



A XVIII-a Conferință internațională – multidisciplinară
„Profesorul Dorin Pavel – fondatorul hidroenergeticii românești”
CLUJ NAPOCA, 2018

STUDIUL NIVELULUI DE IMPLEMENTARE A STAȚIILOR DE ALIMENTARE CU ENERGIE ELECTRICĂ PENTRU AUTOVEHICULE RUTIERE ÎN ZONA METROPOLITANĂ CLUJ-NAPOCA

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THE STUDY OF IMPLEMENTATION LEVEL OF ELECTRIC ENERGY SUPPLY STATIONS FOR AUTOMOTIVE VEHICLES IN METROPOLITAN AREA OF CLUJ-NAPOCA

The present study makes an analysis in the actual level of implementation and operating specs regarding the electrical energy supply stations for automotive fleet in the metropolitan area of Cluj-Napoca. Using all the available material in mentioned area were determined the places specifically built to allow vehicle charging. Also there were estimated the major players in the field at the present moment and for the next five years at least in the region. The importance of monitoring the electricity supply stations and the important players in the field at different levels consists in the fact that these vectors have a great influence on the technic-social movement and automotive marketing trend in the near future, which consequently will further determine the air pollution on one hand and road safety on the other hand. Further improvement and cloning of the electric energy supply stations for road e-vehicles are considered.

Keywords: electricity, energy, supply, stations, transport

Cuvinte cheie: electricitate, energie, furnizare, stații, transport

1. Introduction

Back in 2000 I've translated and compiled a short article [1] about electric vehicle supply stations in a local magazine (figure 1). The ideas

were pursued from the Transport journal, a nationwide magazine which had a futuristic image at the moment for electric transportation. From that very moment have passed 17 years, with intense learning [2], and the electric vehicles and their electric fuel supply stations have actually and slowly arrived in our country and in town of Cluj-Napoca [3].

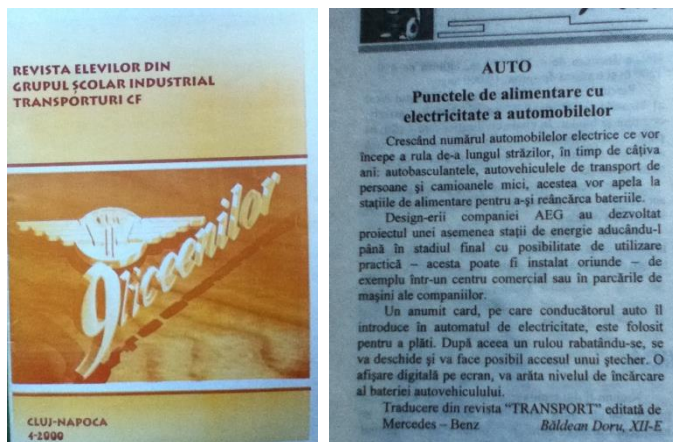


Fig. 1 The local Journal [1] from year 2000 a-magazine cover; b- article on the subject of electric energy supply stations for vehicles



Fig. 2 A BMW [3] vehicle in Cluj-Napoca in the last year

The electric cars not only arrived but they are put to work (figure 2). Dr. Jane Goodall once said “There is still a window of time. Nature can win If we give her a chance.” That means the new generations of humans must make a switch, but the most important should be a change in mind and spirit. They should change their view of how the cars and transportation will look like in the near future and also how they want to travel through cities and between different locations.

Some of us happily welcomed the electric energy supply stations for e-vehicles (figure 3), one of which is in the city block of Mărăști at Kaufland parking lot, close to the junction of Fabricii and București streets [3].



Fig. 3 Electric energy supply station [3] in Kaufland parking from Cluj-Napoca

Due to the fact that the air pollution is a great stress factor on living societies especially in urban area there should be made a change in attitude of the current and future automotive vehicle users. They have to get familiar with electric energy and its characteristics.

It took a while from Edison and tesla to get where we are today but we are far away from the ideal of clean energy and clean vehicles even with the latest achievements in engineering and science today.

This fact makes us responsible for leading on the technology and research toward the point of minimum negative impact on the environment and a friendly attitude toward all life forms.

In the present paper are recorded and analyzed some of the achievements and components found at Automotive Engineering and Transportation Department in the Laboratory for Alternative Propulsion and Hybrid Vehicles from Technical University of Cluj-Napoca.

2. Methodology and materials

The studies developed on the main subject took into consideration the available vehicles in Automotive Engineering and

Transportation Department, a full electric vehicle Renault Twizy and a e-hybrid Porsche Panamera.

