

Assessing the Housing and Mobility Demand of Households and Associated Environmental Impacts on a Regional Level – A Case Study

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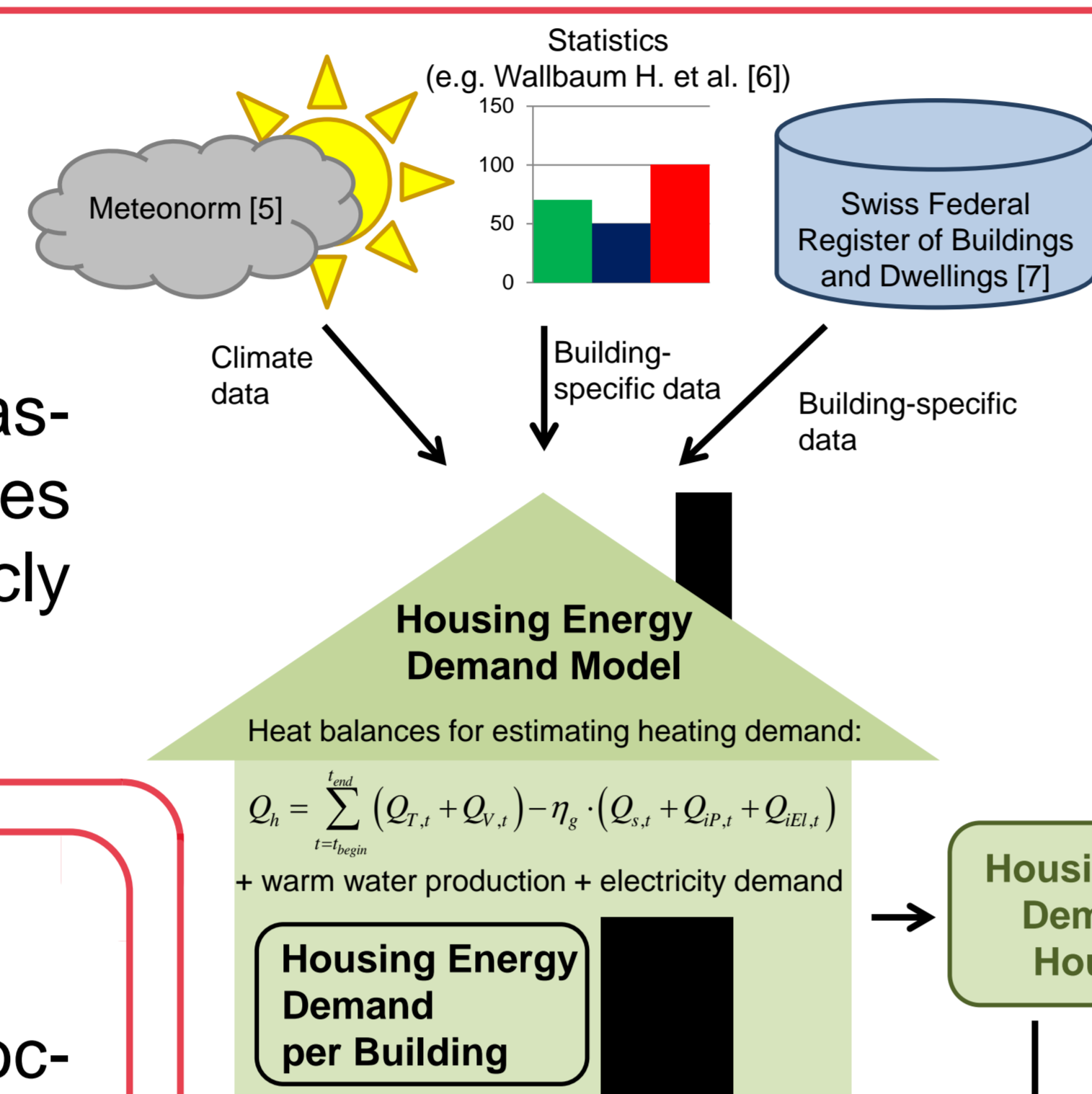
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Introduction & Objectives

