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Table of Contents

List of Abbreviations

AC - Alternating current
AFID - Alternative Fuels Infrastructure Directive
AG - Action Group
CS - Charging station
B2B - Business-to-business
BEV - Battery Electric Vehicles
CAN - Controller Area Network
CCS - Combined charging system
CNG - Compressed Natural Gas
COM - Communication of the European Commission
DC - Direct Current
DSO - Distribution System Operator
EC - European Community
e-CS - Electric vehicle Charging Station
EE - Energy Efficiency
EEA - European Energy Agency
eGUTS - Acronym of the project "Electric, Electronic and Green Urban Transport Systems"
EPC - Energy Performance Contracting
E-REV - Extended range electric vehicles
ESCO - Energy Services Company
ETS - Emission Trading Scheme
EU - European Union
EV - Electric vehicles
GDP - Gross Domestic Product
HEV - Hybrid electric vehicle
ID - Identification
ISO - International Organization for Standardisation
IEC - International Electrotechnical Commission
LEV - Light electric vehicles
LNG - Liquefied Natural Gas
LPG - Liquefied Petroleum Gas
LPT - Local Public Transport
OCA - Open Charge Alliance
OCPI - Open Charge point interface
OCPP - Open Charge Point Protocol
PA - Public Authorities
PB - Public Bodies
PEMS - Portable Emission Measurement System
PEV - Plug-in Electric Vehicles
PHEV - Plug-in Hybrid Electric Vehicles
PLC - Power Line Communication
POS - Point of Sale
PT - Public Transport
RDE - Real Driving Emissions
RB - Regional Body
R&D - Research and Development
RFID - Radio Frequency Identification
RSP - Regional Stakeholders Platforms
SEAP - Sustainable Energy Action Plan

SECAP - Sustainable Energy and Clima Action Plan
SMS - Short Message Service
SPEC - Specification
SUMP - Sustainable Urban Mobility Plan
SWD - Staff Working Document
V2G - Vehicle-to-grid

List of Figures

List of tables

1. Introduction

A rapid evolution in mobility is currently underway worldwide, triggered by advances in technology and in society in general. Electric mobility is gaining momentum at the same time as autonomous driving. The rapid adoption of electric mobility is also contributing to achieve objectives related to greenhouse gas emissions and air pollution in general. In order for this change to be significant, the share of EV's will have to increase worldwide and these EV's will have to provide a reasonable service life and mileage.

Global sales of new EVs have been growing steadily in the past 10 and especially 5 years. Despite this rapid growth, the European market cap of these technologies is still relatively small and dependent on subsidies for both vehicles and infrastructure. Also, most EVs and the charging infrastructure in the EU are concentrated in the western and northern part of the continent, with the DTP member states having some of the smallest adoption rates. There is however an ever-increasing rate of adoption also in most DTP states that are part of this project. The EU has taken important measures to facilitate the adoption of charging infrastructure and the market cap of EVs. There are also various initiatives at the individual states, regional and local level which aim to speed up the adoption of these technologies. The extent to which these initiatives have been adopted and financed correlates directly to a bigger market share for EVs.

At the end of 2018 there were around 60 electric motor car models available to European customers, and this number is expected to rise to 214 models by 2021 [1]. More affordable cars should see a bigger share of consumers switching from ICE cars to EVs. After the early success of Tesla Motors and other start-ups, many of them from China, it seems that the big car manufacturers are ready to embrace the EV. Of the 214 models stated above, 92 will be fully electric and the rest plug-in hybrid. Both these technologies rely on the rapid adoption of charging infrastructure in order to be a viable alternative for most consumers. This means that up to a quarter of vehicles produced by 2025 may have a plug and will help the manufacturers to meet the EU's car CO_2 emissions of 95 g/km by 2025. Most of these EVs will be produced in Italy, Germany, France and Spain [2], while large lithium-ion battery plants will be built all over the European continent.

The change in mobility solutions is also seen in the public transport sector. Alongside traditional forms of electric urban mobility (tram, trolleybus, subway), electric buses are becoming a reality in many European cities and hybrid solutions are also on the rise. These developments are mostly driven by industry, moving towards standardization of the electric mobility technology and infrastructure. Public authorities, on the local and up to the national level, must work together with industry to develop the standards and good practices of the future.

The trend in Europe and in the DTP countries is for a constant increase in the availability of charging infrastructure, especially in densely populated areas. These facilities have been set up by municipalities, private companies, NGOs and even car manufacturers such as Tesla, Nissan or their conglomerates, in order to facilitate the adoption of EVs.

Due to the existence of so many standards and developers of charging infrastructure, one of the key challenges for the future will be to implement those solutions that meet all the criteria necessary for consumer satisfaction and widespread adoption of EVs. Some of these criteria are availability of compatible charging stations, availability of quick charging at all times, industry standards

for charging, and universal standards for billing. Doing all of these right in a specific region will have a measurable positive impact on the adoption of electric mobility.

There are also challenges, such as the relatively high cost of EVs coupled with smaller range compared to ICE vehicles and a longer charge duration (using most technologies). These challenges are however of a purely technical nature and the improvements that have been made so far in these fields foresee similar developments in the future. Other changes that may have to be made are linked to human behaviour related to trip planning and driving behaviour in general (efficient, defensive driving will positively impact EV range). This last point may be however made irrelevant with the advent of self-driving cars. Regarding trip planning, there are online platforms available that can help the user to plan a trip depending on their EV's battery and the availability of charging stations along the route.

Planning and incentivizing the adoption of these technologies will remain critical but the forecast for now is positive, and Europe and DTP states are set for a constant increase in the number and quality of charging stations and range of EVs, and thus for an increased acceptance and adoption of electric vehicles.

What is the DTP eMob Transnational Strategy?

In the last decade, eMobility was experiencing huge developments, passing from a niche solution to an actual alternative solution for personal transportation. The increasing interest both by manufacturers (including automotive industry) and policy makers is a clear signal that also in the next years, electric vehicles (EVs) will gain new shares in vehicle's market, giving a valuable contribution to reduction of CO_2 and pollutants emissions. Despite this promising framework, it has to be acknowledged that eMobility is still struggling against important challenges, which are significantly diminishing the speed of its development.

The eMOB Strategy (referred just as "Strategy" in further text) is document designed to define a comprehensive framework for promoting electromobility in the cities of the Danube region, support Policy Makers and Decision Entities in facing the problems of low and inhomogeneous deployment of eMobility and charging stations network, fostering the expansion of e-mobility services, defining priorities and identifying actors responsible for further development. It could represent a reference for follow-up analyses on e-mobility and the necessary infrastructure to support the development of e-mobility throughout the Danube Region.

The Strategy is one of the most important outputs elaborated in the scope of the eGUTS "Electric, Electronic and Green Urban Transport Systems" project (DTP1-1-454-3.1, January 2017 – September 2019) funded by the Danube Transnational Programme through European Regional Development Funds (ERDF). Although the geographic scope of the document is primarily focused on the EU countries of the Danube Region, it is possible to apply it to other countries that are of similar socio-economic and political conditions, in particular the countries of the Central and Southern Balkans or the former post-Soviet republics.

Text of Strategy is based on other outputs of project, notably on eGUTS Standards and State-of-the-art Reports with SWOT Analysis. Also ideas and comments from stakeholders involved in individual RSPs were a valuable input.

The final version of this Strategy was approved through Regional Stakeholder Platforms (RSP) in individual countries and officially presented to the project Final Conference "Perspectives in European eMobility Future" held on 17.09.2019 in Zadar, Croatia.

Reasons for creation of document and motivation

Danube Region is both a challenging and a rich-of-opportunities area. In a relatively large territory (approximately 800.000 km²), with 120 million inhabitants, it includes fourteen countries among them nine EU-member states (Germany, Austria, Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Bulgaria and Romania) and five countries which are not EU-members (Serbia, Montenegro, Bosnia and Herzegovina, Ukraine and Moldova), from big metropolitan areas to really small communities, a lot of touristic attractions and an extremely variegated geomorphology.

Figure 1. Map of Danube Region

The presence of delicate areas and protected environments makes this territory extremely suitable for the adoption of green and sustainable mobility but, on the other side, the energy consumption required can be a severe challenge. Moreover, the presence of many cross-border commuters, both for work and (mainly) for tourism, asks for high interoperability among the charging networks of different areas and countries. Last, the high seasonal variation in traffic flows, due to tourism patterns, could cause a low usage of the charging stations for long periods, generating the risk of "market failure" for charging operators.

In such a complex situation, the development of fragmentary charging networks and adoption of inconsistent strategies in different areas and different countries could create really severe obstacles for EV users, hindering the development of e-mobility in favour of traditional internal-combustion vehicles.

Thus, eGUTS partnership believe that the development of a transnational strategy is a key factor in order to commonly face the still existing problems and to identify the best solutions that should be adopted jointly by all the involved countries and Public Authorities. Referring to a common view and a common strategy will help Policy Makers to make the best decisions for all potential EV users

of the Danube Region (and not only). A transnational and commonly agreed strategy would guarantee synergy and consistency among the different actions undertaken in the considered area.
The Transnational Strategy described in this document is mainly expressed through five "strategic principles", which represent the most important areas of intervention that Policy Makers and Public Bodies have to focus on. Following the strategic pillars, decision makers inside the PAs will be able to generate a favorable framework for e-mobility development and will actually set-up an effective and optimized charging infrastructure.
The eMOB Transnational Strategy started to be developed in a period in which e-mobility and sustainable transport are much debated aspects, considered as key parts to reach more general environmental targets. Especially in Europe, a strong activity has been carried out with regards to regulation, plans, directives and roadmaps and all the outputs of these activities represent the background and a reference point of eMOB Strategy. In the next paragraphs, a short recall of the most important documents is provided. A particular attention is paid to the activities carried out within the Danube Strategy, specifically devoted to the Danube region.

EU strategies, rules and vision on Transport, Energy & Environment

The general EU goal is to gradually replace conventional vehicles with clean vehicles by 2050. The transition to electro-mobility is the flagship of this effort so it plays an important role in many strategic documents such as:

- ✓ **Transport 2050 and White Paper: Roadmap to a single European transport area "Towards a competitive and resource-efficient transport system" (2011)** [3] - one of the priority objectives is to move towards greener vehicles and fuels for urban transport. By 2030, the share of conventional fuel cars should be reduced by 50% and fully expelled from cities by 2050. Promotion of clean vehicles to supply large city centres by 2030. Public authorities should therefore encourage within public procurement the purchase of low-emission vehicles both for their own car fleet and vehicle fleet used by public services.
- ✓ **EU Strategy for the Danube Region (2011)** [4] - The Danube Strategy involves EU Member as well as non-Member States. The Commission, in consultation with all stakeholders and actors, approved the Communication and Action Plan of the EU Strategy for the Danube Region. Among the priority areas of this strategy are the promotion of sustainable energy (in particular the strengthening of energy infrastructure, of energy market and of the share of clean energy within this market), improving mobility and transport link mainly the Trans-European Transport Networks TEN-T, as well as strengthening multimodality of transport through extending railway and highway axes and increasing the navigability of the Danube.
- ✓ **Green Paper "Towards a new culture for urban mobility (2007)** [5] - reflects on the main problems of mobility in European cities. It addresses in more detail the reduction of greenhouse gas emissions, i.e. one of the objectives of the Energy Policy for Europe. The main idea is to incorporate new modes of traffic management in cities in order to increase the flow of traffic and thereby improve air quality. It also proposes to promote research and development on clean and energy efficient vehicles and alternative fuels (biofuels, hydrogen and fuel cells), to promote the introduction of vehicles with alternative drive or alternative fuel, the possibility of these vehicles

entering certain districts where conventional vehicles are not allowed to enter; last but not least, support the construction of infrastructure for vehicles with alternative fuels and propulsion.

✓ **Action Plan on Urban Mobility (2009)** [6] - it builds on the specific objectives set out in the Green Paper and proposes short- and medium-term measures to achieve the objectives. One measure is the targeted promotion of clean technologies for alternative fuel vehicles and the transition to clean vehicles. Another measure is to support research and demonstration projects for the introduction of zero emission vehicles and alternative fuel vehicles, the promotion of hydrogen vehicles, the promotion of biofuels and hybrid systems in urban transport. In the European Economic Recovery Plan, the European Commission has launched a European Green Vehicles Initiative to fund projects relating to electric vehicles (batteries, driveline, etc.) and other electro-mobility projects (electric vehicles, battery charging infrastructure).

✓ **European strategy for low-emission mobility (2016)** [7] - The European Commission issued this strategy on the basis of the Paris Agreement (2015) on climate change, where EU Member States agreed to reduce greenhouse gas emissions by at least 40% by 2030 compared to 1990. The transport sector represents a quarter of Europe's greenhouse gas emissions and is a major source of urban air pollution, so moving towards low-emission mobility is essential to achieve a greenhouse gas reduction commitment in the transport sector of at least 60% by 2050 compared to 1990. Building the infrastructure for alternative fuels (including electricity) is crucial for the development of low-emission vehicles. It will be up to the EU Member States to support construction as required by the Directive on the deployment of infrastructure for alternative fuels (2014/94/EU) and the involvement of individual cities and municipalities in Member States where the problem of air pollution from transport is significant. It is essential to ensure the availability of alternative fuel infrastructure across Europe and at the same concentration as for conventional fuel vehicles. The deployment of electric vehicles therefore depends in particular on sufficient recharging infrastructure and cooperation between EU Member States to travel with the electric vehicle across Europe.

✓ **European Commission Strategic Plan 2016-2020 - Mobility and Transport (2016)** [8] – The Directorate-General for Mobility and Transport, which is responsible for the development of transport policy, has issued this strategic plan for the European Union, which is in line with EU regulations, with a view to achieve the Europe 2020 strategy commitments. The plan supports greenhouse gas emission reductions, low-emission mobility, the development of alternative fuel vehicles from sustainable and clean energy sources, electro-mobility, the development of modern trans-European TEN-T infrastructure and multimodal sustainable and interconnected transport system which provides a sufficient number of supply points for replenishment of alternative fuels. This plan also includes an ambitious EU target to decarbonise by 2050 the transport and energy sectors.

✓ **Clean energy for all Europeans - Winter Package (2016)** [9] - A total of 8 legislative proposals were presented to the EC in 2016 with the aim of creating a common energy market, increasing energy efficiency, achieving EU leadership in renewable energy use and ensuring a fair energy supply for all EU citizens. One of the strategic objectives is to promote low-emission mobility (electrification of transport) by installing charging stations since 2025, thanks to a proposal to amend the Energy Performance of Buildings Directive, which requires the installation of a rechargeable infrastructure for electric vehicles. For existing buildings, the measure will only apply to commercial

buildings with more than 10 parking spaces. For new buildings and buildings with significant renovation will apply also for residential buildings with more than 10 parking spaces, but only in the form of an obligation to install the necessary cables as opposed to new commercial buildings with more than 10 parking spaces, where the measure imposes an obligation to install charging points. SMEs and public authorities may be exempted from this obligation as they are already included in the Alternative Fuels Directive if their charging points are open to the public.

✓ **EUROPE ON THE MOVE. An agenda for a socially fair transition towards clean, competitive and connected mobility for all (2017)** [10] - The European Commission has set out an agenda to create clean, competitive and networked mobility. This requires an integrated and comprehensive approach based on cooperation between Member States, both at national, regional and local level. The main themes include reducing greenhouse gas emissions from transport in the EU by at least 60% by 2050. In order to achieve this, the transition to zero-emission vehicles needs to be accelerated. Other topics include decarbonisation of the transport sector, support for low-emission technologies (especially electric vehicles), automated road traffic, support for transport, energy and digital infrastructure. Emphasis is placed on maximum synergy between transportation, energy and telecommunications infrastructure within the framework of the Connecting Europe Facility. An essential prerequisite for the development of electro-mobility (i.e. zero-emission mobility) is the establishment of a network of charging stations covering the entire EU road network together with the development of energy storage technologies such as batteries. In accordance with the Alternative Fuels Infrastructure Directive (2014/94/EU [11]), Member States shall draw up their own plans for the development of alternative fuel vehicles and the construction of the related infrastructure. The development of batteries is another key technology for developing electro-mobility, the EU will increase the production of battery cells and power packs and intensify cooperation with stakeholders (under the Strategic Energy Technology Plan (C (2015) 6317)) and-support the creation of an integrated European battery ecosystem[10].

