D1.1 Toolbox for efficient e-mobility

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(*) Dissemination level: **PU**: Public, fully open, e.g. web; **CO:** Confidential, restricted under conditions set out in Model Grant Agreement; **CI:** Classified, **Int =** Internal Working Document, information as referred to in Commission Decision 2001/844/EC.

Contents

Introduction

The purpose of Task 1.1 is to produce a scalable and harmonised toolbox for advanced implementation, management and operation strategies of efficient e-mobility solutions. The main effort is to outline the initial toolbox structure, functionality and implementation guidelines to reflect the project aims and goals to create a database of solutions already developed by some partners' projects such as ZeEUS, ASSURED, ELIPTIC and others, further to be adapted to the local specifics in Asia, Africa and Latin America in the context of the project demonstration actions.

The SOLUTIONSplus Toolbox is the key repository of the project spanning across all the all work packages, providing: Impact assessment tools (WP1), Capacity building material (WP2), Summaries of business plans and models (WP3), Summaries of e-mobility innovations tested in the demonstration actions (WP4), Design, operations and management tools for different e-mobility solutions (WP4), information financing institutions and funding options (WP5).

The toolbox is developed in an iterative approach (living lab based), and it will be elaborated and improved over the project duration based on the experiences gained (feedback loops) from the demonstrations, as well as the findings from impact assessment and other work packages, such as technical specifications to be applied in WP4. Generally, it consists of openly accessible simulation models and tools to address strategic transport and energy systems modelling and exploitation challenges that include planning, management, optimisation and impact evaluation of electric vehicle services and infrastructure, as well as of business models, good practice examples, operation, planning and management tools.

The Toolbox developed in T1.1 will be disseminated to an online audience (via WP6) in a coherent and easy to use web-interface and will be structured in a convenient way to meet the needs of the demo sites and beyond by providing targeted applications for different user groups, e.g. transport professionals, industry, researchers. This task leads to the present deliverable “Toolbox for efficient e-mobility” delivered in project month 6, outlining the Toolbox structure and functionality and summarising the existing tools that can be used for initial assessment in the context of the demos (WP4) and for trainings more widely in the context of the capacity building and peer-learning (WP2).

Next updates of the toolbox will ensure that partner cities, replication cities, professionals and networks can benefit from the innovations developed and tested by the project. The development of the Toolbox will benefit from synergies with the knowledge products generated through the thematic working groups within the Global Programme of the GEF-7 sister project, which will then also continue to maintain the toolbox after the lifetime of SOLUTIONSplus.

1. Toolbox concept and implementation

The SOLUTIONSplus toolbox is a key output of the project, which will guide this Innovation Action, but more importantly, it will boost the capability of key actors to implement e-mobility solutions around the world. The toolbox will include measures:

- to assess the results and outcomes of the demonstration;
- to design and optimise integration of e-mobility;
- to manage an efficient operation of demonstrations;
- to reinforce the knowledge and skills of main stakeholders;
- to ensure the sustainability of e-mobility innovations through business models;

All these tools will be part of a structured toolbox accessible on the project website in a user-friendly manner. The toolbox will also contain capacity building material, summaries of business plans and models, summaries of innovations tested in the demonstration actions, operations and management tools for e-mobility solutions, information on financing and funding options, impact assessment tools, factsheets, and policy briefs.

Assessment tools will provide support on aspects such as:

- technical feasibility and impacts on energy system and energy security;
- financial viability: upfront investment needs (capex), operational costs (opex, life-cycle costing, total cost of ownership, etc.;
- social impacts: user needs, acceptability, accessibility, continuity, affordability, in terms of costs per service unit – compared to other existing solutions, potential improvement of comfort, quality of life, vulnerable group needs;
- environmental and health impacts: congestion, emissions reduction, exposure of population to noise and air pollution, etc.;
- replication and scale-up potential;

The impact assessment will guide the demonstration activities and will directly link to the business model development and the capacity building programme. The assessments will also form a solid basis for the up-scaling of the demo actions and the seeking of finance from domestic and international sources and the regional and international replication and dissemination. The assessment will be also based on the EV readiness approach, which has been developed to select the partner cities droning the proposal development.

Design tools will support decision makers from the definition of integrated e-mobility strategies (passengers and freight) to the launch of implementation projects, covering aspects such as:

- methodological guidance on the elaboration of strategies, involvement of stakeholders, governance, institutional and finance aspects;
- simulation tools to optimise the best locations of infrastructure (depots, charging station, opportunity charging for buses);

- cost estimation to analyse the various dimensions of profitability of the projects;

Operations tools will provide optimisation support of e-mobility resources, for example:

- apps to find the best routes, minimising energy, to know the availability of charging stations;
- software to manage the electric fleet, charging planning and monitoring of vehicles, follow up of energy consumption, maintenance etc.;
- software to optimise energy delivery and grid integration;

Capacity building tools build on the content of thematic tools and focus on tailor-made advice and training material to boost competences and skills of key actors. They address different needs of learners and will be designed mainly for key target groups, e.g. authorities, operators and companies. Tools include peer-to-peer exchange, e-learning courses, training and workshop material, factsheets, policy and business briefs, case studies and academic programmes.

E-mobility business models,

Several business models for innovative e-mobility technologies and services will be developed in the project to help entrepreneurs to sustain the innovations in different contexts. This will cover topics such as electric two- and three-wheelers, mini-buses, cargo-e-bikes, vans, trucks, e-BRT, and related technologies, services, charging systems, operations and sharing schemes. A selection of the innovative technologies and business models that will be tested in the demonstration actions are also included. The business models will be part of the SOLUTIONSplus toolbox and learning will be shared from the partnership opportunities initiated by the project between European industry and SME partners with local companies and start-ups in the partner countries.

1.1 General concept

T1.1 aims at producing toolbox concept for advancing the implementation, management and evaluation of e-mobility solutions, including tools developed by the consortium partners and other organizations, as well as generated outputs from other WPs. The initial version of the toolbox is an initial conceptualisation, which will be enriched throughout the project based on the outputs and activities from other work packages (WPs) and continuous engagement with potential user groups. For this deliverable emphasis is given on structuring the key contents of the toolbox and designing the user interfaces. It must be noted that the sketches presented in this report may not correspond to the final toolbox implementation due to the living lab-based approach. Nevertheless, the plans and sketches will act as a corner stone, on which, the development of the toolbox will be based on.

The initial focus of the toolbox is in selection and structuring of the contents and topics to be covered for different target user groups. A well-defined toolbox structure will facilitate its implementation as a web-platform, where the proposed tools, documents and supporting materials can be easily searchable, findable and targeted to different user groups, according to

predefined criteria, thus aiming to strengthen the support of the demo sites and beyond according to the main project objectives.

The concept of the toolbox is built upon the understanding that it should be organized as a web platform, including a search engine, with structured information for different use cases and target groups and links to additional information and documents. As the aim of the toolbox is to provide specific support to different target user groups, its core contents will include tools with computational capabilities, requiring specific set up of parameters and providing interactive simulation and calculation capabilities to support for example, system level simulation of fleets, economic evaluations and so on. Hence, providing insights on different aspects related to mobility, such as planning, deployment of fleets, vehicle designs, specifications, topologies and components and impact assessment.

In addition to the core contents of the toolbox, other information or supporting materials in the form of documents, e.g. guidance outlines and fact sheets, will be organized in a separate library/thematic pages as part of the toolbox. Another important part of the toolbox will be dedicated to the project demo sites, providing structured content on the developments of the demonstrations.

1.2 Landing page and main Toolbox content topics

The entry point of the toolbox will be the landing page (initial concept below). The landing page plays an important role in the website design and it is the main gateway to the toolbox as all users are directed through it. A well-structured and practical landing page that offers relevant information in a glimpse to the visitor can be one of the key factors behind a user's decision whether to continue investigating tools and solutions provided in the toolbox.

A poorly constructed and unclear landing page bears the risk that the user could lose interest or simply would not be able to find the information. Thus, the design of the landing page is regarded as one of the most important concepts in the toolbox implementation and considerable effort was allocated to its design in the planning phase.

The aim in the design of the landing page of the SOLUTIONSplus toolbox is to facilitate the process of finding relevant information out of the vast collection of solutions. Moreover, it is essential to cater to all the various user groups and tool categories, which also implies its own difficulties to the task. As a result, the initial approach is to form general "Challenges" out of the main issues that the tools of the toolbox are addressing. These Challenges will provide a crosscut as the different aspects of the tools embodying the content of the toolbox and guiding the visitor towards relevant and case-specific tools. Furthermore, the Challenges act as a shortcut to predefined filter options for the toolbox search engine, which means the user is still able to customise and further define the search criteria provided by the chosen Challenge. In fact, the Challenges provide a soft landing to the potentially complex and multi-branched search engine.

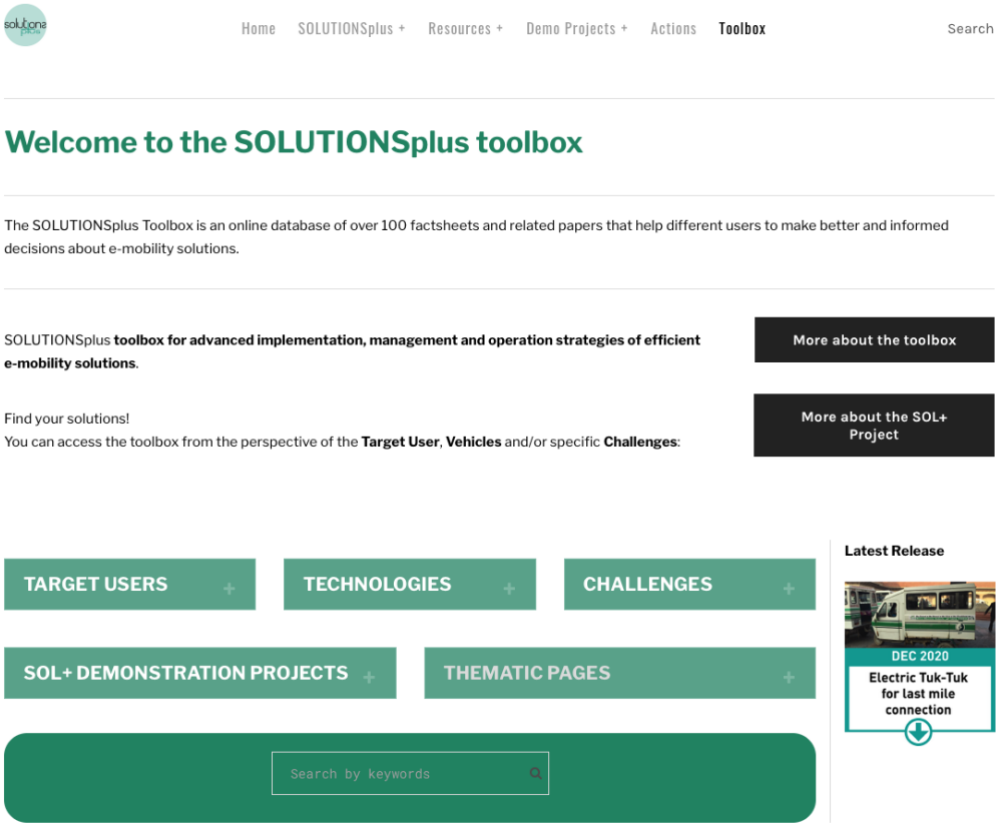

Fig. 1 Initial landing page of the SOLUTIONSplus Toolbox

The thematic tab Challenges was drafted as summary keywords based on the inputs from various tool providers in the toolbox survey, presented below in this document, and thus reflect the initial set of tools included in the toolbox at the time of the creation of this report. The list is still in a draft phase, and will be further processed and appended during the course of the project. The initial list of topics used to identify the main Challenges is presented in Table 1. All of them are further connected to relevant Main Topics of the search engine and after selecting a Challenge, the user is directed to the search engine with the Main Topics pre-selected. Optionally, the user can further specify the search by choosing Subtopics and User Groups.

