# SHared automation Operating models for Worldwide adoption

# SHOW

**Grant Agreement Number: 875530**

## D17.3: Cities and Authorities decision-making mechanisms

This report is part of a project that has received funding by the European Union's Horizon 2020 research and innovation programme under Grant Agreement number 875530

# Executive Summary

The current Deliverable 17.3 “Cities and Authorities decision-making mechanisms” sets the stage for the restructuring and development of the LEVITATE Connected and Automated Transport System (CATS) Policy Support Tool (PST) within the context of the SHOW project, specifically within Task A17.2 “Automation and SUMP assessment, scenarios and DSS” of Work Package WP17 “Decision support, Guidelines & Recommendations & Roadmap”. The LEVITATE PST, designed to support decision-makers in cities and regions, is freely accessible online and can handle varying levels of complexity of Cooperative, Connected and Automated Mobility (CCAM) policies and adaptation to the reality of each city. This document provides a detailed explanation of the original LEVITATE PST, step-by-step examples of its functions and outputs, and outlines the process of engaging participant cities in workshops to reshape the PST for the needs of the SHOW project.

The current document highlights the transformation of the LEVITATE PST into a SHOW-specific PST through city engagement and dialogue, achieving the goal of developing an online dynamic tool compatible with the complexity of differentiated urban characteristics and multiple amounts of available data. Future refinements could include the ability to introduce endogenous or exogenous CCAM Market Penetration Rate (MPR) causes and user-influenced MPR fluctuations. The deliverable underscores the utility of tools like the SHOW-PST in informing and training stakeholders and solving present problems through their usage. It also emphasizes the value of stakeholder engagement and the need for proactive design using the two main subsystems of the tool: (i) the forecasting subsystem, used to investigate the impacts of selected interventions and (ii) the backcasting subsystem, used to investigate the suitability of a wide range of candidate interventions to achieve specific impacts. As new CCAM data emerges, tools like the SHOW-PST facilitate dynamic updates of studies and estimates, supporting cities' adaptive designs.

This tool was tested with the local authorities’ representatives during the workshops of A17.2: Automation and SUMP assessment, scenarios and DSS organised with the cities of Bremen, Helmond, Barcelona, Tampere and Trikala. During these online interactions, the local authorities were able to give feedback and discuss the need of having such a tool for the impact assessment of CAVs against SUMP goals and objectives.

## Document Control Sheet

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# Abbreviation List

| Abbreviation | Definition |
|---|---|
| AD | Automated Driving |
| AV | Automated Vehicle |
| CACC | Cooperative Adaptive Cruise Control |
| CATS | Connected and Automated Transport Systems |
| CAV | Connected and Automated Vehicle |
| CCAM | Cooperative Connected Automated Mobility |
| CCAV | Cooperative Connected Automated Vehicle |
| CV | Conventional Vehicle |
| D or Del | Deliverable |
| kph or km/H | Kilometre Per Hour |
| KPI | Key Performance Indicator |
| Min | Minutes |
| MPR | Market Penetration Rate |
| O-D/OD | Origin-destination |
| PT | Public Transport |
| PST | Policy Support Tool |
| s or Sec | Seconds |
| SUMP | Sustainable Urban Mobility Plan |
| VRU | Vulnerable Road Users |
| WP | Work Package |

# 1 Introduction

## 1.1 Purpose and structure of the document

The scope of the current document fundamentally is to lay the ground for the restructuring and development of the LEVITATE CATS Policy Support Tool (PST) within the context of the SHOW project. This specific subtask is situated within the scope of *Task A17.2 – Automation and SUMP assessment, scenarios and DSS* of the wider *Work Package 17 - Decision support, Guidelines & Recommendations & Roadmap*.

The LEVITATE PST (LEVITATE, 2022) [1] has been selected for inclusion within the activities of SHOW because it already contains some key features, such as:

1. It was designed to support decision-makers of cities & regions, as well as public transport authorities and operators by providing quantified estimates on city-wide impacts of the advent of CCAM and of the effects of related policies.
2. It is accessible freely online and can be used by decision-makers and/or any organizations interested in the topic.
3. It includes several degrees of complexity and personalization which allows to obtain results with a variable level of precisions, depending on the quality and amount of the input data.
4. It was designed to be usable in several European cities, at least 5 of which were consulted in the development process.
5. It was developed by SHOW partners in the framework of other EU-funded projects, namely NTUA (within the LEVITATE project).

The current deliverable offers a comprehensive explanation of the internal workings of the original LEVITATE PST as well as step-by-step examples to comprehend its functions and outputs. The process of engaging with the participant cities within dedicated workshops is also showcased. Finally, the process of reshaping the LEVITATE PST to support the activities of SHOW is outlined.

## 1.2 Intended audience

This document (D17.3) is intended for public and open access. It describes the respective indicators of CCAM deployment that are used to create quantified recommendations regarding city-wide and societal impacts and provide them to interested stakeholders.

This document serves as a manual for the partners involved in SHOW WP17 by providing information on the design and mechanisms of both the original and the updated LEVITATE PST and the updates that have been made to render it more relevant to the SHOW context.

From the "open-access nature of this document" point of view, D17.3 serves as an informative document for external stakeholders as well, outlining the decision-making mechanisms that selected city authorities have consulted within the activities of SHOW. The current document will be also useful for every future user, interested in calculating the city-wide impacts of automated mobility, who will be informed about the tool's purpose, elements and structure and gain all supporting details.

The deliverable is structured as follows: Section 1 begins with an Introduction regarding the purpose and positioning of the deliverable, while Section 2 presents a comprehensive overview of the existing LEVITATE PST. Section 3 outlines the process of city engagement and dialogue, with the workshops as the central point, and the feedback process that was established. Section 4 presents the changes that were undertaken to transform the LEVITATE PST into a SHOW-specific PST. Section 5 presents the exploitation plan for the SHOW-PST while Section 6 concludes the document by summarizing the most useful lessons learnt from the process.

The tool was tested in collaboration with local authorities' representatives during workshops held as part of A17.2: Automation and SUMP assessment, scenarios, and DSS. These workshops were organized with the cities of Bremen, Helmond, Barcelona, Tampere, and Trikala. During the online sessions, local authorities provided feedback and discussed the importance of such a tool for assessing the impact of CAVs in relation to SUMP goals and objectives.

The final form of the SHOW-PST as reshaped within the activities of the SHOW project can be accessed through this link:

https://www.ccam-shuttleimpacts.eu/

Moreover, the tool has been integrated in the SHOW website and is openly accessible through this link:

https://show-project.eu/media/policy_support_tool/

## 1.3 Interrelations

D17.3 builds upon the work of D17.1 “First issue of best practices and decision making mechanisms for different stakeholder groups” and D17.2 “Best practices for implementation and application guidelines for Industry, Operators and Cities” that showcased relevant decision-making mechanisms for Cities/Authorities (SHOW, 2023) [2] in order to provide the basis for making strategic decisions regarding the types of CCAM measures and services. In D17.4 “CCAV integration in SUMP”, SHOW recommends cities to use the SHOW-PST tool as it should support city authorities in assessing which use case could help them in achieving, developing or monitoring their SUMPs. The present work has the potential to also be used in order to obtain quantified impact assessment estimates, such as within the work of WP13 “Impact assessment” of SHOW, or to expand the list of examined KPIs providing alternative an estimate approach.

# 2 Overview of the LEVITATE PST

The LEVITATE PST was developed as part of the Horizon2020 LEVITATE project (Societal Level Impacts of Connected and Automated Vehicles) aiming to consolidate the outputs of different methods into an overall framework for the assessment of impacts, benefits and costs of CCAM, for different automation and penetration levels and on different time horizons. The LEVITATE PST provides estimates of the impacts of CCAM through a multi-disciplinary impact assessment methodology. Within the framework of LEVITATE, three automation use cases were considered: Passenger cars, Urban transport and Freight transport, as well as specific sub use-cases are investigated for each domain, presented on Table 1. In addition, twenty distinct impacts are examined defined by Elvik et al. (2019) [3] and classified into three distinct categories: (i) Direct impacts, (ii) Systemic impacts and (iii) Wider impacts. In order to enable the impact assessments, four predefined base scenarios are also established, concerning the temporal distribution of the market penetration rates (MPRs) of Connected and Autonomous Vehicles (CAVs) throughout the study period (from 2020 to 2050) and are the following: No automation, Pessimistic, Neutral, Optimistic base scenario. Moreover, five different methods were used in order to provide and forecast the examined impacts, which are the microscopic simulation, mesoscopic simulation, system dynamics, operations research and the Delphi method.

**Table 1: LEVITATE PST use cases and sub-use cases**

| Use Cases | Sub-Use Cases |
|---|---|
| **Automated Urban Transport** | Point-to-point Automated Urban Transport Services (AUSS) |
| | Autonomous mobility on-demand |
| **Automated Passenger Cars** | Road use pricing |
| | Green Light Optimised Speed Advisory |
| | Automated ridesharing |
| | Parking pricing policies |
| | Parking space regulations |
| | Dedicated lanes on urban highways |
| **Automated Freight Transport** | Automated urban delivery |
| | Automated freight consolidation |
| | Hub-to-hub automated transport |
| | Truck platooning on urban highway bridges |

The LEVITATE PST estimator was developed in a Javascript environment, comprising a highly ergonomic interface, simple and easy to use. It includes a graphical environment (interactive infographics) for presentation of results. Especially regarding the impacts, the graphical presentation of results (e.g. in a suitably designed chart) allows for the visualisation of the time dimension of the impact (in the x-axis of the chart). The online PST can be found in the following link https://www.ccam-impacts.eu/. The LEVITATE PST comprises two main modules the Knowledge module (static component) and the Estimator module (dynamic component), presented in detail in the following sections. The introductory page of LEVITATE PST presents the three components that the user can access: the forecasting sub-system, the backcasting sub-system and the knowledge module (Figure 1). In particular, the forecasting subsystem is used to investigate the impacts of selected interventions and the backcasting subsystem is used to investigate the suitability of a wide range of candidate interventions to achieve specific impacts. The Cost-Benefit Analysis sub-system (CBA module) is set up as an extra module in the PST. The user can choose and navigate into each one of the tools as presented in the following sections.

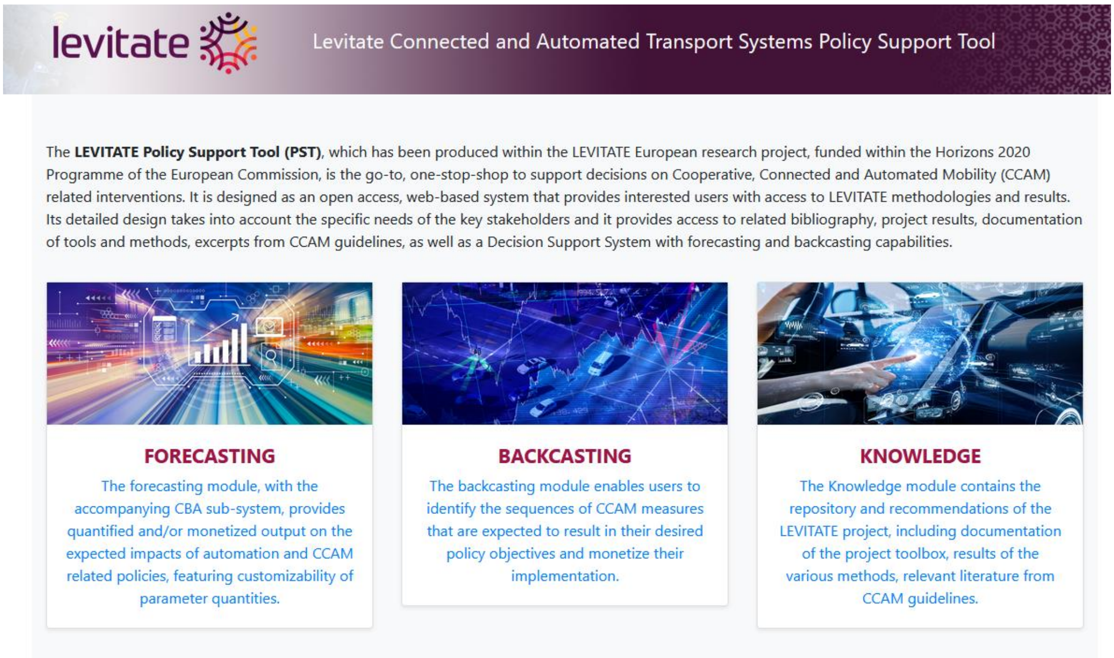



**Figure 1: Online PST components**

## 2.1 Forecasting Sub-System

The forecasting sub-system **provides quantified and/or monetized output on the expected impacts of CCAM related policies**, featuring customizability of parameter quantities. The following steps are followed by the user, with numerical example concerning the impact assessment of the introduction of dedicated lanes of Connected and Automated passenger cars for a high CCAM deployment. The forecasting input steps are shown on Figures 2-4:

1. **Selection of use case, sub-use case** (CCAM intervention) and **deployment scenario** from the drop-down menu (in the example “PASSENGER CARS”, Dedicated Lanes” and “SCENARIO 4 – OPTIMISTIC”. The user can also define the intensity of the policy intervention between the years 2020-2050, which refers to what lies within the control of the authorities, such as route frequency for shuttle buses as well as the policy effectiveness, which refers to what the authorities can measure, observe or expect but cannot directly control, such as public acceptance, regulation obedience or similar aspects of the network and, most importantly, the behavior of the network users. These quantities are predefined in case the user does not want to adapt them.

