TECHNISCHE UNIVERSITÄT WIEN
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GENERATION OF STOCHASTIC LOAD PROFILES FOR MOBILE ENERGY STORAGES

Abstract - A future change from combustion engines to electric drives leads to additional loads, which gives rise to the necessity to take corrective measures in the energy supply sector. In order to be able to scrutinize the impacts on the power grid, a model has been developed with the help of the software MATLAB to generate stochastic load profiles for electric vehicles.

Data collection and parameter settings

- Stochastic about the motorised individual transport in Austria were used
- They refer to workdays (Monday to Friday)
- The four most common trip purposes have been selected to build the used driving profiles.

Table 1: Values of used input parameter

Driving profiles	Commuting	Business	Personal business / shopping	Leisure
Battery capacity	20 kWh	25 kWh	10 kWh	10 kWh
consumption	0.14 kWh/km	0.16 kWh/km	0.12 kWh/km	0.12 kWh/km
Distance / day	28.8 km	71 km	29.6 km	22.1 km
Duration / trip	24 min	36 min	16 min	25 min
Number of trips / day	2	3	4	2
Number of BEV	37	16	30	17

The stochastic load profiles

The goal of the self-made MATLAB routine is to construct charging profiles of the electric vehicles, corresponding to the adequate driving profiles. The resulting charge profiles of the four driving profiles are summed up to one total load profile Electric vehicles with the same properties are members of one driving profile. For the modelling of the load profiles Lithium-ion batteries were chosen.

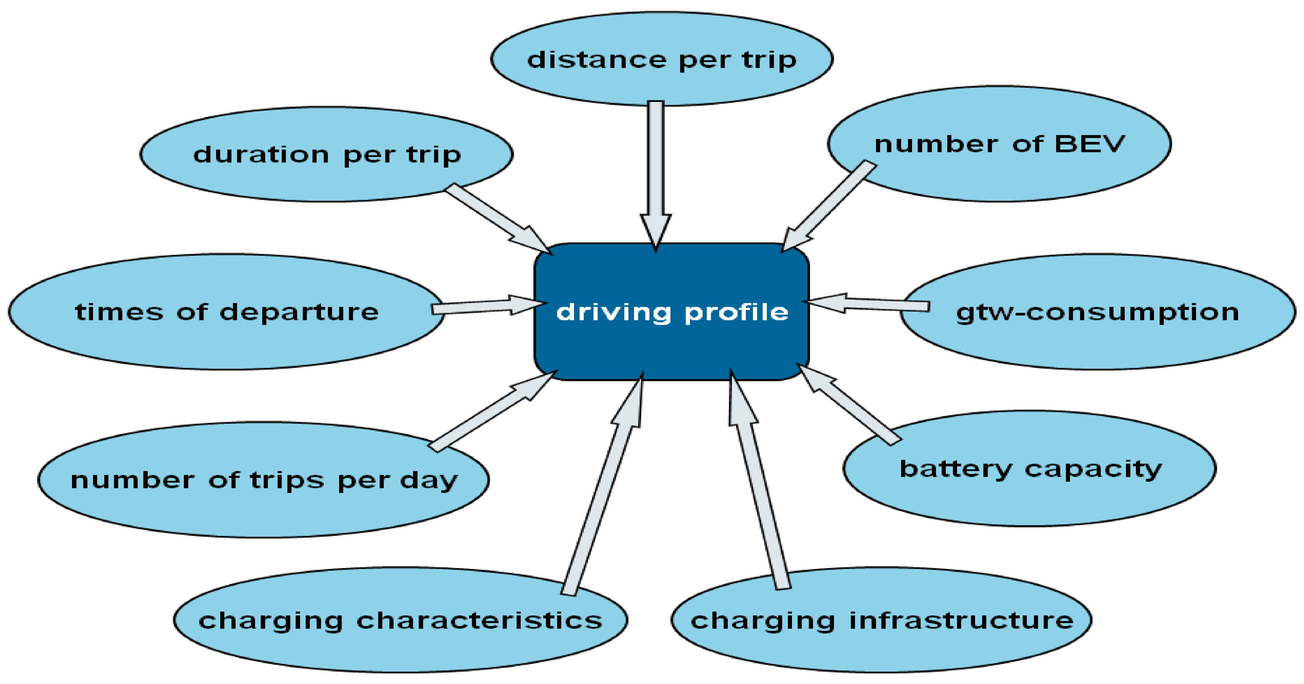


Figure 1: Input parameters for the driving profiles

Normal distribution of the trip departure

In this paper, the departure times of the trips are modelled stochastically using normal distributions. As a basis the trips in progress by time of workdays which refer to the motorised individual transport in Austria are used.
In Figure 2, the replication of the start times of the trips is shown as an example for the commuter driving profile.

