Chapter 10
Green Retrofit Energy Efficiency Potential on Existing Building Envelope for Residential and Non-Residential Building

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ABSTRACT

The chapter deals with the green energetic consideration of today’s building envelopes for residential and non-residential buildings. It investigates the energetic effects the envelopes have on energy efficiency, energy consumption, material use, sustainable use of resources, lifetime considerations, economic and ecological impact. Today’s it is estimated that approximately 30% of the annual primary energy demand for residential and non-residential buildings is needed. Energy resources for heat, electricity, air conditioning and cooling purposes, fossil fuels in form of gas and liquid are predominantly used.

INTRODUCTION

The aim of this chapter is to give a good understanding of possible renovations to building envelopes. The basics should be pointed out to show and estimate possible potentials in the renovation of building envelopes. First of all, the basic building structures are considered more closely for a better understanding. Then the different components for the building envelope are discussed. From this information, the current method of energy considerations of buildings is explained.

Based on two case studies of an outer wall, the physical and economic calculations are shown. The simulation shows different aspects of insulation, costs and savings.

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GREEN ENERGETIC RENOVATION OF BUILDING ENVELOPES

The chapter deals with the green energetic consideration of today’s building envelopes for residential and non-residential buildings. It investigates the energetic effects the envelopes have on energy efficiency, energy consumption, material use, sustainable use of resources, lifetime considerations, economic and ecological impact.

Today’s thermal energy is estimated that approximately 30-35% of the annual primary energy demand for residential and non-residential buildings are needed. As energy resources for the transformation processes in heat, electricity, air conditioning and cooling purpose, fossil fuels in form of gas and oil are in present predominantly used (BP 2018).

The burning of fossil energy sources since the industrial revolution of the 1800s, CO2 pollution is steadily increasing in our atmosphere (Rosenzweig et al., 2018). This rising Concentrations of greenhouse gases are changing our climate at an ever-faster pace (Hutter, 2018). The consequences of the worldwide use of fossil fuels have been scientifically proven and the causative agent clearly transferred (Schönwiese, 2019).

The annual amount on fossil oil per annum are more than 14,000 Mill litre of crude oil per day and 100 mill tons on coal per day (BP 2018). Generating out of these fossil energy source different energy forms mostly through thermal burning processes more than 32,000 mill tons on CO₂/a are polluted in the air. CO₂ is the second most important greenhouse gas that drives climate warming process. In addition to that, a further large number of health-endangering gases and dusts are emitted into the environment.

The amount of Buildings in Germany in 2018 are roughly 42 Mill. The total surface area is roughly 3,900 Mill m² in Germany (DENA 2019). Worldwide estimation is 42.000 Mill houses and buildings. (Krieger, 2017).

The building envelope comprises all the components enclosing it to the outside, e.g. walls, windows, roofs and floors. For a sustainable construction, especially the thermal building envelope is of importance. It includes all components that separate heated rooms from outside air, from the ground and from unheated rooms. The thermal insulation of the thermal building envelope is crucial for the transmission heat demand of a building (Garzon, 2018; Swan, 2013; Wilson, 2013).

Buildings have a much longer service life compared for example to vehicles. While vehicles could theoretically be replaced by environmentally friendly new vehicles within a decade with appropriate regulations, this is not possible with buildings. And in terms of sustainability, it also makes no sense: the continued use of existing buildings, their renovation, conversion and further construction is usually connected with a significantly lower energy and resource consumption than a demolition and new construction, if the grey energy is included.

Against the background of climate change, resource-conserving energy conversion, efficient use of energy, a circular economy, minimization of waste materials is an existential necessity for humanity. With regard to a circular economy for green building elements, the construction industry is still largely at the beginning. A meaningful old building modernization should be preferred to a new building for economic reasons, because the core thoughts of the sustainability belong the recycling, the secondary use and extension of the life span in a reasonable frame.

With a green sustainable renovation, in addition to the known principles of planning and construction, higher-level aspects must also be noticed. They should ensure that the measure also proves to be ecologically compatible, economically convincing and energy efficient in the long term.