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Non-propulsive Energy Demand of Passenger Cars

Gil Georges, LAV ETH Zurich – capacity area A3

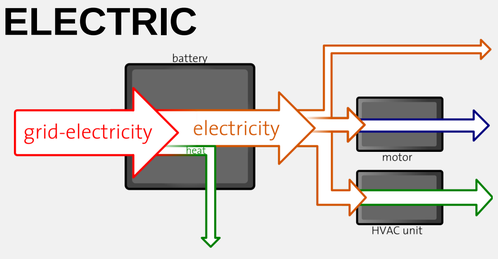
ABSTRACT

In modern cars, there is a large array of non-propulsion relevant devices (lighting, entertainment, ...) that draw significant amounts of power. In conventional vehicles, heating is generally «for free» as the necessary energy can be drawn from the engine's waste heat stream. In battery electric vehicles, that is no longer possible. Heating (and possibly cooling) the cabin can thus severely reduce an EV's autonomy range (resp. increase its energy demand). The following provides a brief overview over LAV's energy system group's approach to modeling and quantifying that influence.

INTRODUCTION

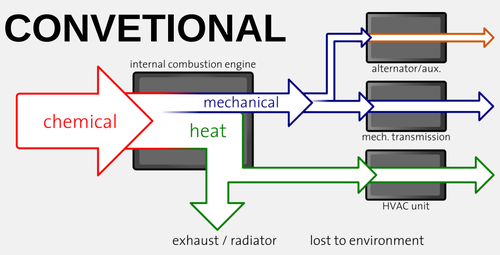
Heating: the issue w/ electric systems

ELECTRIC



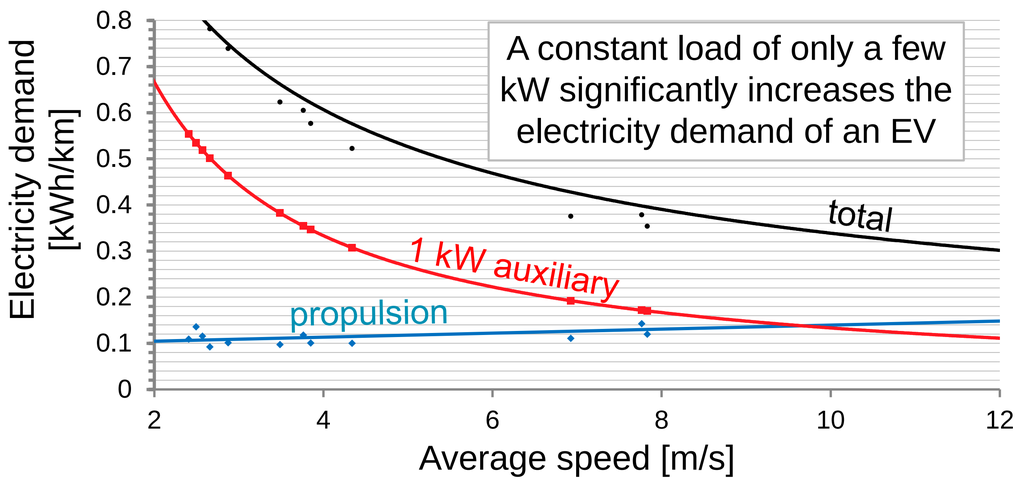
With electric propulsion, any auxiliary power must be drawn directly from battery → competition with propulsion; there is no or little waste heat

CONVETIONAL



With ICE-based propulsion, auxiliary power is drawn from the ICE → higher load point, and waste heat can be used for heating the cabin