2. The user is also given the possibility to **combine two CCAM measures** (sub-use cases) for the impact assessment. For the second measure the user should similarly to the first, define the use case, the sub-use case and the policy parameters.

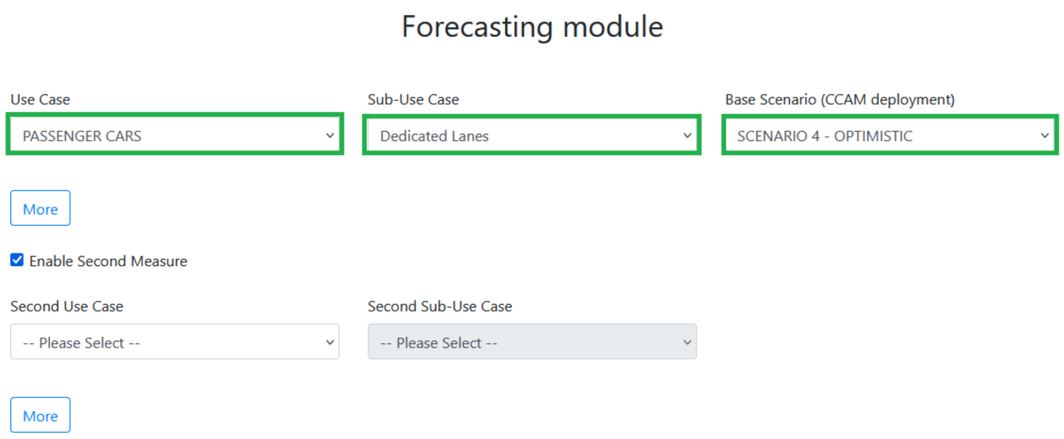



**Figure 2: Policy intervention selection**

3. **System parameters definition**, which include default values, that can be changed based on the data from the user's city, to ensure that the final results will be relevant and transferable. In the example the values different from the default values are: GDP per capita: 25000, Annual GDP per capita change: 0.02, City population: 5, Average load per freight vehicle: 2, Fuel cost: 2, Fuel consumption: 10.

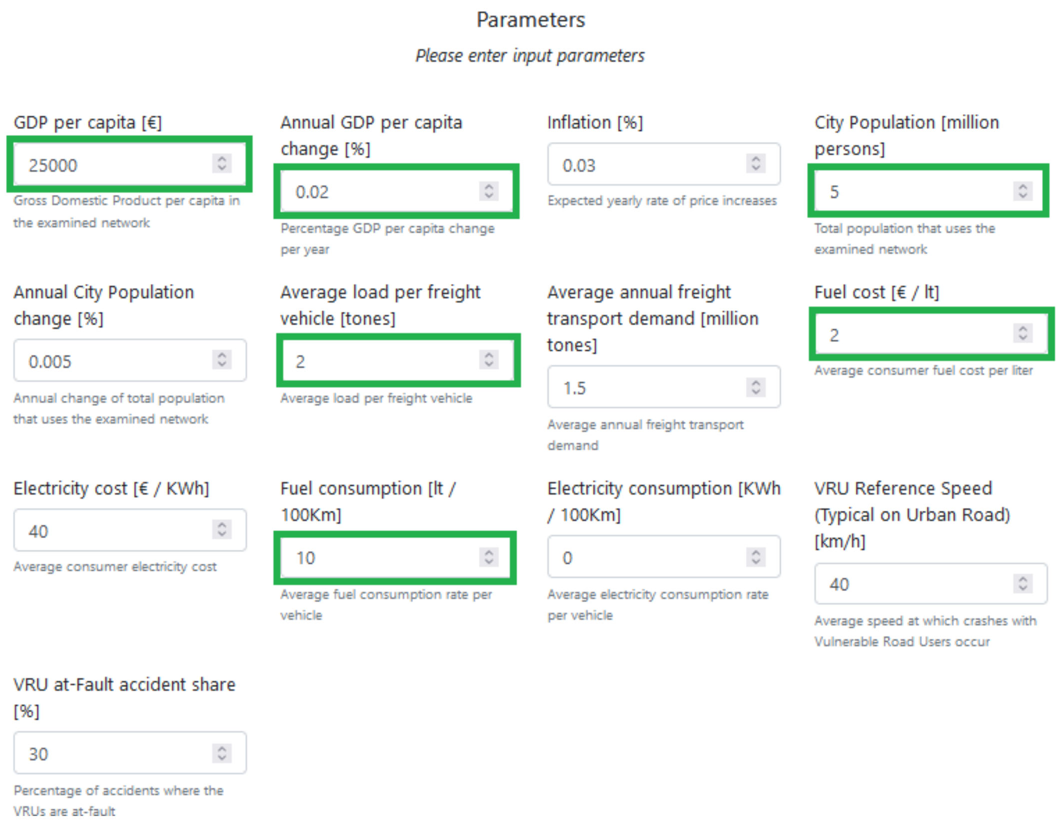



**Figure 3: Forecasting parameters input**

4. **Impacts initial value definition**, which include default values that can be changed based on the user's city data. In the numerical example the initial impact values different from the default values are: Travel time: 30min, $CO_2$ due to vehicles: 2000gr/veh-km.
5. **Submit** selected scenario and proceed to the results page.

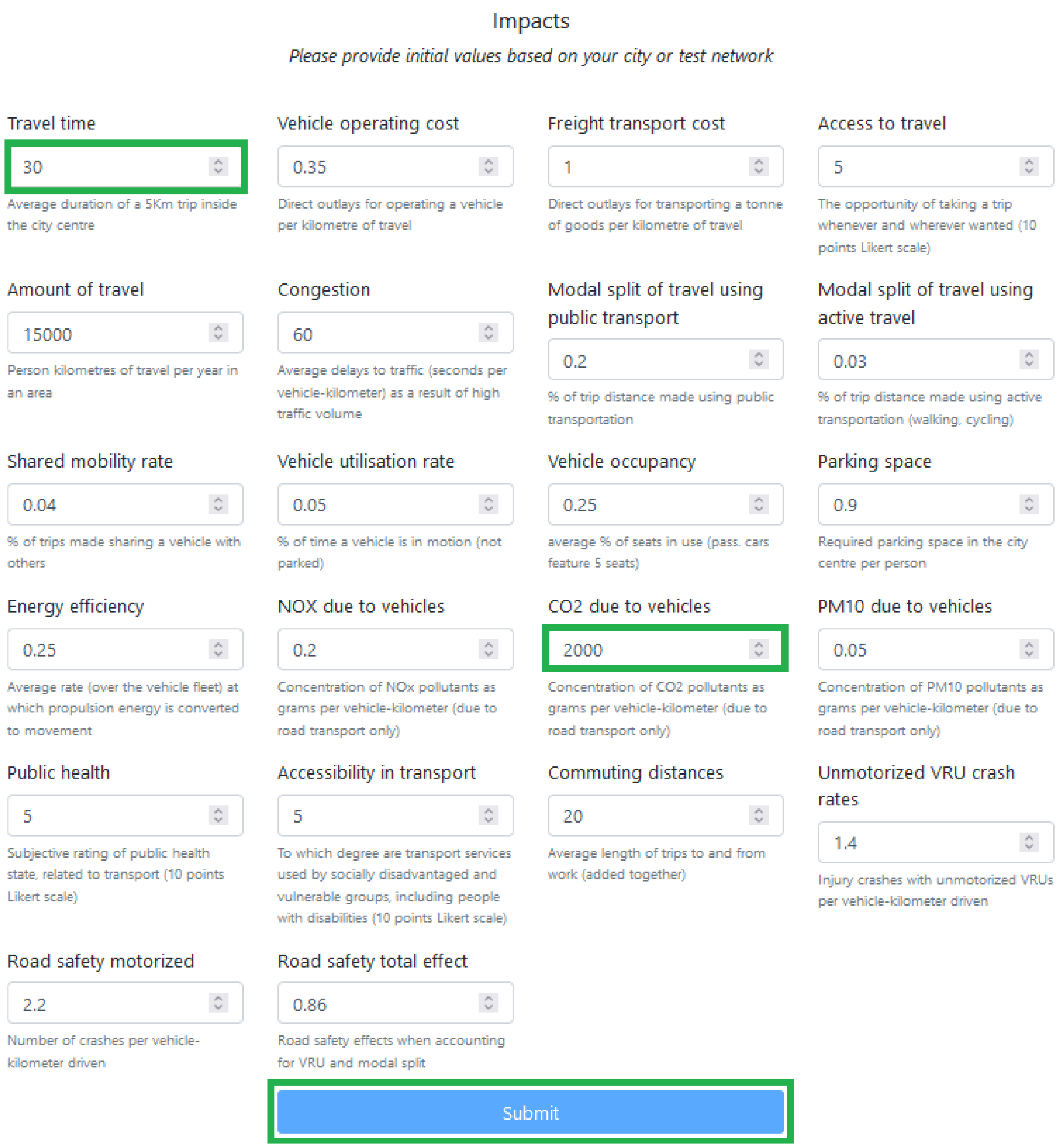



**Figure 4: Forecasting impacts initial values**

6. **Selection of impact** to be presented in the graphical representation
7. **Policy intervention selection** from the policy intervention drop-down menu, in the example the selected scenario is “Motorway and A road”.
8. **Definition of the implementation year** of the selected policy intervention, in the example the year 2026 is selected.
9. The graph (Figure 5) presents the progress of the impact throughout the years with (purple line) and without (grey line) the policy intervention, so that the user can compare the results. In case that the user has chosen two measures, it will be necessary to select the first and the second policy intervention scenarios as well as their implementation year.

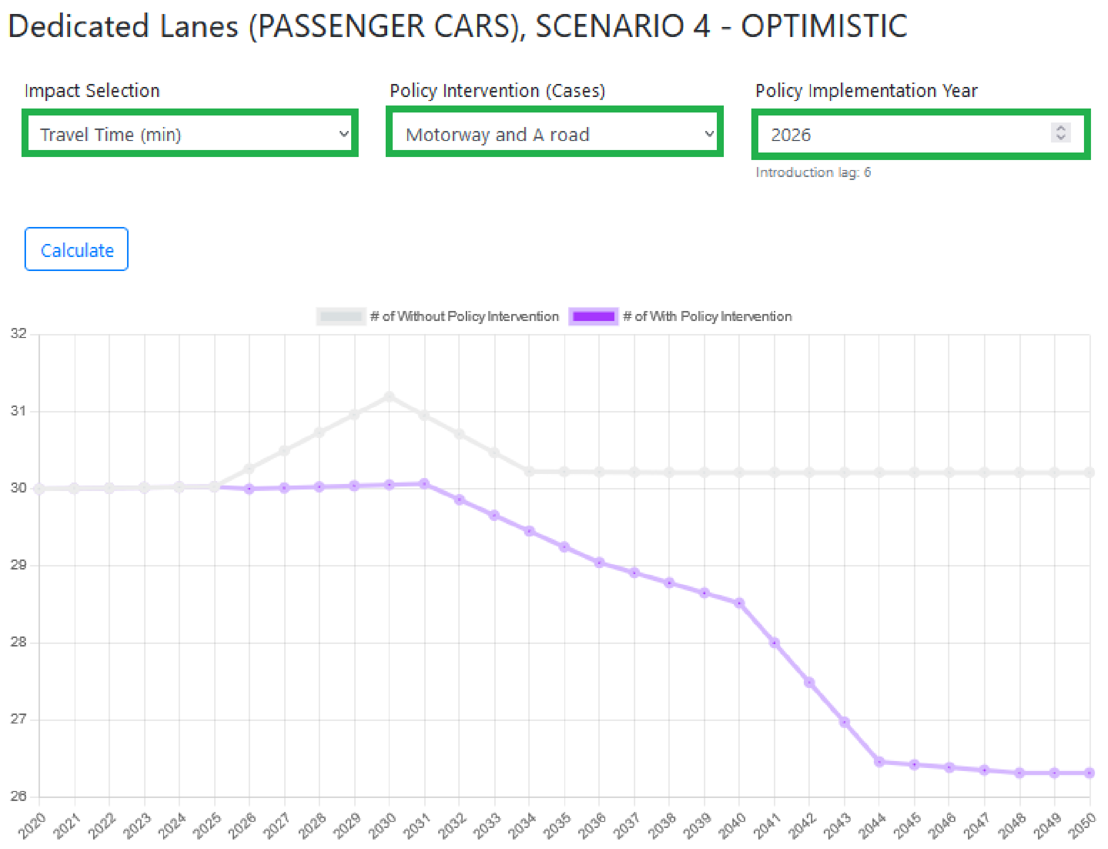



**Figure 5: Forecasting impact assessment graph**

10. Apart from the graph, the tool gives access to the detailed results for all the impacts, for all policy interventions of the selected sub-use case and for all the studied years 2020-2050, as shown on Figure 6.

