it increase or decrease the share of public transport? Will there be more cyclists and walkers, or less?

The share of transport modes in the overall municipality is expected to change slightly compared to the current situation, as the applied measures are focused in central areas and deal mostly with access restrictions that do not radically change the commuting mode. LEZs do not assist on the drop of car usage but do assist on the improvement of quality of life in city centers.

Slight decrease is apparent for car usage which drops by 4,05% (from 71,59% to 67,54%), while a 3,42% increase is evident in public transport use. Walking share remains the same with a slight decrease by 0,24%, while cycling and motorbike use face a 0,03% and 0,36% increase accordingly. A small change, which however shows a significant behavioural change is the uptake of car sharing by 0,45% from no previous presence in the area.

Walking and cycling percentages cannot increase as this scenario does not include measures for walking and cycling facilities and promoting policies. Walking and cycling will increase within the LEZs, however their overall percentage changes in a rather limited way.

- Which part of your future prediction is not in line with upper-level transport policy (of region, country and EU)?

The country and EU policies introduce the use of more environmentally friendly and sustainable means of transport for people and goods while at the same time set goals and activities for the decrease of car use and the uptake of walking, cycling and shared vehicles. Greece has lately started considering urban mobility planning as a national priority funding 162 cities for conducting Sustainable Urban Mobility Plans (SUMPs) at the local level. National guidelines are being prepared while new policy- related regulations are issued. More and more Greek cities are introducing measures promoting walking, cycling and public transport, while several are completing SUMPs according to the EU Guidelines.

Therefore, this scenario does not fully comply with these policies, as it continues the existing car-centric culture although it shows a slight alteration focusing on access regulation and mobility management. Moreover, this scenario does not meet the EU and local goals for emission reduction (minor changes for CO2 emissions from 36111,98 tonnes per year to 35304,66, for PM emissions from 2,10 tonnes per year to 1,281[7]).

Lastly, this scenario, fails to fulfil the EU, national and regional road safety goals as the number of accidents and fatalities seems to only decrease by 0,51 fatalities per 100,000 inhabitants. The latter fatality indicator can be questioned, while better results are expected in the long term as the Regional Authority of Crete plans several awareness raising actions which can have a crucial impact on Hersonisos.

- Is the overall situation improving the living quality of your FUA?

Some aspects show a slight improvement in the overall quality of life. For example, due to the technological improvements, access regulations and low emission zones' implementation along with the expected uptake of green vehicles, air quality is expected improve (see table- decrease in PM, CO, NOx, VOC emissions) and noise emissions will also decrease, however not within the specified targets.

Moreover, road safety will not improve significantly due to the small decrease in car share and the small increase in public transport share, as no supporting measures are apparent to enhance the streetscape. The reorganization of taxi and public transport (PT) stops is expected to alter the accessibility level of residents and visitors in the most crowded areas, while the introduction of freight regulations is expected to show the tendency for change in daily commuting habits.

- What are the effects on particular demographic groups, such as children, elderly, low-income group, foreigners and migrants, students, mobility-impaired people, etc.?

Vulnerable road users (incl. children, elderly, mobility- impaired people etc.) remain excluded as this scenario does not include policy and infrastructure upgrades in terms of walking and cycling promotion. The limited reorganization of public transport and taxi stops is expected to ease the customary commuters in the short and long term, however no positive effect is apparent for other users.

Low-income groups and migrants are not expected to face any further results in their current difficulties. Public transport prioritization policies may enhance the commuting level of service for foreigners or others, but little change is expected. Access regulations along with the support of Information Communication Technology (ICT) tools for controlling illegal parking show a positive impact for mobility-impaired and vulnerable road users as behavioral change is apparent in the selected pilot areas; however the absence of new infrastructure does not allow for proper reallocation of urban space in favor of all the particular excluded groups.

- How will the transport-related cost paid by each end user change? How will the transport-related cost paid by your municipalities or regional government change?

[7]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.

Individual expenditure for transport is expected to slightly increase from 0.674 to 0.739 (1000EUR/year) as there is small change in modal share that does not favour walking or cycling, similarly to the public administration which increases by 168,91 (1000EUR/year). Transport revenues of public administration face a clear uptake by 2350,96 (1000EUR/year) as the UTR tool assesses the impact of the national transport revenues trends. Transport social monetary costs have a slight increase from 16283,87 (1000EUR/year) to 16469,69 (1000EUR/year)[8]. The transport related cost per user is expected to increase as the selected measures in this scenario do not allow the alteration of commuting habits to more sustainable and costless means (i.e. cycling, PT) and the individual commuting remains car-centric.

- Will the overall change will lead to increase or decrease of transport-related energy consumption in your FUA?

There is clear decrease of transport- related energy consumption, due to both the 4,05% drop of car usage and the projected uptake of alternatively-fuelled vehicles[9] (incl. private and public fleets). The introduction of alternatively fuelled vehicles alters the consumption patterns however alterations will only be visible in the long-term.

- Will the overall change will lead to increase or decrease of transport-related CO2 emission in your FUA?

The implemented measures in this scenario lead to minor changes for CO2 emissions in Hersonisos from 36111,98 to 35304,66 tonnes per year, while for PM emissions drop from 2,10 tonnes per year to 1,281[10]. Other emissions, such as CO, NOx and VOC drop by 33,54 tonnes/ year, 28,35 tonnes/ year and 6,70 tonnes/ year accordingly[11].

4.6.3 SCENARIO 2: Promoting active, clean and shared transport

This is a rather challenging SUMP scenario for promoting walking, cycling and shared mobility culture in Hersonisos, assessing its particularities in terms of seasonality and tourist flows in the short and long term.

Viewing the city in 10 to 11 years (2030) from now, there are important infrastructure upgrades for soft modes along with mobility regulations and actions to promote all active and clean transport modes with special emphasis on sharing mobility alternatives. In this view, local stakeholders have assisted and agreed in developing an overall sharing culture by investing and capitalising the related benefits. Specific policies and measures are in place during the touristic season, while others are evident all year long (see also Annex II for Measure package description).

[8]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.
[9]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.
[10]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.
[11]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.

Implemented policies and measures within this scenario include the following under the key described categories;

Demand management/ mobility management

- The development of a strategy for enhancing pedestrian & cycling network,
- Implementation of a campaign for awareness raising on walkability, accessibility and cycling integration,
- Land use planning upgrade.

Optimizing **existing** infrastructure

- Upgrading pedestrian crossings & ramps,
- Implementing sidewalk widenings in the main network,
- Traffic calming implementations in critical areas.

Improvements of existing/ Investing in **new** infrastructure

- Developing new pedestrianized routes and a new scheme for seasonal road closures,
- Developing new cycling routes and facilities,
- Enhancing beach accessibility for disabled.

The above measures are expected to be fully implemented in 10 years' time. All these measures promote ACTIVE MOBILITY, soft transport modes and shared vehicles' alternatives, through both policy implementations and development of infrastructure. Infrastructure measures include low and medium cost applications by developing both new networks and upgrading the existing ones.

The overall expected results from the implementation of the above measures are positive in terms of walkability, accessibility and cycling enhancement. A key element of this scenario is the addressing of the seasonality in Hersonisos and the most deteriorated areas.

Figure 4.30 Scenario 3

- How will the demographic structure of your FUA and the core city in it be in your planning horizon around 2025 to 2030? (No of population, age structure, etc.)

Demographic projections for the Municipality show that the number of population will continue to rise (close to 10% in a decade from 2020 to 2030). The overall region's statistics show a clear population increase according to the national data (+12% in the decade 2001-2011, see 5.1 section of Deliverable T1.1.1)[12]. This is directly related to economic activity and especially to tourism development as Crete – especially its northern part where Hersonisos is located - continues to rise as a European touristic destination, providing motives for young people to work and live there. The age structure is also expected to change in favour of younger people (under the age of 50).

- Which types of transport technology will have been diffused or will disappear in your FUA in your planning horizon around 2025 to 2030?

Advanced technological tools, applications and Information Communication Technology (ICT) assistance is supporting the development of this scenario in order to achieve sustainability in local policies and measures.

To this direction an expanded Bike- sharing network with a fleet including over 250 bikes, will be functioning in the medium and long-term, along with on- demand shared taxi services, providing additional and more sustainable mobility options in an easy and modern way.

Public Transport Service will be rearranged and will be supported by shared modes, and complementary sustainable modes for multimodality.

Another key technology that will evolve in the area is the uptake of alternatively fuelled car vehicles. More specifically for hybrid electric vehicles, their share for personal cars will increase for 8.46% compared to scenario 2 (8.49%) and for 14.31% compared to the baseline scenario (2.64%). At the same time, battery electric personal cars are being used for the first time (compared to scenarios 1 and 2) for 3.62%.

Public transport vehicles are expected to significantly increase the use of Compressed Natural Gas- CNG to 9.37% (almost nine percentage units from scenarios baseline, 1 and 2), have increase the percentage of hybrid electric ones to 11.99% (almost 6 percentage units from scenario 2) and slightly increase the use of battery electric vehicles(0.45% to 0.53%) for serving local needs[13].

Such uptake is reasonable as Scenario 3 addresses the overall mobility situation through various policies and infrastructure, while it supports ICT introduction in numerous transportation fields.

- How will the share of transport mode change in your core city and FUA? Will there be higher share of journey with cars or less? Will it increase or decrease the share of public transport? Will there be more cyclists and walkers, or less?

[12]Data deriving from the local Operation Plan referring to the planning horizon of 2020 and 2030.
[13]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.

This scenario puts a special emphasis on promoting walking and cycling for small and medium distances hence can alter the modal share only at the small scale within the various centralities.

In the total area of the municipality, car use is expected to decrease for almost 2% - compared to scenario 2 - to 65.82%, while the use of public transport will be also slightly less to 11.94% (1% less compared to 12.95% in scenario 2). The use of bikes will increase for almost 1% (mostly for longer distances within the municipality) and the use of motorbikes will also slightly increase for 0.36%. Bike use for trips up to 3 km long are expected to increase from 5% to 12%, based on SMU assessments[14].

Car sharing will be also increased to 1.37% supporting new mobility alternatives. Taking all this into consideration it is noticed that, the vehicle-km by car travelled by conventional vehicles will be significantly decreased to 82.9 compared to the ones travelled before (107.25 km for the baseline scenario, 106.33km for scenario 1 and 103.22for scenario 2). This prediction for modal share is considered to be a software failure of the Urban Transport Roadmaps (UTR) tool as the implemented policies and measures in this scenario impose several policy sets for walking and cycling network enhancement, increase in catchment areas for walking and cycling, access regulations and traffic calming measures that typically will boost the use of walking, cycling and public transport.

Alternative predictions prepared by the Sustainable Mobility Unit NTUA (National Technical University of Athens, the Athenian Polytechnic University's lab) estimate a modal share as follows; walking 8%, cycling 5%, car 56% (including a 25% of share on EVs), car-sharing 5%, motorbike 12% (including electric ones), bus and collective smart transportation 14%.

- Which part of your future prediction is not in line with upper-level transport policy (of region, country and EU)?

The country and EU policies introduce the use of more environmentally friendly and sustainable means of transport for people and goods while at the same time set goals and activities for the decrease of car use and the uptake of walking, cycling and shared vehicles. Greece has lately started considering urban mobility planning as a national priority funding 162 cities for conducting Sustainable Urban Mobility Plans (SUMPs) at the local level. National guidelines are being prepared while new policy- related regulations are issued. More and more Greek cities are introducing measures promoting walking, cycling and public transport, while several are completing SUMPs according to the EU Guidelines.

Hersonisos is now funded through this project for implementing its first SUMP. Green mobility measures will be in force and priority. Funding opportunities for public transport vehicles and infrastructure will be promoted.

Therefore, this scenario does comply with these policies, however fails to achieve a robust change that would follow the EU trends and commitments.

[14] Alternative predictions refer to the local level of Hersonisos, Stalida and Malia settlements.

- Is the overall situation improving the living quality of your FUA?

Significant improvements are being achieved in this scenario as 3 key types of measures are being promoted: (see also Annex II)
1. Demand management and mobility management measures, including land use upgrade, enhancement of bike use and walking alternatives,
2. Optimise existing infrastructure, including upgrade of pedestrian crossings & ramps,
3. Implementing sidewalk widenings in the main network and traffic calming implementations in critical areas
4. Investing in new infrastructure, including expanding of the bike network, new pedestrian routes, new schemes for seasonal roads closure,
5. accessibility improvements for the disabled including the beach, etc.
All the measures and interventions manage to bring a new mobility philosophy for the city, which is on the service of people, citizens or visitors.
For this reason, air quality improvements are being noticed (decrease of PM, CO, CO2, NOx, VOC emissions) and noise emissions are also expected to decrease due to higher use of active modes[15]. Moreover, road safety will improve due to a lower share of car use, the reduction of car speed in peak hours and the increase of use of other modes of transport, which has a positive impact on the living quality. Social inclusion and accessibility will improve due to improved cycling and walking conditions and infrastructure.

- What are the effects on particular demographic groups, such as children, elderly, low-income group, foreigners and migrants, students, mobility-impaired people, etc.?

Effects on such demographic groups are positive as the accessibility improves due to improved walking and cycling conditions, its network expansion and its financial accessibility. Most people can walk, and cycle and they have more opportunities to access education, job opportunities, services, leisure activities, etc, although the planned networks are limited within the urban settlements. This is particularly important for low-income groups, migrants, students and for young people. However, not everyone can cycle.

Basic public transport will remain as it is today, improvements on the fleet will be significant and its use will remain slightly popular with much more comfort and environmentally friendly standards fulfilled. Mobility-impaired people will benefit by this scenario, but more measures/interventions are also needed. Information Communication Technology (ICT) tools will be extensively used in mobility service of the impaired people.

- How will the transport-related cost paid by each end user change? How will the transport-related cost paid by your municipalities or regional government change?

Major improvements of walking and cycling network and on upgrading public transport, require significant investments, which means that public expenditure for transport increases significantly to 7475.92 (1000EUR/year), compared to the baseline and scenarios 1 and 2.

[15]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.

Overall, the net financial result is negative and less than in other scenarios. However, transport social monetary costs are expected to increase to 18197.19 (1000EUR/year)[16].

This is an expected situation for public administrations, which usually expect different kind of revenues in order to assess costs and benefits of investments of that kind, e.g. tourism increase, additional private investments.

- Will the overall change will lead to increase or decrease of transport-related energy consumption in your FUA?

Due to decrease of car use, increase of use of bikes, uptake of alternatively-fuelled vehicles and increase of (green) public transport, this scenario predicts lower transport-related energy consumption.

- Will the overall change will lead to increase or decrease of transport-related CO2 emission in your FUA?

This scenario predicts[17]**minor** changes for CO2 emissions in Hersonisos from 36111,98 to 33158,44 tonnes per year, while PM emissions drop from 2,10 tonnes per year to 1,045[18]. Other emissions, such as CO, NOx and VOC drop by 38,75 tonnes/ year, 32,83 tonnes/ year and 8,52 tonnes/ year accordingly. **Although walking and cycling infrastructure are enhanced through this scenario, Such small alterations in numerical data deriving from the UTR are explained due to the system's immaturity in adding length of networks and connections.**

4.6.4 SCENARIO 3: Modern dealing with urban freight transport & innovative trends on applying active and shared modes measures

This is a highly provocative SUMP (Sustainable Urban Mobility Plan) scenario dealing with **a number of traditional SUMP objectives**, however **including critical innovative techniques to address Hersonisos' urban challenges**.

This scenario assumes the implementation of all three (3) **measure packages** (see Annex II) for mobility enhancing falling under the three following thematics;

1. Promoting walkability and cycling- emphasis on disabled accessibility and addressing seasonality,

Demand management/ mobility management

[16]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.
[17]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.
[18]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.

- The development of a strategy for enhancing pedestrian & cycling network,
- Implementation of a campaign for awareness raising on walkability, accessibility and cycling integration,
- Land use planning upgrade.

Optimizing **existing** infrastructure

- Upgrading pedestrian crossings & ramps,
- Implementing sidewalk widenings in the main network,
- Traffic calming implementations in critical areas.

Improvements of existing/ Investing in **new** infrastructure

- Developing new pedestrianized routes and a new scheme for seasonal road closures,
- Developing new cycling routes and facilities,
- Enhancing beach accessibility for disabled.

2. Smart and flexible transportation

Demand management/ mobility management

- On-demand shared taxi service
- Integrated ticketing service
- Re-arrangement of inner PT service routes
- Integrate tourism operators and hoteliers to sustainable transportation scheme

Optimizing **existing** infrastructure

- Upgrading existing bus stops into smart-protected facilities

Improvements of existing/ Investing in **new** infrastructure

- Bike sharing
- Self-ticketing machines for PT
- Implementing park & ride areas to support new forms of sustainable transportation
- Investment in Green Public fleet and Charging network

3. Upgrading roadspace facilities for all users- special emphasis on Freight and parking management.

Demand management/ mobility management

- New parking regulation polic
- New park & ride scheme
- Freight fleet management scheme

Optimizing **existing** infrastructure

- Enhance taxi stop allocation zones
- Upgrade disabled parking spots

Improvements of existing/ Investing in **new** infrastructure

- Freight delivery parking spots
- Visitors and residents parking areas (on-off street)

Urban freight deliveries and parking issues are faced with robust policies and **technology** is used as a critical asset, creating a vivid and sustainable tourist destination operating in tranquillity all year long.

The overall image of Hersonisos' centralities in 10 years' time – after having implemented all the above measures- reflect a robust complex area with urban mobility at its core of transportation and urban planning challenges.

Figure 4.31 Scenario 4

- How will the demographic structure of your FUA and the core city in it be in your planning horizon around 2025 to 2030? (No of population, age structure, etc.)

The population of MoH is currently estimated at 26,717 inhabitants (2011 census). Demographic projections for the Municipality show that the number of population will continue to rise (close to 10% in a decade from 2020 to 2030). The overall region's statistics show a clear population increase according to the national data (+12% in the decade 2001-2011, see 5.1 section of Deliverable T1.1.1)[19]. This is directly related to economic activity and especially to tourism development as Crete – especially its northern part where Hersonisos is located- continues to rise as a European touristic destination, providing motives for

[19]Data deriving from the local Operation Plan referring to the planning horizon of 2020 and 2030.

young people to work and live there. The age structure is also expected to change in favour of younger people (under the age of 50). Moreover the development of such measures described in this scenario is expected to attract further people from neighboring municipalities (i.e. Municipality of Minoa at the South and Municipality of Oropedio) either as working commuters or as permanent residents in the key settlements of the area. The reallocation of the Heraklion airport at the South of Hersonisos (near Kasteli area) is expected to attract also residents who will commute to Kasteli, however there is no numerical data the needed working force in order to evaluate the increase.

- Which types of transport technology will have been diffused or will disappear in your FUA in your planning horizon around 2025 to 2030?

This scenario includes a number of implementations that are highly interrelated to technologic applications and Information Communication Technology (ICT) assistance for the achievement of various policies and measures. Technology is used as a critical asset, creating a vivid and sustainable tourist destination emphasizing on sustainable travel modes.

Tools are used to support access regulations, seasonal road closures, traffic calmed areas, cycling and public transport prioritization, bike-sharing, car-sharing, park & ride services, e-mobility charging network, freight management, on-demand transport services et cetera.

Similarly to scenario 3, the bike-sharing network will be supported by 250 bikes at first phase (2025) which will be doubled (2030) or tripled based on demand and seasonality. Public Transport Service will be rearranged and will be supported by shared modes, and complementary sustainable modes for multimodality.

Moreover, a key technology that is expected to evolve in the area is the uptake of green and alternatively fuelled vehicles including electric vehicles. The global uptake due to industry evolvement together with the proposed measures is expected to boost the use of alternatively fueled vehicles for both personal and public/ collective use. Predictions for car vehicles show the use of hybrid electric climbing at 19,2%[20] (from 2,64% that is today- baseline), the use of battery electric at 3,62% (from 0 use). Following this trend, public transport vehicles will also increase the use of Compressed Natural Gas- CNG by 9,25% (0.12% to 9,37%) and the use of hybrid electric by 10,39 (from 1,6% to 11,99%) while also the battery electric vehicles are expected to increase their share by 0,41% (0.12% to 0.53%).

- How will the share of transport mode change in your core city and FUA? Will there be higher share of journey with cars or less? Will it increase or decrease the share of public transport? Will there be more cyclists and walkers, or less?

The share of transport modes – according the prediction of the Urban Transport Roadmaps - UTR tool- is expected to change slightly compared to the current situation, although this prediction regards mostly

[20]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.

the main road arteries connecting the key settlement with the three main centralities of Malia, Hersonisos and Stalida.

Important decrease is apparent for car usage which drops by 10,05% (from 71,59% to 62,55%) while a critical uptake is apparent through a 7,29% increase in public transport use[21]. Predictions from the same tool (UTR) show that walking remains similar to the current situation with a share of 4,54%, while cycling and motorbike use face a 0,57% and 0,13% increase accordingly. This prediction for modal share is considered to be a software failure of the UTR tool as the implemented policies and measures in this scenario impose several policy sets for walking and cycling network enhancement, access regulations and traffic calming measures that typically will boost the use of walking and cycling.

Car sharing shows a small increase by 1,15% which is also questionable as this scenario includes a number of actions suggested for Smart- Flexible- Collective Transportation (see Annex II).

Alternative predictions prepared by the Sustainable Mobility Unit NTUA (the Athenian Polytechnic University's lab) estimate a modal share as follows; walking 10%, cycling 12%, car 38% (including a 30% of share on EVs), car-sharing 10%, motorbike 8% (including electric ones), bus and collective smart transportation 22%[22].

Hersonisos has a valuable fleet of rental cars, bikes and bicycles which remain underused throughout the year after the end of the touristic season, that can assist on the development of a robust sharing scheme with the participation of local stakeholders.

- Which part of your future prediction is not in line with upper-level transport policy (of region, country and EU)?

The country and EU policies introduce the use of more environmentally friendly and sustainable means of transport for people and goods while at the same time set goals and activities for the decrease of car use and the uptake of walking, cycling and shared vehicles. Greece has lately started considering urban mobility planning as a national priority funding 162 cities for conducting Sustainable Urban Mobility Plans (SUMPs) at the local level. National guidelines are being prepared while new policy- related regulations are issued. More and more Greek cities are introducing measures promoting walking, cycling and public transport, while several are completing SUMPs according to the EU Guidelines.

Therefore, this scenario does fully comply with these policies as it alters the existing car-centric culture by implementing a number of policies promoting walking and cycling, prioritizing public transport and collective shared modes, while also emphasizes at regulating freight delivery services and parking management.

[21]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.

[22] Alternative predictions refer to the local level of Hersonisos, Stalida and Malia settlements.

Moreover, this **scenario achieves to alter emissions especially in sensitive areas where vulnerable users are mostly concentrated**[23].

Slight changes are also apparent in terms of road safety as fatality rates decrease at 1,68 and serious accidents at 36,39.

- Is the overall situation improving the living quality of your FUA?

This scenario aims at applying a **complete alteration regarding urban mobility strategy by promoting active and shared modes and dealing with freight schemes and parking through an innovative and holistic way** (See Annex II for full measure packages).

Quality of Life improvements are apparent for all users putting human-centric planning at the core of urban development in the area;

Traffic calmed areas, regulated access, pedestrianisations (both permanent and seasonal), slower speeds and new infrastructure allow for the upgrade of the environment in terms of air and noise pollution, while the critical uptake of public and shared transport enhances the social cohesion in the area and introduces social equity standards for particular vulnerable users' groups.

Upgrading the level of service for all modes while at the same time working for the upgrade of roadspace facilities is expected to level up all parameters in terms of the environment, the economy and society.

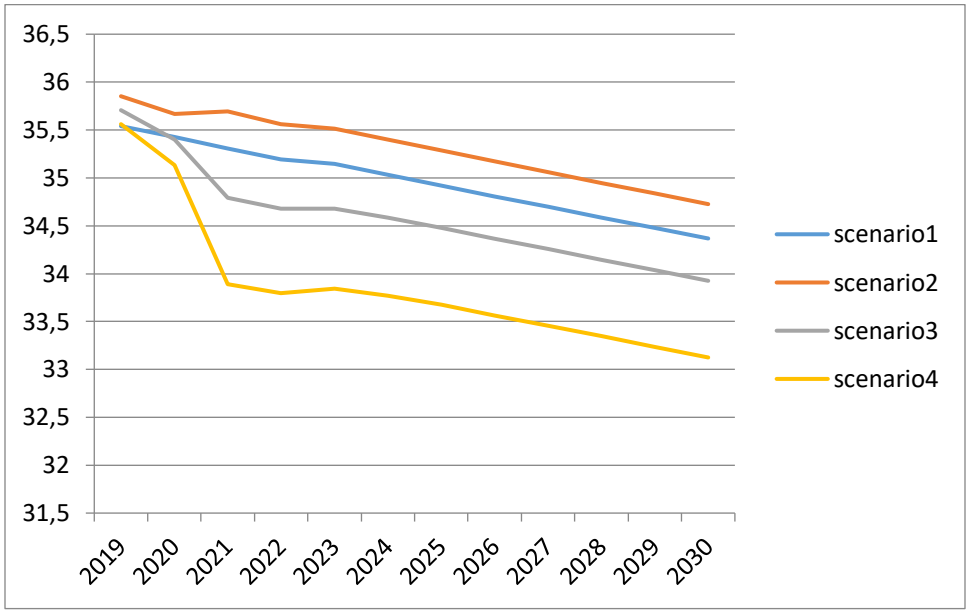
- What are the effects on particular demographic groups, such as children, elderly, low-income group, foreigners and migrants, students, mobility-impaired people, etc.?

Vulnerable road users have an upgraded environment to meet their daily needs without feeling excluded from the streetscape and public spaces. Special policies including the development of a pedestrianized network, traffic calming neighborhoods, slower speeds, seasonal closures, cycling network, sidewalk widenings, upgrading crossings and ramps are directly enhancing their quality of life.

Beach accessibility enhancement does also restore a chronic inequality standard for people with mobility limitations that were kept away from the area's comparative advantage.

It is important to notice the decrease in average car speeds through this scenario as slower speeds call directly for increased road safety for vulnerable road users such as the assessed groups[24].

[23]The overall change is not apparent through the results of the UTR tool predictions which show minor changes for CO2 emissions from 36111,98 tonnes per year 33134,49, for PM emissions from 2,10 tonnes per year to 1,155).
[24]Based on World Health Organization reports and facts from the Global Road Safety Initiative and the Institute for Transportation and Development Policy (ITDP)



Graph 4.15

The decrease of private motorization does also boost the cohesive commuting of low-income citizens and migrants with active modes without feeling endangered in the previously hostile environment. **Children, students and the elderly are moving in a cleaner, safer and regulated environment where human interaction is allowed and promoted. Moreover, the reallocation of urban furniture and transportation facilities advances the use of walking, cycling and collective commuting.**

- How will the transport-related cost paid by each end user change? How will the transport-related cost paid by your municipalities or regional government change?

Major improvements of walking and cycling network and on upgrading public transport, require significant investments, which means that public expenditure for transport shall show an increase in all types of assessment tools (such as UTR). Individual expenditure for transport will slightly increase from 0.674 to 0.726 (1000EUR/year), similarly to the public administration which increases by 5100,49 (1000EUR/year) as there is a lot of infrastructure projects to be implemented.

Transport revenues of public administration face a clear uptake by 2452,29 (1000EUR/year).

Transport social monetary costs face slight increase from 16283,87 (1000EUR/year) to 19988,43 (1000EUR/year)[25].

- Will the overall change will lead to increase or decrease of transport-related energy consumption in your FUA?

There is clear decrease of transport- related energy **consumption** due to both the 9,04% drop of car usage and the projected uptake of alternatively-fuelled vehicles (incl. private and public fleets). **The introduction**

[25]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.

of alternatively fuelled vehicles along with the increase in cycling, walking and shared commuting alter the consumption patterns however alterations will only be visible in the long-term.

- Will the overall change will lead to increase or decrease of transport-related CO2 emission in your FUA?

This scenario predicts[26] minor changes for CO2 emissions in Hersonisos from 36111,98 to 33134,49 tonnes per year, while for PM emissions it drops from 2,10 tonnes per year to 1,155. Other emissions, such as CO, NOx and VOC drop by 39,35 tonnes/ year, 32,25 tonnes/ year and 9,10 tonnes/ year accordingly.

Table 4.17. Scenario comparison MoH (Scenario 1 is highlighted in red)

Indicator	Baseline (2019)	SCENARIO 1 (2030)	SCENARIO 2 (2030)	SCENARIO 3 (2030)	SCENARIO 4 (2030)
Motorisation rate	308	330	329	328	328
Mode split (%)	Pedestrian 4.66% Bicycle 0.47% Motorbike 13.75% Car 71.59% Bus 9.53%	Pedestrian 4.10% Bicycle 0.47% Motorbike 13.74% Car 72.31% Bus 9.37%	Pedestrian 4.42% Bicycle 0.50% Motorbike 14.11% Car 67.54% Bus 12.95% Car sharing 0.48%	Pedestrian4.95% Bicycle1.45% Motorbike14.47% Car65.82% Bus11.94% Car sharing1.37%	Pedestrian 4.54% Bicycle 1.06% Motorbike 13.88% Car 62.55% Bus 16.82% Car sharing 1.15%
Travel distance per trip (km)	2.62	2.62	2.64	2.53	2.55
Average car speed in peak hours (km/h)	35.54	34.37	34.73	33.18	33.13
Average bus speed in peak hours (km/h)	14.33	14.14	14.67	14.82	14.85
Vehicles-km by car conventional vehicles	107.25	106.33	103.22	82.9	79.91
Penetration of alternatively fuelled car vehicles	Hybrid electric 2.64% Battery electric 0.00% Fuel cells 0.00%	Hybrid electric 8.49% Battery electric 0.00% Fuel cells 0.00 %	Hybrid electric 8.49% Battery electric 0.00% Fuel cells 0.00%	Hybrid electric16.95% Battery electric3.62% Fuel cells0.00%	Hybrid electric 19.20% Battery electric 3.62% Fuel cells 0.00%
Penetration of alternatively fuelled bus vehicles	CNG0.12% Hybrid electric 1.60% Battery electric 0.12%	CNG 0.45% Hybrid electric 6.00% Battery electric 0.45%	CNG 0.45% Hybrid electric 6.00% Battery electric 0.45%	CNG9.37% Hybrid electric11.99% Battery electric0.53%	CNG 9.37% Hybrid electric 11.99% Battery electric 0.53%
CO_2 emissions per year (tonnes)	36111.98	36155.68	35304.66	33158.44	33134.49
PM emissions per year (tonnes)	2.10	1.30	1.281	1.045	1.155
CO emissions per year (tonnes)	176.9331	144.5308	143.39	138.18	137.58
NOx emissions per year (tonnes)	75.22387	47.48397	46.87	42.39	42.97
VOC emissions per year (tonnes)	38.4044418	31.77889182	31.70	29.88	29.30
Total Accidents by severity	Fatality 1.90	Fatality 1.87	Fatality 1.85	Fatality 1.69	Fatality 1.68

[26]Numerical data derives from the use of the Urban Roadmaps Tool (UTR) for the specific case of Hersonisos, while the proper initial parameters have been fixed from our Team of Experts.

Indicator	Baseline (2019)	SCENARIO 1 (2030)	SCENARIO 2 (2030)	SCENARIO 3 (2030)	SCENARIO 4 (2030)
	Serious 41.92	Serious 41.37	Serious 40.56	Serious 36.61	Serious 36.39
Fatalities per 100,000 inhabitants	6.97	6.54	6.46	5.90	5.87
Transport expenditure per individual per year (1000EUR/year)	0.674	0.665	0.739	0.696	0.726
Transport expenditure of public administration (1000EUR/year)	4448.83	4438.83	4617.76	7475.92	9549.32
Revenues of public administration (1000 Euro/year)	2597.80	2713.73	4948.76	4852.50	5050.09
Transport social monetary costs (1000 Euro/year)	16283.87	16384.27	16469.69	18197.19	19988.43
Net financial result for public administration (million Euro)	-20	-20	-7	-22	-48

4.7 RDA BANAT

Cities in Europe are vital centers of economic activity, innovation and employment. However, they face increasing challenges to their mobility systems such as congestion, air pollution, ambient noise, CO2 emissions, accidents and urban sprawl. To tackle these problems cities, need to develop and implement coherent and challenging Sustainable Urban Mobility Plans (SUMP). The Urban Transport Roadmaps project provides on-line tool to help develop the first scenarios of SUMP. With its simplified approach the tool serves as a first step and allows:

- to explore and identify appropriate sustainable transport policy measures;
- to quantify the transport, environmental and economic impacts of these measures;
- to consider an implementation pathway (roadmap) for the policy scenario.

The roadmaps tool is focused on developing the overall goals, approach and basic policies packages that form the basis of a SUMP before further elaboration and implementation. This relationship is illustrated in Figure below.[27]

Figure 4.32 Overview of how the tool interacts with the SUMPs process [1]

[27] Study On European Urban Transport Roadmaps 2030, Tool description and user guide, March 2016, D.Fiorello, F.Fermi, G.Hitchcock, D.Clarke

Tool is designed to carry out initial scoping of potential policies that could be applied to a city. It allows single policies and groups of policies to be assessed providing estimates of the impact on a range of transport, environment and economic indicators. The tool has five main structural elements[28]:

- The City Wizard – this is the main entry point of the tool and allows the user to select some basic information to characterize city. This basic information allows the model to set up the most appropriate basic transport patterns to represent the city, providing a simple and quick initial configuration of the model.
- Advanced Settings – for the more advanced user there is the ability to customize the default data, using local data, to provide a more accurate representation of the city.
- Policy selection – having selected a city type, and potentially customized it, the user can then select various policies to apply in their city. The primary policy measures will be associated with default parameters.
    - Policy customization – as with the city types the default data for the policy options can be customized to refine the policy measure.
- Calculation framework – this forms the core of the tool and takes the city setup parameters and policy measure parameters to calculate the results for the policy measures in the selected city. The calculation framework comprises three key elements:
    - The transport module - that calculates the base transport patterns for the city and then adjusts them in relation to the policies.
    - The emissions module - that calculates the emissions and environmental data associated with the transport activity.
    - The policy modules - that translates the policies into impacts.
- Tool outputs – these provide the numerical and graphical representations of the impacts of the transport policies on the city. There are three main types of impact that are generated by the tool:
    - Transport impacts – including mode share, average trip distances and traffic levels;
    - Environment outputs – covering CO2, CO, PM, NOx and VOC emissions, and accident rates;
    - Economic outputs – providing the direct cost/benefits associated with the policies, and the social cost of emissions and accidents.

This tool serves to define mobility scenarios targeting the cities of the 28 EU Member States as well as Norway and Switzerland. As Serbia strives towards the European Union, and has similar socio - economic circumstances is possible to select this tool to create scenarios of mobility in the city of Zrenjanin.

[28]Study On European Urban Transport Roadmaps 2030, Tool description and user guide, March 2016, D.Fiorello, F.Fermi, G.Hitchcock, D.Clarke

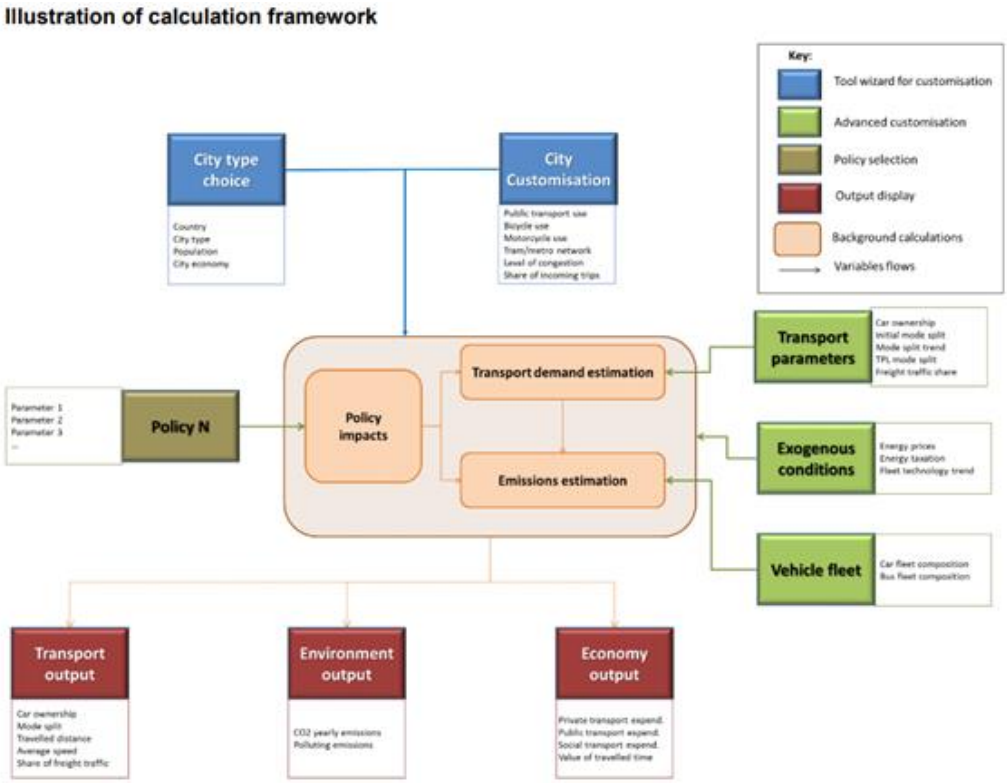


Figure 4.33 Illustration of calculation framework

The variables describing urban mobility are calculated annually between the years 2015 and 2030 on a yearly basis. The basic development of the annual trends is the result of exogenous trends and of the interactions between the variables. These interactions are managed by means of parameters. Initially a reference trend of the urban mobility and of its effects is computed based on the set up defined by the user in the city wizard. This trend can be affected by policy measures. The conditions of urban mobility and its impacts are then summarized by several indicators which are also used to assess the impact of policy measures[29].

The core of the calculation framework consists of:

- The transport demand calculation module which is a basic strategic transport model at the city scale;
- The policy impact modules that estimate the impact of policies on key transport parameters;
- The emissions calculation module the city wizard modules provide the initial configuration parameters that are used to set up the transport and emissions modules.

The advanced settings module then allows further adjustment of key parameters in the transport and emissions modules. The policy module allows for the implementation and configuration of policies and how these affect the core transport and emissions modules. These core modules then generate the

[29]Study On European Urban Transport Roadmaps 2030, Tool description and user guide, March 2016, D.Fiorello, F.Fermi, G.Hitchcock, D.Clarke

transport, environment and economic outputs that are displayed in the tool. This framework is illustrated in figure above.

The first step of project is based on a questionnaire previously submitted to all PPs in order to obtain some essential information needed for the elaboration of mobility scenarios. After data collecting, the next step is to enter socio-economic data on Zrenjanin into the tool (application). These are data on the characteristics of the traffic system of the city (modal split - participation of modes of transport in total traffic, development of public transport, statistics on the number of registered motor vehicles in Zrenjanin and others). The application then generates mobility scenarios on the basis of the entered data and gives graphic representations of certain situations. The application has the option of defining traffic flow forecasts, as well as the Modal Split. From the aspect of the Transport System, Zrenjanin faces a number of problems related to a characteristic decline in the number of inhabitants year after year, accompanied by an increasing number of passenger cars. Also, the problem is the fact that is present a small occupancy rates of passenger cars (app. 1.7). The large share of passenger cars in the overall mode share, followed by a large number of trips by this mode, from which the largest number of trips are for the purpose of going to work (particularly to industrial zone). All this eventually leads to congestion in the central part of the city that is created by local movements and transit traffic. The main problem that the city of Zrenjanin has, in addition to mixing local and transit traffic, is the lack of bypass, as well as many modes of transport and a large amount of transport on a small area of the city, which in turn has a low level of traffic safety.

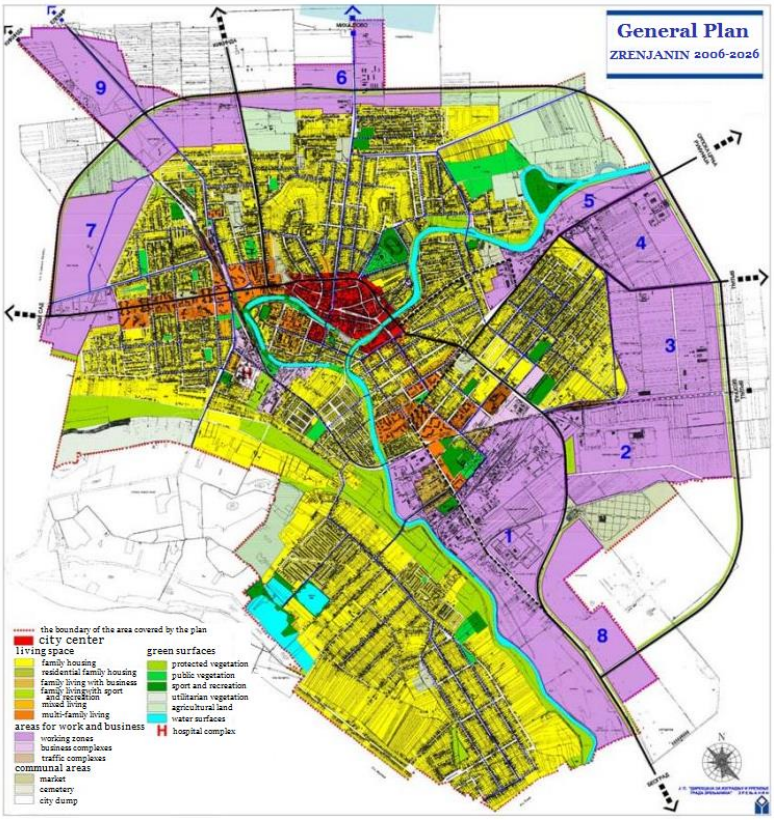


Figure 4.34. Map from General plan of Zrenjanin with land use (SOURCE: http://www.zrenjanin.rs)

City of Zrenjanin plans a construction of the bypass around the City. This is a project of great importance to the City, because it would be a way of relocating transit traffic from the central city zone, which would significantly improve the conditions of urban traffic. Position of the bypass is shown on figure below.