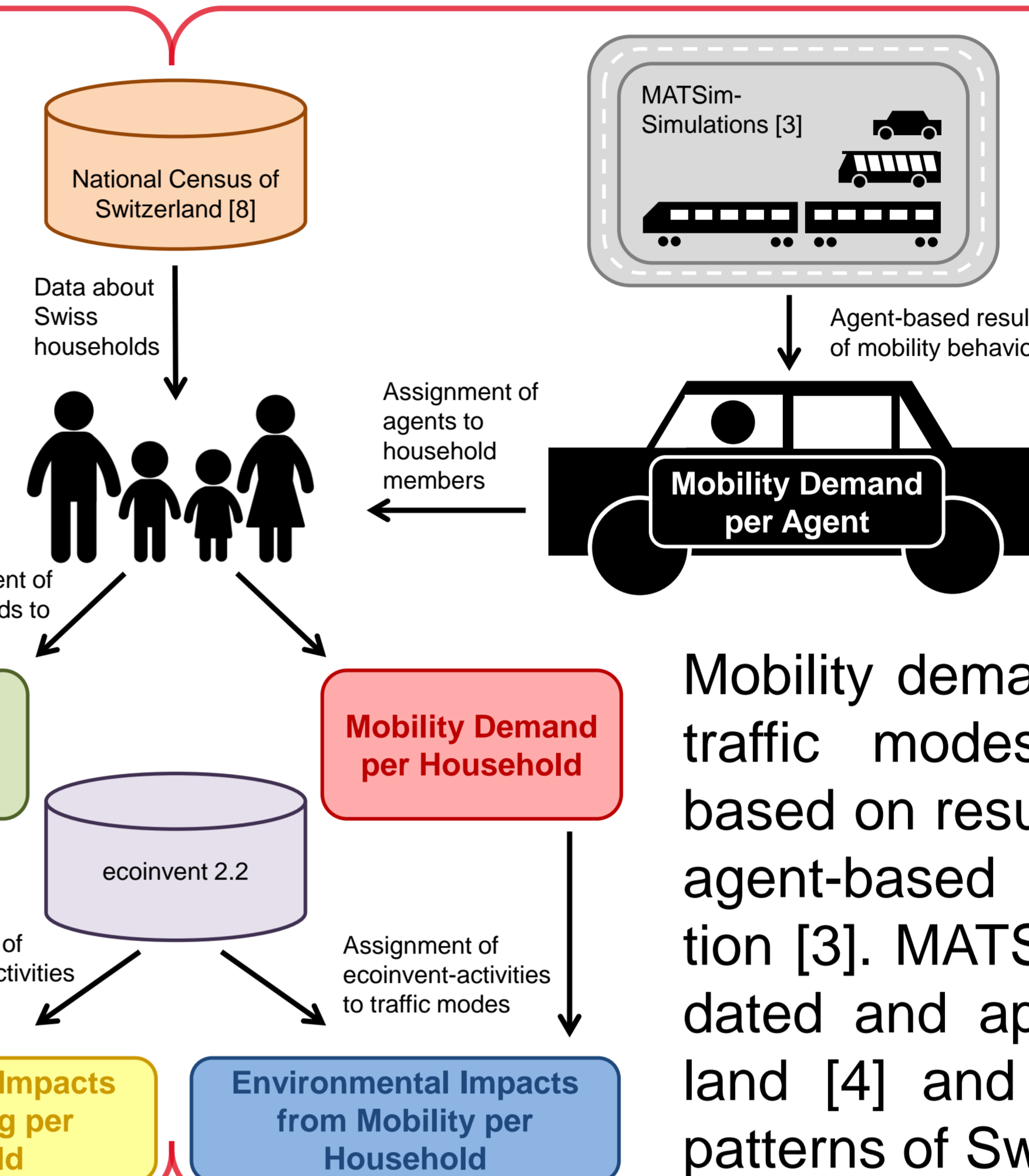
The assessment of environmental footprints induced by housing and mobility demand of households is essential to derive strategies for the abatement of adverse energy-related effects. Therefore, a model for the life cycle assessment of individual housing and land-based mobility was developed [1]. The goal of this study was to apply this model to the Swiss municipality of Zernez. An extensive dataset of measured heating loads was available in this case study [2] and enabled a detailed evaluation of the underlying housing energy demand model.

Housing Demand Model

Energy demand for housing was assessed by simplified energy balances and data retrieved mainly from publicly accessible databases ([5]-[7]).