With Policy Intervention - Motorway and A road

| Type | id | Impact | Description | 2030 | 2031 | 2032 | 2033 | 2034 ▲ |
|---|---|---|---|---|---|---|---|---|
| Direct impacts | 1 | Travel time | Average duration of a 5Km trip inside the city cer | -3.19% | -3.63% | -4.07% | -4.51% | -4.94% |
| Direct impacts | 2 | Vehicle operating cost | Direct outlays for operating a vehicle per kilomet | 0.25% | -0.71% | -1.67% | -2.64% | -3.60% |
| Direct impacts | 3 | Freight transport cost | Direct outlays for transporting a tonne of goods | N/A | N/A | N/A | N/A | N/A |
| Direct impacts | 4 | Access to travel | The opportunity of taking a trip whenever and wh | 4.25% | 6.10% | 7.94% | 9.79% | 11.64% |
| Systemic impacts | 5 | Amount of travel | Person kilometres of travel per year in an area | 3.63% | 4.07% | 4.51% | 4.94% | 5.38% |
| Systemic impacts | 6 | Congestion | Average delays to traffic (seconds per vehicle-kilc | 2.69% | 2.83% | 2.96% | 3.09% | 3.23% |
| Systemic impacts | 7 | Modal split of travel using public transport | % of trip distance made using public transportati | -4.90% | -6.65% | -8.40% | -10.15% | -11.90% |
| Systemic impacts | 8 | Modal split of travel using active travel | % of trip distance made using active transportati | -3.19% | -3.64% | -4.09% | -4.54% | -4.99% |
| Systemic impacts | 9 | Shared mobility rate | % of trips made sharing a vehicle with others | 0.25% | 2.74% | 5.23% | 7.71% | 10.20% |
| Systemic impacts | 10 | Vehicle utilisation rate | % of time a vehicle is in motion (not parked) | 4.15% | 5.65% | 7.15% | 8.65% | 10.15% |

**Figure 6: Forecasting impact assessment results table**

In the provided graph, users are able to examine the projected influence on the chosen impact by contrasting the baseline development (illustrated in grey) against the development with policy interventions (illustrated in purple). For instance, in the presented example of dedicated lines policy intervention in a Motorway and A road, it is estimated to reduce travel time by slightly over 3 minutes on average for a 5-

kilometer journey within the city centre between 2026 and 2050. This visual representation enables stakeholders to comprehend the expected outcomes of CCAM related policy interventions, facilitating informed assessments of their efficacy in achieving desired objectives.

For a more comprehensive understanding of the projected impacts, users can explore the accompanying tables that present all 23 impacts assessed in the PST. These tables furnish detailed insights into the percentage variations of each impact from its initial value across each year within the analyzed time frame. For example, within the results table presented above, it is anticipated that travel time for passenger vehicles would diminish by nearly 5% in 2034 compared to the baseline values set in 2021, should the policy intervention of dedicated lanes in Motorway and A road is introduced. Such data empowers policymakers, analysts, and stakeholders to determine the temporal dynamics of proposed interventions, enabling them to fine-tune strategies and allocate resources effectively to optimize outcomes.

## 2.2 Backcasting sub-system

The backcasting sub-system enables the users to identify the **sequence of CCAM measures** that are **expected to result in their desired policy objectives**. The following steps are followed by the user, with numerical example concerning the desirable future vision of decreasing congestion from 197 delay seconds per vehicle-kilometer to 170 by the year 2030 for low CCAM deployment. The backcasting input steps are shown on Figures 7-9:

1. **Target year definition**, in the example the user will type “2030” in the corresponding cell
2. **CCAM deployment scenario definition**, in the example the low deployment scenario represents scenario 2 from the drop-down menu, the “PESSIMISTIC” scenario.
3. **Target impacts definition and desired future value of the selected impact(s)**. In this example the selected impact is “congestion” and the impact’s future value is 170. More impacts can be selected.

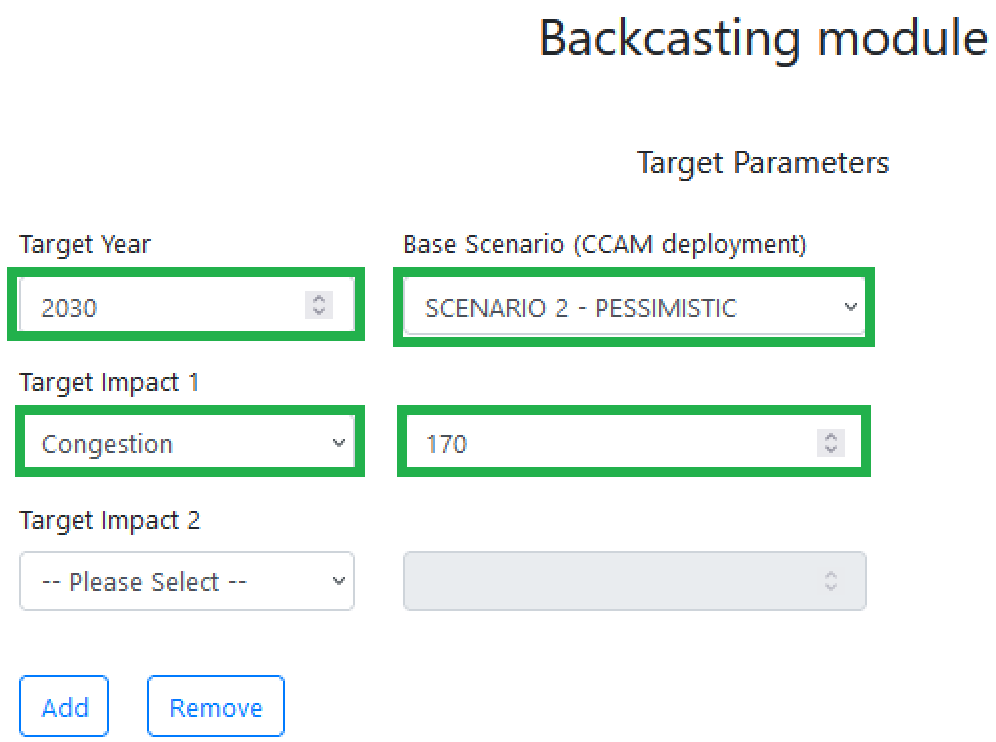



**Figure 7: Backcasting target parameters definition**

4. **System parameters definition**, which include default values, that can be changed based on the data from the user's city, to ensure that the final results will be relevant and transferable. In the example the values different from the default values are: GDP per capita: 25000, Annual GDP per capita change: 0.02, City population: 5, Average load per freight vehicle: 2, Fuel cost: 2, Fuel consumption: 10.

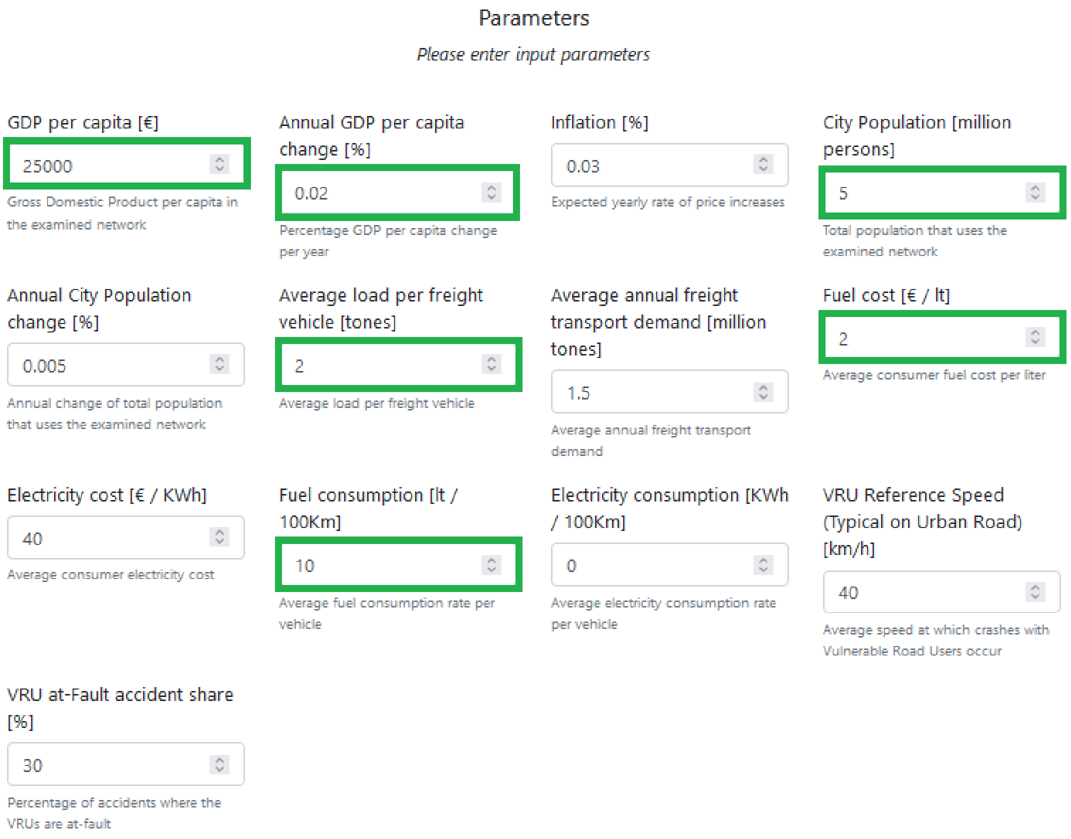



**Figure 8: Backcasting city parameters input**

5. **Impacts initial value definition**, which include default values that can be changed based on the user's city data. In the numerical example the initial impact values different from the default values is: Congestion: 197 delay seconds per vehicle-kilometer.
6. **Submit selection** and proceed to results page.

