3 The philosophy – a holistic view

Way back when the Thermal Insulation Regulation was adopted in 1995 the German government believed that there should be a further tightening of the requirements by the end of the decade with the aim of achieving further reductions in energy demand. The Minister of State also called for this when he gave his approval. Back then the aim was to reduce the energy requirement of new buildings by an average of 30 % compared with the Thermal Insulation Regulation 1995 that was in force.

In the Energy Saving Regulation, the 30 % reduction in the energy requirement refers to the heating energy requirement, whereas the Thermal Insulation Regulation 1995 referred to the heating requirement. Therefore it is not possible to directly compare the reference values of the Thermal Insulation Regulation 1995 and the Energy Saving Regulation. The target heating energy requirement in the Energy Saving Regulation is between 40 and 100 kWh/(m^2·a) and will consequently satisfy the low-energy house standard achieved in the meantime in energy efficient construction. In this respect the Energy Saving Regulation stipulates the low-energy house standard without a specific value being set down in the regulation itself.

The Energy Saving Regulation, published on November 21, 2001, continues the balancing concept of the Thermal Insulation Regulation 1995. Referring to new constructions the Energy Saving Regulation includes two new approaches:

1. The building is regarded as a holistic system, combining physical structural properties with installation engineering. The balance between gains and losses forms the focal point. (Expanding the balance boundaries of heating requirement to heating energy requirement).

2. The supplying of a building with energy is also viewed on a holistic level. In other words, the process chain preceding final energy (heating energy requirement) is taken into account by focusing on the primary energy requirement.

In the case of existing buildings, the approach found in the Thermal Insulation Regulation 1995, i.e. setting down minimum requirements for U values based on different components (see Chapter 6, page 22), is retained.