✓ ***2014/94/EU Directive on Alternative Fuels Infrastructure*** [11]: it establishes a set of measures for the creation of an alternative fuel infrastructure, to minimize oil dependence and mitigate the environmental impact of transport. At national level, the long-term strategic objective is to provide support for the rational use of all alternative fuels while being "technology neutral" and by searching optimal technical solutions and effective incentive/funding schemes. As alternative fuels the Directive considers all the fuels or sources of energy that may work in substitution (including partial, as in the case of hybrid vehicles) of fossil fuel sources in the supply of energy for transport: electricity, hydrogen, biofuels, synthetic fuels and paraffinic, natural gas (including biomethane) in compressed form (CNG) and liquefied (LNG), liquefied petroleum gas (LPG).

The European objectives aimed to the promotion of cleaner transport are mainly based on the documents related to the climate changes and energy efficiency issues:

✓ ***Paris agreement*** [12]: signed by 178 countries on April 21st 2016, it commits the signatories to maintain the world temperature rise below 2°C and, if possible, below 1.5°C compared to pre-industrial levels.

✓ ***Climate and Energy Package 2030*** [13]: it foresees a 40% reduction in greenhouse gas emissions compared to 1990. This target means a 43% reduction in emissions compared to 2005

for the sectors involved in the so- called "Emissions Trading System (ETS)" and a reduction in greenhouse gas emissions of 30% compared to 2005 for "non-ETS" sectors, such as transport.

✓ ***Effort Sharing*** [14]: it delineates the European target on national level by the proposal of the "Effort Sharing" Regulation of the European Commission.

✓ **Energy policy for Europe (2007)** [15] - one of the priority objectives is a more comprehensive interconnection of existing pan-European energy infrastructure and to build up the trans-European distribution network capable to resist fluctuations in energy production from renewable sources. Another objective is to reduce total primary energy consumption and total emissions by 20% by 2020. It also mentions the need to gradually reduce energy production from fossil fuels in favour of sustainable energy produced from low carbon sources, using second generation biofuels and hydrogen fuel cells.

✓ **Energy 2020: A strategy for competitive, sustainable and secure energy (2011)** [16] - This strategy should contribute to promoting a sustainable, low-carbon, secure and interconnected Europe that uses energy and resources efficiently. The main priorities are energy efficiency, renewable energy infrastructure, research on low-carbon technologies, electricity storage, sustainable biofuel production, preparatory work on "electric highways".

✓ ***Regulations 510/2011*** [17] ***and 333/2014*** [18] ***on CO2 emissions***: they impose progressively more severe limits on CO_2 emissions. In particular, they define respectively the average fleet target for new light commercial vehicles, equal to 175 g CO_2/km by 2017 and 147 g CO_2/km by 2020, and for new passenger cars, equal to 95 g CO_2/km by 2021. The Commission is also committed to finalize a strategy aimed at reducing emissions from trucks, buses and coaches before 2030.

Coherence of eMOB strategy with the European Framework

As can be seen in the previous list, European policy on Transport and Mobility covers a wide range of aspects but is particularly focused on environmental aspects and greenhouse gases emissions. Electric mobility can be a real and important key solution to obtain a more sustainable transport system, guaranteeing in this way a dramatic reduction both in pollutant and in greenhouse gases emissions. The absence of noise is another crucial element to improve life quality in the big cities. Given this framework, to support the creation of a transnational consistent and effective network of charging stations for electric vehicles is exactly aligned with European Union targets, contributing to create a favourable environment for e-mobility development.

Moreover, the debates and the adoption of a common strategy in different countries, contributes to lower barriers and to increase the consciousness that global problems as climate changes can be better solved with a synergic approach.

E-Mobility is a cross-cutting topic, related both to the transport and the energy sector. Even was specifically addressed within Danube Action Plan, electric transport could represent a relevant solution to obtain a better "balance between transport infrastructures and the preservation of the territory", as stated by Danube Strategy, requiring at the same time a certain effort about "interoperability". On the other hand, the use of electric vehicles in substitution of traditional combustion vehicles guarantees improvements with regards to "energy efficiency and (the production and) use of renewable energy in the Danube Region", as in the objectives of Danube Strategy.

This Strategy, with the aim of fostering e-mobility development in the Danube region and beyond to entire EU, can therefore give interesting contributions to the objective of Danube Strategy Pillar 1 – Connecting the Danube Region, *Priority area 1B Rail-Road-Air Mobility* by supporting safe and sustainable transport and mobility in the Danube Region and *Priority area 2 – Sustainable Energy* by supporting to achieve the national targets based on the Europe 2030 climate and energy targets and to remove existing bottlenecks in energy to fulfil the goals of the Energy Union within the Danube Region, and the mutual interest has been proved by the continuous contact among eGUTS project partners and Danube Strategy representatives. More in particular, eGUTS was invited to present its activities and results at the last 8th Annual Forum of EUSDR inside the Capitalization Strategy – the Sustainable Transport Thematic Pole meeting.

SWOT analysis of electric mobility in the DTP area

INTERNAL FACTORS	
STRENGTHS (+)	**WEAKNESSES (-)**
• Reduction of tailpipe emissions • Less noise pollution • Reducing congestion in city centers • Know-how in science and engineering exists in EU and DTP states • Simple technology • Public sees electrification as positive and necessary for the future • Reliability of EU and DTP electrical grid • Use of shared (light) electric vehicles increase creates less waste • Reduction of direct operating costs in comparison with conventional alternatives • Better image for public transport operators	• High initial purchase price due to cost of batteries • Environmentally unfriendly production of battery. • Some customers are resistant to change • Existing street infrastructure • Indirect environmental emissions • Low standardization in the field of charging technologies • Electric vehicles are heavier (affects mostly light electric vehicles) • Limited range and longer charging times • Limited battery life span – necessity to replace battery sets approx. in the half of the vehicle life span
EXTERNAL FACTORS	
OPPORTUNITIES (+)	**THREATS (-)**
• Financial incentives in some countries • EU and DTP citizens want higher quality of life, less noise and better air quality • Electrification is a key component of a low carbon energy future • EU high-tech companies can create lots of added value • Security of energy supply by eliminating dependence on fossil resources from politically unstable regions in the world • Unlike trolleybuses, ebuses do not depend on a single route and can adapt to road closures • Light electric public transport can reach more places in an economically sustainable manner • More access in protected areas leads to development of tourism.	• Limited range and lack of charging stations specific for public transport electric buses • Dispersed human settlement outside the major cities makes public transport difficult • EU car industry has lost competitiveness due to late start of electric mobility • Value chain dependent on imports from Asia • Low oil prices • Competition from hybrids, hydrogen, alternative fuels

2. Key principles for eMOB Transnational Strategy

Logical framework and work-plan

One of the core aspects of the eGUTS project is the possibility to debate among countries that, despite being physically really close, could have very different experience and expectations about the development of electro-Mobility. The challenges of the present document of "eMOB Transnational Strategy" were therefore to analyse the different starting points, to identify some common objectives and to jointly select a strategic answer to the most important open issues.
In order to achieve that during the project lifespan, a logical framework was set up which was afterwards directly reflected into an actual work-plan.
Thus, the starting scenario description: *Analysis of the state of the art* in the different participating countries and regions, with respect to e-mobility development, number and characteristics of the charging stations, existing policies by the PAs, business models and involvement of private operators, document containing also a SWOT analysis on the state of the art, performed in WP3, giving a better understanding of the context and of the possible leverages to reach the objectives.
Analysis of existing visions and strategies about e-mobility in Europe and in the Danube region: in order to provide a consistent strategy and to proceed in synergy with the already existing European plans, an overview of the most important existing visions was necessary. A particular attention has been paid to European vision on transport, energy & environment and Danube Strategy strategic vision on transport, energy & environment.
Definition of a common eGUTS long term vision with respect to e-mobility: given the different knowledge, role and background of the different partners (from the PAs to the research centres, coming by different countries), some discussion was needed in order to identify common features to sketch-up a long term vision about e-mobility development in the Danube region.
Finding a common understanding on the most important open issues and on eGUTS project specific objectives: after having defined a long-term vision, it was crucial to address the "short-term" and to commonly identify the most important issues to be directly tackled by the project.
Debate, both internally and with external experts, about the open issues and identification of possible common strategic answers: leverage the experience of partners and external experts in order to identify the best possible solutions to the open points, considering a common approach for the whole Danube region.
First selection of strategic answers, defined as "Key Principles": selection of five most important strategic measures that should be proposed to PAs according to eGUTS project consortium experience. These measures can be presented as "Key Principles" on which to build e-mobility development in the Danube region.
Test and feedback by Pilot Activities: many relevant aspects addressed by the Key Principles were analysed and tested within eGUTS Pilot Activities. Both during the preliminary discussions and during the refining of the transnational strategy, practical feedbacks coming from pilot activities have been a powerful source of knowledge and experience.
Debate and progressive refining of the Key Principles, with special attention to the most critical issues: some aspects included in the Key Principles needed a more intense debate, as different

points of view came out by different partners, given the different frameworks of their home countries.

Final draft and presentation to external stakeholders: development of a final draft, representing a common and agreed version of the document and of its core part, the Key Principles. eMOB Strategy will then be presented to relevant external stakeholders.

Debate management and adopted instruments

The work-plan detailed in the previous section clearly highlights the importance of discussion and debate for the development of the present Transnational Strategy. In order to obtain the most effective inputs and feedbacks from the involved experts, several instruments were adopted.

- *Open discussions*: the most used "instrument", an open debate among partners performed both in face-to-face meeting and in web-conferences. Commonly used by WP leaders to have direct feedbacks on their proposals.
- *External experts* (Transnational Experts Panel) presentations: performed during eGUTS project meetings, they gave the possibility to have an external point of view on the most relevant topics, coming often by private operators or by industries with a complementary knowledge with respect to the consortium.
- *Regional Stakeholders Platforms* meetings: performed by each project partner at local and regional level, gave the possibility to complete the external point of view on the most relevant topics, coming often by private operators or by industries with a complementary knowledge with respect to the consortium
- *Workshops*: mainly organized during eGUTS public events, they were focused on "hot-topics" and they were managed to stimulate parallel discussion in small groups and then to synthetize the key results in plenary sessions
- *Living document approach*: the first release of the Key Principles was developed more than half year in advance with respect to the final one. It was used as a dynamic basis on which the partners could provide comments and updates, in order to refine it and to obtain a completely agreed final version.

Key concepts for eMOB Transnational Strategy design

It has to be mentioned that together with the "vision" and the "objectives", identified through partners' debate, some key concepts of eGUTS project needed to be considered when designing the eMOB Transnational Strategy. These are more general ideas, staying on the background of the whole project activity and also of Danube Strategy. They can be summarized in the following bullets:

- Public Authorities are a key actor to lead the infrastructure development;
- Danube Region is made of different realities, from metropolitan areas to isolated rural/mountain areas. The optimal solutions for transport can be multiple:
    - Local Public Transport in urban, peri-urban and congested areas;

  - Low emissions private transport (mainly electric) for small cities, towns and mountain communities.
- Technologic solutions are ready and mostly available. It's now important to choose common solutions, set up common rules and respect them
- Goals can be reached according to a "priority approach".
- A set of few, focused and coordinated actions would be sufficient to reach the goals.
- Communication, education and training are sometimes more important than technical aspects

Starting point: Identified existing Bottlenecks

In the last ten years, e-mobility experienced an extremely important growth, passing from a "niche" solution, to an actual alternative for a wider range of drivers and a promising industrial opportunity. Despite that, analysing the current situation in the Danube region, it is possible to observe that the overall "framework" is still inadequate to allow a rapid and widespread development of electric vehicles in the short period in all the countries. After a depth and thorough analysis of the state of the art which has been performed within eGUTS project, a short summary is reported focusing on the most critical aspects emerged with regards to charging network development.
Two well-known elements appear to be still particularly critical, respectively Cost and Range. The higher purchase price of electric vehicles with respect to conventional ones is nowadays still an obvious obstacle for potential buyers, in particular in the sector of small and medium cars. On the other side, it is also well known that money is not the only parameter considered when buying a car, especially when moving towards bigger and luxury cars [19]. With the increase of EV sales, moreover, economy scale will help manufacturers to progressively lower production costs and selling prices. The second element is the problem of limited range, mainly due to technical aspects related to battery chemistry (energy and power density). This can be a real barrier for potential buyers, as it actually limits the vehicle functionality. The perception of a limited range can commonly turn into negative feelings towards the vehicle and the driving experience, also known as "range anxiety" [20]. To overcome this problem, two solutions are being addressed by e-mobility stakeholders: work on R&D to obtain improvements in battery performances (store more energy in the same space and weight) and work to deploy an effective charging infrastructure.
Thus, the eGUTS project focuses mainly on the last aspect, aiming to identify policies, tools and solutions able to create a favorable environment for the deployment of an effective charging infrastructure in the Danube region

Big variety of roles played by Public Authorities

A first criticism comes out when considering the role and the interactions of private operators and public bodies in the development of the charging network. To start, within countries of the Danube region (see fig. 1), different administrative organs exist [21], with different powers and responsibilities:

- Slovakia
  - 8 Regions / Kraj
  - 79 Districts / Okres
  - 2890 Municipalities / Obec
- Austria
  - 9 Regions / Bundesländer
  - 79 Political Districts / Bezirke und Statutory cities / Statutarstädte
  - 2096 Municipalities / Gemeinden
- Croatia
  - 21 Counties / Zupanija
  - 556 Cities and municipalities / Gradovi i općine
- Czech Republic
  - 14 Regions / Kraj
  - 6253 Municipalities / Obec
- Romania
  - 42 Counties / Județe
  - 103 Municipalities / Municipii, 320 Towns / Oorașe and 2686 Communes / Commune
- Slovenia
  - 62 Districts / Upravne enote
  - 212 Municipalities / Občine
- Hungary
  - 19 Counties / Megye
  - 174 Districts / Járás
  - 3176 municipalities / Község
- Montenegro
  - 24 Municipalities / Opštine (општине)
- Serbia
  - 29 Districts / Okruzi (округи) + City of Beograd
  - 145 Municipalities / Opštine (општине) + 29 Cities / Gradovi (градови)
- Bulgaria
  - 28 Provinces / Oblasti (области)
  - 265 Municipalities / Obshtini (общини)
- Moldova
  - 32 Districts + 3 Municipalities + 2 Autonomous territories
  - 898 Cities/Towns, Sectors and Villages (communes)
- Bosnia and Herzegovina
  - 3 Self-governing entities, 10 Autonomous cantons + 1 Centralized region
  - 143 Municipalities / Općin
- Ukraine (part of)
- Germany (part of)

Without entering into details, to have different administrative divisions with different competences immediately creates some complexity in developing common strategies and a consistent network. Today, in the Danube region, PAs play indeed many different roles with regards to charging infrastructure deployment.

Choices of PAs can depend on many aspects and can find expression in many different actions. To give an idea of the complex framework of PAs role, a simplified logical map is proposed in Table 1. In the table, a generic PA is characterized simply by two main aspects, its commitment towards e-mobility and its availability of money for the charging infrastructure. For each of these aspects, three levels are considered: low, medium and high. On the other hand, 9 possible actions are listed. According to the characteristics of the PA, different action can be considered feasible and reasonable. It can be easily seen that also within a really simplified framework, the final set of actions can be very different.

PA CHARACTERISTICS		POSSIBLE ACTIONS								
Commitment	Money Availability	Do nothing	Set technical rules	Plan the infra-structure	Promulgate Laws	Pay/ manage the infra-structure	Convey National and EU funds	Simplify authorization procedures	Promote education	Communi-cate with other PAs
LOW	LOW						X			
LOW	MEDIUM			X			X			
LOW	HIGH			X			X			
MEDIUM	LOW		X		X		X	X		X
MEDIUM	MEDIUM		X	X	X		X	X	X	X
MEDIUM	HIGH		X	X	X		X	X	X	X
HIGH	LOW		X		X		X	X		X
HIGH	MEDIUM		X	X	X	X	X	X	X	X
HIGH	HIGH		X	X	X	X	X	X	X	X

Table 1. Possible actions of pas according to their commitment and money availability

Besides the fact of having different rules and different levels of infrastructure deployment in different areas, the complete lack of common strategy and coordination on the role of PAs could also bring to critical (and opposite) situations:

- Very strong commitment and public intervention by the PA, with the risk to distort the market and to hinder private operators and new players entrepreneurship;
- Presence of completely unequipped areas, due to low public commitment/money availability and low economic appeal for private e-CS operators.