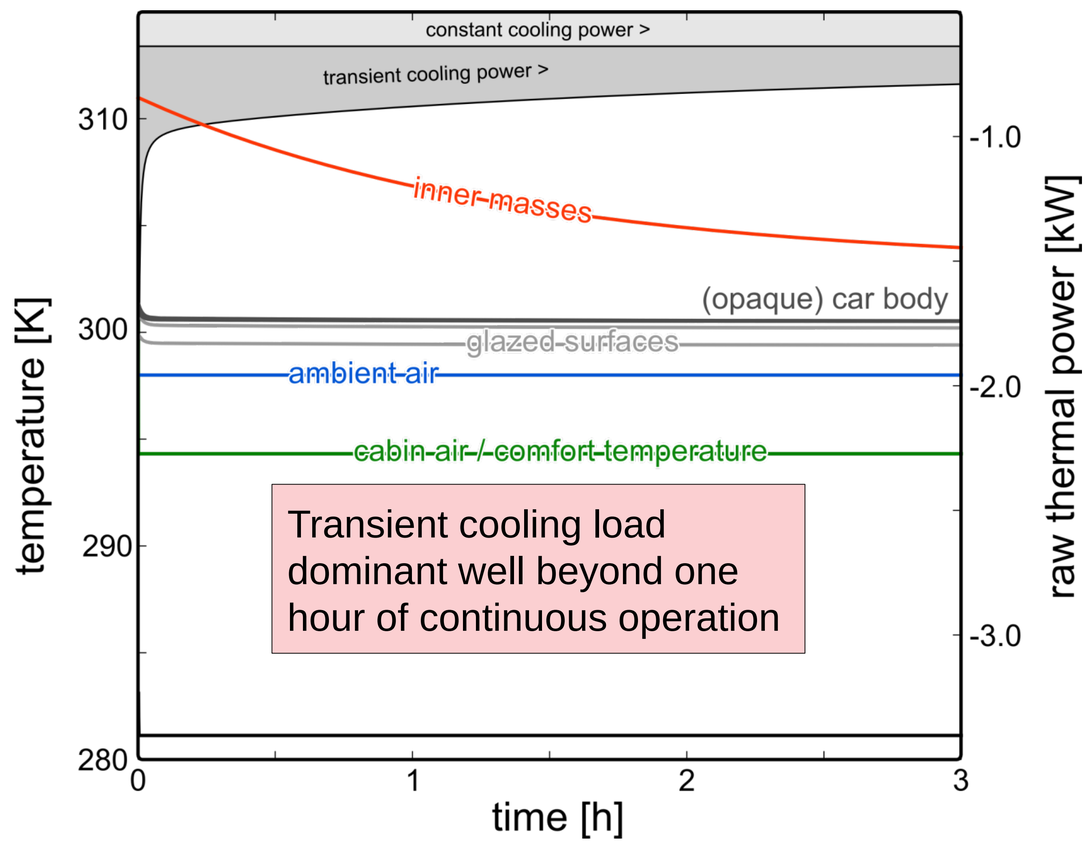
Influence of auxiliaries on energy demand