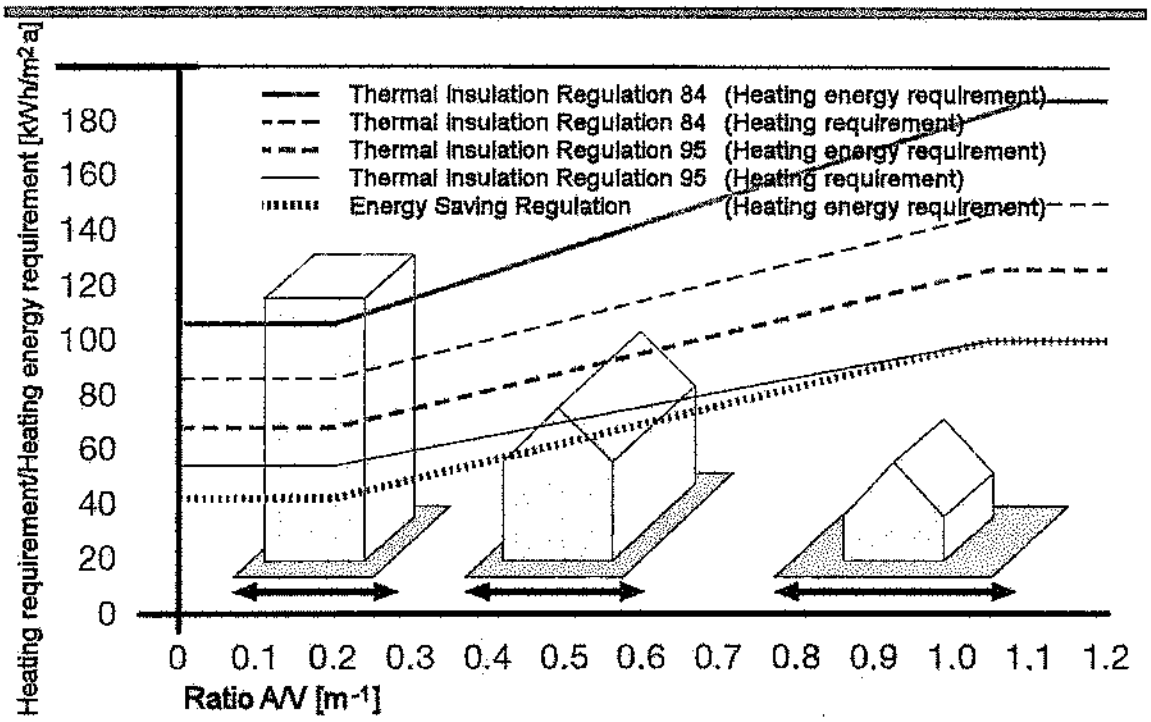

Fig. 10: Different requirement levels: Thermal Insulation Regulations and The Energy Saving Regulation

3.1 The building as a physical structural and installation engineering system

Ventilation-induced losses and losses in the heating system become more important and the significance of individual loss factors changes with a further reduction in heat losses through the building shell (roof, walls, floors, windows, doors). The less the heating system has to contribute to cover heat losses and the heating requirement, the more important its own losses become (generation, distribution, waste gas and regulation losses). It is therefore necessary to incorporate the heating system in the design of the overall energy quality of a building. In residential buildings calculating the heating energy requirement will also include the energy requirement for domestic hot water.

The planning engineers then essentially only have to satisfy one main demand, namely limiting the heating energy requirement. The architects' styling and the client's scope for

decision-making are not restricted as a result. On the contrary, the Energy Saving Regulation makes it possible for the overall heating energy requirement to be satisfied by thermal insulation and/or efficient installation engineering.

3.2 Reference to primary energy

The Thermal Insulation Regulation 1995 calculates the heating requirement as an energy-based characteristic of a building which essentially results from the heat losses of a building and consequently from its physical properties or the quality of the energy.

This heating requirement is covered by the useful energy that the heating system delivers. However, this does not constitute all of the energy (= final energy) that has to be supplied to the building in order to cover the heating requirement because the heating system experiences losses which have an effect on the energy requirement. Building-related losses and heating system-related losses together produce the heating energy requirement.