Mobility Demand Model

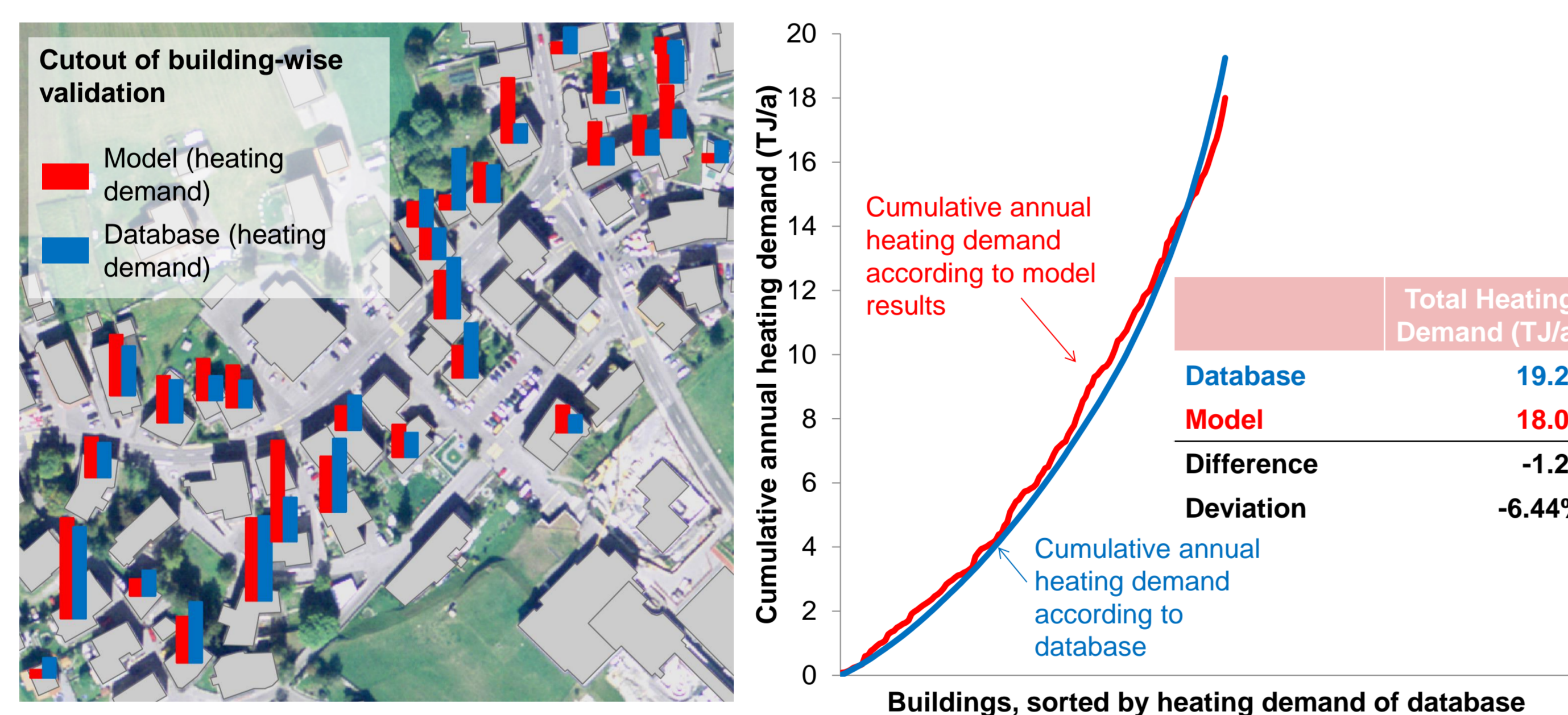


Mobility demand for land-based traffic modes was evaluated based on results of MATSim, an agent-based transport simulation [3]. MATSim has been validated and applied for Switzerland [4] and provides mobility patterns of Swiss inhabitants.

Case Study

Zernez (GR) is a small municipality located in the Swiss Alps. A survey provided detailed data [2] for each building in Zernez allowing for a validation of the applied housing energy demand model.