Complex procedures and regulatory framework

Despite the e-CS being quite a simple component, its installation and the realization of a publicly accessible charging network require a certain interaction among different stakeholders. At first, the e-CS itself is commonly installed on public ground, meaning the need to obtain permission for its usage by the competent administration. Secondly, each charging station needs devoted “parking” areas, meaning other authorization and often the agreement on an annual fee. Coming to the grid connection, there is the need to require it to the local distribution system operator (DSO), with costs and timings depending on the exact location and on the number and power of the e-CSs. Other

examples could be given and it is clear that if these procedures are not well-structured and simple, many hurdles can be experienced by the operators, risking severe delays and economic difficulties.
Probably more critic is the situation when dealing with public tenders and co-financing schemes. Especially in some countries (e.g. Slovakia), a really complex bureaucracy stands behind the possibility to obtain a public co-financing and is not rare to wait more than one year to know if the proposals are accepted. Again, this can create remarkable problems for operators planning activities, creating long stand-by periods in the whole sector.

Infrastructure availability and accessibility

The State of Art analysis pointed out that more than 6800 charging stations are today installed in the Danube region. The number itself is starting to be significant and the service provided to EV users could potentially be satisfying. Nevertheless, the uneven localization and the adoption of multiple business models and systems to access/pay, sensibly limit the possibility to use the charging network, still generating "range anxiety" feelings for the drivers.
Starting from the localization issue (deeply considered also within eGUTS pilot actions), it is evident that the first infrastructure was born following the "demand", so concentrating on the urban area of bigger cities, naturally more suited for the first electric vehicles range, dimensions and use. Following the increase of EV sales and technical characteristics, also the charging network evolved, increasing power and progressively spreading into smaller cities and towns. Nowadays a relevant number of municipalities of the Danube region are (or are becoming) equipped with some charging stations (mainly AC, "normal power" ones) and some "corridors" are equipped with "high power" e-CS. Austria and Slovenia are presenting a good coverage. Anyway, some problem can still be evidenced with regards to:

- Small number of e-CS in some "mountain/rural" areas, with the risk of actual "black areas" where EV drivers could have hurdles in driving and charging. This is mainly due to the presence of "non-profitable" territories, where traffic is too low to guarantee revenues for private operators;
- Need for de-tours while traveling in highways and international corridors. Due to administrative/bureaucratic issues, in some countries is yet impossible to install high power charging stations directly along highways, so forcing EV drivers to modify their route with a consequent increase in traveling time and costs.

By the side of "physical" access, the e-CS are becoming more and more standardized and easy-to-use, being mostly equipped with the so-called "Type 2" plug/connector for AC charging and with "Chademo" and/or "CCS Combo 2" connectors for DC charging. The issue of plug/socket incompatibility, very critical in the first years of e-mobility development, is now becoming solved and cannot be considered an "open point" anymore (some issue still remains on Light Electric Vehicles plugs/sockets). More critical, instead, is the aspects of access and payment, issue encountered also in the development of eGUTS APP. In the last years, the choice of the technical mean to access the charging station and of the payment method and related business model was completely in the hands of the charging point operators (or e-mobility service providers). Considering that hundreds of providers exist in the Danube region is easy to understand how variable and multifaceted the situation can be with regards to access and payment systems. Despite

the current effort in "connecting" the different networks, looking for "interoperability" and "roaming", it is still extremely common to have many networks in the same area, each based on different access methods and on the need to enter into contracts with the providers. This can create significant hurdles to EV drivers, which would be forced to sign many contracts or, on the other hand, to choose only one provider and to use only a small part of the overall number of charging stations. This situation, already critic in a small area, can become a real barrier when crossing borders and moving to other countries, managed by different operators.

Given these aspects, it can be said that despite the good number of installed e-CS, EV drivers still have to carefully plan their travels in the Danube region, gathering information both on the localization and the access/payment method of the needed charging station. These difficulties undoubtedly still slow down e-mobility development in Danube region countries.

Vision

According to Collins English Dictionary [22], a strategy is "a general plan or set of plans intended to achieve something, especially over a long period."

Thus, in this regard, after having a strong a proper analysis of the present situation, the successive action was therefore to clearly identify eGUTS project long term vision about e-mobility development in the Danube region.

Despite a general "vision" being quite clear, including a widespread e-mobility development and an effective, interoperable and easy-to-use infrastructure, given the different knowledge, role and background of the different partners, some discussion was needed in order to identify the key aspects of a more specific "common vision".

In this context, the term "vision" refers to a long-term vision, which indicates what each partner expects to be the future of e-mobility in the next 10-15 years. This includes the evolution of both technical aspects, users' needs & behaviours and PAs role, activities & organization.

Discussing with TEP members and debates inside RSPs meeting about the topic of e-mobility, and more specific on which of characteristics are expected to be included in the future mobility system in 10-15 years, the results depictured the following:

- Integration of EVs charging infrastructure with renewable energy generation and storage systems;
- Implementation of new mobility solutions based on the concept of "mobility as a service", as multiple vehicle-sharing, on-demand services, intermodal systems and others;
- Predominance of domestic/private charging with respect to public charging;
- Development of innovative "Integrated filling stations" that will include ultrafast EV charging stations (very high power), H_2 refuelling, storage systems and other;
- Development of electric vehicles with autonomous drive, allowing new functionalities for the owners;
- Widely diffused e-roaming based on the adoption of a unique and common platform for access and payment;
- Development of wireless charging, both "static" and "dynamic" (charging while driving).

In the eGUTS consortium long term vision emerged the general idea that a core aspect of the future mobility system will be the integration of e-mobility in a virtuous energy and transport system. The possibilities offered by renewable energies and storages will boost the benefits of electric traction, while e-mobility will be the part of a new transport framework based on sharing economy and intermodality. In order to provide the best driving and charging experience, e-roaming solutions should be present, with a preference for B2B agreements among operators.

It can be noticed that in a long-term vision, less importance is given to technological solutions, as wireless charging, ultrafast charging or autonomous drive.

In parallel with the definition of the long-term vision, for the purpose of the project also a "project-term vision" was looked for, in order to commonly identify the most important issues to be directly tackled by eGUTS project.

The "project-term vision" indicates what each partner wants to be the future of e-mobility in the Danube region in the next 3 years. This vision describes the desired features and framework at the end of the project and is strongly related to eGUTS project objectives (which should cover, at least, a relevant part of the vision).

As for the long term vision, the general eGUTS objectives are well known: "contribute to the homogeneous development of eMobility in Danube region and, if possible, beyond in the entire EU, providing a transnational strategy for seamless use of electric vehicles and charging spots with an integrated approach supported by PAs".

To better specify it, all the partners provide their inputs on e-mobility expected developments and on the most important aspects that had to be tackled by the project, in order to achieve the project own view on e-mobility development in the Danube region.

Thus, in regard with the aspects more related to PAs role and processes, especially to processes of planning and framework setting on a local or regional level, and what are the most critical aspects to be dealt with by PAs, i.e. what are the topics for which eGUTS project should contribute, the opinion gathered were:

- Defining very clear the role of PAs in the development of the infrastructure;
- Creating short term plans (time range up to 5 years) for positioning of e-CS;
- Establishing instruments and offices to provide assistance to small municipalities interested in e-mobility;
- Cooperative planning of PAs with enterprises and private operators of e-CS;
- Introducing e-mobility in Green Public Procurement;
- Establishing incentives for the use of e-vehicles (e.g. specific parking place or road lanes);
- Agreeing on rules for the compulsory adoption of "planning documents for sustainable mobility" in the reference area;
- Creating long term plans (time range beyond 5 years) for infrastructure for electric mobility (going beyond existing technology, i.e. for example integrated facilities to fast charge many vehicles including H_2 storage);
- Defining uniform supra-regional authorization procedures for E-CS installation;
- Defining uniform supra-regional rules to manage electric vehicles parking and charging areas;
- Defining uniform supra-regional rules to limit/enable access of electric vehicles to urban centres or controlled traffic zones.

With regards to the "PA point of view", it can be observed that an "essential" aspect is to better define which should be the role of PAs. The interaction with small municipalities, as "on-field" public entities, is considered crucial too, as well as the need for a short term plan to localize the charging stations. Less relevant is instead considered the adoption of traffic and parking management schemes in order to encourage the development of EVs.

Meanwhile, the second topic for debates was more related about the "final users" perspective, considering the final user needs and driving experience about the most critical aspects to be dealt with by operators, public authorities and other supporters of electric mobility, i.e. what would be the topics for which eGUTS project should contribute, the feedback received summaries:

- Real need for an e-CS supra-regional mapping tool to find and/or reserve a charge spot
- Multimodal hubs to integrate e-mobility with local transport and railways
- E-CS access without the need of a contract with any service provider;
- Direct roaming and payment systems among service providers in order to charge with a single contract
- Widespread charging network, covering also low-populated areas (e-CS with low number of charging events but crucial to allow particular routes)
- Platform for locals and guests to find e-CS and get information on terms of use
- Roaming among service providers through a common platform/marketplace (also to compare and select different prices from different providers);
- Provisions of additional non-mobility services at e-CS (food, bank, recreation, etc.)

Considering the "Final user point of view", the results show the importance of having tools and solutions to easily find a charging station, to access to it and to pay for the service without the need of a contract. Simplicity looks as a key solution for eGUTS partners. With that, a good integration with local transport service is required, according to the long term vision of intermodality. All these show very clearly the fact that the initial challenge which eGUTS consortium envisaged 4 years ago is still a problem which did not find a proper solution and the development of eMobility is still an issue which need to be tackled with high attention.

The movement to a zero-emission world is not one that we can do alone. It is a collaborative effort between individuals, businesses, and government to make the future of eMobility a reality. Here are the visions of energy, eMobility services, and clean tech companies that are driving a better future of transport.

Mobility as a service is a transport concept that transforms current models of transport operation, especially in urban areas, across the public and private sectors. MaaS connects different modes of transport in cities - public transport, cycling, transport by cars and bicycles from rentals and through shared services (bike and car sharing) or services on-demand (taxis), allowing citizens to plan a route, choose their preferred way of travelling, book and pay all via one mobile app. The goal is simplicity of the service for users, but putting this concept into practice is a rather complex matter. In introducing MaaS in cities and regions, the main actors are local and regional authorities, which play a key role in the provision and regulation of transport services by promoting the integration of traditional and new approaches to mobility (in particular multimodality), public and private sector integration and MaaS promotion. The operation of this service requires the cooperation of the private and public transport sectors through a third party coordinating the integration of services, while respecting the public sector leadership. The aim is to ensure

a sustainable transport system, reduce its negative impact on the environment and increase transport safety.

The aim of MaaS is therefore to offer users the choice of traveling in various modes of transport, the possibility of integrated mode of planning, reservation and payment through the MaaS application for public and private transport services according to the user's wishes.

If access to mobility is simplified, the demand for different modes of transport (public transport, bicycle and car sharing, taxi services) will increase, which should reduce the use of cars (or their ownership) and thus reduce the environmental impact from transport.

Due to different traffic conditions in different cities and regions, it is not possible to use the universal MaaS concept, but an individual approach is required. Local and regional authorities need to design MaaS to make traveling comfortable, fast, cost-effective and safe for users [23].

3. Target groups

Successful project implementation requires a deep knowledge on stakeholders´ decision-making power and possible influence on the project activities. Therefore, it is important to understand the attitude of relevant stakeholders and to identify their key interest, motivation for development of and their input to promote e-mobility. Each stakeholder group was analysed in terms of a field of activity (traffic, environment, etc.) and competences they operate, and possible level of involvement to implementation.

Policy makers

States body – Ministries, national central body

Description and competences:

The division of competencies between ministries varies from country to country. The key bodies with important role in the field of e-mobility are ministries responsible for following sectors:

Transport – responsibility for the transport sector policy, infrastructure development and construction (support activities at national level like promotion of electric vehicles, coordination of the development of charging stations network on motorways and the national roads).

Environment - mainly the responsibility for environmental protection and development. Supporting of green transportation, green energy, protection from air pollution and climate changing mitigation are the key issues as well.

Industry and Trade - has responsibility for the energy policy and other activities in the market. Between the main activities belong the support of the different national and international strategies related to significant energy efficiency improvement measures and expected or achieved energy savings and promote markets of electricity; supporting the development of new technical designs and providing sufficient material resources for e-mobility solutions

Regional Development - is responsible for regional policy, spatial planning and investment policy. It is support activities in field of Strategy of the Regional Development and support finances for investments to electric means of transport, electric vehicles in public transport, infrastructure.

Profit from strategy:

For all the Ministries the outputs gives a practical guide on how to support the development of the e-mobility on the nation level. The ministries can coordinate the activities on the regional level. Also these outputs bring new information about new smart technologies. Over more the outputs brings possibility to fulfilling the European targets in energy saving, reduce greenhouse gases production, help to protect climate change, decrease dangerous emissions come from transport, decrease dependency of fossil fuels and brings finance supports and benefits.

Municipalities, public ventures

Regional and local state body - Regional offices, Municipal Offices, Public Transport Authority

Description and competences:

Regional and local state bodies responsible for the road administration. It also arranges and approves the planning and strategy documentation on regional and local level. Transport Authority is responsible in area of public transport. The mission it to provide all people living in municipality and visitors to the city with safe, quality and effective local public transport. During the modernization of the car fleet, they can promote e-mobility as the environment friendly mode of transport.

The responsibility is also to offer best mobility standards for inhabitants, particularly in the philosophy of Mobility as a Service (MaaS). MaaS - is the integration of various forms of transport services into a single mobility service accessible on demand. To meet a customer's request, a MaaS operator facilitates a diverse menu of transport options, be they public transport, ride-, car- or bike-sharing, taxi or car rental/lease, or a combination thereof. For the user, MaaS can offer added value through use of a single application to provide access to mobility, with a single payment channel instead of multiple ticketing and payment operations.

Profit from strategy:

The project eGUTS and its outputs are an opportunity to gain experience how to solve e-mobility. The project will also help to increase a smart tool in the fields of road preference and parking policies, charging stations, rental spots. It supports and coordinates the development of charging infrastructure. Also it is possible use the e-cars in their car fleets. The project put on the table catalogue of measures which fulfilling regional strategies (Covenant of Mayors). It is also help to make a Sustainable urban mobility plan. It also brings the list of new technologies and smart solutions. There are lots of best practises from other cities.

Other stakeholders

Media (National Media & Regional Media & Thematic journal)

Description and competences:

Different national, regional and local media and also thematic journals focus on energy, e-mobility and motorists are relevant to promote outputs of the project. Media support increasing of public awareness about benefit of e-mobility. Shared knowledge and experience between experts.

Profit from strategy:

New information about e-mobility, best practises from different cities, new smart solutions.

Public (Broader public, inhabitants of relevant municipalities, drivers)

Description and competences:

Groups include inhabitants – end users. It is not only car drivers but also e-bikes and other electric vehicles drivers. The focus groups are young people (new trends, new machines), middle generation (every day users, for business and shopping) and older people (new type of movement's – e-bike).

Profit from strategy:

The project will increase knowledge of e-mobility, smart tools, best practices and increase environmentally friendly mobility.

Energy companies

Description:

The companies are responsible for production and supply of energy. The outputs bring new information in the field of e-mobility, new idea of potential business. The companies help implementation of e-mobility.

Profit from strategy:

The project will increase acknowledge of e- mobility and smart tools. Also shows best practise and possibilities for e-mobility development.

Other business

Description:

The companies which do business in the field of e-mobility like – sell or rent e-vehicles, e-bikes, small house charging station and other smart e-goods.