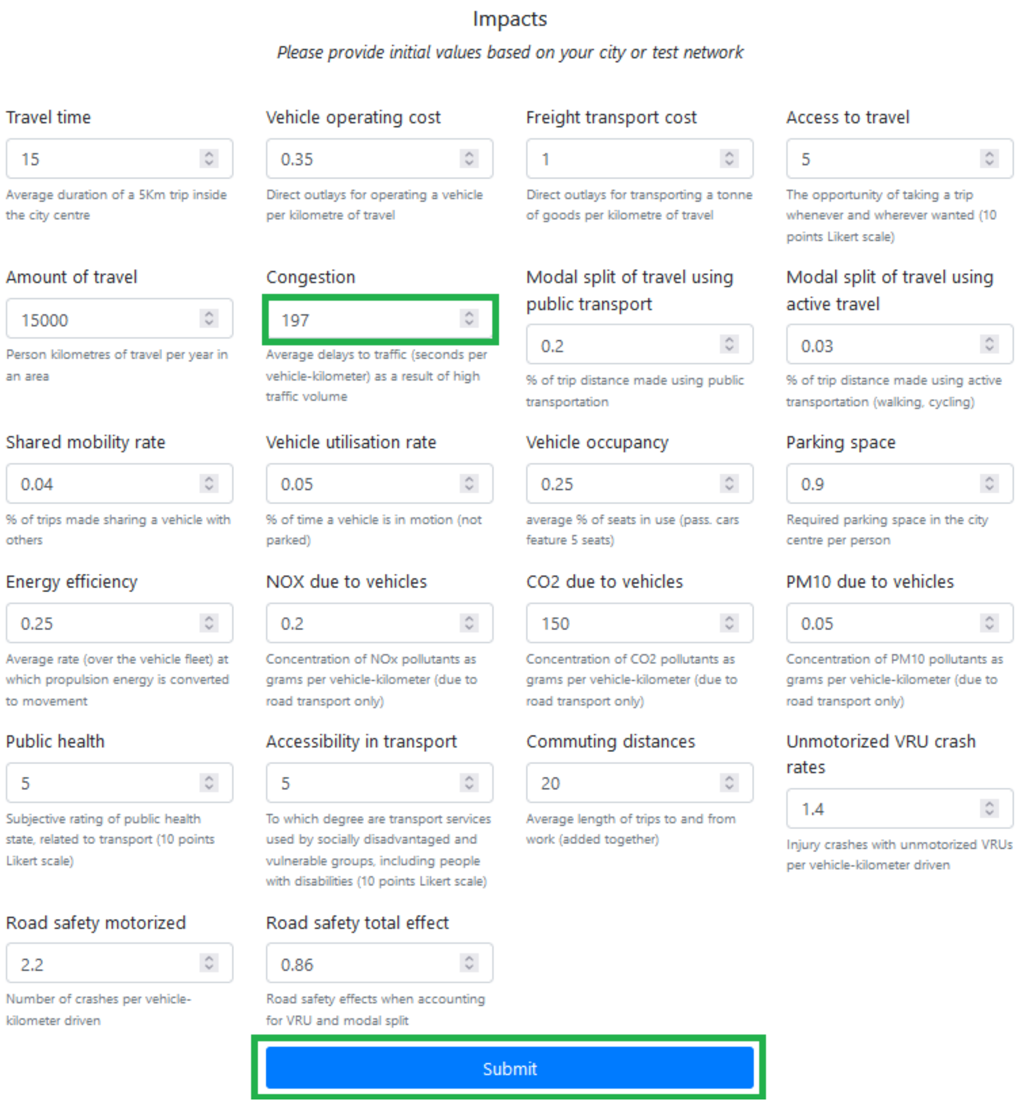



**Figure 9: Backcasting impact initial values definition**

7. In the results page a table is presented (Figure 10) with all the studied policy interventions. If the desirable target for each impact is achievable for the target year, the system specifies it as "true" for the respective policy intervention, while in the opposite case, a "false" message is given. For instance, the targeted congestion can be achieved, with the "City Tolls" interventions, but not with the "Dedicated Lanes" interventions.

BackCasting results for SCENARIO 2 - PESSIMISTIC (target year: 2030)

| Impact▲ | Use case | SubUse case | Policy intervention | Target from inc |
|---|---|---|---|---|
| Congestion | PASSENGER CARS | Automated Ride Sharing | 50% willingness to share - 20% demand served | false |
| Congestion | PASSENGER CARS | City Tolls | Baseline | true |
| Congestion | PASSENGER CARS | City Tolls | Dynamic city toll | true |
| Congestion | PASSENGER CARS | City Tolls | Empty km pricing | true |
| Congestion | PASSENGER CARS | City Tolls | Static city toll | true |
| Congestion | PASSENGER CARS | Dedicated Lanes | Baseline | false |
| Congestion | PASSENGER CARS | Dedicated Lanes | Motorway and A road | false |
| Congestion | PASSENGER CARS | Dedicated Lanes | A road right most lane | false |
| Congestion | PASSENGER CARS | Dedicated Lanes | Motorway only | false |
| Congestion | PASSENGER CARS | Dedicated Lanes | A road left most lane | false |

**Figure 10: Backcasting results table**

The results table of the Backcasting module acts as a roadmap guiding stakeholders through the potential outcomes of each policy intervention. A key feature of this table is the indication of whether the desired target for each impact is attainable within the designated target year. If a policy intervention successfully meets the set objectives within the specified timeframe, the table clearly labels it as "true". On the contrary, if the desired target remains unattainable despite the implementation of a particular policy intervention, the table provides a "false" message. This straightforward classification enables users to quickly identify which interventions could lead to the intended results and which may require reassessment or modification to align with the city goals.

In the presented example, users may observe that targeted congestion reduction is achievable through the implementation of "City Tolls" interventions, as indicated by the "true" label. However, the same desired outcome may not be attainable with the "Dedicated Lanes" interventions, as denoted by the "false" label. By providing clarity on the efficacy of policy interventions in achieving desired objectives, this table gives stakeholders the tools to understand CCAM related decisions more clearly, by identifying which policy interventions are more effective in achieving the city goals.

## 2.3 Knowledge Module

The PST Knowledge Module aims to provide a searchable static repository through fully detailed and flexible concise reports. The concise reports aim to inform the user in the most essential and summarizing way, offering the necessary information. More specifically, the user is able to search by any parameter, to adjust and customize the search according to preliminary results and to access all background information about any stage of the project. The different categories are the following:

- Bibliography: the bibliography of all relevant literature concerning impact assessments of CCAM,
- Project results: the project results, including the case studies on the participating cities (scenarios and baseline conditions, results) and the predefined impact assessments,

- Documentation of tools: the documentation about the toolbox of methods developed in LEVITATE, to enable cities to explore the expected impacts of CCAM in the users circumstances (including underlying models, data and impact assessment methods),
- Guideline excerpts: Guidelines and policy recommendations regarding CCAM.

In the online PST the user will select in the initial page the “Knowledge Module”. The user has access to 6 different sections seen on Figure 11:


**Figure 11: Knowledge module documentation**

Each section includes different documents, and this categorization was established to facilitate access for potential users. The "Project-level Documentation" includes documents that refer to the entire project, including the terminology formulated during the initial stages of the PST development. This section serves as a foundational reference, ensuring that users have a comprehensive understanding of the PST scope and terminology. The "Impact Documentation" section is dedicated to reports on the three categories of impacts studied in the project: direct, systemic, and wider impacts. By categorizing impact reports this way, users can easily find specific information related to the varied impacts included in the PST, enhancing the accessibility and usability of the documentation.

The "Methodological Toolbox Documentation" includes reports on the various impact assessment methods employed throughout the project. These methods include microsimulation, mesoscopic simulation, Delphi, operations research, system dynamics, and cost-benefit analysis (CBA). This section is particularly valuable for users interested in the technical and methodological aspects of the PST. The "Use-case Bibliography Documentation" presents the outcomes of the literature review conducted prior to the impact assessments for each use-case; urban transport, passenger cars, and freight transport. This ensures that users have access to relevant background information and context. The "Sub-use Case Results Documentation" includes findings from the literature review and details the characteristics of each sub-use case presented in the PST. Finally, the "Case Study Results Documentation" section showcases the results of the case studies conducted to verify the PST results. When users select one of these sections, all related documents are displayed and can be directly downloaded, ensuring a seamless and efficient user experience.

A concise description of the PST functions can be seen on Figure 12:

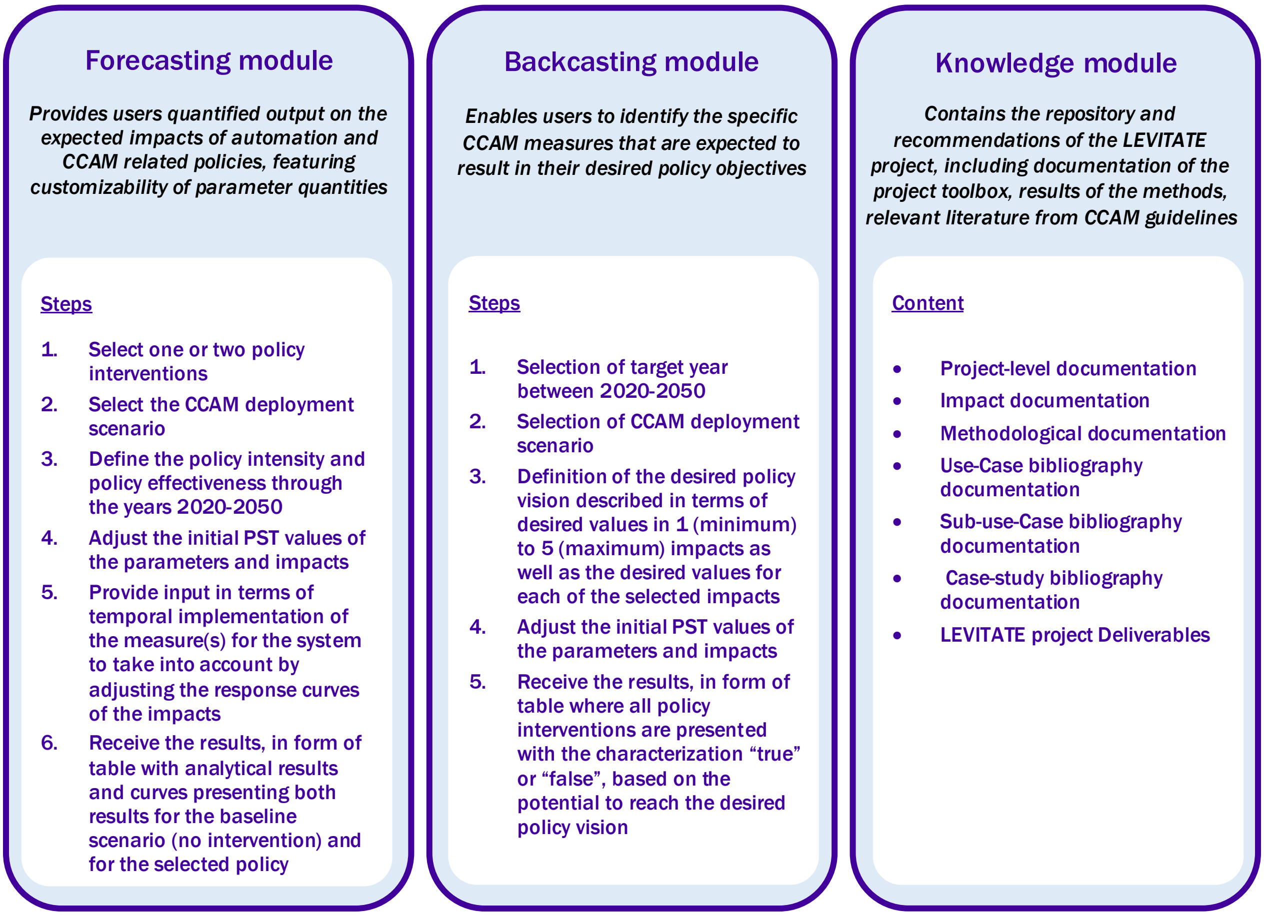



**Figure 12: PST quick reference guide**

# 3 Workshops with SHOW sites/cities

## 3.1 Aim

The LEVITATE policy support tool (PST) is an open-access, online-based system that provides users with access to the LEVITATE methodologies and results. The PST provides decision support on CCAM-related interventions, of City Authorities, transport experts, and interested citizens. This freely accessible tool provides the possibility of interactive use by comparing several different parameters & scenarios and reducing uncertainty during the decision-making process.

As mentioned in D17.1, the LEVITATE Policy Support Tool appears as a good basis and source of inspiration since it focuses on CCAM policies in urban areas. The PST provides a solid basis to develop a system able to guide policymakers on the relevance of their CCAM-related policy measures – especially when it comes to cities that wish to include CCAM into their respective sustainable urban mobility plans (SUMPs).

Thus, a series of workshops to get local authorities familiar with the tool were developed and enabled to collect feedback directly from them (see Figure 13)

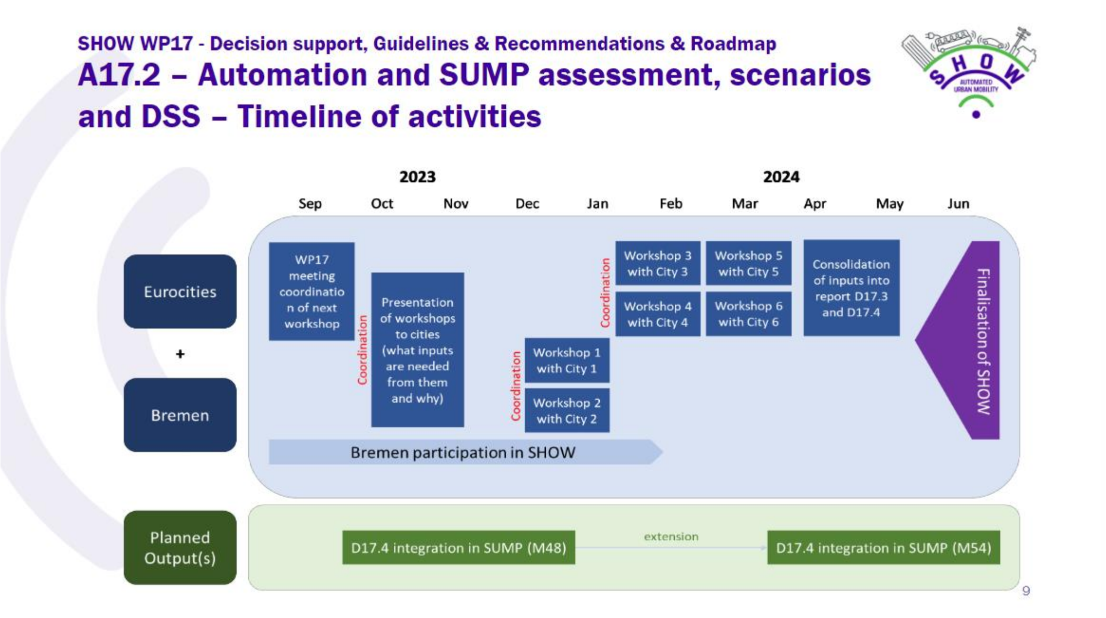



**Figure 13: Eurocities' timeline of activities planned for A17.2**

## 3.2 Data and feedback collected

Before the meeting, cities should trial the forecasting tool in advance and provide feedback or recommendations regarding its usability and how well it aligns with decision-making processes within city administration. For the backcasting tool, cities should gather the necessary information ahead of the meeting, and it may be necessary to verify some data with colleagues, such as the modality mix. Hence, the participants to the workshops were shared the following information ahead of the bilateral meetings with NTUA and Eurocities.

