період спостережень, а також розраховані емпіричні ймовірності перевищення ГДК як відношення кількості випадків, коли C_i>ГДК$_i$ до загального числа випадків. Величини ГДК застосовувались для рибогосподарського призначення. Всього було досліджено 20 речовин. За такими речовинам як розчинений кисень, азот амонійний, азот нітратний, фосфати, натрій, кальцій, хлориди, сульфати та нафтопродукти за досліджуваний період перевищень ГДК не спостерігалось. Найбільшими забруднювачами для рибогосподарського використання у (1,1-10) ГДК є хром, завислі речовини, манган, хімічне споживання кисню (> 50 %) та мідь, азот нітритний, феноли, цинк, біологічне споживання кисню за 5 діб, залізо (20-50 %).

Висновок. Екологічна обстановка у пункті р. Дунай - м. Вилкове за 2009-2018 рр. була «напруженою» для рибництва, спостерігалися одиничні випадки перевищень ГДК до 50 раз по міді та мангану, в окремі періоди екологічна обстановка погіршувалась до «критичної».

Література:

1. Музалевский А. А., Карлин Л. Н. Экологические риски: теория и практика. – СПб.: РГГМУ, ВВМ, 2011. – 448 с.

INDUSTRIAL DEVELOPMENT OF INOVATE FAÇADE FOR ACHEAVING NEARLY ZORO ENERGY BUILDINGS (nZEB)

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Abstract

The development of technologies, the research for new energy sources and the increase of energy efficiency of buildings is a topic that will be relevant for the coming decades. As an EU member, Bulgaria accepted in 2015 “The National Nearly Zero-Energy Building Plan 2015–2020 (NPSBNPE)”, according to it such a building is considered to be a building that meets the requirements: the primary energy consumption of the building to meet class A on the scale for this class category and not less than 55% of the necessary supplied energy for heating, ventilation, cooling, lighting and hot water supply to be from RES.

This report discusses the task of circulating fluid flow glazing suitable for building façade and interior walls. The aim of the project is the to study the movement of the fluid in the glazing and its behavior in different weather conditions. The behavior of the fluid in the glazing will be studied and thus information can be obtained on how to control the technical parameters of the glazing to ensure comfort in the building. The problem of fluid movement in a double-glazed unit will be solved both theoretically on the basis of computer simulations and experimentally, as the respective experimental installation is now under scientific research.

Introduction

In the modern architecture, the area of the glazing is getting bigger and bigger, and this leads to an increasing influence of the windows on energy efficiency of the buildings. A huge amount of electricity is consumed to provide a comfort room temperature through air conditioning. Instead of this advance glazing technologies and materials can be used to reduce buildings energy demands and improve indoor environment.

While trying to solve this problem arose the idea of an adaptive envelope based on glazing with an inner water circulation with the proposal of creating a better internal environment. This type of window is called Water Flow Glazing (WFG), which is composed by at least one fluid chamber in which the fluid is able to circulate in and out of the chamber. This water chamber is intended to absorb radiative energy and transport heat flow.

This water chamber is connected in a close circuit with a hydraulic pump and a heat exchanger. The flow rate of this circuit is governed by switching on and off a hydraulic pump. Depending on the spectral characteristics of each layer of the glazing, solar radiation is absorbed and later this heat is transported by the water in a close circuit.

The glazing units developed within the InDeWaG project use circulating water in the chamber between the glass planes to capture solar radiation and transport the generated heat through a pipe system to be used for different purposes such as heating, preheating, domestic hot water and others. Via a circulation of heated or cooled water within the glass chamber in the window the whole facade may act as either a heating or cooling device. Demonstrator's activity shows technical feasibility in a near to operational environment. Implementing passive and active strategies minimize the use of active HVAC systems, taking advantage of the available natural resources such as solar radiation, thermal variability and daylight.

The use of such a system will allow maximum utilization of daylight and indoor comfort in the room. the fluid in the transparent glass-blades transforms the passive glass facades into active solar collectors. The heat from the heated fluid in the glazing can be used by the heating and cooling systems.

The double-glazed window with circulating fluid flow is a vertical-shaped module with dimensions of 1.3 m x 3 m, suitable for a facade element of the office buildings. It consists of triple glazing with two chambers (fluid chamber and argon chamber) and a modular aluminum frame. Each module includes its own pump and heat exchanger, which make the individual elements of the module independent. Each module can work independently and in a system, which is an advantage in the design of buildings and in the construction process. The circulation pump provides flow rates in the glazing up to 8 l/min. The façade system and its components are assessed for functionality, service life and interoperability.

Facade application and lighting

Double-glazed windows can be used as façade elements and / or internal partition walls (ceilings and walls) and completely replace the existing façades with their mechanical and thermal characteristics. The technical characteristics of the facade can be actively controlled in order to achieve the best energy parameters. Another main advantage of the facade modular glazing is the increased natural lighting of the interior spaces due to their large size. This also reduces the energy for lighting and reduces the cooling costs caused by the lighting. With the achieved energy savings, the buildings can meet the criteria for LNG.

Heating, ventilation, air conditioning (HVAC)

Modular glazing is an important part of the building's HVAC system. The costs associated with the standard HVAC system can be covered 100% if the common partition walls are replaced with fluid glazing. Thanks to the high absorption of infrared radiation from these façade elements, the peak loads of the conventional cooling system can be significantly reduced by up

to 30% less installed nominal cooling capacity - without the use of mechanical solar protection. (for example, blinds). The excess heat generated by the glazing can be used for domestic hot water (DHW) and to improve the operation of the heat pump in the HVAC system of the building.

Renewable energy sources

Facade glazing windows function as transparent solar collectors with low working temperature, and their efficiency is relatively lower compared to conventional solar collectors (less than 40%). This is due to the facade orientation and vertical installation, as well as their transparency, but their installation on large areas leads to generation of a sufficient amount of energy.

Mathematical and simulation models have been developed to predict the behavior of the glazing unit, as well as to optimize the modular unit and its components. These models cover all physical processes - heat transfer, fluid flow dynamics, optical and structural behavior, as well as environmental impact and are based on in-depth research and modern methods for computer simulation.

Result

The project aims to technical innovation, introducing a new, disruptive building envelope system which has at least 15% building cost reduction potential and could be brought to industrial ripeness.

This project can be seen as a pioneer example to promote collaboration between researchers and companies in the Bulgaria and Europe, their ideas and knowledge to achieve the best available solution for this problem.

Acknowledgement

The study is by funded by the European Union under the Horizon 2020.

References:

1. “The National Nearly Zero-Energy Building Plan 2015–2020 (NPSBNPE)” https://www.seea.government.bg/documents/BG_National_nZEB_Plan_EN.pdf.
2. Industrial Development of Water Flow Glazing Systems, Project Documentation.