Change in design targets for building energy towards smart cities

Designing cities from an overall energy optimization system point of view, demands changes in engineering procedures. Traditionally the design was driven independently between the involved domains and energy system components. By modelling the whole energy system in one, it is expected that there are exposed solutions where synergy effects arise that unleash extra saving potentials. Based on the insight gained by the simulations, IT intelligence and cross-component communication are to be invented to control the components and hereby to optimize the total system performance. One main strategy in doing so is, to move demands from high demand periods to low demand periods and hereby to avoid “peak” demands. This is called “flexibility” within the terminology of “smart grids”. In early solutions the search was for energy capacities within the domain of the electrical grid, hence car batteries where seen as relevant solutions for providing flexibility. However, it seems that the demand is too large for electricity-only solutions. A next search for flexibility is aimed at finding electricity-thermal energy solutions such as electrical heating and cooling, heat pumps and cooling technologies that can help to stabilize the el-grid. To acquire even higher potentials, thermal system components are studied these days upon their flexibility potentials, such as heating and cooling of whole building structures. Hereby the question arises, how much “flexibility” there is in relation to the thermal capacities of buildings that enable shifting energy demand for heating and cooling over periods of hours? While the availability of these capacities is a topic of current research, the consequences for building design are obvious. While we in the past could focus on energy optimization, we now have to design our buildings to its context, offering flexibility to the surrounding energy system. No final answers are given due to the fact that this is the edge of current research in this field, while a first concept draft is presented here.

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