Table 1. List of initial tool topical areas used to draft the Toolbox challenges.

Initial list of tool topics
Costs of electric vehicle systems
How to enter electro-mobility market (as company)
How to electrify vehicle fleets (freight)
Shared e-mobility application
How to set up smart charging stations (communication, security etc.)
How to set up cost-effective charging stations
What are the emissions of different vehicle categories
How to electrify bus lines
Assess electrification project viability (Cost-Benefit Analysis, Data Analysis, Events and Incident Definition, Legal and Ethical Issues, Impact Assessment and Scaling Up, Data Sharing)
What battery/charging/vehicle technology to choose
How to estimate the cost of transportation

Help to better optimise electric city logistics operation
Shared mobility application
How to improve logistics flow in a city design
How vehicle electrification affects energy usage/GHG-emissions/costs in the long term
Estimate energy, GHG and cost implications of sustainable transport scenarios
Where to cut first to get most impact on CO2-emission reduction
Set up shared e-mobility service
Investigate electric vehicle operation (energy use)
How to better design last-mile delivery
How to perform cost-benefit analysis (on electrification projects)
Identify electric vehicle fleet opportunities
Where to set up charging infrastructure
How to calculate EV TCO
How to accelerate transition to fossil free transport
Impacts of climate change mitigation plans (total GHG reduction, investments and annual costs)
How to choose right EV solution
How to choose right charging solution
How to plan and dimension shared-vehicle fleet
How to fund sustainable mobility
Guidance on e-mobility public procurement
Investigate electric bus operation details (charging, energy use, costs)
Electrification strategies of city buses, freight trucks and vans
Factsheets on e-mobility, infrastructure, logistics, mobility management and planning
Assess accessibility in a city (walk, bike, car, public transport)
Performance and commercial viability of electric last-mile delivery
How to choose right charging solution
Investigate electric vehicle operation details (charging, energy use, costs)
Costs of electric bus systems
Investigate electric refuse truck operation details (emissions, energy use, costs)
Choosing the charging strategy
How to design cities in respect to Traffic & mobility, Air Quality (transport + industry), Noise (transport + industry), Health impact, Road safety (under development), Zero emission mobility - mobility demand
How to electrify bus operation (costs, reliability)
How to design vehicle powertrain control
Vehicle development
How different electric and hybrid-electric vehicle topologies fare against each other
How to size components of electric vehicles

The core contents of the toolbox will be structured around the main user groups, different technologies and key challenges in the mobility sector, thus ensuring the easy structuring of the information along trending topics of interest for different user groups. The tentative list of User groups, Technologies and Challenges aims to provide a quick access to selected thematic pages, which will collect relevant tools, guidance documents and training materials.

Fig. 2 Selection options: Users, technologies and challenges

As part of the toolbox it will be provided a separate category with the tentative name SOLUTIONSplus Demonstrations, including structured information from the city demonstration and pilots, in order to provide targeted overview of the achieved results and adopted solutions. A separate category with tentative name SOLUTIONSplus Thematic Pages will provide a summary of selected guidance documents, business models, fact sheets and tools related to selected areas. A keyword text box will be provided for free search on terms on the bottom of the page, if the user is searching for specific information. The pre-identified contents in the selection tabs is tentative and it represents the potential split around topical areas. The final selection will be made before the start of the implementation of the toolbox.

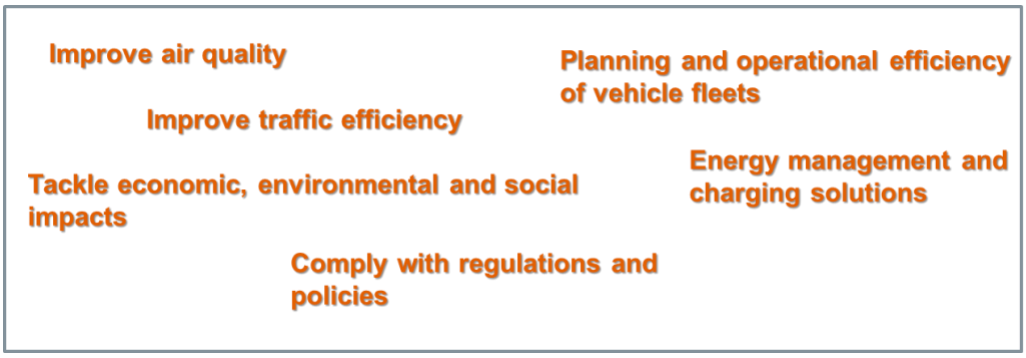

Fig. 3 Examples of Challenges

One of the key features of the toolbox will be a versatile search engine, the main entry level of which covers the main components of every transport system, starting with the compliance with the recent regulations and policies, supporting the planning and deployment of electric fleets and assess the impacts at different techno-economic or social levels. The logic behind the search mechanism is explained through the potential Challenges topics, example outlined in Fig. 3

Further, the Challenges are linked with the internal pages of the toolbox providing additional tools to navigate through the structure of the contents and facilitate the search for specific tools or documents related to specific topics of interest for various user groups. Thus, the key elements from the landing page are further linked with the core contents of the toolbox through pre-defined Main topics aiming to provide structure of the contents and ensure the quick navigation and generation of results. Ten Main topics were outlined to cover the main aspects of e-mobility solutions implementation. The tentative list of the pre-defined Challenges, Main topics and User groups is provided in Fig. 4.

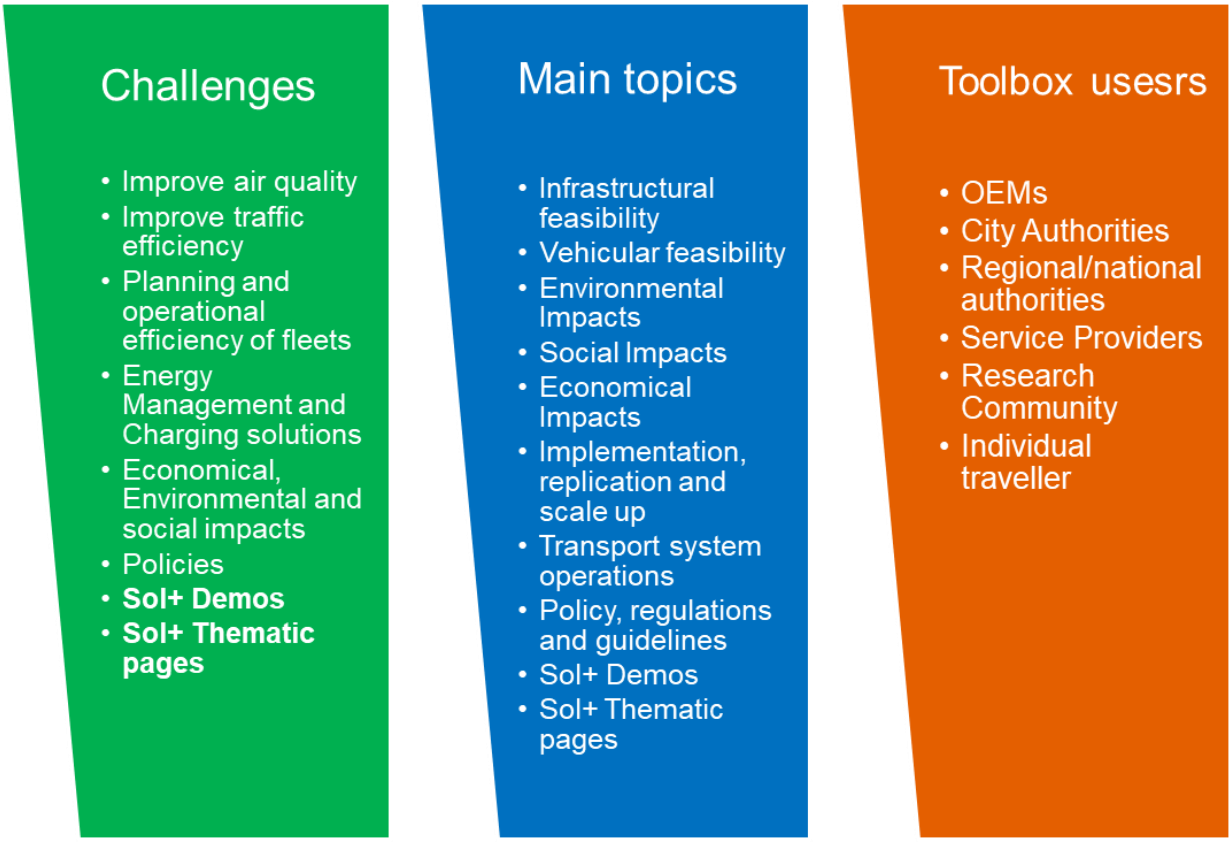

Fig. 4. Main Toolbox topics, user groups and challenges links.

The first topic is linked with the Energy Management and Charging solutions challenge aiming to provide contents structured in further subtopics about the Infrastructural Feasibility for deployment of energy and charging solutions. The next topic is the Vehicular Feasibility, which aims to provide structured information about different types of electric vehicles, their topology and core components, as solutions that are directly linked to the main challenge of Planning and operational efficiency of e-fleets.

Three of the core Main topics are related to different impacts of implementation of mobility solutions – environmental, societal and social having links to the Air quality and Traffic efficiency challenges separately, as identified global challenges, as well as with the possibility to include others relevant to the project. Implementation, replication and scale up Main topic intends to address issues related to implementation and scaling up of use cases and scenarios, in

the context of cities in different geographical regions with local specifics and user needs, thus to support the implementation and deployment of various solutions.

The following Main topic is related to Transport systems operation, thus expected to cover tools and solutions related to various aspects in the system level planning, deployment and operation of transport systems at different scales and scenarios with techno-economic insights. The last Main topic reflects the regulation frameworks for operation of electrical fleets with link to the main Challenge related to Policies. The SOLUTIONSplus Demos and Thematic pages connect the corresponding elements from the landing page, forwarding the user to topics related to project demonstrations sites and related documents stored in the library.