## FORECASTING

The users can estimate the impact of CCAM on their cities.

### Steps of the Forecasting Analysis

1. Select one or two policy interventions
2. Select the CCAM deployment scenario
3. Define the policy intensity and policy effectiveness through the years 2020-2050
4. Adjust the initial PST values of the parameters and impacts
5. Provide input in terms of temporal implementation of the measure(s) for the system to take into account by adjusting the response curves of the impacts
6. Receive the results, in form of table with analytical results and curves presenting both results for the baseline scenario (no intervention) and for the selected policy intervention(s)

### Forecasting info before using the tool

**Based on your local climate objectives/SUMPs, please gather the data needed for the exercise:**

**Table 2: Parameters for the forecasting tool**

| Parameters | Unit of Measurement | Default Initial Value (can be changed by user) |
|---|---|---|
| GDP per capita | € | 17,000 |
| Annual GDP per capita change | % | 1.50% |
| Inflation | % | 1.00% |
| City Population | million persons | 3.000 |
| Annual City Population change | % | 0.50% |
| Urban shuttle fleet size | no. of vehicles | 300 |
| Freight vehicles fleet size | no. of vehicles | 100 |
| Average load per freight vehicle | tones | 3 |
| Average annual freight transport demand | million tones | 1.5 |
| Fuel cost | € / lt | 2.50 |
| Electricity cost | € / KWh | 40 |
| Fuel consumption | lt / 100Km | 6.00 |
| Electricity consumption | KWh / 100Km | 15.00 |
| VRU Reference Speed (Typical on Urban Road) | km/h | 40.00 |
| VRU at-Fault accident share | km/h | 30.00 |

**Table 3: Indicators for impact in the forecasting tool**

| Impacts | Description/measurement | Unit of Measurement | Default Initial Value (can be changed by user) |
|---|---|---|---|
| Travel time | *Average duration of a 5Km trip inside the city centre* | min | 15 |
| Vehicle operating cost | *Direct outlays for operating a vehicle per kilometre of travel* | €/Km | 0.35 |
| Freight transport cost* | *Direct outlays for transporting a tonne of goods per kilometre of travel* | €/tonne.Km | 1 |
| Access to travel | *The opportunity of taking a trip whenever and wherever wanted (10 points Likert scale)* | - | 5 |
| Amount of travel | *Person kilometres of travel per year in an area* | person-km | 15000 |
| Congestion | *Average delays to traffic (seconds per vehicle-kilometer) as a result of high traffic volume* | s/veh-km | 60 |
| Modal split of travel using public transport | *% of trip distance made using public transportation* | % | 20.00% |
| Modal split of travel using active travel | *% of trip distance made using active transportation (walking, cycling)* | % | 3.00% |
| Shared mobility rate | *% of trips made sharing a vehicle with others* | % | 4.00% |
| Vehicle utilisation r ate | *% of time a vehicle is in motion (not parked)* | % | 5.00% |
| Vehicle occupancy | *average % of seats in use (pass. cars feature 5 seats)* | % | 25.00% |
| Parking space | *Required parking space in the city centre per person* | $m^2$/person | 0.9 |
| Energy efficiency | *Average rate (over the vehicle fleet) at which propulsion energy is converted to movement* | % | 25.00% |
| $NO_X$ due to vehicles | *Concentration of $NO_x$ pollutants as grams per vehicle-kilometer (due to road transport only)* | g/veh-km | 0.2 |
| $CO_2$ due to vehicles | *Concentration of $CO_2$ pollutants as grams per vehicle-kilometer (due to road transport only)* | g/veh-km | 150.00 |
| $PM_{10}$ due to vehicles | *Concentration of $PM_{10}$ pollutants as grams per vehicle-kilometer (due to road transport only)* | g/veh-km | 0.05 |
| Public health | *Subjective rating of public health state, related to transport (10 points Likert scale)* | - | 5 |
| Inequality in transport | *To which degree are transport services used by socially disadvantaged and vulnerable groups, including people with disabilities (10 points Likert scale)* | - | 5 |
| Commuting distances | *Average length of trips to and from work (added together)* | Km | 20 |
| Unmotorized VRU crash rates | *Injury crashes with unmotorized VRUs per vehicle-kilometer driven* | injury-crashes/veh-km | 2.20 |
| Road safety motori zed | *Number of crashes per vehicle-kilometer driven* | crashes/veh-km | 1.40 |
| Road safety total ef fect | *Road safety effects when accounting for VRU and modal split* | crashes/veh-km | 0.86 |

## BACKCASTING

The users can find the most appropriate combination of CCAM technologies and measures to provide specific policy objectives – which could be relevant to defining their sustainable urban mobility plans (SUMPs).

### Steps of the backcasting analysis

1. Selection of target year between 2020-2050
2. Selection of CCAM deployment scenario
3. Definition of the desired policy vision described in terms of desired values in 1 (minimum) to 5 (maximum) impacts as well as the desired values for each of the selected impacts
4. Adjust the initial PST values of the parameters and impacts
5. Receive the results, in the form of a table where all policy interventions are presented with the characterization "true" or "false", based on the potential to reach the desired policy vision

### Backcasting info before using the tool

**Based on your local climate objectives/SUMPs, please gather the data needed for the exercise:**

**Table 4: Indicators for target impact in the backcasting tool**

| Target Impact | Value example |
|---|---|
| Travel time | 20min/5km |
| Vehicle operating cost | 0.30€/Km |
| Freight transport cost | 1.1€/tonne.Km |
| Access to travel | 6 out of 10 |
| Amount of travel | 16000person-km/year |
| Congestion | 50 s/veh-km |
| Modal split of travel using public transport | 40% |
| Modal split of travel using active travel | 5% |
| Shared mobility rate | 3% |
| Vehicle utilization rate | 4% |
| Vehicle occupancy | 50% |
| Parking space | 2m²/person |
| Energy efficiency | 30% |
| NOX due to vehicles | 0.1g/veh-km |
| CO2 due to vehicles | 100g/veh-km |
| PM10 due to vehicles | 0.04g/veh-km |
| Public Health | 7 out of 10 |
| Accessibility in transport | 4 out of 10 |
| Commuting distances | 15 km |
| Unmotorized VRU crash rates | 1 injury-crashes/million veh-km |
| Road safety motorized | 3 crashes/ million veh-km |

Other supporting materials can be found here.

During the meetings, the aim to discuss the PST and refine it, making it more specific to SHOW and determining if any adjustments are needed to enhance its benefit for the cities. The other half of the meeting with the local representatives enabled an open discussion led by Eurocities to discuss more widely about CCAM in SUMPs (see **Table 5**). Each of the meetings lasted two hours overall.

**Table 5: Summary of feedback received from city representatives in SHOW**

| City | Date | Immediate Feedback and reaction to the PST | Summary of the open discussion with Eurocities |
|---|---|---|---|
| Brno | 7 December 2023 | During the interview, the city representatives emphasized their proficiency in utilizing various tools similar to the one in question. They clarified that although they lack expertise in mathematics, they perceive the tool to be intricate. Nevertheless, they expressed satisfaction with its user-friendliness, noting that the graphical representations are readily comprehensible. | When questioned about the potential consideration of policy interventions, Brno's representatives disclosed that they have not previously employed a tool with integrated economic aspects, which they underscored as crucial for their Sustainable Urban Mobility Plan (SUMP) development, particularly in evaluating specific policies. They highlighted that incorporating economic impact renders proposed measures more tangible for decision-makers. |
| Helmond | 23 January 2024 | Helmond conveyed that interpreting the graphs within the LEVITATE forecasting tool proves to be quite intricate. They suggested that the summary tables at the forecast's conclusion should clearly denote the presence of calculations and additional details located on the right side of the table. Furthermore, they advised NTUA to incorporate an option to freeze certain columns for enhanced usability. Emphasizing the tool's potential utility in elucidating the rationale behind specific actions to decision-makers, they proposed the inclusion of a functionality allowing users to download both tables and graphs for improved accessibility. | During the testing of the backcasting module, the representatives discovered that implementing automated public transport during off-peak hours in mixed traffic could serve as a viable strategy for the city to realize its goal of reducing $CO_2$ emissions resulting from vehicles. |
| Barcelona | 16 February 2024 | The Barcelona representative emphasised the importance of incorporating density into the tool's considerations. Additionally, they expressed curiosity regarding the definition of the optimistic scenario and sought clarification on NTUA's perception of the most realistic scenario. In response, NTUA clarified that the most realistic scenario lies between the neutral and pessimistic ones. | The Barcelona representative conveyed that cities currently lack sufficient readiness to fully support CCAM, except on specific roads. They highlighted two primary challenges: (a) the difficulty in obtaining data without a mandate, particularly regarding micro mobility and integrating data into Mobility as a Service (MaaS), and (b) the complexity of centralizing all relevant data. Barcelona's representative also highlighted that |

| City | Date | Immediate Feedback and reaction to the PST | Summary of the open discussion with Eurocities |
|---|---|---|---|
| | | | Barcelona's transport authority main focus has shifted away from CCAM as they need to prioritise cleaning the transport system (i.e., electrification of the fleet and the charging infrastructure). |
| Tampere | 19 February 2024 | The representative from the City of Tampere started by stating that it was very difficult to find one person in the administration that could provide all the data needed to fill in LEVITATE'S PST. | Tampere's representative highlighted that there is a need to rethink public administration when developing automated transport. For the moment, these solutions are tackled by the branch working on land use planning and they do not work very closely with other sectors which could represent an obstacle for the deployment of CCAM solutions. |
| Trikala | 6 March 2024 | The representative from Trikala expressed that having a use case as a basis would be helpful to grasp the functionality of the tool more effectively. In response, NTUA pointed to the documentation of specific Case Study examples that have been prepared and integrated in the Knowledge module. | The representative from Trikala argued that they are already utilizing similar tools for Sustainable Urban Mobility Plans (SUMP) and find this particular tool very beneficial for enhancing the evaluation process of SUMP. |

## 3.3 Feedback from participating cities

Following the meeting, the inputs gathered contributed to D17.3 and D17.4. Moreover, the methodology used during the workshops with city representatives was elaborated and added in a dedicated page for SHOW Policy Support Tool for Cities of the project's website.

After the workshop, an outro questionnaire was issued for participants to complete and to facilitate the collection of related feedback. The cities were asked repeatedly to provide feedback after the conclusion of the workshops individually and collectively. Only three responses were received by participant cities. The questionnaire was hosted online and it is also provided in the following:

**SHOW WP17 Levitate PST: Post-workshop questionnaire.**

1. Name/Surname [Open-text answer]

2. City [Open-text answer]

3. Position [Open-text answer]

4. Total years of experience in the transport sector [Number]

5. On a scale of 1 (minimum) to 10 (maximum), how technically-oriented are you as a professional, i.e. how likely are you to require quantitative information in your daily duties?

6. On a scale of 1 (minimum) to 10 (maximum), how technically-oriented is your transport department, i.e. how likely are they to require quantitative information before making policy decisions?

7. On a scale of 1 (minimum) to 10 (maximum), how likely are you to use policy support tools overall? A policy support tool is a tool/software developed to support analysts and decision-makers in making better decisions and faster.

8. On a scale of 1 (minimum) to 10 (maximum), how easy was it to navigate and use the Levitate PST after attending the online workshop by NTUA and Eurocities?

9. Do you have any feedback regarding the parameters/impacts used as starting values in forecasting & backcasting in the Levitate PST? [Open-text answer]

10. Is the documentation available in the Levitate PST sufficient? Have you noticed any particular gaps? Yes/No [If No, please explain, Open-text answer]

Initially, NTUA followed up with the city representatives with the aforementioned survey to gather their feedback and recommendations. However, with some cities being follower sites and not having the appropriate resources (time and budget) to complete thoroughly the form, it was decided that the inputs collected from the online webinar would be sufficient. NTUA and Eurocities adjusted the questions asked during the workshop to be able to feed into the parameters of Table 2.

