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EFFECT OF FAÇADE INSULATION ON HEATING ENERGY CONSUMPTION, INDOOR AIR QUALITY AND THERMAL COMFORT: CASE STUDY IN SELECTED LATVIAN DAYCARE CENTERS

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ABSTRACT

Nowadays the building sector accounts for about 40% of final energy consumption in European countries, contributing greatly to global warming and climate change. Since most of energy in eastern European buildings is used for heating, thermal insulation of building envelope has recently become one of the most commonly implemented energy efficiency measures. However, energy improvement should not compromise health and comfort of building occupants, especially in daycare environments, where children can spend up to 12 hours daily. This study aims to investigate the effect of façade insulation and tightness on heating energy consumption, indoor air quality and thermal comfort in daycare buildings in moderate climate zone of Latvia. Measurements of carbon dioxide, air temperature and relative humidity were carried out in six daycare centers (old, renovated and new-built), and data regarding heating energy consumption as well as daycare center characteristics and maintenance activities was collected via combination of field visits, record analysis and interviews. This field study showed that different types of building construction as well as ventilation strategies employed by daycare centers can cause significant variations in indoor air quality and comfort. It was found that in all facilities temperature and relative humidity was kept in comfort range. Carbon dioxide concentrations exceeded 1000 ppm in 75% of daycare centers studied, with the highest (1356 ppm) measured in a renovated facility with the natural ventilation system. Thus additional insulation of external walls should be accompanied with installation of more efficient ventilation system (mechanical) to account for air tightness.

Key words: thermal insulation, heating energy consumption, indoor air quality, thermal comfort, daycare center.