To increase the added value of the toolbox, the usability and easy access to topical information the tools will be sorted according to predefined User Group categories. Initially, six main user groups have been identified as: OEMs – manufacturers of vehicles and components, city authorities dealing with planning and deployment of e-mobility networks, regional and national authorities – expected to cover national/regional level of stakeholders participating in the planning of mobility services and legislation frameworks, service providers identified as companies proposing various mobility services aiming at optimal and efficient deployment of the transportation network according to the parameters of the service or operational business models, research community which can provide tools to support the effective implementation of e-mobility solutions, assessment of the potential impacts and technology implications and individual travellers interested in specific technology or mobility solution.

The Main topical categories in the Toolbox are further divided into sub-category topics covering more specific aspects to ensure the easy navigation through the contents of the tool database and increase the easy navigation and selection of specific group of tools covering specific area. Therefore, for every Main topic were elaborated several tentative subtopics, which can be further revised depending on the type of the tools that need to be stored into the Toolbox database.

The contents of the sub-topics is presented in the Fig. 5 and Fig 6. The initial tentative contents of the sub-categories were outlined as: under the main topic of Infrastructural feasibility including energy and charging solutions are outlined four main sub-topics: charging operations – to address tools related to efficient operation, deployment and scheduling of charging services, charging standards providing tools and supporting materials for adopting of charging standards, batteries to provide tools for various aspects related to batteries e.g. modelling, lifecycle assessment, optimization, deployment of battery storages, optimal exploitation of battery storages and etc. and energy systems to cover topics related to implications of the transportation systems with the energy grid, energy demands, and infrastructure deployment.

The potential impacts with various nature are divided in separate main topics and sub-topics, as they may cover various aspects. Thus, the Environmental impacts addressing issues related to emissions and air quality will encompass sub-topics related to environmental and air quality assessment tools and emissions calculators. The Social impacts topic is tentatively split on subtopics related to modal split, concerning different transportation modes and their interactions, the user needs, experience and travel behaviours, and their impact on the quality

of life and health of people, as well as to accessibility options. The Economic impacts topic aims to address various economic aspects reflected in the tentative sub-topics about investment needs, techno-economic evaluation tools, Total Cost of Ownership calculators and potentials business plans and models for deployment.

Infrastructural Feasibility	Environmental impacts	Social impacts	Economic impacts
• Charging operations • Charging standards • Batteries • Energy systems	• Impact Assesment • CO2 emissions calculators	• Modal split • User needs • Travel behaviors • Quality of life, health • Accessibility	• Investment needs • TCO • Cost estimation • Business models • Business plans

Fig. 5. Sub-topics to refine the contents of the Toolbox.

The Transport system operations main topic is tentatively divided to subtopics addressing issues to system simulation of electrical vehicles fleets, fleet management including various aspects to scheduling, maintenance and optimal operation of the vehicles and their components and Optimal routing in different conditions. Policies and regulations are usually the starting point for deployment of e-mobility solutions that need to comply with the local specifics and governmental roadmaps. Therefore, this major topic is tentatively divided to include methodological guidance tools and documents, recommendations for compliance with polices and regulations, and integration of e-mobility services. The SOLUTIONSplus Demos category is intended to summarize and provide information about the project demo cities. Its tentative contents is divided on sub-topics related to survey implementations and results, demo studies and showcasing of implemented solutions. The Solutions Plus Thematic Pages is intended to contain organized topical contents that does not fit in any of the other predefined categories e.g. other tools of interest or supporting materials like fact sheets and documents. The Vehicular Feasibility main topic will be divided on subtopics related to specific type of vehicles and their topologies that are in the project scope.

Transport system operations	Policy, regulations and guidelines	SOLUTIONSplus DEMOS	SOLUTIONSplus Thematic pages	Vehicular Feasibility
Fleet Management Optimal routing Fleet simulation	Recommendations Integration of e-mobility services Methodological guidance	Study Design Efficient Operations demos Survey Implementations	Replications and Sclae up Fact sheets	Electric bikes Electric trucks E-3-wheelers E-bikes

Fig. 6. Subtopics to refine the contents of the Toolbox.

1.3 Search engine implementation

Vast selection of tools and solutions are projected to be included in the toolbox. In fact, 54 separate tools have already been identified during in the idea phase of the toolbox design (see Appendix 1). In order to alleviate the user to grasp the aggregated perception, search engine will be a mechanism that helps the user in browsing the various themes and topics that the toolbox addresses. As discussed earlier, a coherent classification and structure is required for the toolbox inventory to make it a manageable entity. Structuring content into main and sub topics, as presented in chapter "1.2 Landing page and main Toolbox content topics", will act as the base to which the search engine concept will conform. As a result, it has planned that the search engine will follow the same hierarchical structure in the classification of the tools.

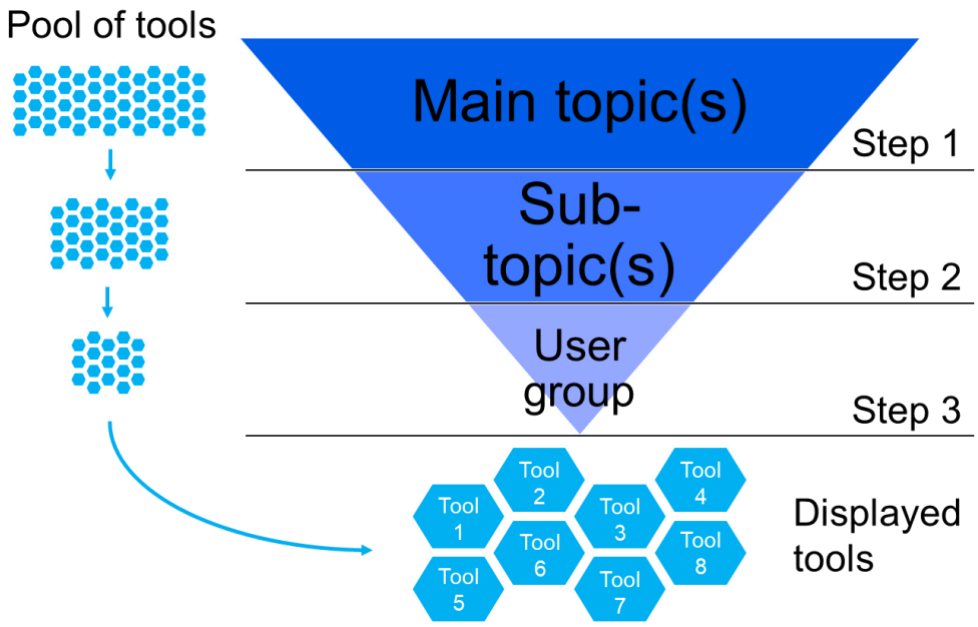

Fig. 7. General concept of the step-by-step progression in the search engine.

A step-by-step search wizard is planned to be applied to the search engine concept, which is presented in Fig. 7. The search engine starts with full list of tools and filters relevant tools based on the user's choices. The search is initiated in Step 1 where the user selects one or multiple main topics. While a main topic is selected, the search engine will interactively present sub-topics that are linked to the chosen *main topics*. When some of the main topics are left outside the selection, the pool of relevant tools will simultaneously decrease. In Step 2, the pool of tools can be further narrowed if relevant *sub-topics* are selected and some options are left out. In Step 3, final step before the actual searching process is initiated, the user can define applicable *user groups*, narrowing the pool of tools ever more. As a result, the search engine will separate only relevant tools, which will be displayed to the user after the search finishes. Moreover, the search engine has interactive functions, which display contents of the different topics and user groups in real-time, supporting the user to fathom high-level understanding of the key aspects that the Solutions+ Toolbox can cater to. In practice, the user can check through each main topic to investigate, what kind of sub-topics are included.

In addition to the step-by-step based approach, a keyword search is included in the search concept. The keyword search provides a shortcut to the tools and is intended for users that have visited the website previously and other advanced users who have explicit knowledge on the kind of tool that is in search. Instead of going through all the steps of the search wizard, the user may input keywords to the query and the search engine will directly list all tools that are matching with the queried keywords. The implementation of keyword search requires that all the tools will be marked with keywords. The keywords should be short, maximum of couple word length, description of the main aspects of the tools. Each tool may have several keywords tied to it. In addition, the keywords should be unified into a common list, where similar keywords and synonyms are conformed into single keywords. For example, tools containing keywords such as "vehicle simulation" and "vehicle modelling" should be merged into one keyword. As reference for the users, complete list of keywords should be accessible in the Toolbox website.

1.3 Search results

After the search is executed the server will present relevant tools to the browser in the form of a list. The search result window could be appended below the search wizard or the user could be directed to a separate search result page. The search results provide an overall glimpse of the tools compiled based on the user inputted filters and search criteria, which may be removed or modified post-search. Moreover, additional filters can be applied on the results. These filters reflect more on the technical attributes of the tools, such as tool format or licence, than thematic properties processed in the actual search wizard. The additional filters allow the users to choose tools that fit their operating scheme, however, a comprehensive list of additional filters is yet to be defined. A visualisation of possible search results layout is provided in Fig. 8.

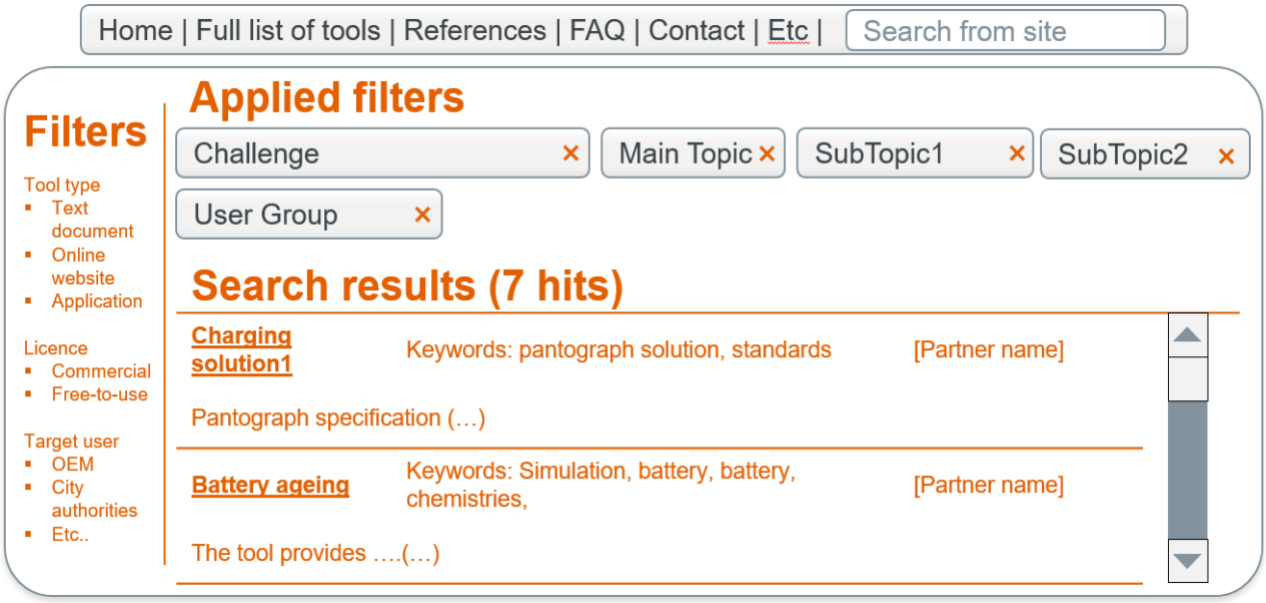

Fig. 8. Initial sketch of search results layout for the Toolbox website.