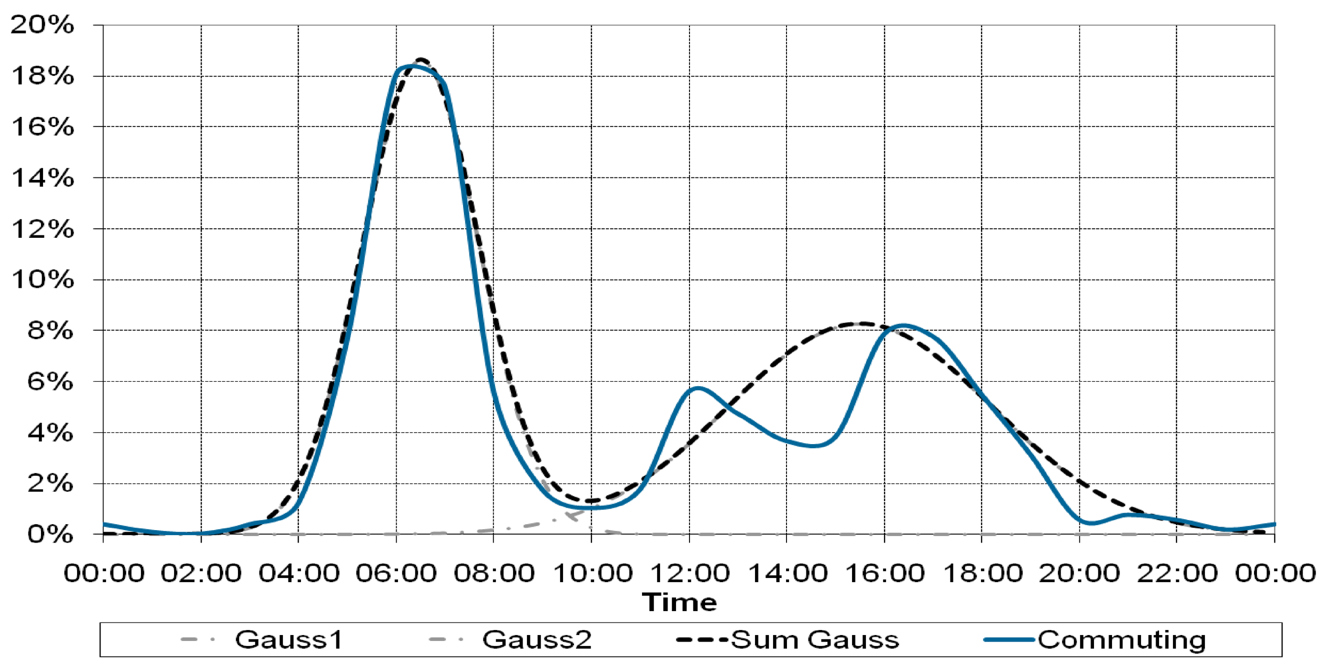


Figure 2: Reproduction of the trips in progress for the driving profile "Commuting"

Results

Figure 3 shows the charging profiles of the four driving profiles (100 BEV) and their sum. This sum is equal to the charging profile of the entire driving profile mix (subsequently referred to as total load profile). The total load profile shows a distinct peak at 7:00 pm with an output of 115 kW. The sum of the charging energy needed from all driving profiles (100 BEV) is 418 kWh / day. The average power consumption of an entire day is 20.7 kW.

