COMPARISON OF NEW SLOVENE REGULATION "THERMAL PROTECTION AND EFFICIENT USE OF ENERGY IN BUILDINGS" WITH EnEV

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ABSTRACT

In the framework of harmonisation of the Slovene legislation with the European, in 1995 the Ministry of Environment and Physical Planning of the Republic of Slovenia began with the preparation of new Slovene standards and regulations. In the first phase adopting of a whole range of standards was planned. In the second phase, which is presently running, the preparation and adopting of regulations has to be completed. In the field of building physics the work on regulations for day-lighting in living and working environment, energy use in buildings, ventilation, waterproofing and glass is underway. This paper presents the proposal for a new Slovene regulation on "Thermal Protection and Efficient Use of Energy in Buildings". The Slovene regulation is in the preparative phase, thus certain points can still be discussed and changes can be made. The presentation is designed as a case study. The annual energy use is calculated according to two regulations: the new Slovene regulation proposal and the German "Energieeinsparung-Verordnung". The comparison is carried out on a case of a simple residential building of 196 m^2. The building has a rectangular floor-plan with 8 m and 12 m sides. It is 6 m high (ground-floor and 1st floor). On the basis of both calculations comments on similarities and differences are presented.

KEYWORDS
environment. building physics. energy use. buildings. legislation.

1. INTRODUCTION

In the framework of the harmonisation of Slovene legislation with the European, in 1995 the Ministry of Environment and Physical Planning of Republic of Slovenia began with the preparation of Slovene standards and regulations in the field of construction works. In the first step, which is currently in the final phase, the adopting of a whole range of new standards was planned. In the second phase, which is presently running, the preparation and adopting of new regulations has to be completed. A group of experts who gathered around the Chair for Buildings and Constructional Complexes at the Faculty of Civil and Geodetic Engineering in Ljubljana is working on new regulations for day-lighting in living and working environment, thermal energy in buildings, ventilation, waterproofing and glass. A special attention is paid to the inclusion of the Construction Products Directive CD 89/106 EEC into the legislation.This paper presents the proposal for a new Slovene regulation 'Thermal Protection and Efficient Use of Energy in Buildings'. The presentation is designed as a case study. The annual energy use is calculated according to two regulations: the new Slovene regulation proposal and the German 'Energieeinsparung-Verordnung' (EnEV). The comparison is carried out on a case of a simple single family house.

The current regulation on managing energy use in buildings in Slovenia is one of the most obsolete legal documents in the field of building physics. In practice smaller objects built by private investors are much better thermally insulated than should be according to the regulated values. More problematic are larger buildings (multy-family houses built by developers and then sold in the market, and public buildings), where the designers and investors due to their poor knowledge in this field or due to lack of financial interest stick to the maximum values.

Nevertheless in the recent years the way the architects dealt with energy flows through building has changed greatly. More and more architects, builders and designers use the holistic approach toward the design of buildings (form and orientation, approach toward construction, control of energy use, aesthetics, day lighting, structure of envelope,...). Dealing with energy issues in the design has gained importance not only because of the potential energy savings and thus smaller impact on the environment, but also because of the awareness that human well being plays an important role in the working process. The consideration of this problem from various perspectives should be encouraged through the legislation, too. It would support the understanding of the principles of energy efficient design and stimulate designers to produce a quality living and working environment.

2. BASIC PROVISIONS

As boundary conditions for the development of the Slovene regulations the following provisions were defined:

- the regulations must comply with the basic philosophy of the Slovene energy policy,
- they must comply with the CD 89/106 EEC,
- the regulations must correspond to the Slovene standards, regulations and regulations for day-lighting, artificial lighting, glazing, energy consumption, sanitary requirements, and fire safety requirements,
- they should support the understanding of the principles of ecologically conscious and energy efficient design and quality living and working environment,
- they must be as simple as possible and they should be formulated in a way that permits only one interpretation,
- their basic requirements should be easy to calculate and control.

Remarks given in the first lines concern mostly the experts dealing with writing of the regulations and the governmental structures. Designers and users of buildings are affected indirectly. On the other hand the last three lines concern the wider public, the users of buildings and designers, because quality living environment often presents a problem, especially when dealing with larger residential and public buildings.

Users of the regulation are first of all architects and they are - especially older generation – used to the old ways of controlling thermal behaviour of the building. With the introduction of the new standard, SIST EN 832, the calculation has changed substantially. The controls in the new regulation have spread from separate elements of the envelope on the building as a whole. They are more complicated to calculate and take longer time of execution. Quick manual controlling of the building adequacy is no longer possible. With the introduction of the new regulations new software for the calculation will be necessary.

Controlling of the calculated values for civil servants is ensured by the introduction of an "energy card" in which, besides the calculated values, the maximum allowed values have to be indicated too.