Moreover, it was decided to integrate the values provided by Helmond in the PST in order to have a practical example of a SHOW participant city applied within the context of the updated tool. Initial value arrays for parameters and impacts of more cities can be easily added in future iterations if they become available.

# 4 Reshaping a SHOW specific PST

The LEVITATE policy support tool (PST) was updated to be more relevant within the SHOW context, regardless of the absence of the feedback that was received. The following section outlines the steps taken for this transformation and enhancement of the original system. Within the following, the updated system is going to be referred to as the SHOW-PST website.

The SHOW-PST is openly available and accessible in the registered domain of: https://www.ccam-shuttleimpacts.eu/

The SHOW-PST website is developed with Javascript, using the REACT framework, using the full available back-end database of the original PST. It should be also noted that the original PST website is also available for all interested users and has not been altered in any way. The domain will be active and maintained for at least 5 years after the end of the SHOW project life cycle.

The following changes have been implemented to prepare the SHOW-PST website, differentiating from the original PST:

1. Focus on the public transport Use-Cases: The main focus is shifted towards the Automated Shuttle Service Use-Cases (the remaining Use-Cases have been hidden).
2. Visual identity changes: The logos and banners have been updated to reflect the SHOW orientation of the new tool. This is showcased in subsequent screenshots.
3. Introductory paragraph changes (shown in the subsequent screenshots)
4. An example array of different starting values based on a SHOW-specific city (Helmond), which is provided as an option in parallel to the original PST starting values via a drop-down menu, with new starting value, as shown on Tables 6 & 7
5. Targeted explanations and pop-up bubbles as requested by some workshop participants. Specifically, the following fields have been added, as shown on Tables 8 & 9

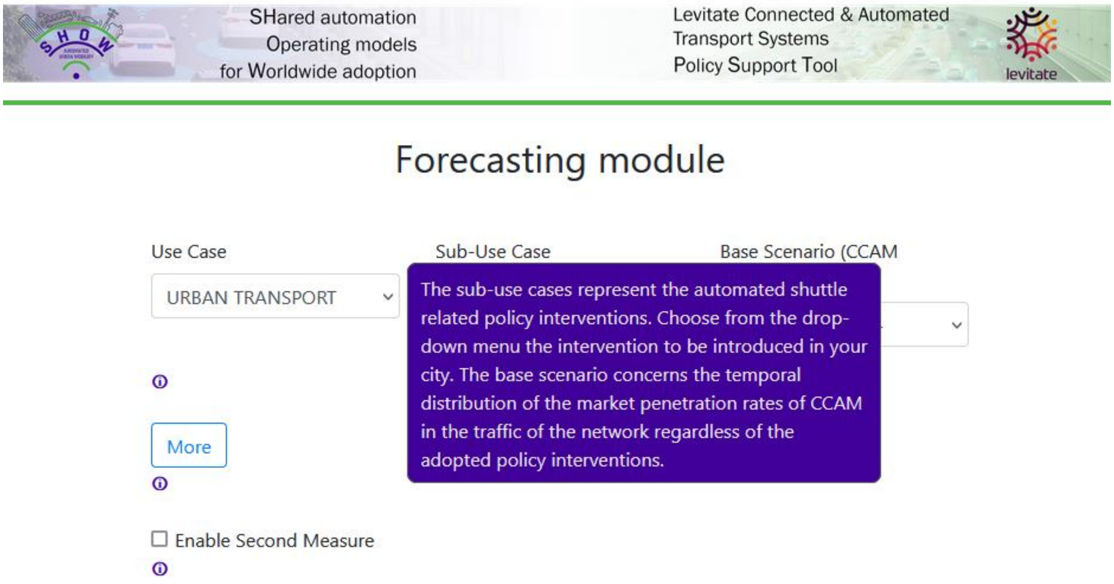
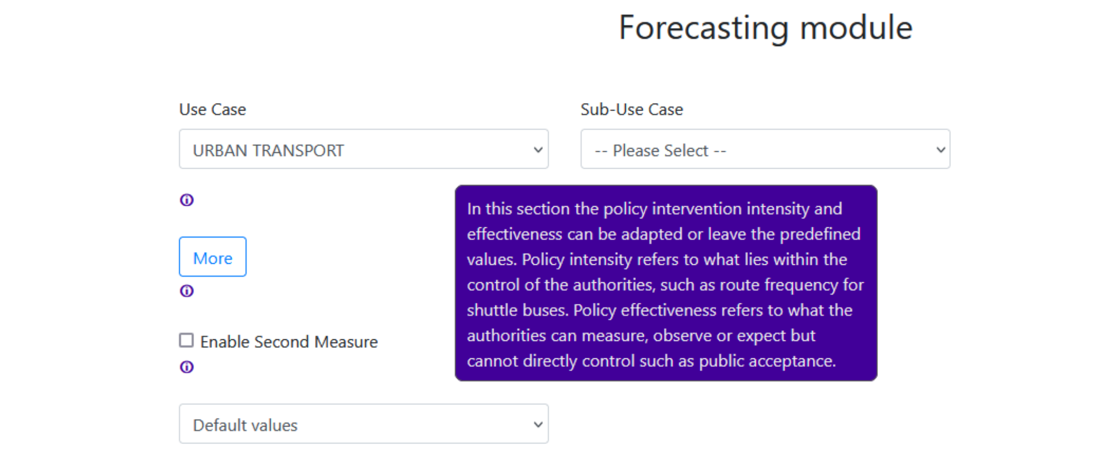
**Table 6: Overview of changes of Parameter starting values based on Helmond data**

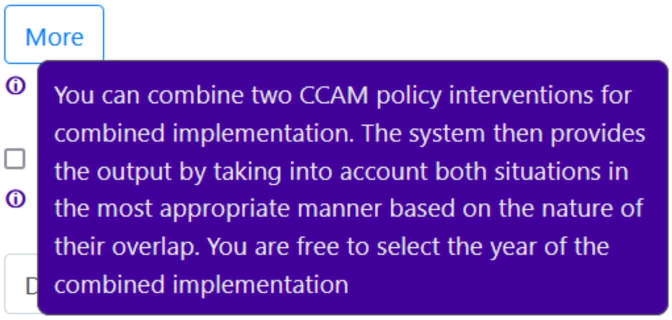
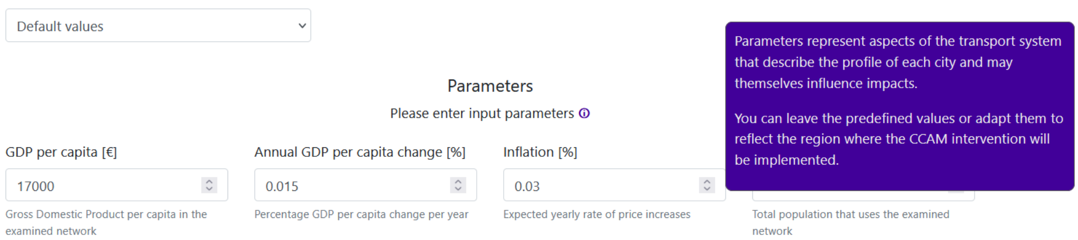
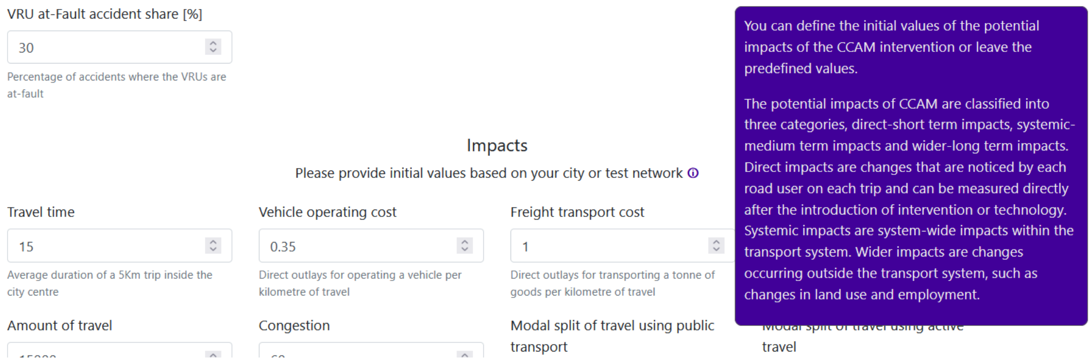
| Parameters | Default Value | Helmond Value |
|---|---|---|
| GDP per capita | 17,000 | 54,150 |
| Annual GDP per capita change | 1.50% | -0.60% |
| Inflation | 1.00% | 1.60% |
| City Population | 3,000 | 0.095 |
| Annual City Population change | 0.50% | 0.90% |
| Urban shuttle fleet size | 300 | keep original |
| Freight vehicles fleet size | 100 | keep original |
| Average load per freight vehicle | 3 | keep original |
| Average annual freight transport demand | 1.5 | 2.975 |
| Fuel cost | 2.5 | 1.909 |
| Electricity cost | 0.000 | 0.4 |
| Fuel consumption | 0.00 | 6.6 |
| Electricity consumption | 0.00 | 0.15 |
| VRU Reference Speed (Typical on Urban Road) | 17 | keep original |
| VRU at-Fault accident share | 18 | keep original |

**Table 7: Overview of changes of Impact starting values based on Helmond data**

| Impacts | Default Value | Helmond Value |
|---|---|---|
| Travel time | 15 | 11 |
| Vehicle operating cost | 0.25 | keep original |
| Freight transport cost* | 0.25 | keep original |
| Access to travel | 5 | keep original |
| Amount of travel | 19165.40 | 10736.70 |
| Congestion | 197.37 | keep original |
| Modal split of travel using public transport | 40.00% | 5% |
| Modal split of travel using active travel | 3.00% | 35% |
| Shared mobility rate | 4.00% | keep original |
| Vehicle utilisation rate | 8.00% | 4% |
| Vehicle occupancy | 25.00% | 28% |
| Parking space | 0.9 | keep original |
| Energy efficiency | 25.00% | keep original |
| NOx due to vehicles | 1.80 | 4.89 |
| CO2 due to vehicles | 2500.00 | 9877.76 |
| PM10 due to vehicles | 0.20 | 0.32 |
| Public health | 5 | keep original |
| Inequality in transport | 5 | keep original |
| Commuting distances | 20 | 17.86 |
| Unmotorized VRU crash rates | 2.20 | keep original |
| Road safety motorized | 1.40 | 4.28 |
| Road safety total effect | 0.86 | keep original |

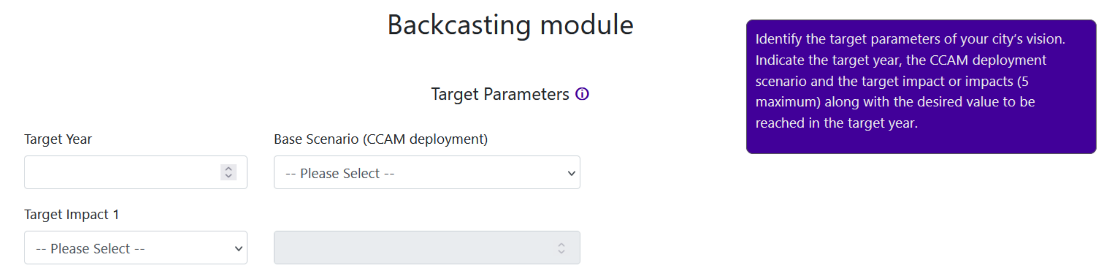
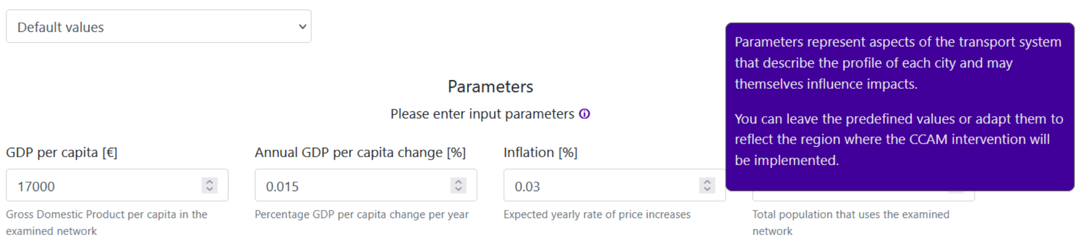
**Table 8: Overview of pop-up text additions to the Forecasting Module to facilitate PST use by the cities**