The displayed information will include the name of the tool, related keywords, the author of the tool, as well as a short description of the tool functionalities, just about once sentence long. In technical prospects, the description could be the first sentence of the general tool description. In such a case, a general structure for the tool descriptions is required, including summarising the main aspects of the tools in the first sentence.

1.4 Tool pages

Once a specific tool in the list is clicked, the user will be guided to the tool's page, where the tool is presented and which is the end point of search engine process. There will be individual pages dedicated to each tool of the toolbox, providing the user with elaborated information about the chosen tool. Noteworthy is that the tools are not planned to be hosted on the toolbox server, and thus, they are not directly operated through the toolbox website. The search engine will be medium to enhance the usability of the tools, while the actual hosting and access will be provided by external links supplied by the submitting organization.

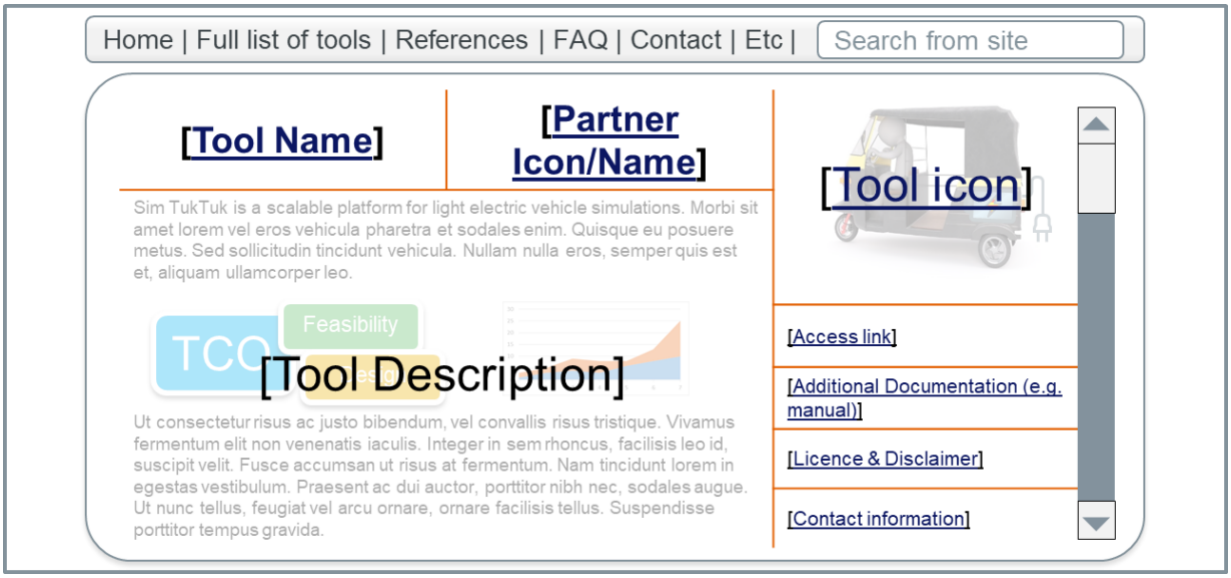

Fig. 9. Initial sketch of a tool page for a mock-up tool, including concepts for layout and included information.

The tool pages will offer relevant information in a concise form that will be uniform to all the tools. A visualisation of an initial sketch for the tool page is presented in Fig.9. In this stage, the tool page will include separate fields for name of the tool, authoring partner (including partner icon), tool icon, general tool description, link to access the tool, link to additional documentation (optional), license and disclaimer information and contact information to the authors or technical support. However, it is still emphasised that the implementations plans briefly discussed in the first draft of this report are still in development and may change as the actual implementation begins.

Name of the tool and authoring partner should be clearly emphasised to the user, thus they are positioned in the header row of the page. The authoring partner field should be a hyperlink that directs to the homepage of the partnering company. Moreover, space for a

possible tool icon will be reserved in the layout, which can act as hyperlink to the tool together with the access link.

Majority of the tool page layout will be designated to the tool description, where the functionalities and general use of the tool shall be presented. Additionally, use case examples or case references can be added. The description field will not be limited to text, instead the use of pictures, graphs and embedded video materials is highly recommended. In the initial planning phase, no strict character limit will be appointed to the tool description field, but limitations might be imposed once the technical implementation of the toolbox is initiated.

As the tools will not be hosted or operated directly on the toolbox, an access link to a tool will be provided. The access link should lead to the tool interface or download page, and not for example to a general landing page of the partner or the tool, where the tool cannot be directly accessed. Link to additional documentation, such as manuals or instructions, may also be listed in the tool page. However, in some cases such material might not exist, thus the relevance of this link is being discussed. Dedicated space will be reserved for information regarding licencing and disclaimers of the tool, as well as, for contact details such as email addresses of sales or technical support.

2. Initial Toolbox Contents

The initial Toolbox contents to be included encompass tools and solutions contributed by the project partners that are already developed as part of previous projects or provided under certain licensing terms. The information about the tools was collected via designed submission form, allowing to specify basic tool information related to pre-designed toolbox Main topics and allowing to produce statistical information about the scope of the collected tools, in order to identify possible gaps in the covered topical areas.

During the course of the project, the contents of the toolbox will be updated with more tools and supporting materials, generated by the SOLUTIONSplus WPs, as well as with information about the project demonstrations sites and topical information relevant to the project objectives but not falling into the toolbox Main topics and scope. The initial toolbox scope is to cover mainly the tools of the project partners, while other tools or materials generated by the project over the time will be added in the future toolbox updates.

2.1 Toolbox submission form

To collect information about the tools and supporting materials of the project partners, a submission form with predefined structure was designed. Simple overview of the submission form is presented in Fig. 10 and 11. It represents a simple interactive form including options to be selected, free text and additional information about the respective tool. The submission form is divided in five sections requiring various information to be supplied, in order to get sufficient overview on the type of the tool, its requirements for installation, operation and support, as well as to any applicable terms of use, disclaimers and relevance to the project scope and objectives.

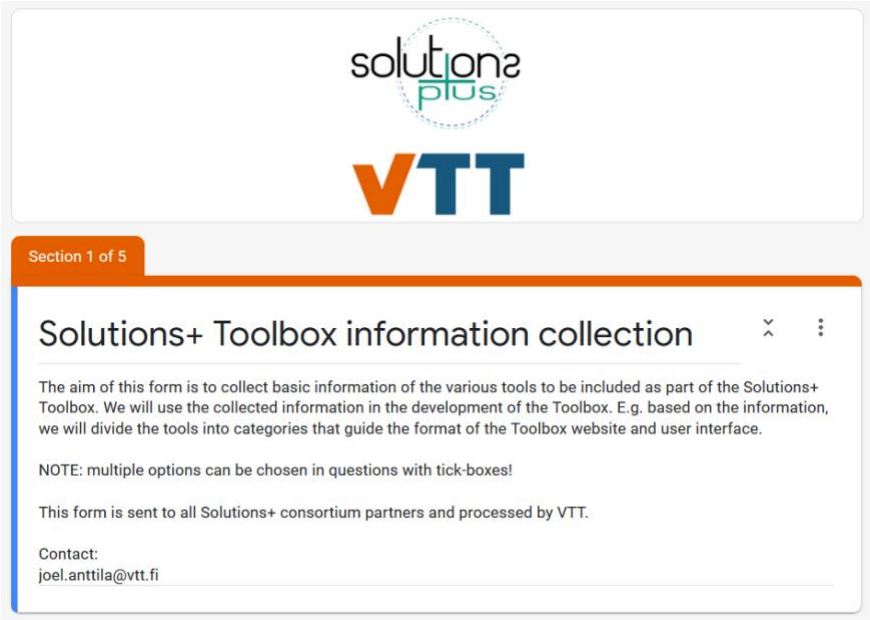

Fig. 10. Simple overview of the Toolbox information collection form for the initial contents.

The first section of the submission form provides basic guide about completing the information in the form, the company/institution providing the tool and respective persons for contact in case of specialized information or guidance is needed about the operation of the tool.

The second section of the form includes free text information to be supplied as general description of the tool, how it is used and what kind of challenges it can solve, as well as links to potential use case examples and references. Following, the user is asked to pick one or more of the predefined toolbox Main topics, described above and then to provide more information as free text how the tool address the topic/s, as well as the main purpose or objective of the tool.

The next section collects information about the target user groups of tool, as specified in the Main User Groups above, as well as to provide as free text more extensive information about the usability of the tool, including specific information about its operation e.g. standalone application requiring installation, programme code, document format or direct web access through supplied link requiring registration and etc. In addition, an information about the availability of guidelines and documentation of the tools is required and relevant contacts to provide support is requested to be included in the tool's specific information page.

The fourth section is requesting technical information about the tool, including the format of the tool and the operational environment needed for running it. For example, if the tool is a calculation sheet in Excel, or programming code in Python relevant software needs to be preinstalled to run the tool, or if the tool is provided by accessing some web based engine or standalone installation is needed. Separately, additional information needs to be provided about specific requirements for the tools e.g. licence needed, access credentials and etc., as well as what kind of input information is needed for a tool supplied by input parameters or loading specific files and the output of the presentation of the results e.g. graphs, csv data file and etc.