Profit from strategy:

The project will increase acknowledge of e-mobility and smart tools. Also shows best practise and possibilities for e-mobility development. The companies help implementation of e-mobility in common life.

4. Evaluation and prioritization of measures; Implementation arrangements

The just described processes led to build a common vision on the evolution of e-mobility and, above all, on the most important aspects that have to be tackled by eGUTS project in order to accelerate e-mobility development in the Danube region in a short-term period.

The "top-rated" aspects can be easily transposed into short-term objectives. Considering the aim of this document, mainly targeted to "high-level" policy makers within PAs, a further transposition was made, expressing the objectives as "Key Principles". Five Key principles were identified, representing a set of priorities commonly agreed by 13 partners in 10 countries, core part of eMOB Transnational Strategy.

Key Principle Nr. 1 – Define the best possible roles of PAs

Within Danube region, PAs play many different roles with regards to charging infrastructure deployment. In order to guarantee a coherent environment for e-mobility development and to limit the presence of different rules and different levels of infrastructure deployment in different areas, eGUTS project partners agree on the importance that all the involved PAs act homogenously, at least on a minimum number of aspects and topics.

While addressing this issue, it has to be reminded that the intervention of public bodies in the deployment of the charging infrastructure must respect the general concept stated by the Alternative Fuels Infrastructure Directive (2014/94/EU) [24]: "The establishment and operation of recharging points for electric vehicles should be developed as a competitive market with open access to all parties interested in rolling-out or operating recharging infrastructures."

According to AFID, the intervention of PAs can't therefore create limits or inhibit the development of a free and competitive market.

PAs can be divided into three main categories, with different roles and areas of intervention:

- National Institutions (Ministries and Government);
- Regional/Territorial PAs;
- Municipalities.

According to the scope of the project, the target audience of the present Transnational Strategy covers all the three categories, with a special attention to Regional/Territorial PAs. As already recalled in section 2. Key Principles of this document, due to different administrative divisions, different administrative organs exist within the 10 countries participating of the Danube region, with different powers and responsibilities. A unique case, in particular, is Slovenia, where no intermediate organs are interposed between National Institutions and Municipalities. For this case, it can be considered that role and responsibilities of the Regional/Territorial level are covered directly by National Organs.

While respecting the variety of roles now existing in the different Danube region countries, the experience gathered within the eGUTS project shows that all the Regional Authorities and Municipalities should act, at least, in order to facilitate and coordinate the deployment

of a homogenous and effective infrastructure inside their territories and with a strong attention also to neighbouring areas.

Thus, recommendations for **REGIONAL BODIES** are:

1. Set minimum technical rules on infrastructure deployment

Despite the presence of some international and national rules on charging infrastructure development, many aspects are still "uncovered" and the rules themselves can be open to different interpretations. Without a set of clear rules or boundaries set up by a regulator, e-mobility service providers can therefore adopt many different solutions while developing the charging infrastructure. This could lead to a fragmented infrastructure composed by many small networks with different characteristics in terms of: charging power (time needed to charge the vehicle), accessibility, identification and billing systems, connectivity, availability of additional services. The absence of minimum common rules could create hurdles to EV drivers, which can't properly plan their trips and the related charging events [25].

Regional bodies should identify a set of technical rules according to the most effective technological solutions, the international regulation and the local characteristics and should transpose them into a "Guideline" document or directly into a "Territorial Law", to be used as a reference by the operators. eGUTS partners strongly suggest that each Regional PA in the Danube region adopt and transpose in their area the technical rules presented in the following section "set supra-regional common minimum rules on infrastructure access".

2. Set infrastructure requirements for new buildings and new fuel stations

In the vision of remarkable e-mobility development in the next years, new buildings and new fuel stations should be equipped from now on to answer to next-future charging needs. The additional cost related to these interventions could detain the building contractor from realizing the charging facilities that should be therefore required by law.

Regional bodies should analyse the potential development of e-mobility in their territory and the traffic fluxes from/to neighbouring areas and identify a coherent percentage of needed charging points in new buildings and new fuel stations. While imposing the percentage, also a specific attention to technical requirements has to be paid, following the rules set according to the previous section.

3. Organize information and education programmes and coordinate the actions of different stakeholders and operators in the regional territory

E-mobility is nowadays a multi-dimensional topic and only a small part of it is related to technical aspects. A huge importance has instead to be given to education, social aspects and governance. To increase final user's trust in this new technology, education and formation activities have to be carried out [26]. At the same time, education is also needed by smaller public entities (e.g. small municipalities) that have to set up a fruitful framework to foster the charging infrastructure deployment, in strong correlation with operators and other PAs. Last but not least, the interest in e-mobility could come from many different actors (e.g. tourist centres, taxis, Local Public Transport companies, airports and multimodal hubs managers, commercial operators,…) and it is a duty of Regional PA to maintain a systemic view and to promote synergies among all the involved stakeholders.

4. **Coordinate the different planning activities within the Regional/Territorial Public Authority, creating synergy among territorial planning, urban planning, traffic planning, environmental planning and more**

As stated before, e-mobility is nowadays a multi-dimensional topic, which can find multiple expressions in the regional framework. It can affect traffic management and urban planning, but also air quality and environmental planning, as well as economic development, education and new jobs creation. Within the internal structure of Regional PAs, these topics are commonly addressed by different divisions (e.g. Environment, Infrastructure, Mobility, Economic Development etc.) that are in charge of their own planning activities. The lack of coordination can create a not-homogeneous environment, with the risk of taking overlapping or contradictory decisions and of missing important synergies.
Regional PAs should create a dedicated sub-structure devoted to e-mobility, able to monitor the activities of the different divisions and able to detect possible synergies. A constant communication should be pursued and periodic plenary meetings should take place, in order to obtain a systemic and constantly updated view.

As recommendations for **MUNICIPALITIES** should at least:

1. **Act as a stimulus for the infrastructure deployment, without a direct intervention on realization and management**

The presence of a charging infrastructure within the territory of the municipality is crucial in order to provide the needed services to EV drivers. The PA should act so to create a favourable context and to involve private operators in order to realize a charging infrastructure with public access. As the realization and management costs of the infrastructure is still quite relevant and its planning and design require technical skills, eGUTS partners consider generally inefficient the direct involvement of the Municipality as infrastructure owner or as e-mobility service provider. Exceptions can exist, as in the case of the very first stages of the network development (where municipality could be the only actor to invest on it) or in the case of public funding legally reserved only to public bodies.
In this regard, Municipalities should perform spatial planning activity, with preliminary studies on e-mobility demand in their area, including the identification of key points which could be optimal to serve a high number of EV drivers. They should then involve potentially interested service providers which could develop the infrastructure at their own expenses but with the benefit of PA agreement and coordination. While giving public-ground usage permission, the Municipality can also foster technical solutions and specific localizations, as a condition for the service providers to obtain the permission and possibly fee discounts. When being directly involved as network owners (see the exceptions before), municipalities should carefully identify a private operator that would take the role of e-mobility service provider for the public infrastructure.

2. **Facilitate the installation of charging stations both in public and private areas (permissions, public- ground usage regulation, technical support)**

In many cases, the authorization process for charging stations installation could be critic. It could involve, indeed, authorization for the use of public areas, for the installation of electric equipment, for construction work and more (fact proven also during the installation of the Pilot Actions of eGUTS project). This could create hurdles and blocks to private operators installation plans, as involves additional costs and additional time for the infrastructure set-up. Also technical aspects, as grid connection, energy measuring and correct billing can need a complex interaction among operators, DSOs and public bodies (especially if the municipality is the owner of the infrastructure).
Perform an analysis to identify the most important problems that investors and operators are

facing during the installation process. If needed, simplify the administrative procedures, identifying special rules and requirements for the charging infrastructure. It has to be considered, for example, that the charging infrastructure serves as a "public service" and the use of public ground should therefore be privileged with respect to other potential uses. Moreover, technical offices within the public body should be well prepared to answer to service providers questions and should give easy and exact references to the "in force" regulation.

3. Include e-mobility and infrastructure development in the planning activities, leveraging on Sustainable Urban Mobility Planning instruments

The European Commission, starting from the Action Plan on Urban Mobility (2009) [6] and the Transport White Paper (2011) [3], is widely promoting the adoption of Sustainable Urban Mobility Plans, which aim to represent a new planning concept able to address transport-related challenges and problems of urban areas in a more sustainable and integrative way. In contrast to traditional transport planning approaches, the new concept places particular emphasis on the involvement of citizens and stakeholders, the coordination of policies between sectors (transport, land use, environment, economic development, social policy, health, safety, energy, etc.), between authority levels and between neighbouring authorities. Sustainable urban mobility planning is therefore a challenging and complex task. Planners are asked to manage many requirements, sometimes conflicting, mainly based on the local level but linked to national and international targets on climate and environment. It is crucial that e-mobility and EV charging infrastructure is considered as a relevant aspect in this new planning process, in order to find the best synergies with the overall urban mobility evolution [27], [28] .

Follow national rules on Sustainable Urban Mobility Planning and consider, in a well-structured and concrete way, also the topic of e-mobility and infrastructure development. Create a cooperative framework among different technicians and offices within the municipality and promote events including e-mobility as a relevant aspect in urban planning. Take advantage also of international reference documents, as the Guidelines "Developing and Implementing a Sustainable Urban Mobility Plan" proposed by ELTIS, Europe's main observatory on urban mobility (financed by the European Commission) [27].

4. Keep constant attention to regional regulations, guidelines and suggestions and actively answer to the requirements

In some countries it is quite common to have a wide production of laws and regulations, both on national and regional level. It is often difficult for Municipalities (especially small ones) to have a constantly updated and complete view of the in-force rules, including laws, regulations, guidelines, plans and more. In this decisive moment for the creation of a homogenous and interoperable charging infrastructure within the Danube region, it is fundamental that Municipalities comply at least regional territory. If Regions properly acted, this coherence will also be guaranteed outside the local borders and internationally. Moreover, it is essential that Municipalities quickly comply with the duties imposed by Regional bodies (e.g. the adoption of SUMPs or the modification of rules on authorizations procedures).

It is necessary that both by the side of Municipality and of the Region, an effective communication is created. In order to do that, the instrument proposed as such an e-HUB pilot could be extremely useful, as well as the clear identification of a devoted structure/office within the Municipality organization.

5. Intervene on traffic/parking management and green public procurement to increase EV adoption and generate more profitable conditions for e-mobility service providers

The realization of the charging infrastructure actually creates the "offer" of a service. Despite

the importance to have the infrastructure already in place, in some AS countries the demand for that service is today quite low. This could easily ingenerate a vicious cycle where the infrastructure deployment doesn't generate revenues and is therefore blocked. The absence of the infrastructure, on the other hand, limits EVs usability and therefore creates additional obstacles to their diffusion. In this complex "chicken or the egg" situation, Municipalities should try to stimulate the "demand" for charging, creating an urban environment which calls for the adoption of electric vehicles and creates profitable conditions for e-mobility service providers [29].
Municipalities can leverage many instruments in order to stimulate EV adoption. The most commonly used are related to traffic and parking management, where EVs could benefit of special permissions or special discounts (including free parking) [30]. In addition to that, a good way to create the "demand" is to adopt a "Green Public Procurement" approach and to progressively convert public (and public-related) fleets to e-mobility [31].

Key Principle Nr. 2 – Set regional minimum rules on infrastructure

In the last years several public and private actors are paying attention to e-mobility and are starting developing first samples of EVs fleet and charging infrastructure, also in the Danube region. According to eGUTS project vision and objectives, it is really important that in this moment of "development", all the initiatives are seen as a part of a much more complex and integrated "system": EVs need to cross borders and the infrastructure has to be able to charge them.
Some international and national rules on charging infrastructure development have been established in the last years. Despite that, many technical aspects are still "uncovered" and the rules themselves can be open to different interpretations. In order to avoid the development of a fragmented infrastructure, eGUTS partners consider crucial to set some supra-regional common minimum rules that PAs should put in place while facilitating and regulating the deployment of the charging infrastructure, as mentioned also in the document eGUTS Standards. Next sections are therefore thought to give an overview of high level technical rules and suggestions, whit a special attention to access/interoperability/roaming issues. If all the PAs in the Danube region would follow at least these indications, an easy and seamless driving and charging experience will be offered to EV owners.

1. Power Level and uni/bi-directional energy flow

There is no need to set up a unique rule on the power level, as its choice depends on the aim for which the infrastructure is set up. It can be said that two levels are nowadays widely adopted:

- "Normal power": 22 kW AC (32 A – 3 phases);
- "High power": 50 kW DC or higher (up to 350 kW in recent future).

The first power level implies quite long stops and can be considered mainly as an alternative to home/work charging for users that don't have availability of a private box. An infrastructure with this power level should be planned according to several parameters typical of the urban environment [25]. Among others:

- Number of inhabitants;
- Private parking spots/total parking spots ratio;
- Number of cars for inhabitants;
- Foreseen e-mobility market penetration;
- Average daily mileage.

The second solution, commonly referred as "high power charging" (or "fast charging"), will instead

have as main objective to allow longer daily mileage to the vehicles. The chargers will be used mostly as "fuel stations" during mid-range missions and their localization should therefore be planned according to that (highways, city rings, etc.). Most of the present cars accept 50 kW fast charging and this could be seen as a reasonable power almost in the mid-term. Despite that, some high-level brands are already installing more powerful chargers (up to 125 kW) and 350 kW chargers are under development [32], [33], [34].
A reasonable public infrastructure should include both the power levels (22 kW and 50 kW) localized after a careful planning and taking into consideration the different aims.
While setting up rules about the electrical characteristics of the charging stations, it is worth keeping a particular attention on the development of "bi-directional" DC chargers. These solutions, able to perform the so-called "Vehicle-to-Grid" (V2G) providing energy back from the vehicle battery to the electric grid, are today available in Japan and are starting to spread in some European countries [35]. V2G development is not yet mature in the Danube region, as it still requires some work both on technical and (especially) on regulatory level, with a lack also in business-models definition [36]. Considering the interesting opportunities provided by V2G solutions, it is recommended to support pilot activities and to monitor the evolution of bi-directional charging stations and of the related regulation, so to possibly include these systems in successive medium-period technical rules.

2. Connectors and communication between vehicle and charging station

The topic of connectors has been highly debated in the last years, but the already mentioned 2014/94/EU Directive finally identified a common choice and gave clear recommendations [24]:

- Type 2 connector (EN 62196-2) for AC normal and high power charging;
- Combined Charging System (CCS) Combo 2 connector (EN 62196-3) for DC high power charging, preferably coupled with a CHAdeMO connector for a "multistandard approach".

An open point still exists only in the field of Light Electric Vehicles (LEVs) with on-going work on IEC level [37]. In order to charge LEVs, a different socket could be added to the e-CS, but the 2014/94/EU Directive does not specify a common solution. Due to that, different standards are adopted across Europe (e.g. Schuko socket in Germany and Type 3A socket in Italy) and are still difficult to set common rules on this aspect. eGUTS suggestion is to identify a unique solution in order to get a complete transnational interoperability.
Once the vehicle is plugged-in, an effective communication between the vehicle and the charging point is fundamental to allow a safe and controlled charging process. Also on this aspect, European standards are now well-established. All the charging stations installed in the Danube region should so adopt one of the following standards that cover the three most common charging technologies:

- AC charging: PWM communication according to IEC 61851-1 (mode 3);
- DC CCS Combo 2 charging: PLC communication according to DIN SPEC 70121 (ISO 15118);
- DC CHAdeMO charging: CAN communication according to IEC 61851-24.

3. Communication charging station – backend

The communication between the charging station and its backend is still an open issue, as no definitive choices have been made on the protocol to be used (API - application program interface). At present, many manufacturers adopt proprietary solutions as they often represent both the charging station and the backend sides. In a future, more complex, environment, it will be advantageous to have a common standardized solution and many efforts are on-going to develop and identify a common protocol. In particular, some standardization groups gathered in the last year's industries, operators and research centres and proposed interesting solutions. An example, now widely recognized around Europe, is the so-called OCPP (Open Charge Point Protocol) by OCA

(Open Charge Alliance) [38].
In absence of a univocal standard, it is anyhow recommended that the communication between the charging system and the control system takes place through a protocol that is as open, flexible and shared as possible and that already has a significant market diffusion, so as to facilitate the progressive implementation of a fully interoperable infrastructure. Moreover, the control system should perform at least the minimum following functions in real-time:

- Verification of correct functioning;
- Verification of availability (free/occupied);
- User identification;
- Activation / inhibition of the charge;
- Measure and reading of electrical parameters during charging.