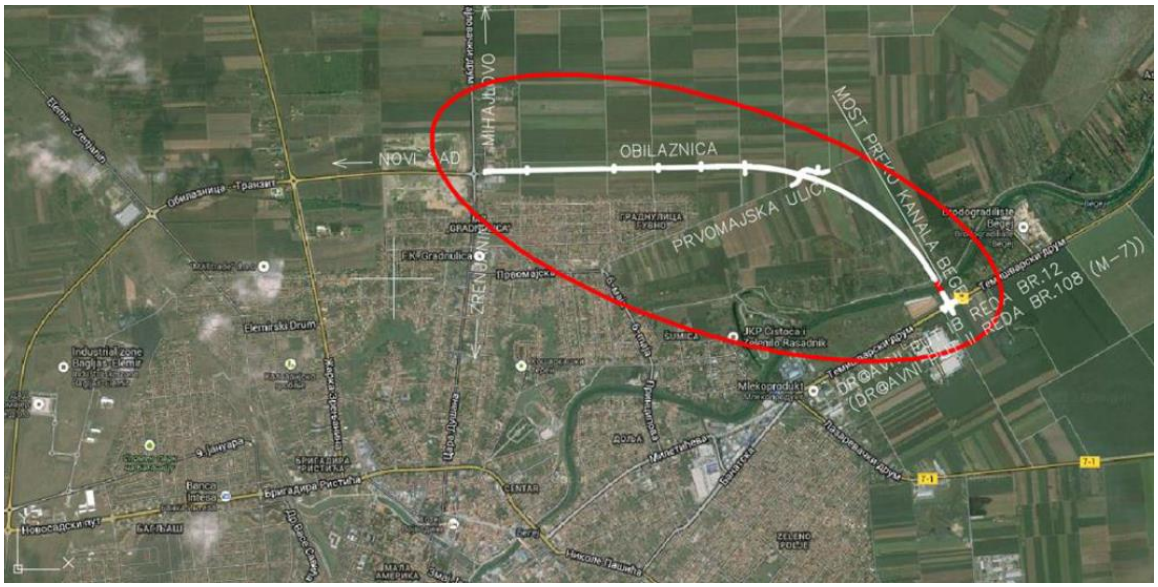


Figure 4.35. Planned continuation of the construction of the bypass Zrenjanin

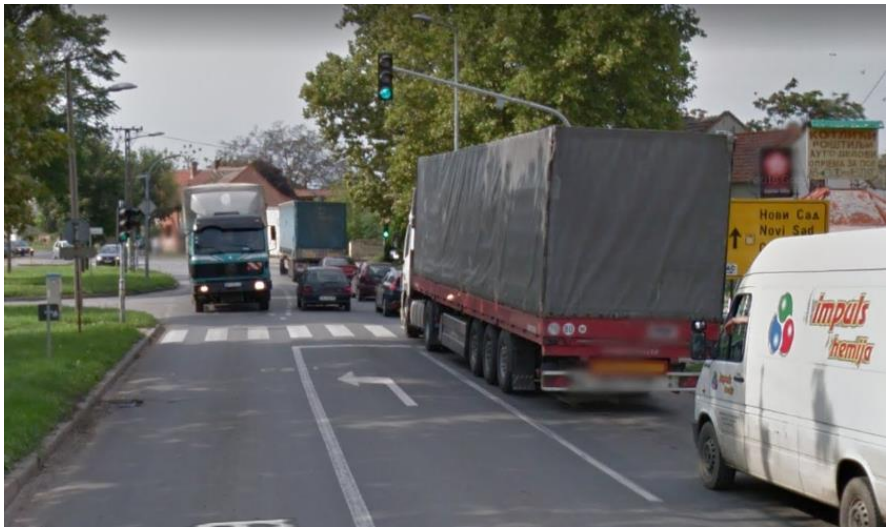


Figure 4.36. View of intersection in Zrenjanin near city center with a large number of freight vehicles

The significance of the construction of the bypass will be more obvious by its impact on State road IB, through which most of the city's public passenger transport routes are currently undergoing.

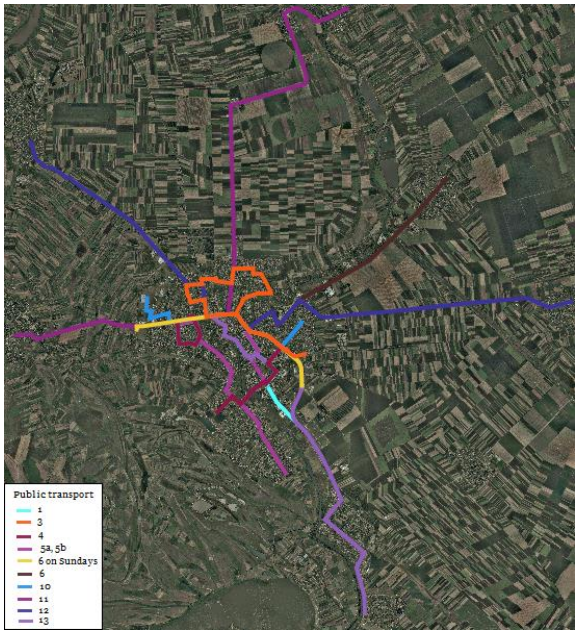


Figure 4.37 Position of Public transport lines throws the City of Zrenjanin (SOURCE: GIS portal Zrenjanin)

Bearing in mind all the problems in the transportation system of the city of Zrenjanin, for this purpose, three scenarios have been defined, as required in the Project Task.

The first is the Pessimistic scenario, where there is no investment in the transport infrastructure, where the bypass will not be built, an increase in traffic is foreseen due to increase of the traffic volume on State roads due to the development of the state of Serbia at the regional level and the development of industry in the City of Zrenjanin. There is small development of cycling but not sufficiently.

The second is the Moderate scenario, which foresees the construction of the bypass and the measure of prioritizing public transport which will affect a development of a public transport system for passengers, where there is no characteristic increase in passenger car traffic due to traffic relocation. Because of predicted measures on improving public transport system for passengers it is predicted decrease in

The third is the Optimistic scenario, which, in addition to the measures included in the moderate scenario (construction of the bypass and the measure of prioritizing public transport), includes and implementation of a number of measures that will be described below.

Based on these data, the application exposes data on possible network congestion, air pollution by the traffic system, economic costs.

The scenarios defined to improve the sustainability of urban transport consist of the implementation of various policy measures. Policy measures are the elementary components that are used for defining the roadmaps that will be described later. A wide range of policy measures exist that are potentially useful for setting up urban strategies aimed at addressing transport sustainability.

From this long list of measures a set of key policy measures was identified based on criteria including:

- Policy type (i.e. demand management; green fleets; infrastructure investment; pricing and financial incentives; and traffic management/control);
- Institutional level of implementation (i.e. by national or local authorities);
- Effectiveness on key impact areas, cost distribution, and transport modes covered.

A policy initiative is expected to select some of the potential measures and to combine them in order to define a realistic policy scenario.

In the initial conditions the city has some congestion and pollution problems despite a good level of coverage of public transport. Cars are often used when alternatives are available because many individuals are not used to travelling by public transport and do not have a clear perception of its level of service while the car can be used basically everywhere. The policy effort starts with the implementation of short-term measures and with the design of more complex measures. In order to promote other sustainable mobility solutions (not only public transport) a plan is prepared for building a network of cycling lanes and pedestrian paths. Streets where these facilities should be introduced are selected taking into account traffic calming interventions and traffic restrictions defined with other measures.

In table below (Table 1) the socio-economic data required as an input parameter of the tool are shown. With the help of a tool, when entering these data, it is allowed to build up profile of Zrenjanin. It starts with some basic information about the city such as city type, population size, name of country, population trend, basic economic data. Next step is further customization of the tool to be applied to Zrenjanin.

Table 4.18 Socio - economic data on Zrenjanin that are necessary for launching the tool

Context	Indicator	Value
City	City type	Medium city (100.000-500.000 inh.)
	Population	123,362 inhabitants
	Country	Serbia (same socio-economic circumstances as Croatia)
	Population trend	Limited decline: growth rate of -0.5% per year
	Sprawling trend	Some sprawl
	City economy	Relevant industrial sector
	Income	Medium average income per capita
Mobility	Mode split of internal mobility	Pedestrian 30.9% Bike 1.7% Motorbike 0.9% Car 47.4% Bus 19.1%
	Parking fare	0.33 euro / h
	Parking regulation	Mix of parking lots are charged
	Public transport reserved lanes	Reserved lanes for bus/tram do not exist or are negligible - Less than 5% of the public

		transport network length consists of reserved lanes.
	Cycling reserved lanes	An extensive network of bike reserved paths exists - Bike reserved lanes length is 8% or more of the road network length.
	Car sharing service	Not available
	Park & ride service	Not available

DATA SOURCES[30]: It is worth considering that the strategic nature of the tool and the need for a flexible structure that can be customized to meet the needs of a large number of urban areas made challenging the task of populating the calculation framework with data. Many elements required in the calculation framework are context specific. Examples are the average trip distance by mode, the trip distribution between peaks and off-peak periods, but there are many others. Also, the impacts of policy measures are highly context-sensitive as the implementation under real-world conditions is important. Furthermore, the aggregated level of the tool required to quantify the impacts of changes in transport demand at a very general level which is not necessarily what can be found in the research literature. Finally, many initial elements of the model, but also several elasticity parameters that influence policy impacts are not locked and hidden in the model structure but available for users' adaptations. What is needed for these elements is not an exact value, but rather a plausible starting point. All these aspects mean that the data set for the tool is a combination of robust literature-based parameters (e.g. emissions factors), generalizations of data based on case studies and estimates based on professional judgment when needed.

Therefore, the parameters driving the calculation framework (including the impacts of the policies) have been estimated on the basis of a wide range of data sources: travel surveys, Eurostat database, national statistics, modelling source (e.g. ASTRA-EC model, TREMOVE model), policy focused researches, professional literature, project reports, urban traffic studies, conference papers. As an example, about 70 different documents were used as a reference to estimate the parameters driving the impacts of the policies. Furthermore, whenever possible and meaningful, parameters were differentiated by countries (e.g. car ownership, PT production costs by mode, energy mix for electricity generation, vehicle fleet composition, etc.).

With reference to the exogenous assumptions related to technology, energy and national taxation trends, the quantification of projections was defined based on recent studies, such as e.g. European Commissions (2013), Krail et. al. (2014), Fiorello et. al. (2012).

4.7.1 SCENARIO 1: Pessimistic scenario

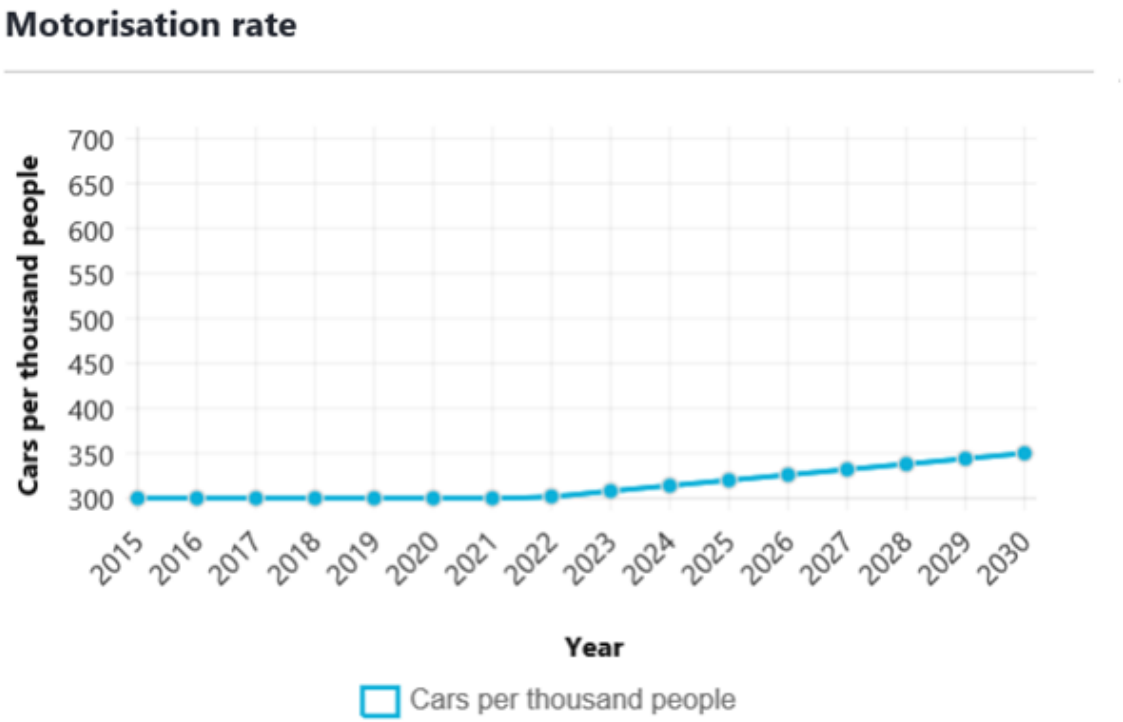
Zrenjanin is a city suitable for the development of pedestrian and bicycle traffic, however, these types, as well as public transport in the city are something that was not sufficiently used in Zrenjanin. The

[30] Claudia de Stasio et al. / Transportation Research Procedia 14 (2016) 3189 – 3198

pessimistic scenario shows the consequences that will occur if there is no development of cycling or other alternative forms of traffic. Also, as mentioned above, there will not be the bypass construction.

Figure 4.16 shows ratio between cars and thousand inhabitants per years for pessimistic scenario. This tool allows traffic flow forecasts until 2030.

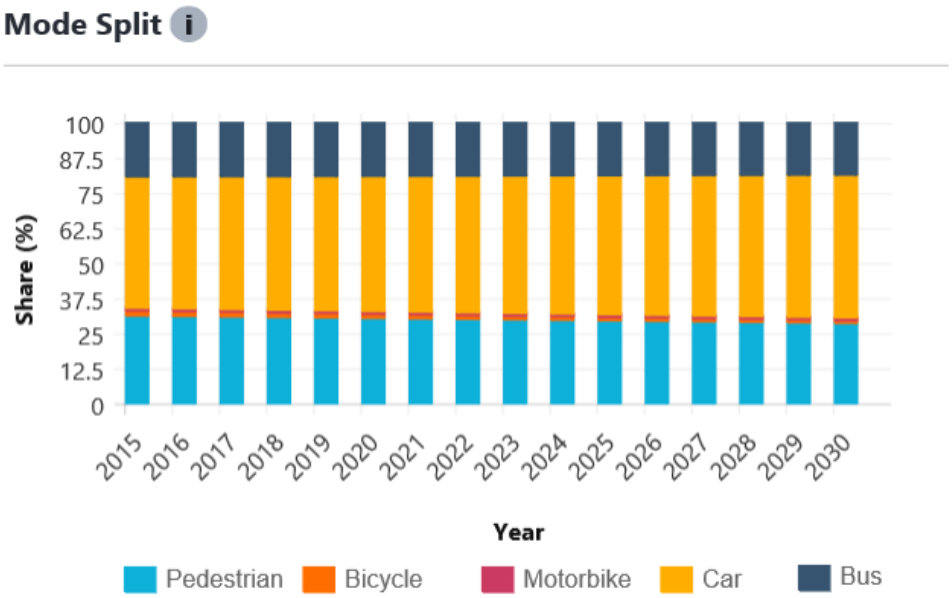
The tool use impact on car ownership simulated at EU level in the HOP! Project (Macro-economic impact of High Oil Prices) (2008) as a reference to estimate the alternative trend.



Graph 4.16 Motorization rate, in terms of ratio between cars and thousand inhabitants per years for pessimistic scenario

From figure above it is noted that in 2017 the number of passenger cars per 1000 inhabitants is 272 (which is measured value inserted in a tool), while the forecasted number in 2020 is 290, and in 2030 is 350 passenger cars. This is an increase in motorization of 28.7% in just 13 years.

The input required is the share of trips made with each of the available alternatives: car, motorbike, bikes, pedestrian, public transport. An initial value is provided based on the data collected by the research. The total sum of the shares had to be 100%. Even without any policy intervention, the use of transport modes changes over time. This input allows the tool updating the mode shares of the base year according to either observed or expected trend. The input is focused on the role of car for urban mobility.

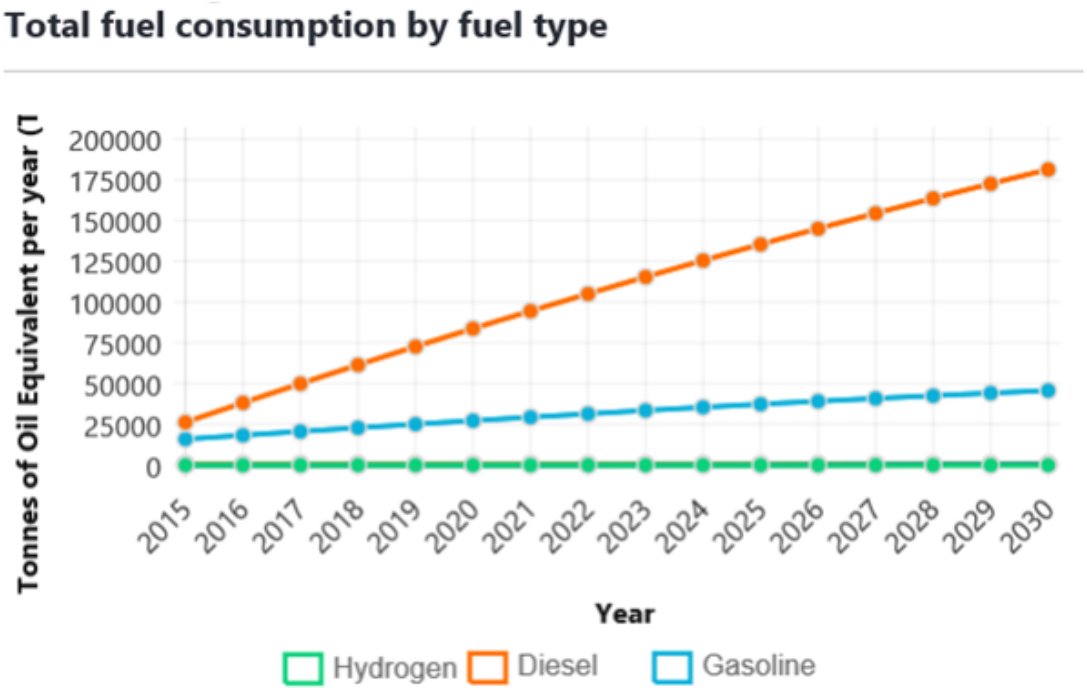


Graph 4.17. Percentage share of each mode of transport per years for pessimistic scenario

From Figure 4.17 it is noticeable that in 2017 the largest share in modes of transport is by passenger cars as well as in all foreseen years. If the situation is as it is up to now, without certain measures to improve the conditions for sustainable modes of transport, it is projected that in 2020 the percentage of pedestrians will be 30.39%, cyclists 1.53%, motorists 0.91% cars 48.17% and buses 18.99%, which is an increase in the number of passenger cars and a decrease in the number of pedestrians, cyclists and the use of public transport. It is even more noticeable that a number are getting worse in forecasted 2030, when it is predicted that the percentage of pedestrians will be 28.64%, cyclists 1.04%, motorists 0.89% cars 50.9% and buses 18.54%.

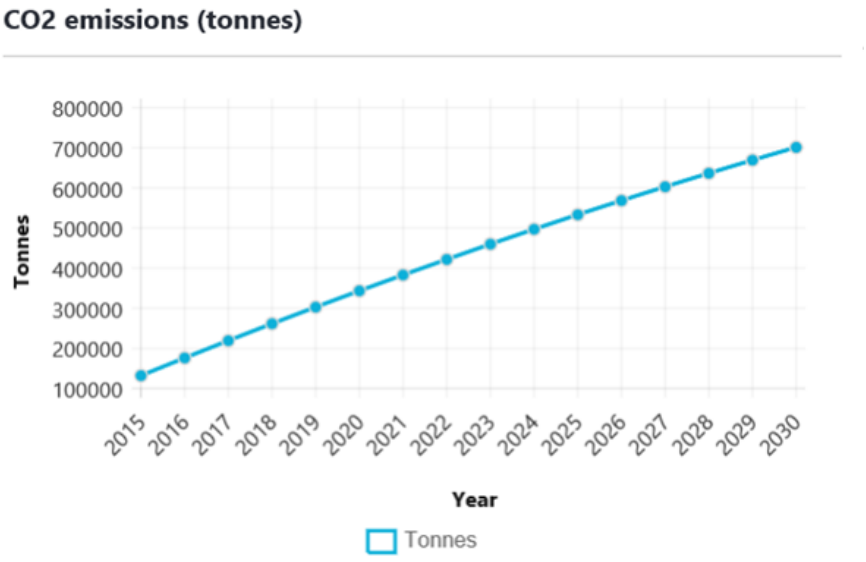
The average car fuel consumption is assumed to improve at double speed than in the reference scenario. The improvement rate for gasoline, diesel, CNG and LPG vehicles is therefore about -2.6 / -3.0 % per year, while for innovative vehicles a growth rate of about -0.8 % / -1% per year is implemented (Source: Study on Urban Transport Roadmaps 2030).

The tool also provides an overview of current and predicted fuel consumption by type. It is noticeable that this pace will drastically increase the consumption of diesel fuel as well as gasoline. Forecasts are in the pessimistic scenario that diesel consumption will increase by more than 3 times by 2030, and gasoline for more than 2 times. In 2017, the consumption of the diesel is 49940 tons per year, gasoline 20623.9 and hydrogen 0.065. In 2020. the consumption of the diesel will be83731.9tons per year, gasoline 27267.9 and hydrogen 0.123. In 2030. the consumption of the diesel will be 181347.4 tons per year, gasoline 45745.5 and hydrogen 12.86 (*Figure 4.18*).



Graph 4.18. Total yearly transport fuel consumption by fuel type (both internal mobility and incoming trips are considered) per years for pessimistic scenario

It's becoming more and more apparent how much the harmful impact of CO_2 emissions actually is. By doing nothing predictions are that a huge increase in quantity of CO_2 will occur. In 2017, emission of CO_2 is 219295.4 tons, in 2020, emission of CO_2 will be 343427.8 tons and by 2030, emission of CO_2 will be 701159.9 tons which is 68.7% more than in 2017. The CO_2 emission increase graph is shown below in figure 4.19.



Graph 4.19. Transport yearly CO2 emissions in pessimistic scenario

4.7.2 SCENARIO 2: Moderate scenario

The moderate scenario takes into account the construction of the bypass around Zrenjanin (Planned route of the bypass in Zrenjanin is shown in Figure 4.38. on this design) with whose construction the route of the state road IB No.13 will become a street road. This measure aims at relocating complete transit traffic outside the area of the city. Since the State Road IB No. 13 is the hub of most public passenger transport lines and has two separate pavement lanes, this scenario envisages further improvement of this mode of transport by marking a yellow bus lane along the entire section (app 6km). The planned bus lane links the Industrial Zone with the city center.

Figure 4.38 The planned route of the newly designed yellow bus lane

Figure 4.39 Section on State road IB no.13 in Zrenjanin on which the marking of the yellow lane for the buses is planned

Figure 4.40 Bus lane in New York City

(Source: https://www1.nyc.gov/html/brt/html/home/home.shtml)

Figure 4.41 Yellow lane in Belgrade

For the purpose of creating a moderate scenario for Zrenjanin, policy measures are chosen on base of collected data, local knowledge of socio - economic data, transportation system.

Selected measures are:

- Bus network - Redesigning the network layout of public transport by extending the service as well as by improving bus stops, stations, etc.
- Prioritizing public transport - Improving the service reliability and attractiveness to the general public, mainly by priority lanes.

The selected group of measures is aimed at promoting and popularizing pedestrian and the use of public transport which are currently insufficiently used in Zrenjanin.

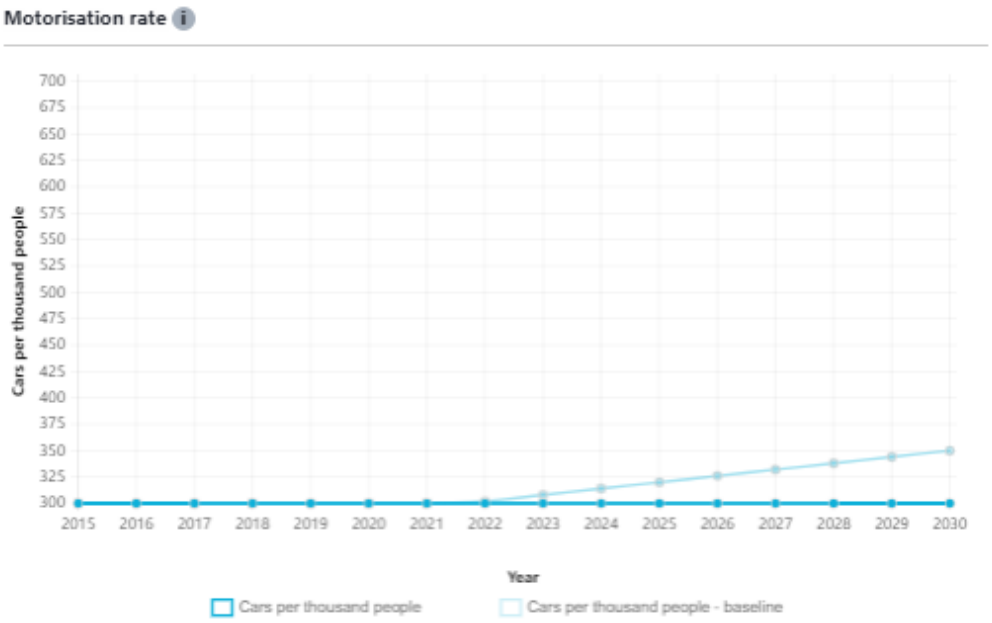
When choosing policy measure of prioritizing public transport, for initial year of the measure is planned 2022 with 2-year period for implementation and designed length of bus reserved lane 6km.

Figure 4.20 shows ratio between cars and thousand inhabitants per years for moderate scenario. As a reference for estimation the alternative trend, the tool use impact on car ownership simulated at EU level in the HOP! Project (Macro-economic impact of High Oil Prices) (2008).

This tool allows traffic flow forecasts until 2030. On figure 4.20 there are two lines; one (darker) represents the values in moderate scenario while the other represents the values in basic - pessimistic scenario. It is noted that the motorization rate for 2017 is 245, while the forecasted number in 2020 is 253, and in 2030 is 298 passenger cars per 1000 inhabitants.

Observing this scenario in relation to the base - pessimistic scenario, there is a significantly lower motorization rate. If specific measures were implemented in the moderate scenario, the expected motorization rate in 2030 would be 14.9% lower than for the same period in the pessimistic scenario.

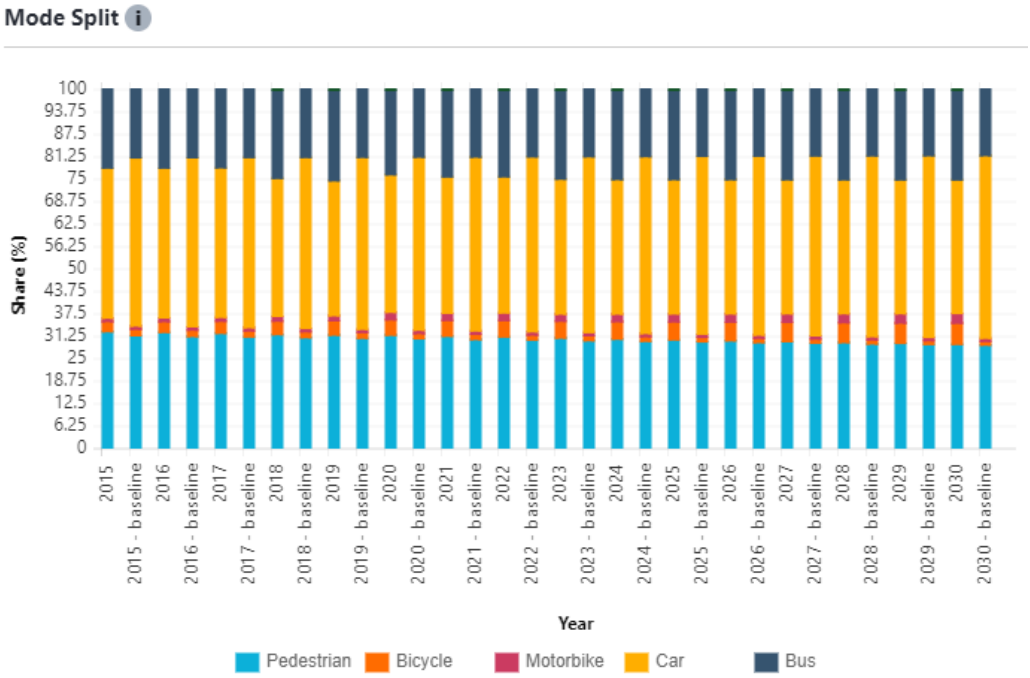
Although passenger car participation in Modal Split is reduced, it can be expected that with the rise in population standards, the motorization rate will increase, bearing in mind that the Republic of Serbia is in the process of economic development. This should not be understood in such a way that residents of Zrenjanin will use passenger car for the purpose of moving around the city (the purpose of going to work or some other), but for the purpose of leaving the city for a weekend, on vacation or for other purposes not related to basic purposes movements in the urban area. This is in accordance with the statistics of development of Motorization Rate in the European Union. A graph showing the motorization rate in the EU for the period 1990-2016 is given below (source: https://www.statista.com/statistics/452238/europe-eu-28-number-of-cars-per-1000-inhabitants/).



Graph 4.20 Motorization rate, in terms of ratio between cars and thousand inhabitants per years for moderate scenario

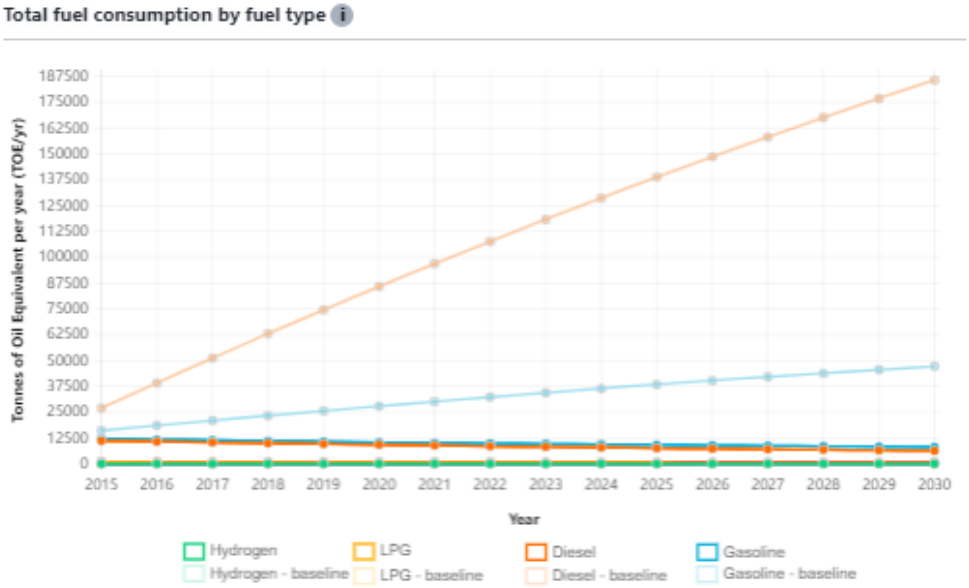
From Figure 4.21 it is noticeable that in 2017 the largest share in modes of transport is by passenger cars as well as in all foreseen years. Projections are that in 2020 the percentage of pedestrians will be 28.6%, cyclists 3.6%, motorists 1.2% cars 35.9% and buses 30.8%, which is a significant improvement in the use of public transport. It is even more noticeable that number are getting better in forecasted 2030, when it is predicted that the percentage of pedestrians will be 28.6%, cyclists 7.4%, motorists 0.6% cars 29.8% and buses 33.6%.

In this scenario, it is envisaged that by 2030, percentage in the use of public transport will increase by 6% at the expense of reducing the number of passenger cars by10.1%.



Graph 4.21 Percentage share of each mode of transport per years for moderate scenario

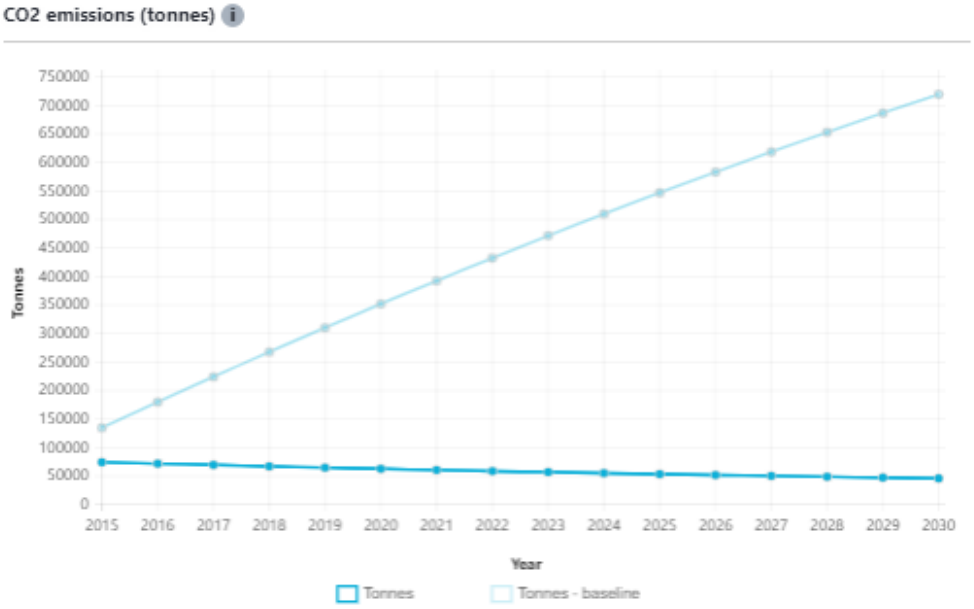
An overview of current and predicted fuel consumption by type for moderate scenario is shown in figure 4.22. It is noticeable that, with the application of a minimum number of measures, decrease of the consumption of diesel fuel as well as gasoline shall occur in according to base year (pessimistic scenario). Forecasts are that in2017, the consumption of the diesel is 10354.9 tons per year, gasoline 11466.0 and hydrogen 0.060. In 2020. the consumption of the diesel will be 9247.7 tons per year, gasoline 10408.9 and hydrogen 0.108. In 2030. the consumption of the diesel will be 6310.4 tons per year, gasoline 8136.6 and hydrogen 10.1.



Graph 4.22 Total yearly transport fuel consumption by fuel type (both internal mobility and incoming trips are considered) per years for moderate scenario

All this leads to data about predictions ofCO_2. In 2017, emission of CO_2 is 69581.2 tons, in 2020, emission of CO_2 will be 62682.1 tons and by 2030, emission of CO_2will be 45991.1 tons. The CO2 emission increase graph is shown below in figure 4.23 and shows the values for a moderate scenario (darker color) and a basic - pessimistic scenario (brighter color).

In this scenario, it is predicted that by 2030, emission of CO_2 will decrease by 23590.1 tons, compared to 2017 year. Savings in emission, relative to the one that would be in the pessimistic scenario, for 2030 year is 673553.8 tons (Figure 4.23).



Graph 4.23 Transport yearly CO2 emissions in moderate scenario

4.7.3 SCENARIO 3: optimistic scenario

This scenario envisages implementation of various policy measures.

The tool possesses a wide range of policy measures that are potentially useful for setting up urban strategies aimed at addressing transport sustainability. Sources such as the ELTIS, CIVITAS and EPOMM websites provide a wide range of examples of individual actions to promote sustainable mobility. These existing catalogues of solutions and best practice formed the basis for developing a prioritized set of policy measures. A long list of policy measures was identified from these sources by clustering the actions into broader measures. From this long list of measures a short-listed set of key generic policy measures was identified. The short-list comprised the 19 policy measures that can be selected in the tool.[31]

For the purpose of creating an optimistic scenario for Zrenjanin policy measures are chosen on base of collected data, local knowledge of socio - economic data, transportation system. This scenario involves the implementation of measures that appear in the moderate scenario, related to construction of the bypass around Zrenjanin and building a yellow strip along the entire section (of State road IB no.13) for buses only. The planned bus lane links the Industrial Zone with the city center, with an additional package of measures that will be aimed at improving pedestrian and bicycle traffic in Zrenjanin.

One of the measures to improve the bicycle as a mode of transport is the construction of bicycle lanes on the state road IB of the order no. 13, which is being provided along with yellow lane for buses, but also the construction of new bicycle lanes that will connect industrial zones to the city center, as well as to

[31]Study On European Urban Transport Roadmaps 2030, Urban transport policy roadmaps, March 2016, C.de Stasio, D.Fiorello, F. Fermi, G.Hitchcock, S.Kollamthodi

make entirety and good connectivity so that the bike becomes more attractive and more accessible mode of transport. On figure 4.42 is shown a planned location of new bike lanes in total length of 9.6 km.

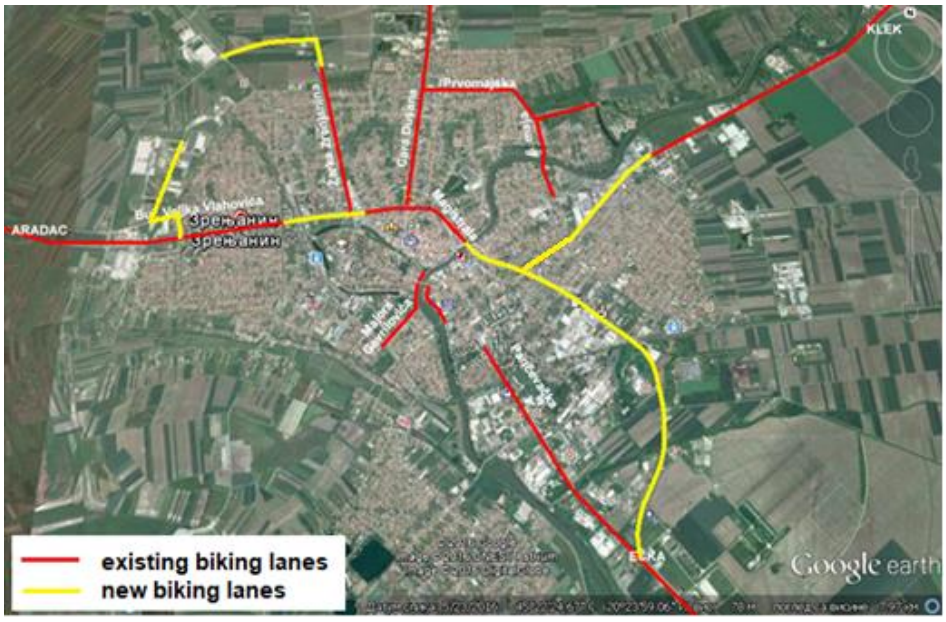


Figure 4.42 Existing and newly designed biking lanes in Zrenjanin

Figure 4.43The appearance of cycling lanes in Zrenjanin

Another measure planned to be meet in Optimistic Scenario is introduction of the concept "Zone 30" (Streets planned to be covered by Zone 30 are shown on figure 4.42). Zone 30 is designed in the central part of the town, creating a friendlier environment for pedestrians, cyclists and the local residents (the entire central city zone is shown in Figure 4.42 in red). Due to reduced speed of cars, other road users receive more freedom in their mobility. On the narrow roads of the city center it would be hard to

provide separate lanes for bicycles because of limited space and potential danger, but calmed traffic (down to 30 km/h or less) allows both cars and bicycles to use one street or lane.

Figure 4.44 The extra (red) and first zone (orange) of the urban zone on which the Zone 30 is planned to be introduced

Figure 4.45 Solution of marking Zone 30 together with cycling lanes on narrow streets in Netherlands

Start of the implementation of a bike-sharing service in Zrenjanin is planned. At the beginning of the implementation it is foreseen to set up 3 bike share system, of which 2 would be located within bus stops and one in the pedestrian zone in the city center.

Figure 4.46 Location of bike sharing system

Figure 4.47 Location of planned bike sharing system no.1 and 2

Figure 4.48 Location of planned bike sharing system no.3

Figure 4.49 Appearance of bike sharing system along with a bus stop in New York

Figure 4.50 Appearance of bike sharing system along with a bus stop in China

So, in the optimistic scenario selected measures are:

- The bike sharing service which provides short term bicycle rental at unattended stations: anyone can pick up a bike in one place and return it to another.
- Bus network - Redesigning the network layout of public transport by extending the service as well as by improving bus stops, stations, etc.
- Walking / cycling network - enhancing the quality and/or convenience of walking and bike trips through improved infrastructure (e.g. extension of cycling reserved lanes).
- Integrated ticketing systems means seamless travels and no requirement to buy tickets whilst switching either transport modes or services. Tariff schemes can be revised to attract more public transport passengers.
- Prioritizing public transport by improving the commercial speed of public transport vehicles, thus improving the service reliability and attractiveness to the general public, priority lanes etc.
- Traffic calming measures consist of various design features and strategies intended to reduce vehicle traffic speeds and volumes and so improve road safety. These measures can range from minor modifications of an individual street, or comprehensive redesign of the road network in specific areas (i.e. “30 Zone”), to the concept of 'shared space' (under the principle that all transport modes must share the given street space).

