Towards a Minergie®-standard for tropical climates

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Abstract

The Minergie®-standard is among the most applied building energy label in the world (about 20'000 labelled buildings in Switzerland by the end of 2010). It is obviously a strong incentive for designing low energy buildings in a perspective of climate change, as the standard not only asks for low energy consumption, but for above average comfort and competitive cost. It has even been extended by "Minergie-Eco" (low environmental impact buildings) and "Minergie-P" (optimized for passive solar gain). However, the methodology applied to evaluate the building energy performance and the conditions for getting the label are yet valid for temperate - cold climates only, where buildings are dominated by space heating and domestic hot water production and where cooling is only a minor issue. For hot and humid areas, a Minergie®-standard exists for small villas in southern Japan only, where heating and cooling are equally required. There is therefore a need for a similar standard that can be applied to different types of buildings in areas dominated by cooling loads, as it is common in the tropical and sub-tropical climates of the world.

The new EPFL campus planned in Ras al Kaimah (United Arab Emirates) should be exemplary and gather buildings with high user comfort and best energy performance. Therefore, a project was launched by the Dean of EPFL Middle East, together with Minergie®-Association and the Solar Energy and Building Physics Laboratory of EPFL, in order to set-up a new Minergie®-standard for tropical climates.

In order to initiate this project, two buildings (a single family dwelling and an office building) were chosen and assessed using a simplified monthly energy balance method. Starting from the current buildings configurations, several variants implementing various improvements towards energy efficiency were considered. On the other hand, the single-family dwelling was simulated at an hourly time step using a detailed dynamic thermal model based on the computer simulation programme Energy plus issued from LBNL. The monthly energy consumption of the dwelling shows a good correlation with the monitored data. In addition to that, both energy consumptions, calculated with the dynamic and the simplified models are close to each other, giving confidence to the predictions of the latter.

These study shows that it is possible, by implementing well-known energy saving measures at a reasonable cost, to reduce the energy consumption for air conditioning (mainly cooling and drying) of these types of buildings by a factor larger than five. These measures include, namely:

- Thermal insulation of the building envelope (walls, roof and windows)
- Efficient adjustable solar shadings
- Airtight envelope and enthalpy recovery through efficient HVAC systems
- Efficient appliances and lighting
- Solar hot water heater.

Other computer simulations and validations remain however necessary to support the future labelling rules of the Minergie®-standard for tropical climates.

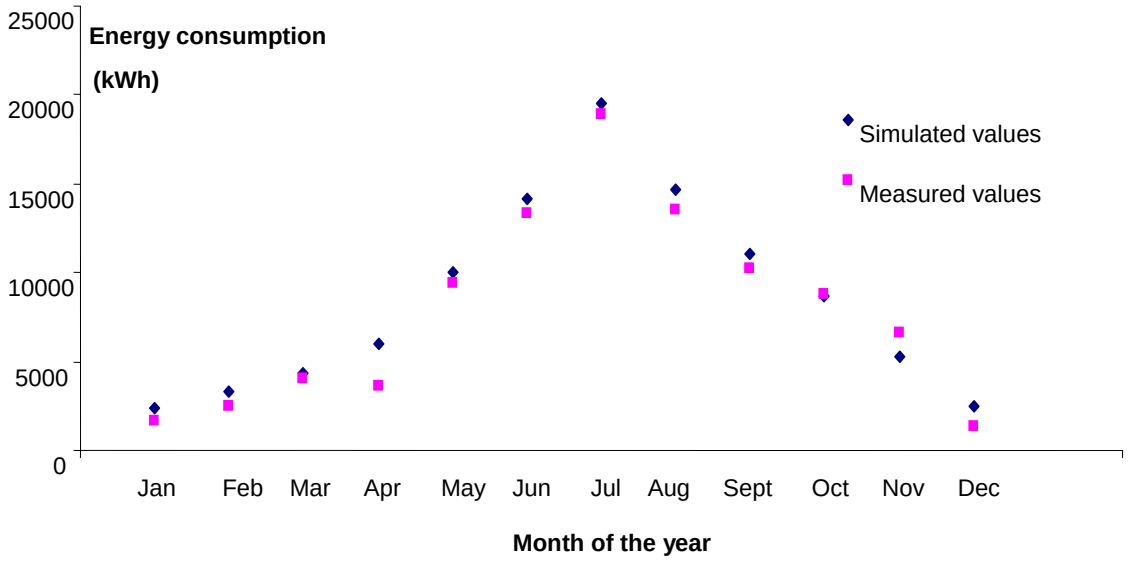

Figure 1: Measured monthly energy use and results of dynamic simulation of the family house.

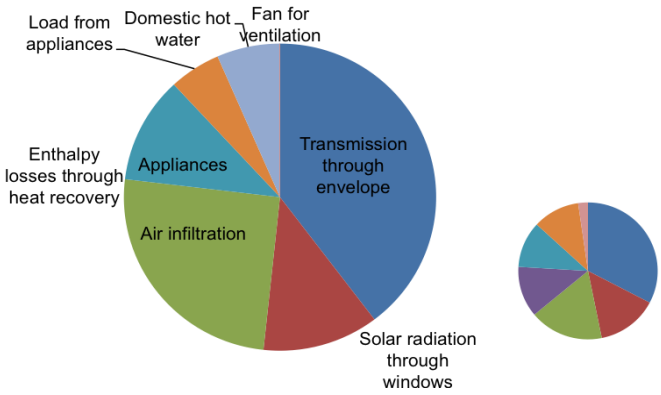

Figure 2: Electricity used for appliances and for compensating heat loads. Left: existing home, right: home built according to energy efficient standard. The areas of the disks are proportional to the electricity use.