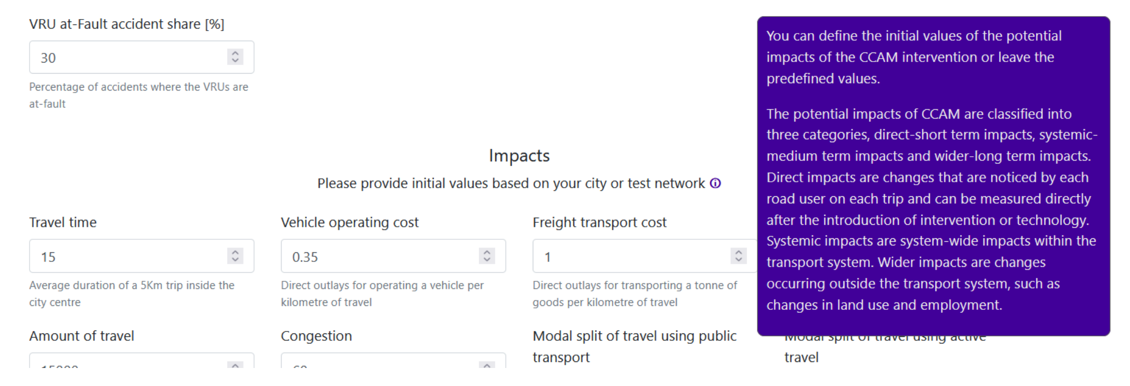
| **SHOW–PST: Forecasting Module Additions** | |
|---|---|
| Use-cases/sub-use cases/ base scenario | The use cases and sub-use cases represent the CCAM related policy interventions. Choose from the drop-down menu the intervention to be introduced in your city.<br>The base scenario concerns the temporal distribution of the market penetration rates of CCAM in the traffic of the network regardless of the adopted policy interventions.<br><br>**Figure 14: SHOW-PST Forecasting module input with tooltips (1)** |
| More | In this section the policy intervention intensity and effectiveness can be adapted or leave the predefined values. Policy intensity refers to what lies within the control of the authorities, such as route frequency for shuttle buses. Policy effectiveness refers to what the authorities can measure, observe or expect but cannot directly control such as public acceptance.<br> |

<table>
<tr><th colspan="2">SHOW–PST: Forecasting Module Additions</th></tr>
<tr><td>Enable second measure</td><td>You can combine two CCAM policy interventions for combined implementation. The system then provides the output by taking into account both situations in the most appropriate manner based on the nature of their overlap. You are free to select the year of the combined implementation.<br><br>
</td></tr>
<tr><td>Parameters</td><td>Parameters represent aspects of the transport system that are influenced by policy interventions or themselves influence impacts.<br><br>You can leave the predefined values or adapt them to reflect the region where the CCAM intervention will be implemented.<br><br>
</td></tr>
<tr><td>Impacts</td><td>You can define the initial values of the potential impacts of the CCAM intervention or leave the predefined values.<br><br>The potential impacts of CCAM are classified into three categories, direct-short term impacts, systemic-medium term impacts and wider-long term impacts. Direct impacts are changes that are noticed by each road user on each trip and can be measured directly after the introduction of intervention or technology. Systemic impacts are system-wide impacts within the transport system. Wider impacts are changes occurring outside the transport system, such as changes in land use and employment.<br><br>
</td></tr>
</table>

| SHOW–PST: Forecasting Module Additions | |
|---|---|
| | |
| Results graph/tables | The graph presents the progress of the selected impact throughout the years with and without the policy intervention. The tables below present the detailed results for all the impacts and for all the studied years. |

**Table 9: Overview of pop-up text additions to the Backcasting Module to facilitate PST use by the cities**

| SHOW–PST: Backcasting Module Additions | |
|---|---|
| Target parameters | Identify the target parameters of your city's vision. Indicate the target year, the CCAM deployment scenario and the target impact or impacts (5 maximum) along with the desired value to be reached in the target year.<br><br> |
| Parameters | Parameters represent aspects of the transport system that are influenced by policy interventions or themselves influence impacts.<br><br>You can leave the predefined values or adapt them to reflect the region where the CCAM interventions will be implemented.<br><br> |
| Impacts | You can define the initial values of the potential impacts of the CCAM interventions or leave the predefined values.<br><br>The potential impacts of CCAM are classified into three categories, direct-short term impacts, systemic-medium term impacts and wider-long term impacts. Direct impacts are changes that are noticed by each road user on each trip and can be measured directly after the introduction of intervention or technology. Systemic impacts are system-wide impacts within the transport system. Wider impacts are changes occurring outside the transport system, such as changes in land use and employment. |

| SHOW–PST: Backcasting Module Additions | |
|---|---|
| |   |
| Results table | The table presents all the policy interventions. If the desirable target for each impact is achievable for the target year, the table specifies it as “true” for the respective policy intervention, while in the opposite case, a “false” message is given. |

Below follow some of the screenshots of the updated SHOW-PST, as formulated in the new tool website (https://www.ccam-shuttleimpacts.eu/).

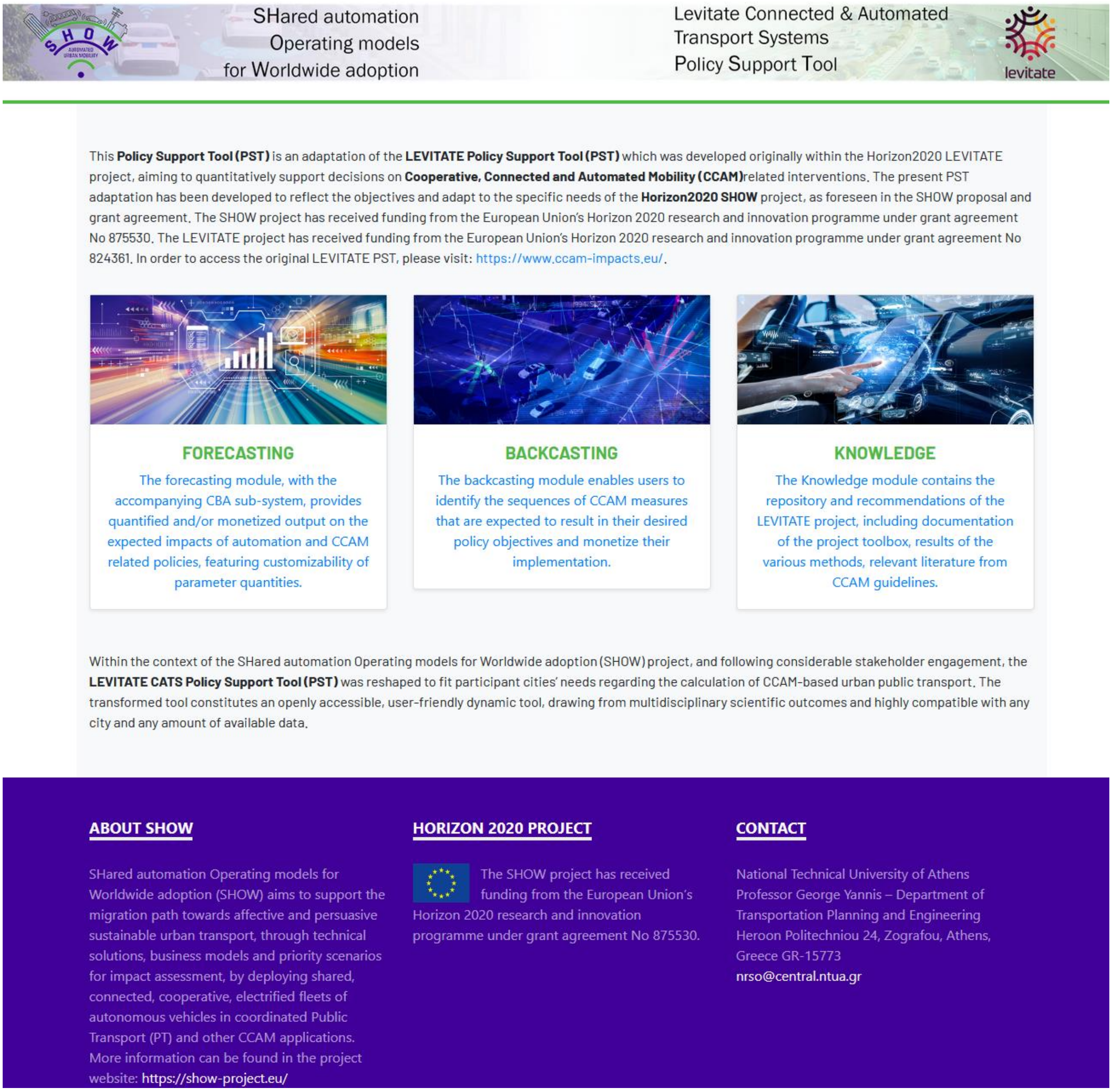



**Figure 15: SHOW-PST landing page with updated visual identity**

The updated visual identity of the SHOW-PST is reflected in the entire tool in accordance with the SHOW project. Below are some screenshots that focus on particular features and show specific details as per the aforementioned.

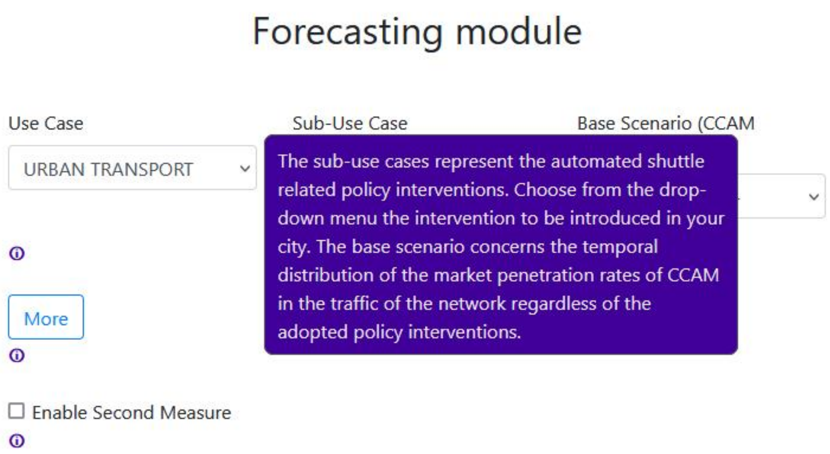



**Figure 16: SHOW-PST Forecasting module input with tooltips (1)**

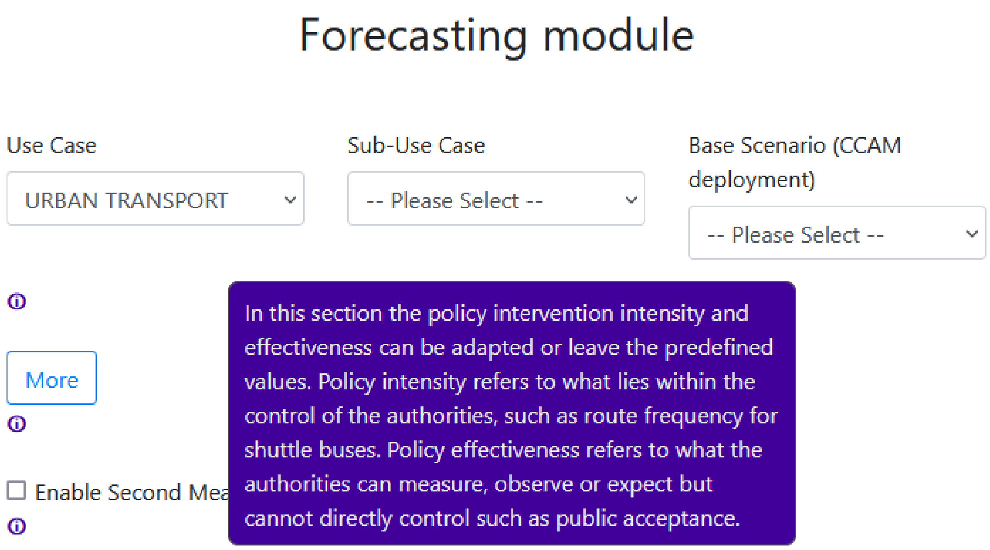



**Figure 17: SHOW-PST Forecasting module input with tooltips (2)**

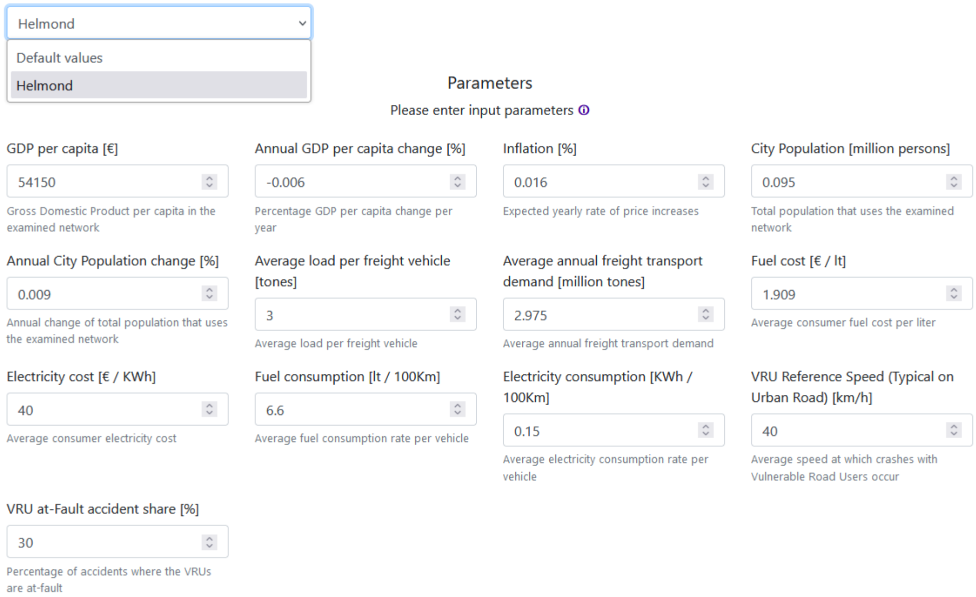



**Figure 18: SHOW-PST Forecasting and Backcasting module inputs with starting value changes of Parameters based on a SHOW city**