Experimental testing and handling methodology is structured in correlation with the electric car research development in specific phases, as it is shown in the following steps:

- choosing the electric vehicles for the development of the research;
- choosing the electric charging stations and methods according to particular specifications
 - locating the charger supply door on the vehicle body;
 - configuration of the charging system;
 - preparing both vehicles for proper charging operation;
 - measuring the electric energy supply charge;
 - realizing the basic experimental measurements of voltage and current in the energy supply procedure;
 - recording and analyze of the data acquired through experimentation;
 - images capturing during the study;
 - inspection of critical aspects;
 - outlining the risky aspects;
 - analyze of particular characteristics in charging process;
 - highlighting the differences between the electric charging procedures of different available vehicles;
 - suggestions concerning the effectiveness and easiness;
 - suggesting the future perspectives for developing and continuing the testing procedures, as well as supplementary inspection concerning the electricity supply system to the electric vehicles.

3. Experimental development

During the experimental research and testing were recorded and stored some of the basic available data concerning the mileage of vehicle in question, as well as other significant parameters regarding the operation and status of the propulsion system.

In figure 4 is presented the first available Zero Emission Vehicle, with electric power-train, which has an output of 13 kW and 57 Nm.



Fig. 4 Renault Twizy undertaken for study and testing

1-front axle; 2-front cover hood and the electric interface connector for re-charging procedure; 3-lights and signaling; 4-wind shield and wiper; 5-pasenger compartment; 6-rear axle of the studied vehicle.

Experimental determination have allowed us to know the traveled distance of 47 km, the actual speed when driving etc. (figure 5).



Fig. 5 Screen-captures from the Renault Twizy dash-board

a-panoramic view of the panel dash-board display; b-detailed imaging of the available electric energy in the battery.

There were localized the components and procedures for fast and slow re-charging of each vehicle under the testing, which for the Renault Twizy was placed at the front, according to figure 6.



Fig. 6 Frontal cover hood for vehicle's charging system

In figure 7 is a close detail image of components located under the cover hood in front of the Twizy.



Fig. 7 Supplies cover in front of Renault Twizy, for liquid and electric energy

Figure 8 shows the experimental testing sequence of recharging the Porsche Panamera in Automotive Laboratory from Technical University from Cluj-Napoca.

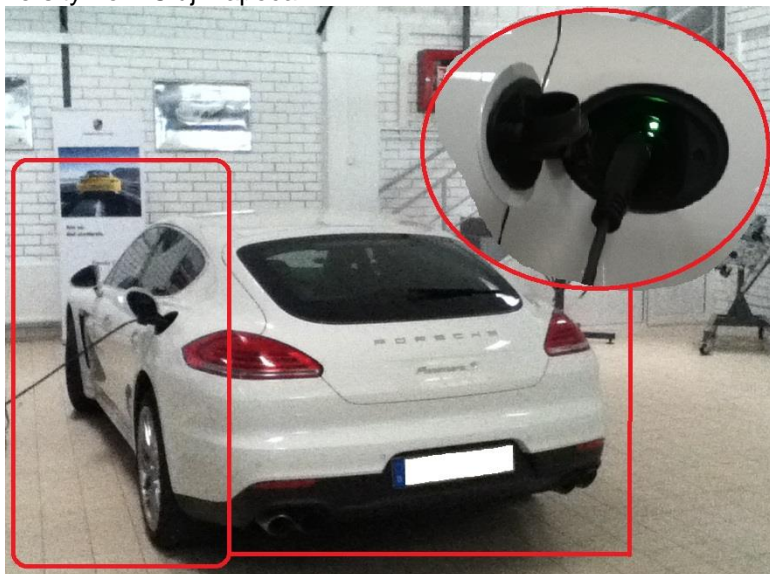


Fig. 8 Analyzed vehicles and the location of the electric energy connector

In figure 9 is presented the detailed connector plugged in the vehicle's electric interface/ socket while charging the batteries.



Fig. 9 Electric energy connector attached to the Porsche Panamera socket

Figure 10 presents the inverter and charger for the Porsche Panamera.

In figure 11 are some details from the charger, display and keys.

Figure 12 presents the directional indicator and marking for energy supply station used in electric charging of some road vehicles.

In the following there is presented the supply station for Zero Emission Vehicles-ZEV, according to figure 13.