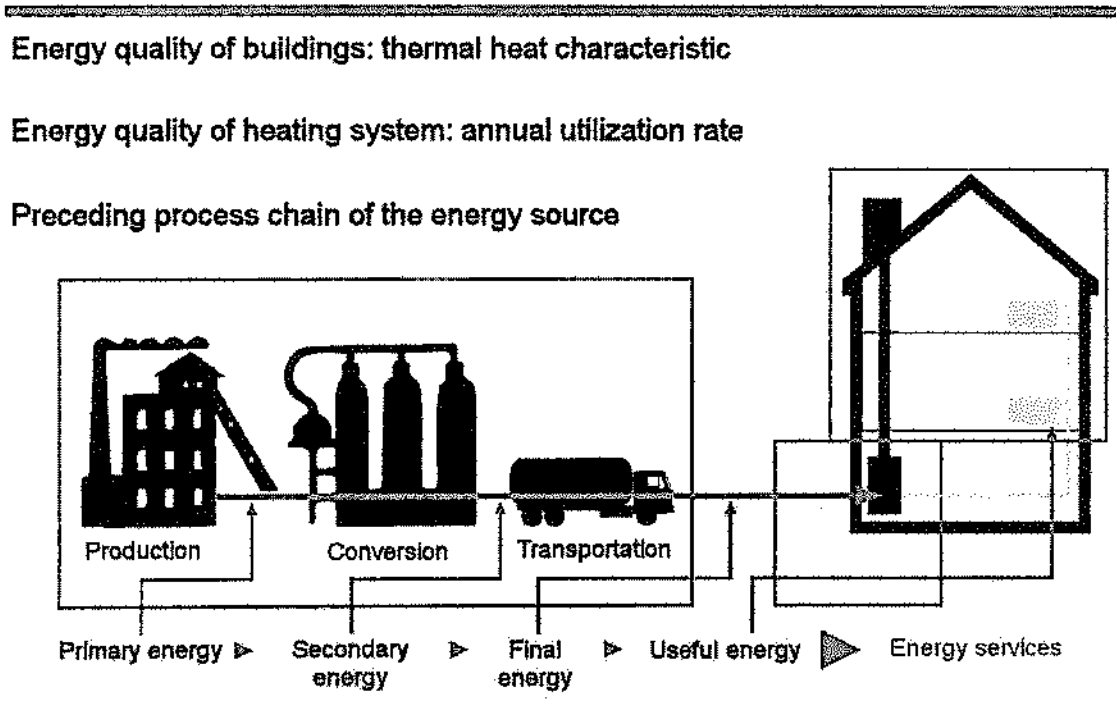

Fig. 11: Types of energy and balance boundaries

The heating energy requirement, i.e. final energy, is determined in the Energy Saving Regulation, and what is known as the balance boundary from the outlet of the heating system to the building boundary is transferred into the balance sheet.

This makes it possible to include the process chain (which precedes the final energy supplied) and its losses in the evaluation and to base the requirement of a building on primary energy.

Each heating system (equipment configuration plus energy source) experiences some losses during conveyance, processing, conversion, transportation and distribution of the energy source. The equipment energy requirement index e_p takes account of the fact that different amounts of primary energy are required to generate one kilowatt hour of final energy, depending on the heating system and energy source. The e_p value ranges between 0.1 in the case of renewable fuels and 3.0 for electricity (see Fig. 12). The basic initial decision for a specific energy source and therefore for the overall balancing of energy consumption has already been made with the choice of heating system. This initial decision constitutes the start of the planning stage and involves consultation with the architect and/or the engineer.

Energy source	**e_p value**
Fuel oil EL	1.1
Natural gas H	1.1
Liquefied gas	1.1
Hard coal	1.1
Lignite	1.2
Local/district heating from combined heat and power	
Fossil fuel	0.7
Renewable fuel	0.0
Local/district heating from heating systems	
Fossil fuel	1.3
Renewable fuel	0.1
Electricity mix	3.0[1]

[1] *Night storage heaters and electrical domestic water heating in buildings with storage heaters have been rated only at a value of 2.0 For eight years*

Fig. 12: Primary energy evaluation of the energy sources (e_p values)

Source: Energy Saving Regulation, Appendix 1, Section 2.1.2

The focus of the Energy Saving Regulation on primary energy leads to energy sources being treated equally, because the final energy requirement of buildings is evaluated with the losses of the respective process chain and relativized accordingly. If the regulation focused on the final energy requirement instead of the primary energy requirement, heating systems whose losses occurred in the preceding chain, i.e. outside of the building, would be better placed.

It is only by focusing on the primary energy requirement that all heating systems can be dealt with equally. The new evaluation rule for heating system DIN 4701-10 "Energy evaluation of heating and air conditioning systems; heating, water heating, ventilation" establishes the primary energy requirement as a characteristic of the respective equipment system and therefore makes it possible for owners and planning engineers to make an appropriate decision.

3.3 More transparency in energy consumption

The legislative decision to limit the heating energy requirement and simultaneously assess consumption in terms of primary energy means greater transparency for the consumer.

– The true energy requirement can be measured from the actual stocks.
– Actual energy consumption, as it can be read from the energy suppliers' invoices, can be better controlled.

The energy requirement certificate (§ 13) demanded by the Energy Saving Regulation shows the occupier of a building the calculated consumption as a reasonable estimate of the actual consumption and therefore documents a key parameter of the building which will in future also fundamentally determine the value of a property.

§ 13 (4) Energy Saving Regulation

According to German state law the energy requirements certificate ... shall be presented on demand to the relevant authorities and made available for inspection on request to buyers, tenants and other persons entitled to use the building.

The overall evaluation of the energy losses in terms of building physics and installation engineering and the focus on primary energy constitute a new approach. Energy efficiency is aimed firstly at minimizing losses and then at optimizing the energy supply.