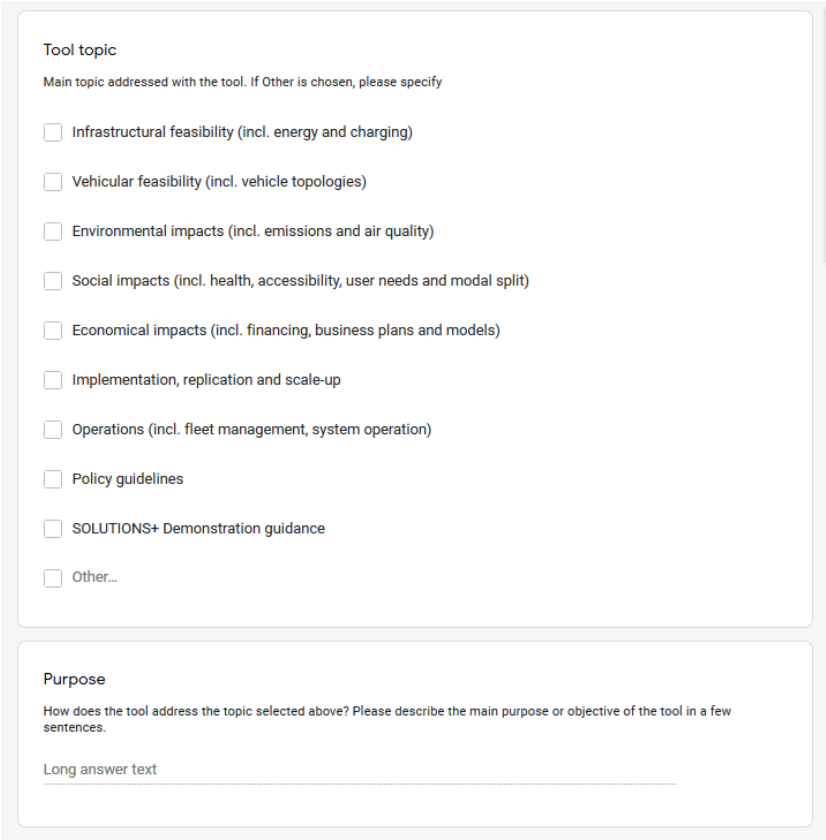

Fig. 11. Simple overview of the Toolbox Main topics selection.

The last fifth section provides space for the tool supplier to provide free text description of any other information relevant to use and run the tool, which is not covered by the previous tool sections, in order to get additional information and possibly to amend the submission form for future submissions, if relevant.

2.2 Toolbox statistics on the initial set of tools

During the initial submission campaign information about 54 available tools supplied by the project partners was submitted. The number of the tools per project partner is summarised in Fig. 12 and summary of the information about the tools is attached in Appendix 1. Most of the tools are provided by research organizations and companies, as well as from stakeholder organisations.

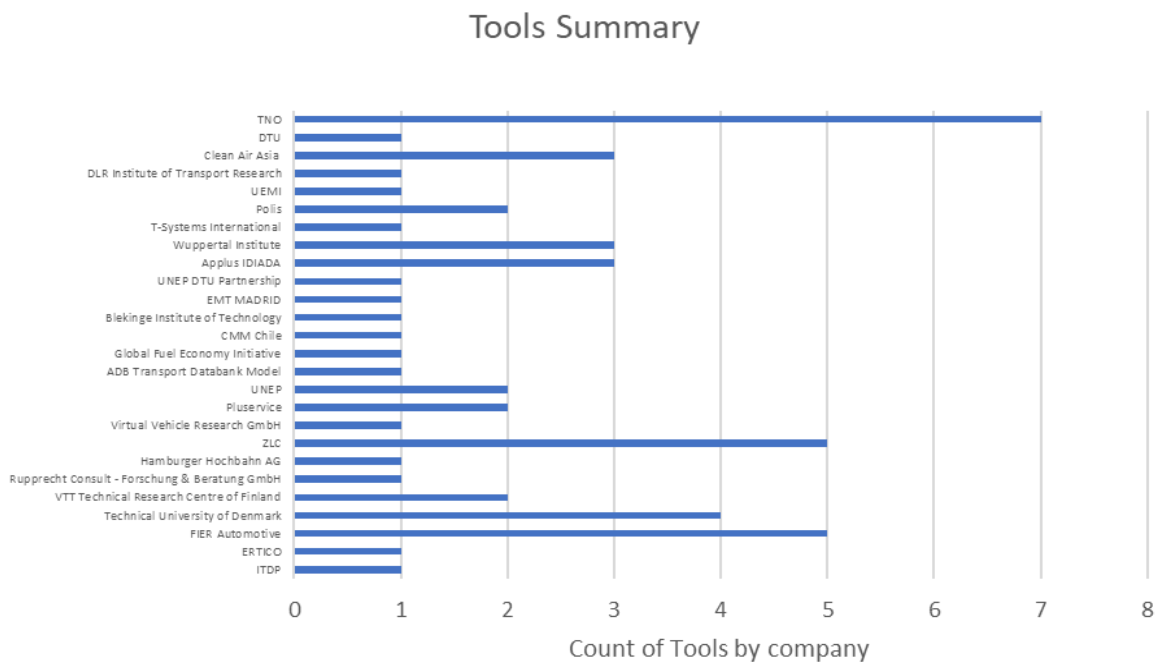

Fig. 12. Summary of the submitted tool per project partner during the initial submission campaign.

In the following figures, a breakdown on the number of tools per pre-defined Main Topic and corresponding submitting organization is provided. In Fig. 13 is presented the number of the tools under the topics of Infrastructural and Vehicular Feasibility, where 15 tools were submitted for each topic. Following, in Fig. 14 are presented the respective number of tools under the topics Environmental and Social Impacts, which are 21 and 9 correspondingly.

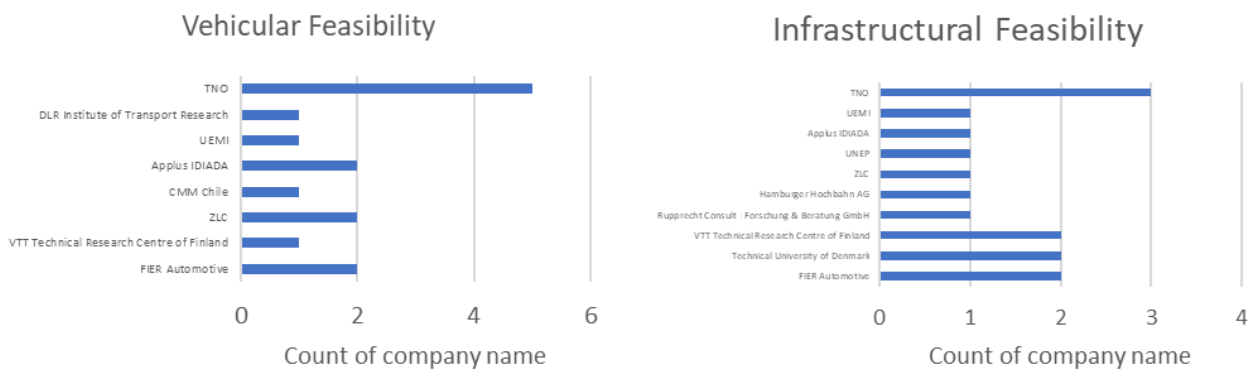

Fig. 13. Tools collected under the Main Topics – Infrastructural and Vehicular Feasibility.

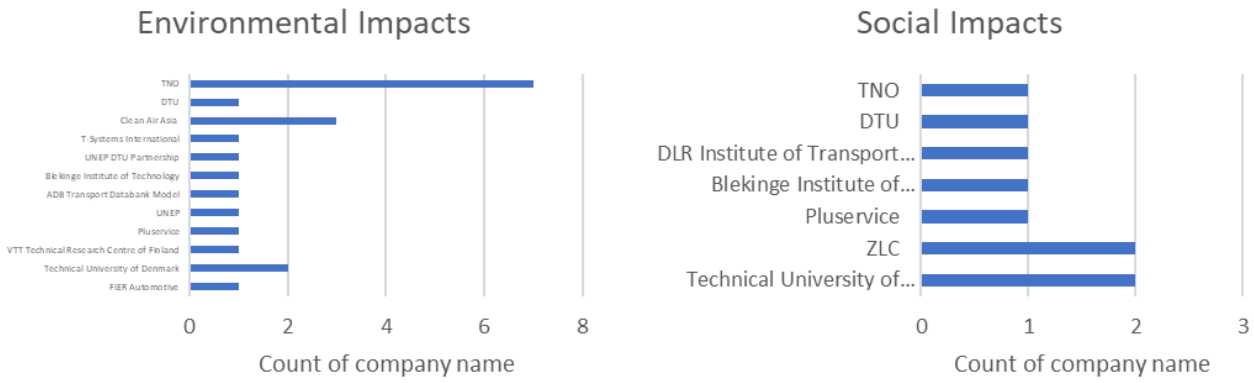

Fig. 14. Tools collected under the Main Topics – Environmental and Social Impacts.

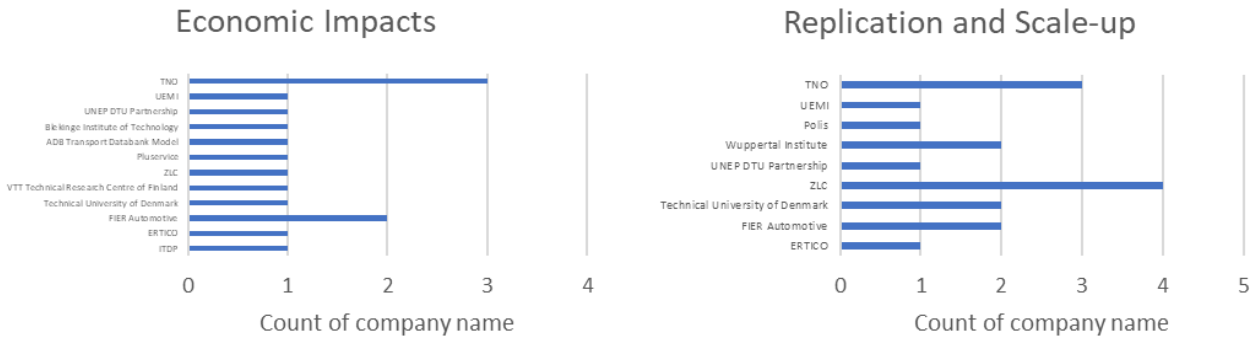

Fig. 15. Tools collected under the Main Topics – Economic Impacts and Replication and scale up.

In Fig. 15 are presented the number of the tools under the Main Topics of Economic Impacts and Replication and Scale up, including 15 and 17 tools respectively, while in Fig. 16 is presented the number of tools collected under the topics Transport system operation and Polices and Guidelines which consist of 11 and 14 tools, respectively, as well as the number of tools under the topic SOLUTIONSplus Demos, supporting the project demonstration sites which shows 8 tools contributed by different partners. The last Main Topic – Solutions Plus Thematic pages does not include tools as such as this point, as it is expected to cover mostly topical information that is presumed as supporting material, rather than actual tool. The total number of tools for all topics is greater than the actual submitted number, as part of the tools are indicated to fall up under the scope of more than one Main Topic.

