



*Dr. István Tibor
TÓTH*



Replacing diesel bus lines by extending trolleybus network with trolley-hibrids

Multipurpose use of infrastructure for (re)charging trolley-hibrids & e-vehicles

29.04.2019. Szeged



Horizon 2020
Programme

Horizon 2020 Program, ELIPTIC (Electrification of Public Transport in Cities)



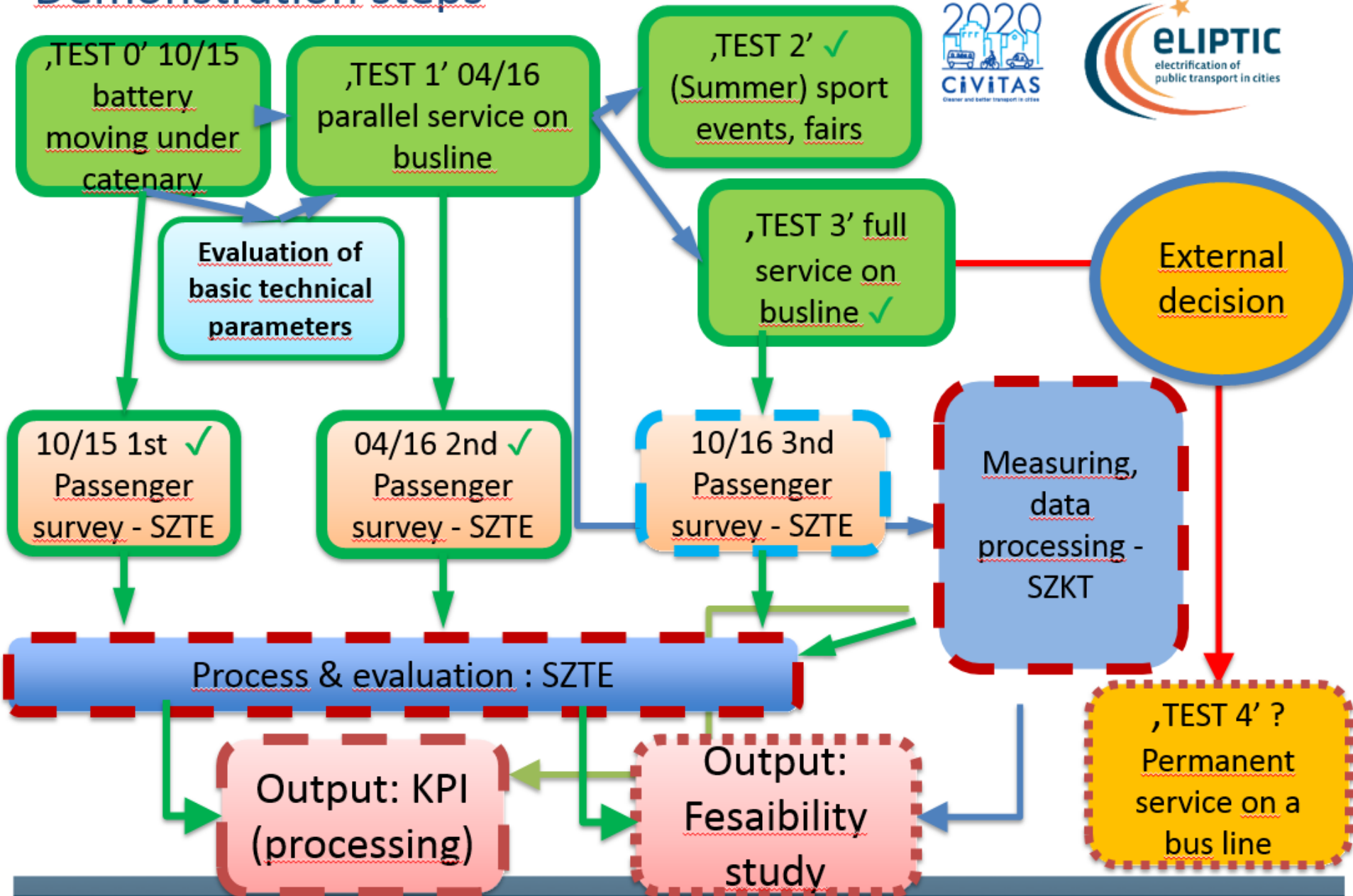
- Participants were 33 partners, from 8 EU countries (A, B, D, E, GB, H, I, PL), include 15 transport operators and coordinators, authorities, 7 research centers and universities, 5 industrial organizations.
- ELIPTIC looked at three thematic pillars:
 - Safe integration of e-buses into existing electric PT infrastructure through (re)charging e-buses “en route”, upgrading trolleybus networks with battery buses or trolley-hybrids and automatic wiring/de-wiring technology.
 - Upgrading and/or regenerating electric public transport systems (flywheel, reversible substations).
 - Multi-purpose use of electric public transport infrastructure: safe (re)charging of non-public transport vehicles (pedelecs, electric cars/ taxis, utility trucks).
- ELIPTIC analysed 21 use cases within the three thematic pillars. ELIPTIC addresses the challenge of “transforming the use of conventionally fuelled vehicles in urban areas” by focusing on increasing the capacity of electric public transport, reducing the need for individual travel in urban areas and by expanding electric intermodal options (e.g. linking e-cars charging to tram infrastructure) for long-distance commuters.

