THELMA: Household Consumption on Municipal Level

Scientific contribution of the research group for Ecological Systems Design to the CCEM/swisselectric Project THELMA.
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THELMA is a project funded by the Competence Center for Energy & Mobility (CCEM) and swisselectric Research. The name stands for "Technology-centered Electric Mobility Assessment". The project assesses implications of widespread electric vehicle use in Switzerland (http://thelma-emobility.net/). Project partners are PSI-LEA, EMPA-LCAM, LAV and PSL. The group for Ecological Systems Design performs, in close collaboration with the Institute for Transport Planning and Systems (IVT), regional case studies. The aim of the work is to model, assess and optimize the environmental performance of current and future household consumption on a municipal level, thereby bedding the introduction of electric mobility in the broader context of general private consumption like mobility, housing and nutrition. Life cycle assessment (LCA) is applied to identify strategies to minimize the overall environmental impacts.

Data from MATSim, a multi-agent transport simulation developed by IVT, and from the federal dwelling register has been combined to model household specific demand of mobility (i.e. public and individual transport) and housing (i.e. space heating and warm water). As an example the environmental impacts caused in Buchs, a municipality in canton St. Gallen, have been assessed. For the calculation only data from 10% of the inhabitants were considered due to computational reasons. The per capita CO2 equivalent (eq.) emissions for a day in November are presented in Figure 1. They suggest that some people compensate high mobility emissions with low housing emissions and vice versa. Figure 2 shows that in the current situation only 20% of the inhabitants are responsible for 46% of the CO2 eq. emissions from housing and for 83% from private mobility.

An illustrative ceteri paribus scenario, where car drives shorter than 15 km are performed by electric city cars, has also been modeled. Under this assumption approximately 11% of mobility emissions would be saved, if the current electricity supply mix for Buchs can be used to run the electric cars. Coming research within THELMA will also consider future changes in the electricity mix, based on consistent future scenarios. Further, municipal household consumption will be assessed with additional environmental impacts (e.g. particulate matter formation, cumulative exergy demand or ecological scarcity) to reveal potential environmental trade-offs of various consumption strategies.

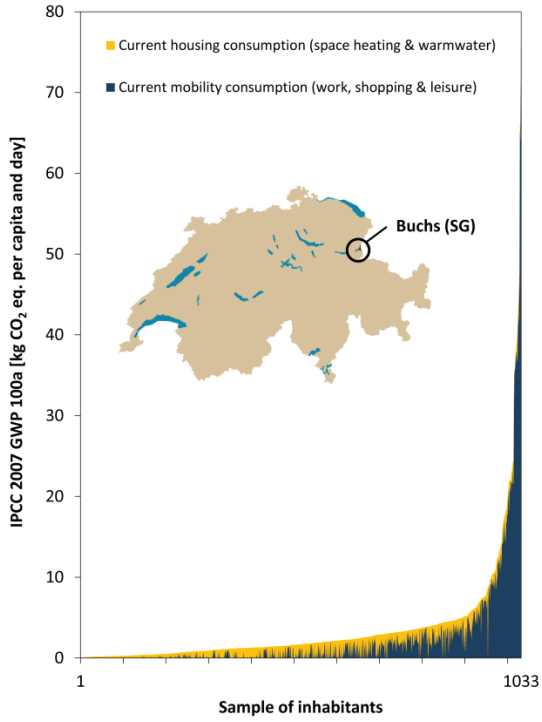

Figure 1: Global warming potential of current housing and mobility consumption of a 10%-sample of the inhabitants of Buchs (SG).

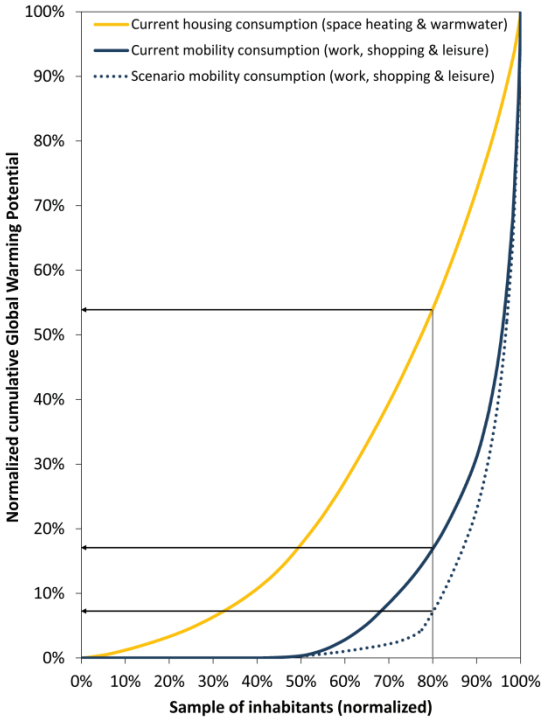

Figure 2: Normalized cumulative global warming potentials for housing and mobility consumption.