ды). Система имеет подъемную трубу диаметром 0,021 м и длиной 1,25 м. Выполнен эксперимент для пяти диаметров всасывающего трубопровода (0,021–0,063 м) с фиксированной длиной 0,3 м при коэффициентах погружения от 0,2 до 0,5. Результаты показывают, что чем больше диаметр всасывающей трубы, тем выше скорость откачки при фиксированном коэффициенте погружения. С другой стороны, чем выше коэффициент погружения, тем выше скорость откачки для фиксированного диаметра трубы всасывания. Кроме того, при большом коэффициенте погружения высокая скорость откачки достигается при более низком расходе воздуха по сравнению со случаем малых коэффициентов погружения. Результаты экспериментов показывают хорошее совпадение с моделью, предложенной Стеннингом и Мартином для описания работы воздушных подъемных насосов.

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ALUMINIUM AND GLASS CONSTRUCTION. ENERGETIC PLANNING

The features take into account the effect of various design parameters of building envelopes on the effectiveness of insulation. The ways to improve the design of window openings to provide a desired heat transfer between the areas of the building and the environment are discussed.

Sun protection for the building surfaces is the basic technique for the reduction of thermal charges inside the building in summer. Also, sun radiation is a big source of heat, which enters through the slits and leaks of the building. Proper sun protection is the main condition for all types of building lightning, no matter what light is used: natural or artificial. It contributes to keep the temperature in tolerated levels inside the building and consequently it improves comfortable thermal conditions. It significantly helps to save energy for the building cooling and to reduce electric charge in “peak time” and to reduce probability of heatstroke.

Energy conservation.

Building energy efficiency depends on the thermal performance of the constructive elements, and specifically in aluminum constructions such as cases and frames, buildings’ facades, which includes all characteristics which affect their behavior on energy consumption. Basements, frames and windowpanes play an active role in factors mentioned above. They are predominant parts of the building protective cover. Protective covers regulate the energy exchange rate between external and internal environment, so they affect the common building energy efficiency [1, 2].

Building thermotechnical characteristics for energy saving.

Energy efficiency of translucent constructions depends on 3 parameters.

1 U_w – *coefficient of the window thermal diffusion* (heat transmission coefficient).

It characterizes the ability to protect the internal temperature. Also it should be considered as a day-night coefficient. Coefficient U_w depends on three partial coefficients (figure 1): U_f – glass thermal diffusion coefficient; U_g – frame thermal diffusion coefficient; Ψ_g – coefficient of the glass and frame contact. New non metallic elements are improving Ψ_g from 0,1 to 0,2 W/m^{2}K in comparison with traditional one [3, 4].

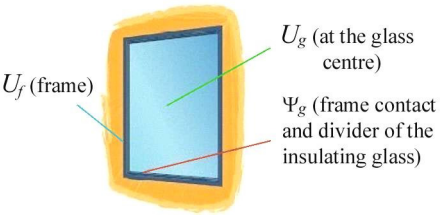

Figure 1 – Coefficient of the window thermal diffusion

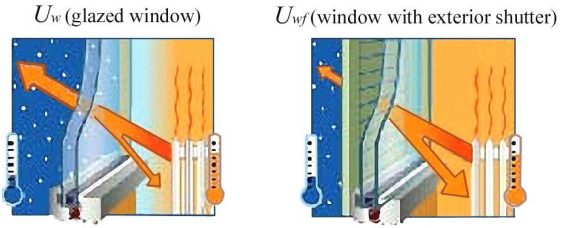

Figure 2 – Average thermal isolation coefficient day-night

Average day-night thermal isolation coefficient U_w+U_{wf}: coefficient of thermal diffusion (figure 2). Presence of outside layer isolation, such as Persian curtains, improve general ability of frame up to values U_{wf} < approximately 0,2 from U_w.

2 S_y – *glass coefficient of reflection (solar factor).*

It characterizes the ability to pass heat, generated by the sun, into the room (figure 3) [5].