Horizon 2020 Program, ELIPTIC (Electrification of Public Transport in Cities)



- Two use cases in Szeged:
 - Replacing diesel bus lines by extending trolleybus network with trolley-hybrids.
 - Multipurpose use of infrastructure for (re)charging trolley-hybrids & e-vehicles.
- In the preparation phase (October 2015) we made some initial tests ('TEST 0') to define the basic capabilities and technical limits. The real range of electric vehicles highly depends on environmental parameters e.g. outside temperature. It is important to the passengers - and traction batteries also - to keep the temperature in the comfort-zone which requires high energy in winter or in summer and therefore reduce the possible range.
- We'd made a basic passenger-questionnaire to explore the social awareness and support these technologies. And, of course, try to influence the population.
- As demand-analysis we'd examined some possible bus lines to change hybrid trolley lines. The possible buslines had to fit partly an existing trolley overhead wire and mustn't be too high capacity because the limited number of trolleys.
- It means that we have prepared the test conditions for the expected research results, more or less.

Demonstration steps



The surveys of passengers and drivers.



This first survey was made in October 2015, as a start point of public transport development in Szeged using modern environmentally friendly forms of it. The 2nd and 3rd in April and October of 2016,

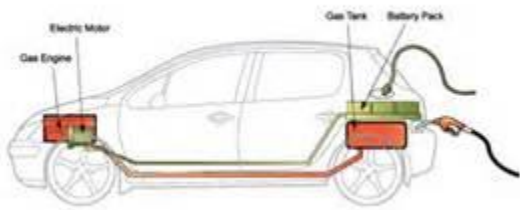
- The first difficulties. Where, when, who, how many and what kind of questions, who will ask in what way etc.
- At least filled in more than 3000 questionnaires.
- The aims and the results were approached.



Ikarus-SKODA Tr187-2



Multipurpose use of PT infrastructure.