Key Principle Nr. 3 – Adoption of an integrated trans-regional mapping tool

The need to find a charging station while driving or while planning a trip is a common issue for any EV driver in the Danube region. Nowadays, different solutions are co-existing:

- Mapping tools provided by each e-mobility service provider, listing their own infrastructure via web or via mobile-app;
- Mapping tools provided by car manufacturers and available on vehicles navigation systems;
- Mapping tools provided by third parties (mainly private companies or no-profit organizations), collecting data of multiple service providers also thanks to crowd-sourcing;
- Mapping tools provided by networks of operators linked through "roaming platforms" (e.g. Plugsurfing, Hubject or Freshmile);
- Official national mapping tools provided by Ministries or National Institutions.

None of these solutions yet represents the perfect answer to EV driver's needs, as they commonly include only a partial representation of the complete infrastructure or partial/not verified information. Most of them also lack "real-time" information. While planning a long and international trip along the Danube region, EV users will still have to adopt and compare different instruments.
In this regard, eGUTS partners agree that important benefits could come by fostering the adoption of more structured solutions, which could provide EV drivers a sure and reliable source of information for the whole area, including real-time data. eGUTS APP can be the start of such a complex mapping tool.
In order to reach that, the best way to obtain a complete and reliable mapping tool is to create an official "National Register" and to compel each operator to provide real-time data of their infrastructure, at least with regards to publicly accessible EV charging points. These national databases will provide EV drivers with the location of the charging points and possibly indicate whether they are free or occupied, out of order, or momentarily not accessible, for each country in the Danube region. Similar databases already exist in some European countries (e.g. U.K., Norway and Germany [39], [40]), even if their characteristics are different and none of them can be used as a perfect reference (e.g. some real-time features are missing or some kind of e-CS are not mapped).
eGUTS partnership agree on the need that PAs, both on a local and a national level, highlight the importance of this issue and put some political pressure on National Bodies responsible

for the realization of the National Registers, suggesting meantime to quickly proceed in order to publish tender notices for the creation of the Registers, which could be owned by the Public Authority but run by a private operator under specific contracts.
It has to be noticed that the exchange of real-time data by many operators to one single database requires a particular attention to technical aspects and mainly to the communication protocol. In absence of clear rules or indications coming from European regulation, so there is the strongly suggest to avoid "new" or "proprietary" protocols, and to adopt a solution that is already existing and well diffused, preferably open-source, flexible and widely shared. An example could be the so-called "Open Charge Point Interface" (OCPI), an independent and open protocol developed by a group of Dutch companies starting from 2014 and now adopted by almost 30 operators.
A second crucial issue is to identify a proper legal instrument to force operators to contribute to the national register providing their real-time data. This can be a compulsory requirement when benefitting from public funds, but should be officially required also for private operators using completely private funds. A solution could be to include this aspect within the administrative/ bureaucratic procedures to obtain authorization for installing and connecting an e-CS.
Once National official register will be available and reliable data will be accessible to third parties, it will be a natural consequence to aggregate them into a "transnational map". This will be probably done by actors which are already managing mapping systems for EV infrastructure, till now using unofficial data. The presence of official data will increase the reliability of many mapping instruments, providing an effective service for drivers and allowing an easy traveling around the Danube region.
In this framework, crowdsourcing and the use of feedback provided by users could be really valuable to identify failures and database errors and also to add the localization of e-CSs installed by private business like restaurants, shops or others. Information platforms can be seen not only as a "provider of information" but also as a "receiver", getting daily valuable user feedback that would be lost otherwise and that can be used to improve operations.

Key Principle Nr. 4 – Communication among PA

Within the Danube region are more than 160 Regional PAs and thousands of municipalities. It is immediately clear that in order to create a favourable and homogenous environment for e-mobility development, there is a strong need of communication and coordination among them. In particular, communication is needed in order to:

- Commonly identify minimum technical requirements for the infrastructure among different Regions;
- Share knowledge and experience about "best practices" among different Regions;
- Share information about "specific choices" made by Regions which could have some impact on neighbouring Regions;
- Transmit, by Regions to municipalities, information about tenders and funding opportunities;
- Transmit, by Regions to municipalities, information about rules, guidelines, best-practices on infrastructure deployment;
- Transmit, by Regional technical offices to small municipalities, general and technical knowledge about e-mobility and charging infrastructure, in order to educate and train non-expert employees in smaller realities;

- Transmit, by municipalities to Regions, on-field information about final users' needs, operators requests, potential synergies with other issues in the territory (e.g. public transport, multi-modal hubs, point of attractions…).

As visible also in this brief list, according to eGUTS experience the most active body should be the Regional PA. Given its bigger dimensions and the possibility to leverage internal technicians and to have a wider view on national and international developments, the Region should be designated as the reference point for gathering, and consequently spread, the most relevant information. In particular, according to what stated also in section 2, within the Regions a dedicated sub-structure devoted to e-mobility should exist, able to monitor the activities of the different divisions, to detect possible synergies and to take care of communication activities towards other Regions and municipalities. It has to be underlined that while giving the necessary importance to "internal" communication among PAs, Regions and Municipalities must not disregard also "external" communication with citizens and final users, crucial for e-mobility development [41].
Many possible solutions exist in order to foster communication and to spread knowledge, such as workshops, seminars, conferences, training courses, video tutorials, newsletters, social media environments, forums and web communities, etc.

Key Principle Nr. 5 – Guarantee synergy among private and public transport and communication among public authorities

Private transport dramatically represents the biggest component of urban traffic and urban pollution and is therefore a crucial aspect on which to intervene through more sustainable solutions, as e-mobility. Nevertheless, it has to be taken into serious consideration that local public transport (LPT), especially within metropolitan areas, is one of the most effective modal solution and that a sensible shift from private to public transport would have a very effective impact on sustainability of urban mobility.
More in particular, a wider adoption of public transport could guarantee [42], [43]:

- Environmental benefits
  - Reduction of pollutant emissions;
  - Reduction of greenhouse gases emissions;
  - Reduction of noise pollution.
- Social benefits
  - Increase of road safety;
  - Decrease of road congestion (and related personal stress);
  - Increase of accessibility for disabled and elderly people.
- Economic benefits
  - Decrease in global transportation costs;
  - Decrease in cost of living;
  - Decrease in sanitary costs;
  - Value increase for properties in cities.

The best option for PAs in this moment is therefore to find and exploit the best possible synergies between e-mobility and public transport. A good planning of EV charging infrastructure could indeed sensibly affect the interactions and the integration of the two sectors.
eGUTS partnership indicate some priority actions that should be put in place especially around bigger cities of the Danube region, such as:

- Equip with a proper number of charging stations the parking areas located outside the urban centre and dedicated to park-and-ride schemes. This will let home-office

commuting by intermodal EV+LPT solutions and will guarantee to EV users a daily charge for their vehicle. By a technical point of view, this infrastructure should be based on low-power charging points, possibly provided with power management systems in order to optimize the energy flow.

- Equip with a proper number of charging stations the most important transportation hubs like railway stations and airports. This case, the best solution would be "high power" charging stations which could allow charging for:
  - Electric vehicles coming from surrounding areas with pick-up/drop-off purpose (both private vehicles and dedicated vehicles);
  - Electric vehicles under "vehicle sharing" scheme, commonly used for last-mile purpose;
  - Electric Taxis performing short-time parking.
- Encourage public transport companies and e-mobility service providers to integrate their services. The access to charging infrastructure and LPT could be obtained by a unique system (card or smartphone App). A common application could provide integrated information about public transport timetables and charging stations position and availability. Moreover, special discounts and fidelity packages could be offered in order to promote intermodality and sustainable transport. Also vehicle-sharing solutions (both two-wheelers and cars) should be seen as a part of the LPT and be included in this integrated service.

5. Applicability of measures in Danube region

Selection and evaluation of most appropriate measures for Danube region

Based on discussions with stakeholders (grouped in Regional Strategic Platforms) and close cooperation with partner cities, a set of measures suitable for the development of e-mobility in the conditions of the Danube Region was identified. All measures were designed in accordance with the 5 key principles outlined in Chapter 4.

Set of measures can be divided into five basic groups, namely:

- Strategic;
- Transport-organizational;
- Operational;
- Technological and infrastructural;
- Soft.

Strategic measures are focused on the creation and updating of key documents facilitating e-mobility, especially at regional and local level. Strategic measures may include plans (such as SUMP, SEAP, LAP, etc.) and policies (such as Parking Policy). Transport-organizational measures concern the indirect support of electric vehicles in the form of various operating advantages. Operational measures are focused on new forms of transport, a combination of transport modes and alternative transport services. Technological and infrastructure measures include the introduction of alternative (electric) vehicles into fleets, vehicle replacement, building a network of charging stations and accompanying infrastructure needed for the development of e-mobility. Soft measures include various informational, promotional and educational campaigns.

In order to facilitate the public authorities' perception of the time required to implement them, the individual measures were divided into:

- Short-term;
- Medium-term;
- Long-term.

In the beginning of intensive development of e-mobility we can consider 1-2 years period as short-term horizon, 3-5 years as medium-term and more than 5 years as long-term. However, it is not always possible to make a clear classification. In some cases, for one measure, the implementation period may fall within both the short and the long term. Especially in the case of costly measures, it often depends on the method of financing, especially the possibility of using subsidies. A typical example is the renewal of public transport vehicles. Without the possibility of drawing subsidies, the replacement takes place gradually, in pieces per year and lasts several years depending on the age and size of the fleet. If there is a possibility to use subsidies, the fleet will be replaced more rapidly in a shorter period.

The evaluation of the measure, taking into account the initial conditions in the Danube region, is carried out on the basis of:

- Economic demands;
- Process demands;
- Realization demands.

The evaluation of demands is in all aspects three-stage, i.e. low, medium and high.

Economic demands are determined by the amount of investments required or the amount of operating costs. Higher economic costs can be expected in the group of technological and infrastructure measures. Conversely, the lowest for soft measures.

Process demands are expressed by the complexity of the approval process, the amount of permits or approvals required, and the time needed to obtain them. The highest process demands are in the case of infrastructure measures, eventually transport-organizational measures, the lowest again for soft measures.

Realization demands are related to the preparatory phase (tenders, etc.), the construction, commissioning, preparation of information and educational materials, etc. and also with the implementation phase, i.e. the actual operation of the infrastructure, the introduction of vehicles or systems for sharing vehicles, the implementation of information and education campaigns, etc. Also in this case, the lowest demands can be expected for soft measures. The actual assessment of the implementation demands depends on the case. For example, for infrastructure measures, it can be high if the infrastructure is built by public authorities. In case they only provide space or plots for it and realization including subsequent operation is provided by a private company, then the difficulty for public authorities is rather low.

Strategic measures				
Measures	**Time horizon**	**Economic demands**	**Process demands**	**Realization demands**
Strategic documents (SUMP, SEAP etc.)	short-term	medium	low	low
Mobility plans	short-term	low	low	low
Parking policy	short-term, mid-term	low	low-medium	low-medium

Table 2. Set of strategic measures

Transport-organisational measures				
Measures	**Time horizon**	**Economic demands**	**Process demands**	**Realization demands**
Parking policy support	short-term	low	medium	low
Limited access	short-term	low	low-medium	low

Table 3. Set of transport-organisational measures

Operational measures				
Measures	**Time horizon**	**Economic demands**	**Process demands**	**Realization demands**
Introduction of alternative transport services (passenger transport)	short-term	medium	medium-high	medium-high
Introduction of alternative transport services (freight transport)	short-term, mid/term	medium	medium-high	medium-high
Bike rentals, bike sharing	short-term, mid-term	low-high	high	medium
Car rentals, car sharing	short-term	low	medium	low

Table 4. Set of operational measures

Technological and infrastructure measures				
Measures	**Time horizon**	**Economic demands**	**Process demands**	**Realization demands**
Development of charging stations network	mid-term	low-high	high	low-medium
Development of bicycle charging stations network	short-term	low-medium	low-medium	low-medium
Accompanying infrastructure for bicycles	short-term	low-high	low-high	low-high
Introduction of e-bikes	short-term	low-medium	low	low
Introduction of vehicles with alternative powertrain in municipal fleet	short-term, mid-term	medium-high	low	low
Introduction of vehicles with alternative powertrain in public transport	short-term, mid-term, long-term	high	low	low-medium
Introduction of communal vehicles with alternative powertrain	short-term, mid-term	medium-high	low	low-medium
Introduction of e-taxi	short-term, mid-term	low	low	low

Table 5. Set of technological and infrastructure measures

Soft measures				
Measures	**Time horizon**	**Economic demands**	**Process demands**	**Realization demands**
Education	short-term	low	low	low
Providing information	short-term	low	low	low
Promotion	short-term	low	low	low
Platform for the development of e-mobility in the municipality	short-term, mid-term	low	low	low

Table 6. Set of soft measures

Local action plans

What is LAP

Policies place Local Action Plans (LAPs) at the heart of the planning system as they translate policies into concrete framework of measures for development in relation to specific aspects of society (housing, the economy, community facilities, infrastructure, mobility, safeguarding the environment etc.). Local action plans make clear what is intended to happen over the life of the plan, where and when this will occur and how it will be delivered. This is done by setting out specific measures to be implemented, actions to be taken, specific allocations of land for different purposes or through criteria-based policies to be taken into account when considering development. Usually local action plans also provide financial frameworks for implementation.

The main objective of the local action plan is to identify and detail specific actions to be implemented. In short local action plan deals with four major elements:

1. Specific tasks: what will be done and by whom?
2. Time horizon: when will it be done?
3. Resource allocation: what specific funds are available/needed for specific activities?
4. Monitoring: how will the progress be monitored and by whom?

In this respect eMobility local action plan is a structured and scheduled municipal plan to promote and advance electric mobility in municipality. It helps municipalities to detail short- and long-term measures, assign responsibilities for actions completion and to involve key stakeholders. At its core, e-mobility local action plan is concrete implementation plan expressing commitment of a municipality to implementation of electro-mobility actions.

LAP development methodology

Development of an eMobility Local Action Plan starts with review of existing strategic documents (Sustainable Urban Mobility Plans – SUMPs, Sustainable Energy Action Plans – SEAPs etc.) of the municipality and identification of measures already outlined and/or defined in strategic documents. These measures are then translated into concrete actions with clearly defined time frame, budgets, funding sources and responsibilities. Municipalities can also opt to define additional measures/actions that do not stem directly from adopted strategic documents but could be a part of municipality's vision and interest for development of its transport system, changing the way its personnel travels, introducing e vehicles in municipality owned fleets or supporting/joining initiatives of other public or private stakeholders. Not only does the eMobility Local action Plan define the actions including time frames, budgets and funding sources but it also has to incorporate monitoring process using accessible and verifiable indicators. Furthermore, the plan has to provide a benchmark against which to measure progress. The more concrete steps an Action Plan contains the better – pre-defined budgets, clear allocation of responsibilities and progress monitoring will ease implementation of the eMobility Local Action Plan.

Municipalities have different starting points and motivations for LAP development can be versatile thus also the results will vary – there is no "one fits all" eMobility Local Action Plan. Local circumstances and goals should always affect the way an Action Plan turns out to be. The methodology for development of eMobility Local Action Plan has to be generic, allowing municipalities to adapt it to local priorities and local context. Nevertheless, a systematic approach to eMobility LAP development facilitates the process and makes it more transparent.