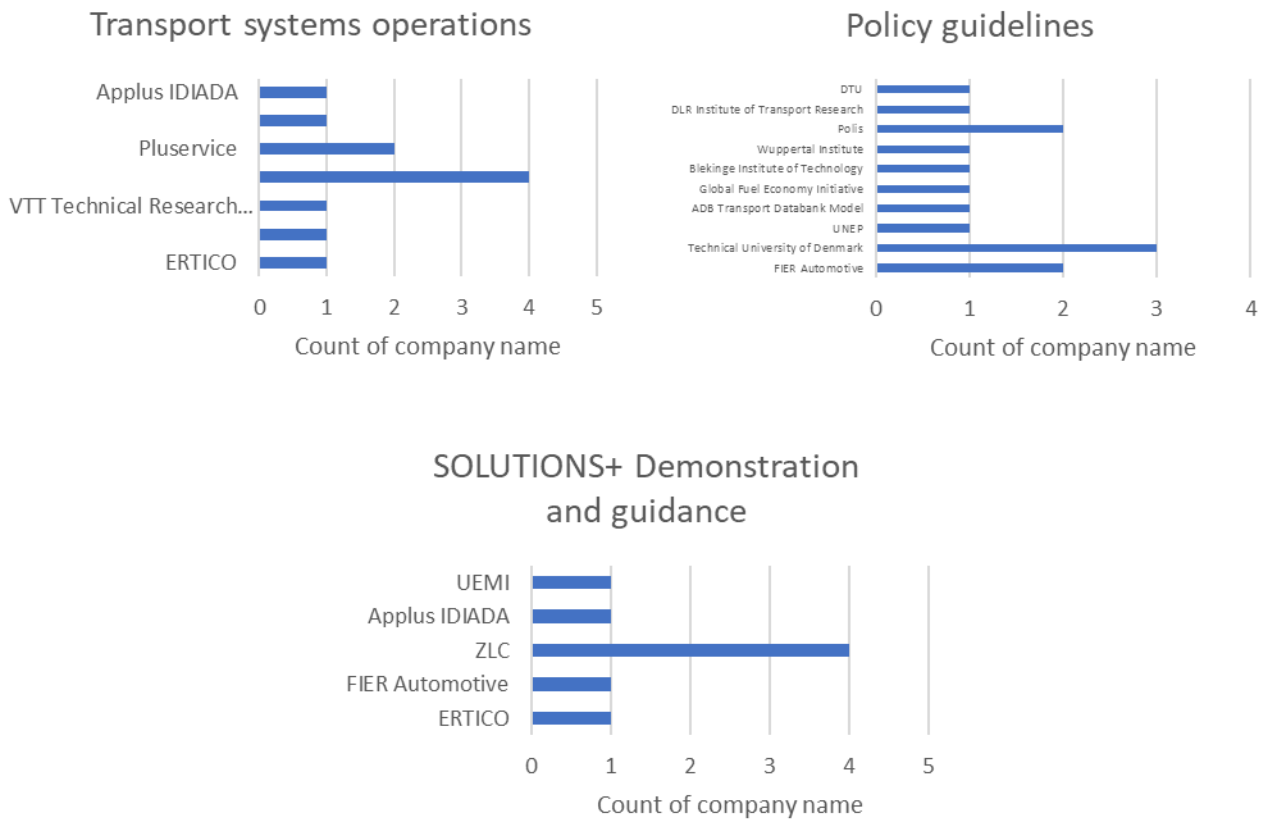

Fig. 16. Tools collected under the Main Topics – Economic Impacts, Replication and scale up and SOLUTIONSplus Demonstrations.

2. Future steps and developments

The development of the toolbox will continue throughout the project. It will be closely coordinated with the users groups, e.g. through the partner city networks (e.g. Polis and ICLEI), technology platforms (e.g. ERTRAC, EGVIA) and international partners, in particular the GEF-7 partner project coordinated by IEA and UNEP. This will aim to increase the usability of the toolbox and match the user perspective when searching for relevant tools and materials. A potential idea to be considered on the next phase is to elaborate the navigation panels allowing the user to quickly navigate to topical information. The idea draft is presented in Fig. 17 where navigation pads like buttons are proposed for quick reference access to information relevant to different user groups, mobility challenges and vehicles topologies and structures as quick access links to the core contents of the toolbox.

Therefore, to finalize the design sketch of the toolbox landing page, a User Experience workshop will be organised with potential users from the consortium and beyond to discuss the potential ideas to elaborate the landing page landscape, thus to improve the user experience, usability and findability of the toolbox instruments and information. Hence, the initial toolbox idea sketch will be reviewed before proceeding with its actual technical implementation on the project website. In addition, more specific information about the initial tools will be requested

e.g. as guidelines, guidebooks, extensive descriptions of the capabilities of the tools, access links and etc. to be included into the tool specific pages.

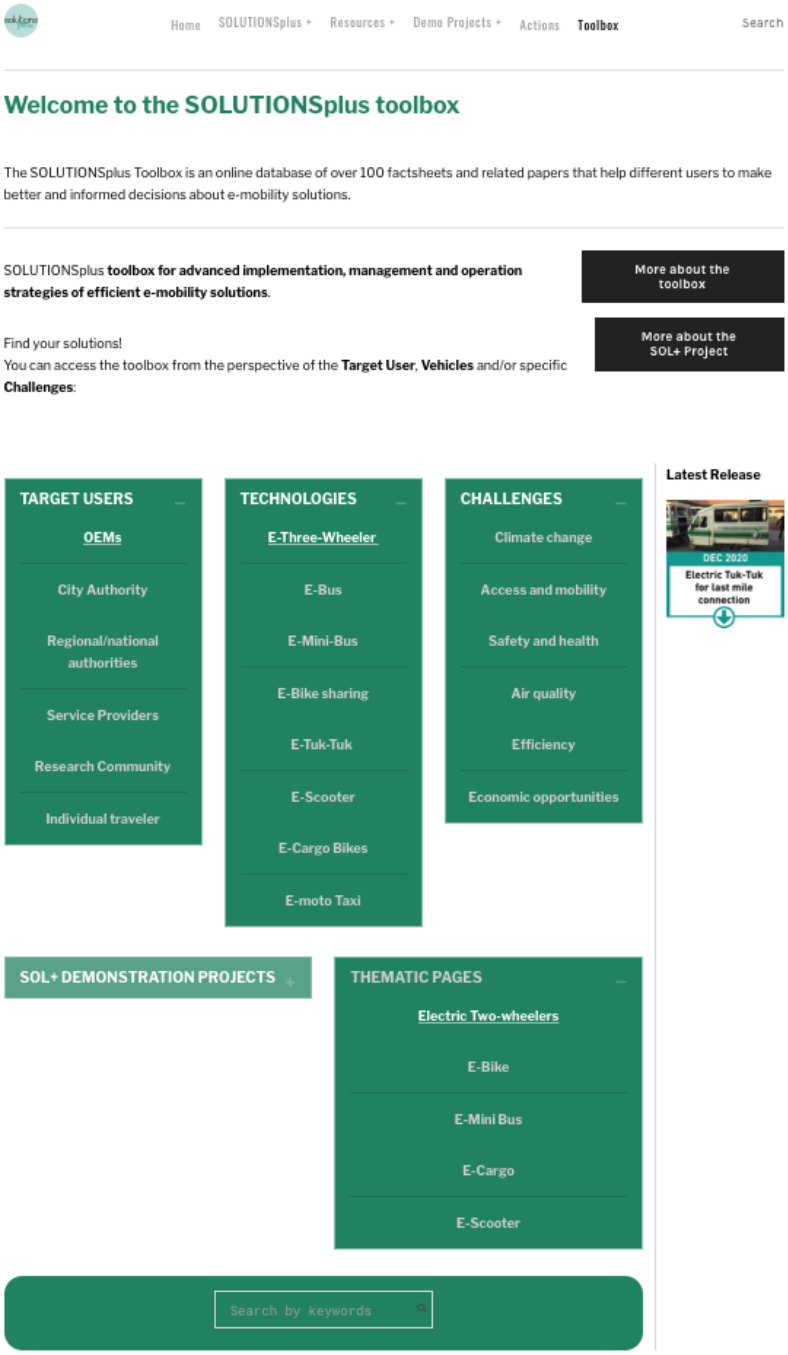

Fig. 17. Current Toolbox landing page structure with more focused topical selection pads

Appendix 1 - List of initially selected tools (this list will be continuously updated and expanded)

Tool name	Corresponding partner	Tool description	Tool topic
Bus Rapid Transit Planning Guide	ITDP	The Bus Rapid Transit Planning Guide is the most comprehensive resource for planning a bus rapid transit (BRT) system, beginning with project preparation all the way through to implementation.	BRT planning
Rapid planning toolkit	ITDP	Cities are looking for tools to help understand the capital and operating costs associated with electric vehicles. Another area of interest is business models for the operation of e-vehicles.	Economic impacts (incl. financing, business plans and models)
Start-up business assessment tool	ERTICO	The tool is an guidance for a 1.5 h in depth interview with the start-up that reveals it readiness and status as a company to deliver solutions to the market	Economic impacts (incl. financing, business plans and models), Implementation, replication and scale-up, Operations (incl. fleet management, system operation), SOLUTIONS+ Demonstration guidance
Electric Freight Vehicle implementation support	FIER Automotive	Based on the support of 50 organisations, FIER has managed to support the implementation of more than 100 electric freight vehicles. FIER has also supported several governmental organisations in policy development with regards to these vehicles. The gained knowledge and experience can be offered to support organisations in the implementation of electric freight vehicles. Topics include: feasibility study, choice of vehicle, choice of charging infrastructure, use case analyses, total cost of ownership calculations, etc..	Infrastructural feasibility (incl. energy and charging), Vehicular feasibility (incl. vehicle topologies), Economic impacts (incl. financing, business plans and models), Implementation, replication and scale-up, Operations (incl. fleet management, system operation), Policy guidelines
GoodMoovs integral sharing platform	FIER Automotive	GoodMoovs is an integral sharing platform used for electric car and e-bike sharing in different settings and which can be combined with different public transport modalities. It includes a sharing app, a back-office system in which insight in the rides and costs and the possibility to set up invoices towards users and members. It also includes elements of social feedback possibilities, incentives and gamification. Thirdly the platform shows calculations, graphs and figures about the use and uptake of the shared electric vehicles within the system. Currently the GoodMoovs platform is used in electric vehicle sharing by different stakeholders and organisations in The Netherlands (for example WeDriveSolar	Environmental impacts (incl. emissions and air quality), Economic impacts (incl. financing, business plans and models), Implementation, replication and scale-up, SOLUTIONS+ Demonstration guidance