3. CASE STUDY

3.1 Simulation Model

The comparison between the two regulations is designed as a case study. The annual energy consumption is calculated according to two regulations: the new Slovenian regulation proposal and the German "Energieeinsparung-Verordnung". Since the Slovenian regulation proposal has not been entirely completed, the cross - checking was made with the current Slovenian regulation too. The comparison is carried out on a case of a simple single family house. This is the most commonly built type of residential house in Slovenia. We can consider it as a representative of the majority of single family houses. It has a rectangular floor-plan with 8 m and 12 m sides. The longer side is oriented toward south. It is 6 m high (ground-floor and 1st floor). The south facade has 20% of glazing, the north facade has 5% of glazing, east and west facades have 10% of glazing. Floor to floor height is 2.7 m (Fig.1). The roof is sloped and unheated.

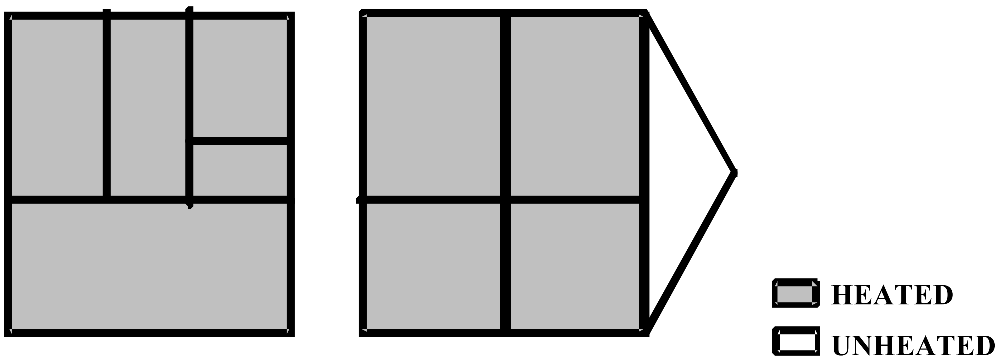

Figure 1: Scheme of the typical one family house (floor-plan and cross section)

3.2 Calculation According to EnEV

In EnEV, similarly to the new Slovenian regulation proposal, the energy demand of the building is regulated via the maximum allowed heating energy consumption per year (depending on the shape of the building) and with the maximum allowed transmission factors of the building envelope elements (independent of the shape). The calculations are carried out on the basis of EN 832.

In the first step we calculated the annual heating energy demand according to the maximum allowed U values for the building envelope (the way that is practised in the current Slovenian regulation). According to the EN 832 calculating procedure the annual heating energy demand is 22366 kWh.

According to EnEV the annual heating energy demand adds up to 15408 kWh or expressed differently to 92.95 kWh/m2. The energy consumption is 7.8% over the maximum allowed, which ads up to 86.65 kWh/m2. The correction of the transmission factors was necessary to adapt thermal performance of the building to the regulated values. We lowered the thermal transmittance of external walls from 0.45 W/m2K to 0.40 W/m2K and improved windows from 1.7 W/m2K to 1.5 W/m2K. U values of the ceiling adjacent to unheated roof and U values of the floor remained the same. With these values the demands met exactly the requirement (Table 1).

TABLE 1
Table of used U values and calculated heating energy use according to EnEV

Elements of the envelope	U max. (W/m2K)	U corr. (W/m2K)
external wall	0.45	0.40
Ceiling	0.30	0.30
Floor	0.50	0.50
Window	1.70	1.50
annual heating energy demand - EN832 (kWh)	22366	20931
annual heating energy demand - GeNV (kWh)	15408	14354
annual heating energy demand – GeNV (kWh/m2a)	92.95	86,60

3.3 Calculation According to the "Thermal Protection and Efficient Use of Energy in Buildings" proposal

In the case of the new Slovenian regulation the energy demand of the building is regulated via the maximum allowed heating energy consumption per year, which depends on the proportion between the heated volume and the area of the building envelope. Separate elements of the building envelope are also regulated with the maximum allowed U values. The annual heating energy calculations are based on SIST EN 832.

The control of the new Slovenian regulation proposal was carried out as followed. First we calculated the annual heating energy demand only on the basis of the maximum allowed U values. In the next phase the thermal transmittance of the building envelope had to be corrected in order to meet the requirements concerning annual heating energy demand in residential buildings according to the proposal. The demand was also calculated according to the current Slovenian regulation and to GeNV.

The annual heating energy demand according to the maximum allowed U values of the building envelope (the way that is practiced in the current Slovenian regulation) was calculated first. On the basis of SIST EN 832 the annual heating energy demand is 25015 kWh and is 35 % over the maximum allowed annual energy consumption.

