

## Objectives of the measure

- **At measure level:**
  - Reduce used energy
- **Contributing to city level objectives of:**
  - Improve environmental conditions
  - Improve user satisfaction

## Description of the measure

- **Situation before:**

It is expected that within 2023, 130 e-buses will arrive in the city of Thessaloniki for renewing the bus fleet that currently operates. Moreover, within the upcoming years it is anticipated that the number of e-buses in the city will surpass 400. The integration of such a large electric fleet creates challenges and therefore appropriate studies are needed for securing the smooth operation of the PT system. Since the vehicles' specifications are already known, two key questions are still in place: a) in which lines should these e-buses operate, b) where and how these e-buses should be charged.

- **General description:**

The output of this measure will be a two-fold plan. On the one hand, suggestions regarding bus lines electrification will be reported based on e-buses simulation results. On the other hand, mechanisms for communicating effectively this new (electrified) era for city's PT will be defined in order to raise awareness of sustainable transport options in favour of public buses.

For securing the optimal operation of the e-buses fleet, electric vehicle simulation will be performed. Simulation will be fed with inputs regarding the technical specifications of the e-buses and ideally with data regarding the actual consumption of the e-buses. Using this input, the simulation tool will accurately estimate the state of charge (SoC) of the e-buses battery in several scenarios. Through the accurate estimation of SoC and the knowledge of the main characteristics of the bus lines (e.g. scheduling, routes), it will be identified for which lines electrification is feasible, marginally feasible or unfeasible. Moreover, for the selected lines different charging options will be examined, i.e. overnight charging at bus depot, opportunity charging at bus intermediate stops, fast charging at bus/start end stops. In this way, guidance will be provided to the PTO and PTA regarding the ideal locations for implementing charging stations, as well as regarding the specifications of each station.

Considering the bus lines that will be selected for electrification, CO2 savings comparing with the baseline scenario will be calculated, with support from the U-SUMP tool. Moreover, U-GOV will contribute significantly by assisting, with means of consultation and dialogue, in understanding the optimal mechanisms for raising environmental awareness within Thessaloniki's community. The dissemination of the appropriate messages will be made through digital channels and through variable message signs (VMS) both within buses and in bus stops.

- **Measure outputs:**

This measure will deliver:

- Simulation of e-buses operation in Thessaloniki.
- A plan for the operation of e-buses.
- A plan for utilizing the positive momentum of the fleet renewal and raise awareness of sustainable transport options

- **Supporting activities:**

For the provision of more accurate simulation results it will be attempted to use as an input some data of actual consumption coming from some test routes in the city. The participation of TheTA in the consortium ensures that the outcomes of the analysis will be utilized in practice.

- **Interaction with other city measures: UPPER and non-UPPER measures**

This measure is related to the renewal of Thessaloniki's bus fleet and specifically to the gradual introduction of e-buses in the city, which is expected to start in the following months.

## Target groups and/or geographical impact areas

- **Target groups:** Transport authority, transport operators, PT users, potential PT users.
- **Geographic implementation area:** The whole bus network, which covers the whole city, will be examined for identifying in which lines should e-buses ideally operate.

## Stakeholders

The following stakeholders will be required for the implementation of this measure.

- **CERTH:** E-buses operation simulation, selection of ideal lines for electrification, identification of optimal charging options, CO2 savings and metrics calculations.
- **TheTA:** Define behavioural change mechanisms, data collection, data provision.

## U-tools support

The implementation of this measure will be actively supported by one IT tool from the UPPER toolkit:

- **U\_SIM.plan:** It can be used for validating analyses of CERTH regarding e-buses charging options.
- **U-SUMP:** CERTH recently developed a platform regarding CO2 emissions for the Municipality of Thessaloniki, U-SUMP can support in the definition of additional KPIs and the calculation of CO2 savings for various possible interventions.
- **U-GOV:** It can be used in the definition and implementation of appropriate mechanisms for raising environmental awareness.

## Link to other UPPER measures

This measure is similar to UPPER measures implemented in other cities, especially:

- **ROM\_05:** To design the PT surface infrastructure adapted to the gradual introduction of new electric buses.

## Process of implementation of the measure

Stages	Description	Intermediate milestones
<b>Design</b>	Data collection	<ul style="list-style-type: none"> <li>- PT static data</li> <li>- OD for PT</li> <li>- E-buses specifications</li> <li>- Collection of actual consumption data</li> </ul>
<b>Preparation</b>	Simulation analysis	<ul style="list-style-type: none"> <li>- E-buses model development</li> <li>- Examination of various scenarios</li> <li>- Selection of bus lines for electrification</li> <li>- Proposal for e-buses charging</li> <li>- Definition of mechanisms for behavioural change</li> </ul>

## Sub-measures and preliminary indicators

Measure	Sub-measure (if applicable)	Impact indicators
<b>TES_09</b>	n/a	<ul style="list-style-type: none"> <li>- CO2 emissions</li> <li>- Energy used</li> <li>- User satisfaction</li> </ul>