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Economical Aspects of Solar-Powered Hot-Water Heating in Multi-Storey Apartment Buildings

The starting point for this study on the economical aspects of hot-water heating in multi-storey apartment buildings is the documentation of existing units that were classified according to predetermined orders of magnitude in respect to the size of multi-storey apartment buildings: small units with a collector area of up to 100 sq. meters, mid-sized units of 100-200 sq. meters, and large units with collector areas comprising more than 200 sq. meters.
In addition to the representation of the unit design and the investment costs, the operating results are documented and from these the cost-effectiveness of the units are deduced. The specific costs of the system, defined as the costs related to 1 sq. meter of the solar units collector area, together with the useful solar heating costs serve as characteristic data for cost-effectiveness. These are ascertained by annualizing the investment costs at an assumed interest rate of six percent and an assumed useful life of twenty years. This factor is then divided by the measured solar yield, whereby repair and maintenance costs annually at one percent of the cost of investment are taken into account.
The specific systems costs range from approx. 2,800 D-Marks per sq. for units with 30 sq. meters of collector area to approx. 1,000 D-Marks per sq. meter for units with 600 sq. meters of collector area. In principle, a significant reduction of costs relative to the increased area of the collector can be detected. In the same way the useful solar heating costs of the documented units are lower as the areas of the collectors increase in size. These costs range from approx. 0.90 D-Marks per KH for small units up to 0.22 D-Marks per KH for large units with a collector area of 300 sq. meters or more.
Yet another facet of this study involves basic considerations concerning the potential for the use of solar hot-water heating in multi-storey apartment buildings. In light of the radically reduced interest in the construction of new multi-storey apartment buildings, older apartments and the possibility of their modernisation in respect to solar hot-water heating have become especially meaningful. In a theoretical experiment on a model it became clear that even eight-storey apartment houses with flat roofs yielded approx. 2 sq. meters of collector area per person and those with slanted roofs approx. 1.4 sq. meters per person when a factor of 0.5 for roof cowls was employed. We can reasonably

assume therefore that principally speaking there are possibilities of employing solar hot-water heating in even higher-storied structures.

The economic feasibility of solar units for the provision of hot water is essentially determined by the specific amount of hot-water consumption as a quotient of consumption and collector area. While it is true that large scale units with low specific levels of consumption indicate a high proportion of solar rate, they nevertheless show lower useful energy yields in relation to the size of the collector area than those with high specific levels of consumption. That is to say that the systems call fill decreases relative to increases in the proportion of solar supply. Many of the units tested indicated that the interpreted levels of consumption had been set much higher than the actual level of hot-water consumption, which meant that the cost-effectiveness of the units were significantly reduced. For this reason the determination of consumption values during the planning phase is of special importance.

Thermal solar energy use has been known and employed in individual projects for decades now. As result there has been a remarkable reduction in costs. This is due above all to the larger units, but also to further developments in, specifically, unit design and unit sizing. Indeed, large-scale units are especially interesting for multi-storey apartment structures and allow over the next few years for a realistic assessment of solar heating costs in the area of 0.15 to 0.20 D-Marks per KH. This falls within a range of conventional energy sources while contributing at the same time toward a better environment.