		www.wedrivesolar.nl) and is partner within the European EMEurope project eMAAS (www.emaas.eu)	
National requirements for smart charging spots	Technical University of Denmark	A document describing the suggested requirements for charging spots in Denmark. I.e. what should a charging spot be able to do in regards to communication, control and security/interoperability to be considered 'smart'. We hope that these requirements may ultimately result in a formal national requirement.	Infrastructural feasibility (incl. energy and charging), Implementation, replication and scale-up, Policy guidelines
Guidelines for charging equipment planning and installation	Technical University of Denmark	Guidelines aimed at companies and housing associations who are tasked with the procurement of charging infrastructure. In Denmark such guidelines are in high demand.	Infrastructural feasibility (incl. energy and charging), Implementation, replication and scale-up
GASELLI+	VTT Technical Research Centre of Finland	Extension of GASELLI model to include environmental impacts (the model addresses the evaluation of policy measures directed to the renewal of vehicle fleet excluding mass transport solutions)	Infrastructural feasibility (incl. energy and charging), Environmental impacts (incl. emissions and air quality)
E-Bus Decision Support Tool	Rupprecht Consult - Forschung & Beratung GmbH	The E-Bus Decision Support Tool was developed with the intention to help public transport authorities and operators in the electrification of bus lines. The tool allows you to compare your own local bus line parameters to the data collected within 150 different use cases. Based on a similarity index, the tool helps you determining which technology is appropriate in your situation based on your operational profile and specific city context. After entering your local input parameters into the search mask a ranking list of comparable, already electrified bus lines is automatically generated, placing the most similar lines at the top of the list. You can then select the individual use cases to obtain more detailed information on the various electrification components. For the ELIPTIC use cases, additional information on results and lessons learned is provided.	Infrastructural feasibility (incl. energy and charging)
FESTA Handbook	ZLC	SPROUT Project is using FESTA methodology to analyse the viability of the project pilots. It includes Cost-Benefit Analysis, Data Analysis, Events and Incident Definition, Legal and Ethical Issues, Impact Assessment and Scaling Up, Data Sharing. FESTA Handbook is the result of the activity of five Working Groups in the FOT-NET 2 Support Action during 2012 and 2013. The handbook provides applicants to subsequent ICT calls, as far as possible (given the range of near-market ICT systems), practical guidance to allow them to develop compelling FOT projects that address the Commission's desire for an integrated and coordinated program of research. The FESTA Handbook covers issues concerning all aspects of the time-line and administration of an FOT, such that advice will be provided regarding aspects from needs	SOLUTIONS+ Demonstration guidance

		analysis at the commencement of an FOT all the way through to the integration of the acquired data and estimation of socio-economic benefits at the end. Link to the tool: http://wiki.fot-net.eu/index.php/FESTA_Handbook Examples of projects applying FESTA methodology to their field operational tests: http://wiki.fot-net.eu/index.php/FOT_Catalogue#tab=By_type	
Data Storage Repository	Virtual Vehicle Research GmbH	Provide storage repository to serve needs for data collection and evaluation.	Project Infrastructure / Data Storage Repository
Handbook on the external costs of transport Version 2019	ZLC	Overview of the methodologies and input values that can be used to provide state-of-the-art estimates for all main external costs of transport. Furthermore, the report and corresponding excel file present the total, average and marginal external costs for all relevant countries. PDF document: https://ec.europa.eu/transport/sites/transport/files/studies/internalisation-handbook-isbn-978-92-79-96917-1.pdf Excel files provided by the EC can be downloaded here: https://ec.europa.eu/transport/themes/sustainable/studies/sustainable_en	Economic impacts (incl. financing, business plans and models), Implementation, replication and scale-up, Operations (incl. fleet management, system operation), SOLUTIONS+ Demonstration guidance
Toolkit from MIT Megacity Logistics Lab	ZLC	The MIT Megacity Logistics Lab conducts innovative theoretical and applied research to help companies operate better logistics for cities and governments to design better cities for logistics. Megacities Logistics Lab focus on solving real-world problems using state of the art techniques that provide ROI to their partners. It provides data-centric and data-driven solutions to empower complex operational, tactical, and strategic decision making in the urban logistics environment. https://megacitylab.mit.edu It includes a Urban Logistics Toolkit and Best Practices and a section in Last-mile Delivery: https://megacitylab.mit.edu/why-last-mile-logistics/	Infrastructural feasibility (incl. energy and charging), Vehicular feasibility (incl. vehicle topologies), Social impacts (incl. health, accessibility, user needs and modal split), Implementation, replication and scale-up, Operations (incl. fleet management, system operation), SOLUTIONS+ Demonstration guidance
myCicero	Pluservice	myCicero is a multiservice technological platform designed to simplify the access to the different mobility services available within the territory. myCicero is the first italian MaaS application operating at national level, it includes several mobility services (train, buses, parking services, etc) and about 1,8 million of users. Pluservice calls this application one-stop-shop	Environmental impacts (incl. emissions and air quality), Social impacts (incl. health, accessibility, user needs and modal split), Economic impacts (incl. financing, business plans and models), Operations (incl. fleet management, system operation), Interoperability, integrated services

AVL	Pluservice	Automatic Vehicle Localization: Real-time localization for the whole fleet	Operations (incl. fleet management, system operation)
UNEP e-mob calculators (LDVs, buses 2&3 wheelers)	UNEP	Model to estimate energy, GHG, air pollutant and cost savings until 2050. Includes scenario modelling of a baseline and an e-mobility scenario. Input can be as simple as GDP, population, vehicle stock and sales. Default parameters for technical lifetime, mileage, fuel consumption, price, carbon footprint of fuels etc. can be changed. Based on ASIF methodology. Contains TCO and financial calculations. Contains a stock turnover model. Technology shares are applied to vehicle sales and penetrate into the stock based on sales and retirements. Download for free: https://www.unenvironment.org/resources/toolkits-manuals-and-guides/emob-calculator	Infrastructural feasibility (incl. energy and charging), Environmental impacts (incl. emissions and air quality), Provides relatively comprehensive output based on simple inputs. Is Excel based and transparent.
ADB Transport Databank Model	ADB Transport Databank Model	Transport model for simultaneous development of a Benchmark and mitgation scenario. Includes road, rail, air, shipping. High technology resolution for road. Includes all Avoid-Shift-Improve measures. Has a large set of default policy interventions. Can be applied on national and regional level. Needs quite a comprehensive set of input data. Is based on ASIF methodology.	Environmental impacts (incl. emissions and air quality), Economic impacts (incl. financing, business plans and models), Policy guidelines
	Global Fuel Economy Initiative	Visualized policy database to provide an overview of implemented fuel economy policies (including standards, regulation, fiscal and labeling) world-wide.	Policy guidelines
UNEP Electric Vehicle Database	UNEP	Free database covering a large amount of policy information by country world wide https://www.unenvironment.org/resources/publication/global-electric-vehicle-policy-database	Policy guidelines
Autonomie	CMM Chile	Vehicle technology modelling software	Vehicular feasibility (incl. vehicle topologies)
SHORTENING THE LAST MILE: WINNING LOGISTICS STRATEGIES IN THE RACE TO THE URBAN CONSUMER	ZLC	White Paper from DHL on last mile delivery for 2020 (updated in 2019), new tendencies in last mile delivery and reference to methods base on big data, artificial intelligence… This white paper discuss in depth the evolution of the interaction between consumer and industry and the impact this has had in reshaping the future of the last mile. By evaluating the urban consumer's delivery needs and how current innovations seek to service them, the paper aims to light the path for transport operators towards developing a flexible business model that can adapt to new expectations while maintaining profitability. This will be illustrated through a conceptual framework — the FAD triangle — that describes the parameters and considerations necessary to acknowledge as the industry adapts to tomorrow's last mile. For adjacent industries, it will also offer practical guidance to online	Vehicular feasibility (incl. vehicle topologies), Social impacts (incl. health, accessibility, user needs and modal split), Implementation, replication and scale-up, Operations (incl. fleet management, system operation), SOLUTIONS+ Demonstration guidance

		retailers on how to best leverage transport operators over the last mile to maximize their competitiveness. Download link: https://discover.dhl.com/business/getting-to-market/last-mile-delivery	
CBA method	Technical University of Denmark	Methodology on how to perform cost-benefit analysis (CBA) on transport projects	Environmental impacts (incl. emissions and air quality), Social impacts (incl. health, accessibility, user needs and modal split), Economic impacts (incl. financing, business plans and models), Policy guidelines
MCDA method	Technical University of Denmark	Methodology on how multi-criteria decision analysis (CBA) can be performed on transport projects	Environmental impacts (incl. emissions and air quality), Social impacts (incl. health, accessibility, user needs and modal split), Policy guidelines
Strategic map charging infrastructure for Electric Vehicles	FIER Automotive	Based on different models on charging behaviour of electric drivers and socio-econmomic analyses it is possible tot set up a strategic map within a region or city to get insight in the best locations combined woth the best fitted stakeholders to set up the right future proof charging infrastructure.	Infrastructural feasibility (incl. energy and charging)
Training and coaching on TCO calculations	FIER Automotive	Based on knowledge and experience we are able to set up a set of trainings and coachings in TCO calculations which are based on the different cost aspects and very relevant in scenario analyses for the uptake of EV's	Vehicular feasibility (incl. vehicle topologies)
The Roadmapper - a navigator for regional transport transitions to sustainability (The Roadmapper)	Blekinge Institute of Technology	This is a strategic planning approach for accelerated transition to fossil free and sustainable transport systems. It helps societal planners make roadmaps for their particular contexts and to adapt along the way for short term crises like the corona pandemic. The approach has been developed and tested in a series of regional projects in southeast Sweden. this has also led to a roadmap publication in book form (in Swedish) and an English summary (Ny et a. 2017. On track for 2030. Roadmap for fast transition to sustainable personal transport). Around the approach a new research team is forming (see www.bth.se/sustaintrans) under the leadership of the initiator associate professor Henrik Ny. Here is a direct link to the English book summary as well: https://a.bth.se/sustaintrans/on-track-for-2030-roadmap-for-a-fast-transition-to-sustainable-personal-transport/	Environmental impacts (incl. emissions and air quality), Social impacts (incl. health, accessibility, user needs and modal split), Economic impacts (incl. financing, business plans and models), Policy guidelines

		The next step is to develop the approach further into a modeling tool and potentially a commercial online service.	
Sistema de Ayuda a la Explotación, SAE	EMT MADRID	The SAE is the control system for EMT operations. It integrates dozens of subsystems, such as ticketing, Wifi network, video surveillance cameras, bus positioning, communications with the bus driver, control of the information pannels, the supervision of various bus operating parameters, emergency systems, etc. It operates 24/7 from EMT headquarters. It operates in three shifts, 25 inspectors manage an average of 8 lines and more than 80 buses, providing drivers with valuable support in their daily work. Not only do they regulate traffic by monitoring compliance with intervals and by repositioning buses along the bus line in the event that a 'clearing' is formed at one of their points, they are also there to respond to emergencies or unforeseen situations: Accidents in which buses are involved, interceptions of the road by badly parked or damaged vehicles, diversions due to sporting events or incidents related to the breakdown of service networks, etc. In permanent coordination with the rest of the City Council's means (Police, Emergencies..) and with the EMT's own means, such as the mobile customer service (SAM), they are capable of both sending an ambulance or a crane to any point in Madrid to help any bus incidence. The SAE has access to the City Council's network of traffic cameras, 8 of which can be simultaneously seen on the screens of the SAE room. The level of integration offered by the software and the communications network is such that these inspectors can find out in real time whether a bus is experiencing Wi-Fi failure or if its canceling device misdiagnoses, in addition to providing them with the driver's file at all times in charge of each expedition and the situation of the same in relation to the rest of the line (delayed, on time or early). From all this data, the information that users see on the time information screens located at bus stops and through the EMT mobile / web applications that are updated almost in real time (every 30 seconds)	Operations (incl. fleet management, system operation)
GACMO Model (Greenhouse Gas Costing Model)	UNEP DTU Partnership	1. The model start with an energy balance for the start year (e.g. 2015) in mass units (tonnes and m3) or in energy units (ktoe or GJ). We often use an OECD like energy balance which we can get from ENERDATA. 2. The projection for the BAU to 2020/2025/2030/2050 is made quick and dirty by using an annual growth factor for each sector, which are then transformed into factors bringing the BAU value forward to the future.	Environmental impacts (incl. emissions and air quality), Economic impacts (incl. financing, business plans and models), Implementation, replication and scale-up