The selected group of measures is aimed at promoting and popularizing pedestrian, bicycle and the use of public transport which are currently insufficiently used in Zrenjanin. Planning the expansion of pedestrian and bicycle infrastructure as well as the introduction of the bike share system would lead to a significantly higher percentage of their use (which is shown by the results below), and the City of Zrenjanin has very favorable conditions for these measures.

The way public transport will be more attractive to people is to make it more accessible, more regular and more reliable for all its users (not only for workers and trips for school). Also, ticketing system should be arranged so there is no requirement to buy tickets whilst switching either transport modes or services. A good measure is to prioritize public transport by improving the commercial speed of public transport vehicles which will improve its attractiveness which is predicted by this optimistic scenario.

All the mentioned measures should be considered to elaborate when developing the SUMP because of the great influence on the results which are shown below.

The following implementation aspects linked to the specific measures should be taken into account[32]:

• Traffic calming interventions can be very different in nature. Some are basically only a matter of regulation (e.g. setting speed limits) others require some civil engineering work and some investment. The budget for the whole roadmap should be carefully considered.

[32]Study On European Urban Transport Roadmaps 2030, Urban transport policy roadmaps, March 2016, C.de Stasio, D.Fiorello, F. Fermi, G.Hitchcock, S.Kollamthodi

• Public transport ticket prices can be a powerful instrument to attract demand but attractive tariffs may not be economically viable for public transport operator in terms of revenues. Financial support to the transport operator might be needed.

• Integrated ticketing cannot be planned or decided at the urban level alone. The cooperation of regional operators and probably of urban operators of other cities is needed. A single city can stimulate the other institutions but cannot proceed independently.

• Effective measures to prioritize public transport can reduce space for cars (e.g. if parking lots curbside are removed to build a reserved lane) and generate local congestion. The same applies to cycling lanes. Especially at an early stage, when most of the trips are made by car, interventions can be unpopular.

• Bike sharing schemes are generally characterized by low profitability and therefore might need to be subsidized by the municipality. To increase revenues, bikes might be customized for displaying advertising messages of private clients who pay for the publicity.

• The effectiveness of bike sharing depends on several practical conditions, e.g.:

- stations and bikes are well maintained;
- system easy to understand;
- various types of registration offered;
- combination and synergies with PT;
- fees structured to encourage use for short trips;
- effective redistribution systems to redistribute bikes.

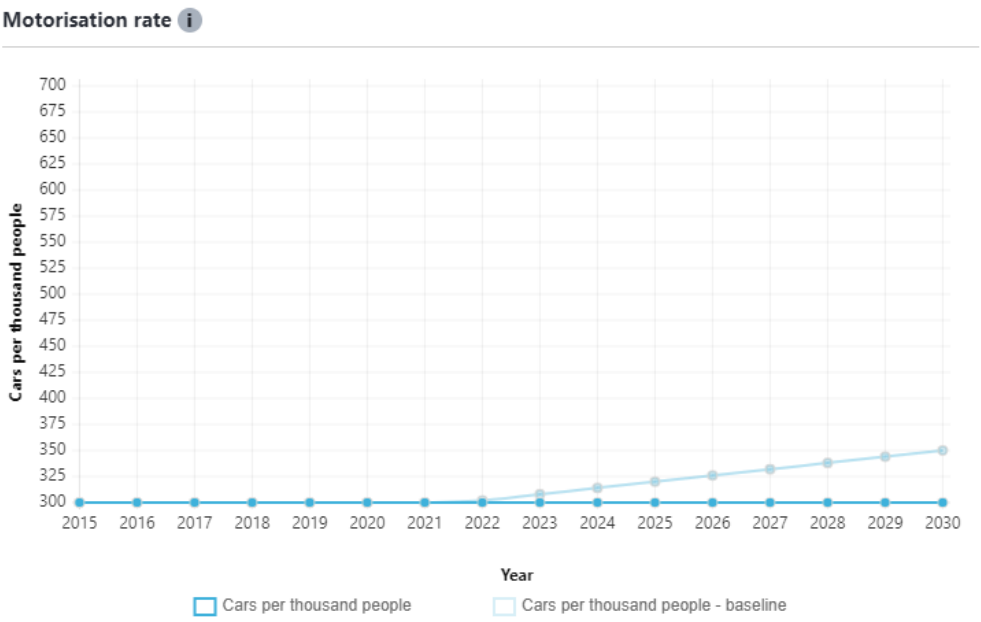
Figure 4.24 shows ratio between cars and thousand inhabitants per years for optimistic scenario. On figure there are two lines, one (darker) represents the values in optimistic scenario while the other (lighter) represents the values in pessimistic scenario. Result is that, for optimistic scenario, in 2017 the motorization rate is 220. Results are showing that the motorization rate is 19% lower than in the pessimistic scenario, which is justified in Figure 28, which shows the percentage participation of passenger cars, which is by more than half that less than in the initial scenario.

Forecasted number in 2020 is 223 and in 2030 is 265 passenger cars. Observing this scenario in relation to the previous moderate scenario, there is a significantly lower motorization rate. If specific measures were implemented in the optimistic scenario, the expected motorization rate in 2030 would be 11.0% lower than for the same period in the moderate scenario.

Although passenger car participation in Modal Split is reduced, it can be expected that with the rise in population standards, the motorization rate will increase, bearing in mind that the Republic of Serbia is in the process of economic development. This should not be understood in such a way that residents of Zrenjanin will use passenger car for the purpose of moving around the city (the purpose of going to work or some other), but for the purpose of leaving the city for a weekend, on vacation or for other purposes not related to basic purposes movements in the urban area. This is in accordance with the statistics of development of Motorization Rate in the European Union. A graph showing the motorization rate in the

EU for the period 1990-2016 is given below (source: https://www.statista.com/statistics/452238/europe-eu-28-number-of-cars-per-1000-inhabitants/).

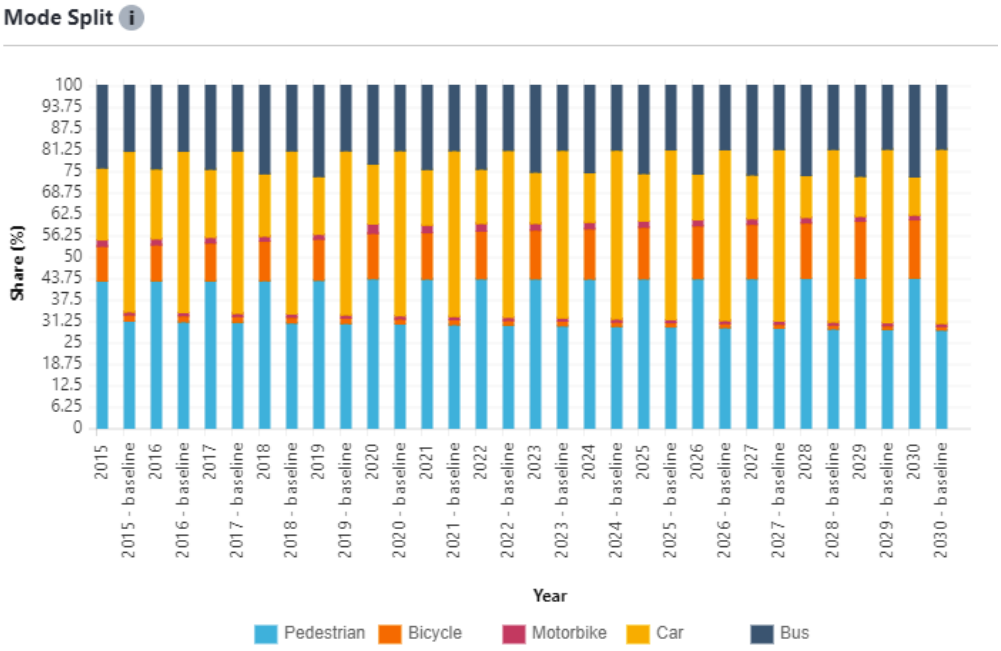
The tool use impact on car ownership simulated at EU level in the HOP! Project (Macro-economic impact of High Oil Prices) (2008) as a reference to estimate the alternative trend.



Graph 4.24 Motorization rate, in terms of ratio between cars and thousand inhabitants per years for optimistic scenario

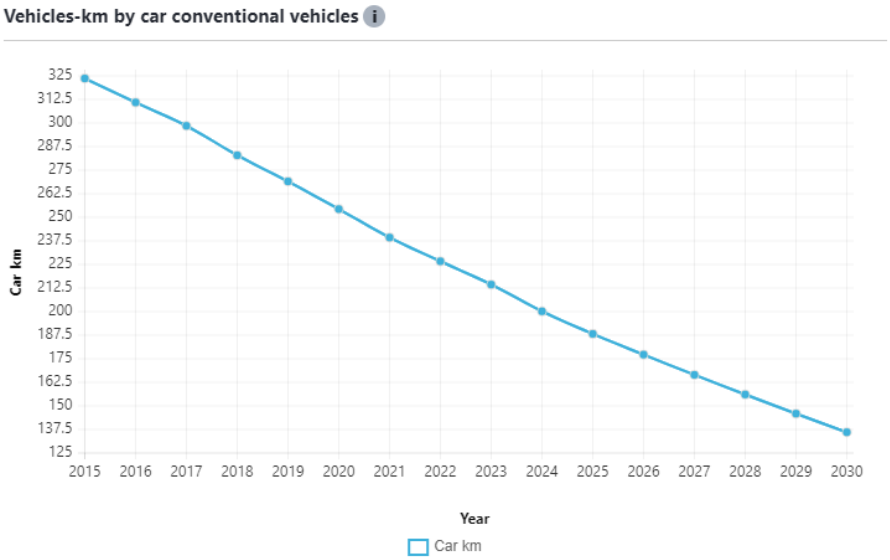
Figure 28 shows in a parallel, values of mode split for the base-pessimistic and optimistic scenario, so it is easy to spot a significant difference between them. From It is noticeable that in 2017 the largest share in modes of transport is by pedestrians and public transport for all foreseen years. Projections are that in 2020 the percentage of pedestrians will be 43.7%, cyclists 13.2%, motorists 2.7% cars 17.5% and buses 22.9%, which is a significant decrease in the number of passenger cars and an increase in the number of pedestrians, cyclists and the use of public transport. It is even more noticeable that number are getting much better in forecasted 2030, when it is predicted that the percentage of pedestrians will be 43.8%, cyclists 17.0%, motorists 1.4% cars 11.1% and buses 26.7%.

In this optimistic scenario, it is envisaged that by 2030, percentage of passenger cars will decrease by 8.8%observing the base year. When comparing the optimistic and pessimistic scenario for the target 2030-yearpercentage of passenger cars will decrease by 39.8%, the percentage of pedestrians increases by 15.2%, by cyclists by 16.0%, and percentage of using public transport would be higher by 8.2%.



Graph 4.25 Percentage share of each mode of transport per years for optimistic scenario (comparing with data for basic – pessimistic scenario)

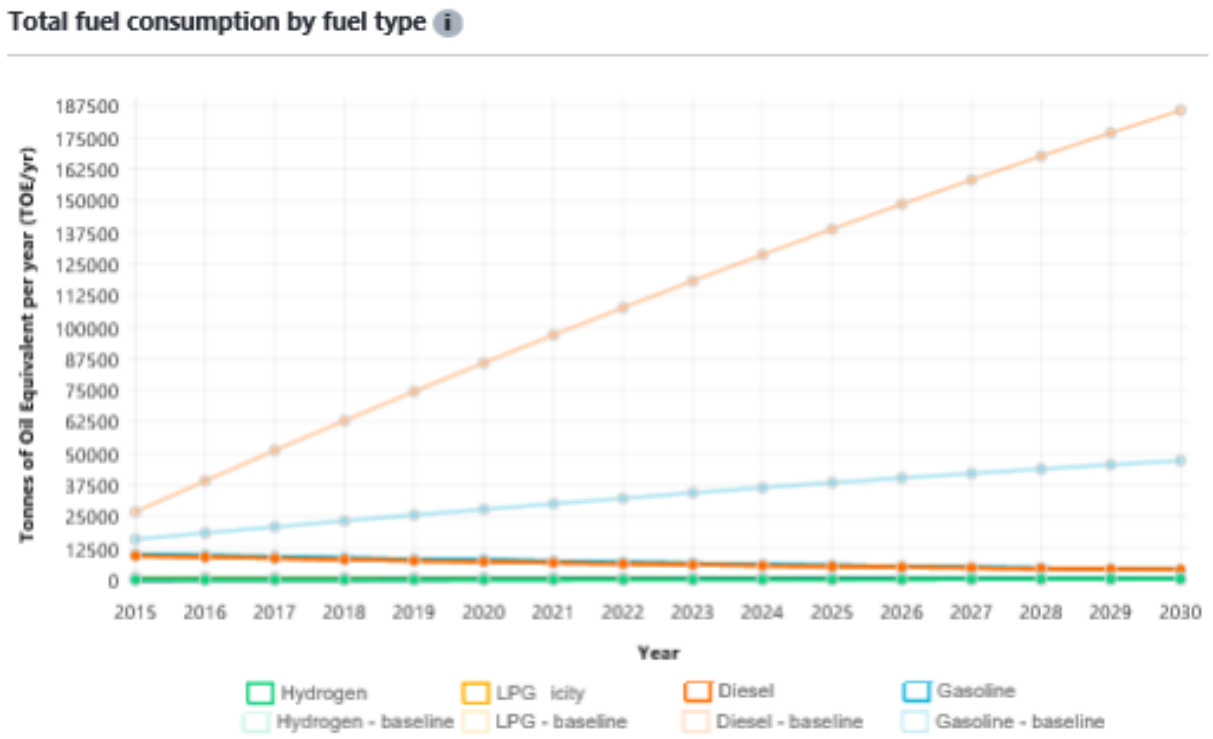
It is expected that planned measures give results in case of decreasing the portion of PA within overall city traffic. Related to the foreseen increase of PA, next figure clearly shows that it is not expected the PA will be used for city driving and meeting of basic need such as work, recreation, etc. Figure 29. shows traffic volume in terms of vehicle-km of passenger cars with conventional fuel (diesel, gasoline) traveling on the road network of the city. Graphic shows that vehicle-km is decreasing by 58.0%for the observed period.



Graph 4.26 Traffic volume in the Zrenjanin

The improvement rate for gasoline, diesel, CNG and LPG vehicles is therefore about -2.6 / -3.0 % per year, while for innovative vehicles a growth rate of about -0.8 % / -1% per year is implemented (Source: Study on Urban Transport Roadmaps 2030).

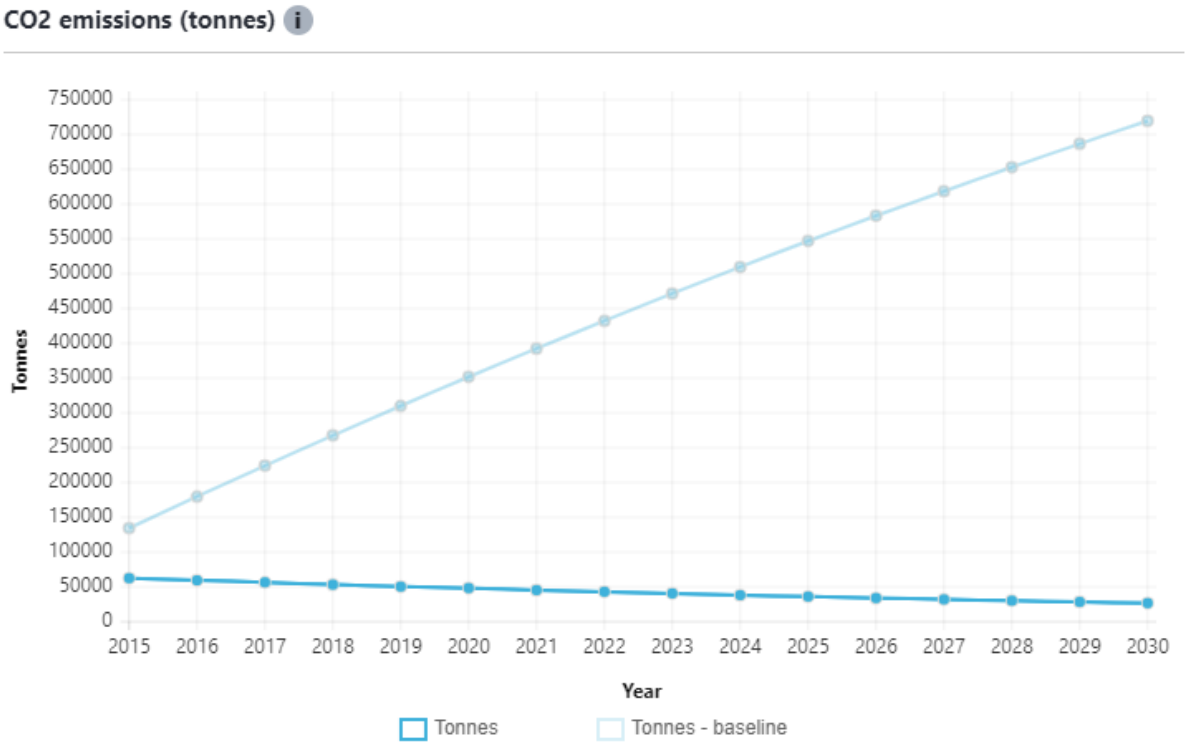
An overview of current and predicted fuel consumption by type for optimistic scenario is shown in figure 30. It is noticeable that decrease in the consumption of diesel and gasoline fuel shall occur both in the optimistic scenario over the years and in relation to the base year (pessimistic scenario) and to a great extent. Forecasts are that in 2017, the consumption of the diesel is 8481.5tons per year, gasoline 9205.8, LPG 430.6 and hydrogen 0.019. In 2020. the consumption of the diesel will be 7096.8 tons per year, gasoline 7956.6, LPG 340.0 and hydrogen 0.017. In 2030 the consumption of the diesel will be 3964.4 tons per year, gasoline 4003.2, LPG 141.1 and hydrogen 331.4 (*Figure 29*). The savings in diesel are 53.3% and in gasoline are 56.5% for the period from 2017 to 2030 (only optimistic scenario observed).



Graph 4.27 Total yearly transport fuel consumption by fuel type (both internal mobility and incoming trips are considered) per years for optimistic scenario (also showing data for basic – pessimistic scenario)

Figure above shows in a parallel, values of total fuel consumption for the base-pessimistic and optimistic scenario, so it is easy to spot a significant difference between them. It is envisaged that if the all measures are adopted, by 2030, percentage of fuel consumption will decrease for diesel by 97.8% and gasoline by 91.5%.

Data about emission of CO_2, in 2017, is 56629.2tons, in 2020, emission of CO_2 will be 48399.2 tons and by 2030, emission of CO_2 will be 26788.1 tons. The CO2 emission graph is shown below on figure 4.28 and shows the values for an optimistic scenario (darker color) and a basic - pessimistic scenario (brighter color).



Graph 4.28 Transport yearly CO2 emissions (a pessimistic and optimistic scenario is shown)

It is predicted that by 2030, emission of CO_2 will decrease by 29841.1 tons, compared to 2017 year (52.7%). Also, a significant reduction in the CO_2 emission relative to the one that would be in the pessimistic scenario (for the same year) is envisioned. Savings in emission, for 2030 year is 692756.8 tons or 96.3%. These differences are best shown in the figure above.

Campaigns

As one important step, the promotion of sustainable forms of traffic should not be omitted, and in relation to walking, cycling and using public transport. This is a step that comes after implementation of the envisaged measures. Example of good promotion of a cycling is in Munich, city of Germany[33]:

- The city was organized a large evening bicycle tour on the roads
- A bicycle safety check (including the bike safety joker);
- Bicycle fashion shows;

[33]ELTIS; www.eltis.org

- A cycle star casting contest - a participation campaign with online-voting;
- A photoshoot;
- Bicycle exchange markets;
- Bicycle exhibitions;
- School activities like a 'check your bike' programme, a bike quiz show, the creation of a bicycle campaign song;

The approach is always to inform and to create more understanding for all traffic participants in order to achieve a sense of togetherness rather than competitiveness on the roads.

Public transport promotion included[34]:

- Public events
- Workshops with students and seniors
- Exhibitions (history and development of PT in the city)
- Competitions (promotional video, history of PT)
- Training activities (training bus for children, education materials for traffic court)
- Promotion in local media
- Promotional PT vehicles with free WIFI

Figure 4.51, 4.52. 4.53 Public transit promotion

Public transport information brochures include:

- General information

[34]CIVITAS; Measure 39, Public Transport Promotion Campaign, K. Oktabcova,2012

- Information about touristic lines
- Information about night lines
- Information about PT in the city center
- Information about barrier-free access routes to PT

Summary

Table 4.19 Summary

Indicator	Pessimistic scenario (2017)	Moderate scenario (2017)	Optimistic scenario (2017)	Pessimistic scenario (2030)	Moderate scenario (2030)	Optimistic scenario (2030)
Motorisation rate	272	245	220	350	298	265
Mode split (%)	Car: 47.4% Bus: 19.1% Bike: 1.7% Motorbike:0.9% Walk: 30.9%	Car: 37.0% Bus: 30.2% Bike: 3.2% Motorbike:1.0% Walk: 28.6%	Car: 19.9% Bus: 24.4% Bike: 11.1% Motorbike:1.7% Walk: 42.9%	Car: 50.9% Bus: 18.5% Bike: 1.0% Motorbike:0.9% Walk: 28.6%	Car: 29.8% Bus: 33.6% Bike: 7.4% Motorbike:0.6% Walk: 28.6%	Car: 11.1% Bus: 26.7% Bike: 17.0% Motorbike:1.4% Walk: 43.8%
Average bus speed in peak hours (km/h)	13.4	17.8	18.8	10.7	19.9	20.4
Vehicles-km by car conventional vehicles	413.306	351.310	323.625	291.427	203.998	136.032
Total fuel consumption by fuel type (tons per year)	49940.0 diesel 20623.9 gasoline 0.065 hydrogen	10354.9 diesel 11466.0 gasoline 0.060 hydrogen	8481.5 diesel 9205.8 gasoline 0.019 hydrogen	181347.4 diesel 45745.5 gasoline 12.86 hydrogen	49940.0 diesel 8136.6 gasoline 10.1 hydrogen	3964.4 diesel 4003.2 gasoline 331.4 hydrogen
CO_2 emissions per year (tonnes)	219295.4	69581.2	56629.2	701159.9	45991.1	26788.1

4.8 AGENCY "PREDA-PD"

4.8.1 SCENARIO 0: Business As Usual

Hypothesis

City of Prijedor will continue current mobility policy until 2025. Mobility policies will not change until 2025. Implementation of SUMP will provide better mobility conditions for different users. Common vision: reconstruction, rehabilitation and modernization of infrastructure; development of cycling lanes; development of pedestrian areas; better coordination and promotion of public transport; implementation of smart and innovative transport solutions.

Strategies and measures

No new measures for supporting sustainable mobility are foreseen.

Short, medium and long results

Until 2025 all transport modes will remain the same as today. Number of cars will be increased. There is a possibility, if local authorities adopt Sustainable Energy and Climate Action Plan for City of Prijedor, to exempt from parking paying people who are using cars on alternative fuels.

Table 4.20 Different impacts of choices

Indicator		Baseline (2018)	Business as usual	Making PT more attractive	Fostering active transport modes
Mode split	Car	46.16%	60.69%	41.96%	33.16%
	Bus	10%	7.53%	16.42%	7.22%
	Walking	34%	23.94%	31.50%	43.78%
	Cycling	9.84%	7.84%	10.12	15.84%
Number of cars		230.7 cars/1000 inhabitants	303.48 cars/1000 inhabitants	221.02 cars/1000 inhabitants	200 cars / 1000 inhabitants
Number of population walking		34%	23.94%	31.50%	43.78%
Number of population cycling		9.84%	7.84%	10.12%	15.84%
Number of population using PT		10%	7.53%	16.42%	7.22%
Number of PT vehicles		27 buses	30 buses	37 buses	32 buses

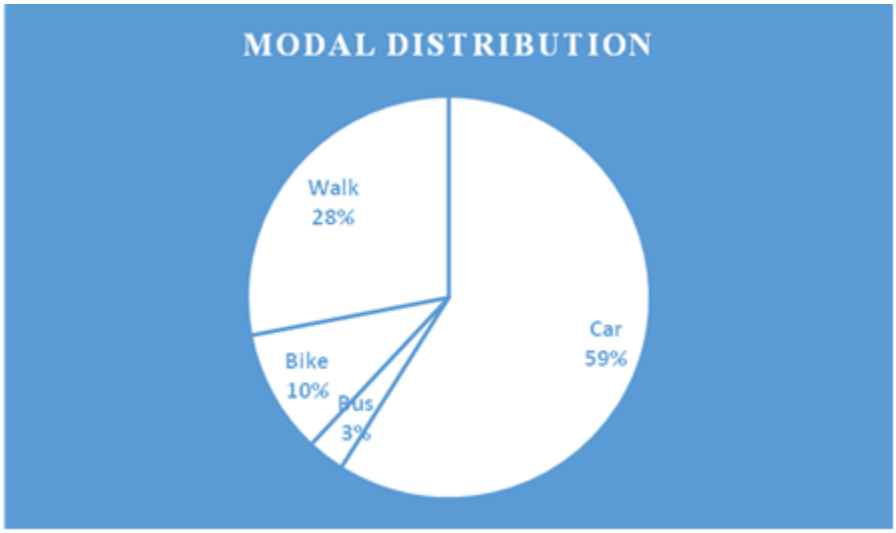
4.8.2 SCENARIO 1: Making public transport more attractive

Public transport of passengers in the area of the City of Prijedor is taking place by bus and taxi. Bus public transport was organized in the area of City of Prijedor and in the neighboring municipalities. The busyness of the bus network is limited by the network of roads and topology of the city and therefore has a low density of coverage. The entire bus transport takes place over 4 urban and 30 suburban routes, while taxi service is performed mainly in the city area.

The public bus transport fleet consists of 27 buses with an average age of 14,6 years. Vehicles as motor fuel use diesel.

Hypothesis

Data collection is important for traffic planning. It provides insight into current state of traffic, indicates the necessary reconstructions, building new traffic directions, measures to improve existing traffic. Within data collection is possible to determine the needs of passengers, thereby improving public transport services.



Graph 4.29 Modal split

In order to reduce the large number of vehicles that come to the city on a daily basis (8 918) and cause problems in the traffic flow, it is necessary to establish an adequate system of public urban and suburban passenger transport in the area of Prijedor. By establishing an adequate system of urban and suburban passenger transport, the number of vehicles that daily arrives in the city will be reduced by 10 to 15%.

Some of public transport problems:

- poor connection of lines with certain settlements
- Lack of bus lines
- Low frequency of buses
- Unorganized timetable

Strategies and measures

- Co-financing of public transport by local authorities

In order to introduce more public transport (bus) lines, local authorities should work on reconstruction existing infrastructure thereby to enable public transport to take place in more shares. By the annual budget of the City of Prijedor, every year is foreseen circa 1 Million Euros for maintenance, reconstruction and construction of transport infrastructure, but in order to make public transport more attractive, what is also according all strategic documents of City of Prijedor, focus should be on facilitating public transport through, as much as possible, the streets of the city of Prijedor.

- Purchase of 10 new buses for urban transport on LPG

By purchasing 10 new buses for urban transport on LPG, CO2 emissions will be reduced (646 tCO2). With new buses, public transport of passengers will be more frequent.

- Related bus lines

Introducing connection between different bus lines. This is especially important for passengers who are traveling from one part of the city to other. Concerning that there is no direct line from point A to point B, passengers with one bus arrive in city centre and then they have to wait another bus. With related bus lines, time for waiting and searching adequate bus line to target destination will be decreased as well as total time of traveling from one part to another.

- Bus lines according to needs of passengers

Schedule of bus lines should have individual needs in focus, as much as it is possible. Here should be considered when passengers go to work, to school and in that time introduce frequent bus lines. Those bus lines have to reach target destination right on time, without delaying or late arrival. City of Prijedor already has bus lines from 7 am to 17 pm on every half an hour, and after 17 pm on every hour. With introducing more frequently bus lines this practise will be improved.

- One ticket covers all bus lines

With one ticket for all bus lines, or at least for group of bus lines in certain direction, will have positive effects. Passengers would not waste time buying different bus tickets, and most important, it is cost effective.

- Introduction of modern technologies

In the public transport system, it is most important to ensure availability of the information, in order to public transport becomes easier to use. Every public transport user must have proper information in real time. Public transport provider has to provide information on the arrival of the public transport vehicle, develop web pages, mobile web applications for easy and quick travel planning using public travel services. With real-time information number of unsatisfied public transport users is reduced as well as number of dissatisfied users with the availability of the information. With modern technologies, share of public transport will increase in total modal distribution.

- Introducing e-tickets

With e-tickets, passengers will be able to buy ticket online. Passenger saves his ticket on his phone or other device. On request, passenger shows his ticket with code, which is scanned by bus driver. With implementation of e-tickets, there is no printing tickets and it is contributing to saving the environment.

Short, medium and long results

Until 2025 all transport modes will probably remain the same as today with more emphasis on the usage of clean vehicles and fuels.

Due to improvements in public transport, there will be fewer journeys with car. The share of public transport will increase. With more frequently bus lines, car traveling to work will be replaced with using public transport.

Quality of life will improve significantly. Passengers will be able to buy bus ticket online. With sustainable web platform, information about bus lanes and other important information for passengers will be available. With frequent and related bus lanes, passengers will arrive on target destination with decreased total time of traveling. E-tickets contribute to environment protection.

With implementation of mentioned measures and strategies, number of public transport users will be increased. Car using will be reduced. This all will lead to air quality improvements, noise reduction and positive health effects.

Overall change will lead to decrease of transport-related CO2 emission in City of Prijedor.

4.8.3 SCENARIO 2: Fostering “active” transport modes (walking and cycling)

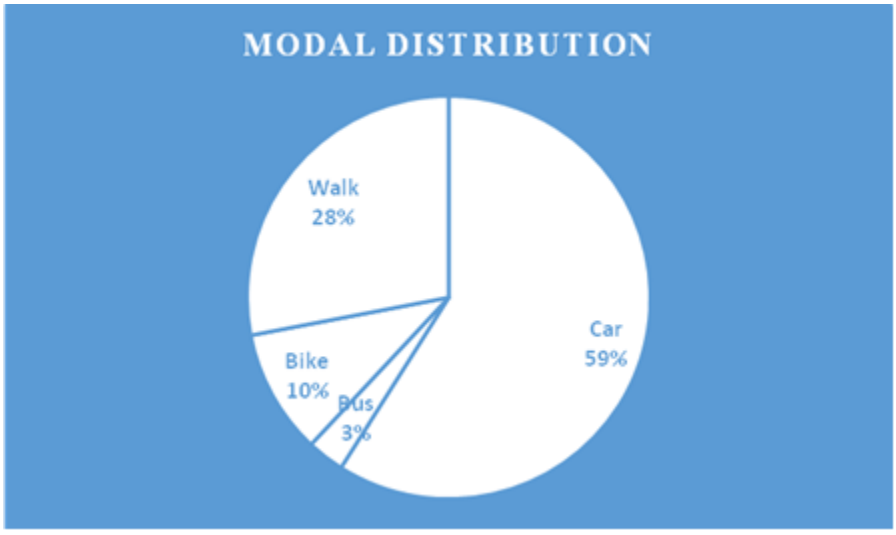
In City of Prijedor in the past period, in order to foster active transport modes, especially walking, measures have been taken. Before, the main street and square in Prijedor were available for cars, bikes and pedestrians. Today, this street and square is closed for cars and represent pedestrian area. This area is only one marked as a pedestrian area in City of Prijedor. There are also sidewalks beside every street, which pedestrians use.

Figures 4.54, 4.55 Active transport promotion

Hypothesis

Walking: Existing pedestrian zone in city center (main street and square); Sidewalks next to each street

Cycling: Existing cycle route with length of 90km, mostly used for sport and recreation; Cycling takes place among streets and sidewalks; No marking of bicycle lanes nor traffic signs for bicycle traffic on the streets



Graph 4.30 Modal distribution

The research has shown that the average time of transport by different modes is:

- walking 17.1 minutes
- car 16.7 minutes

- public transport 27.1 minutes
- bike 18.2 minutes

Strategies and measures

- Promotion of sustainable mobility and healthy lifestyle through educational activities

Promotion of sustainable mobility and healthy lifestyle through brochures, posters, roll up banners, workshops, online marketing campaigns among citizens and promotion of benefits of using non-motorized movements in relation to car use. The importance of this measure is raising awareness of healthier way of life and promotion of importance of sustainable mobility which has impact on the overall transport system of the city.

- Creation of cycling and walking trails and tracks

Connected streets and sidewalks allow better pedestrian travel, because not connected sidewalks create barriers to pedestrian and cycling travel. Bicycle and pedestrian facilities (paths and lanes) and roadway conditions consider favorable to cycling and walking tend to increase walking and bicycle travel. With this measure, people who are not able to drive will have better conditions for walking or cycling. This measure also has positive effect on quality of life, especially for low-income groups of people who have to pay parking.

- Design quality infrastructure that maximizes safety

Safety is one of the barriers to walking and cycling. Pedestrians and cyclists are highly vulnerable when they interact with motorized vehicles in the road environment. Sidewalks pedestrians and cyclists are using, are also used for parking cars, what makes it difficult to walk or cycle. Well-designed infrastructure is important to improve safety on transport network in the City of Prijedor. Walking and cycling paths have to be marked and separated from roads and motorized transport.

- Traffic signs for cycle traffic and parking spots

In order to increase number of cyclists and improve their safety, there have to be traffic signs for cycle traffic. Also, parking spots are necessary. Parking spots have to be near different institutions in the City of Prijedor, important for inhabitants.

Short, medium and long results

Until 2025 all transport modes will probably remain the same as today with more emphasis on the usage of clean vehicles and fuels.

Due to improvements for active transport modes, there will be fewer journeys with car. The share of active transport modes (walking and cycling) will increase. With traffic signs, pedestrian and cycling paths, marked and separated from road, more people will choose this way of transport. Considering that

difference between walking and car using is less than a minute, improved infrastructure will lead to increasing of active transport modes.

Quality of life will improve significantly. New, better, conditions for active transport modes will have positive health effect. They will reduce car using on short distance. This will have positive effect on low-income groups and people who are not, because of various reasons, able to drive.

Adopting all mentioned measures will lead to air quality improvement, noise reduction and positive health effects.

Overall change will lead to decrease of transport-related CO2 emission in City of Prijedor.

Table 4.21 Different impacts of choices

Indicator		Baseline (2018)	Business as usual	Making PT more attractive	Fostering active transport modes
Mode split	Car	46.16%	60.69%	41.96%	33.16%
	Bus	10%	7.53%	16.42%	7.22%
	Walking	34%	23.94%	31.50%	43.78%
	Cycling	9.84%	7.84%	10.12	15.84%
Number of cars		230.7 cars/1000 inhabitants	303.48 cars/1000 inhabitants	221.02 cars/1000 inhabitants	200 cars / 1000 inhabitants
Number of population walking		34%	23.94%	31.50%	43.78%
Number of population cycling		9.84%	7.84%	10.12%	15.84%
Number of population using PT		10%	7.53%	16.42%	7.22%
Number of PT vehicles		27 buses	30 buses	37 buses	32 buses

4.9 GRADISKA

4.9.1 SCENARIO 0: Business As Usual

Baseline data for 2017 shows that Gradiska has a motorization rate of 275 per 1000 residents. The modal split is the following: car 56,6%, public transport 13,8%, cycling 0,9% and walking 28,7%. Other types of transport (tram, train, metro) do not exist on the target territory. Green vehicles are not registered in the territory. On the demographic side, Gradiska has a population of around 48000 residents with negative trend of slow decrease of population, which is characteristic for the wider area. Gradiska, and Bosnia and Herzegovina as a whole, are considered as low income areas. Number of registered accidents in 2017 with serious injuries is 38, while there were 4 fatalities. The baseline data is based on the previously carried out survey, experts estimates and calculations using the EU Urban Transport Roadmaps tool[35].

This scenario foresees continuation of the current transport/mobility policies in the next 10 years.

The local authorities will continue with current trend of small investments in regular maintenance of the road network. Construction of cycling lanes and pedestrian paths is not considered as a priority. The public transport is operated by private companies, licensed by the local authorities and no incentives for replacement of the bus fleets are foreseen by the local authority. The bus network does not cover the central urban area of Gradiska, rather it connects the suburban areas to the main bus station in the city.

The results of scenario "Business as usual" are mainly influenced by overall trend of economic growth are slightly rising incomes, leading to increase of the motorization rate and modal share of cars. The motorization rate will continue its current trend of increase and will be 353 vehicles per 1000 residents. The modal split of cars will increase to 57,6%, while other modes will slightly decrease. The uptake of green vehicles will be negligible and in any case not a result of policies, but rather the result of rising incomes and individual awareness of citizens on environmental protection. Emissions from transportation (CO_2, PM, CO, NO_x and VOC) will decrease, mostly as a result of technological improvements and replacement of older vehicles with newer, cleaner engines. However, this decrease is not a result of any specific policy or incentive by the local authority.

Impacts of "Business as usual" scenario are very limited since it is not made by the choices of the local authority but rather by external factors. There are some positive impacts regarding decrease of emissions and accidents, but there is constant increase of use of personal cars for transport that will have negative effects of congestion. If these policies continue to be implemented in the long term, the currently positive impacts will turn to negative, caused by the high motorization rate, neglected public transport and active modes. The scenario foresees continuation of the current, very limited and outdated, mobility policies.

Describe this scenario

This scenario foresees continuation of current transport / mobility policy in the next 10 years. The traffic congestion caused by border crossing in the municipality will be getting bigger until realization of new border crossing in 2025. The modal share of cars will increase, with increase of the motorization rate to 353 cars per 1000 residents, while congestion in the urban center will be increased. Traffic will adversely affect the environment and business activities. The modal share of cycling and walking will decrease.

[35] http://www.urban-transport-roadmaps.eu/

Public transport will be of poor quality and its modal share will decrease. There will be an increase in the number of improperly parked vehicles, and a worsening of traffic safety. Vehicles will have an advantage over people. Integrated mobility will not exist.

How will the demographic structure of your area and the core city in it be in your planning horizon around 2025 to 2030? (No of population, age structure, etc.)

The total population in the city will decrease by 5% and will be around 45.000 but number of private vehicles will be increased by 10%. There will be significant changes in the age structure, they will continue the current trend. The share of the population 0-44 will decrease, and the share of the elderly population will increase. The share of population older than 45 will be over 60%.

Which types of transport technology will have been diffused or will disappear in your area in your planning horizon around 2025 to 2030?

The modal share of public transport will further decrease to 13,5%, while the modal share of cars will further increase to 57,6%. The modal share of cycling will remain negligible at 0,8%, while walking will decrease slightly to 28,1%. The uptake of green vehicles will be

How will the share of transport mode change in your core city and area? Will there be higher share of journey with cars or less? Will it increase or decrease the share of public transport? Will there be more cyclists and walkers, or less?

Characteristics of transport:

- the number of trips will not increase and the average length of trips will remain the same
- the motorization rate will increase to 353 vehicles per 1000 population
- the modal share of cars will increase to 57,6%
- the modal share of public transport will decrease to 13,5%
- the modal share of cycling will remain negligible and decrease to 0,8%
- the modal share of walking will decrease to 28,1%

Which part of your future prediction is not in line with upper-level transport policy (of region, country and EU)?

This scenario is a continuation of the current mobility policy from the municipality. The current mobility policy of the municipality does not feature sustainable development. This scenario is completely contrary to the upper-level transport policy region and the EU.

Is the overall situation improving the living quality of your area?

No. The scenario business as usual will not lead to improvement of living quality in particular related to acceleration of mobility, transport safety and land use.

What are the effects on particular demographic groups, such as children, elderly, low-income group, foreigners and migrants, students, mobility-impaired people, etc.?

Emissions from transport will be decreased as a result of technological improvements and purchase of vehicles with newer, cleaner engines. Traffic safety will be increased, with reduction of accidents with serious injuries and fatalities resulting from regular activities and safety campaigns, for all groups and traffic modes, especially for pedestrians.

How will the transport-related cost paid by each end user change? How will the transport-related cost paid by your municipalities or regional government change?

The number of public transport users will be reduced due to the lack of a policy of favoring public transport. Then there will be an increase in the price of tickets in public transport, which will lead to further reduction of the number of passengers. Costs related to maintenance and construction of new roads will increase due to increased traffic. The end users will have higher costs due to increase of fuel prices and vehicle ownership duties.

Will the overall change will lead to increase or decrease of transport-related energy consumption in your area?

There will be an increase in consumption.

Will the overall change will lead to increase or decrease of transport-related CO2 emission in your area?

CO2 emissions will be slightly decreased. However, this reduction is not result of policies but rather the result of technological improvements and replacement of older, more polluting vehicles.

4.9.2 SCENARIO 1: Fostering „active“ transport modes (walking and cycling)

Baseline data for 2017 shows that Gradiska has a motorization rate of 275 per 1000 residents. The modal split is the following: car 56,6%, public transport 13,8%, cycling 0,9% and walking 28,7%. Other types of transport (tram, train, metro) do not exist on the target territory. Green vehicles are not registered in the territory. On the demographic side, Gradiska has a population of around 48000 residents with negative trend of slow decrease of population, which is characteristic for the wider area. Gradiska, and Bosnia and Herzegovina as a whole, are considered as low income areas. Number of registered accidents in 2017 with serious injuries is 38, while there were 4 fatalities. The baseline data is based on the previously carried out survey, experts estimates and calculations using the EU Urban Transport Roadmaps tool.

