Smartphone application for optimizing charging patterns of electric vehicles

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This project will deal with the development of a generic application for smartphones that will make it easier for the user to optimize the charging behavior for electric vehicles and use of their electric vehicles. The charging process is a great challenge, therefore if the general population begins to adapt the electric vehicle in big scale. Users will typically charge their vehicle after coming home from work, which will result in heavy loads on the power grid. An intelligent charging behavior will reduce the CO₂ emissions and the costs of charging the battery of the electric vehicle. User guidance will help the user to decide whether a trip is possible with an electric vehicle or a conventional vehicle is needed, given the distance of the trip and battery size of the electric vehicle.

The charging optimization in this project is based on mathematical methods presented in a paper published at DTU [1] intended for use in the EDISION electric vehicle aggregator. This model uses day-ahead energy spot prices in order to predict the most optimal charging patterns.

Since this application is intended to be generic, several existing smartphone applications on the market made for electrical vehicle management has been analyzed. This analysis has concluded which features are most typical for this kind of application.

It became clear in the analysis that the must have features include statistics, notifications, general vehicle settings, charging stand information/location and power management. In addition to these features, charging stand reservation and Vehicle-to-Grid management/information (communication with the power grid to sell demand response services by either delivering electricity into the grid or by throttling their charging rate) would also be useful features in such an application. An additional feature implemented in this prototype is a trip planning feature. The electrical vehicle has today a limited range available. While driving conditions like air-conditioning and stereo turned on are important inputs to decide whether the trip is possible since these conditions drains significant amounts of the battery. The environmental and economic benefits of electrical vehicles compared to conventional vehicles will be presented to the user during the planning process.

In this project is made a prototype of such an application, intended to be adapted for any electrical vehicle.

REFERENCES

[1] Abbrandt Andreas, Andersen Peter Bach, Pedersen Bro Anders, You Shi, Poulsen Bjarne, O’Connell Niamh & Østergaard Jacob
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Changing the management of special waste, a Life cycle assessment

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INTRODUCTION

In Denmark automotive shredder waste, copper-chromate-arsenic (CCA) impregnated wood waste and PVC waste is currently landfilled. This project uses an life cycle assessment approach to evaluate on this practise by comparing it to incineration as an alternate scenario, with the goal of determining the optimum treatment method.

RESULTS

The life cycle assessment was created using the software EASEWASTE, to compare landfilling with incineration. The landfilling scenarios is created by using sources from scientific literature on emissions of leachate, while the alternate scenario incineration is based on an existing EASEWASTE model that is modified using data from a study on the FASAN incinerator testing combustion of different waste fractions

For PVC waste it was found that landfilling PVC causes very few impacts to the environment, as the PVC waste remains mainly inactive. PVC incineration, showed a typical impact scenario for incineration, savings in the categories global warming, acidification and nutrient enrichment, but loads in the human toxicity category. However dioxin releases from PVC combustion, which is known to be a major problem, was not accounted for. In comparison the incineration is the more environmentally friendly option, but this may be changed by accounting for the extra dioxin release or a change in marginal energy source.

CCA impregnated wood waste landfilling causes major impact in the human toxicity via soil and ground water pollution categories. These big impacts are caused by the release of the arsenic that was originally used to preserve the wood. Incinerating CCA treated wood waste, causes almost the same impacts as incinerating PVC. Sensitivity scenarios run on the two management options could not change the overall conclusion that incineration was an environmentally far better option.

The major impacts from the landfilling of automotive shredder waste, was in the stored ecotoxicity categories, especially in the stored ecotoxicity via water category. Incinerating the shredder waste causes an unusual high effect in human toxicity via water, besides the typical effects from incineration. In conclusion the incineration seems to be the better alternative, but only as long as the marginal energy source is coal, and the spreading of the stored toxicity is not given a high priority.

Another major concern that affects the results for all three fractions, is the utilization of bottom ashes from the incinerator. If the spreading of the contaminants left in the ashes is considered a major problem this may influence a decision on the preferred waste management technology.

Conclusion

The three cases studied in this project shows that incineration, using the current waste to energy plants, may be a good alternative for managing some problematic waste fractions. The major uncertainty in this conclusion is on the release of dioxin and the marginal energy source, and therefore incineration must be seen as a temporary solution for these fractions.