GERFRIED CEBRAT[1], Mag. Christine Seelhorst [2]

MODELING THE DISSEMINATION OF BATTERY ELECTRIC VEHICLES

[1] Austrian Mobility Research, Schönaugasse 8a, Graz, Styria 8010, Austria
gcebrat@fgm.at
[2] Energie- und Umweltconsulting Graz, 8020, Austria
cs@energie-umwelt.at

INTRODUCTION/BACKGROUND

The paper presents a modeling approach for increasing efficiency when implementing battery electric vehicles. By modeling socio-technological developments the boundary conditionsfor the implementation of BEVs as we know now, could be improved. More and more OEMs are approaching the introduction of qualified battery Electric Vehicles BEVs on the markets at a high pace. Due to the elevated requirements for BEVs some precautions in the design had to be taken by the producers. Extended range Battery Electric Vehicles EREVs for example are having low Depth of Discharge DoD to allow a longer battery service life and have big power generators on board as fallback solution1. But the price of those vehicles will be higher than desired, preventing a quick penetration of the market. Beside those precautions there might be however other factors helping to overcome the range anxiety and residual (resale) value problem2. But whilst the correlation between model choice on the one hand and aspiration (safety, emissions, resale value, engine size, standing charges etc.) and household characteristics (income, number of children etc.) combining revealed and stated preferences on the other hand is well known3 and also used in economic modeling like DTRs VMM, the influence range anxiety and acceptance of related facilitating or enabling conditions for using battery electric vehicles in practice in the decision making is less known. Thus it is less used in scenario techniques predicting future shares of BEVs. But the ALTER-MOTIVE project, investigating into least cost policies, cannot neglect those influences, which might form self-energizing effects. Since *price* is even ranked lower than *acceleration* in the models apart from *financial incentives*, complementing measures increasing BEV utility shall be investigated. The following figure shows the influence scheme which was set up as a hypotheses in order to see how the trends (socio-economical and technical factors) will influence the introduction of monovalent BEVs. It has to be said that the model is based on a rational and informed customer, something which is not the case today within many central European markets, where additional demand is generated by enforcing emotional factors leading to an oversatisfaction of needs and affecting the procurement processes of BEV. But the time will be helping since customers may have hands on experience with BEVs and will be learning how to adapt their mobility patterns in a flexible way overcoming existing range anxiety. At this point in history we might be entering a decade where less focus may be put on individual convenience and consumerism but more focus on rational decisions and protection of the environment/climate. The influence model - set up in CONSIDEO – shows the way of the impact (+/-), the delays (///)and where curves are used as input factors to allow a simulation for the next 20 years. The resulting factors are also marked with a gauge.

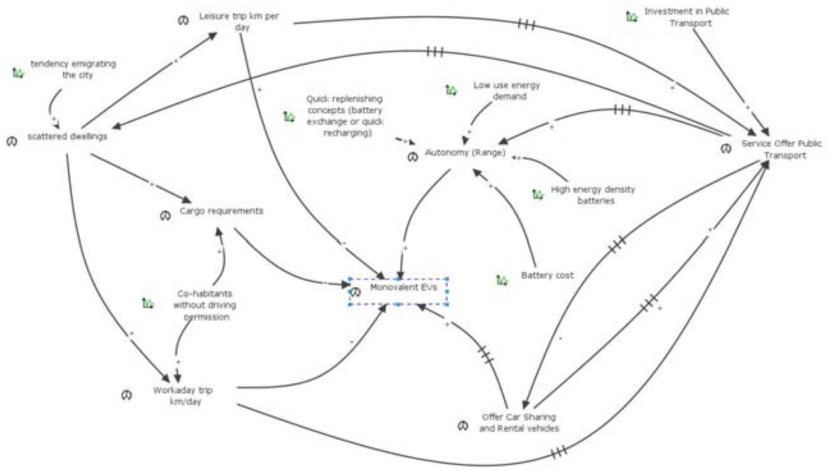

Fig. 1. Influence Model (showing impacts and delays)

This model now helps setting up policies creating an integrated clean and cost efficient mobility service, combining public transport and vehicle rental schemes. Even with a hypothetical full market penetration of BEVs or EREVs having no local emissions, large BEVs with low occupancy will block urban space, causing congestion and altogether indirectly add cost to dwindling city budgets. Therefore it makes sense to skip the strategy of replacing the vehicles power train only - which would not have solved all traffic related problems anyway - and plan for intelligent mobility patterns, opting for smaller monovalent BEVs and including public transport and rental car schemes in the policy setting. The following excerpt of the hypothetical impacts shows, what factors have been used in the household decision model, determining whether a EREV or BEV will be bought. Literature confirms that hands on experience of multi-optionality will reduce anticipated range anxiety4. The low cargo capability of today's City Electric Vehicles might be a factor which will be solved offering modular concepts. The quantification of the basic factors and the delays were given without dimensions in a rough form, so the model in its current form may be seen as preliminary without having validated buyers preferences (revealed preferences).

2 RESULTS FROM THE SURVEY

The first results from the on-line survey are showing that solutions with a good media coverage are ranked high. Multi-modality and after sales alterations are not seen as primary decision triggering factors. The vehicle's specification may not be downgraded, may be less electric support is acceptable. More than 20% of the respondents have a home charging possibility and are thus not affected by public recharging infrastructure plans. The mobility demand will rather not change in the next future, may be the point of interest will be chosen a little bit closer by nearly 30% of the respondents whilst other possibilities have a total for “yes or rather yes” of only 15%. Two third are making their decisions alone, which gives the very interesting group decision making some importance. Problem solving like bargaining and convincing, may be combination, in the context of different degrees of specialization are found.

As assumed for holidays partly other transport means are chosen. Commuting up to 50 km (average single trip distance) dominates the usage for BEVs. The decision is influenced mostly by the price. Sharing complementary vehicles with friends is not appreciated. But a new business model might by on the horizon, having adaptive leasing rates depending on the wear of the most precious part of the vehicle, the batteries. If the calendaric life time might be improved the cycles depths at different temperatures might influence the residual value in leasing schemes.

3 CONCLUSIONS

The results are showing that monovalent BEVs may be on the rise constantly if the assumptions with regards to the influence factors are right. Even with the pessimistic approach we have a steep increase in the fist year and overall half the increase of the optimistic approach. It might be useful however to split the model for different person groups and research the policy tendency with regards to rolling and parking traffic and also financial incentives. Without massive investments in innovation and implementation of on street recharging, there will be a gap for procurements of monovalent BEVs but not for EREV's. Their attractiveness depends on the introduction of environmental zones where zero emission operation is mandatory. From today's perspective there is no policy visible capable of enforcing that. Whilst zero emission EREVs are feasible from a technological point of view now using fuels cells, their economics renders them being no viable alternative for another 20 years. The future compilation of integrative policies shall be balancing all the issues mentioned. Telematics may certainly help to master the data protection issues. Some measures do need a European approach, especially when acting on the industrial level. Bargaining processes with inhabitants will be very interesting to balance the benefits with regards to air quality and additional traffic load caused by zero emission vehicles. Since the procurement of cars is basically a rational investment even in those cases where irrational goals are focused on, it might not be assumed that buyers of expensive cars adding only to their self esteem might risk more money to buy potentially underperforming cars. Thus the development of an acceptable setting for the use of monovalent BEVs is mandatory for their success.