This scenario foresees fostering of active transport modes. The local authority will support increase of the modal share of walking and cycling by implementing targeted measures.

The local authorities will implement targeted measures in order to support increase of modal share of walking and cycling.

- Land use planning will be utilized during planning and design of new construction and development in the target territory in order to support sustainable urban mobility and active transport modes.

- The local authority will implement a bike share system, mainly as a promotional tool for the larger population but also to incentivize cycling as a transport mode. The bike share system will at first be set up in the central urban area and later expanded to cover wider area of the FUA.

- The local authority will widen the walking/cycling network, with obligatory pedestrian and cycling paths constructed with each new road. Cycling paths will be built along the streets, the green surfaces, Sava river and off-road trails to National park Kozara. Traffic signs for bicycle traffic will be set up as well as parking spots for bicycles.

- The local authority will implement traffic calming measures during urban planning and design of neighborhoods with the aim to increase safety and support use of sustainable mobility modes, mainly walking and cycling.

- Implementation of access regulation will define low-emission zones where regulation will define the emission standards of vehicles that may operate in that area, while other will be prohibited. This measure will greatly incentivize walking and cycling as they are the least expensive model of complying with the regulation.

The results of scenario “Fostering active transport modes” are focused on the modal shift to sustainable mobility modes and decrease in emissions. The motorization rate will continue its current trend of increase and will be 350 vehicles per 1000 residents. The modal split of public transport, cycling and walking will increase to 16,6%, 1,7% and 36,7% respectively, while the modal share of cars will decrease to 45%. The uptake of green vehicles will be remain negligible and in any case not a result of policies, but rather the result of rising incomes and individual awareness of citizens on environmental protection. Emissions from transportation (CO2, PM, CO, NOx and VOC) will decrease significantly as a result of increase in the modal share of sustainable mobility modes. The focus on safety will result in decrease of accidents with serious injuries and fatalities.

The “Fostering active transport modes” scenario has a significant impact on the modal split and its shift to sustainable mobility modes. Furthermore, transport emissions will be significantly reduced and accidents will be moderately decreased. While the overall population is expected to be reduced, the quality of life will be improved. Congestion caused by local vehicles will be reduced, while congestion caused by the border crossing is expected to be eliminated with construction of the new bridge and border crossing outside of the urban area, expected to be completed in 2025.

Describe this scenario

Topographically, Gradiška is very favorable for bicycle traffic. There will be a network of bicycle trails and tracks in the municipality. On the street, where possible, cycling routes will be marked. Some streets will turn into one-way ones, and there will be space for marking bicycle tracks. Bicycle paths will be built along the streets and along the green surfaces, Sava river and off-road trails to National park Kozara. Traffic signs for bicycle traffic will be set up as well as parking spots for bicycles. The bike sharing system will be implemented with terminals for rent in every major part of the municipality. Walking trails will be maintained and new will be build up. The area of joint use for all traffic modes will be designated in the municipal center.

How will the demographic structure of your area and the core city in it be in your planning horizon around 2025 to 2030? (No of population, age structure, etc.)

The quality of life in the municipality will be better. The municipality will attract young people to come to live in. The total population will steadily slow its decline while the share of the population 0-14 and 15-39 and 40-64 will increase in comparison with the previous years, and the share of the elderly population (65-84 and 85+) will start to decline.

Which types of transport technology will have been diffused or will disappear in your area in your planning horizon around 2025 to 2030?

Penetration of green vehicles will be negligible, while the population will slowly replace older vehicles with newer, more efficient and cleaner ones.

How will the share of transport mode change in your core city and area? Will there be higher share of journey with cars or less? Will it increase or decrease the share of public transport? Will there be more cyclists and walkers, or less?

Characteristics of transport:

- the number of trips will increase
- the modal share of cycling will increase to 1,7%
- the modal share of walking will increase to 36,7%
- the modal share of public transport will increase to 16,6%
- the modal share of passenger cars will decrease to 45%
- the local population will develop awareness of healthy life-styles and non-motorized movements

Which part of your future prediction is not in line with upper-level transport policy (of region, country and EU)?

This scenario is in line with the upper-level transport policy of the country, the region and the sustainable urban mobility policy of the EU

Is the overall situation improving the living quality of your area?

Yes, thanks to increased modal share of walking, cycling and public transport, population will be healthier, transport emissions will be significantly reduced and overall traffic in FUA will be more efficient. The quality of life in the area will be improved.

What are the effects on particular demographic groups, such as children, elderly, low-income group, foreigners and migrants, students, mobility-impaired people, etc.?

The use of cycling and walking as a transport mode by all inhabitants will increase. Simultaneously with the construction of bicycle trails along the Sava river and through the park (green) areas, pedestrian tracks will be built and this will lead to increased movement of the older population. Tourists and local population will be able to use a bike sharing system. With a high number of users, bike sharing system will be available at lower costs, so it will be accessible for low-income groups.

How will the transport-related cost paid by each end user change? How will the transport-related cost paid by your municipalities or regional government change?

Local governments will find financing models in order to invest in infrastructure and bike sharing system that will be eventually payed off by end users of the system. In total, end users will achieve savings thanks to lower cost of fuel, parking and vehicle maintenance.

Will the overall change will lead to increase or decrease of transport-related energy consumption in your area?

There will be a reduction in transport-related energy consumption.

Will the overall change will lead to increase or decrease of transport-related CO2 emission in your area?

Transport-related CO2 emissions will be significantly reduced due to decrease in the modal share of passenger cars and gradual replacement of older, more polluting vehicles with newer, more efficient and cleaner ones.

4.9.3 SCENARIO 2: Making public transport more attractive

Baseline data for 2017 shows that Gradiska has a motorization rate of 275 per 1000 residents. The modal split is the following: car 56,6%, public transport 13,8%, cycling 0,9% and walking 28,7%. Other types of transport (tram, train, metro) do not exist on the target territory. Green vehicles are not registered in the territory. On the demographic side, Gradiska has a population of around 48000 residents with negative trend of slow decrease of population, which is characteristic for the wider area. Gradiska, and Bosnia and Herzegovina as a whole, are considered as low income areas. Number of registered accidents in 2017 with serious injuries is 38, while there were 4 fatalities. The baseline data is based on the previously carried out survey, experts estimates and calculations using the EU Urban Transport Roadmaps tool[36].

The local authorities, in addition to regular maintenance of the road network will develop and implement measures in order to boost utilization of the public transport by residents and tourists. The local authorities will implement the following group of measures:

- Land use planning – planning of new construction and development in the target territory in order to support sustainable urban mobility and public transport modes.
- Introduction of the green public fleets – Local authorities will provide support to the public transport operators in order to modernize bus fleet and introduce green buses in the public transport system.
- Improvement of bus network – Local authorities will coordinate with public transport operators in order to redesign layout of public transport and to introduce new lines where necessary. The occupancy and economic impact of each line will be measured and regular updating of the network will be realized. Local authorities will invest in modernization of bus stops and station.

[36] http://www.urban-transport-roadmaps.eu/

- Public transport integrated ticketing and tariff schemes – The integrated ticketing for all public transport operators will be realized in order to increase flow of the travel by public transport and improve convenience of passengers traveling long distances or to more than one location. Tariff schemes will be developed in order to reduce costs for passengers and stimulate use of public transport.
- Prioritizing public transport – The traffic system in the target area will be designed in order to give priority to public transport vehicles were ever possible and to reduce travel time in public transport. This measure will stimulate use of public transport.

The results of scenario "Making public transport more attractive" are influenced by realized measures of the local authorities in target area during short, medium and long term. Nevertheless, the motorization rate will continue its current trend of increase thanks to overall economic growth and in 2030 will be 350 vehicles per 1000 residents. The modal split of cars will decrease to 44,6% while other modes will increase, bus to 18,6%, bicycle to 1,1% and walking to 35,7%. The accidents with serous and fatal injuries will be reduced in comparison to the base year thanks to better land use planning and decrease of personal car use in mode share. The uptake of green vehicles will remain negligible, but thanks to support of the local authorities public buses on alternative fuels will start to emerge. Emissions from transportation (CO_2, PM, CO, NO_x and VOC) will be significantly reduced. This reduction is mostly result of the actions taken by local authorities in support of green public buses and tanks to reduced modal share of personal cars in overall traffic in addition to the technological improvements and replacement of older vehicles with newer, cleaner engines.

Impacts of "Making public transport more attractive" scenario are mostly visible in the changes of the mode split where use of car is reduced and all other modes are increased. While the main objective of the scenario is to support use of the public transport, the positive effects are showed in increase of active modes as well. Significant jump of public transport in mode split for 4,8% in 10 years is result of active policies and change in the behavior of the residents that is indicator of constant growth in future years as well. While the indicators regarding introduction of the green public fleet and increase in average bus speed are positive, they are very limited thanks mainly to the low level of resources that local authority can invest in full realization of the foreseen measures.

Describe this scenario

This scenario is putting public transport in priority. Local authorities will co-finance the cost of public transport in large part. They will finance modernization of bus stations and introduction of green bus fleets consisting of primarily new buses. Specially designated traffic lanes for public transport will be developed. Modern technology such as an electronic map will be used, the stations will have bus time displays, Wi-Fi and LCD monitors for useful information. Buses will be used up to 10 years old. New bus lines in the urban part of the municipality will be put in place. The parking cost in the central area will increase. The use of passenger cars will be reduced. The number of passengers in public transport will increase. The negative impact on the environment will decrease.

How will the demographic structure of your area and the core city in it be in your planning horizon around 2025 to 2030? (No of population, age structure, etc.)

The quality of life in the municipality will be better. The municipality will attract young people to come to live in. The total population will steadily slow its decline while the share of the population 0-14 and 15-39 and 40-64 will increase in comparison with the previous years, and the share of the elderly population (65-84 and 85+) will start to decline.

Which types of transport technology will have been diffused or will disappear in your area in your planning horizon around 2025 to 2030?

New buses with more efficient engines will be used in public transport. In long term, buses on alternative fuel such as hybrid, CNG and electric will start to be used in public transport. Intelligent Transport System will be used to inform passengers. The population will be able to use different types of payments for public transport (electronic cards, monthly and daily tickets, prepaid tickets that can be used for other modes like bike sharing etc.) Current buses that are over 20 years of age will not be used. With increase of modal spilt of public transport, residents will use more cycling and walking rather than personal vehicles.

How will the share of transport mode change in your core city and area? Will there be higher share of journey with cars or less? Will it increase or decrease the share of public transport? Will there be more cyclists and walkers, or less?

Characteristics of transport:

- travel distance per trip will be reduced to 2,8 km
- modal share of public transport will increase on 18,6%
- modal share of passenger cars will be reduced to 44,6%
- modal share of walking will increase on 35,7%
- total emissions from the transport will be reduced
- buses will be able to transport bicycles in a convenient way

Which part of your future prediction is not in line with upper-level transport policy (of region, country and EU)?

This scenario is in line with the regional upper-level transport policy and the sustainable urban mobility policy of the EU. The problem is the lack of effective transport policy at the entity level that would give priority to public transport. For example, at the moment of registration of the bus, a fee for the use of the highway is paid and buses in public transport do not use the highway. For example, the state should co-finance the use of biodiesel. Public and private institutions should buy a ticket for public transportation to workers and not to pay funds to their accounts that afterwards are not used for the public transport.

Is the overall situation improving the living quality of your area?

Yes, thanks to increased use of public transport, overall emissions from transport (CO2, PM, CO, NOx, VOC) will be reduced and overall traffic in FUA will be more efficient.

What are the effects on particular demographic groups, such as children, elderly, low-income group, foreigners and migrants, students, mobility-impaired people, etc.?

Measures under this scenario imply cheaper tickets, free tickets for people older than 65 years, cheaper tickets for student, LCD displays on bus station and in the buses with the ability to display in English, the greater use of low-floor buses and others. This will affect all demographic groups of the population as well as tourists and visitors from the region. As a result of implementation of measures in this scenario, number of accidents with severe injuries and fatalities will be reduced. Overall traffic safety for all groups will be improved.

How will the transport-related cost paid by each end user change? How will the transport-related cost paid by your municipalities or regional government change?

Local governments will find financing models in order to invest in infrastructure and provide more funding in public transport based on public-private partnership. The end users will have cheaper tickets with better service and will achieve savings thanks to lower cost of fuel, parking and vehicle maintenance.

Will the overall change will lead to increase or decrease of transport-related energy consumption in your area?

There will be a reduction in transport-related energy consumption, since use of personal vehicles will be decreased.

Will the overall change will lead to increase or decrease of transport-related CO2 emission in your area?

CO2 emission will be reduced for approximately 4600 t/year in comparison to the 2017 as the base year.

Table 4.22 Different impacts of choices

Indicator	Baseline (2017)	Business-as-usual	Fostering active transport modes	Making PT more attractive	Mix of policies of fostering active and PT
Motorisation rate	275	353	350	350	348
Mode split (%)	Car: 56,6% Bus: 13,8% Bicycle: 0,9% Walk: 28,7%	Car: 57,6% Bus: 13,5% Bicycle: 0,8% Walk: 28,1%	Car: 45,0% Bus: 16,6% Bicycle: 1,7% Walk: 36,7%	Car: 44,6% Bus: 18,6% Bicycle: 1,1% Walk: 35,7%	Car: 39,6% Bus: 21,9% Bicycle: 2,2% Walk: 36,3%
Travel distance per trip (km)	3.1	3.1	2,8	2,8	2,8
Average car speed in peak hours (km/h)	36	35,7	35,5	37,5	37,2
Average bus speed in peak hours (km/h)	14,4	14,3	14,6	15,1	15,4
Vehicles-km by car conventional vehicles	109	95	80	79,4	69,2
Penetration of alternatively fuelled car vehicles	0.0% hybrid electric 0.0% battery electric 0.0% fuel cells	0,07% hybrid electric 0.0% battery electric 0.0% fuel cells	0,07% hybrid electric 0% battery electric 0 % fuel cells	0,07% hybrid electric 0.0% battery electric	0,07% hybrid electric 0.0% battery electric
Penetration of alternatively fuelled bus vehicles	0%	0,05% hybrid electric 0.0% battery electric	0,052% hybrid electric 0.004% battery electric	0,09% CNG 0,11% hybrid electric 0.0% battery electric	0,09% CNG 0,11% hybrid electric 0.0% battery electric
CO_2 emissions per year (tonnes)	48216	46376	43928	43579	41967

Indicator	Baseline (2017)	Business-as-usual	Fostering active transport modes	Making PT more attractive	Mix of policies of fostering active and PT
PM emissions per year (tonnes)	6,43	3,85	3,55	3,44	3,25
CO emissions per year (tonnes)	114	99	98	94	95
NOx emissions per year (tonnes)	143	78	74	70	67,9
VOC emissions per year (tonnes)	27	22	22	21	21
Total Accidents by severity	38 serious 4 fatal	33,4 serious 3,51 fatal	30,2 serious 3,34 fatal	30,2 serious 3,3 fatal	27,5 serious 3,1 fatal
Transport expenditure per individual per year (EUR)	758	763	747	718	782

PART 5: A SUMMARY OF MOBILITY SCENARIOS

As previously recalled, the structure of the scenarios for each area has been proposed at the beginning of the activities by the WPL. However, the elaboration of the scenarios in different areas is not homogeneous, as clearly visible form section 4. This is due to their different characteristics, the different amount of data available, the different degree of involvement of PPs in the project, and the different purposes that are at the basis of the scenarios. This section provides some final evidences deriving from the interpretation of the scenarios by different PPs.

A first aspect that is worthy to be mentioned is the **nature** of scenarios. In some cases (e.g., Koper), they are qualitative description, limited to specific sectors, such as land use and regional (urban) development interaction. This has led to the representation of new maps, which generated an added value and, jointly with the outputs of projects Mobilitas and Chestnut, provide a more comprehensive vision about the potential development of the area. Some other scenarios (e.g., Ragusa) are developed in a quantitative way, starting from data collected in WPT1 and elaborated through a tool platform provided by the EU. Other scenarios (Dura, Zadra Nova) start from data collected in WPT1, and develop scenarios according to the vision of the responsible PP. A fourth group of cities has adopted a different approach: rather than providing quantitative data, scenarios set the targets and the measures that should bring to such desired values. In this case, the nature of scenarios is not quantitative, but more general.

A second aspect is the definition of **alternative scenarios**. As for this aspect, a more shared approach is visible: except for the Slovenian city of Koper (where three different urban developments have been assessed), all other PPs have described a "business-as-usual" starting point and compared it to some alternative visions (based e.g. on the development of public transport, on the development of alternative mobility solutions or ad hoc measures, such as Low emission zones). Such visions may include only one specific policy (e.g., scenario 2 of Velenje) or a set of multiple policies (e.g., the optimistic scenario in Banat, or scenario 1 of Hersonisos). This should allow cities having a better knowledge of the potential implications deriving from the adoption of specific policies.

Despite this similar approach, **results** are expressed in different ways: they can be maps with qualitative information; tables and graphs containing information about future modal split, infrastructural development, reduction of emissions and similar information; maps visualizing expected changes; and even text with a more general description of expected impacts. Even when similar data is provided, it seems misleading the direct comparison between cities, since their starting condition is different. For instance, the modal split of Gradiska in BAU scenario is car 56,6%, public transport 13,8%, cycling 0,9% and walking 28,7%. In Koper, 0,4 % commute by railway, 2,4 % by bus, 77,2 % by car, 2,4 % by bicycle, and 17,5 % by foot as pedestrians. These differences are not only related to the policies already implemented, but also to some geographical, economic and social features, as well as to the behaviours of the citizens.

In conclusion, we can affirm that scenarios developed by each city present specific peculiarities, which make them not comparable. Such differences were expected and suggest a final recommendation in interpreting the scenarios: they should be analysed *per se* in terms of inner coherency and should be seen in view of the next practical activities that PPs should carry out in the framework of the project.

APPENDIX 1: RRC KOPER, SCENARIOS DEVELOPED IN PROJECT CHESTNUT

Attribute/Scenario	Business-as-usual	National pricing on all roads	Fostering active transport modes	More attractive public transport
Description	This scenario assumes continuation of the current transport policy in the next 20 years. This means that in FUA Koper travel habits are centred around car use. No new measures for supporting sustainable mobility are foreseen, only the continuation of the existing ones such as P+R, parking regulation, cycle tracks. Use of public transport continues to be minimal and the service remains uncompetitive compared to car use. Walking remains important on the local level but cycling does not build on it its potential. Regional, national and EU policies do not change.	The national government decides to introduce nation-wide road pricing for automobiles and trucks including all types of urban roads in 2025 (there is already nation-wide road pricing in Slovenia on motorways so this measure extends this to all national roads (20% of all road network) in the form of congestion & pollution charging measure). The pricing is 2% of average annual household income per automobile (the price amounts to 431 EUR per automobile or 1 EUR per trip for cars, 2 EUR per trip for LGVs, 3 EUR per trip for HGVs with a price differentiation by EURO standard.	Implementing 200km bicycle lanes in five years; Introduction of shared space or pedestrian zone in all of local centers within FUA (traffic calming measures in 40% of urban core area and 10-20% of other areas) Introduction of "Superblock" neighborhood model upon Barcelona model (access regulation measures based on emissions in 20% of urban core area, and up to 10% in other areas). Introduction of bike sharing in 20% of urban area.	Public transport covers 80 % of the FUA's population and workplaces/schools by 2025 within 300 m of stations/stops: bus network is extended by 100 km. New, green bus fleets are put in place. High frequency of the service and longer service hours is provided. 80 % of network sees headway reduction by 5 min. Prioritization measures such as reserved lanes (20 % of all network) are implemented. Introduction of integrated ticket system for all types of public transport (bus, tram, railway) Public transport fare is made affordable to everyone: already affordable price remains the same as today.
Transport technology	The main technology that will evolve in the FUA is an uptake of green vehicles. Their share will increase from less than 1% today to around 30%. Also, car sharing will likely evolve but it will not present a significant share in the transport system.	The main technology that will evolve in the FUA is an uptake of green personal vehicles. Their share will increase from less than 1% today to around 30%. The share of green vehicles in public transport will increase from 0% to 20 %.	The main technology that will evolve in the FUA is an uptake of green personal vehicles. Their share will increase from less than 1% today to around 32%, higher than in the Business-as-Usual scenario due to access regulations. The share of green vehicles in public transport will also increase from 0% to 20%, also due to access regulations. Bike sharing will be introduced.	The main technology that will evolve in the FUA is an uptake of green personal vehicles. Their share will increase from less than 1% today to around 30%. The share of green vehicles in public transport will increase significantly from 0% to 33 %. More sophisticated integrated ticketing will be available and measures for prioritisation of

				buses will be implemented.
Modal split	The modal split will not change significantly. The share of car use will increase by 3 percentage points to 80 %, mainly on the account of bike use and walking. Use of bus will remain on the same level.	Mode share of car will remain the same, bus use will double whilst walking and cycling will both decrease.	Car use will decrease by 7 percentage points to 70%, bus use will also decrease on account of significant increase of cycling (to 19%). Similarly, share of walking will decrease, mainly because of major uptake of cycling.	Car use will decrease by more than 10 percentage points; bus use will increase significantly from 3% to one fifth. On the other hand, walking and cycling will be less important due to a better public transport.
Prediction not in line with upper-level transport policy	The country and EU policies advocate for move towards more sustainable travel and decrease of personal car use. Therefore, this scenario is not in line with these policies as it continues the existing trends of car reliance. It will also not fulfil the road safety goals as the number of accidents and fatalities will not decrease in line with them.	Predicted decrease of walking and cycling and failure to decrease car use is not in line with the national and EU policy goals.	Predicted decrease of public transport use is not in line with the national and EU policy goals.	Predicted decrease of walking and cycling is not in line with the national and EU policy goals.
Quality of living	Some aspects will certainly improve quality of life. For example, due to the technological improvements and uptake of green vehicles air quality will improve (decrease PM, CO, CO2, NOx, VOC emissions) and noise emissions will also decrease. However, road safety will not improve significantly due to a higher share of car use which has an impact on the living quality. Also, transport expenditure per individual or household will increase. Already today Slovenia is at the top of European countries by households' expenditure for mobility which certainly has negative impacts on quality of life. This is also linked to the predicted rise in already high	Overall, quality of living improves a lot. This is related to the air quality improvements (decrease of PM, CO, CO2, NOx, VOC emissions is the highest of all scenarios) and noise emissions will also decrease. Also, road safety will improve slightly due to a higher share of public transport use which has an impact on the living quality. However, transport expenditure per individual or household will increase the most out of all scenarios. Already today Slovenia is at the top of European countries by households' expenditure for mobility which certainly has negative impacts on quality of life. This is partly linked to the predicted rise in already high motorisation rate and partly due to	Overall, quality of living improves a lot. This is related to the air quality improvements (decrease of PM, CO, CO2, NOx, VOC emissions) and noise emissions will also decrease due to higher use of active modes. Also, road safety will improve (but not so much as in Scenario 2) due to a lower share of car use which has an impact on the living quality. Social inclusion and accessibility will improve due to improved cycling conditions which is one of the most inclusive transport modes. Moreover, transport expenditure per individual or household will remain roughly on the same level as today, the lowest of all scenarios. Namely, Slovenia is today at the top of European countries by households' expenditure for mobility which certainly has negative impacts on quality of life, hence the reduction of mobility costs	Overall, quality of living improves a lot. This is related to the air quality improvements (decrease of PM, CO, CO2, NOx, VOC emissions) and noise emissions will also decrease. Also, road safety will improve significantly due to a higher share of public transport use which has an impact on the living quality. Social inclusion and accessibility will improve significantly due to improved public transport. However, transport expenditure per individual or household will increase. Already today Slovenia is at the top of European countries by households' expenditure for mobility which certainly has negative impacts on quality of life.

	motorisation rate.	higher road pricing.	will be beneficial for inhabitants. Higher use of active modes will improve people's health, which has an overall positive impact on quality of life. Larger public spaces for people instead of cars will also enable more quality spending of free time, foster social connections and improve liveability of the city.	This is partly linked to the predicted rise in already high motorisation rate and due to high investments in to public transport.
Effects on particular demographic groups	The most negative effects will be on all people who are not able to drive either because of age, income, health or purely personal reasons. These groups may account for half of population; hence their social inclusion might be compromised due to limited mobility. Basic public transport will remain but the effects of ageing will probably reveal even more challenges in terms of mobility provision for elderly. In the urban area, walking and cycling can represent an important transport mode, particularly for young people, but mobility challenge for inhabitants in the outskirts and in the rural areas will be exacerbated.	As no improvements of sustainable transport modes are planned, the most negative effects will be on all people who are not able to drive because of either age, income, health or purely personal reasons. These groups may account for half of population; hence their social inclusion might be compromised due to limited mobility. Basic public transport will remain but the effects of ageing will probably reveal even more challenges in terms of mobility provision for elderly. In the urban area, walking and cycling can represent an important transport mode, particularly for young people, but mobility challenge for inhabitants in the outskirts and in the rural areas will be exacerbated, especially for low-income groups who already struggle to afford mobility.	Effects on such demographic groups are positive as the accessibility improves due to improved cycling conditions and its financial accessibility. Most people can cycle and they will have more opportunities to access jobs, services and free time activities. This is particularly important for low-income groups, migrants, students and for young people. However, not everyone can cycle. Basic public transport will remain but the effects of ageing will probably reveal even more challenges in terms of mobility provision for elderly. In the urban area, walking and cycling can represent an important transport mode, particularly for young people, but mobility challenge for (particularly older) inhabitants in the outskirts and in the (hilly) rural areas will be exacerbated. Some mobility-impaired people will benefit in this scenario but not all of them.	Effects on such demographic groups are positive as the accessibility improves due to improved public transport and its financial accessibility. They have more opportunities to access jobs, services and free time activities. This is particularly important for the elderly, for low-income groups and for young people.
Transport-related costs	Individual expenditure for transport will increase due to increase of individual motorised mobility. On the other hand, the expenditures for transport by public administrations will not change; to the contrary, they might increase on the account of increased demand for parking.	Individual expenditure for transport will increase due to increase of price of individual motorised mobility. On the other hand, the expenditures for transport by public administrations will not change; to the contrary, they will increase on the account of increased road pricing and low investment in	Major improvements of cycling network require relatively significant investments, which means that public expenditure for transport increases both compared to Business-as-Usual scenario and today. Overall, the net financial result is positive but less so than in other scenarios. However, transport social monetary costs	Major improvements of public transport require significant investments which means that public expenditure for transport increases both compared to Business-as-Usual scenario and today. However, also revenues are predicted to increase with increase

	Transport social monetary costs decrease compared to today.	other transport systems. Overall, the public financial net result will be the most positive of all scenarios. Transport social monetary costs decrease compared to today.	will decrease.	public transport usage. Overall, the net financial result is positive but less so than in the Business-as-Usual scenario. Transport social monetary costs remain on a similar level as today.
Energy consumption in transport	In spite of increase of car use, this scenario predicts lower transport-related energy consumption due to uptake of alternatively fuelled vehicles.	In spite of same levels of car use, this scenario predicts lower transport-related energy consumption due to uptake of alternatively fuelled vehicles.	Due to decrease of car use, uptake of alternatively-fuelled vehicles and increase of (green) public transport, this scenario predicts lower transport-related energy consumption.	Due to decrease of car use, uptake of alternatively-fuelled vehicles and increase of (green) public transport, this scenario predicts lower transport-related energy consumption.
CO_2 emissions in FUA	In spite of increase of car use, this scenario predicts around 16% decrease of CO2 emissions due to uptake of alternatively fuelled vehicles.	In spite of increase of car use, this scenario predicts around 17% decrease of CO2 emissions due to uptake of alternatively fuelled vehicles.	Due to decrease of car use, uptake of alternatively fuelled vehicles and increase of (green) public transport, this scenario predicts around 19% decrease of CO2 emissions.	Due to decrease of car use, uptake of alternatively-fuelled vehicles and increase of (green) public transport, this scenario predicts around 20% decrease of CO2 emissions.

APPENDIX 2: RAGUSA, IMAGES REFERRED TO THE SCENARIO DEVELOPMENT

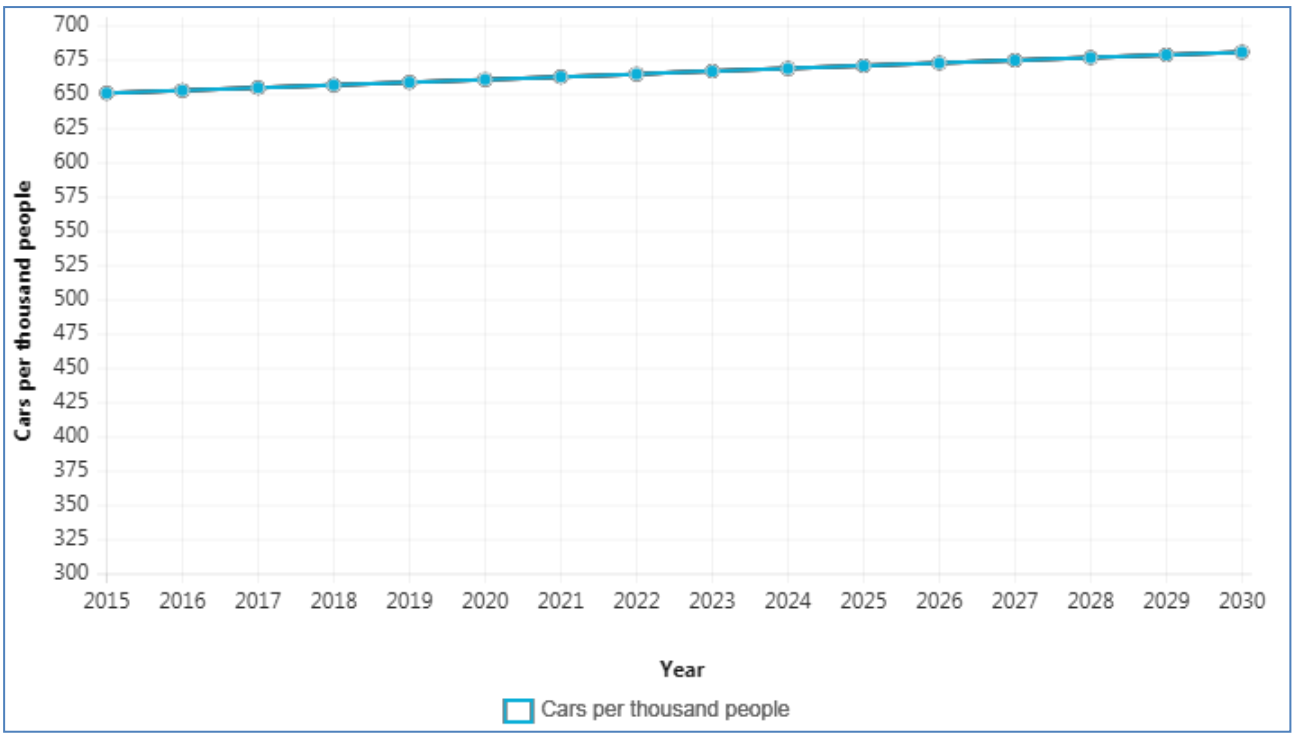


Figure 1. Motorisation rate - SCENARIO 1: Business as usual

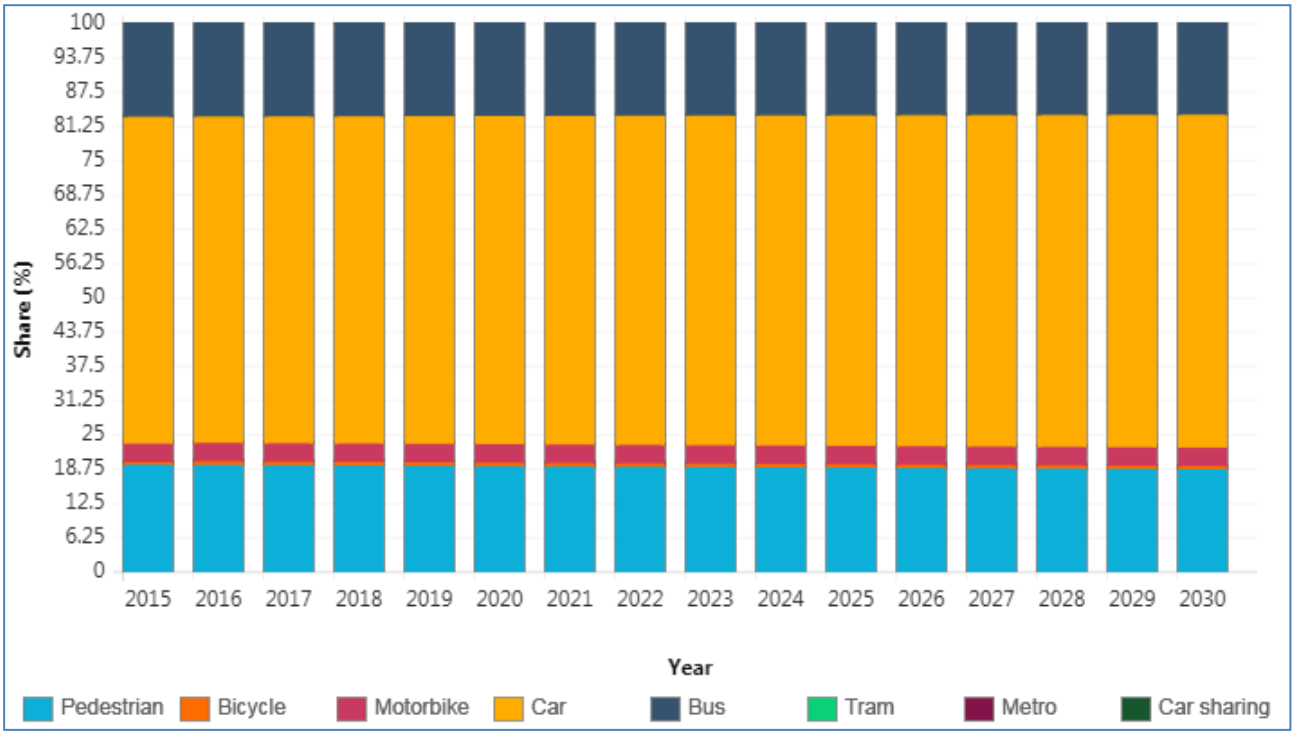


Figure 2. Mode split (%) - SCENARIO 1: Business as usual

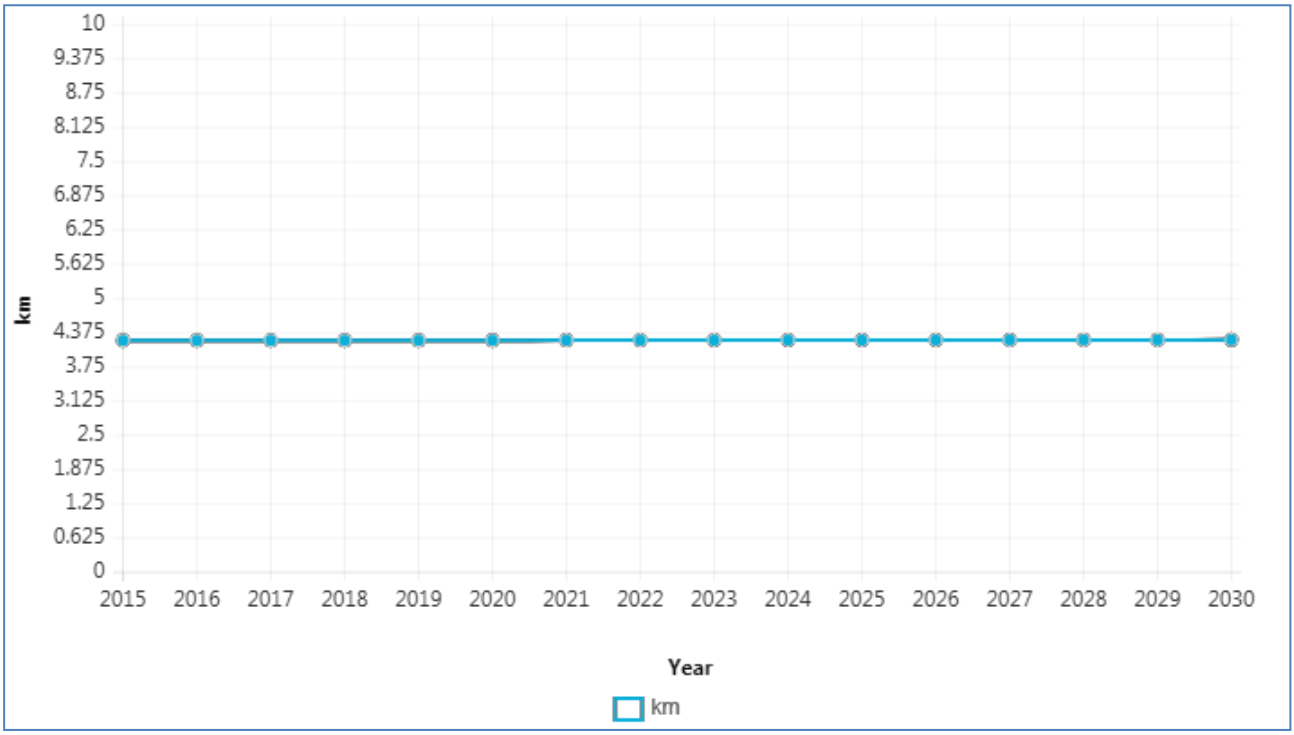


Figure 3. Travel distance per trip (km) - SCENARIO 1: Business as usual

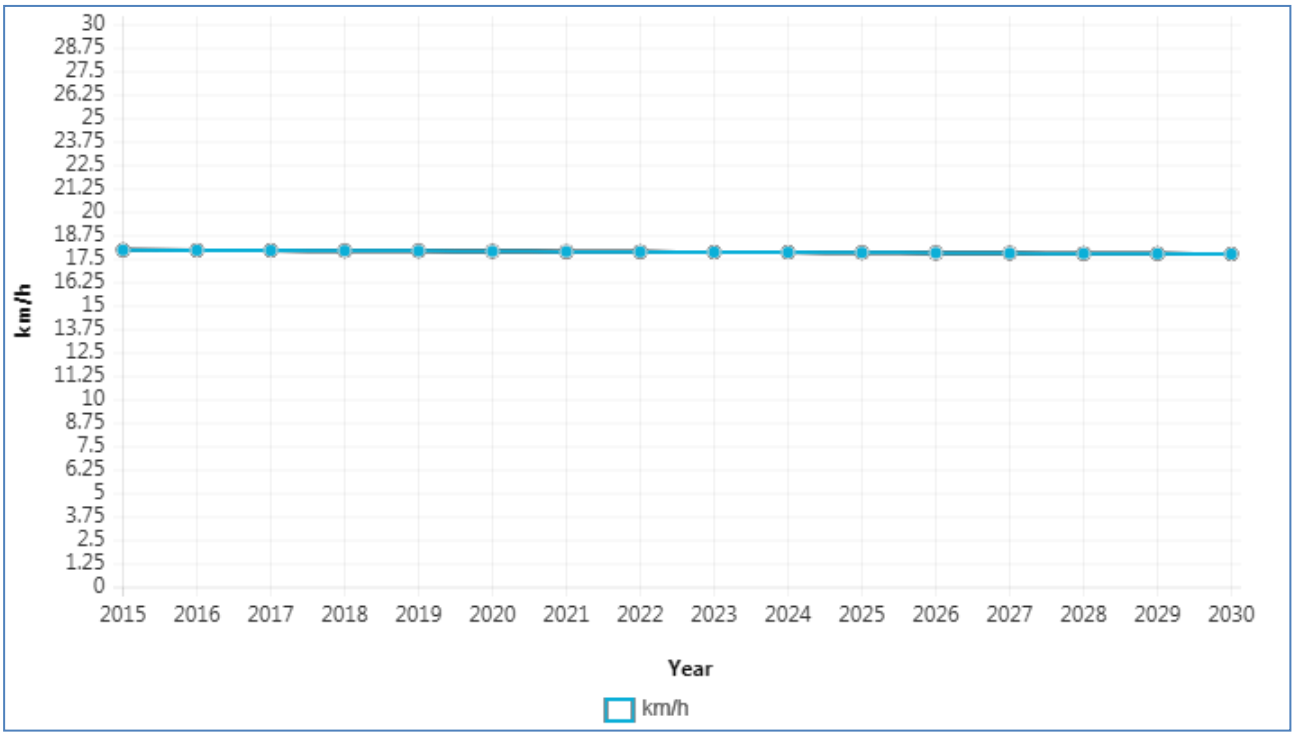


Figure 4. Average car speed in peak hours (km/h) - SCENARIO 1: Business as usual

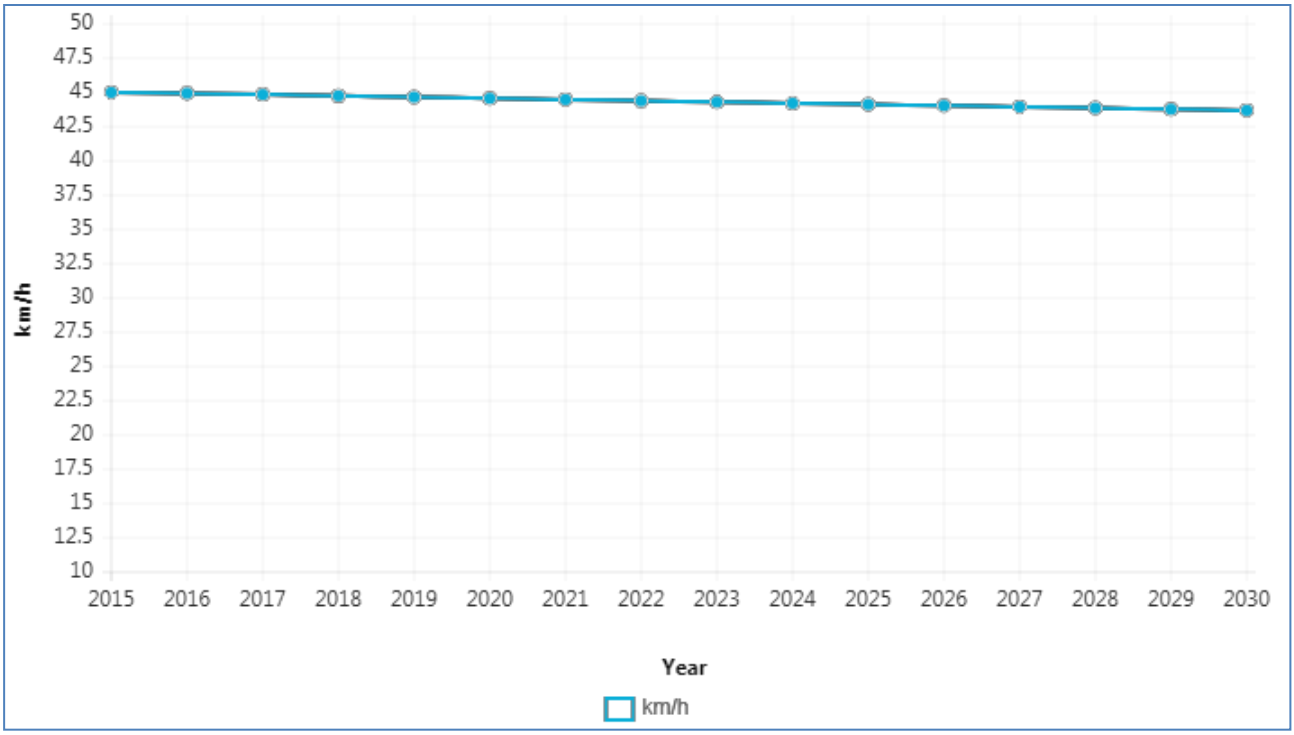


Figure 5. Average bus speed in peak hours (km/h) - SCENARIO 1: Business as usual

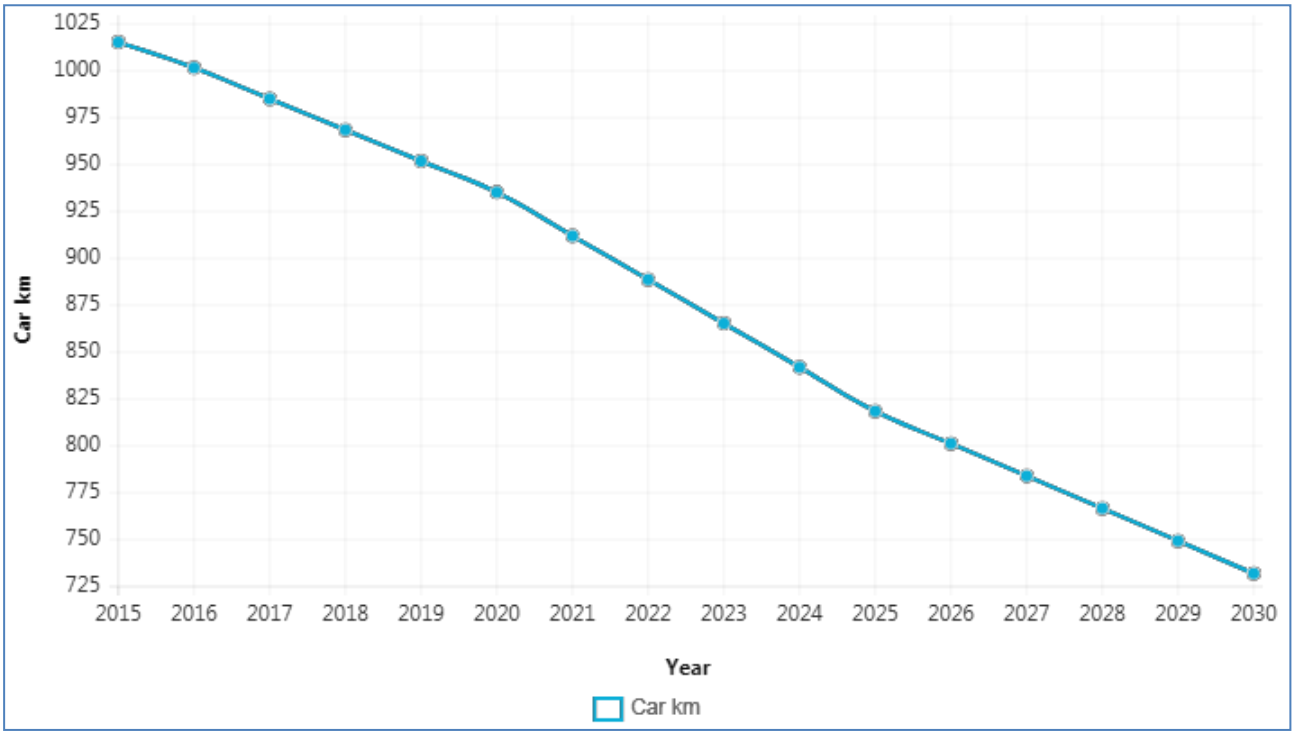


Figure 6. Vehicles-km by car conventional vehicles - SCENARIO 1: Business as usual