In the first place, the municipality has to commit itself to the process of LAP development and lead its preparation. The LAP development team/working group needs to be appointed and it should consist of municipality's personnel with participation of external members (representatives of any interested stakeholders). Once the team/working group is established, it has to review all strategic documents of the municipality in order to identify eMobility measures and plans already specified in various strategic documents adopted by the city council. Additionally the team/working group can identify and nominate other/supplementary actions. Based on identified measures concrete and specific actions need to be pinpointed, including timetable, budgets, funding, responsibilities and monitoring. The list needs to be re-examined and evaluated in terms of feasibility, priority and time. The revised list is then submitted to city council for adoption and official approval. With this, the implementation of the LAP is officially entrusted to municipality and its departments appointed in LAP. As part of each action, monitoring has to be specified and needs to be implemented after LAP adoption. With LAP adoption the work of the LAP development team/working group is done. Yet the team/group can continue – the municipality can authorize

the team/group to monitor the LAP implementation and/or to periodically review and update the LAP.

The eGUTS process of Local Action Plan development is comprised of following steps:

1. Study and understand **Local Action Plan Terms of Reference** (LAP ToR).
2. **Engage** stakeholders.
3. Compose a **working group** responsible for Local Action Plan development.
4. **Train the working group** (and stakeholders) using Training materials (modules 1 – 6).
5. Understand **Local Action Plan Template** (LAP Template).
6. **Review municipality's strategic documents** and identify eMobility measures/actions to be included in Local Action Plan.
7. Adapt LAP template to your needs and **insert eMobility measures** to be implemented
8. Constantly **coordinate with City Council.**
9. Hold public consultations (optional).
10. **Submit** Local action Plan to City Council.
11. City Council officially adopts Local Action Plan.
12. **Implement** Local Action Plan, **monitor implementation** and **update** the plan **periodically.**

eMobility Local Action Plan is prepared for definite (explicit) time period in which measures should be implemented. But as the LAP should also make allowance for unexpected events, corrective actions and deviations, periodic review and update of LAP are fundamental. It is advisable that LAP progress is reviewed periodically and to allow for LAP updates at least once per year (it is not necessary to update LAP every year but the possibility should exist while it should also be possible to update the document more often if needed). If SUMP is already in place, LAP update should be done at the same time as the SUMP update.

At the time of LAP progress review and LAP updates new challenges for the next eMobility Local Action Plan generation can be identified. But before starting the work on the next generation of an eMobility Local Action Plan, the lessons learnt so far should be reflected. This can help to optimise the planning process and the measure selection in the future. Experience shows that each planning cycle helps to improve the expertise on urban mobility planning and to increase the effectiveness of the next planning round.

Importance of LAP

eMobility Local Action Plans are built on strategic documents (Sustainable Urban Mobility Plans – SUMPs, Sustainable Energy Action Plans – SEAPs etc.) and supplement these plans by adding needed details for achieving the goals set in strategic documents. LAPs specify what needs to be done in form of detailed short- and long-term measures while also assigning responsibilities for actions completion.

With action planning in the ability of municipalities to advance beyond policies to implementation of change and effects greatly increases. Planning is often very time consuming task for matching interventions and strategies to community needs and objectives but it is also an essential task for reaching objectives. The process of establishing concrete, attainable goals and objectives provides a roadmap of specific tasks for action and reporting on progress. These makes implementation easier as the plan provides measures while also specifying details for implementation of each measure (timing, finances etc.) as well as delegating responsibilities. Thus, municipalities are more likely to reach objectives of strategic documents if these strategic documents are backed-up with concrete and specific action plans.

6. Opportunities for financing the implementation of energy efficiency measures

Sectoral challenges

In Europe, more than 60% of the population live in urban areas [44]. Citizens share not only space, but also the infrastructure developed for mobility. If current trends continue, by 2050 over 82% of the entire EU population will live in cities, demanding more infrastructure for transportation. What is even more challenging is the ever-increasing number of city dwellers that are moving to the suburbs, creating a phenomenon of urban sprawl leading to settlement structures with longer travel distances [45].

Longer distances and inadequate public transport imply larger numbers of car ownerships which results of increasing congestion [46] and infrastructure maintenance costs, while reducing availability of parking spots. Transport congestion in and around urban areas has also economic costs. Delays and pollution amount to nearly 100 billion euro each year, or 1 % of the EU's GDP. Noise, due to road traffic, is also a growing problem.

The transport sector, excluding international aviation and maritime emissions, contributed to 21% of the total EU-28 greenhouse gas emissions in 2015 [47]. Furthermore, from 1990 to 2015, road transportation was the only of the largest key source categories for CO_2 emissions that hasn't been reduced in the period, presenting the highest increase in absolute terms of CO_2 among all energy-related emissions and accounting "for 24 % of CO_2 emission in 2015" [48].

These transport-related challenges have pushed cities to find new ways to improve mobility while, at the same time, reducing congestion, accidents, and pollution. Local governments, knowing more about their circumstances, are in the best position to create solutions for these transport challenges. In fact, the 2030 climate and energy proposals aim to intensify the EU's strategy to set ambitious CO_2 standards for vehicles. For example, public authorities are required to take account of lifetime energy use and CO_2 emissions when procuring vehicles, and there is a target to reduce the greenhouse gas intensity of fuels by 6 % by 2020.

Financing instruments

The implementation of proposed measures may require significant investment. Every country that is a full member of the European Union, has been allowed to withdraw funds from Structural and Cohesion Funds and increased available funding sources. Besides Structural and Cohesion funds, other funding sources which can contribute to the revitalization of investment activities are the ESCO model, revolving funds, public-private partnership, etc. So far, these models are not currently being used to a significant extent. European funding programs provide direct financial incentives to public bodies to develop profitable projects. Financial products such as guarantees and equity are also used to support the project.
The basic and detailed breakdown of funding sources is shown below in Figure 2 and Figure 3.

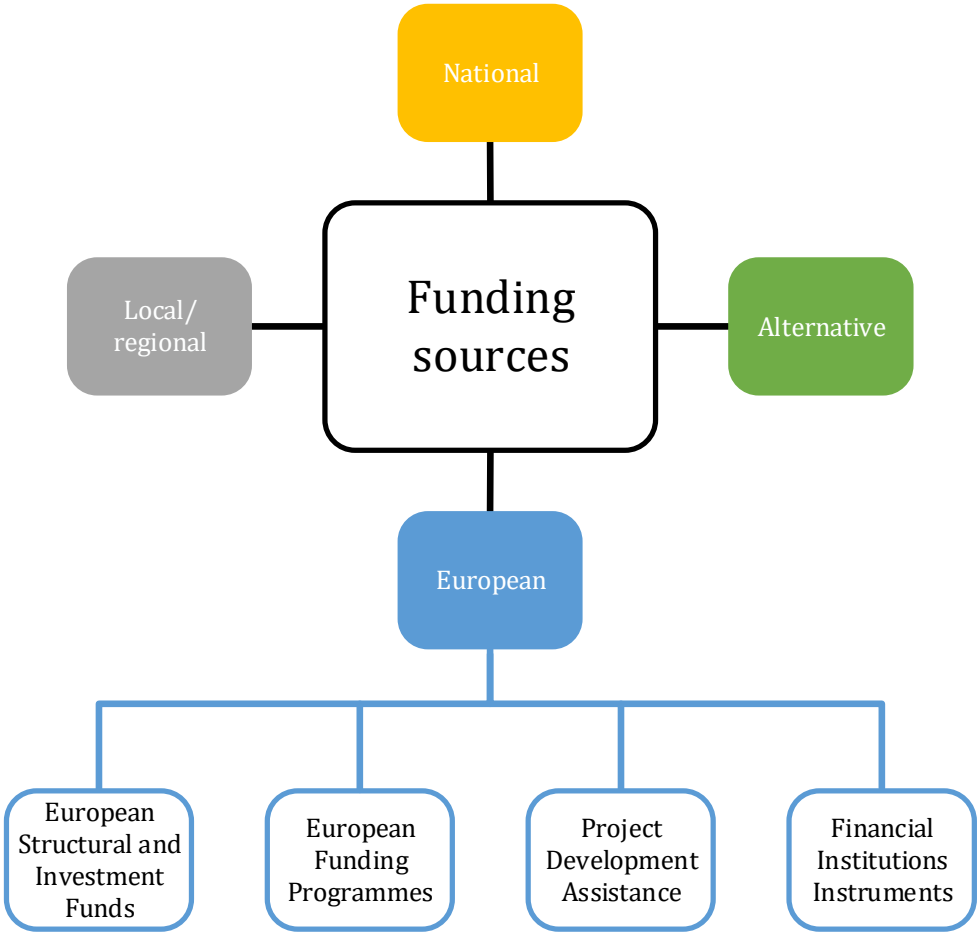

Figure 2 Funding sources

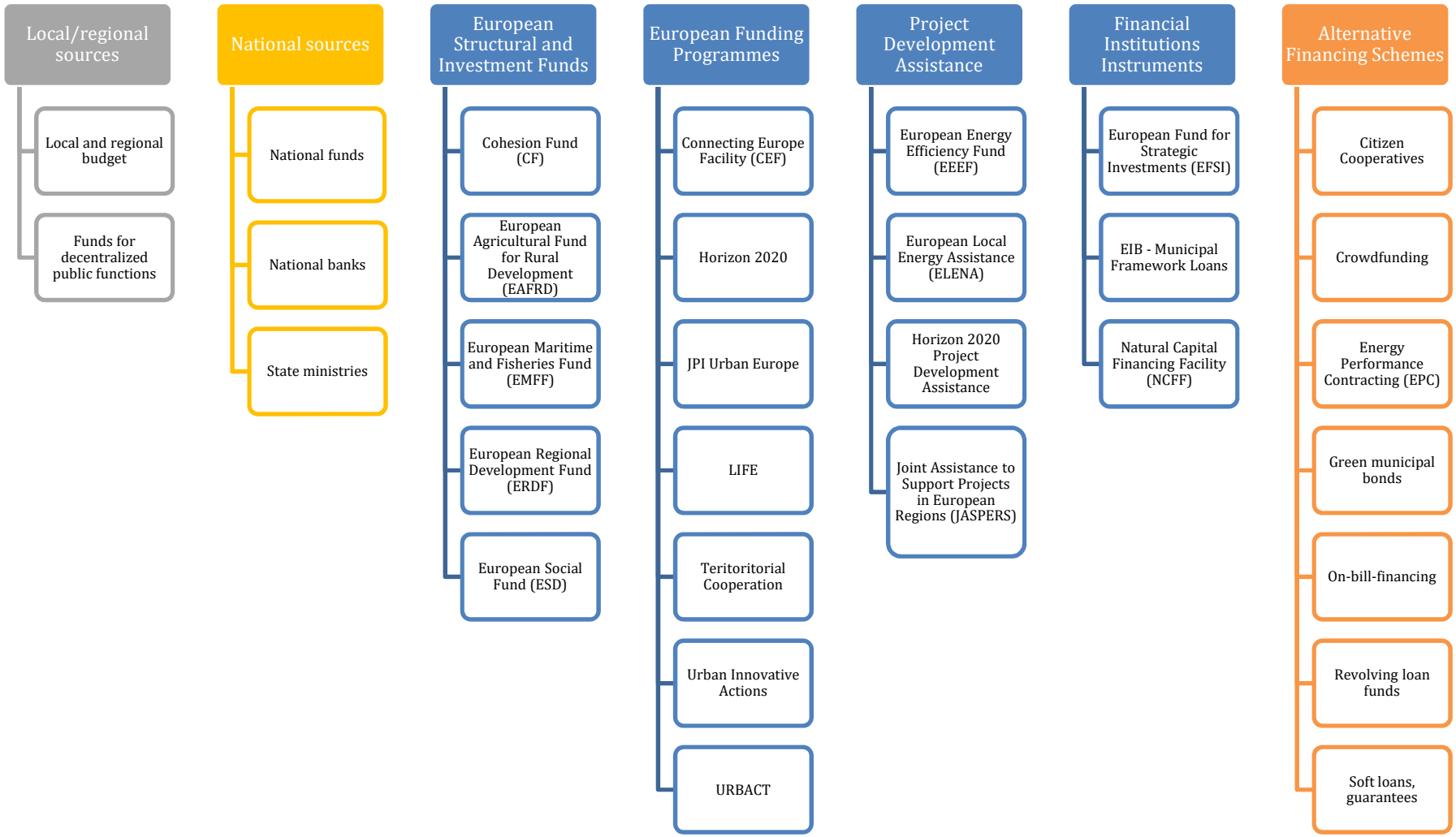

Figure 3 Classification of main funding sources

Decision Tree

The decision tree represents a flow chart of the most appropriate financing mechanisms to address specific situations faced by municipalities in financing energy efficiency (EE) projects. The scheme is not binding as, in many cases, multiple mechanisms may be combined.

The first thing to address is whether the municipality has sufficient resources to fund the project(s) or not. If the municipality has sufficient financing for the project(s), it can allocate part of its budget for the project(s); by establishing a budget line item for project and carrying out the mechanism of general budget financing. If the municipality does not have enough funds, it should seek any grants available from donors. If there are available grants, the municipality should apply for them. Often this grants do not cover the entire project cost as they represent a mechanism of partial budget financing. It is often possible that funds may also come from the national government; in this case the municipality will capture new budget for financing part of the project(s). If the fund does not come from the national government, it is possible to look for energy efficiency funds; this financing scheme is subject to EE fund eligibility criteria.

Beside this funds, commercial banks can also offer dedicated credit lines and/or risk sharing programmes. In order to take advantages of these opportunities, the municipality must respond for its creditworthiness as well as its collateral and borrowing capacity.

Other financing systems can be found in commercial or financial ESCOs; if there are ESCOs in the market the municipality should develop favourable EPCs by negotiating them with ESCOs. If the ESCO is not an option, leasing or vendor financing programmes can be searched. In such case, when the eligibility criteria are satisfied, similarly to the commercial financing scheme, the municipality should negotiate the leasing or the vendor financing agreement. Finally, if the municipality has the capacity to issue municipal bonds it should create a municipal bond programme by taking into account the transaction costs and market situations.

The example of choosing relevant financing model for sustainable energy and climate action projects by using a simple decision tree is shown in Figure 4.

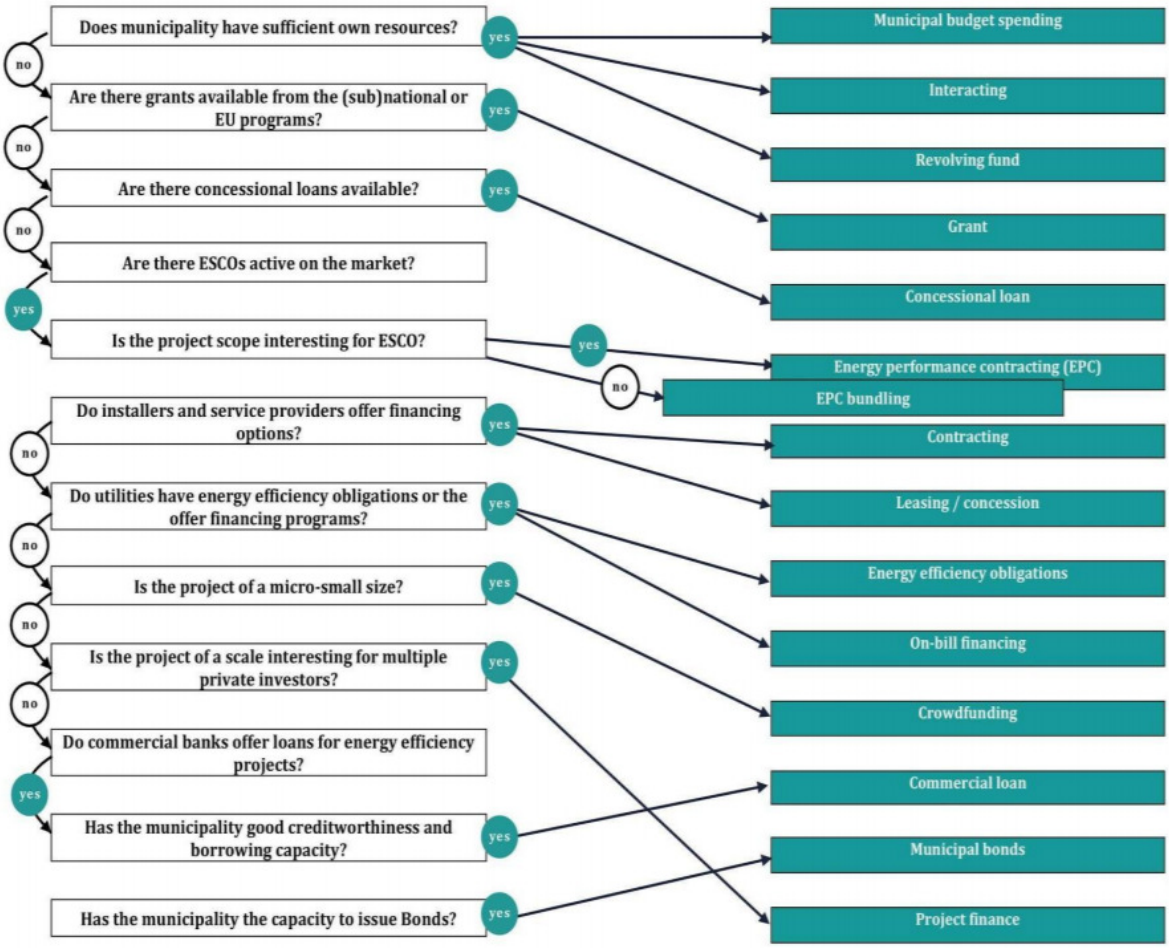

Figure 4 Decision Tree [49]

Conclusions & Recommendations

The countries of the Danube region are on the verge of new major challenges. Global economy, limited availability of non-renewable resources, climatic changes, population aging - a rapid evolution in mobility is currently underway worldwide, triggered by advances in technology and in society in general. The rapid adoption of electric mobility is an important way to achieve objectives related to greenhouse gas emissions and air pollution in general. The number of electric vehicles and coverage by publicly available charging infrastructure is gradually increasing, both in terms of individual mobility and public transport.

