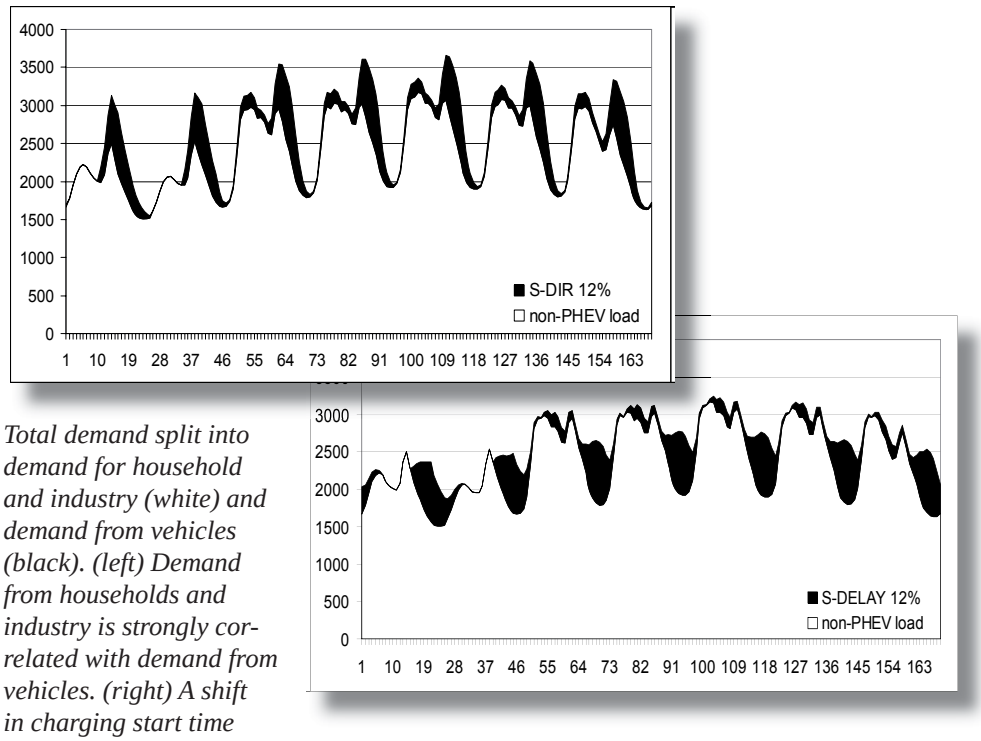
PHEV:s in a power system with wind power

We have investigated the consequences of integrating plug-in hybrid electric vehicles (PHEV:s) in a wind-thermal power system. The study shows that the alteration in load profile and the flexibility provided by PHEV:s can reduce the emissions of the power system, mainly by reducing emissions related to thermal plant start-ups.

If 12% of the generated electricity is used to supply PHEV:s, emissions of the heat and power sector are according to the simulations reduced with up to 6%. Allocating this emission reduction to the private vehicle fleet, and taking into account that the emissions of the private vehicle fleet are about one third of the emissions of the heat and power sector in average in Europe, the corresponding emission reduction of the private vehicle fleet would be 18%. The simulations also indicate that to realise this reduction an active integration strategy is required. An inactive approach to PHEV integration (i.e. letting people charge the car at will) would cause an increase in vehicle emissions.

Wind power intermittence

The threat of climate change calls for a drastic reconstruction of the power system over the coming decades. A key measure is to find cost efficient ways to deploy renewable electricity generation such as wind power. As wind power reach above a certain grid penetration level the associated variations in wind generation start to influence the power system, resulting in curtailments of wind power or an increased number of start-ups and part load operation hours of conventional power plants, e.g. condense power plants. Since power plant cycling and part load operation in thermal plants typically imply high costs and emissions, it is important to find ways to reduce the influence of variations in wind power production on these plants without forsaking large amounts of wind power.



Total demand split into demand for household and industry (white) and demand from vehicles (black). (left) Demand from households and industry is strongly correlated with demand from vehicles. (right) A shift in charging start time decreases the correlation and evens out the demand. This smoothening of demand thorugh a decrease in correlation is referred to as the correlation mechanism.

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