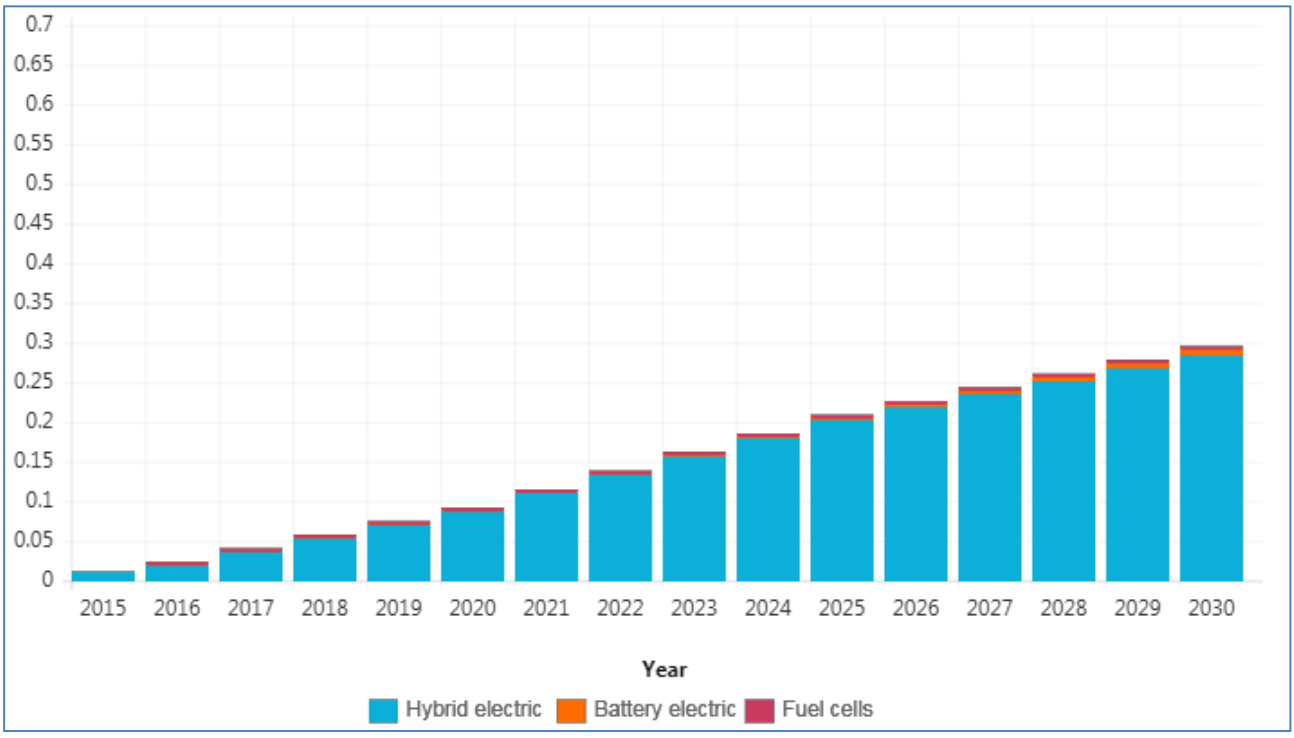


Figure 7. Penetration of alternatively fuelled car vehicles - SCENARIO 1: Business as usual

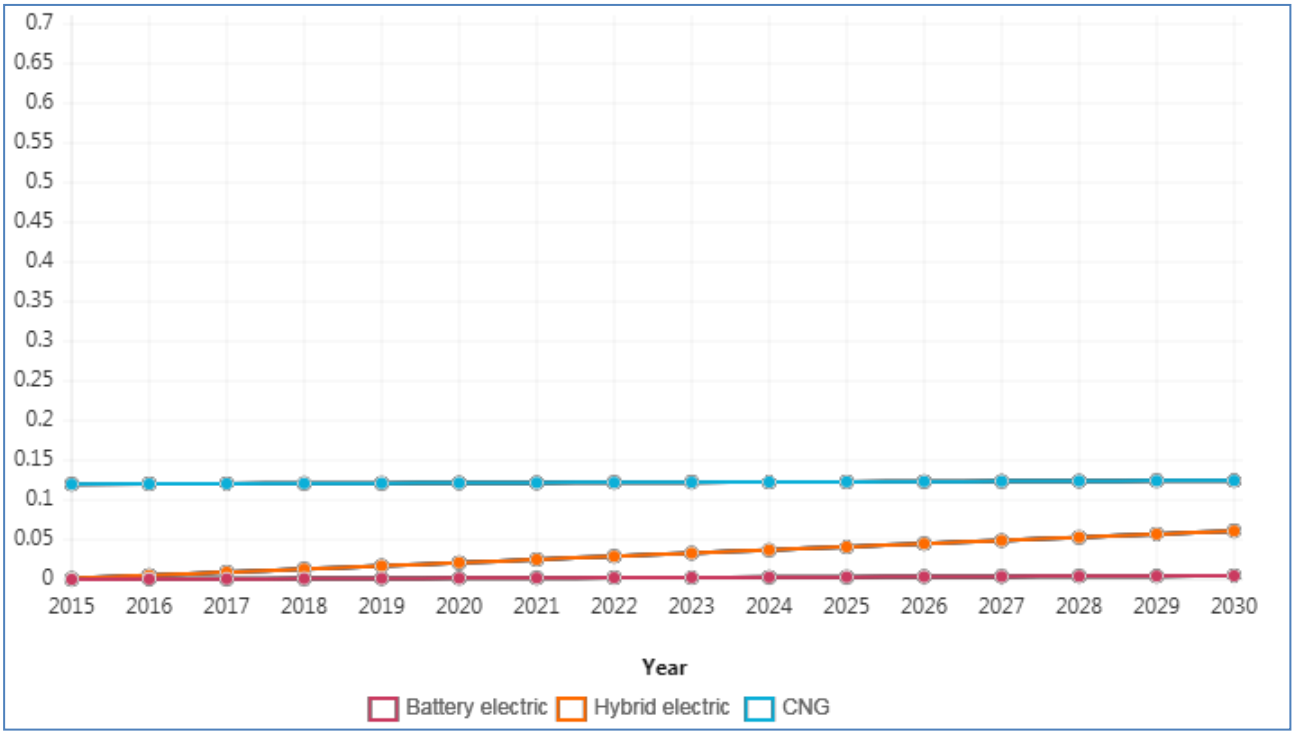


Figure 8. Penetration of alternatively fuelled bus vehicles - SCENARIO 1: Business as usual

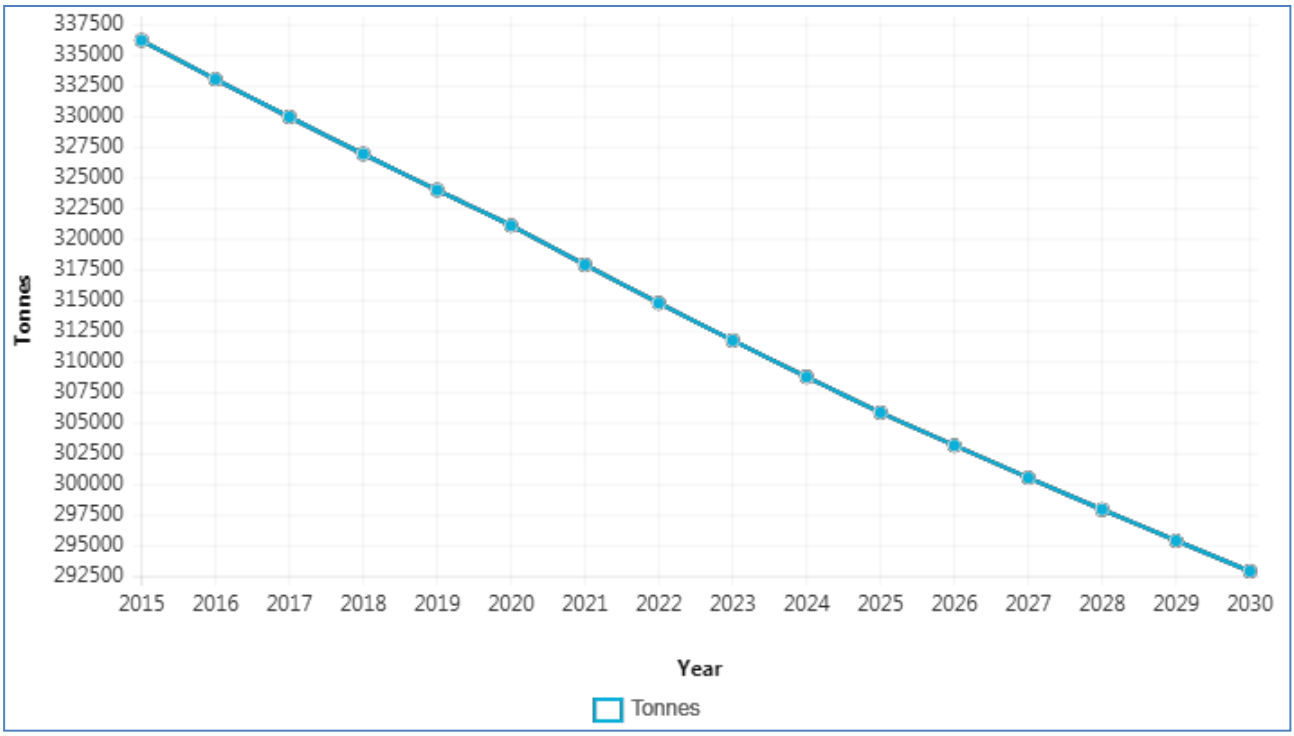


FIgure 9. CO_2 emissions per year (tonnes) - SCENARIO 1: Business as usual

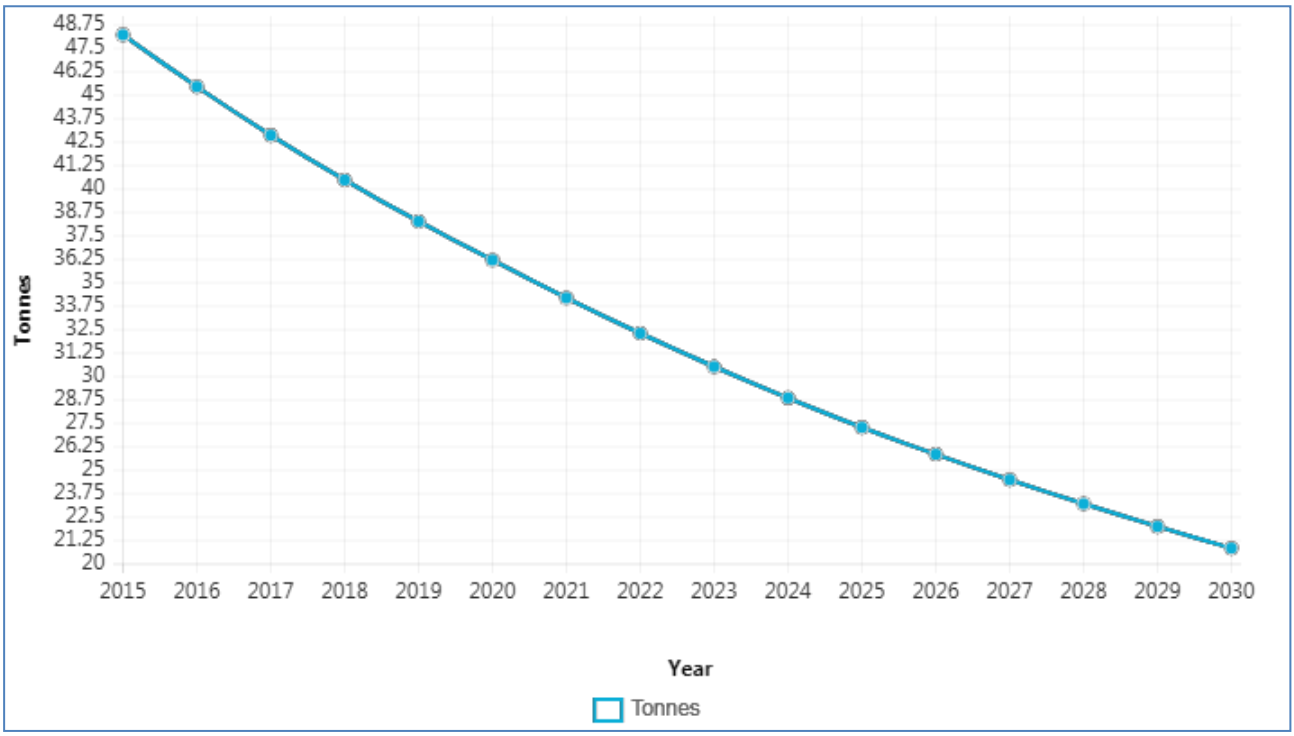


Figure 10. PM emissions per year (tonnes) - SCENARIO 1: Business as usual

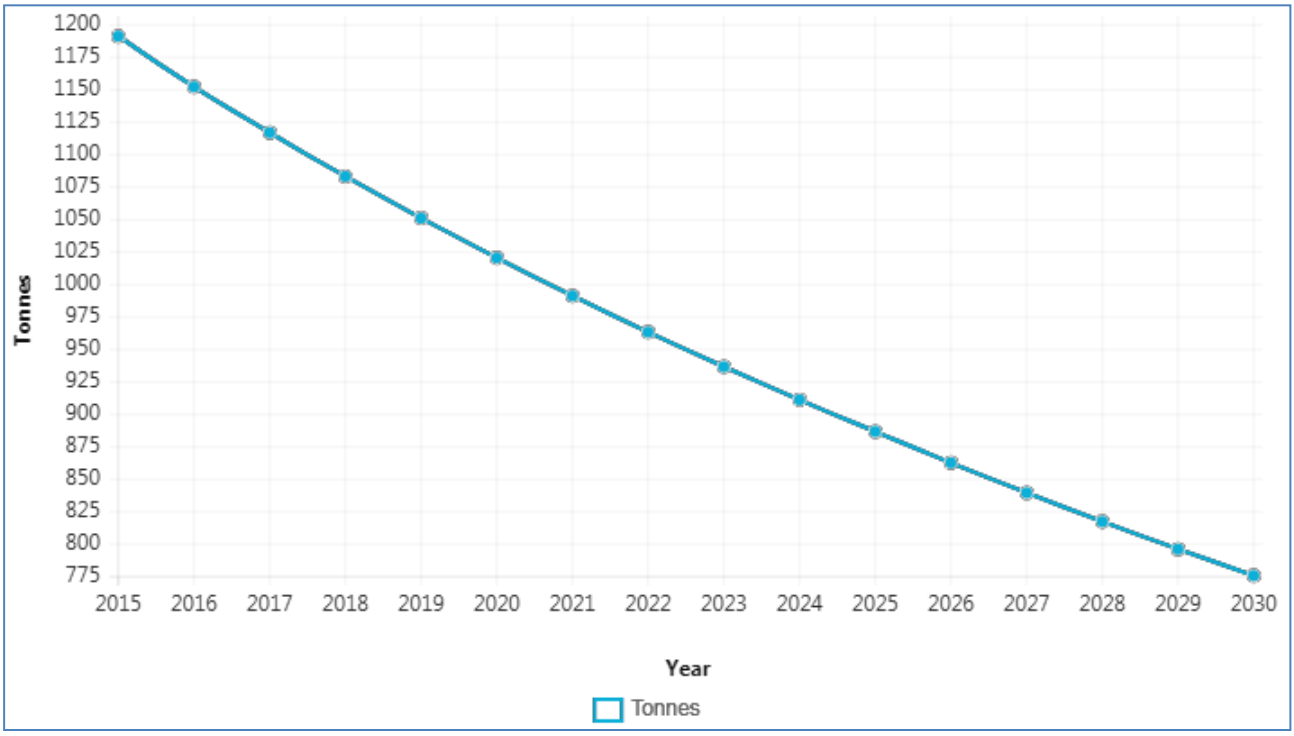


Figure 11. CO emissions per year (tonnes) - SCENARIO 1: Business as usual

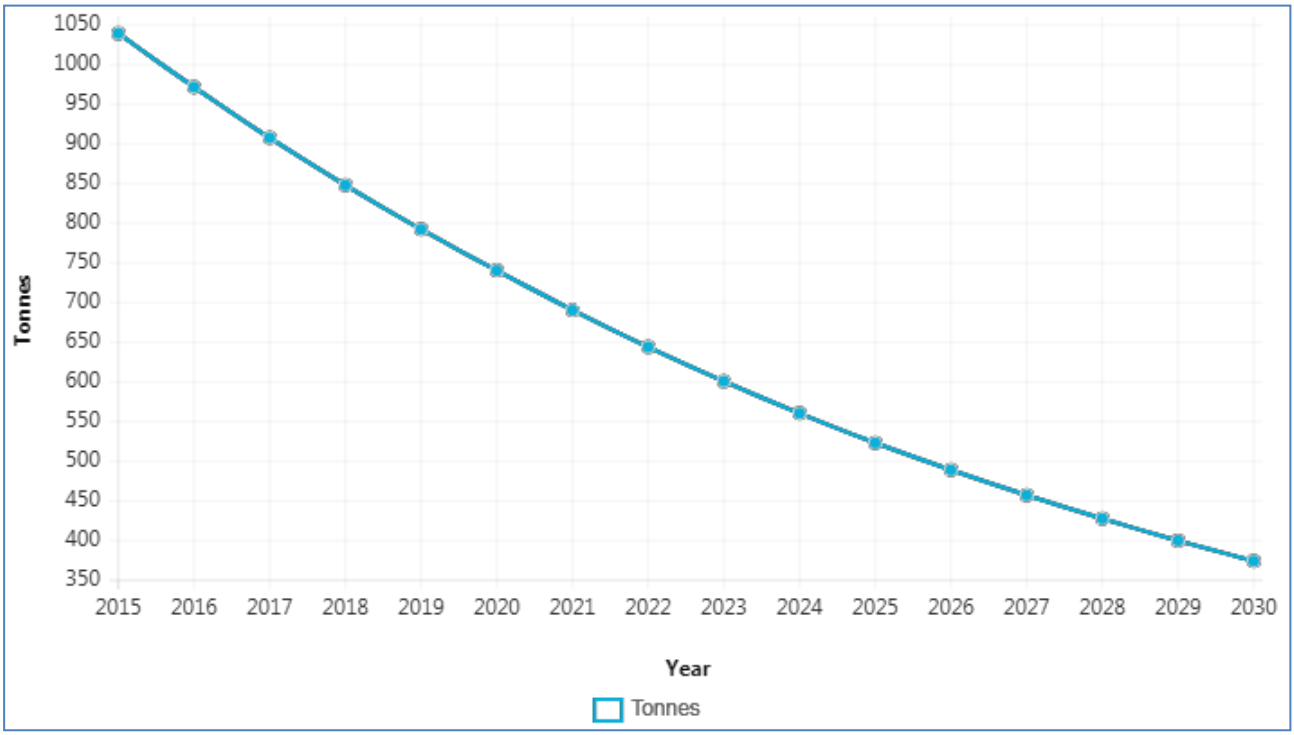


Figure. 12 NO_x emissions per year (tonnes) - SCENARIO 1: Business as usual

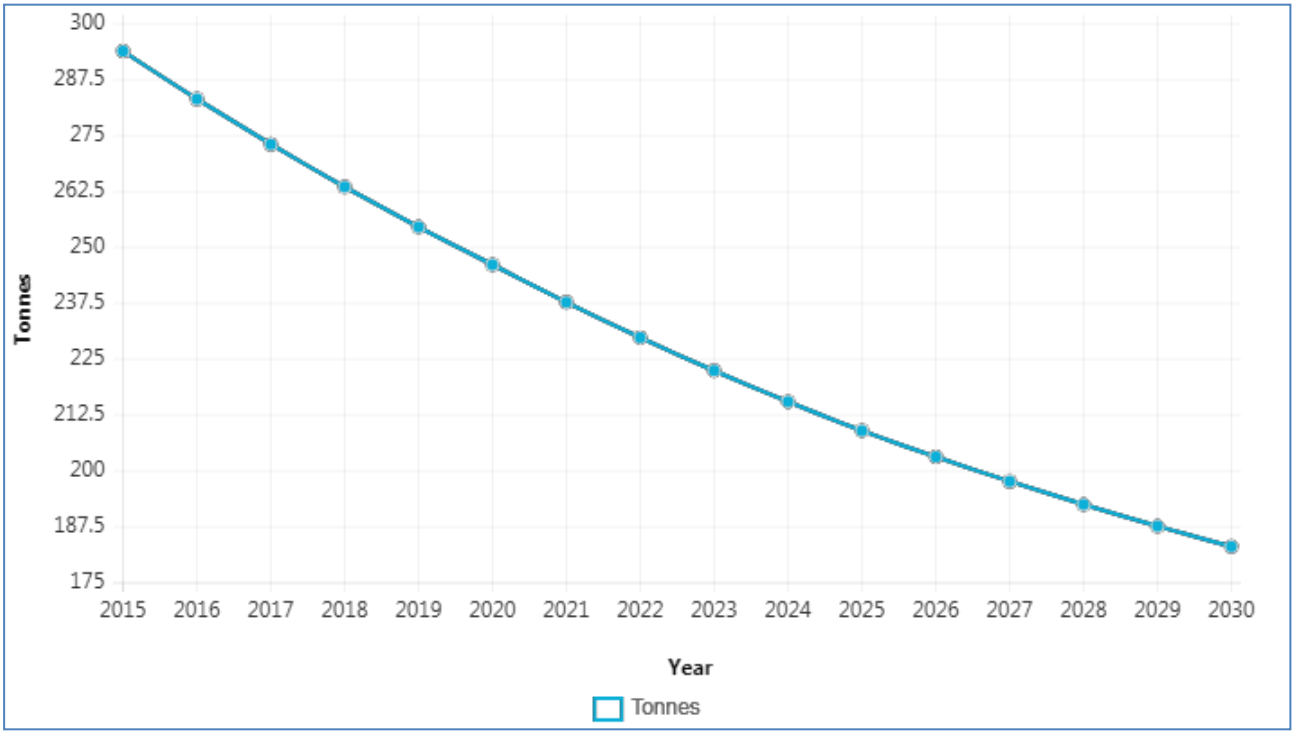


Figure 13. VOC emissions per year (tonnes) - SCENARIO 1: Business as usual

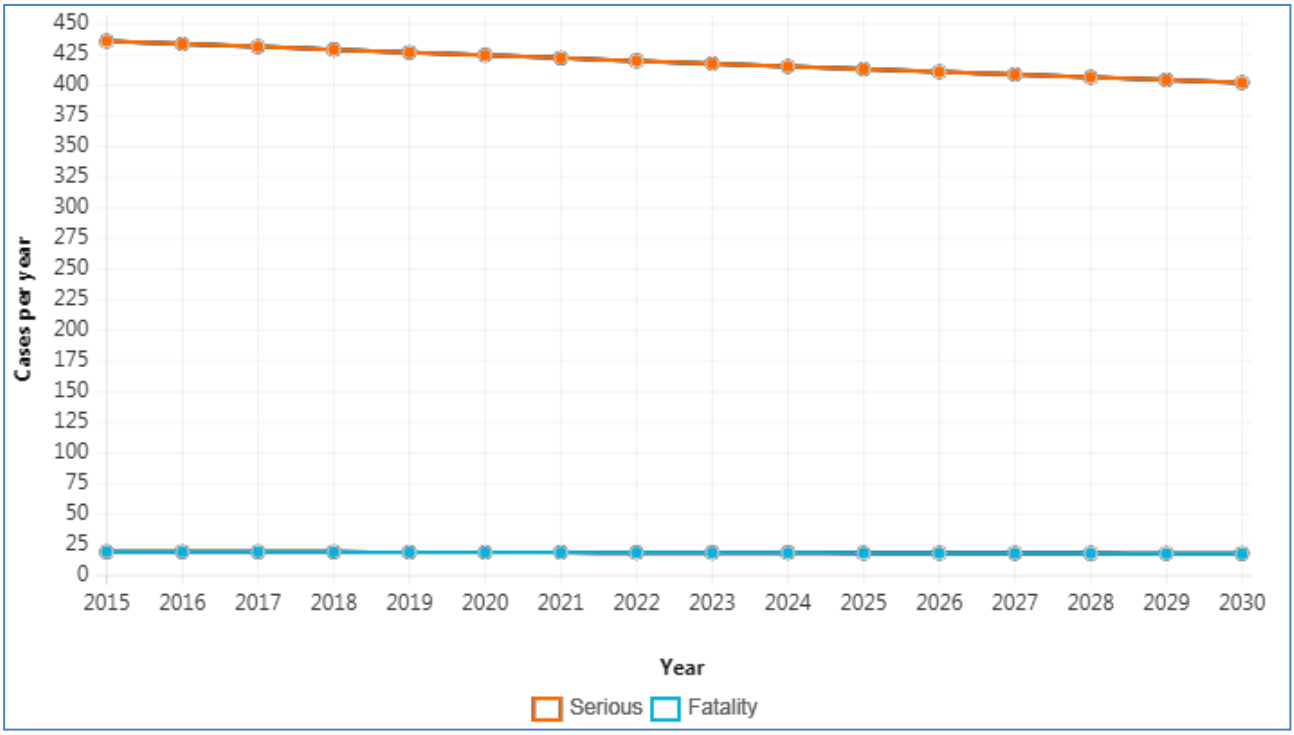


Figure 14. Total Accidents by severity - SCENARIO 1: Business as usual

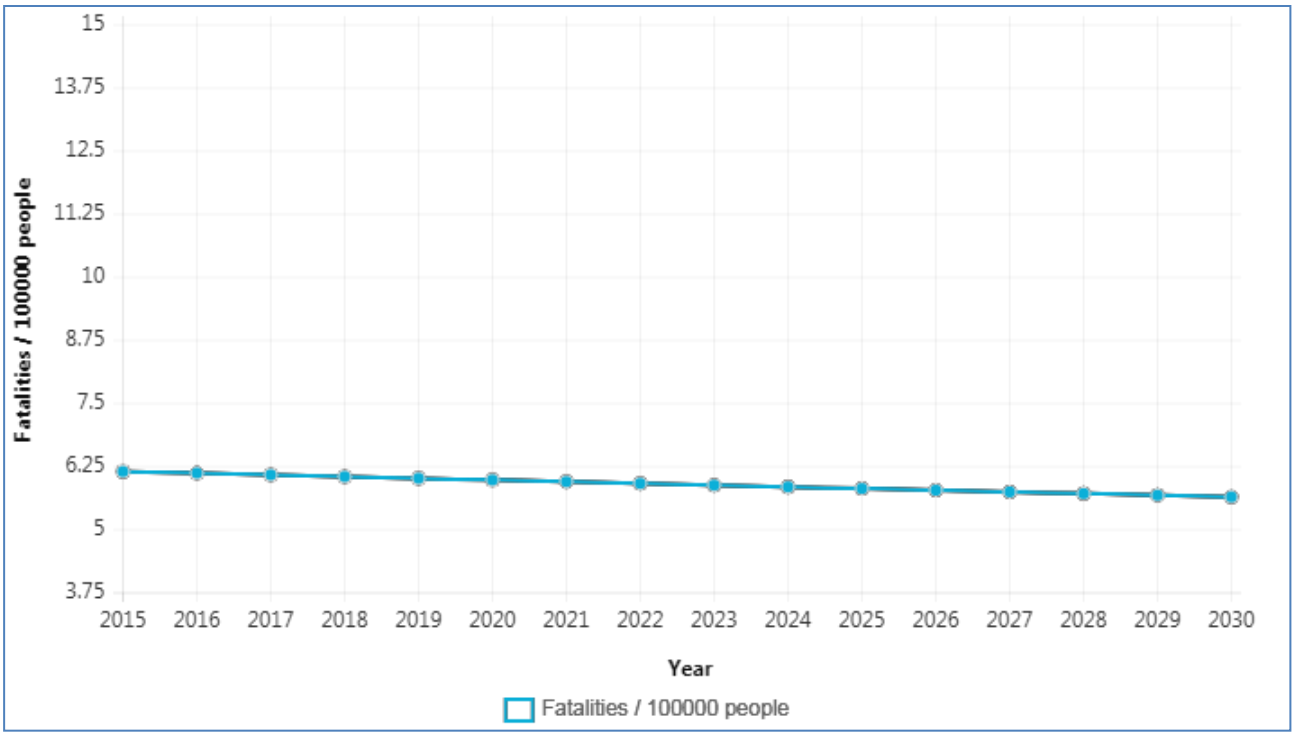


Figure 15. Fatalities per 100,000 inhabitants - SCENARIO 1: Business as usual

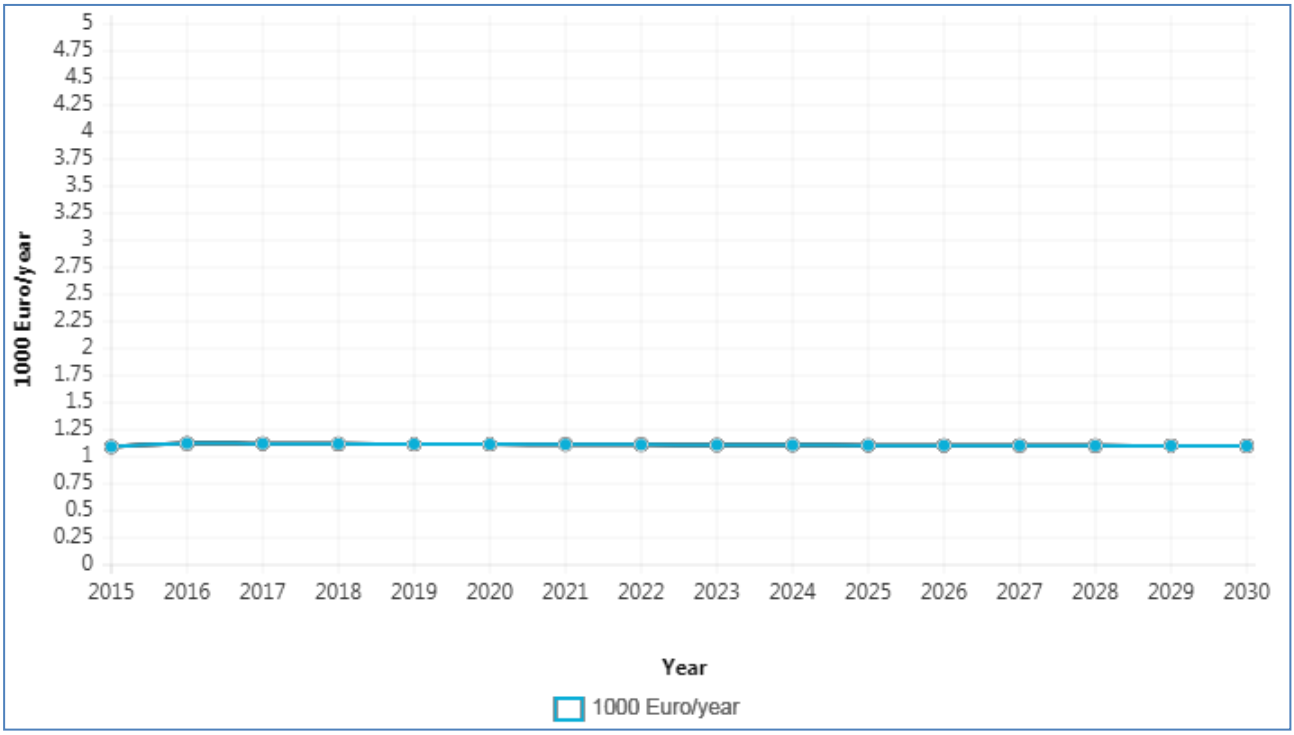


Figure 16. Transport expenditure per individual per year (1000€/year) - SCENARIO 1: Business as usual

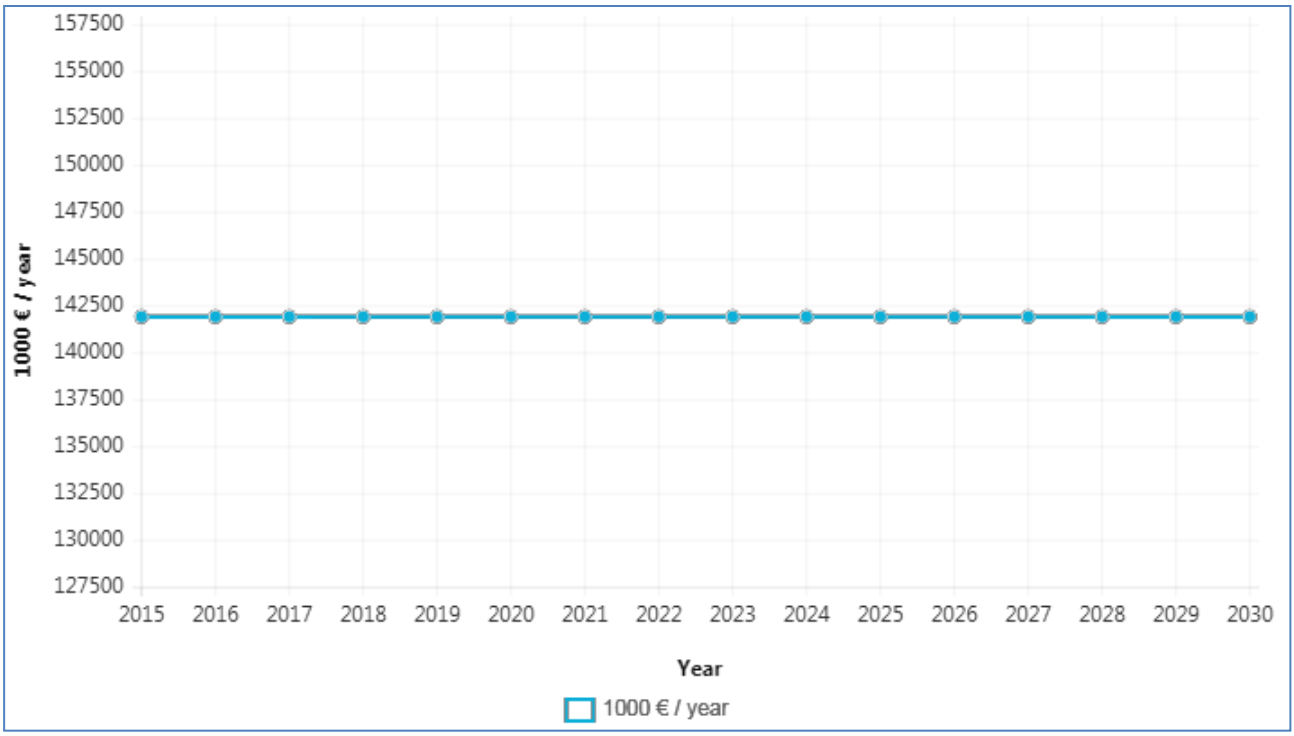


Figure 17. Transport expenditure of public administration (1000€/year) - SCENARIO 1: Business as usual

