

SHORT REPORT

Title

long version: Statistical analysis of proportions of net floor areas and user electricity demand in zones of non-residential buildings (Förderkennzeichen SWD-10.08.18.7-18.29)

Occasion/ status quo

For common non-residential buildings, there are only few information about the occurrence of different building zones and their proportional net floor area available. In addition, there is a lack of normative possibility to estimate the overall user electricity demand in the energy balance of non-residential buildings with assured characteristic values in a realistic way.

Subject of the research project

This research project analyses the composition of building zone net areas of real non-residential buildings as well as user-specific influences in the equipment and use of electrical devices, based on a statistic-empirical sampling method.

The analysis of the composition of building zone net areas is based on 200 given data sets of non-residential buildings out of 5 selected categories of use (office and administrative buildings, schools, retail buildings, event buildings, hotels). At first, the room-by-room collected sample allows to determine characteristic values of the statistic appearance of building zones and their proportion of the net floor area.

For single buildings, which are representative, a further detailing follows by a building zone related, room-by-room documentation of the electrical devices (type, quantity, characteristics of power) and their intensity of use (duration of operating states) in a second step.

In the next step, electrical power characteristics are figured out by a systematic research in available documents. The intensity of use is given by several user interviews and data from technical standards. Information about the measured overall electricity consumption of single buildings for at least one year are collected and interpreted.

Based on the acquired data about the net floor area, electrical appliances and their characteristics of use the overall annual electricity demand has been calculated. All given electrical devices have been considered. Afterwards the calculated demand is compared and balanced with the available data of the measured consumption.

A conclusion about the overall user electricity demand can be made subtracting the approximately calculated demand for facility systems (heating, cooling, lighting, ventilation, domestic hot water) and further electrical consumers (central technical services, various equipment, exterior lighting) from the overall electricity demand.

Following this, all rooms of each building zone are considered separately. By connecting the qualitative and the quantitative characteristics of every device with the related room areas, specific annual building-zone-related characteristic values of the user electricity demand can be developed. A further exploration deals with the range of typical features of electrical devices in common building zones, based on the collected data, to design different categories of using intensity and a more detailed matching.

In a model calculation, the developed characteristic values of the user electricity demand are combined with values of facility systems from existing technical standards to validate the range of the overall electricity demand. This calculation includes all remaining buildings of the sample data for which values of the overall annual electricity consumption are available.

Conclusion

This report provides detailed information about the composition of differently used non-residential buildings. Frequency distributions of building zone net areas are given for administration buildings, schools, day nurseries, food markets, hotels with a restaurant, museums and theatres.

As the result of the modeling of the overall electricity demand in 7 administration buildings, 10 schools and 1 day nursery, specific annual building-zone-related characteristic values of the user electricity demand have been developed.

Detailed values (low / medium / high) for 10 frequently appearing building zones and initial values for 2 rarely appearing building zones can be given. Additionally, this report provides an overview of typical features of electrical devices in different categories of using intensity.

Key Data

Short title: "Proportions of net floor areas and user electricity demand in non-residual buildings"

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Share of federal grant: 32.878,89 €

Project duration: 15 months (01/19-03/20)

Project supervision by the Federal Institute for Construction, Urban and Regional Research: Dr.-Ing. Arch. Arnd Rose

Illustrations

Picture 1: A1_1_SWD1008187_1829.jpg (Report: Abbildung 1)

Caption: Methodology to elaborate specific building-zone-based values for the user electricity demand

Picture 2: A2_4_SWD1008187_1829.jpg (Report: Abbildung 4)

Caption: Context of calculation to elaborate statistical proportions of building zone areas and values of user electricity demand

Picture 3: A3_15_SWD1008187_1829.jpg (Report: Abbildung 15)

Caption: Origin and distribution of non-residential buildings in the collected sample

Picture 4: A4_25_SWD1008187_1829.jpg (Report: Abbildung 25)

Caption: Relative proportions of building zones based on the net floor area – office and administrative buildings – entire building

Picture 5: A5_67_SWD1008187_1829.jpg (Report: Abbildung 67)

Caption: Specific annual user electricity demand – usage profile no. 01 (single office)

Picture 6: A6_93_SWD1008187_1829.jpg (Report: Abbildung 93)

Caption: Compositions of the overall electric demand – relative shares – office and administrative buildings