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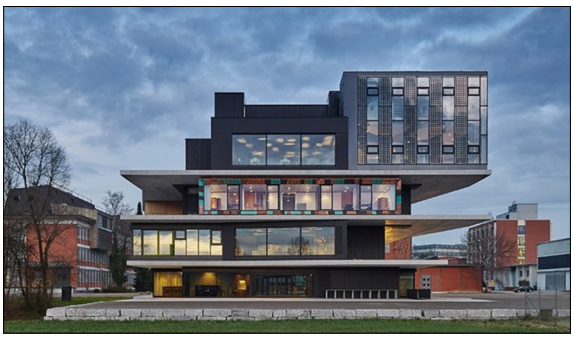
Energy ratings for building design

Verification of energy rating with seasonal factors at units of NEST



The NEST
https://www.empa.ch/de/web/nest/overview

$$Energy\ index\ E = \frac{Energy\ demand\ E_D * weighting\ faktor\ g}{Energy\ reference\ surface\ A_E}$$

Formula to calculate the energy rating
Own presentment

Unit	Energy rating [kWh/m²]	Limit [kWh/m²]	OK?
UMAR	26.60	38	✓
VW	37.85	38	✓
SFW	22.82	<0	×
SolAce	9.02	38	✓
m2c	60.7	53	×

Calculated NEST energy rating for each Unit
Own presentment

Introduction: Energy efficiency is an increasingly important issue. This also applies to building services engineering. To evaluate the energy efficiency of buildings, there is the so-called energy rating. This key figure is defined by the SIA 380 and is the total energy demand multiplied by a weighting factor and divided by the energy reference area. The MuKEn and the MINERGIE standard use this energy rating as a measure of the energy efficiency of buildings.
Empa has also defined an energy rating for its new modular research and innovation building NEST. NEST serves as research and test environment for new technologies in the building sector. The building consists of various temporary so-called “units” where research can take place under real conditions.
The aim of this work is to calculate the energy rating for the units of NEST and to analyse the results.
A more detailed statement about NEST energy rating should be made. For this purpose, the energy requirements of the individual units were evaluated with MATLAB and the energy rating was calculated. To verify the influencing factors of the NEST energy rating a case study and sensitivity analysis was carried out.

Result: All units, except for the "Meet to creat" (m2c) and the "Solar Fitness and Wellness" (SFW) units, can comply with the limits imposed by Empa. The m2c unit is a pure office unit which does not implement any special energy efficiency measures. The SFW unit is a solar fitness and wellness unit which should be able to cover its own energy requirements and the energy requirements of the units on the lower floor, which is not the case.
The limit of NEST energy rating is less strict compared to MuKEn 2014. If the MuKEn energy rating is calculated for the individual units, only the unit SolAce can meet the limits. The reason for this is that this unit produces a lot of solar energy.
The case study revealed that especially the production and feed-in of electrical energy has a positive influence on the NEST energy rating. Measures such as the improvement of the building envelope or the supply or use of solar thermal energy have a smaller influence on the energy rating. The leverage of NEST energy rating is therefore the production of electrical energy.

Conclusion: With regard to the MuKEn 2014, a tightening of the limits may be considered. Although the derivation of the NEST limit is physically well-founded, the limit can be kept despite partly high thermal energy consumption compared to standard use according to SIA 2024:2015 references. The NEST indicator can be tightened up by introducing, for example, monthly weighting factors or increasing the thermal weighting. By adjusting the weighting factors, the incentives can be shifted to different criteria, e.g. own consumption. In this way, the incentive can also be balanced between thermal and electrical energy. Thereby, the building envelope also receives higher weighting.