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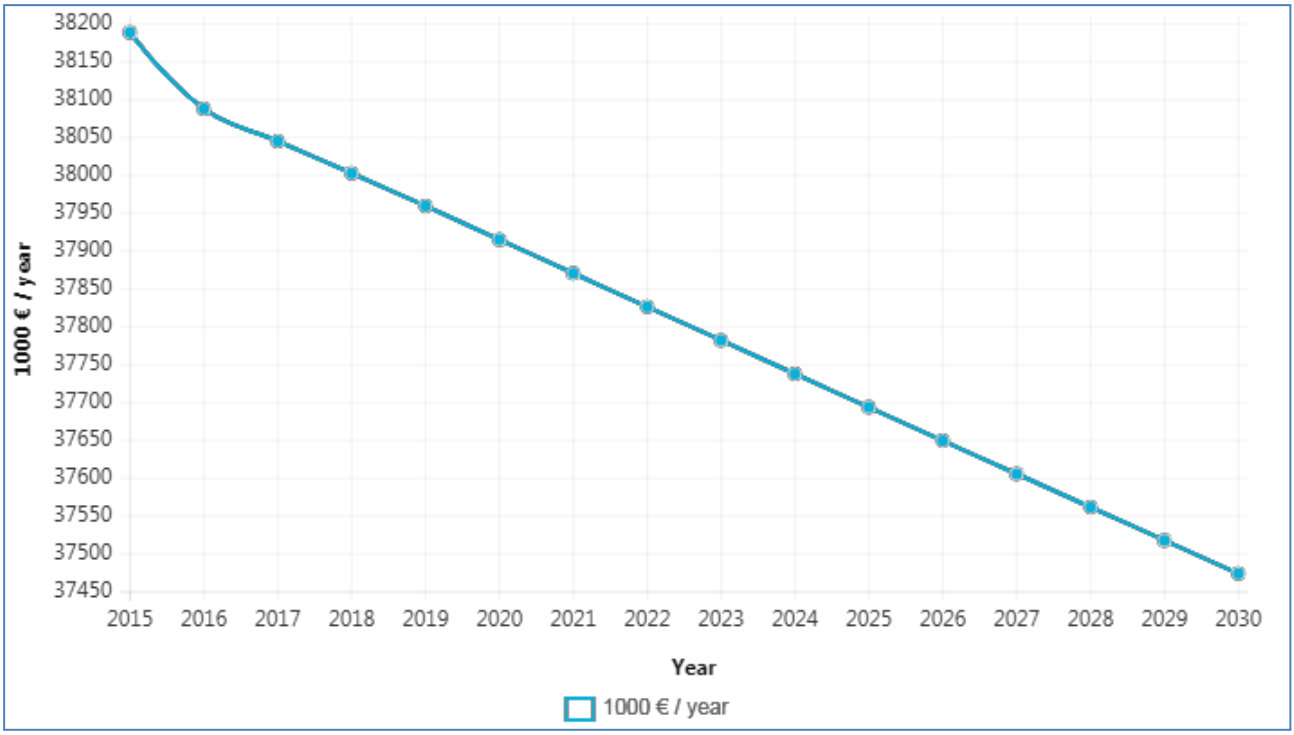

Figure 18. Revenues of public administration (1000€/year) - SCENARIO 1: Business as usual

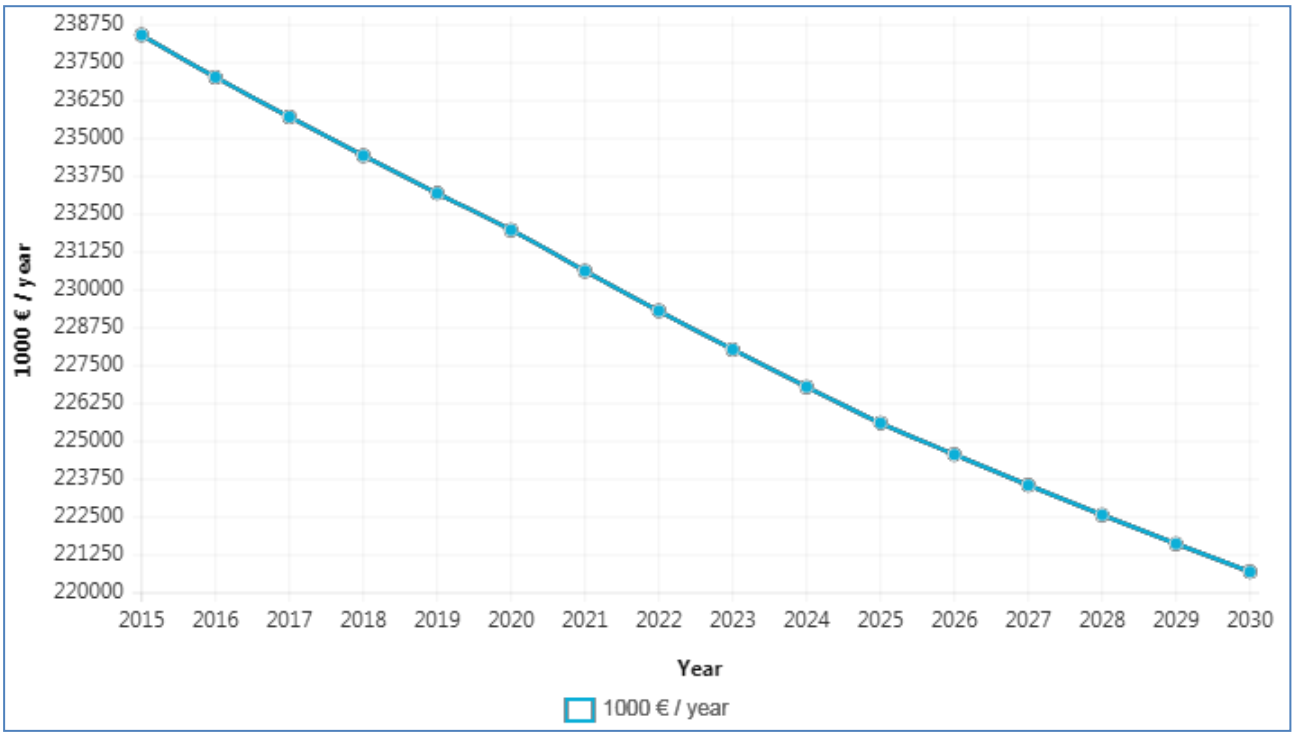

Figure 19. Transport social monetary costs (1000€/year) - SCENARIO 1: Business as usual

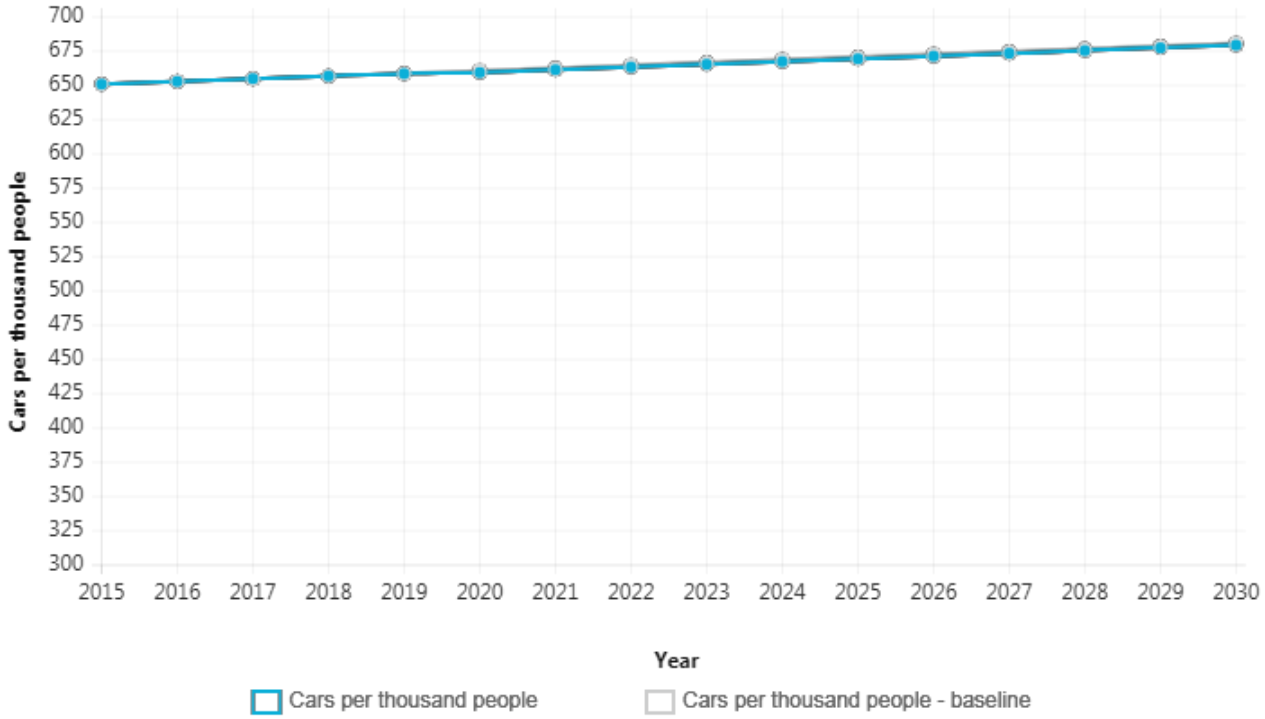

Figure 20. Motorisation rate - SCENARIO 2: Implementation of alternative measures by local authorities

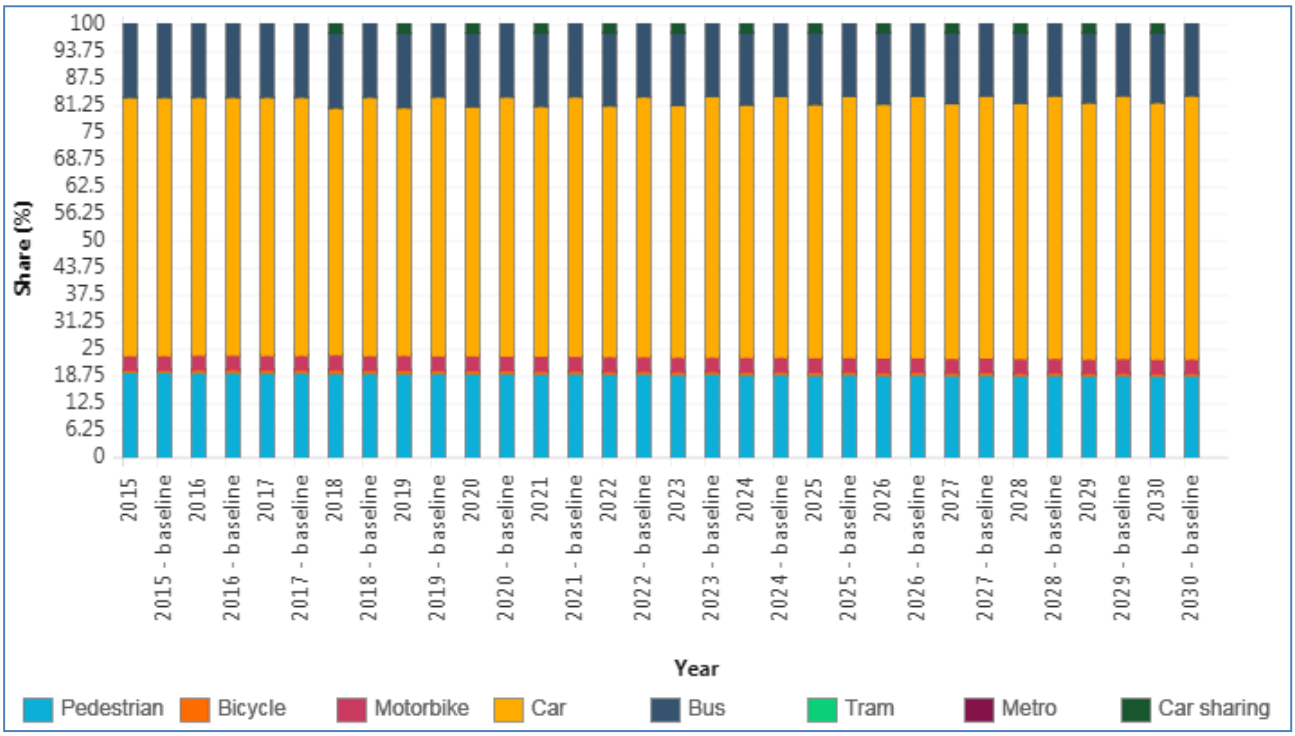

Figure 21. Mode split - SCENARIO 2: Implementation of alternative measures by local authorities

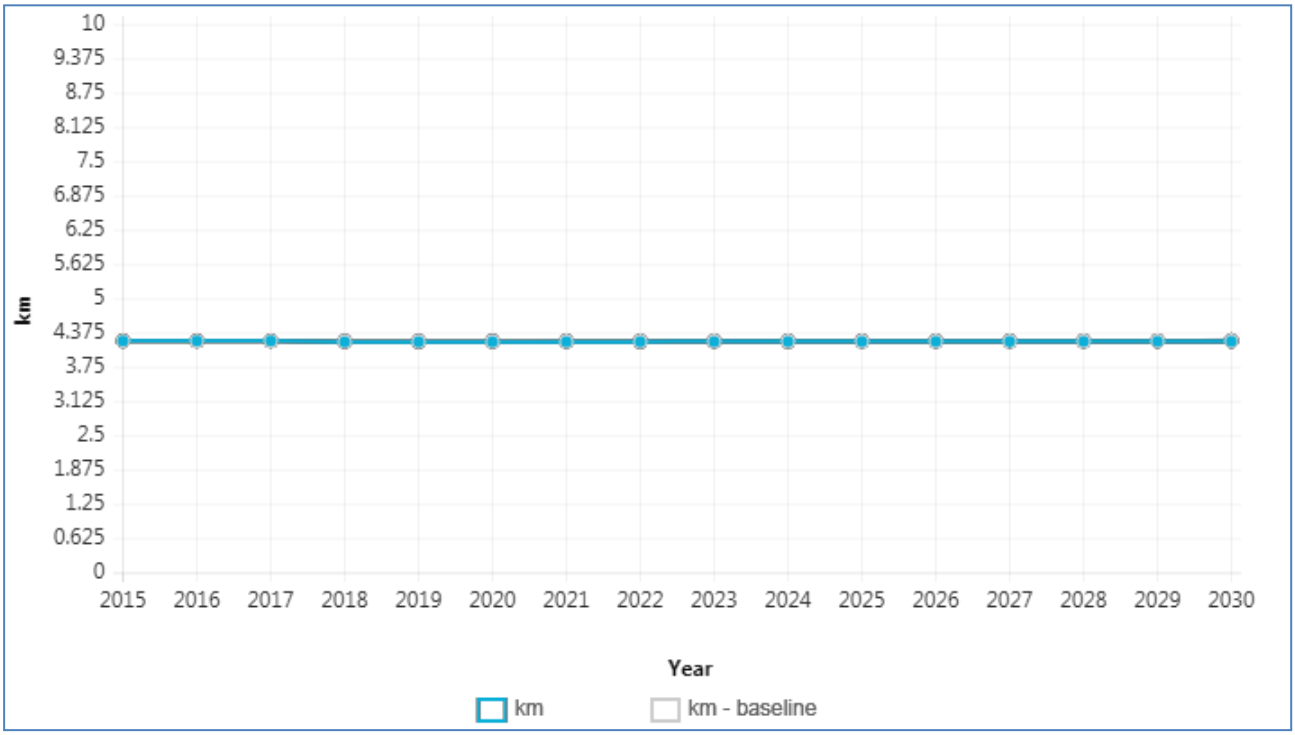

Figure 22. Travel distance per trip - SCENARIO 2: Implementation of alternative measures by local authorities

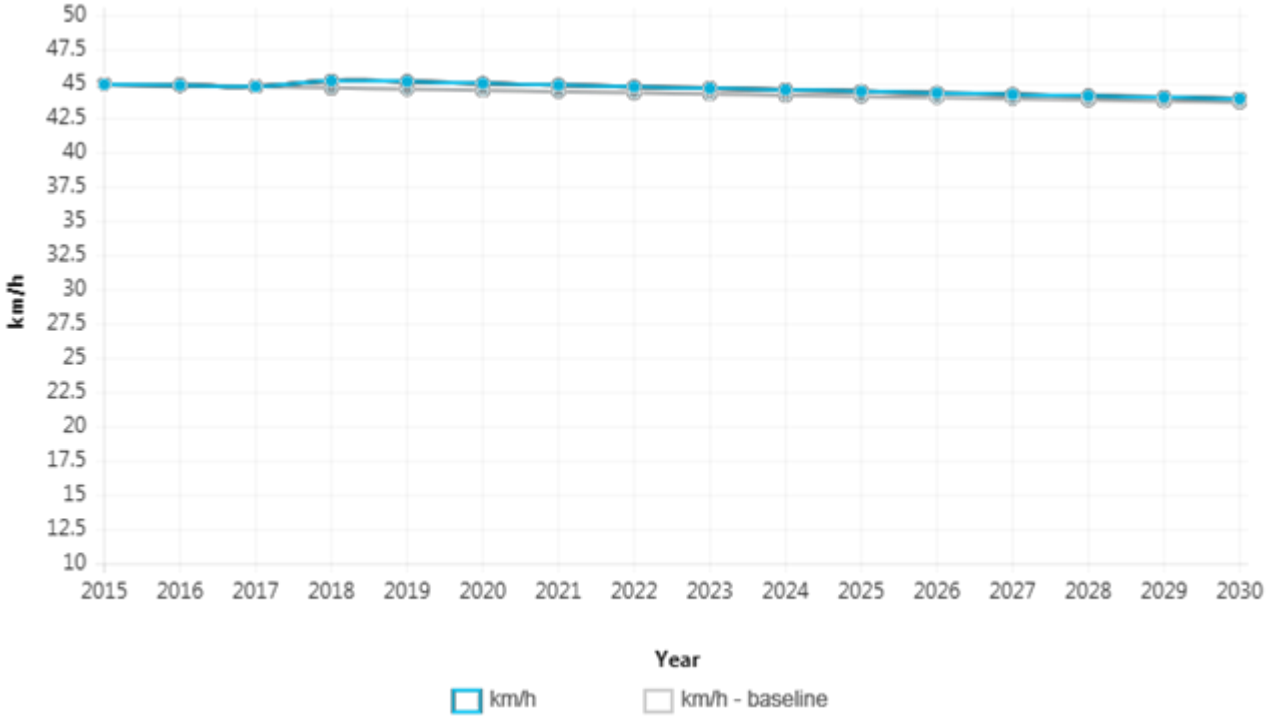

Figure 23. Average car speed in peak hours - SCENARIO 2: Implementation of alternative measures by local authorities

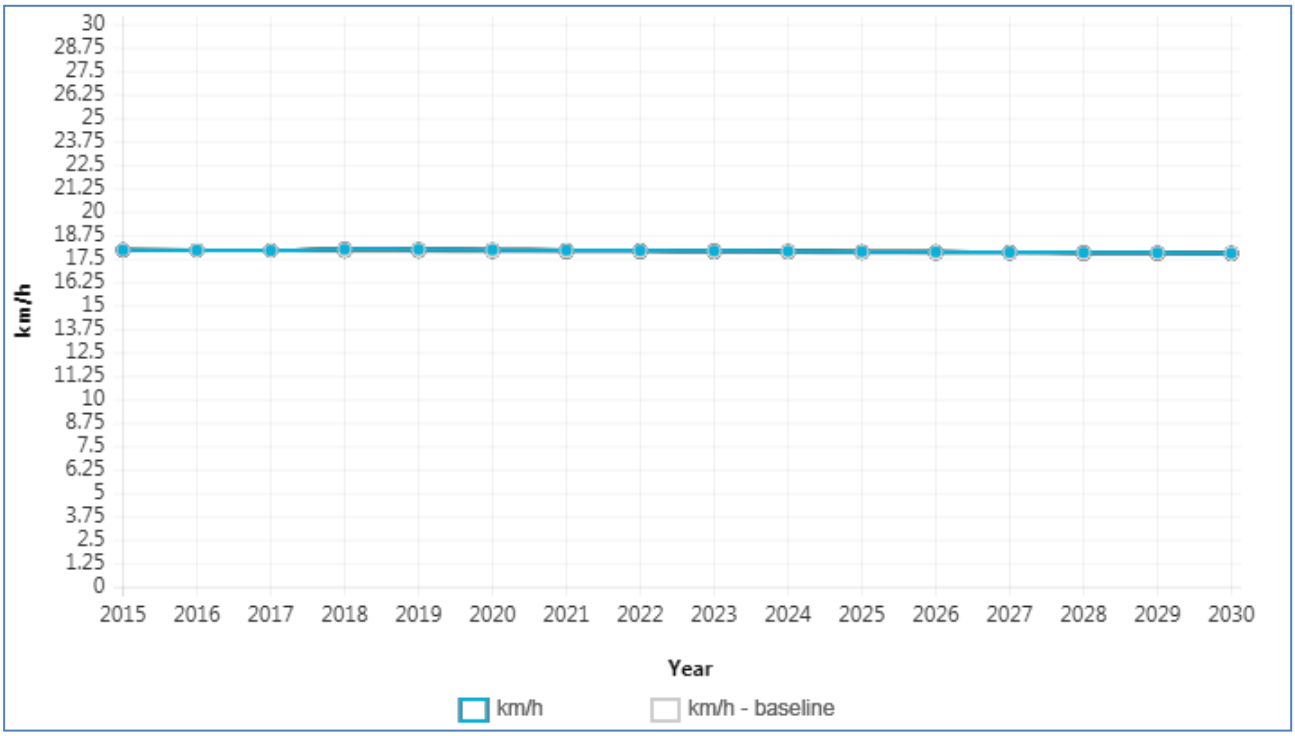

Figure 24. Average bus speed in peak hours - SCENARIO 2: Implementation of alternative measures by local authorities

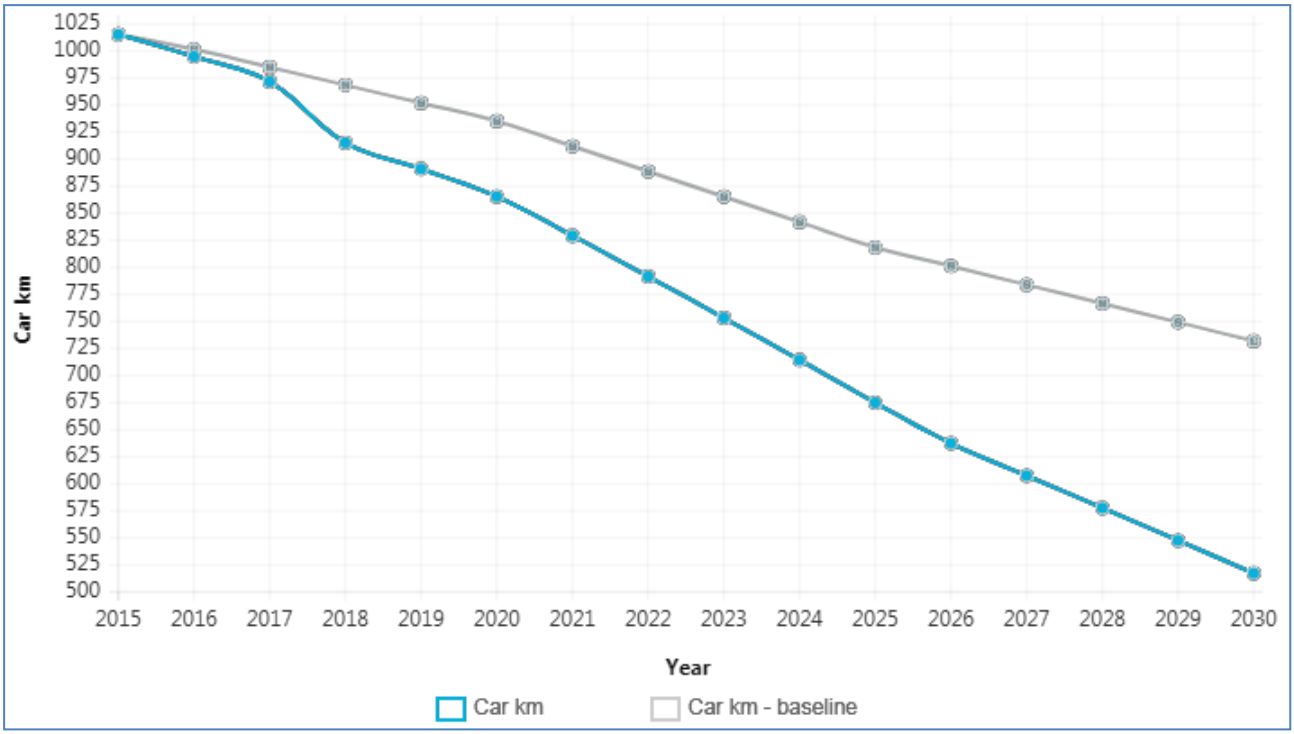

Figure 25. Vehicles-km by car conventional vehicles - SCENARIO 2: Implementation of alternative measures by local authorities

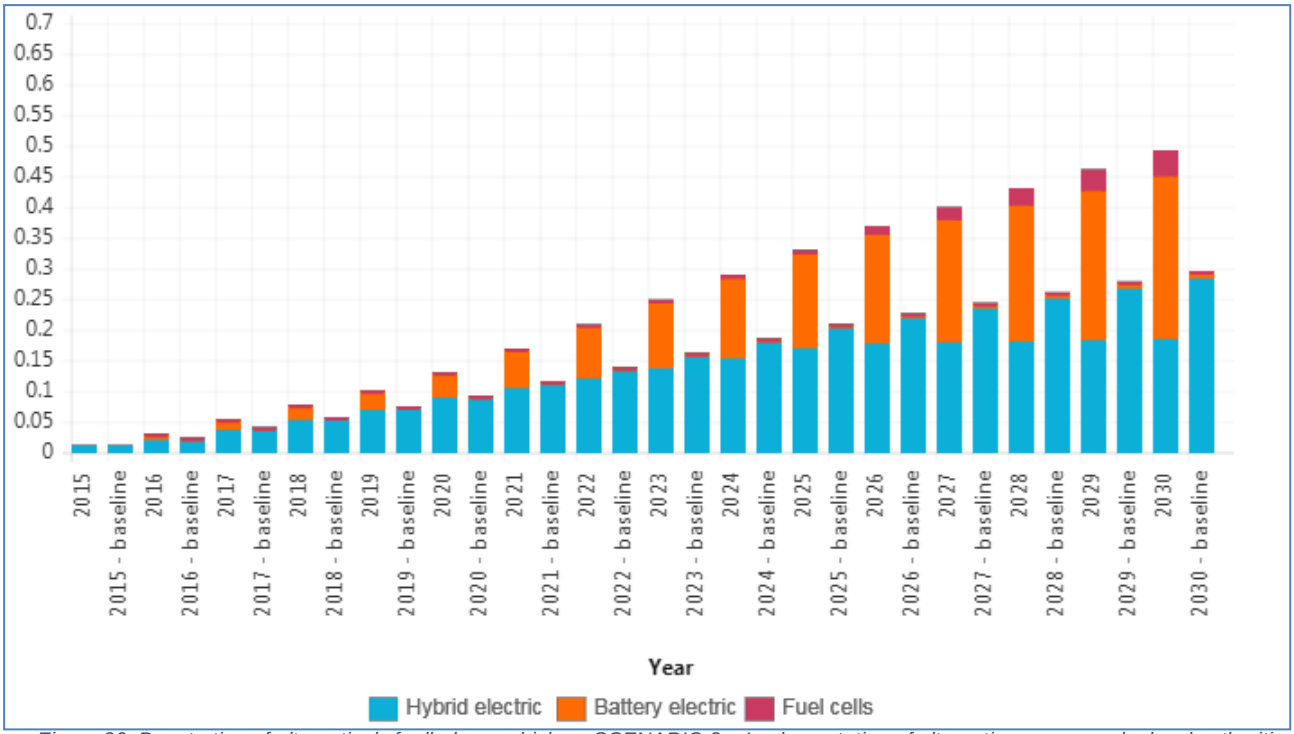

Figure 26. Penetration of alternatively fuelled car vehicles - SCENARIO 2: Implementation of alternative measures by local authorities

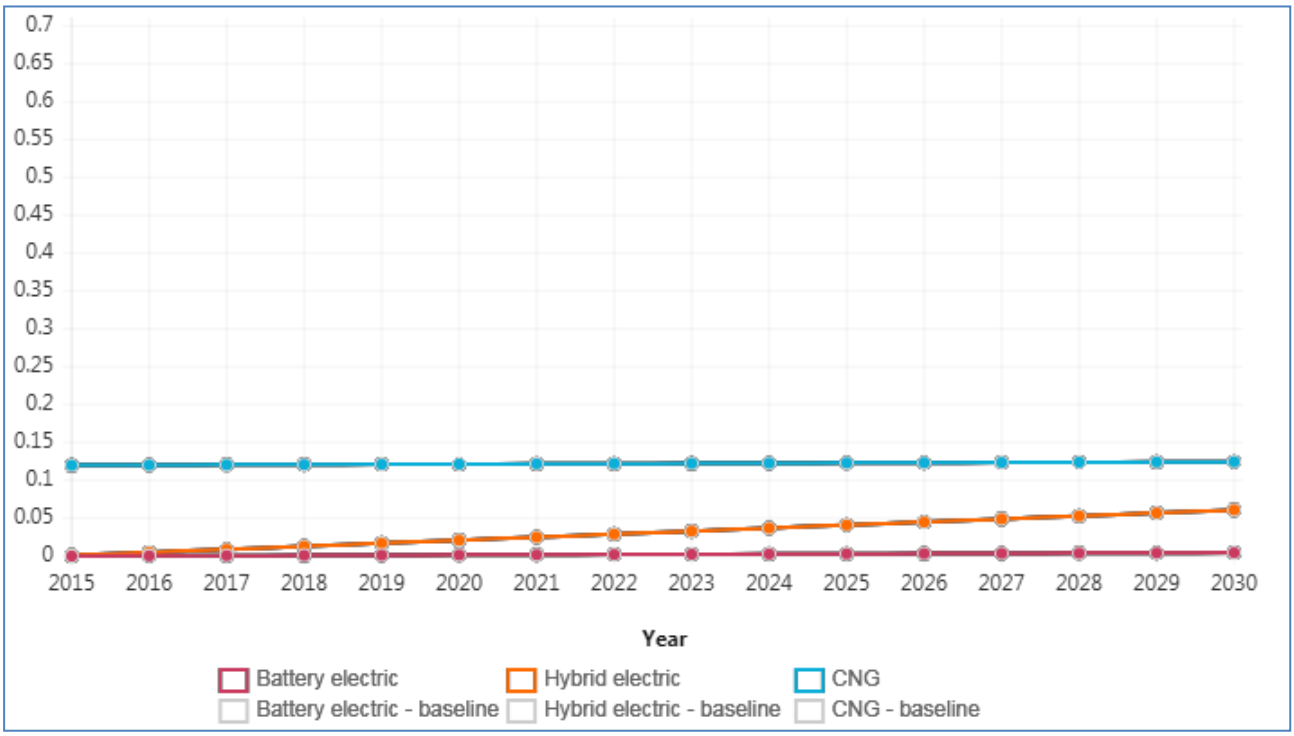

Figure 27. Penetration of alternatively fuelled bus vehicles - SCENARIO 2: Implementation of alternative measures by local authorities

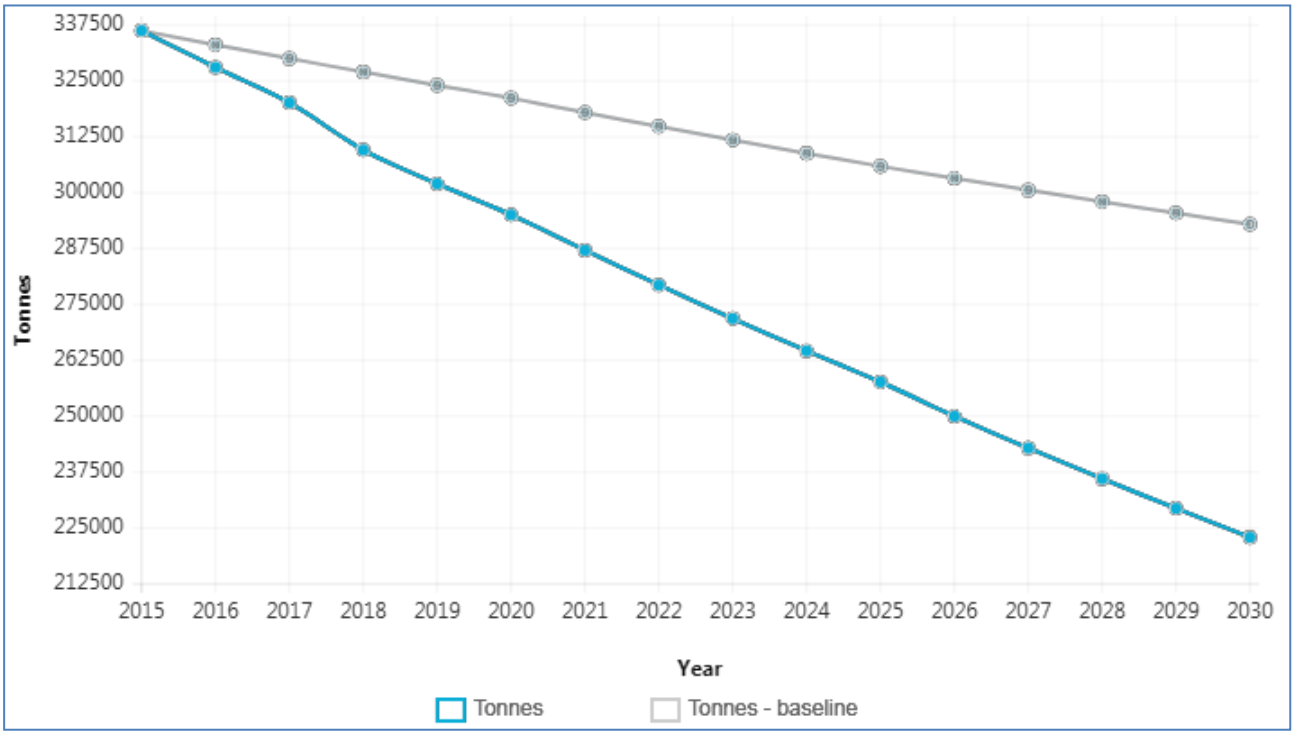

Figure 28. CO_2 emissions per year (tonnes) - SCENARIO 2: Implementation of alternative measures by local authorities

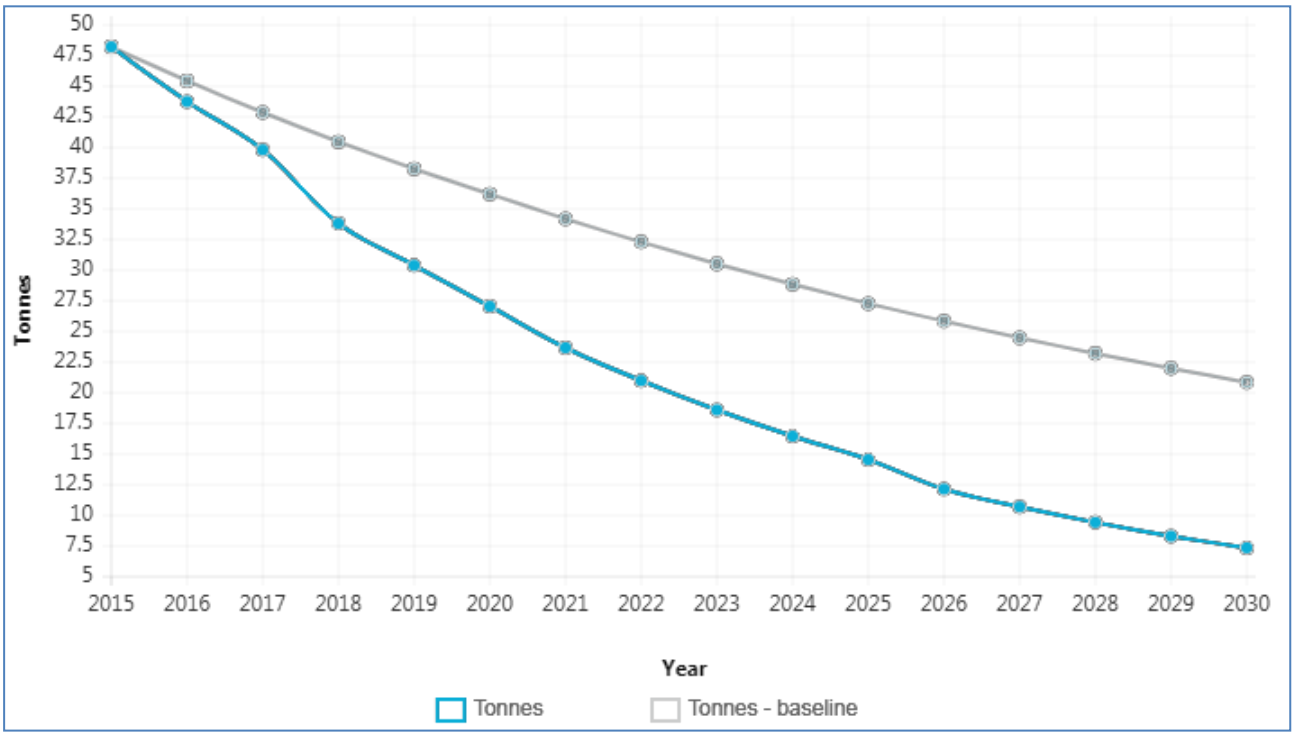

Figure 29. PM emissions per year (tonnes) - SCENARIO 2: Implementation of alternative measures by local authorities

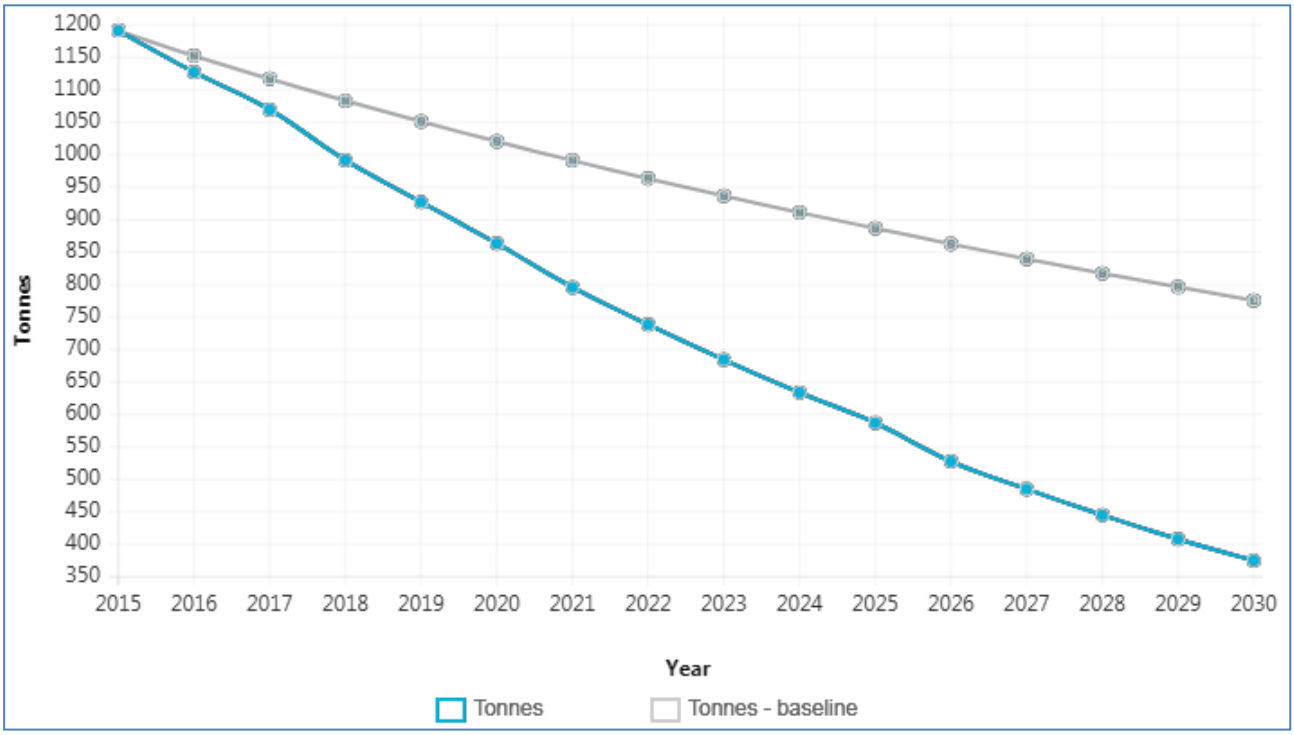

Figure 30. CO emissions per year (tonnes) - SCENARIO 2: Implementation of alternative measures by local authorities

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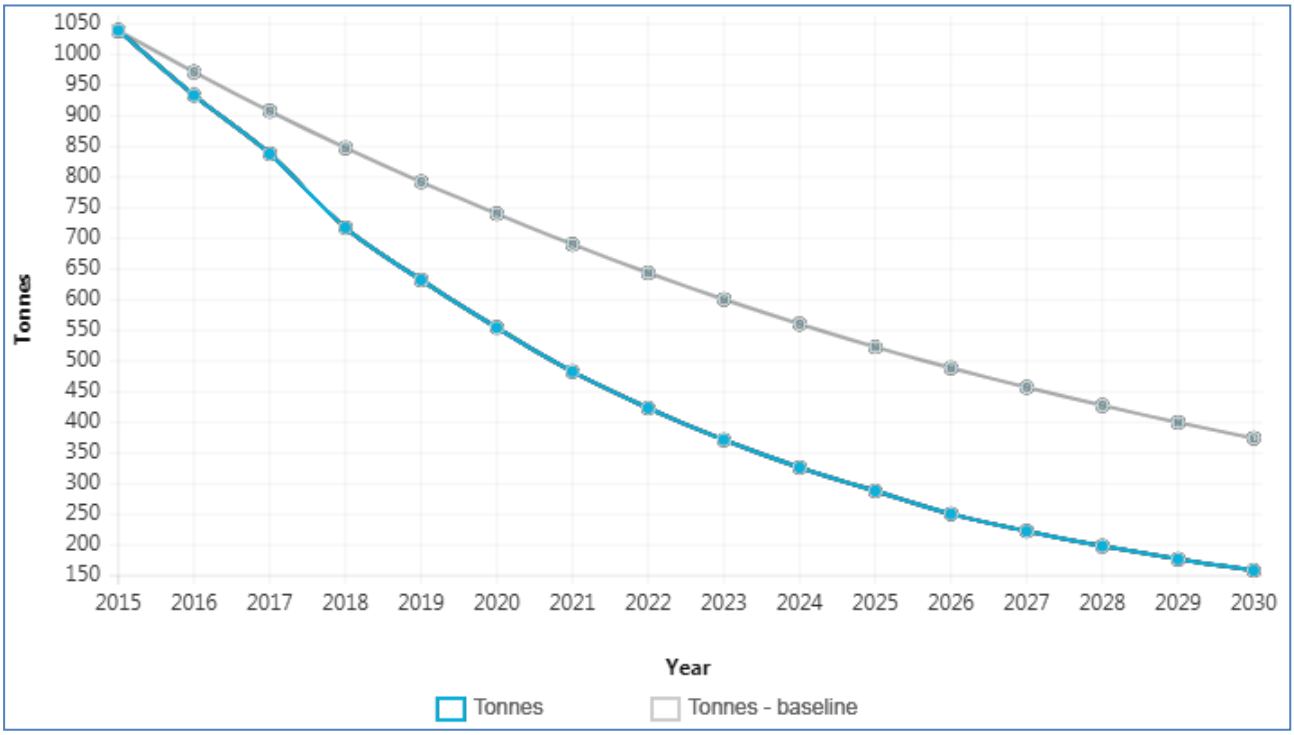