According to EnEV the annual heating energy demand adds up to 24769 kWh (105.28 kWh/m2a). The energy consumption is according to EnEV 20.5% over the maximum allowed value. Correction of the transmission factors was necessary to improve the thermal performance of the building. We lowered the thermal transmittance of external walls from 0.60 W/m2K to 0.30 W/m2K. U values of the ceiling adjacent to unheated roof were lowered from 0.45 W/m2K to 0.40 W/m2K. U values of the floor and windows remained unchanged. At the same time these are the U values usually used in architectural practice for buildings of this type. With these values the demands of the proposal were met exactly (Table 2). If we compare the result to the EnEV demands, the annual heating energy use is by 11.8% lower than the maximum allowed value.

The comparison of the new Slovenian regulation proposal and GeNV with the current Slovenian regulation (JUS U.J5.600) shows that the maximum allowed U values of the latter are substantially higher. The calculation of annual heating energy demand according to SIST EN 832 shows, that energy consumption is by 40 % higher than in the case of the calculation according to U values regulated in the new proposal, and by 93 % higher than in the corrected case (according to the maximum allowed annual consumption). If we compare the current regulation values with the values denoted in GeNV, we see that the annual heating energy consumption would be by 72% higher than the maximum allowed.

TABLE 2
Table of used U values and calculated heating energy use according to Slovenian regulations

Elements of the envelope	U max. current (W/m2K)	U max. new (W/m2K)	U corr. (W/m2K)
external wall	0.80	0.60	0.30
Ceiling	0.70	0.35	0.30
Floor	0.65	0.45	0.45
Window	2.50	1.50	1.50

annual heating energy demand EN 832 (kWh)	33966	25015	18581
annual heating energy demand GEnV (kWh)	24769	24769	12665
annual heating energy demand GenV (kWh/m2a)	149.4	105.28	77

4. DISCUSSION

If we compare the both regulations we see that they are based on EN 832, which enables the basic comparisons. During the comparison of the maximum allowed U values we found out that the demands of the regulations are similar, the only difference worth mentioning occurs between the outer wall values where the Slovenian value is much higher (0.6 W/m2K compared to 0.45 W/m2K in GEnV). The calculation carried out on a simple single family house proved the following results. If we take into account only the maximum alowed U values (the current way of calculating transmission losses in Slovenia), EnEV shows 22366 kWh annual energy consumption. Similar calculation according to the Slovenian proposal shows 25015 kWh per year. This means that according to the Slovenian regulation proposal the energy consumption would be by 12 % higher than the consumption calculated according to EnEV. If we correct the U values to the point where the annual energy consumption of the building corresponds to the maximum allowed values according to both regulations we see that the Slovenian regulation demands by 11.8% lower consumption than GeNV. Similarities or differences concerning the maximum allowed transmission losses can not be commented because the data for Slovenia that would enable the calculation has not been prepared yet.

In the Slovenian proposal there also appear demands concerning hot water collectors. For buildings with not more than four apartments, when the orientation and the slope of the roof are appropriate and the actual degree of the sun exposure enables the use of solar energy, installation, connecting the collectors on the roof and the boiler has to be built in. The designers can use flat plate collectors or vacuum collectors. The area of installed collectors for which the owner receives a bonus in form of energy consumption reduction is limited in both cases.

Both regulations demand the "energy card", which is a kind of energy identity card of the building and has to be added to the building permit project. The data stated in the card are similar in both regulations and comprise of area and volume data of the building, U values of opaque and transparent elements, transmission losses, annual heating energy demand and in Slovenian case data on collectors. In both regulations small buildings have simplified treatment.

5. CONCLUSIONS

In the recent years the way architects have dealt with energy flows through the building organism has changed greatly. More and more architects, builders and designers use the holistic approach toward the design of buildings (form, construction, energy, aesthetics, daylight, envelope,...). The consideration of energy issues in the design has gained importance not only because of the potential energy savings and thus smaller impact on the environment, but also because of the awareness that human well-being plays an important role in the working process. Daylight, adequate thermal conditions and air quality are among the most important factors for creating quality internal environment. The new regulations in the field of energy use in buildings the approach should follow the same path.

The new regulations are expected to be primarily used by practising architects. They have an important role in sustaining and developing the principal aspects of environment conscious building and creating a quality environment. The new regulation in Slovenia will probably cause some turmoil, because of the changed way of calculating the energy response of the buildings. But for the first time the regulation actually enables the designers to predict the consequences of their decisions. The developments in the field of computer technologies help them to do so. It also allows them to combine a whole range of information such as climatic data, site configuration, energy consumption, economical impacts, human comfort, all in the search for the best solution.

6. REFERENCES

JUS U.J5.600
SIST EN 832 – Thermal performance of buildings
Verordnung ueber eneregiesparenden Waermeschutz und energiesparende Anlagentechnik bei Gebaeuden (Energieeinparenverordnung _EnEV)
Pravilnik o toplotni za__iti in u_inkoviti rabi energije v stavb (Regulation on Thermal Protection and Efficient Use of Energy in Buildings)