Master thesis project: Study of relationship between electricity consumption and driving behavior

Background:
In order to reach targets to limit global warming to 1.5-2 degrees Celsius, a decarbonization of the transportation sector is needed. A large share of current transportation emission are related to private vehicles. The fast growth of electric vehicles (EV) have in recent years placed it ahead of alternative technologies for private transport, and is likely to become a significant technology in the future. A benefit of EV, compared to gasoline or hydrogen vehicles, is that the customer can charge the vehicle at its home location. This can reduce driving costs, improve flexibility and can allow the household to use the EV battery as a storage. When compared to an efficient diesel vehicle, an EV charged at home costs about 75% less per driven km.
The charging power of most home EV chargers falls between 3.7-11 kW. This can be compared to the average power rating of a Swedish household (around 11 kW). The potential increase of power consumed by household could be expected to cause issues in the electric power system, which could lead to large infrastructure investments. Especially, during a full electrification of private transportation. However, research have shown that cars are parked most of the time, and they rarely arrive home at the same time. The implication is that peak electricity usage from households can have large variation depending on the driving behavior and electricity usage of single households. How much challenges that EV charging cause for the grid will therefore depend on how home charging and household electricity usage correlate. Unfortunately, there are no datasets with electricity load profiles and driving behavior from the same households.

Objective
The aim of this project is to conduct a semi-large-scale analysis of driving behavior, and electricity load profiles from different households to identify more and less likely combinations and patterns. This will require both statistical analysis, combinatorics and qualitative analysis of metadata. The project will use existing datasets from the Swedish Car Movement Dataset (SCMD) [1] and load profiles from Energimyndigheten [2].

Prerequisites: No specific master's program is required but the applicant should have an expressed interest in renewable energy and EV.

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Submit your CV and personal letter to Elias Hartvigsson (elias.hartvigsson@chalmers.se) before December the 1st.

References
[1] S. Karlsson, "The Swedish Car Movement Data Project Final Report," Gothenburg, 2013.
[2] J. P. Zimmerman, "End-use metering campaign in 400 households In Sweden Assessment of the Potential Electricity Savings," Eskilstuna, 2009.