Figure 31. NO_x emissions per year (tonnes) - SCENARIO 2: Implementation of alternative measures by local authorities

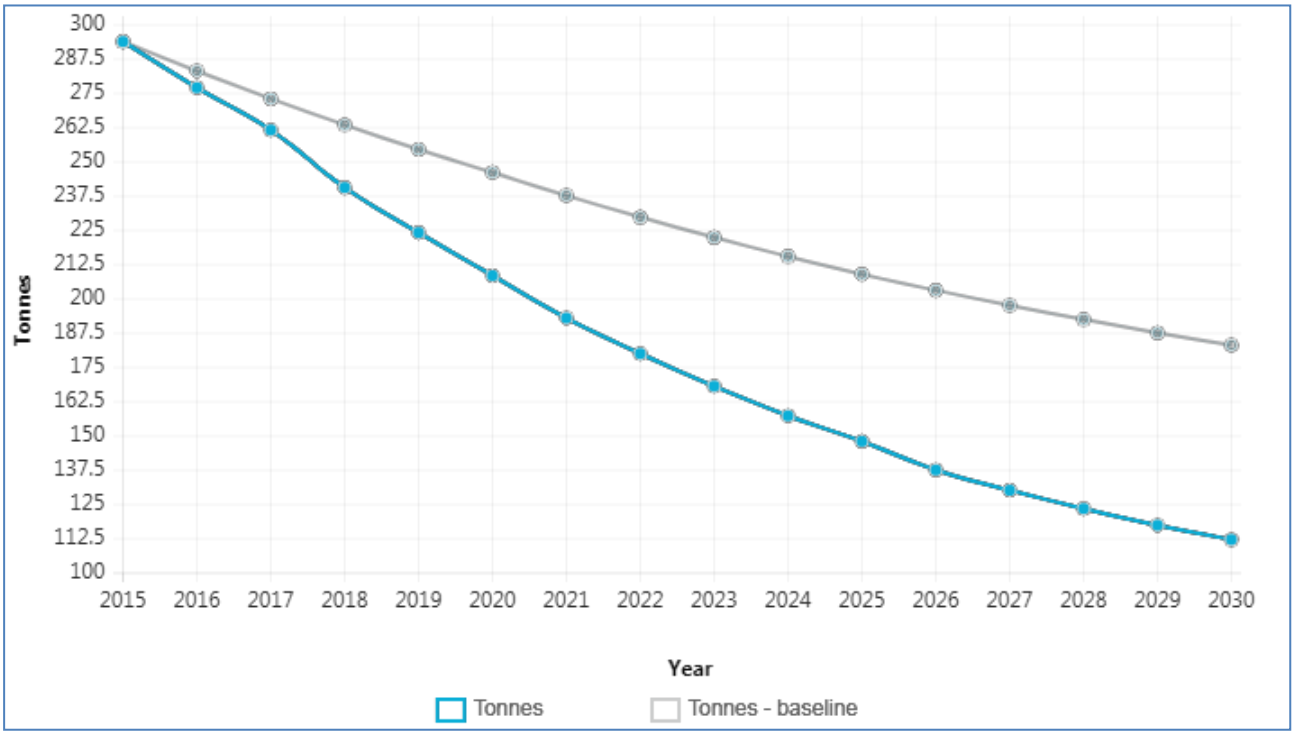

Figure 32. VOC emissions per year (tonnes) - SCENARIO 2: Implementation of alternative measures by local authorities

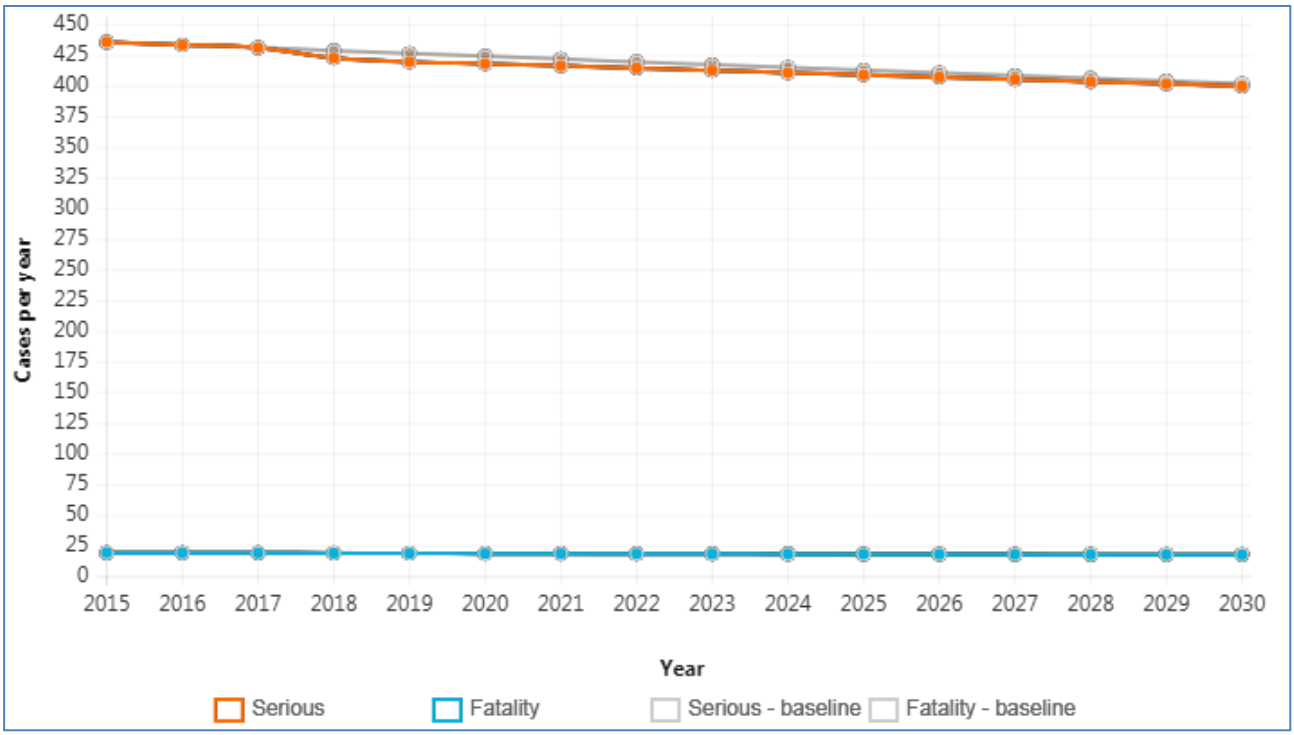

Figure 33. Total Accidents by severity - SCENARIO 2: Implementation of alternative measures by local authorities

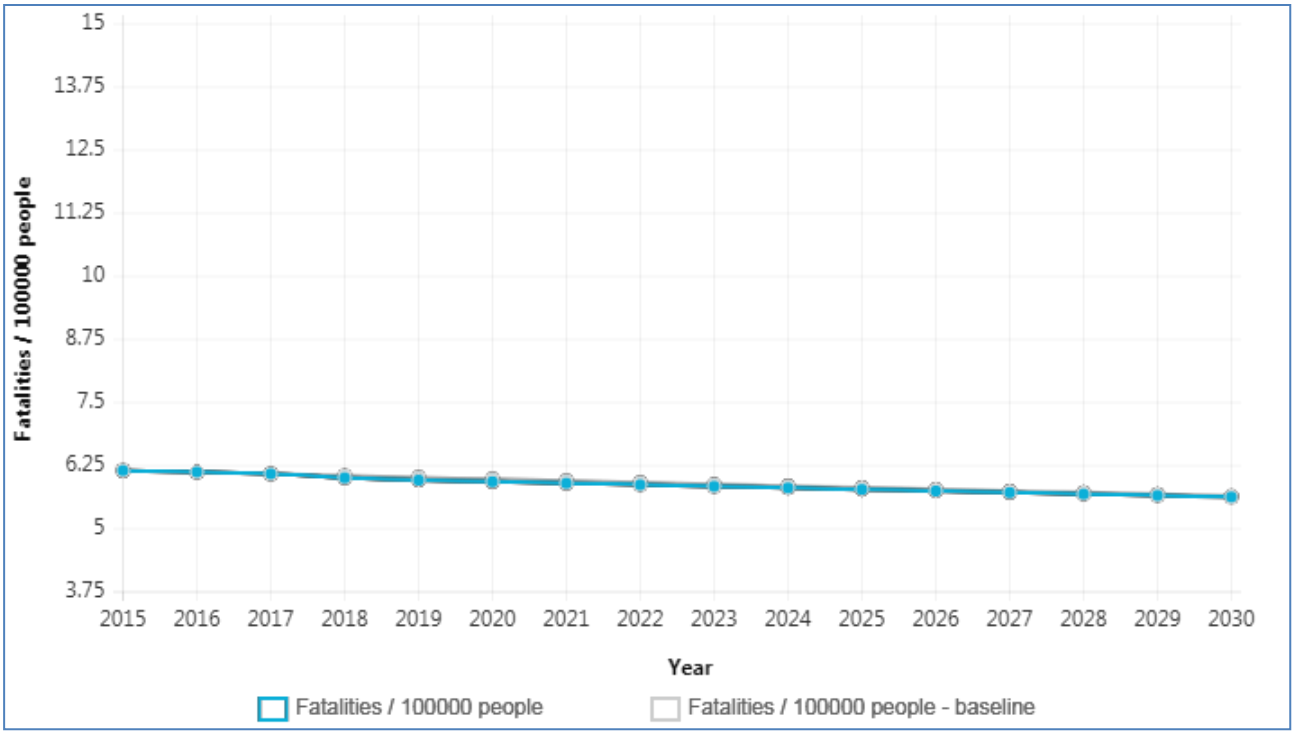

Figure 34. Fatalities per 100,000 inhabitants - SCENARIO 2: Implementation of alternative measures by local authorities

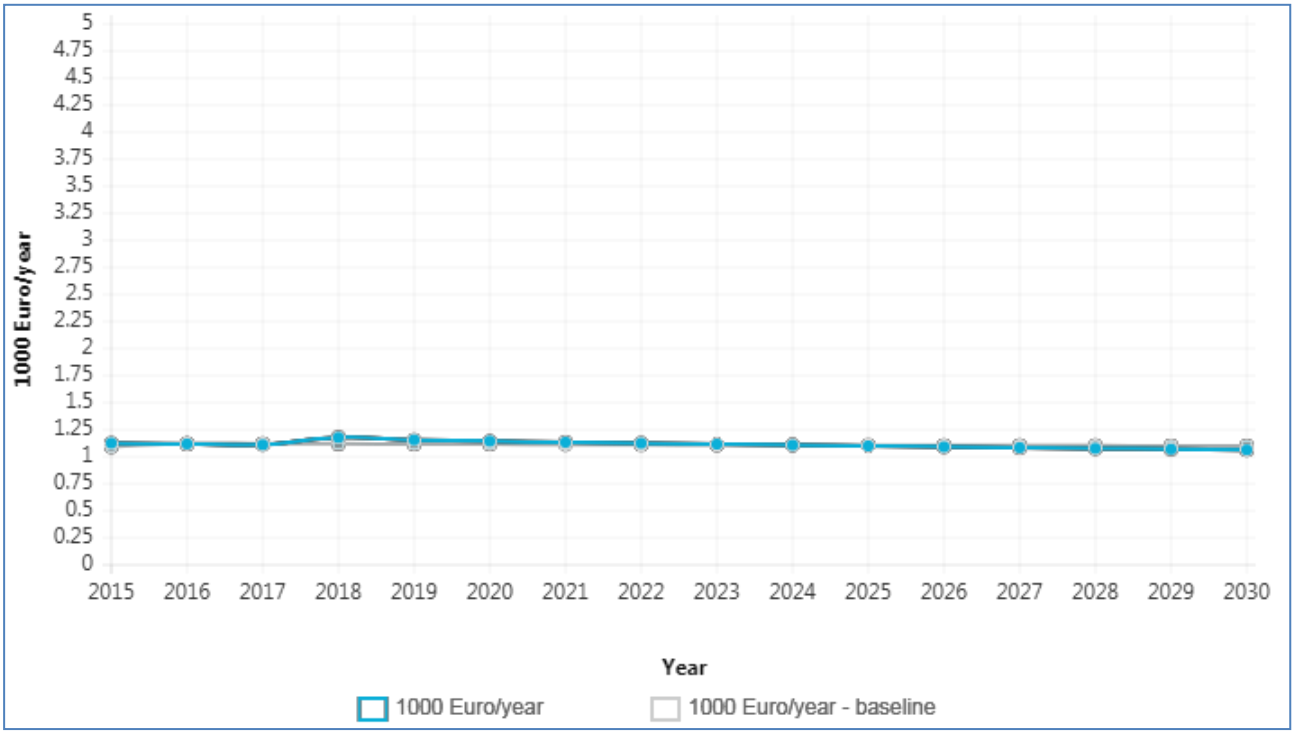

Figure 35. Transport expenditure per individual per year (1000€/year) - SCENARIO 2: Implementation of alternative measures by local authorities

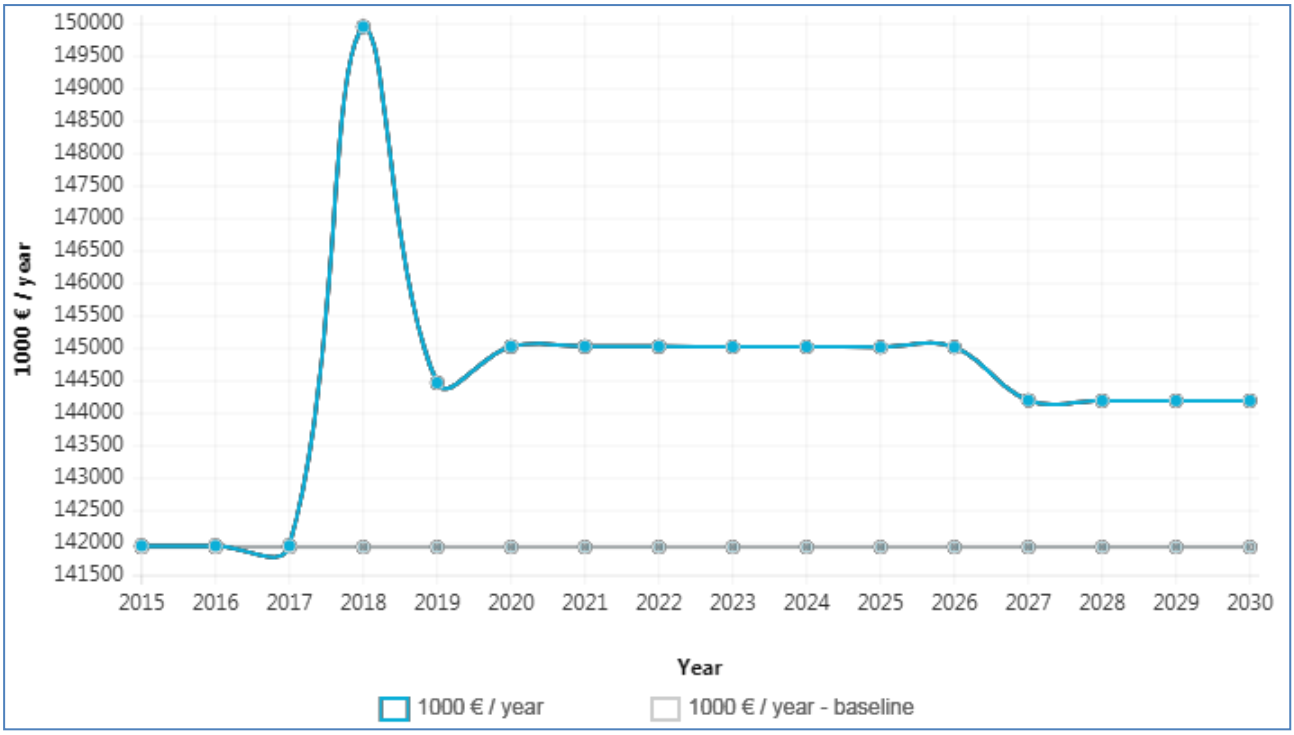

Figure 36. Transport expenditure of public administration (1000€/year) - SCENARIO 2: Implementation of alternative measures by local authorities

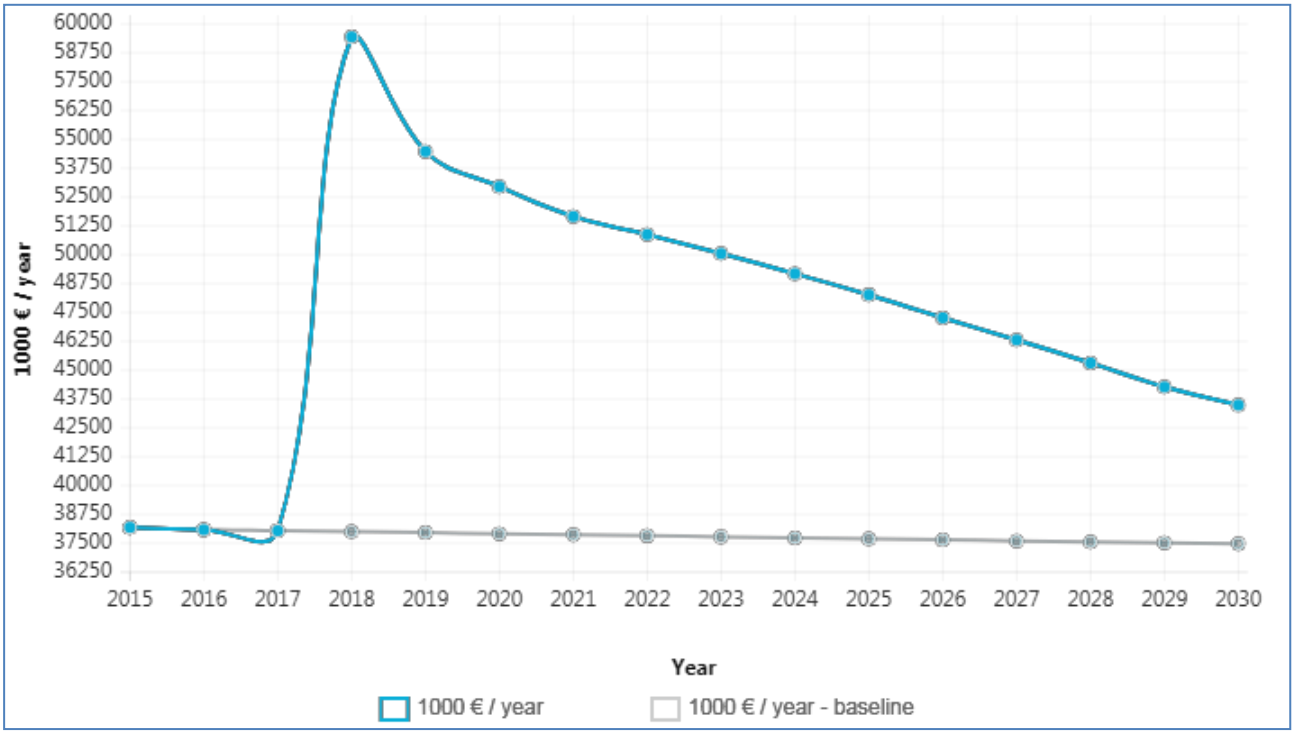

Figure 37. Revenues of public administration (1000€/year) - SCENARIO 2: Implementation of alternative measures by local authorities

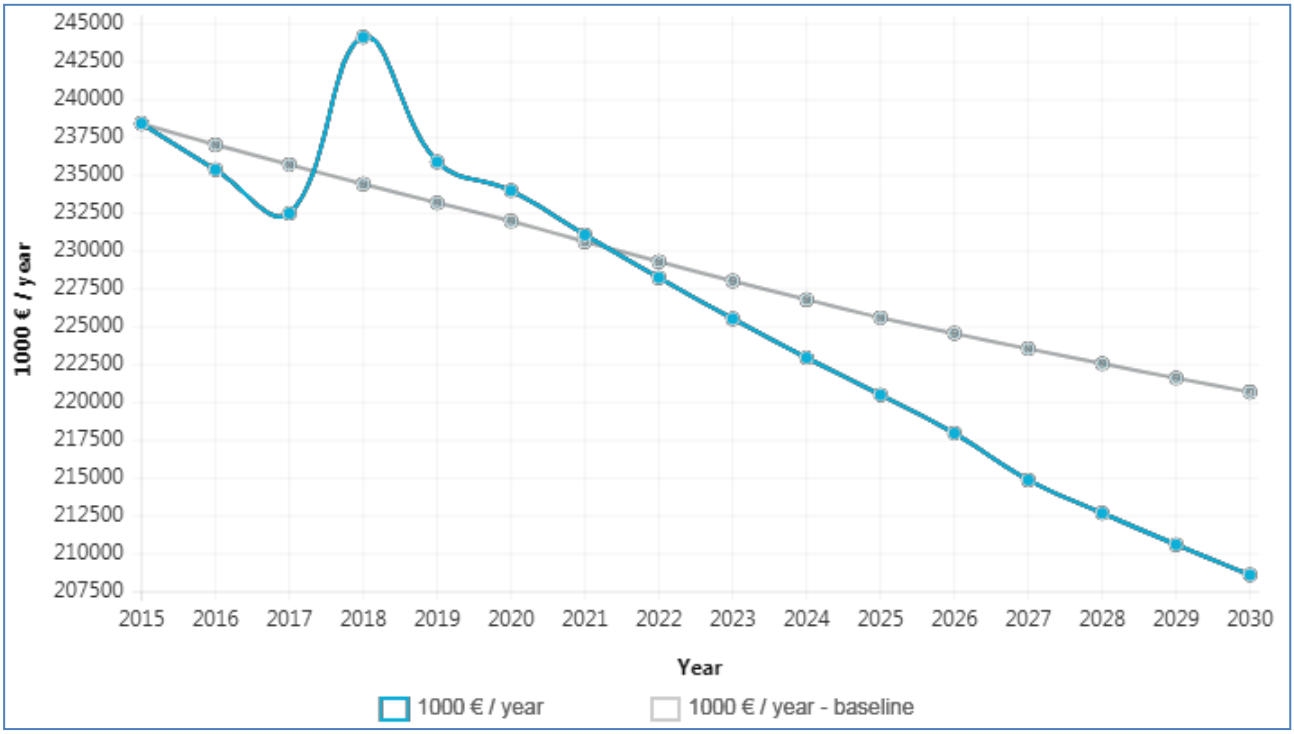

Figure 38. Transport social monetary costs (1000€/year) - SCENARIO 2: Implementation of alternative measures by local authorities

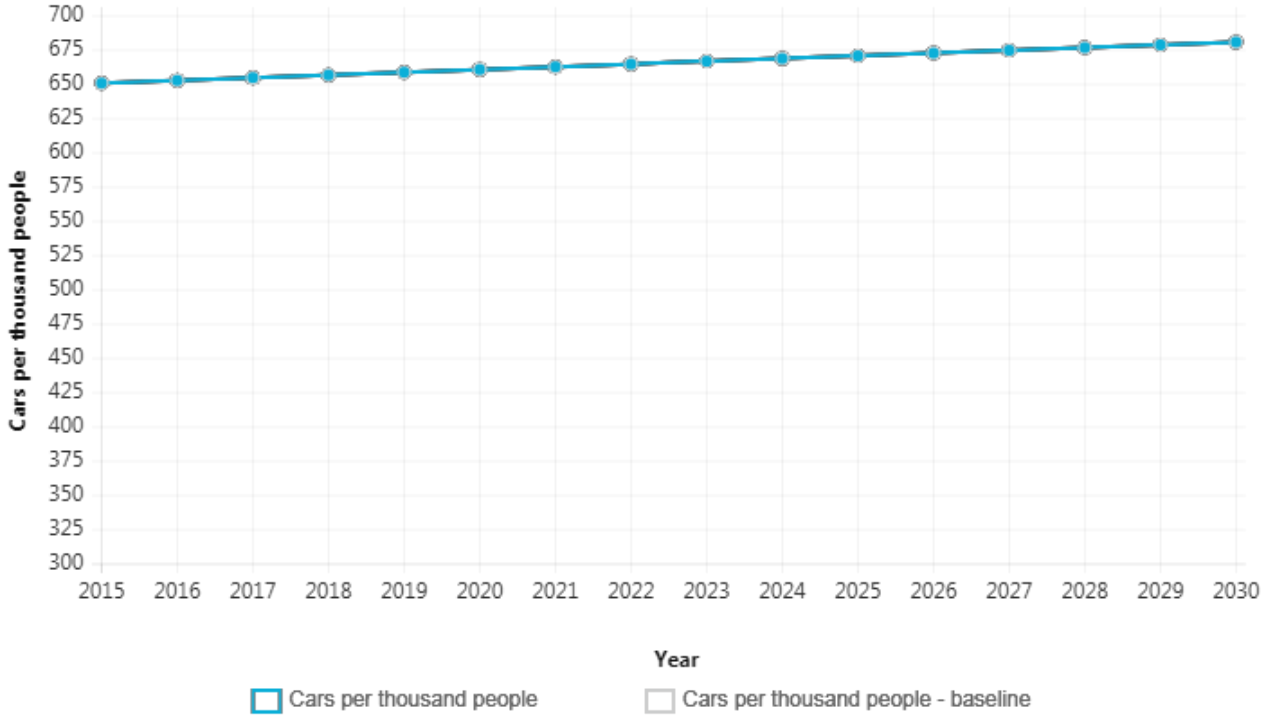

Figure 39. Motorisation rate - SCENARIO 3: I ncreasing of energy and fuel costs

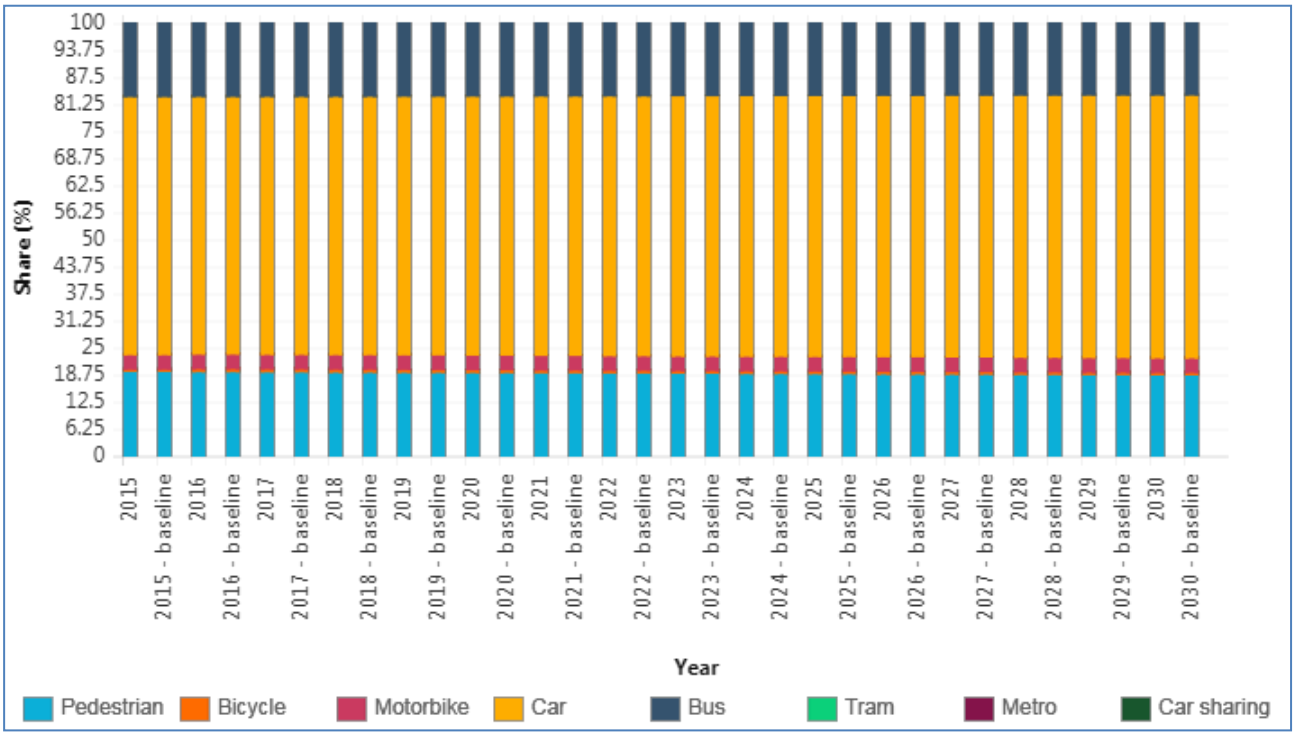

Figure 40. Mode split - SCENARIO 3: Increasing of energy and fuel costs

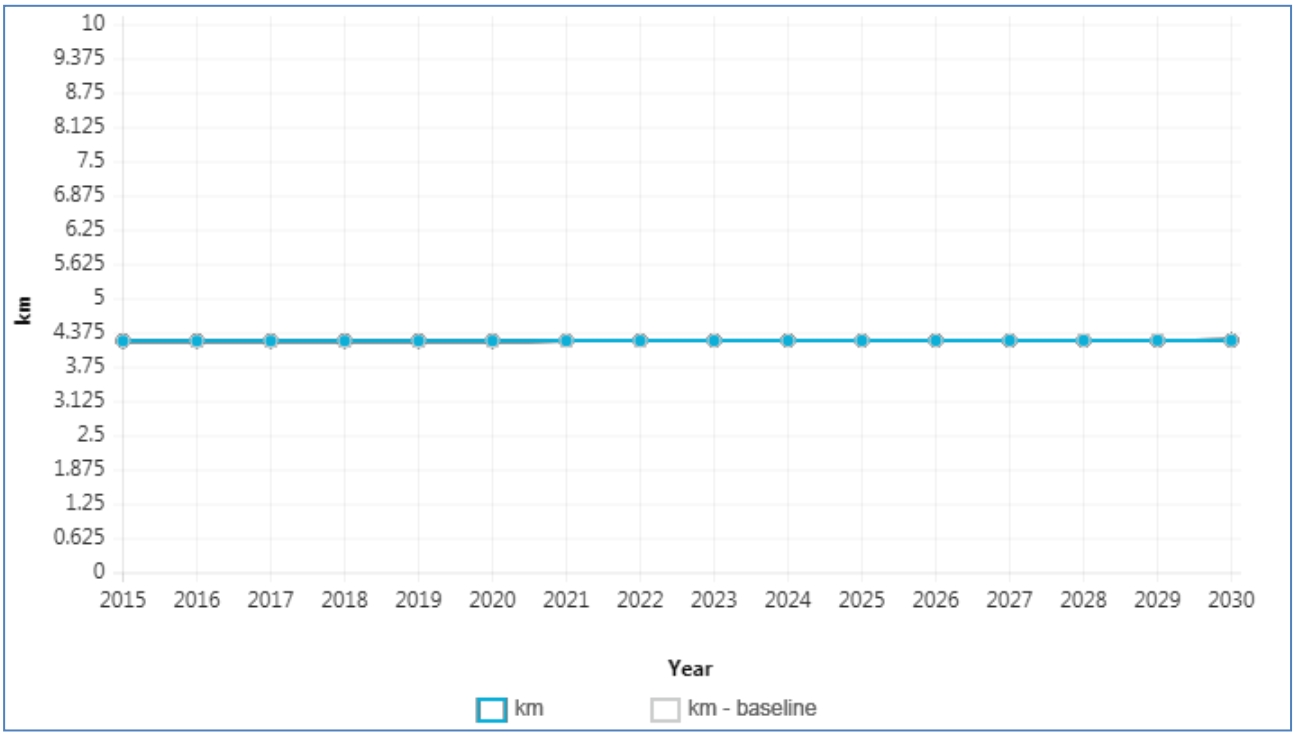

Figure 41. Travel distance per trip - SCENARIO 3: Increasing of energy and fuel costs

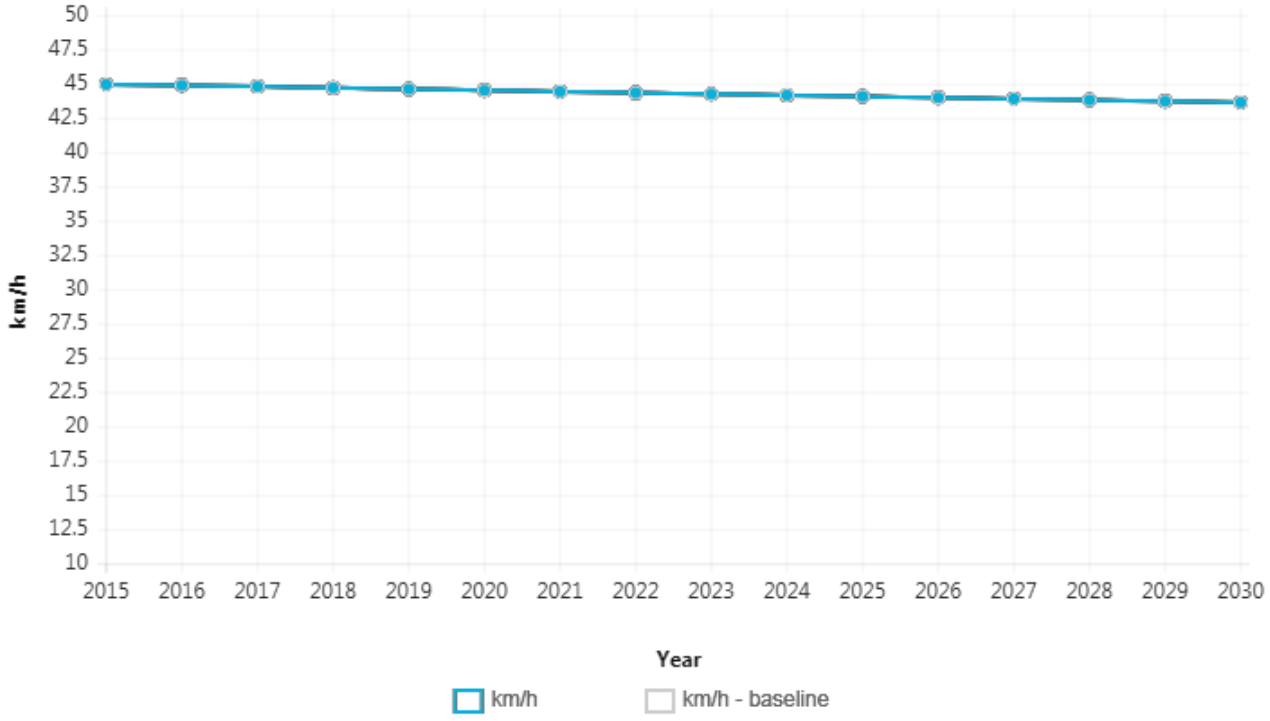

Figure 42. Average car speed in peak hours - SCENARIO 3: Increasing of energy and fuel costs

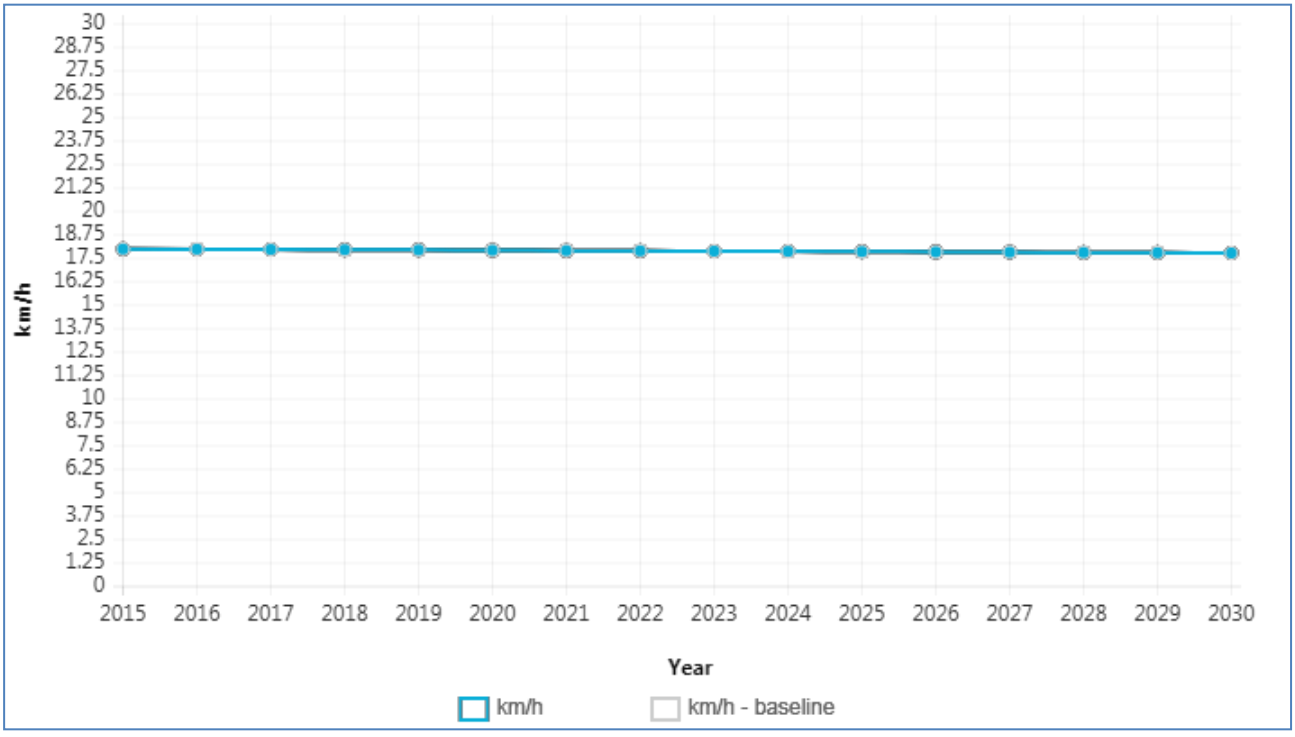

Figure 43. Average bus speed in peak hours - SCENARIO 3: Increasing of energy and fuel costs

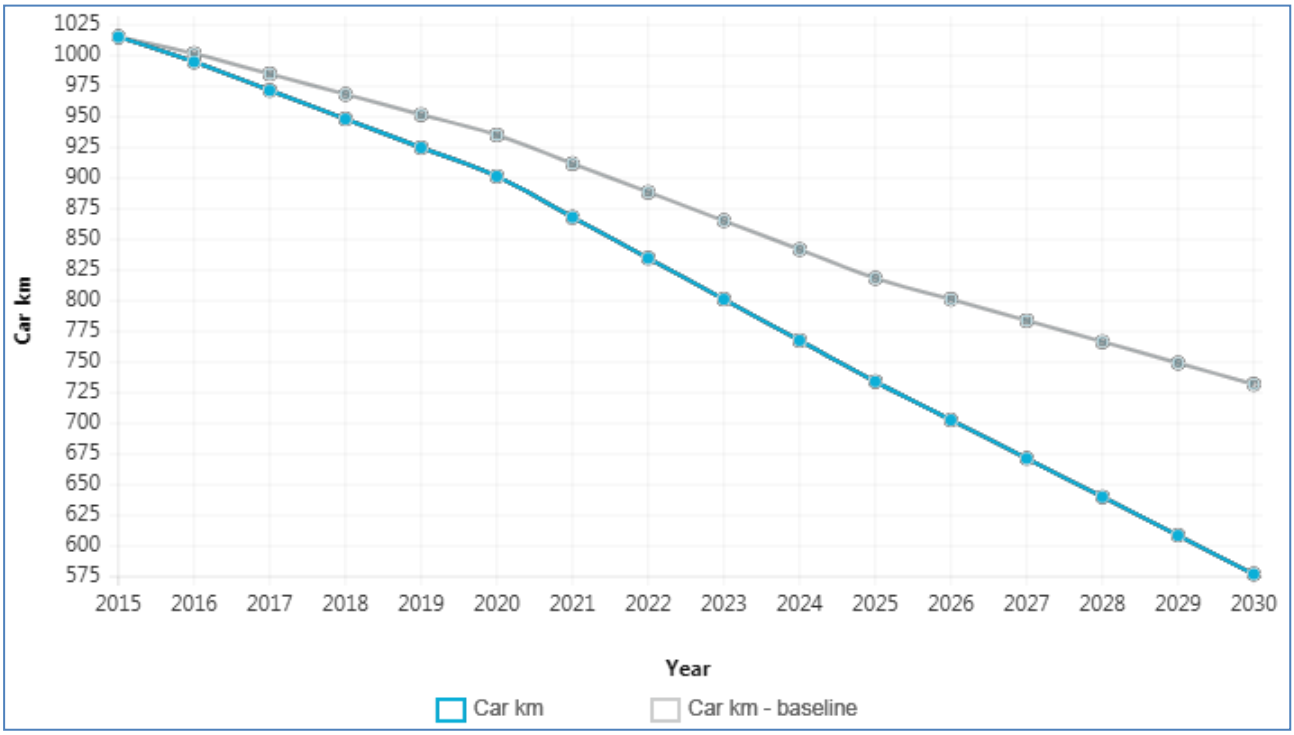

Figure 44. Vehicles-km by car conventional vehicles - SCENARIO 3: Increasing of energy and fuel costs

