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IFAC-PapersOnLine 49-25 (2016) 535–540

Energy-independent concept of a house using an electric vehicle traction

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Abstract: Owing to the development of renewable and alternative energy sources, especially photovoltaic and photo thermal systems has their applications in family homes. The problem with these types of resources is efficient accumulation of electrical energy that is not consumed immediately in production. Economically and environmentally suitable alternative seems to be use for electric vehicles, specifically its accumulators as a storage power source for transport and energy backup house. This article focuses on the interconnection of a house equipped with alternative and renewable energy sources together with electric vehicle and to minimize the consumption of electricity from the public grid.

Keywords: Consumption, electric vehicle, family house, home appliances, management optimization

1. INTRODUCTION

Today's global trend is the use of electric vehicles both in public transport and private passenger transport (Friedrischkova and Horak (2011); Friedrischkova et al. (2013); Friedrischkova and Horak (2013); Friedrischkova et al. (2014b)). Everyone under the term can imagine electric car powered electricity, which is stored in batteries in the vehicle. These batteries are of different types, but they have one thing in common and that a large amount of energy that is in the order kWh. If we look at the system from a greater distance it can be understood as energy storage for bikes (Friedrischkova and Horak (2014c)). Which means that you can use in addition to electric transportation from point A to B as an external power source. If we go further and link the trends of previous years as a photo-voltaic system and an intelligent power management system, a new technological concept of island systems (Kaczmarczyk et al. (2012); Bradac et al. (2013); Zezulka et al. (2012); Prokop and Misak (2012); Misak and Prokop (2010)).

To implement such an island system is necessary to know the energy concept of all variables that enter into the system and a significant rate prediction probability for the optimal management of the entire system.

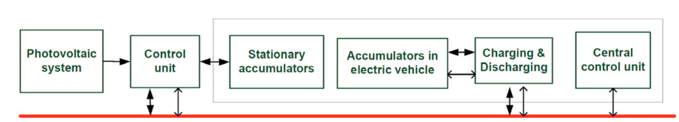

Fig. 1. Schematic block diagram of proposed system

2. ELECTRIC VEHICLE

Among the most famous electric vehicles currently is without a doubt electric cars from Tesla Motors company

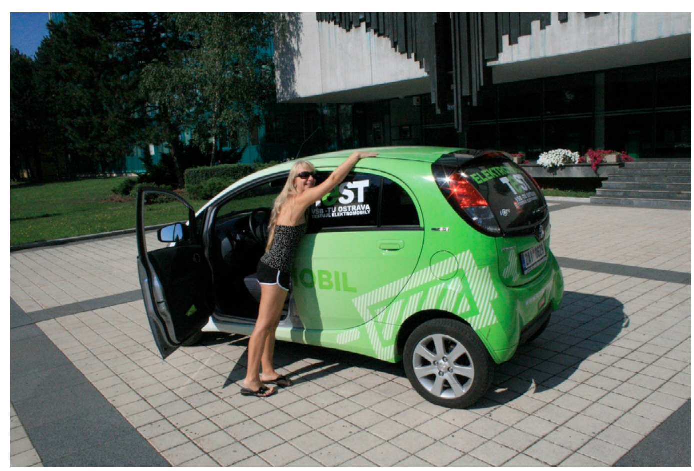

Fig. 2. Tested electric vehicle Peugeot Ion

that use Li-ion. This type of battery is composed of carbon anodes and cathodes consisting of a metal oxide. The inner space is filled with a lithium salt in an organic solvent. Part of these batteries is simple electronics that monitors the battery and charging.

The main advantage of these batteries is that they do not suffer from memory effect. But both have influences of temperature, charge and discharge cycles

$$U = U_0 - \frac{Q}{Q - It} I - k \frac{Q}{Q - It} + A^{-BIt} \qquad (1)$$

where:

U_0	-Nominal voltage (V)
k	-polarization constant (Ah^{-1})
Q	-battery capacity (Ah)
A	-exponential voltage (V)
B	-exponential capacity (Ah^{-1})
I	-current (A)

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10.1016/j.ifacol.2016.12.084

t -time (h)

The capacity of these batteries in electric ranges currently between 53 -85kWh, the average electricity consumption per 100km ranges from 7-10 kW.

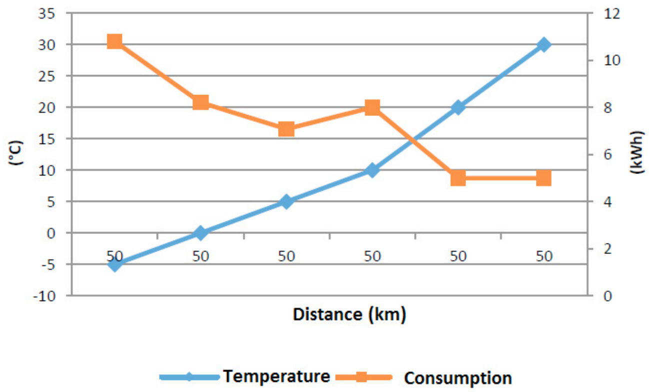

Fig. 3. Temperature dependence of consumption for the tested vehicle Peugeot Ion.