Evaluation of Housing Energy Demand Model

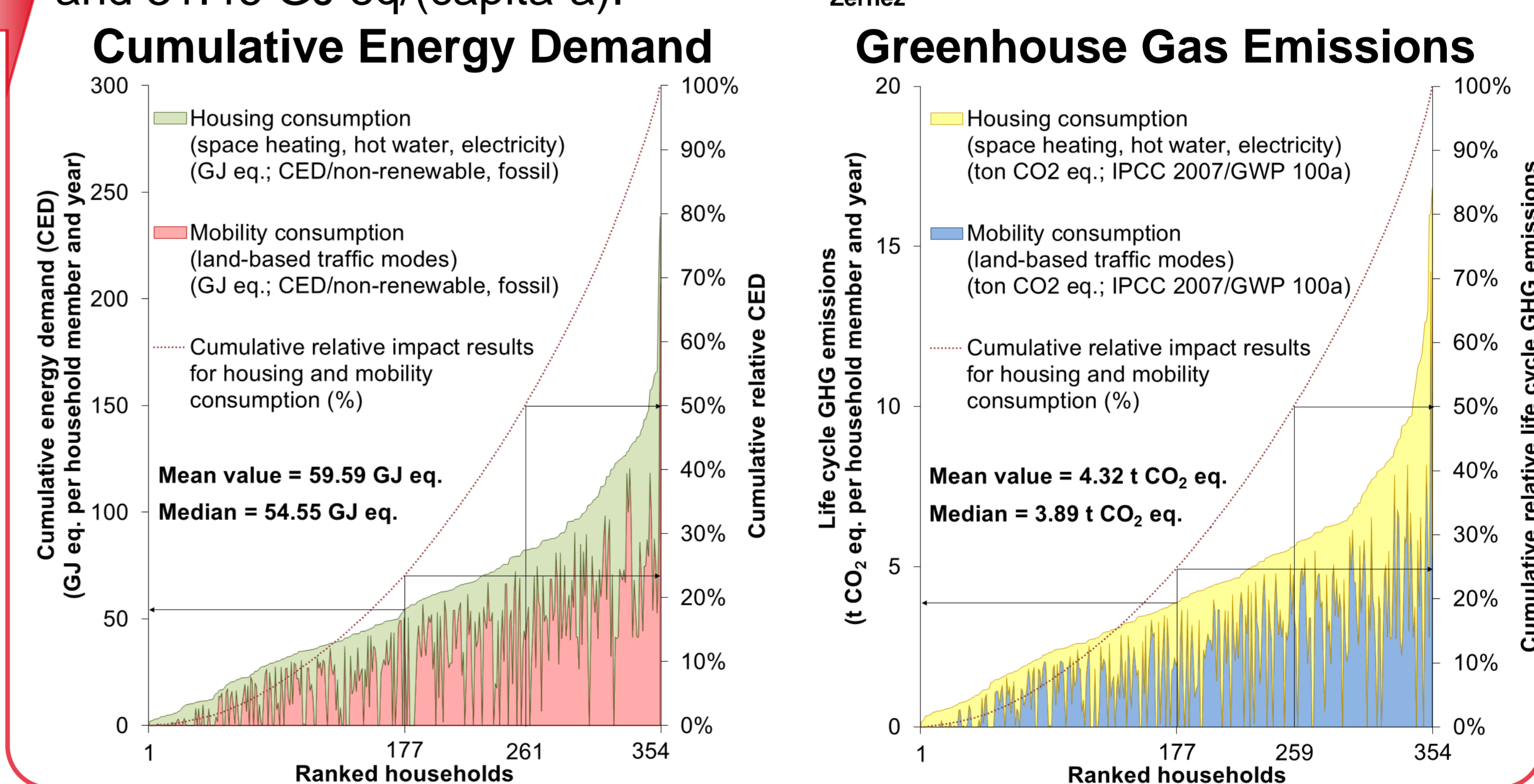


- Annual heating demand of 133 residential buildings in Zernez was computed by the housing energy demand model;
- Building-wise comparison of model results and database;
- Large deviations for some single buildings; explainable by occupants' behavior, construction types of traditional buildings, and assumptions to derive heating demand from measurements (efficiencies, electricity use);
- Cumulative and total heating demand are well reflected;

Model is **not able to simulate single buildings** always accurately, but it reproduces well the overall characteristics of the residential building stock's heating demand.

Results & Discussion

- LCA of housing and mobility impacts per household in Zernez (s. flow diagram); impact assessment methods: Cumulative Energy Demand (non-renewable, fossil) and IPCC 2007 (GWP 100a);
- Approximately **26-27% of the households** are responsible for about **50% of the environmental impacts** from housing and mobility;
- Housing and mobility are equally important consumption areas;
- Land-based mobility GHG emissions comparable to Swiss average; housing GHG emissions below Swiss average due to the large share of buildings heated directly by low-carbon Swiss electricity mix;
- More than **99% of mobility impacts stem from motorized private transport**. Mean: 2.15 tCO₂ eq/(capita·a) and 31.46 GJ eq/(capita·a).



Conclusions & Outlook

The simplified housing energy demand model worked well on an aggregated level in the case study and mobility demand corresponded well with national data. This model is unique in that the analysis of impacts on household level enables the identification of targeted measures aimed at lowering environmental consequences, while the simplicity allows also for simulations on the national scale. In a next step, **this model shall be applied to the whole of Switzerland**. This will allow for studying the interrelations of mobility and housing from a nationwide perspective and it will support the definition of corresponding urban settlement typologies. These results can then serve as a basis for the development of political measures for reducing overall impact.

Acknowledgements & References

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