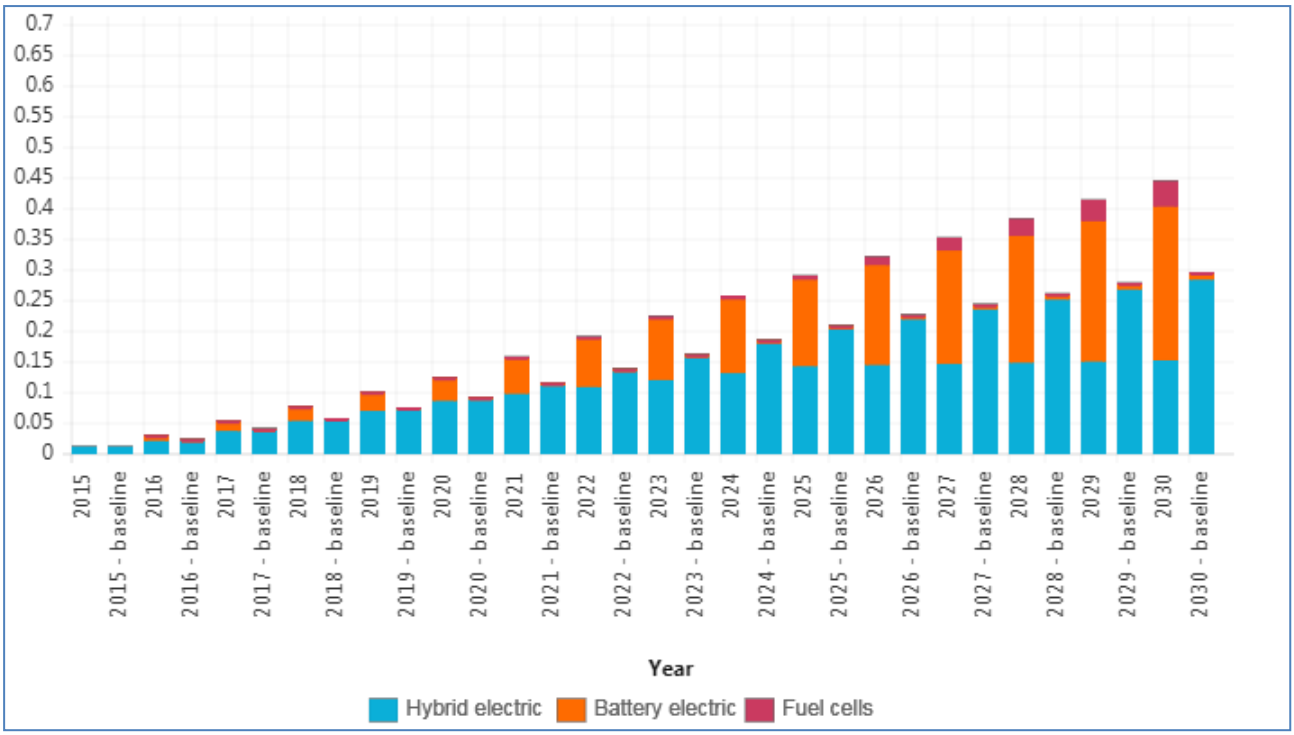

Figure 45. Penetration of alternatively fuelled car vehicles - SCENARIO 3: Increasing of energy and fuel costs

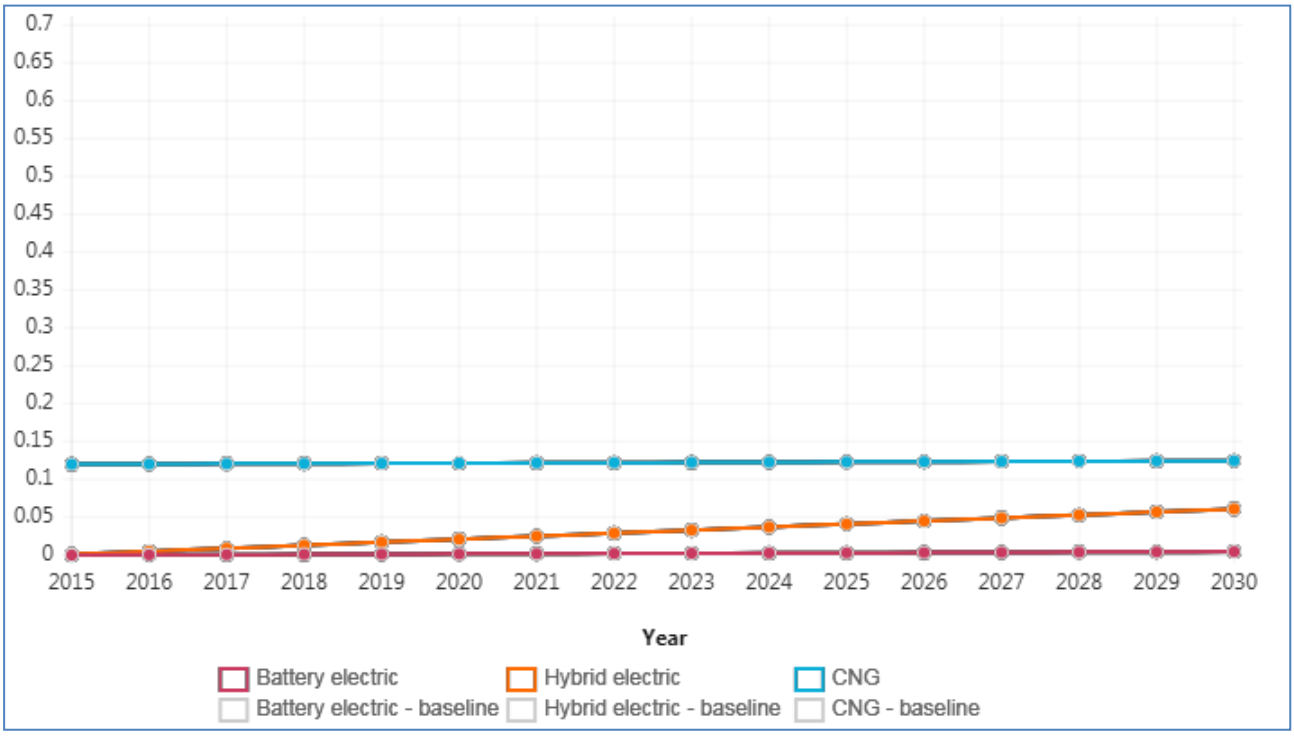

Figure 46. Penetration of alternatively fuelled bus vehicles - SCENARIO 3: Increasing of energy and fuel costs

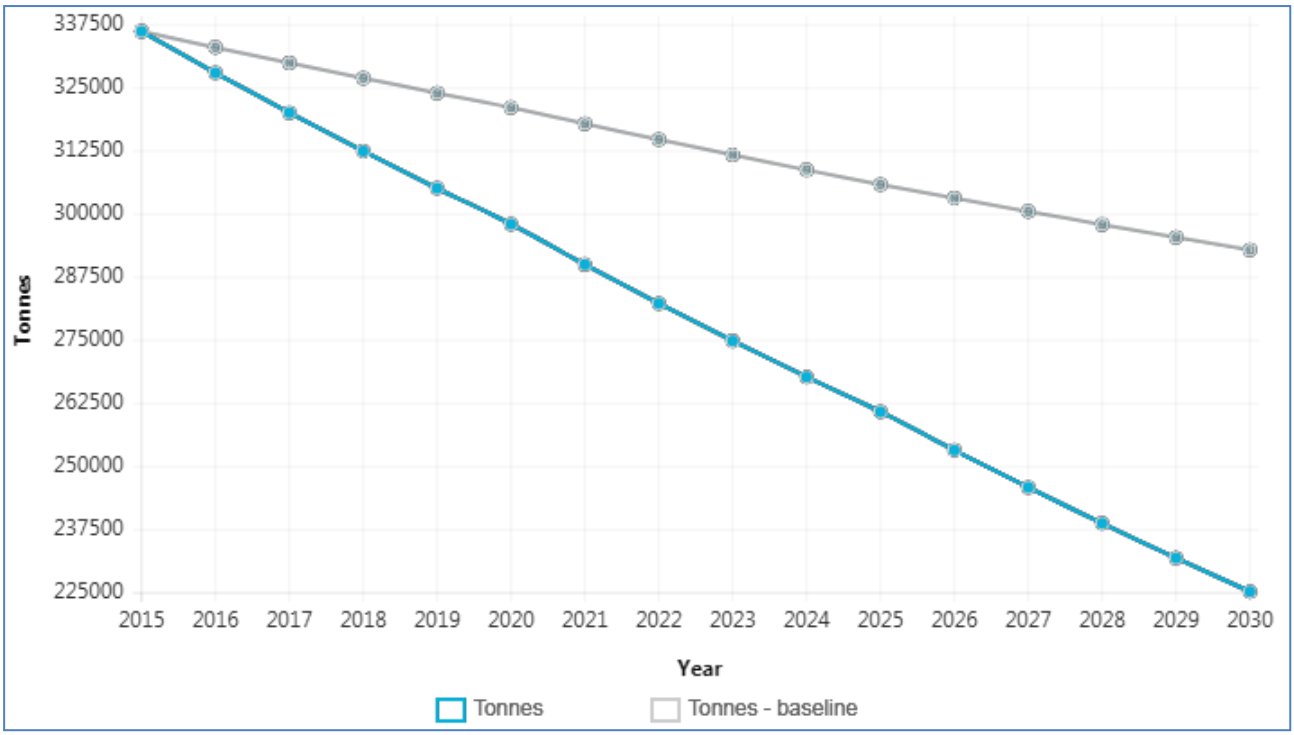

Figure 47. CO_2 emissions per year (tonnes) - SCENARIO 3: Increasing of energy and fuel costs

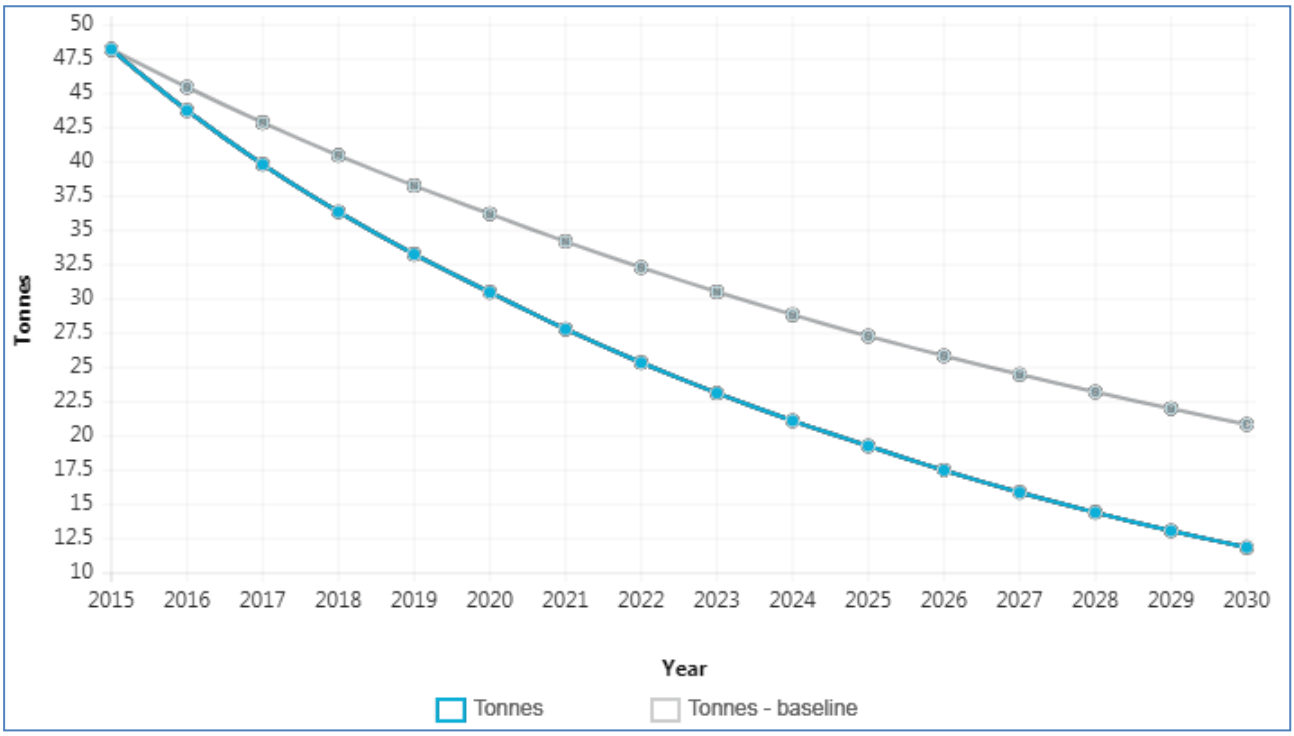

Figure 48. PM emissions per year (tonnes) - SCENARIO 3: Increasing of energy and fuel costs

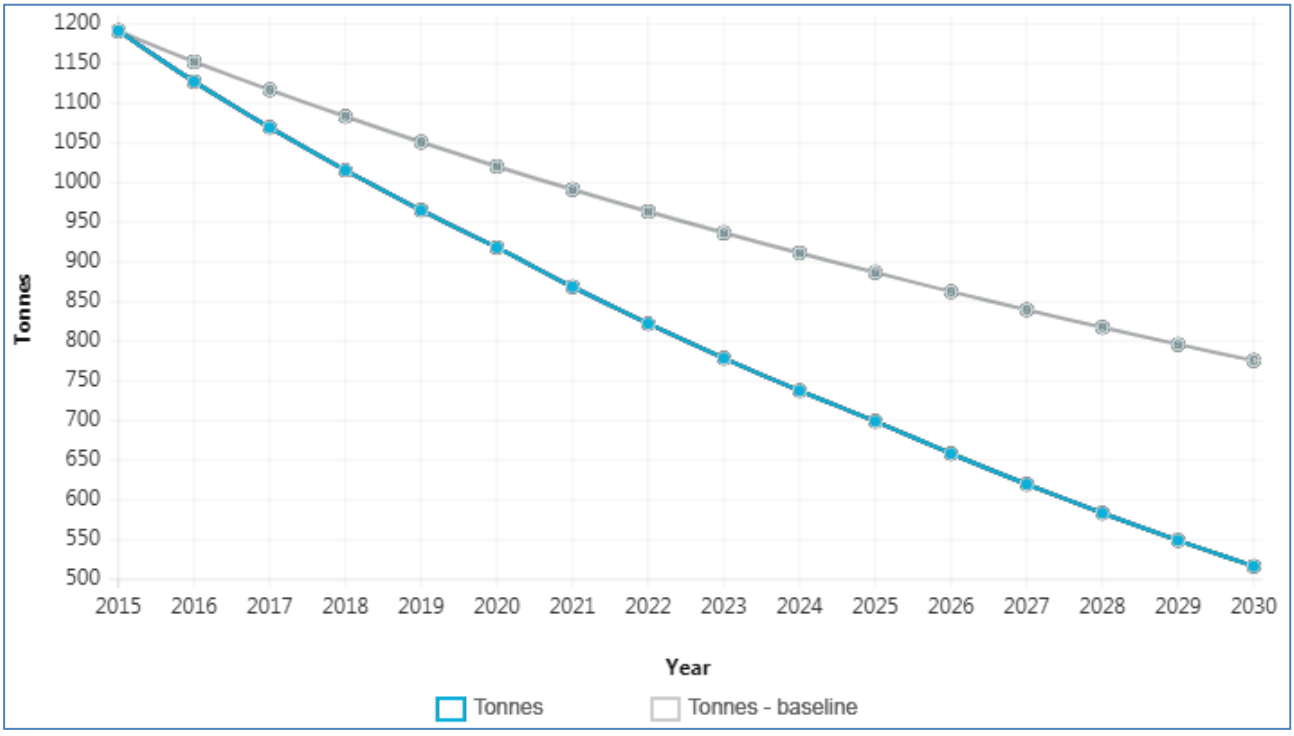

Figure 49. CO emissions per year (tonnes) - SCENARIO 3: Increasing of energy and fuel costs

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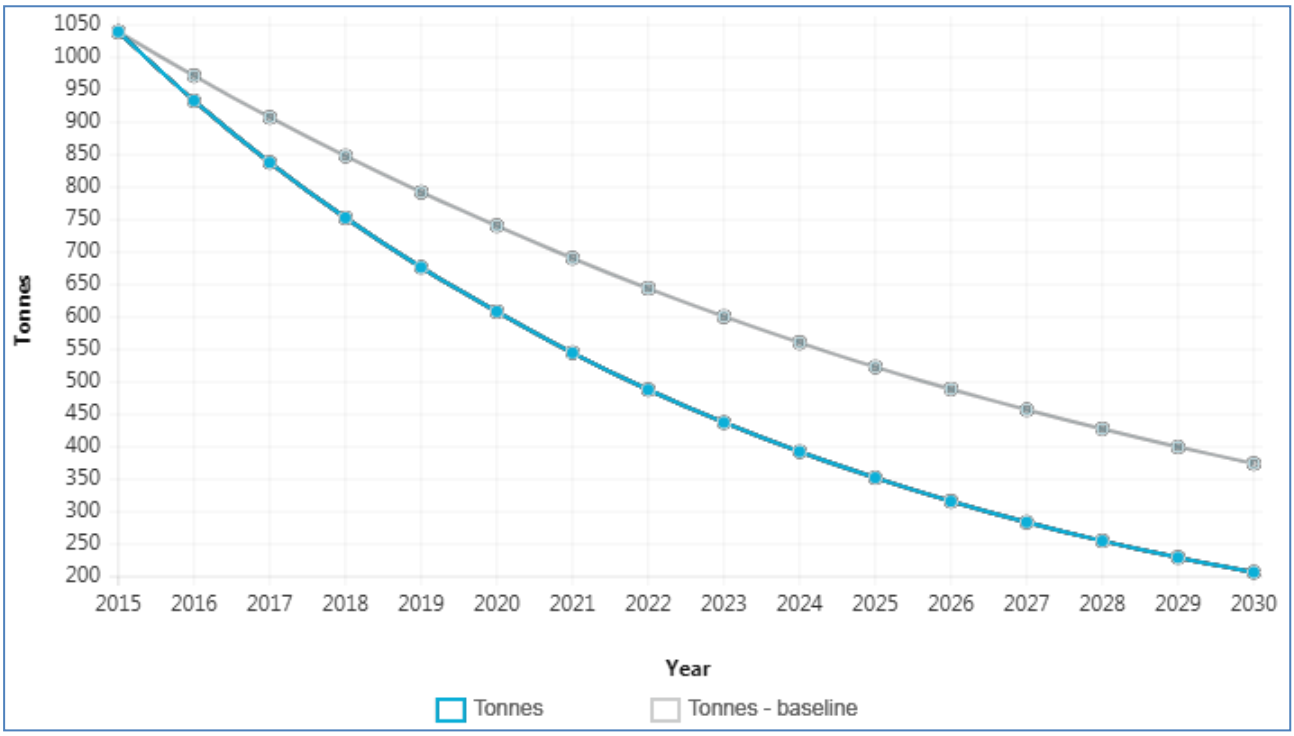

Figure 50. NO_x emissions per year (tonnes) - SCENARIO 3: Increasing of energy and fuel costs

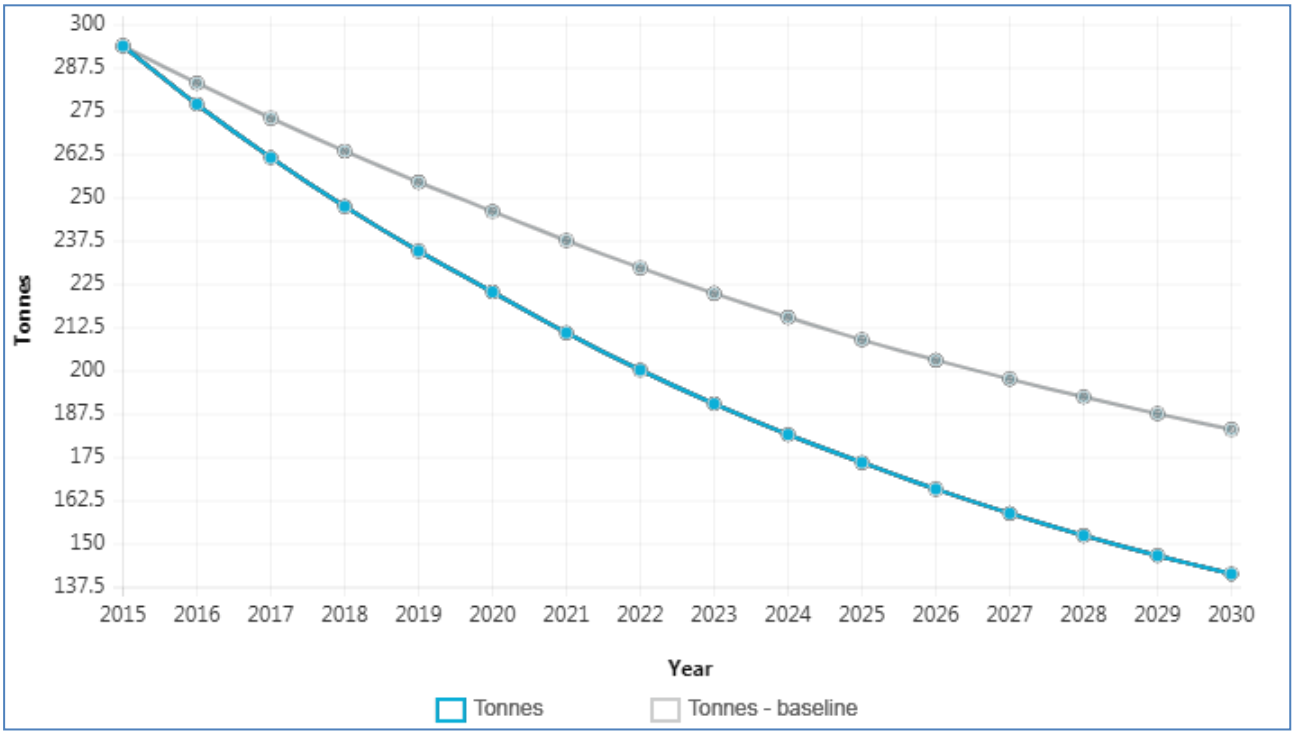

Figure 51. VOC emissions per year (tonnes) - SCENARIO 3: Increasing of energy and fuel costs

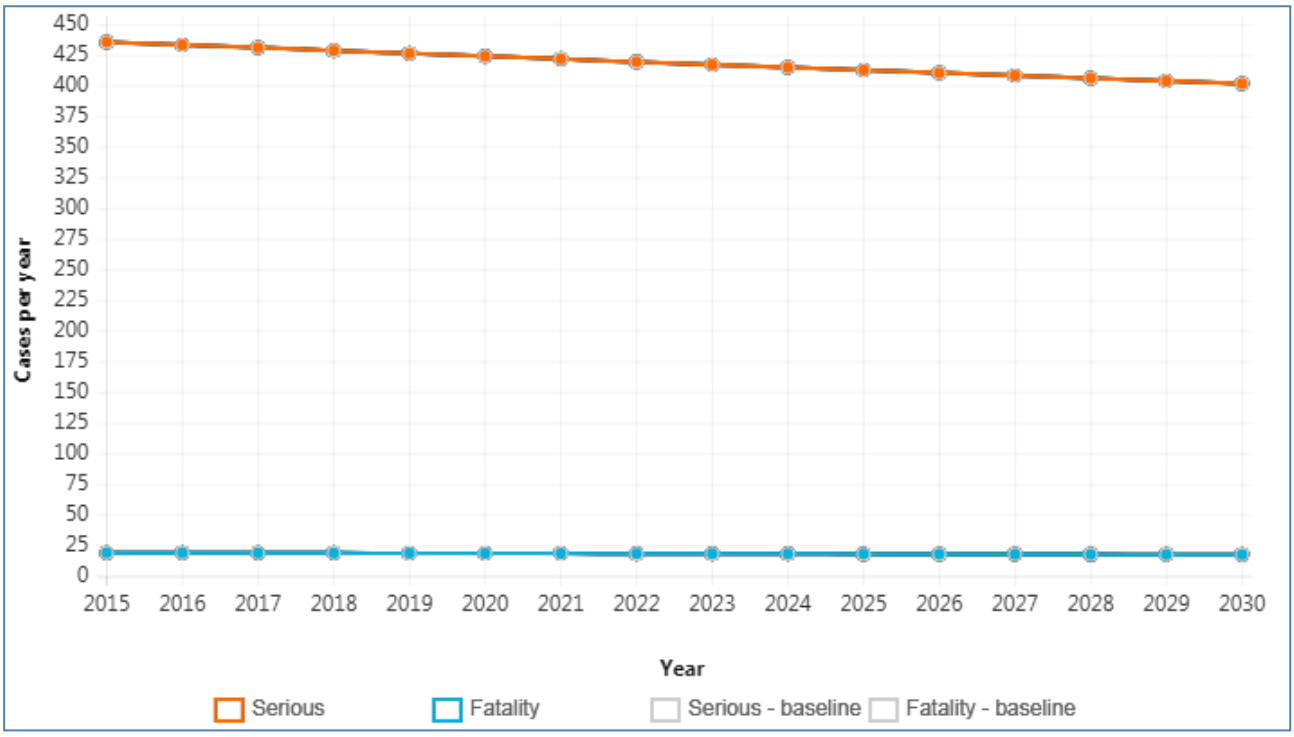

Figure 52. Total Accidents by severity - SCENARIO 3: Increasing of energy and fuel costs

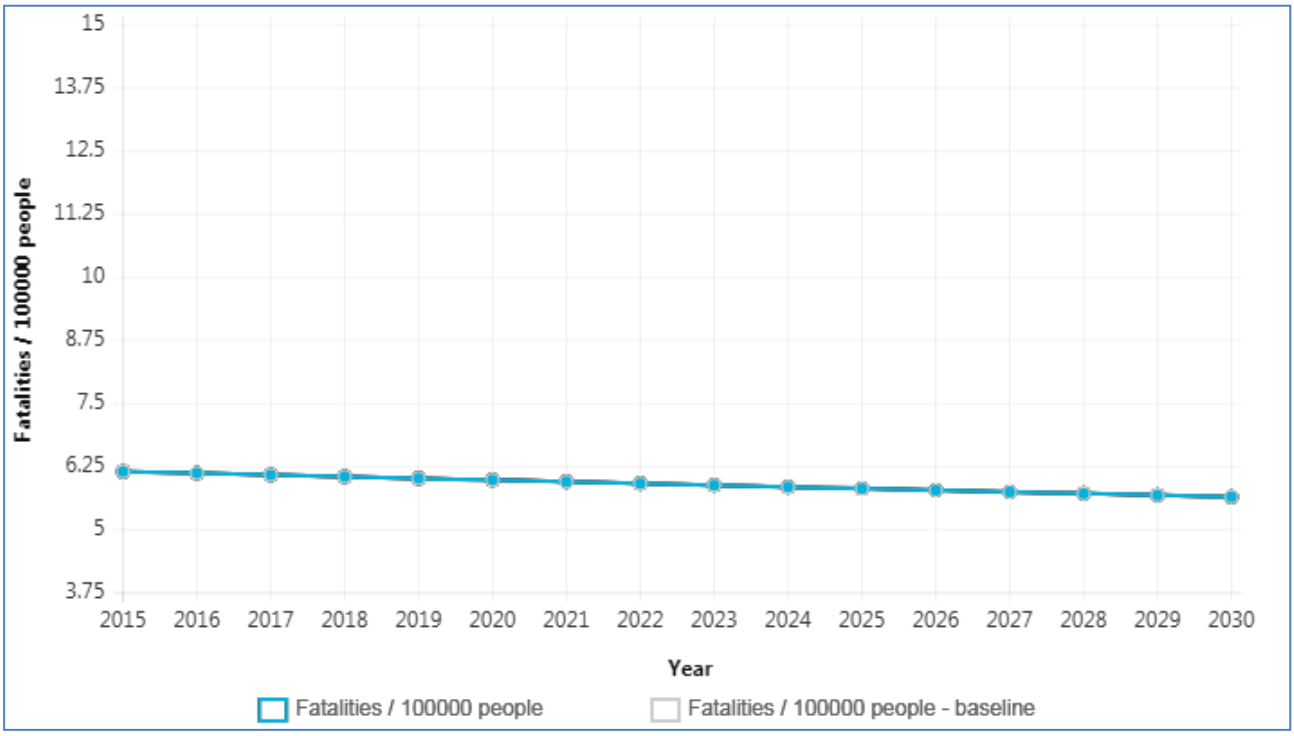

Figure 53. Fatalities per 100,000 inhabitants - SCENARIO 3: Increasing of energy and fuel costs

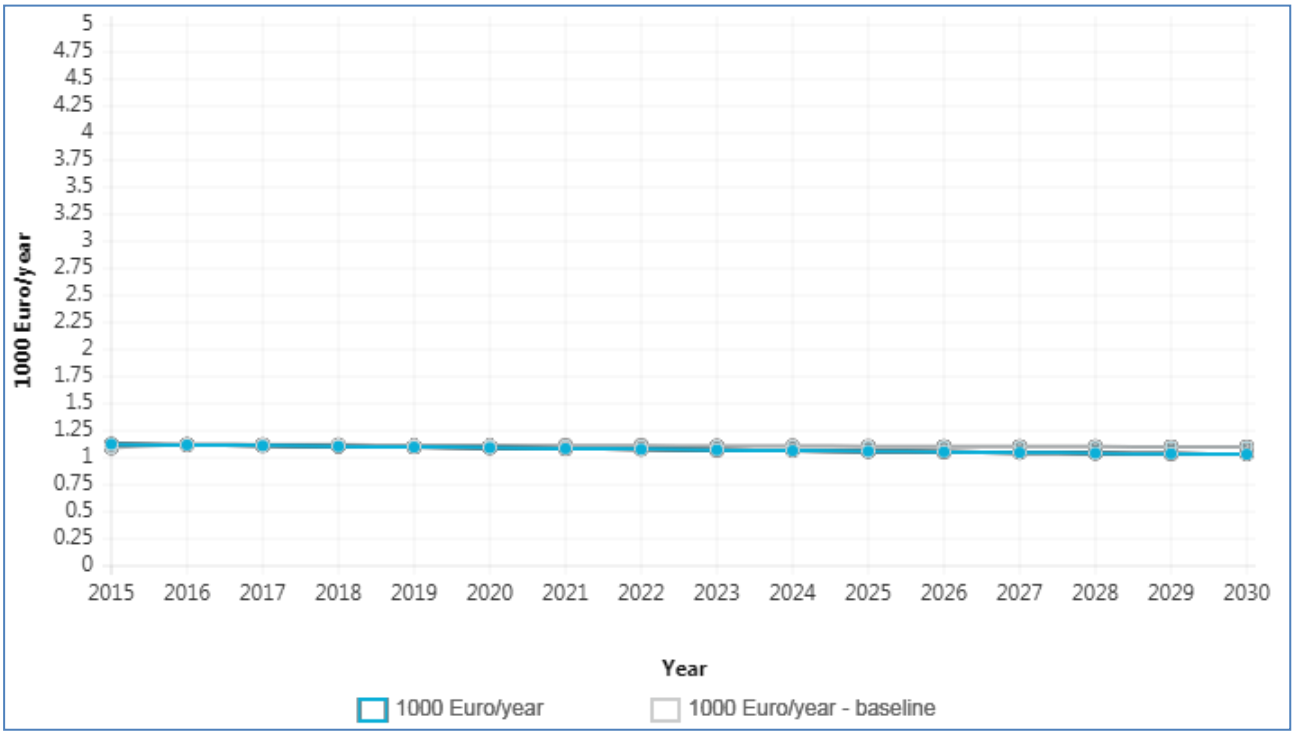

Figure 54. Transport expenditure per individual per year (1000€/year) - SCENARIO 3: Increasing of energy and fuel costs

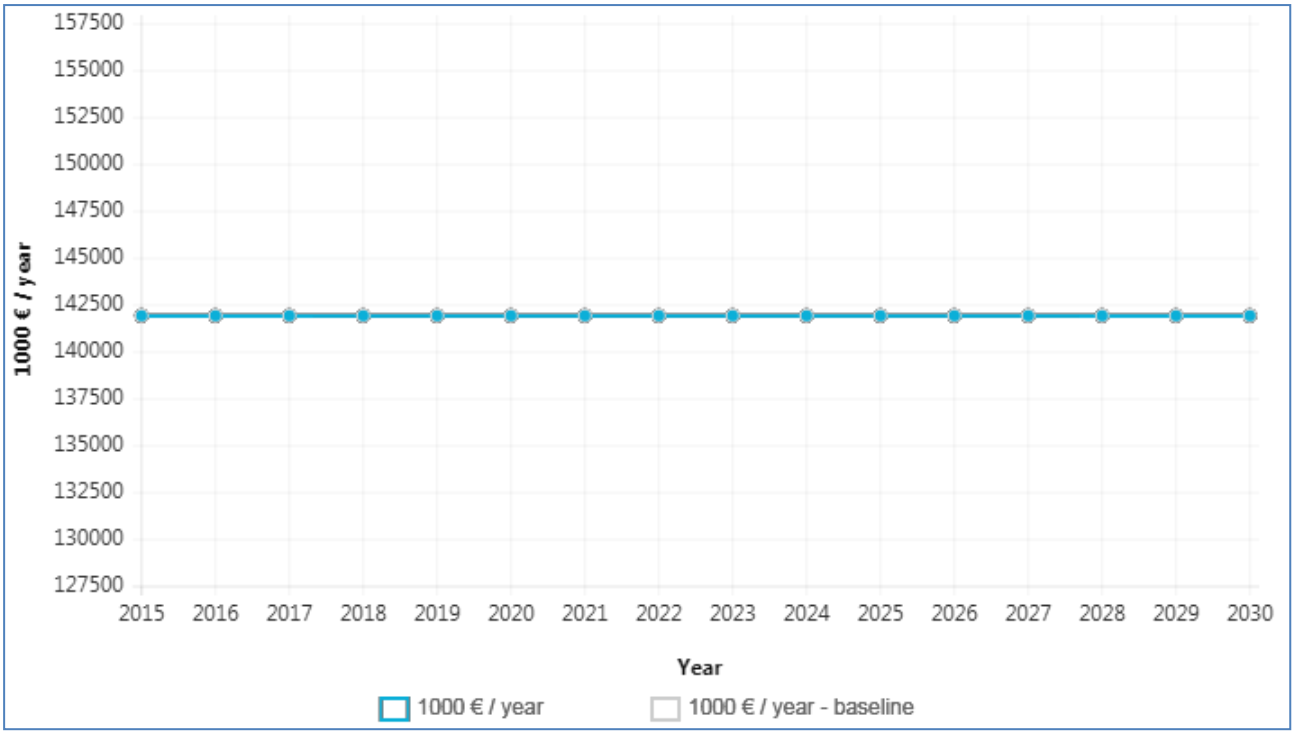

Figure 55. Transport expenditure of public administration (1000€/year) - SCENARIO 3: Increasing of energy and fuel costs

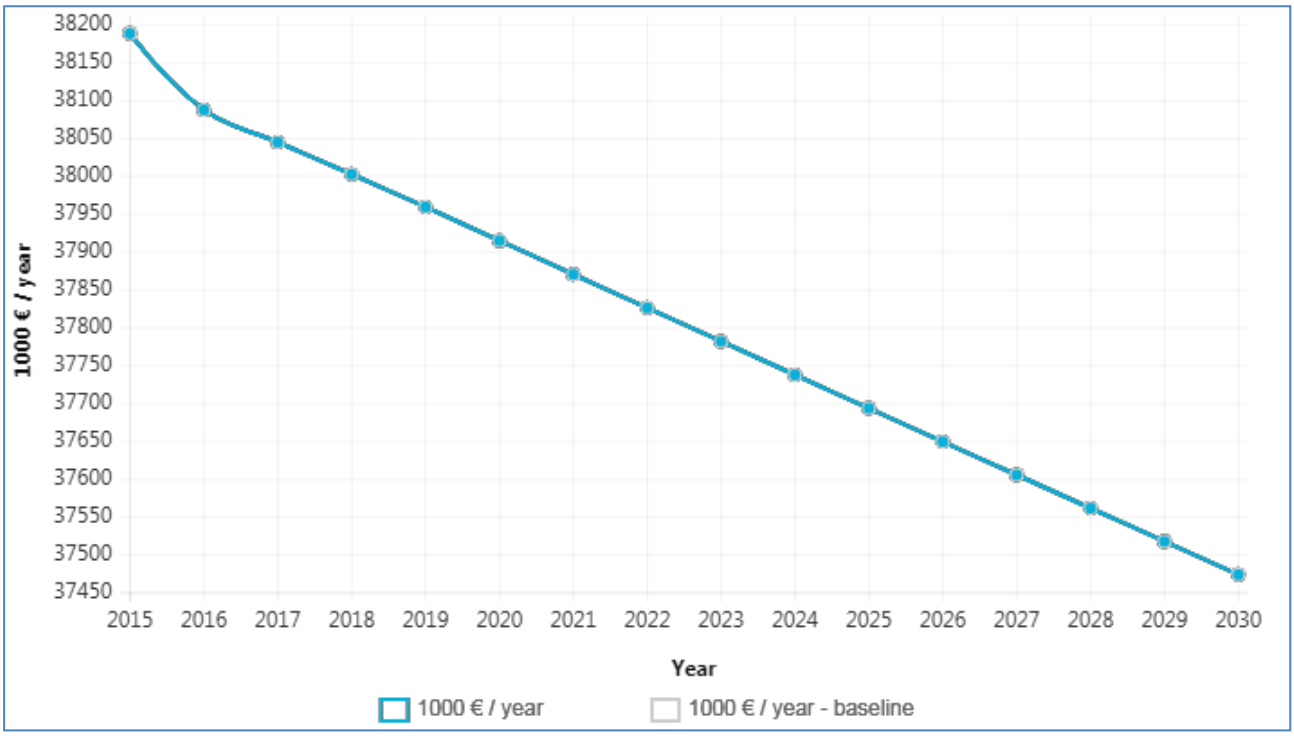

Figure 56. Revenues of public administration (1000€/year) - SCENARIO 3: Increasing of energy and fuel costs

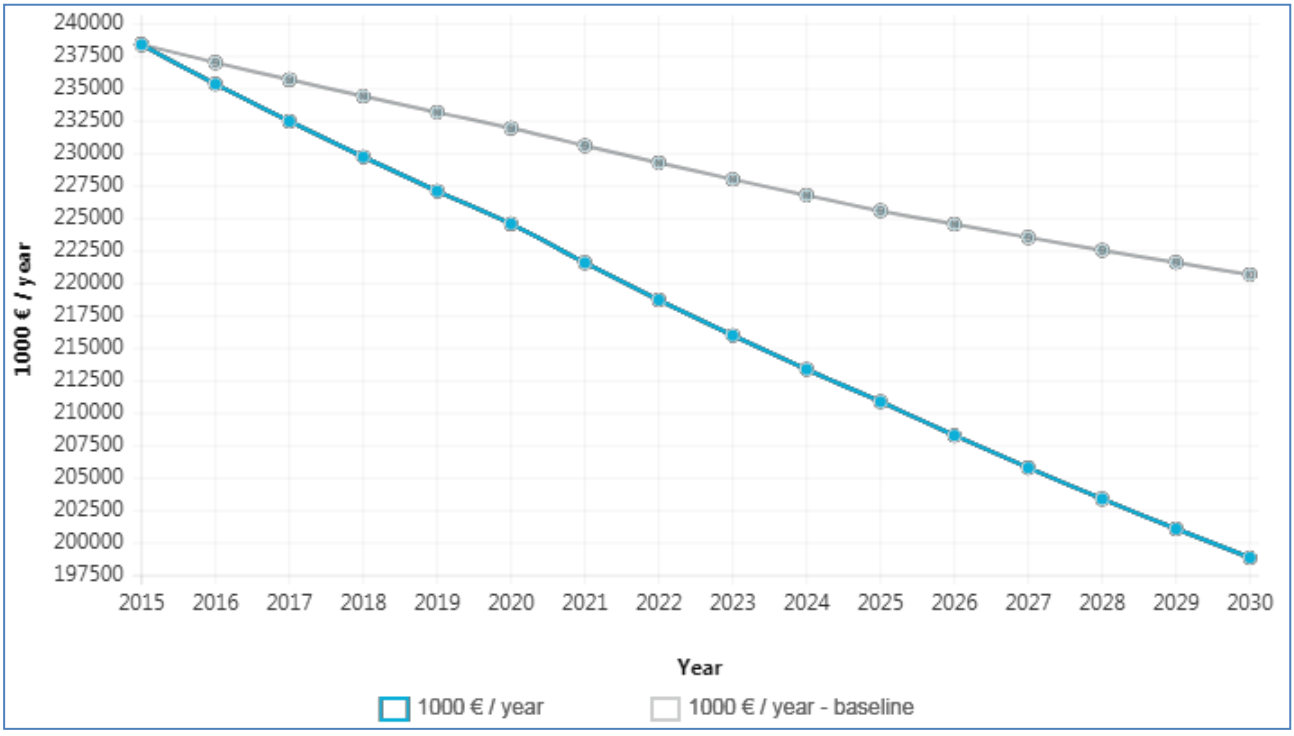

Figure 57. Transport social monetary costs (1000€/year) - SCENARIO 3: Increasing of energy and fuel costs