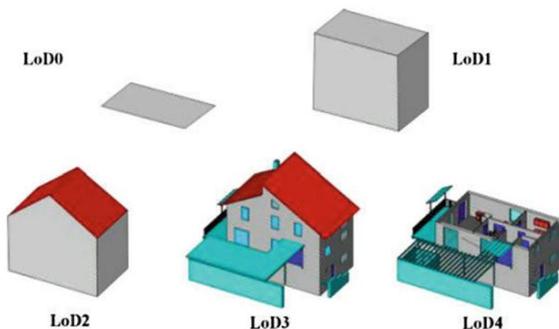


The Modelling of Energy Performance in Residential Buildings and the Significance of Levels of Detail

In times of climate change, the analysis and visualisation of buildings' energy performance becomes increasingly important.

This study builds upon a 3D city model used for such studies and seeks to examine how the visualisation of geodata can be improved using modelling methods based on geo-information systems, the significance of the achievable results regarding energy analyses and therefore the contribution that can be made to sustainable urban development.

To enable the possibility to describe different levels of representation, CityGML introduces so-called levels of detail. They are supposed to define how detailed a city has been modelled.



Levels of detail provided by CityGML

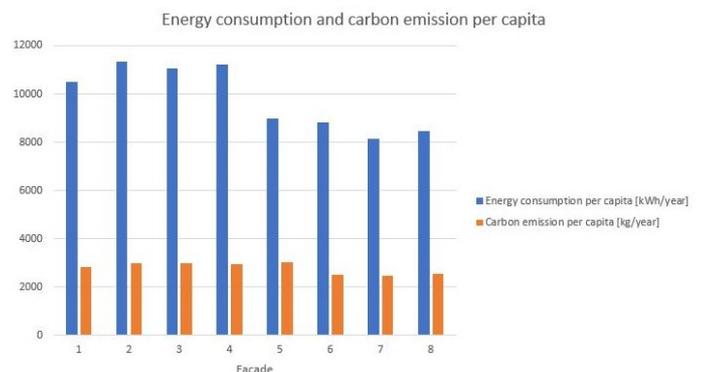
Improving the level of detail of the existing 3D city model requires the modelling of eight different façade types.

Subsequently, the types are identified using Google Street View and Bing StreetSide and modelled with the help of Esri's software „CityEngine“.

Eventually, a new column is added to the attribute table, containing the particular type of façade and the model is exported to ArcGIS as a geodatabase.

To perform a sensible analysis, several factors need to be taken into account, namely location, façade type, house group and occupant type.

The average values of carbon emissions and energy consumption are calculated per household, volume and capita. This enables the analysis to be more detailed and to identify the reasons for differences in energy performance and therefore, possibilities to reduce those figures.



Energy performance per façade type and capita

In general, none of the examined charts shows big differences in energy performance that can certainly be explained by any one of the analysed categories. There are no significant variations regarding carbon emissions and also the values for energy consumption only vary in a relatively small range.

After going on to investigate the urban context of the buildings, it appears that the differences lie in the context, where the buildings are sited in relation to one another as a mass of material, rather than the type of building, system or occupant. Conclusively, this category ought to be explored further.