Fig. 10 Inverter and modulator unit for charging procedure of Porsche Panamera

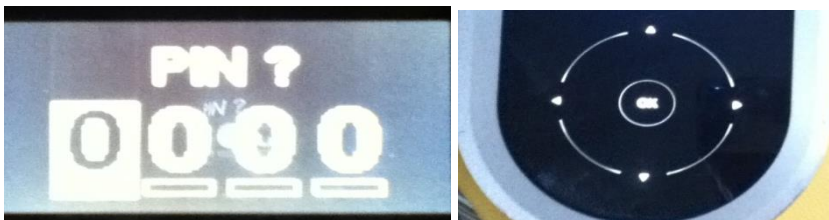


Fig. 11 User interfaces on the charger/inverter of Porsche Panamera



Fig. 12 Indicator panel for electric vehicles EV in Kaufland Cluj-Napoca

In the following there is presented the supply station for Zero Emission Vehicles-ZEV, according to figure 13.



Fig. 13 Public station available for electric energy supply for ZEV and Hybrids
a-electric energy point; b- renovatio e-charge commercial panel.

Some systems of energy supply/charging are given in figure 14.

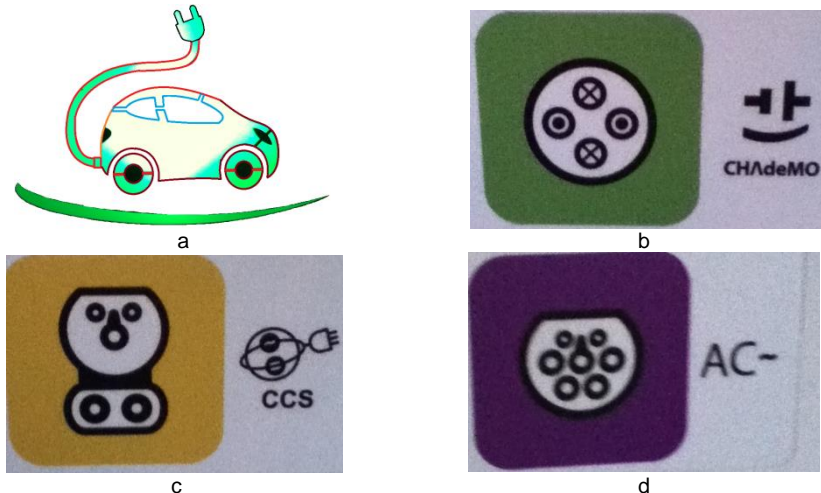


Fig. 14 The three types of available connections in the public energy Supply. a-e-vehicle logo; b-conexiune CHAdeMO; c-CCS (Combined Charging System); d-alternative current charge protocol

4. Conclusions

Analyzing through experimental means the electric energy supply to ZEV and hybrids, as well as some specifications that are already available regarding the re-charging procedure with specialized stations in different locations of the city, one of which is at Automotive Engineering Department as well as interpretation of the some aspects, have led to postulation of some conclusions, like the ones issued below:

- there were taken two specific e-vehicles, a Renault Twizy full electric with zero emission cause it has no exhaust and no combustion on-board, on one hand, and a Porsche Panamera e-hybrid with auxiliary electric power train, on the other hand;
- the secondary battery of Renault Twizy got deteriorated in the first year of use/and stand-by, because it is recharged during vehicle's operation from the main/propulsion battery and standing still for a while it changed its shape;
- after inspecting and establishing the level of deterioration the secondary battery was replaced with a new one;
- both tested vehicles have specific protocols and components for re-charging the batteries from electric wall socket;

- the full electric vehicle has a built-in cable and adapter/inverter for recharging operation;
- Porsche Panamera being a superior class car, with hybrid propulsion system, which gives an extra-bit of complexity, has a dual energy supply system, for electricity and for liquid fuel, that leads to some risky aspects concerning each fuel level and when or how to charge the vehicle;
- in this later case the user has to be aware of both energy supply and charging systems, which increases the level of competence and preparation;
- the implementation level of electric energy supply for automotive sector is still at the beginning stage in Cluj that is why further development is awaited;
- experimental research and the developed paper impose the continuation and perfecting the studies concerning the energy supply process and electric charging stations for ZEV and hybrids in order to increase the level of data.

BIBLIOGRAFIE

- [1] Băldean, D., *Punctele de alimentare cu electricitate ale automobilelor*, Editura Poli Print, Cluj-Napoca, nr. 4, 2000, p. 16.
- [2] Băţaga, N., ş.a. *Combustibili, lubrifianţi şi materiale speciale pentru automobile. Economicitate şi poluare*, ISBN 973-8397-37-5, Editura Alma Mater, Cluj-Napoca, 2003.
- [3] Hângănuţ, R., Vakarcs L., *Viitorul auto într-o Românie în pană de curent*, Sinteza – Revistă de cultură şi gândire strategică, <http://revista.sinteza.ro/viitorul-auto-intr-o-romanie-pana-de-curent/> 2017.07.26.
- [4] * * * *Charging station*, https://en.wikipedia.org/wiki/Charging_station 03.08.2017.

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