Sales growth in the sector of e-cars opens up opportunities for a reduction in their high price, in the future however, it can bring yet unknown challenges such as urban micromobility, ensuring enough electric energy for charging of e-cars or materials for the manufacture of batteries.

This Strategy makes ambitions to define a comprehensive framework for promoting electromobility in the cities of the Danube region, bring a tool to Policy Makers and Decision Entities in facing the problems in the deployment of eMobility and charging stations network, fostering the expansion of e-mobility services, defining priorities and identifying actors responsible for further development. At the same time it is necessary to keep in mind that not all measures are arbitrarily applicable, what works in one place cannot be haphazardly replicated elsewhere. Each city has its own conditions that differentiate them from others, thus needs also its own mix of selected after careful consideration of the potential impacts and benefits both individually and in particular in the context of the mobility of the whole city. That is why it is of utmost importance at the very beginning stage of the e-mobility development to prepare a Local Action Plan (individually or as a part of a bigger document like SUMP), which will give everything a strategic framework and address the issue in context. A wider team of experts can be invited to improve the process of preparation of these documents, especially professional platforms aimed to promote eMobility can bring better outlook from various types of stakeholders. The document must be discussed with the public as well.

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Annex 1 - Catalogue of measures

Name:

Strategic documents (SUMP, SEAP etc.)

Description:

The need for more sustainable and integrative planning processes, as a way of coping with the complexity of urban mobility, is widely recognized. New approaches to urban mobility are emerging as an effort by local authorities to break past access and develop strategies that can stimulate a shift towards cleaner and more sustainable modes of transport.
The SUMP define the basic features of modern and sustainable urban mobility and transport, as well as measures to achieve them. The measures set out in the SUMP should include all forms and modes of traffic throughout the city agglomeration such as public and private, passenger and goods, motorized and non-motorized, movement and parking.
SEAP and SECAP include an assessment of the geographical, demographical and energy local context, a Baseline CO_2 Emission Inventory (BEI) referring to a specific base year, a clear identification of the emissions reduction target, and the actions planned together with time frames, assigned responsibilities and estimated impacts and costs [50].

Benefits:	**Risks:**
Significant energy savings and reduction of CO_2 emissions.	
Group of measure: Strategic	**Economic demands:** Medium
Responsibility for implementation: Municipality	**Process demands:** Low
Time horizon: Short-term	**Realization demands:** Low

Examples of implementation:

Many cities in Europe, Danube region included, are already involved in EU activities to promote and apply the concept of a Sustainable Urban Mobility Plan (SUMP). Database (Eltis), which is created for this purposes, provides the names of cities involved in such ongoing and completed urban mobility projects and initiatives. There is also database of all the Sustainable Energy (and Climate) Action Plan on the Covenant of Mayors web pages, submitted by Covenant signatories either already accepted or currently under assessment by the European Commission's Joint Research Centre.

https://www.eltis.org/mobility-plans/city-database
https://www.eltis.org/mobility-plans/sump-concept
https://www.covenantofmayors.eu/plans-and-actions/action-plans.html

Relation to other measures:

None

Name:

Mobility plans for companies and institutions

Description:

The mobility plan consists of a set of measures implemented by a company to facilitate employee travel and to address the problems caused by vehicular traffic and the shortage of parking places. Typical measures are definition of the preferred modes of transport to be used depending on type of travel and destination, offer of alternatives to own car (PT tickets, bikes etc.), preference of videoconferencing, optimization of traveling.

Benefits:	**Risks:**
Commuting with using of Sustainable Transport. Optimizing Commuting for Employees of Selected Institutions.	Free capacities if plans are self-developed. Non-compliance with set rules.
Group of measure: Strategic	**Economic demands:** Low
Responsibility for implementation: Municipality, institutions and companies	**Process demands:** Low
Time horizon: Short-term	**Realization demands:** Low

Examples of implementation:

The CIVITAS Initiative has realised 46 measures on mobility planning and awareness raising in 31 different cities from 2002 to 2012. Some of the most successful can be seen on Civitas web page.

https://civitas.eu/mobility-management/planning

Relation to other measures:

None

Name:

Parking policy

Description:

Generally parking policy has four main objectives [51]:
1.To contribute to a better accessibility and mobility of the urban area;
2.To contribute to a better quality of life in the city;
3.To support the local economy;
4.To raise municipal revenue;
Typical example is preparing of the parking policy for the city centre with the conditions:
· For individual types of users: e.g. residents, tourists, disabled people
· For individual engine types: electric, all combustion, diesel engines
· For individual types of vehicles: passenger, commercial vehicles, trucks
· For individual seasons or times of day

Benefits:	**Risks:**
Reduction of emissions from IAD operations.	Maintaining the availability of parts of the city with restrictions on IAD. Setting of the parking zone correctly. Effect of IAD parking load shifting from the city centre to its immediate vicinity.
Group of measure: Strategic	**Economic demands:** Low
Responsibility for implementation: Municipality	**Process demands:** Low-Medium
Time horizon: Short-term, mid-term	**Realization demands:** Low-Medium

Examples of implementation:

Eight partner cities/institutions (involved in the project Push&Pull) implemented parking management measures and mobility management measures. Examples are on project web.

http://push-pull-parking.eu/index.php?id=21

Relation to other measures:

Parking policy support

Name:

Parking policy support

Description:

In order to ensure that electric vehicles can be guaranteed to be charged, parking spaces designated exclusively for such vehicles need to be specially marked in the immediate vicinity of the electric vehicle charging station. Such vehicles have free parking space in the designated area and may be retained until the end of the specified vehicle charging period.
An additional option is the introduction of free parking spaces for electric vehicles that are not in the immediate vicinity of the charging station and are located in areas of the city with a high concentration of traffic. In this way it is possible to facilitate parking for such vehicles in the city center, especially during the tourist season when there is a high concentration of vehicles. This measure encourages residents to purchase an electric vehicle with which they can always have a secured parking space.
Parking incentive system:
- Dedicated parking spaces for BEV / PHEV
- Preferential pricing policy for BEV / PHEV
- Reserved parking at the BEV / PHEV operator's residence

Benefits:

Incentive to buy BEV / PHEV - potentially increased number of BEV / PHEV used in the City and thus lower environmental impact (reduction of energy consumption and CO_2 emissions).
If these designated parking places are free and secured space for the users in the inner city area, this measure will affect the greater interest of citizens in electric and hybrid vehicles.

Risks:

Low utilization rate of marked places, which decrease parking sector revenue due to non-payment of parking.
Restriction to public parking lots only.

Group of measure:

Transport-organizational

Responsibility for implementation:

Municipality

Time horizon:

Short-term

Economic demands:

Low

Process demands:

Medium

Realization demands:

Low

Examples of implementation:

Dedicated parking spaces for BEV / PHEV in Paks (HU)

Source: CDV

Relation to other measures:
Parking policy

<table>
<tr><td colspan="2">Name:
Limited access</td></tr>
<tr><td colspan="2">Description:
Regulation of the entrance of service transport systems to the designated areas of the City within a limited time (e.g. peak hours)
- without limitation BEV / PHEV</td></tr>
<tr><td>Benefits:
Reducing the number of utility vehicles in designated areas - calming traffic during peak hours.
Decreasing of environmental impact.
Increasing of pedestrian security in historical centre of the city.</td><td>Risks:
Dissatisfaction of the subjects concerned.</td></tr>
<tr><td>Group of measure:
Transport-organizational</td><td rowspan="3">Economic demands:
Low
Process demands:
Low-Medium
Realization demands:
Low</td></tr>
<tr><td>Responsibility for implementation:
Municipality</td></tr>
<tr><td>Time horizon:
Short-term</td></tr>
<tr><td colspan="2">Examples of implementation:
Not found</td></tr>
<tr><td colspan="2">Relation to other measures:
Strategic documents (SUMP, SEAP etc.)</td></tr>
</table>

Name:

Introduction of alternative transport services (passenger transport)

Description:

Introducing alternative means of transport that are available to citizens in the form of payable services is undoubtedly a welcome alternative to the traditional offer. The alternative transport services entail electric minibuses available to elderly people within the city centre, electric train used on an attractive circular tourist trails. Autonomous minibuses are another example. This type of vehicle is intended mainly for short service lines currently outside normal road traffic in closed locations (technology parks, university campuses, spa or hospital areas) or in historical city centres with pedestrian zones or otherwise significantly restricted traffic.

Benefits:	**Risks:**
Improving of availability of locations out of public transport routes and flexibility in route selection. Operation in parts of the city for recreation and relaxation. Easy realization of connection in on-demand mode.	Legislation not allowing the operation of autonomous vehicles in public space. Increased demand for transport exceeding vehicle capacity. Insufficient offer of vehicles.
Group of measure: Operational	**Economic demands:** Medium
Responsibility for implementation: Municipality and PT operator or contract operator.	**Process demands:** Medium-High
Time horizon: Short-term	**Realization demands:** Medium-High

Examples of implementation:

Service Kavalir in Ljubljana (SI)

Source: https://www.visitljubljana.com/en/visitors/explore-the-region/traffic-and-transport/kavalir-getting-around-the-city-centre-by-electric-car/

Relation to other measures:

Strategic documents (SUMP, SEAP etc.)

Name:

Introduction of alternative transport services (freight transport)

Description:

The measure includes the introduction of electric freight hand trucks to deliver freight within the pedestrian zone of the city. Formation of transshipment points of goods outside the pedestrian zone is necessary initial step for the implementation of this measure. From there continue delivery to the pedestrian zone with the help of electric trolleys. Given the limited delivery time for motor vehicles within the pedestrian zone, this measure will allow nonstop delivery (0-24 hours).
The measure can be implemented through two frames:
- Internal - use of freight trolleys for the needs of the city administration and institutions of the city.
- External - use of freight trolleys for all interested parties.

For the proper implementation of the measure, it is necessary to define parameters such as:
- Defining the needs of the users of the loading points and trolleys for cargo delivery
- The type and size of delivery trolleys to be used
- The positions where the trolleys will be stored
- A way to secure the trolleys from theft and vandalism
- System management (maintenance and control).

The other possibilities are incentives for delivery and distribution services on a pedelecs/cargo e-bike. It means emission-free transport of small consignments to the customer, especially for the last mile.

Benefits:	**Risks:**
Implementation of this measure reduces noise and emissions within the pedestrian zone. Prolongation of time frame for delivery. Flexibility of delivering of small consignments and goods.	Little interest on the part of the provider to use this service.

Group of measure: Operational	**Economic demands:** Medium
Responsibility for implementation: Municipality and its companies or parcel companies	**Process demands:** Medium-High
Time horizon: Short-term, Mid-term	**Realization demands:** Medium-High

Examples of implementation:

Source: http://www.easybarrow.co.uk/battery_powered_electric_hand_trucks_x.htm

Relation to other measures:

Strategic documents (SUMP, SEAP etc.)

Name:

Bike rentals, bike sharing

Description:

The e-bike sharing system is partly self-service (the exception is the redistribution of bikes between stations), whereas rentals need full service. Design can be similar. It includes the installation of a construction and pylon for charging electric bikes and electric bikes themselves at a convenient location in the city. The location must be determined according to factors dependent on the needs of residents and tourists (traffic levels, human circulation, location convenience, bicycle needs at a specific location). It is possible to design station as an autonomous system powered by photovoltaic panels.
For the proper implementation of the measure it is necessary to define certain parameters:
- Defining user needs
- Specifications of bike sharing stations and bikes
- Station placement position
- A way to protect the system from theft and vandalism
- System management (maintenance and control).

It is recommended to consider possibility to offer basic levels of bikesharing within the public transport subscription (interconnection of mobility services within the MaaS concept).

Benefits:	**Risks:**
Increasing the availability of cycling for people in need of electric drive support. Increasing the availability of sustainable transport for low-income groups. This measure will influence the connection with the urban transport system, popularize a healthy lifestyle and improve the tourist offer.	Incorrect system sizing, traffic security, not accepting the bicycle as a means of transportation. Securing pedelecs and separately their batteries against destruction or theft. Undisciplined returning of pedelecs to stations.
Group of measure: Operational	**Economic demands:** Medium-High, Low (if municipality isn't investor)
Responsibility for implementation: Municipality and PT company or private companies	**Process demands:** High
Time horizon: Short-term, Mid-term	**Realization demands:** Medium

Examples of implementation:

Terminal in Koprivnica (HR)

Source: http://www.kc-sump.eu/hr/u-koprivnici-otvoren-terminal-s-elektricnim-biciklima/

Relation to other measures:

None

Name:

Car rentals, car sharing

Description:

This measure involves car sharing in business form, that is, services of public rentals. This measure involves car sharing in business form, that is, services of public rentals. The e-car sharing system is self-service, whereas rentals need full service. Car sharing combines some of the benefits of individual and public transport. It brings users a reduction in investment and operating expenses, worries and obligations compared to operating their own vehicle. Benefit for the cities is mainly reduction of the amount of parking places.

Aims of the measure in municipality point of view are:

- Support in the form of providing plot for carsharing.
- Support for the construction of infrastructure for carsharing.

The following provisions should be included in any agreement between cities and carsharing organizations [52]:

- Ensure that vehicles emit minimal pollutants. Require that all vehicles parked in on-street spaces have zero emissions.
- Verify benefits. Require that the carsharing organizations provide annual travel behavior data on their members to the municipality.
- Ensure expansion—not just subsidization. The city's investment should help carsharing organizations expand, not simply reduce their current operating costs.

