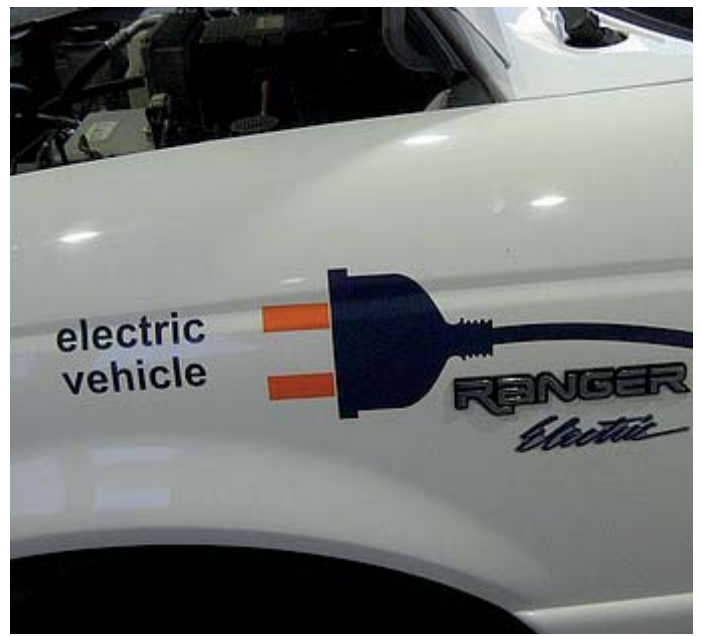


# Profit for PHEVs as providers of frequency control



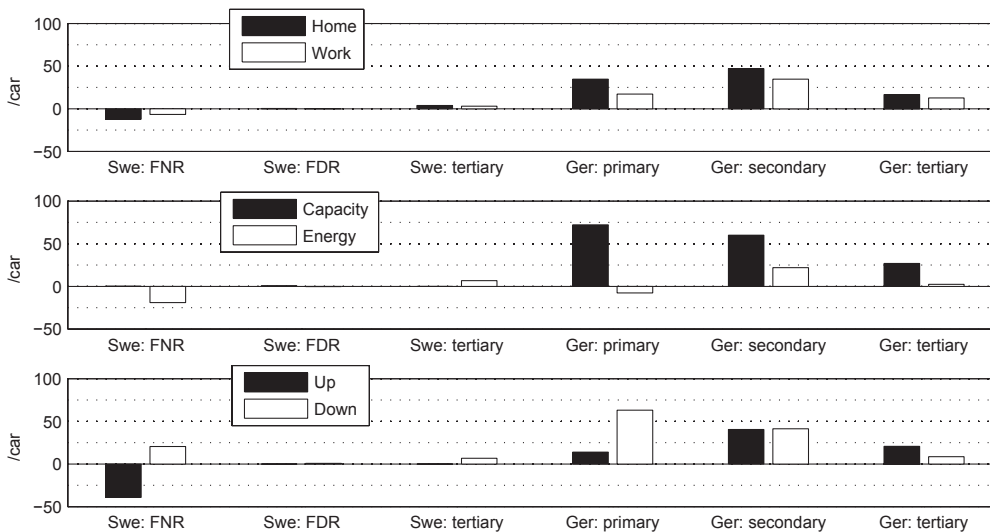
In their Master's thesis, Anna and Sara Linnea Andersson show that Hybrid Electric Vehicles can profit by providing real time frequency control in the electricity grid. The work is about to be finished and will be published on the Pathways homepage soon.

This study investigates the profit for Plug-in Hybrid Electric Vehicles (PHEVs) as providers of real time frequency control. One benefit of using PHEVs as control power is that it allows increased share of renewable intermittent power production in the system. A simulation model was constructed to estimate the maximum possible profits that PHEVs could generate by participating on the control power markets.

PHEVs can regulate both up and down by discharging and charging their battery, respectively. A capacity price can be paid to an actor (e.g. PHEVs) that is ready to deliver control power with short notice. In the case of regulation up, the energy price

is paid to the actor that delivers energy. In the case of regulation down, the actor pays for the energy it extracts from the grid as regulation down, but it pays a lower price than it would have done if buying the energy in a conventional way.

The results indicate that PHEVs cannot generate a profit while acting as control power on the Swedish control power markets, but that maximum average profits generated on the German markets lie in the range of 30-80 €/per vehicle and month. The higher profits in Germany can be explained by higher price levels on both capacity and energy for control power in Germany.



Top: Comparison of average profit generated by one PHEV one month from the time parked at home and the time parked at work. Middle: Comparison of average profit generated by one PHEV one month originating from capacity and energy payments. Bottom: Comparison of average profit generated by one PHEV one month by providing regulation up and down