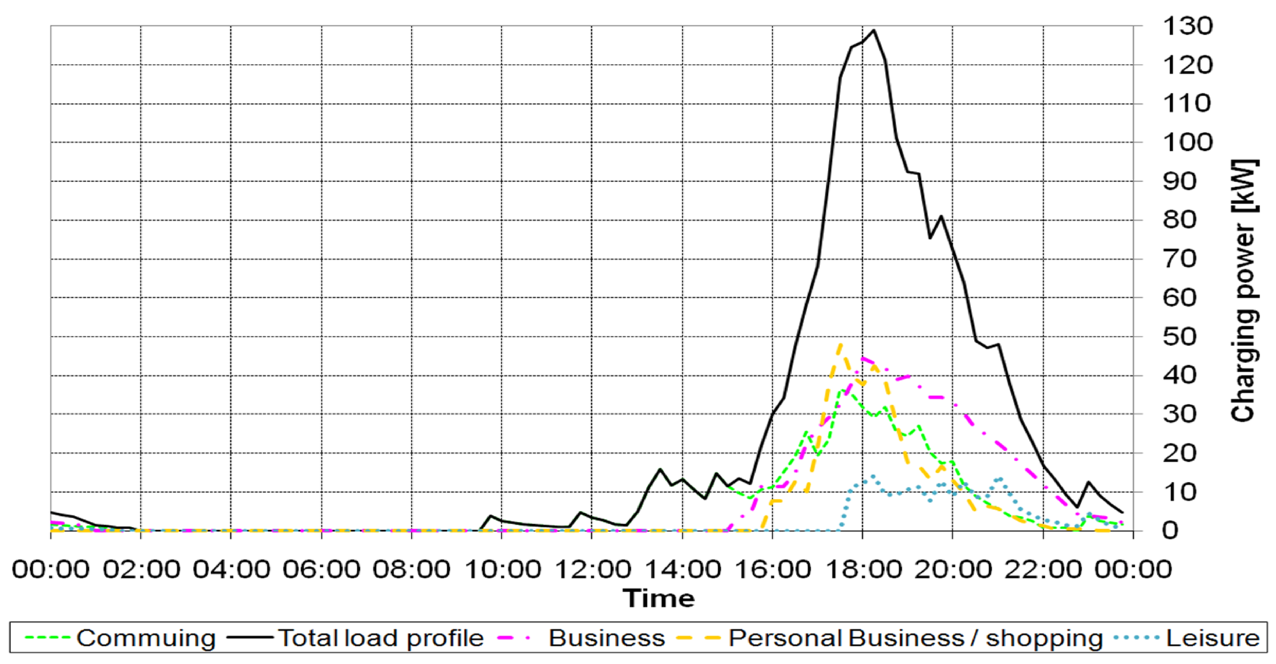
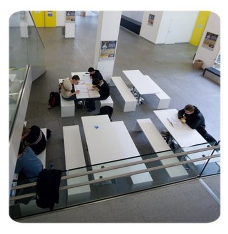


Figure 3: Charging profiles of the four driving profiles and their sum



The uncontrolled charging

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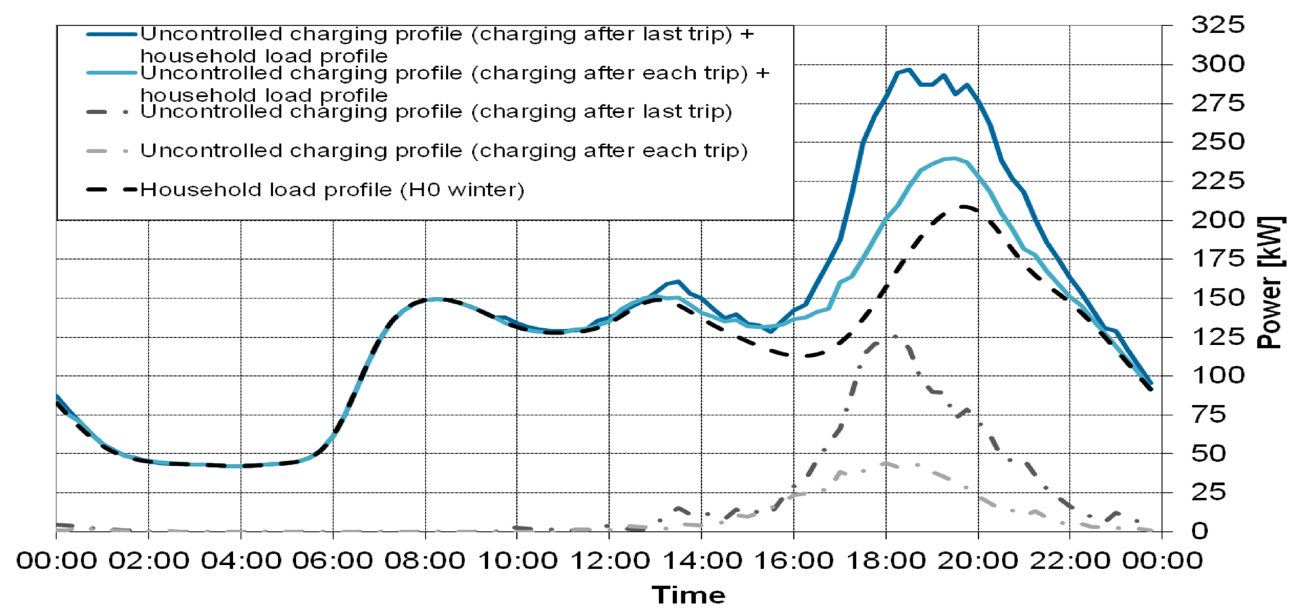