Benefits:	**Risks:**
Presumption of reduction parking space for passenger cars and reduction of public space requirements. Increasing of the availability of electric vehicles for groups other than high-income groups is expected.	Lack of available plots for reserved parking. Incorrect system sizing. Insufficient vehicles maintenance. The human factor in carsharing causes increased wear on shared vehicles.
Group of measure: Operational	**Economic demands:** Low
Responsibility for implementation: Municipality	**Process demands:** Medium
Time horizon: Short-term	**Realization demands:** Low

Examples of implementation:

Source: http://carsharingus.blogspot.com/2017/09/some-resources-about-reserved-on-street.html

Relation to other measures:

Parking policy

Name:

Development of charging stations network

Description:

The measure represents one of the basic steps in the development of e-mobility and is crucial for the expansion of electric vehicles. The aim of the measure is to build a minimum network of publicly available charging stations in the city. In principle, the goal can be achieved by building charging stations directly by the city or in cooperation with a partner (only by means of a partner or as a PPP). It will be necessary to locate charging stations according to user preferences (e.g. at shopping, sports, recreation, or other leisure activities). Depending on the length of stay at the place of the charge, various type of charging infrastructure is available (for example, restaurant fast charging station, residential building - slow charging).
To implement this measure, it is necessary to define the following parameters:
- User needs
- The location of a charging station with a defined capacity of the electricity grid on the site
- Technical characteristics of the charging station (type, power, charging mode, charging time)
- System of management (maintenance, monitoring)

Benefits:	**Risks:**
Given that one of the reasons for the low rate of purchase of electric vehicles is the poorly developed charging station infrastructure, this measure will encourage residents to become more interested in the application of electric mobility in the city, and thus to reduce vehicle energy consumption and exhaust emissions. Increasing the availability of charging infrastructure and thus removing one of the barriers to e-mobility.	City budget. Issues with placement of charging stations (e.g. ownership relationships when connecting to electricity grid) Capacity of existing electricity grid. Low utilization rate of charging stations.
Group of measure: Technological and infrastructural	**Economic demands:** Low-High
Responsibility for implementation: Municipality and private investor	**Process demands:** High
Time horizon: Mid-term	**Realization demands:** Low-Medium

Examples of implementation:

Charging station in Paks (HU)

Source: CDV

Relation to other measures:
None

Name:

Development of bicycle charging stations network

Description:

Charging stations for bicycles should be set up along bicycle routes where a constant presence of cyclists is expected as well as a growing number of them. To this aim at least one electric charging station has to be set up in the framework of a bicycle rest area along an attractive and well-arranged cycle track. An electric charging station added to the bicycle rest area equipped with benches, tables, hospitality service, information support, bicycle racks and tools for small repairs will make such rest area even more popular with cyclists in the growing segment of electric bikes. Historic sites (castles, chateaux, etc.) are also suitable for charging stations placing. In order to set up such a rest area an adequate plot of land is required with all documents, ownership relations and connections arranged.

Benefits:	**Risks:**
Prolongation of bike range. Making distant locations more accessible to older people.	Low utilization rate of charging stations.
Group of measure: Technological and infrastructural	**Economic demands:** Low-Medium
Responsibility for implementation: Municipality and its companies or private investor	**Process demands:** Low-Medium
Time horizon: Short-term	**Realization demands:** Low-Medium

Examples of implementation:

Charging station at the Vorderkaserklamm gorge (Sankt Martin bei Lofer, AT)

Source: CDV

Relation to other measures:

Accompanying infrastructure for bicycles

Name:

Accompanying infrastructure for bicycles

Description:

Construction of self-service service points equipped with basic maintenance tools alternatively with pump or compressor for inflation. Placing storage boxes for charging electric bicycle batteries and storing personal items (e.g. helmet) at points of interest. Construction of parking spaces (boxes, cycling towers) in places with longer stopping time (transport terminals, shopping centres, etc.), allowing safe storage of pedelecs, which value is several times higher than the price of conventional bicycles.

Benefits:	**Risks:**
Development of bicycle transport security through the development of basic bicycle repair services (with a ban on electric drive repairs).	Share of financing or co-financing of the purchase by implementer.
Group of measure: Technological and infrastructural	**Economic demands:** Low-High
Responsibility for implementation: Municipality and its companies or private investor	**Process demands:** Low-High
Time horizon: Short-term	**Realization demands:** Low-High

Examples of implementation:

Bike tower for 118 bikes in Přerov (CZ)

Source: Ivo Dostál

Relation to other measures:

Development of bicycle charging stations network

Name:

Introduction of e-bikes

Description:

Electric bikes should be used in the framework of the bike rental service. This will contribute to the wider range of bicycle services as more demanding terrains and longer distances will now also be accessible by e-bikes.
Acquisition of pedelecs for use by employees of the municipality and public institutions. Appropriate charging and parking areas should be set aside, safeguards against misuse should be considered and clear operating rules established.

Benefits:	**Risks:**
Reducing emissions from the urban fleet. Increasing mobility in less accessible places. The advantage is faster transport and at the same time comfort of the user (reduction of physical load on hills, rider can ride in normal office clothes and can choose the level of support of electric drive).	Location and type of chargers versus number of pedelecs for acute charging. Availability of fully charged pedelecs.
Group of measure: Technological and infrastructural	**Economic demands:** Low-Medium
Responsibility for implementation: Municipality and its companies or private companies	**Process demands:** Low
Time horizon: Short-term	**Realization demands:** Low

Examples of implementation:

Ten pedelecs for municipality employees - Litoměřice (CZ)

Source: https://www.litomerice.cz/aktuality/7485-urednici-nasedaji-na-elektrokola

Relation to other measures:

Development of bicycle charging stations network, Mobility plans for companies and institutions

Name:

Introduction of vehicles with alternative powertrain in municipal fleet

Description:

In order to implement this measure, the city must define the criteria for green public procurement of vehicles owned by the city and city institutions / companies when procuring new vehicles. It is necessary to prescribe the procurement of vehicles with exclusively low CO_2 emissions, that is, vehicles with alternative powertrain that will comply with the criteria of green public procurement. In this way, the purchase of electric motor vehicles is also encouraged.
In the framework of this measure optimize the fleet tailored to the needs of the city and its entities (increase vehicle utilization and thus economic efficiency / reduce their number). When renewing the vehicle fleet, consider the replacement with an electric vehicle or a vehicle for the given needs. Use subsidy to support e-mobility if exists (electric vehicles, charging infrastructure, etc.).

Benefits:	**Risks:**
This measure has a positive impact as an example of good practice on citizens' awareness of environmental protection, increasing energy efficiency and promoting renewable energy and e-mobility. More efficient use of city resources and operational savings. Reducing emissions from the operation of city-owned vehicles.	Possible financial failure. Very diverse needs of the city - the inability to optimize the park. Obstacles to the use of electric vehicles. Unavailability of suitable subsidy schemes. Amount of full price of electric vehicles (especially vans). Share of financing or co-financing of the purchase
Group of measure: Technological and infrastructural	**Economic demands:** Medium-High
Responsibility for implementation: Municipality and its companies	**Process demands:** Low
Time horizon: Short-term, Mid-term	**Realization demands:** Low

Examples of implementation:

e-Cars in municipal fleet – Litoměřice (CZ)

Source: CDV

Relation to other measures:

Development of charging stations network, Strategic documents (SUMP, SEAP etc.), Mobility plans for companies and institutions

Name:

Introduction of vehicles with alternative powertrain in public transport

Description:

In connection with the introduction of e-buses into public transport, it is important to note which routes the e-bus has to cover and how long the breaks between individual laps are. This is crucial in terms of the necessary charging infrastructure and the size of the battery. For the implementation of measures in this thematic area, it is also relevant which other demands are placed on the purchase of electric buses, how the public transport system has been set up so far, and what infrastructure and charging requirements there are. Consideration should be given to the possibility of recharging outside the depot, for example from existing trolley wire (in cities with tram or trolleybuses transport).
Trolleybus is typical mean of transportation in many DTP cities. Modern trolleybuses are being often equipped with battery providing auxiliary power. Such vehicle is not 100% dependent to move just under the contact network thus main disadvantage of older trolleybuses is suppressed. The range of movement on battery energy is based on its capacity but generally these vehicles are capable to travel about 8-15 kms out of reach of power lines. Those vehicles are good alternative for increase share of electric vehicles in cities with trolleybus lines.

Benefits:	**Risks:**
Reduction of environmental burden from public transport on selected lines.	Inappropriate operational parameters of vehicles available at the market. Purchase co-financing rate. Finishing of the subsidies. Termination of state incentives to support the acquisition of emission-free public transport vehicles. Failure of the procurement.
Group of measure: Technological and infrastructural	**Economic demands:** High
Responsibility for implementation: PT companies	**Process demands:** Low
Time horizon: Short-term, Mid-term, Long-term	**Realization demands:** Low-Medium

Examples of implementation:

Electric buses in Hradec Králové (CZ)

Source: Jan Majurník, iDNES.cz

Relation to other measures:
Development of charging stations network, Strategic documents (SUMP, SEAP etc.)

Name:

Introduction of communal vehicles with alternative powertrain

Description:

In the case of municipal vehicles, there is a wide range of universal carriers that are suitable for replacing conventional vehicles, often with exceeded lifetime. A variety of light and practical vehicles are available on the market for the transport of materials in enclosed areas, parks and sports venues, which, although not approved for road use, are a simple and reliable solution for given purpose. Electric vehicles are also available in the area of sweeping vehicles and municipal waste collection vehicles; these are small vehicles, especially suitable for use in the city centre.

Benefits:	**Risks:**
Quiet and emission-free operation Significant energy saving, compared to combustion engine, there is not idling	The battery capacity is not enough for the whole shift. Failure of the procurement.
Group of measure: Technological and infrastructural	**Economic demands:** Medium-High
Responsibility for implementation: Municipality companies	**Process demands:** Low
Time horizon: Short-term, Mid-term	**Realization demands:** Low-Medium

Examples of implementation:

Electric vehicle for cleaning in parks – Litoměřice (CZ)

Source: CDV

Relation to other measures:

Development of charging stations network, Strategic documents (SUMP, SEAP etc.)

Name:

Introduction of e-taxi

Description:

E-taxi preference in central parts of the city. At the same time, the possibility of charging and dedicated places for taxi stand must be ensured.

Benefits:	**Risks:**
Potentially increased BEV / PHEV usage in the city and thus lower environmental impact.	Lack of interest of taxi services to operate e-taxi

Group of measure:	**Economic demands:**
Technological and infrastructural	Low
Responsibility for implementation:	**Process demands:**
Municipality and taxi operator	Low
Time horizon:	**Realization demands:**
Short-term, Mid-term	Low

Examples of implementation:

e-Taxi in Olomouc (CZ)

Source: ecoTAXI
http://www.ecotaxiolomouc.cz/

Relation to other measures:

Parking policy, Development of charging stations network

Name:

Education

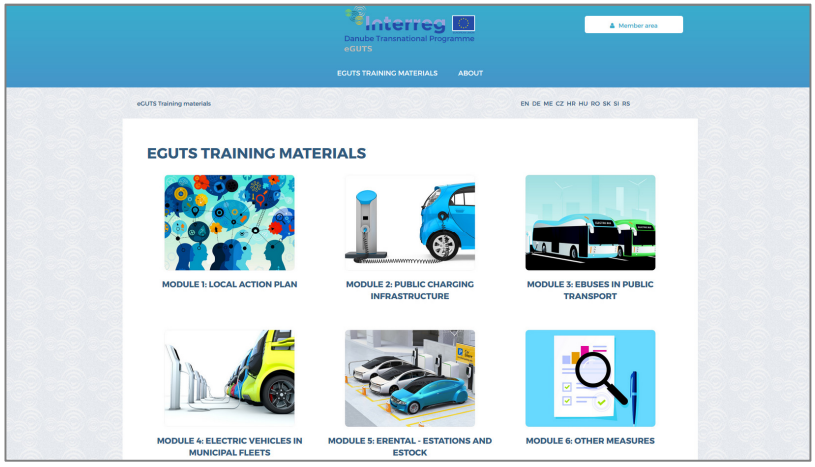
Description:

E-mobility is the mobility of the future. Consequently, a special emphasis on future generations is required. This includes a regular cooperation with schools. The latter may become involved in many different ways, either through promotional events or in the framework of regular school activities such as seminar papers, lectures, art contests, etc.
Increasing energy efficiency is aimed at reducing energy consumption, but without reducing the comfort of life and habits of citizens. One of the items in increasing energy efficiency is educating citizens and presenting opportunities to increase energy efficiency. Education can be done through various educational modules, public forums, open days, educational campaigns, advertisements, leaflets, etc.
The measure can be implemented through two frames:
- Internal - education within the city administration and institutions or enterprises
- External - education for all inhabitants and other stakeholders

Benefits:	**Risks:**
Positive impact on citizens' awareness of environmental protection, increasing energy efficiency, and promoting renewable energy and sustainable urban mobility.	Inadequate lecturers. Number of interested participants in education.
Group of measure: Soft	**Economic demands:** Low
Responsibility for implementation: Municipality and external lecturer	**Process demands:** Low
Time horizon: Short-term	**Realization demands:** Low

Examples of implementation:

eGUTS Training Materials (available in 10 languages)



Source: http://eguts.fe.um.si/root/module

Relation to other measures:

None

Name:

Providing information

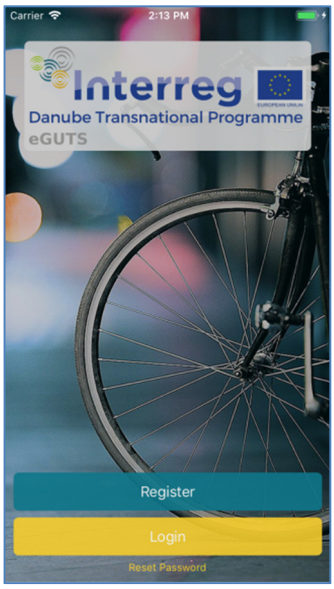
Description:

IT tools have extremely important role by sensitizing general public/stakeholders and stimulating use of public transport and especially new sustainable mobility options. IT platforms providing the essential information about mobility services, preferably based on smartphone platforms, are nowadays essential part of public transport service and presents the so called Critical To Quality parameter.
The aim of the measure is to integrate available information on electromobility (static and dynamic data on charging infrastructure in the city, information on indirect support for electromobility, information on support schemes, etc.) in one place together with related traffic information.

Benefits:	**Risks:**
Available information to the public. Increased use of support measures, Increased utilization of charging infrastructure.	Unavailability / outdated information
Group of measure: Soft	**Economic demands:** Low
Responsibility for implementation: Municipality	**Process demands:** Low
Time horizon: Short-term	**Realization demands:** Low

Examples of implementation:

The eGUTS platform



Source: Municipality of Velenje

Relation to other measures:

None

Name:

Promotion

Description:

Promotional activities play an important role in the development of e-mobility. This means that participation in as many promotional activities at national level as possible is important (e.g. European Mobility Week, Earth Day, etc.). The providers of e-mobility must be part of such events so they can introduce their services to end users and test electric vehicles.
A regular cooperation with schools is important too. The latter may become involved in many different ways, either through promotional events organised to celebrate European Mobility Week, technical science days, field trips, art contests, etc.
Raising awareness among the general public and the professional public entails a large number of activities such as:
- Campaigns and consultations
- Promotion through posters, conferences, local media and social media
- Various methods aimed at understanding and learning people
- Activities that will result in changes in principles in daily life.

Active organization, engagement and support awareness-raising and awareness-raising actions on e-mobility and green transport (European Mobility Week; Car-free day; To work on a bike/e-bike, mobility day, support for third-party information actions).

Benefits:	**Risks:**
Measure has a positive impact on citizens' awareness of environmental protection, increasing energy efficiency, and promoting renewable energy and sustainable urban mobility. Raising public awareness, especially of the younger generation.	Number of interested participants at events Inadequate moderators. Underestimation of modern communication channels
Group of measure: Soft	**Economic demands:** Low
Responsibility for implementation: Municipality	**Process demands:** Low
Time horizon: Short-term	**Realization demands:** Low

Examples of implementation:

eGUTS E-Mobility Event in Burgenland - Bruckneudorf / Bruck an der Leitha (AT)

Source: CDV

Relation to other measures:

None

Name: Platform for the development of e-mobility in the municipality	
Description: Role of platforms is support communication and knowledge exchange for the development of strategic documents and development of e-mobility generally. Platform should be composed from key municipality employees, local and regional actors (such as PT company, electricity distributor, infrastructure provider etc.), initiatives, platforms and associations. Mainly in case of platforms and associations there is a wide base of subjects from different branches related to electromobility. Their knowledge could be also helpful.	
Benefits: Knowledge from all related branches. Close cooperation with key stakeholders.	**Risks:** Low interest of the participants.
Group of measure: Soft	**Economic demands:** Low
Responsibility for implementation: Municipality	**Process demands:** Low
Time horizon: Short-term, Mid-term	**Realization demands:** Low
Examples of implementation: Regional strategic platforms in project eGUTS (AT, CZ, HR, HU, ME, RO, RS, SI, SK)	
Relation to other measures: None	