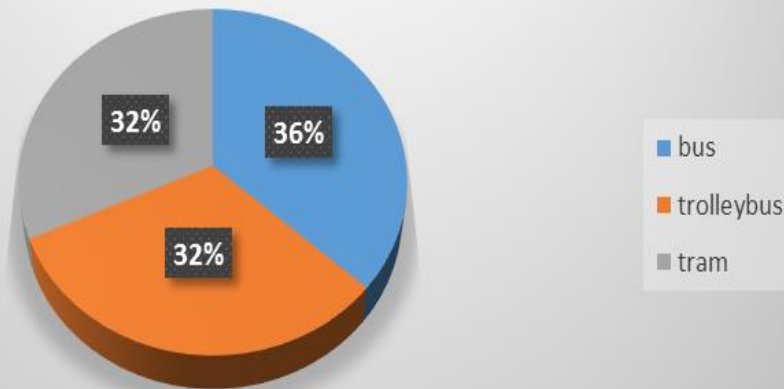


The survey of passengers

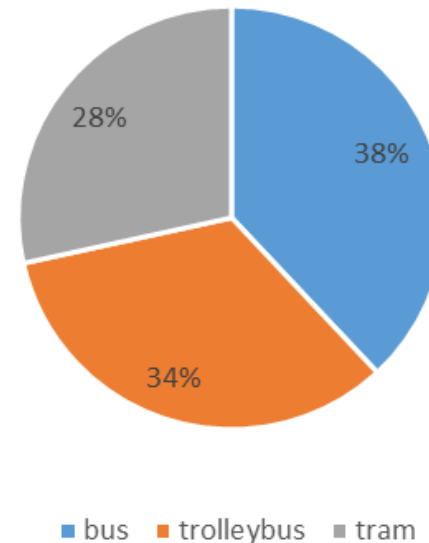


- How often do you travel by local public transport (tram, trolleybus, bus)?
First approximation can be read from the data that the three technology in carriage of passengers cannot be discussed, passengers use them about the same proportion. The data, what the trolley fan want to see!

**Use of different modes of public transport minimum once a month
(N: 942)**



Distribution of daily users

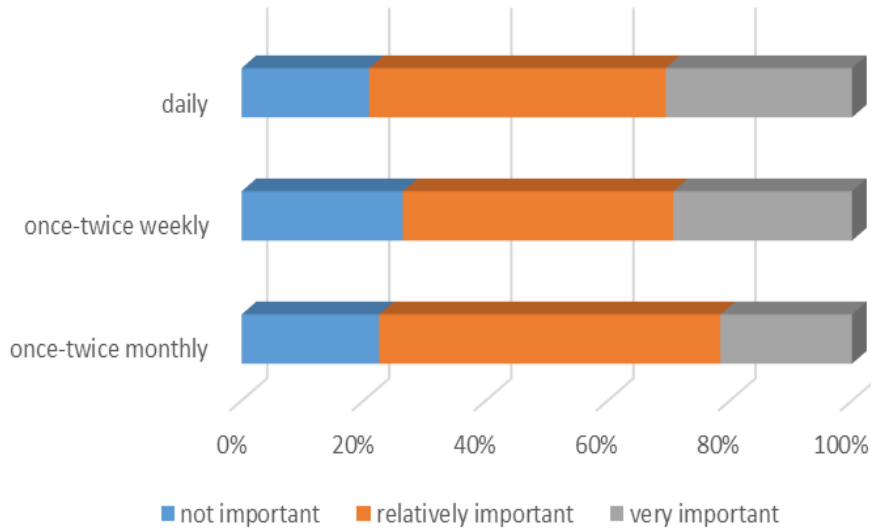


The survey of passengers

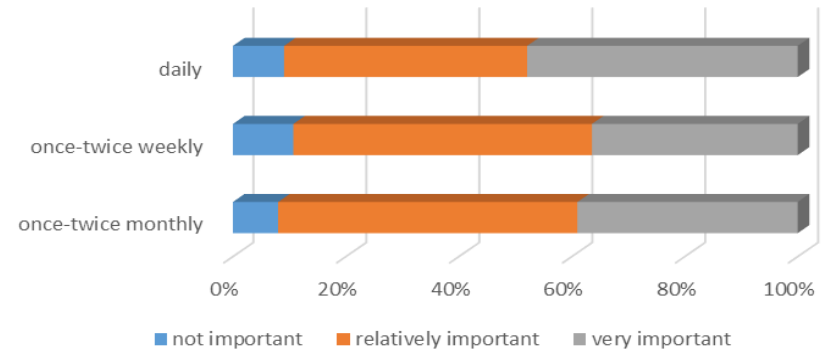


- Increasing frequency is important and goal to the users.
 - As the environmental protection.
- Just a little ratio of the asked population is non-sensitive on this area.
- Tender H2020 is on-going on some extension of trolleybus lines.