		3. The energy balances for the start year are changed to GHG balances by multiplying with IPCC default factors. 4. An excel sheet is prepared for each mitigation option, and added together in the "Main" sheet. 5. A mitigation revenue curve is made. 6. The resulting NDC is simple to compare with other countries.	
Knowledge about effectiveness of incentives	FIER Automotive	Since 2014, FIER has been studying the effectiveness of financial and non-financial incentives for electric driving. Moreover, FIER has done extensive research on other incentives like tax reduction or –exemption, purchase tax reduction or – exemption, purchase grants and other tax benefits. Also the recurring incentives like road tax reduction or – exemption. Based on this we also have insight into the residual values and with that the depreciation of ICEs and BEVs. The beforementioned has been combined with the knowledge of the local financial system (and the appliance of the incentives) and with that we were able to make an extensive TCO comparison. Only with this method the real effect of an incentive can be determined. The TCO and BiK calculations are not fully comprehensive. There are also other non financial factors playing a roll in the development of sales figures of BEVs.	Policy guidelines
Guidelines for vehicle selection	Applus IDIADA	The tool will provide guidelines on what to consider to select a vehicle to comply with the desired range for the applications	Vehicular feasibility (incl. vehicle topologies)
Guidelines on charging solutions	Applus IDIADA	Guidelines to help municipalities choose charging solutions and operation	Infrastructural feasibility (incl. energy and charging)
Fleet sizing guidelines	Applus IDIADA	Guidelines for dimensioning shared vehicle fleets, selecting the type and amount of vehicles	Vehicular feasibility (incl. vehicle topologies), Operations (incl. fleet management, system operation), SOLUTIONS+ Demonstration guidance
Funding and Financing of SUM Measures	Wuppertal Institute	This document provides guidance on a specific topic related to Sustainable Urban Mobility Planning (SUMP). It is based on the concept of SUMP	Implementation, replication and scale-up, Funding and financing
Public Procurement of SUM Measures	Wuppertal Institute	The tool provides guidance on how public procurement can be used to used to contribute towards the shift to sustainability mobility. The Guide discusses the general concept of sustainable public procurement, the legislative environment in the EU and leads through the different stages of a procurement process for SUMP measures in a stepwise approach. It also discusses different inherent principles of sustainable public procurement in the field of urban mobility such as life cycle costing and how these can be applied. In so	Implementation, replication and scale-up, Public procurement

		doing, it points to relevant further guidance discussing specific issues and concepts. https://www.eltis.org/sites/default/files/public_procurement_of_sump_v2.pdf	
TIDE Toolbox	Wuppertal Institute	The TIDE Toolbox is a product of the European TIDE (Transport Innovation Deployment for Europe) project and aims to provide guidance on how to integrate innovations in urban mobility policies (a cluster on electric mobility is included).	Policy guidelines, Financing schemes as well
LCMM	T-Systems International	LCMM is a tool to measure carbon emission of vehicles based on driving and route profile	Environmental impacts (incl. emissions and air quality)
ELIPTIC Policy Recommendations	Polis	ELIPTIC evaluated various approaches and technologies for electrifying public transport and demonstrated that the further take-up of electric vehicles can be done in a cost-efficient way by integrating multi-purpose charging into existing public transport infrastructures. ELIPTIC received funding of €5.9 million through which it was able to realise 20 different use cases in the form of both practical operation and feasibility studies.	Policy guidelines
Specification of city & PT stakeholders strategies and needs	Polis	Assessing the needs and strategies of local administrations, and public transport authorities and operators regarding the integration of fully battery-electric buses, freight trucks and vans. Facilitating the best possible identification and understanding of cities' and Public Transport needs, a three-step analysis takes place including: categorisation of cities, collection of cities' and Public Transport stakeholders' demands, survey of existing roadmaps for transport electrification.	Implementation, replication and scale-up, Policy guidelines
UEMI/SOLUTIONS toolkit	UEMI	Collection of factsheets on e-mobility, infrastructure, logistics, mobility management and planning	Infrastructural feasibility (incl. energy and charging), Vehicular feasibility (incl. vehicle topologies), Economic impacts (incl. financing, business plans and models), Implementation, replication and scale-up, SOLUTIONS+ Demonstration guidance
Urban Mobility Accessibility Calculator (UrMo AC), OSS	DLR Institute of Transport Research	An Open source tool developed by DLR Transport Research to calculate accesibility indicators in cities, for transport modes walk, bike, car and public transport. Data inputs needed are: building + population data, road infrastructure for walk/bike/car (for instance OSM) and GTFS for public transport. Besides GTFS, such data can typically also derived using open data. Tool available online: https://github.com/DLR-VF/UrMoAC/	Vehicular feasibility (incl. vehicle topologies), Social impacts (incl. health, accessibility, user needs and modal split), Policy guidelines

		Introduction Paper and Presentation: https://elib.dlr.de/106451/ Application in Berlin and Mexico City: https://minas.medellin.unal.edu.co/gruposdeinvestigacion/gaunal/images/imagenes/Eventos/MOVICI_MOYCOT/sesion5/1-Jorge-Narezo.pdf	
Mayor of London & Gnewt Cargo Electric Vehicle Trial	ZLC	The Mayor of London and Gnewt Cargo secured funding from Innovate UK in 2017 to run a commercial electric vehicle trial. The trial ran until the end of December 2019 and evaluated the performance, impact and commercial viability of using electric vehicles for last-mile deliveries in central London. https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/electric-delivery-vehicle-trial	Implementation, replication and scale-up, Operations (incl. fleet management, system operation)
Transport Emissions Evaluation Models for Projects (TEEMP)	Clean Air Asia	TEEMP is an Excel-based, free-of-charge, open-source models designed to estimate potential impacts (CO2, and air pollutant, like PM and NOx). The tool is most appropriate for ex-ante evaluation in places with poor data. There are default data if local data is lacking (such as emissions by vehicle type by speed, travel activity parameters, elasticities); however, confidence in model outputs higher when local data replaces defaults. TEEMP developed and evolved over time. Excel calculators are available for projects such as Bike sharing, Bikeways, Pedestrian Facility Improvement, BRT , LRT/MRT, Roads Projects – Expressways, Rural Roads and Urban Roads, Railway projects. Also developed under the TEEMP suite are Excel calculators for commuter strategies, eco-driving, parking management. Different set of calculations have then been integrated into city-level application, called the TEEMP City.	Environmental impacts (incl. emissions and air quality)
Low Carbon Mobility Planning Toolkit (LCMP Toolkit)	DTU	LCMPs have been developed for a number of Asian and European cities. This document draws inputs from these LCMPs, and mainly from the experience of preparing LCMPs in India where the authors of this publication were involved in developing an LCMP methodology and testing it in three Indian cities.	Environmental impacts (incl. emissions and air quality), Social impacts (incl. health, accessibility, user needs and modal split), Policy guidelines
Smart eFleet	VTT Technical Research Centre of Finland	Map-based energy flow simulator for vehicle systems. Includes modelling of vehicles and charging infrastructure. Can be utilised in technical and economic feasibility studies and operation optimisation/management.	Infrastructural feasibility (incl. energy and charging), Vehicular feasibility (incl. vehicle topologies), Economic impacts (incl. financing, business plans and models), Operations (incl. fleet management, system operation)

Bus simulation model	TNO	This tool can be used to simulate the energy consumption for an electric line bus driving a fixed route. The influence of charging strategy and bus climate control can be investigated with this model	Infrastructural feasibility (incl. energy and charging), Environmental impacts (incl. emissions and air quality), Economic impacts (incl. financing, business plans and models), Implementation, replication and scale-up
electric refuse collecting truck simulation model	TNO	This tool can be used to simulate the energy consumption for an electric refuse truck	Vehicular feasibility (incl. vehicle topologies), Environmental impacts (incl. emissions and air quality), Economic impacts (incl. financing, business plans and models), Implementation, replication and scale-up
SEMS	TNO	Smart Emision Measurement System (SEMS) is a sensor-based hardware tool that can be used for real-life emission measurements on vehicles. The tool measures CO2, NOx and NH3 at the vehicle tail-pipe and combines this with GPS and OBD information. The measurement data is streamed to a server and accessible real-time	Environmental impacts (incl. emissions and air quality)
Urban Strategy	TNO	Urban Strategy is a platform for integral and interactive urban planning and monitoring. It combines fast computational models from multiple domains and a user-friendly web-based interface into a powerful simulation platform	Infrastructural feasibility (incl. energy and charging),Vehicular feasibility (incl. vehicle topologies),Environmental impacts (incl. emissions and air quality),Social impacts (incl. health, accessibility, user needs and modal split) Other: Multiple domains: - Traffic & mobility - Air Quality (transport + industry) - Noise (transport + industry) - Health impact - Road safety (under development)

			- Zero emission mobility - mobility demand
eBus tool	TNO	The eBus tool is used as a strategic planning and decision support tool, to help develop a bus electrification strategy. It allows speedy full fleet simulation of various bus, battery and charging technologies and allows for quantified comparison of electrification approaches (e.g. depot charging vs opportunity charging) based on relevant KPIs like reliability and total cost of ownership.	Infrastructural feasibility (incl. energy and charging), Vehicular feasibility (incl. vehicle topologies), Environmental impacts (incl. emissions and air quality), Economic impacts (incl. financing, business plans and models), Implementation, replication and scale-up
MEMS	TNO	Modular Energy Management System is a tool to support development of the powertrain control for electrified vehicles. The tool is supported with Graphical User Interface where user can define the vehicle configuration and generate the corresponding powertrain control	Vehicular feasibility (incl. vehicle topologies), Environmental impacts (incl. emissions and air quality)
ADVANCE	TNO	ADVANCE is a vehicle simulation environment in which the user is able to perform complete vehicle simulations. Vehicle dynamics, after treatment and control can be taken into account and may be coupled to each other. The model setup has been made modular, taking full advantage of the MATLAB/Simulink environment on which ADVANCE is based. This enables rapid and reusable model implementation. The ADVANCE library, containing validated component models, is added to the Simulink libraries and may be used as all other standard Simulink libraries. These models have all been developed with real-time applications in mind. In addition, the user can add further models as desired. These can be tuned to the simulation requirements at hand or may be supplied by system suppliers, providing accurate behaviour based on production components. For extra ease of use, the standard Simulink environment has been extended where needed to enable simplified handling of system parameters and post processing. As large amounts of data are generated in the process of analyzing vehicles, facilities have also been provided to reduce the load on required data storage.	Vehicular feasibility (incl. vehicle topologies), Environmental impacts (incl. emissions and air quality)