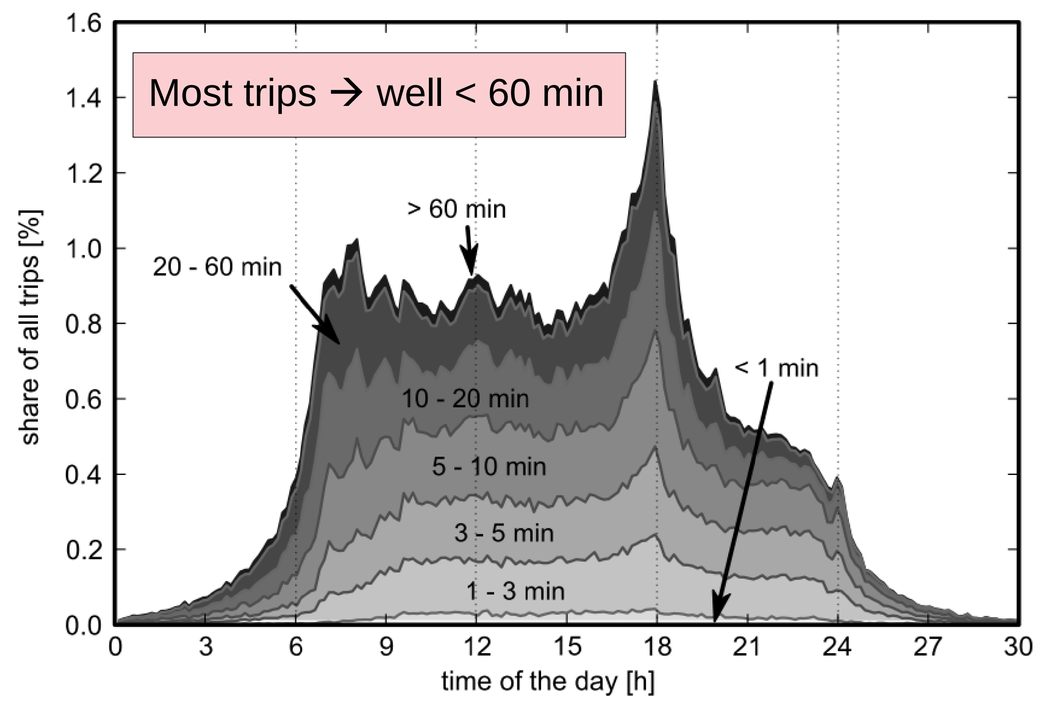
The cabin as a thermal environment

RESULTS

Transient load → dominant

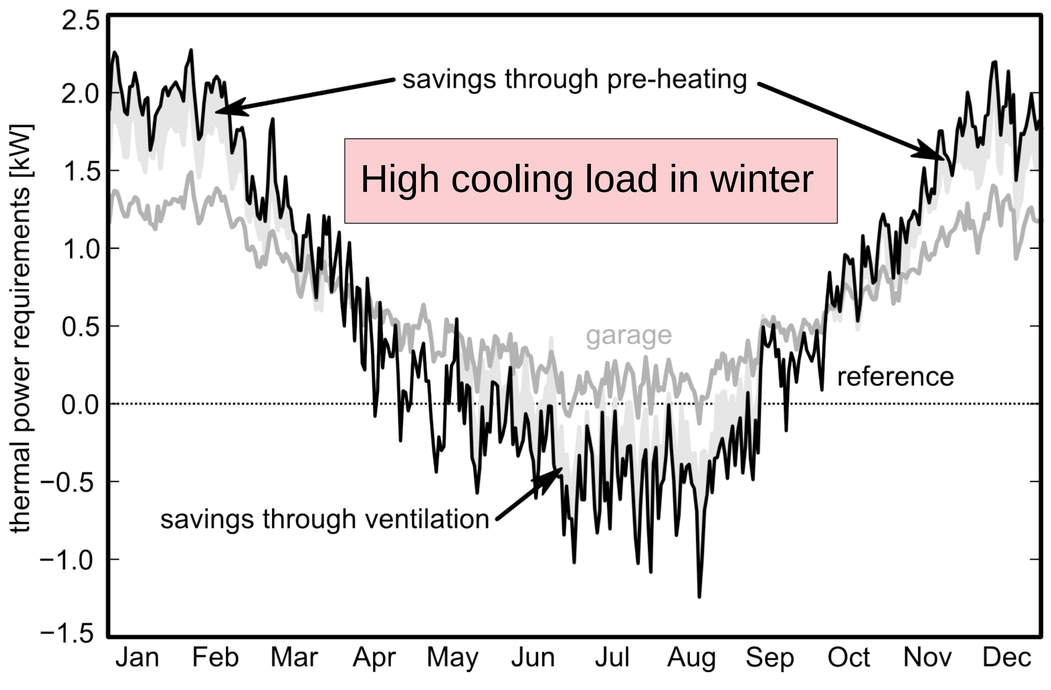


Inclusion of driver behavior



Data source: Dr. Rashid A. Waraich, ETHZ-IVT, MATSim scenario Zurich

Raw thermal heating/cooling power



About us

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LAV's enrergy systems group specializes in the technology assessment of energy conversion technologies and the analysis of interconnected energy ecosystems, including mobile systems and their supporting infrastructure(s). Further activities revolve around stationary power generation, in particular decentralized, biogenic CHP plants.

OUTLOOK

- Experimental validation (collaboration with EMPA-ICEL)
- Application to different climates («global» validity of results)
- Extension to other vehicle types (incl. busses)
- Co-simulation with powertrain (advanced hybrid systems)