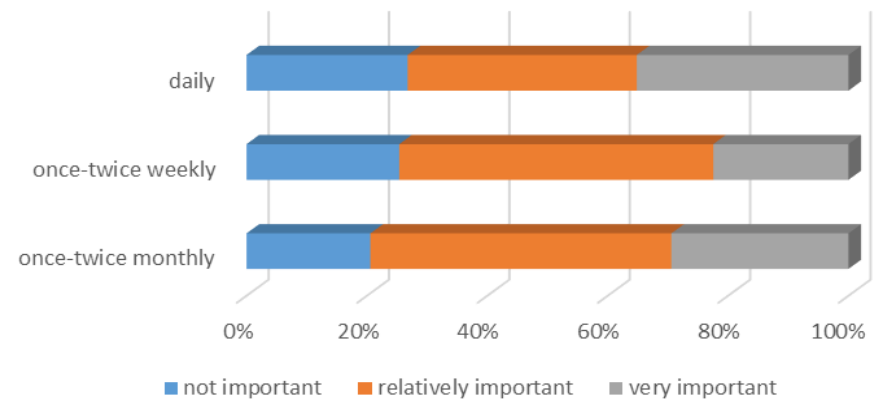
Increasing of frequency N:553



The gas-powered buses are set to be transferred to save environment N:549



Increasing number of trolley buses and trams instead of buses required N:550



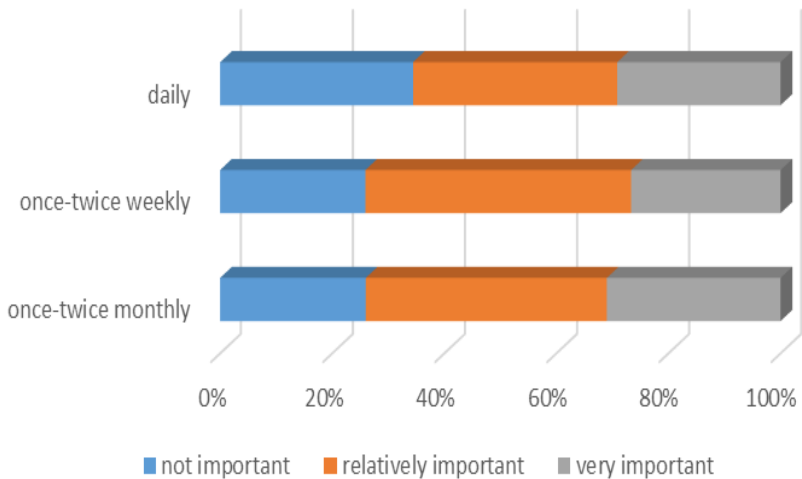
The survey of passengers



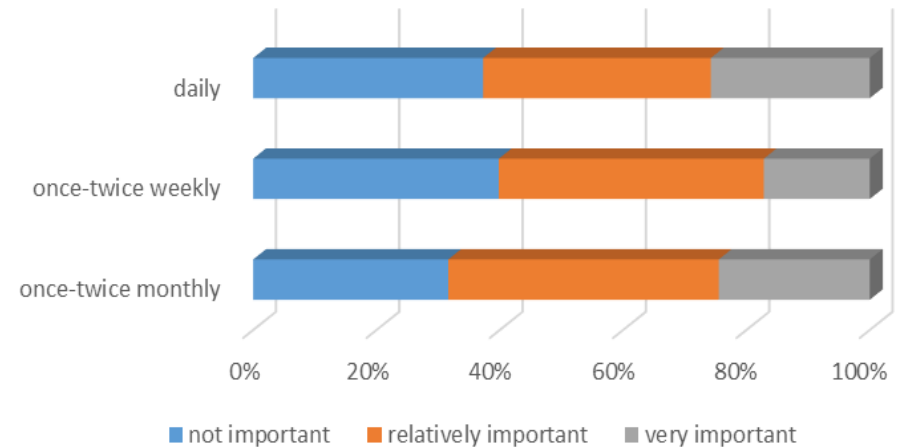
- Paper-based ticket system is used in Szeged. It is important for the development of easy purchase tickets or monthly pass.

Question for the future!

Order tickets, season tickets to take the vehicle ticket-vending machine N:537



Order tickets, season ticket account online, smartphone N:521



That was the first time in Szeged ...



- That was the first time in Szeged when battery powered trolleybuses examined in a scientific project.
- That was the first time in Szeged when the trolley service used overhead catenary connection roofs for fast connecting the trolleys after a self-moving section.
- That was the first time in Szeged when trolleybuses were running paralell with the bus service (line 77A).
- That was the first time in Szeged when bus service was replaced by the trolleys (line 77A).
- That was the first time in Szeged when was opened the first fast e-charger for e-cars (Dózsa u.).
- That was the first time in Szeged opened the first public multipurpose charger (trolleybus depot).