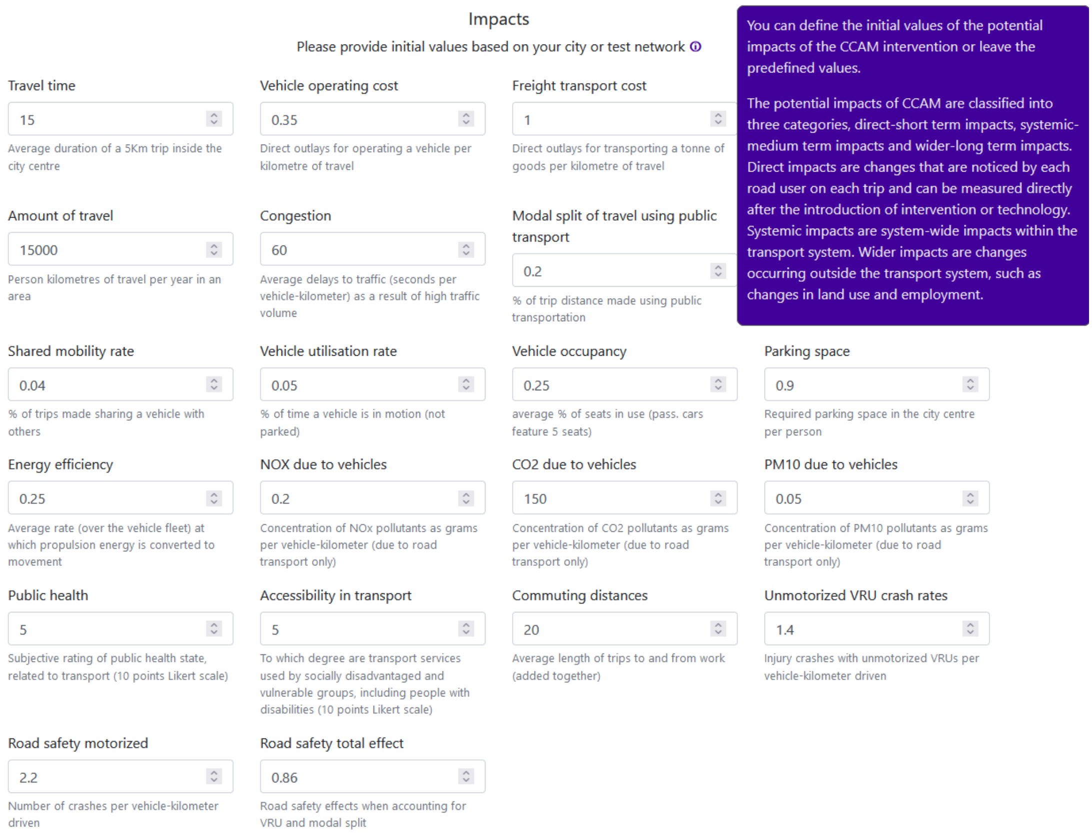



**Figure 19: SHOW-PST Forecasting and Backcasting module inputs with starting value changes of Impacts based on a SHOW city (and another tooltip)**

# 5 Further exploitation of the SHOW-PST

The exploitation of the new SHOW-PST tool is centered on synthesizing the SHOW project's outcomes and insights with the interests of stakeholders, market dynamics, and regulatory requirements. This synthesis aims to form the basis of the establishment of robust business models and address intellectual property (IP) issues, thereby producing comprehensive plans and agreements for post-project utilization. The specific objectives encompass contributing to policy development, fostering further research based on the developed methodologies, providing open access to the toolkit, developing a decision support system as an interactive web tool, and promoting further exploitation to effectively disseminate and implement the results. This promotion involves conducting thorough assessments based on the tool components, and supporting simulations and consultancy services for an efficient rollout of the results.

The new SHOW-specific PST is relevant to a diverse array of target audiences, including city partners and stakeholders, which comprises representatives from local and regional authorities, national authorities, European decision-makers, global initiatives, operators, think tanks, and groups representing pedestrians, cyclists, public transport users, motor vehicle users, researchers, and consultants. Additionally, it is pertinent to local and regional authorities, national authorities, transport and modelling professionals, the research community, associations, industry and interest groups, as well as European and international institutions. While local authorities are expected to deal increasingly with more mobility data – and have more easy access to them through national access points – the SHOW PST is a solution for local stakeholders to assess whether shared CCAM solutions (and which ones) are relevant to deal with their specific objectives. As highlighted in D17.4 [4], this aligns with the need to integrate CCAM into Sustainable Urban Mobility Plans (SUMPs), ensuring that emerging technologies are effectively incorporated into urban planning to address local challenges and enhance mobility.

Even within the SHOW project, this work has the potential to be employed for obtaining quantified impact assessment estimates, relevant to the activities of WP13 or to enhance the scope of examined KPIs by providing an alternative estimation methodology. Regardless, it is intended that the tool will remain operational in the long term after the conclusion of the project, gradually evolving into a reference information system with contributions from an increasing number of experts and organizations providing quantitative study results. It is essential to ensure that the tool becomes a service for impact assessment for CCAM, and that the project outcomes will be further exploited. Due to an open access, but sustainable business model, the tool will remain a reliable, meaningful, scientifically proven and up-to-date source of data and assessment, to the potential users. This will enable them to actively plan and steer the implementation of CCAM following pre-defined transformation paths in order to reach prioritised policy goals. Training sessions for the assessment of individual and detailed use cases could be provided at the end of and after project life-time.

The SHOW-specific PST will function as a promotional instrument, attracting potential customers to utilize the comprehensive SHOW outputs. The combined stakeholder networks within SHOW will serve as a foundation for further collaborative opportunities, facilitating the coordination of research activities and the strategic alignment of funding programs. Additionally, a training could be instituted for in-depth professional simulation modelling training, including backcasting for urban, transport, and traffic planners. Another aspect of the business plan involves upskilling and reskilling the personnel of local authorities in the domains of CCAM, digitalisation and green transition. Efforts will be made to explore pathways for maintaining the functionality of the SHOW tool beyond the conclusion of the project.

In pursuit of a more comprehensive global outlook, the SHOW tool could aim to incorporate studies originating from regions beyond Europe, facilitated by the project partners international network. Moreover, an expansion strategy is discussed, through the integration of studies conducted in diverse cities and countries, spanning various linguistic backgrounds, in order to enrich the Tool repository with a diverse array of insights and perspectives. Furthermore, the innovative methodologies inherent in the SHOW-specific PST lay a solid foundation for perpetual growth and evolution. In alignment with this vision, SHOW partners aim to cultivate a sustainable network aiming at fostering the exchange of emerging CCAM knowledge and methodologies. This envisioned network will serve as a conduit for the dissemination of the latest advancements and best practices in the field, transcending geographical boundaries. Additionally, insights gleaned from analogous research endeavours both within and outside Europe are expected to enrich this collaborative exchange, amplifying the tool's utility and relevance on a global scale.

Subsequent to the project's conclusion, SHOW cities and project stakeholders accorded priority as key users, are expected to play a pivotal role in steering the trajectory of the tool's evolution. Their input, drawn from diverse expertise and perspectives, will serve as a guiding force for the refinement and enrichment of the tool's functionality. Specifically, these stakeholders will contribute to the formulation of detailed scenarios, thereby shaping the tool's responsiveness to real-world challenges and emerging trends. By leveraging the collective wisdom and expertise of the project partners and stakeholders, the SHOW-specific PST endeavours to remain at the forefront of policy discourse and decision-making processes. This iterative engagement not only ensures the tool's alignment with evolving needs and priorities but also underscores its status as a dynamic and adaptive tool poised to address the multifaceted challenges of CCAM integration in the urban and transport planning of the contemporary landscape.

To further capitalize on the outcomes of the SHOW project, partners will continue to actively participate in other CCAM-related projects, facilitating the integration of the SHOW-specific PST into the broader impact assessment frameworks of the new projects, thereby enhancing and expanding the capabilities of the tool. Through this integration, a diverse array of impact studies on emerging and future mobility technologies is expected to be generated, significantly enriching the tool's repository of data and analytical tools.

In addition, SHOW partners are collaborating with organizations across various countries to foster connections with public bodies in different regions. This effort aims to promote the tool to a wider audience, extending its reach and utility. By establishing these international links, the partners will not only facilitate the adoption of the tool by new users but also ensure that the tool remains responsive to a broad spectrum of regional needs and regulatory environments. This global engagement strategy underscores SHOW's commitment to maintaining the tool as a cutting-edge resource in the realm of CCAM continuously informed by diverse, real-world applications and feedback.

# 6 Conclusions

The present deliverable laid the ground for the restructuring and development of the LEVITATE CATS Policy Support Tool (PST) within the context of the SHOW project. This specific subtask is situated within the scope of *Task A17.2 – Automation and SUMP assessment, scenarios and DSS* of the wider *Work Package WP17 - Decision support, Guidelines & Recommendations & Roadmap*.

The current document offered a comprehensive explanation of the internal workings of the original LEVITATE PST as well as step-by-step examples to comprehend its functions and outputs. The process of engaging with the participant cities within dedicated workshops was also showcased. Finally, the process of reshaping the LEVITATE PST to support the activities of SHOW was outlined.

Given its focus on CCAM policies in urban areas, the LEVITATE Policy Support Tool provides an excellent foundation and source of inspiration for the development of a SHOW-specific PST. While integrating all aspects of the application guidelines into such a tool may not be feasible, it offers a strong starting point for creating a system that can effectively guide policymakers on the importance and effectiveness of their CCAM-related policy measures.

Thus, through city engagement and dialogue, the PST was reformulated into a SHOW-PST, as per the aforementioned processes. To a very large extent, the goal set in the conclusion of SHOW Del. 17.1 (SHOW, 2023) [2], namely developing an online dynamic tool, accessible to all, compatible with any city, with any amount of available data, was largely accomplished. Nevertheless, several directions can be explored further.

PST-oriented tools can be further refined in the future with different internal structures, such as the capability to introduce endogenous or exogenous CCAM MPR causes, or the capability for the user to influence MPR fluctuations temporally. Undeniably, this undertaking should take into account the dimensionality issue, as the combinations of different parameters can quickly explode beyond the resources of a project consortium (and it is already beyond the scope of the present task).

Nonetheless, the present deliverable showcases the utility of tools such as the SHOW-PST, especially when some effort is expended towards informing and training the interested stakeholders in their usage and towards discovering new solutions to their present problems through their exploitation. By extension, the present deliverable also highlights the intrinsic value of stakeholder engagement and discourse-driven improvements to existing tools. Furthermore, new possibilities emerge for more proactive design via the implementation of proper forecasting and backcasting scenarios. As new CCAM data emerge every year at a rapid pace, the reality of cities adapts, and therefore the available options advance and shift at a rapid pace. The PST enables the quantification and anticipation of policies so that future designs are integrated in the most seamless and smooth manner possible. In other words, using tools such as the SHOW-PST, the dynamic update of studies and estimates is facilitated and supported scientifically.

By enabling policymakers to simulate and evaluate various scenarios, the SHOW-PST facilitates the anticipation of the outcomes of different policy options, leading to more proactive and adaptive urban planning. This not only improves the alignment of policies with evolving urban realities but also fosters more resilient and sustainable development strategies. Moreover, the ability of the SHOW-PST to integrate and update with new CCAM-related city data ensures that policy frameworks remain relevant and responsive to emerging challenges, ultimately contributing to more effective governance and better societal outcomes.

# References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