Figure 4: The total load profiles for two uncontrolled charging scenarios of 100 BEV, the load profile of 200 household s and their sum.

The controlled charging

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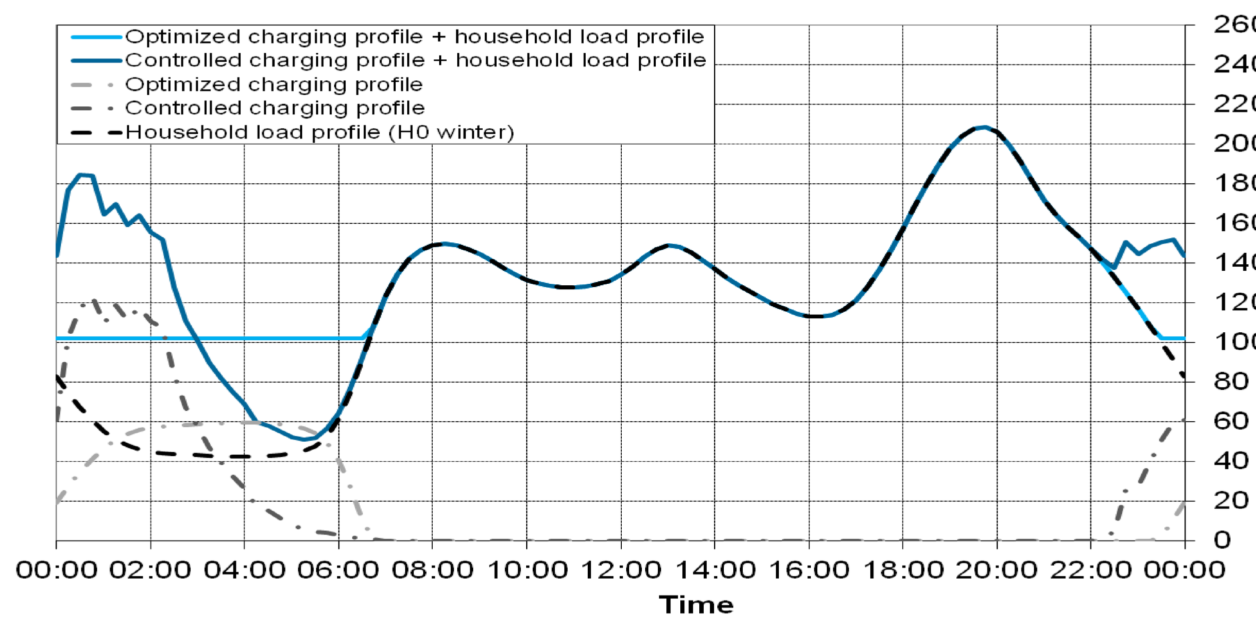
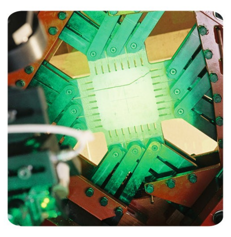
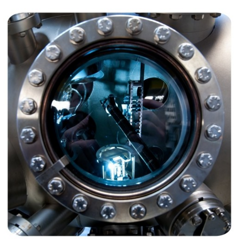


Figure 5: The total load profiles for two controlled charging scenarios of 100 BEV, the load profile of 200 household s and their sum.





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