Interesting facts and data.

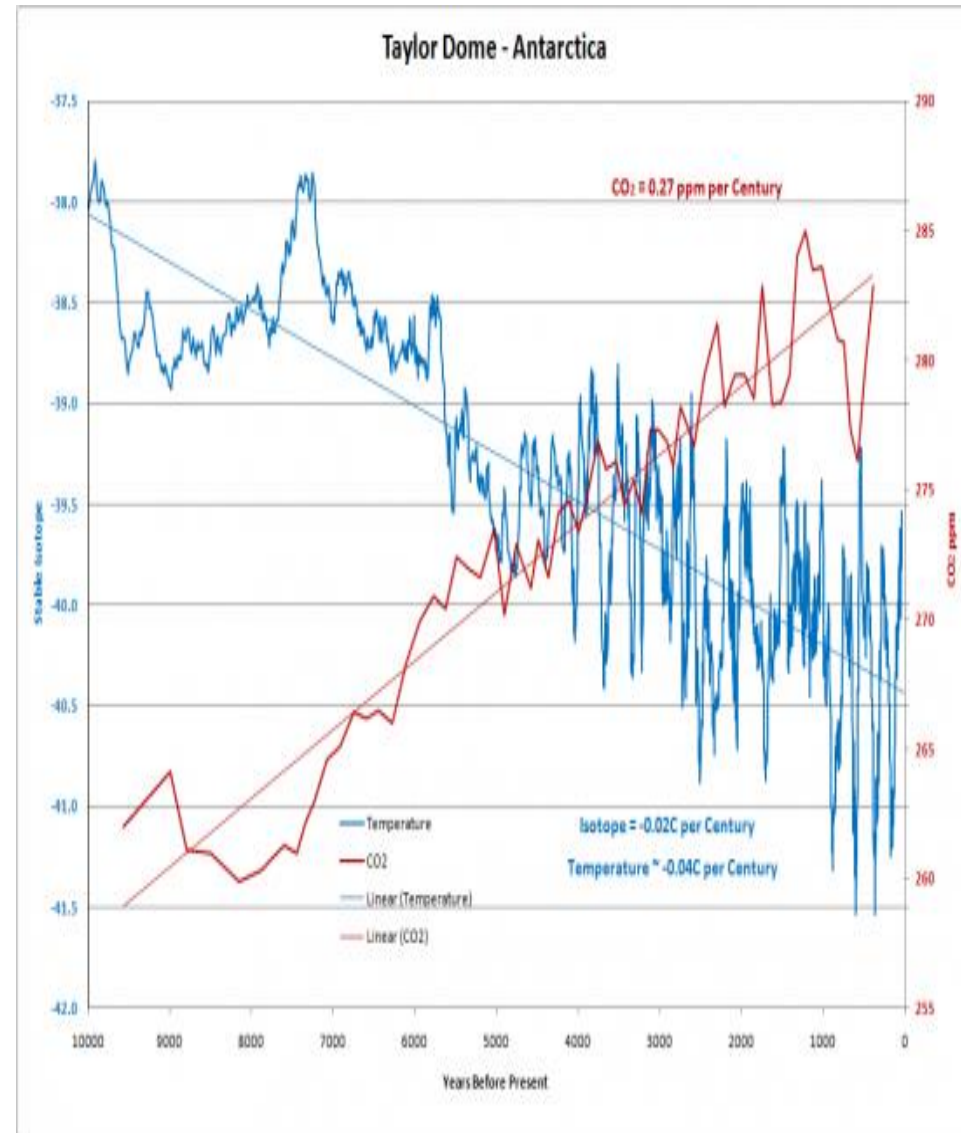
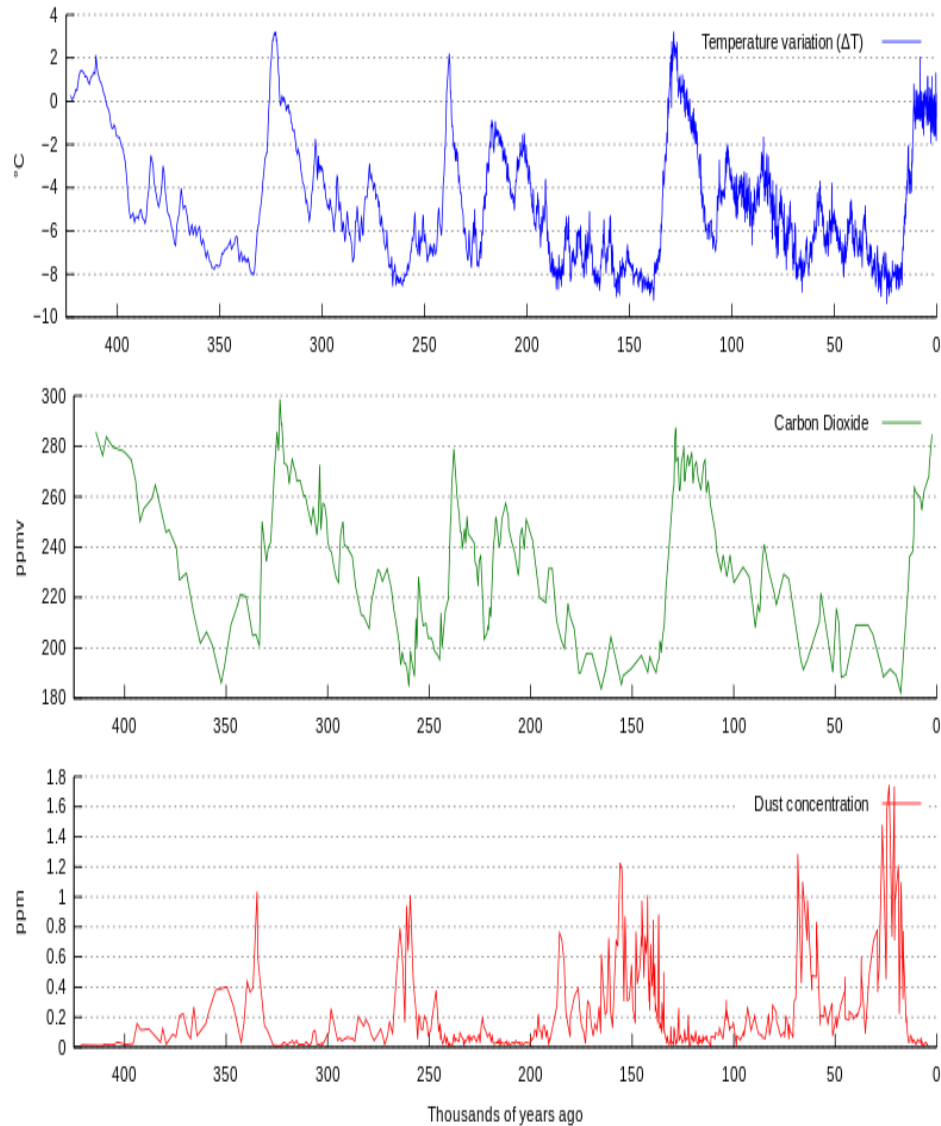


	Energy density Wh/kg	Renewable	Price	Infrastructure
Lead battery	100	Partly	Irrelevant	Partly
Lithium battery	140	Partly	Significant	NO
Metal Hybride battery	100	Partly	Irrelevant	Partly
Hydro-pneumatic	600-1200	YES	Unknown	Partly
Mechanical KERS	120	YES	Unknown or Irrelevant	YES
Fossil	8-9000	Partly	Habitual	YES

	Specific energy consumption [Wh/km (l/100km)]	Required reserve [%]	„fuel” mass to 1000 km [kg] (140/8-9000)	Recharging time [h] (e 3kW-170kW)
Small e-car	100-150	20-50	893-2143	0,58-50
Small diesel	388-486 (4-5)	1-5	43,5-64	0,03-0,05
Bigger e-car	180-230	20-50	1607-3286	1,06-76,7
Bigger diesel	680-972 (7-10)	1-5	76,1-128	0,05-0,1

Rádásul az sem biztos, hogy az e-autó kevésbé környezetterhelő a dízelnél, vagy bármely hibridnél! Dodzsem?

„To the margins” of global warming



THANK YOU FOR YOUR ATTENTION.



Dr. István Tibor TÓTH



Horizon 2020
Programme

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 636012