3. PHOTO-VOLTAIC SYSTEM

The most common and yet most effective are monocrystalline photovoltaic panels, which work optimally direct sunlight. Their efficiency is around 17-18When designing such a system is the main limiting parameter size of the area to which it is possible to place solar panels (Friedrischkova (2013b,a); Friedrischkova et al. (2015)). These panels also affect the parameters, see 4.

If we want to know what power is able to give photovoltaic power can be calculated using the following formula:

$$P = \frac{G}{1000} A\eta(G, T_m) = \frac{G}{1000} A\eta_{nom}\eta_{rel}(G, T_m) \qquad (2)$$

where:

G -radiation intensity (W/m2)
A -panel area (m2)
η -efficiency (%)

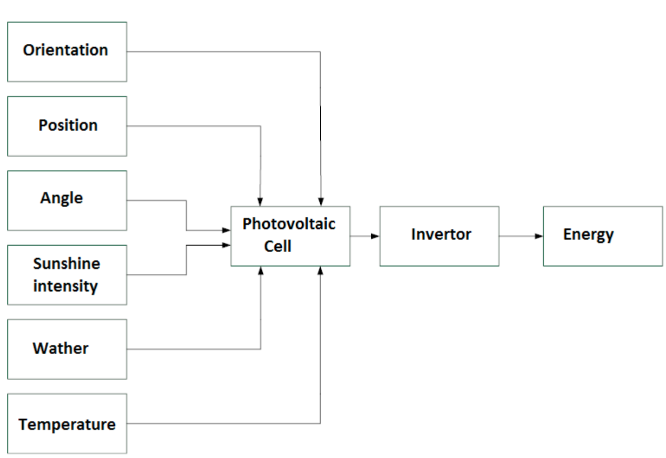

Fig. 4. Factors affecting the efficiency of the PV system.

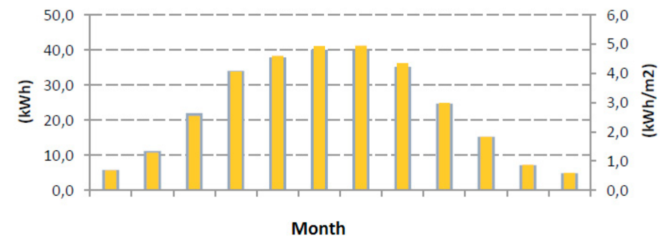

Fig. 5. The average daily production of electricity from photovoltaic power plants with an output of 29 kWp.

In our latitudes seem to be optimum use of amorphous panels that can optimally absorb, both direct and diffuse radiation.

4. HOUSE CONSUMPTION

Earlier it said that most of domestic energy is consumed for heating and domestic water heating. This is still true in most cases, but in recent years, the difference between the energy consumption for heating and hot water and energy consumption for the operation of electrical household appliances decreases With the availability of new technologies and their affordability, consumption of electricity in houses with increasing amenities of electrical and electronic appliances increased slightly. And because technology constantly going in addition to lower prices and availability are also lower power consumption (Friedrischkova and Horak (2014a,b)).

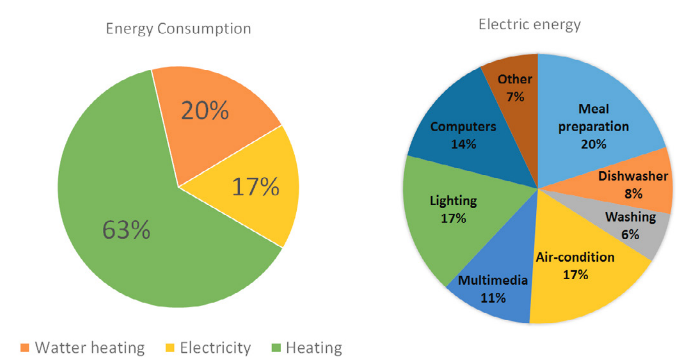

Fig. 6. Consumption of family house in percents

Appliances in houses can be divided into: - With a deferred start time - Constantly connected - short-term

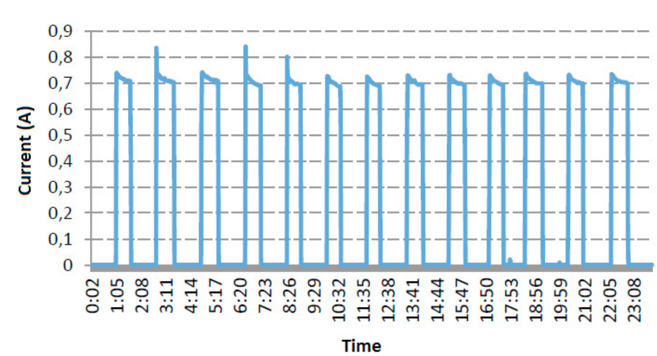

Fig. 7. Consumption fridge A ++ and volume 180 l