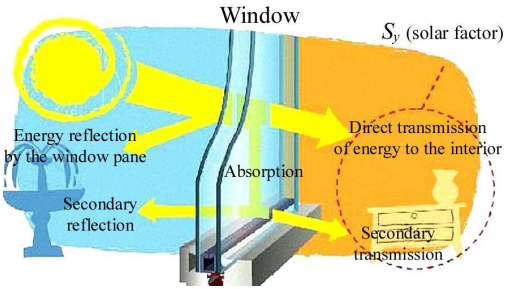

Figure 3 – Glass coefficient of reflection

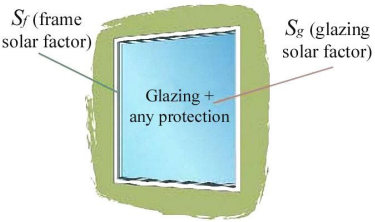

Figure 4 – Window coefficient of reflection

Window coefficient of reflection (solar factor) S_w (figure 4).

$$S_w = \frac{S_g \times glazing\ surface\ area + S_f \times section\ surface\ area}{total\ glazing + frame\ surface\ area}.$$

Values between 0–1 indicates the ability to miss significant amount of heat. For a window installed in the interior wall face (> 20 cm), S_w is multiplied by 0,9 in order to take into account the shading.

Two translucent windows with equal dimensions might have different solar factor according to the frame width.

3 T_l: Coefficient of sun light transmitting through the window (light transmission factor).

Practically it describes the ability of sun light to enter the interior.

Sun light transmitting coefficient T_l for the window depends on the T_l coefficient of the glass casing, surface ratio of the frame/glass casing. The higher value between 0–1 means that more natural lights pass through the frame.

4 The combination result.

You can easily align the heat loss in cold and warm areas of building by changing the ratio of the areas of frames and glazed windows.

Thermal resistance coefficient of the window block U_w plays an important role in the energy efficiency of the whole building. Coefficient of the window profile reflecting (solar factor S_w) also has a decisive role in the energy efficiency. The best impact for energy efficiency could be achieved with the use of two coefficients combination: frame thermal resistance coefficient with the value $U_w = 1,8$ and solar factor $S_w = 0,45$.

Due to the rational coefficients' combination the increase of the window surfaces oriented towards the south direction, will decrease the energy consumption in all areas.

The choice of the window frame construction should be based on its location and functionality. The optimal combination of coefficients allows to increase the frame energy efficiency.

Energy efficiency of frames, glass constructions and glazed windows at the design stage.

The main purpose of modern constructions is to maximize the diversity of their use and modification.

During the summer time it can be achieved by following solutions:

– set of sun-protective elements, which prevent the sun rays diffusion in the environment, and at the same time they have high aesthetic properties inside and outside the building;

– usage of the open-close elements, which is very important when the temperature outside is lower than inside the building;

– presence of ventilated facades with the ventilated air gaps between thermal insulation and gas insulation and decorative plates.

The thermal performance of the building can be achieved by changing the following parameters:

– thermal resistance (e. g., using effective thermal isolation, or ventilated facades);

– shade coefficient of facades (using special shading elements, sun shields or special glass constructions);

– air diffusion (using windows opening and artificial air flow).

To achieve the above-mentioned goals it is rational to use special technical tools and mechanisms, which allow to vary the efficiency and some characteristics of the frames and windowpanes in the changing conditions.

The protection from the sun impact of the building surfaces is the main action for reducing the thermal loads on the building during the summer period. Besides, it is necessary to take into consideration the amount of solar heat, which passes inside through the wholes and leaks.

The proper sun protection is a fundamental condition, for effective air conditioning and ventilation of premises. It helps to keep the temperature at the acceptable level inside the building and, as the result, it improves thermal comfort conditions.

These energy-saving measures are very important for creating the favorable microclimate and allow to decrease the loads in power networks at the peak hours.

Requirements for the main protection of the building.

The fundamental protection requirements are: water and air impermeability, thermal isolation (figure 5) with environmentally-friendly materials, sun protection (shadowing), high-lux light protection, fire and smoke protection, high frequencies radiation protection [6].

Figure 5 – Building with the 1,6 W/m^{2}K thermal diffusion coefficient (Semi Structural Solar Facade Serial ALUMIL M3 alutherm [7])

Additional useful functions are: natural ultraviolet light, prevention of reflecting and direct natural light, natural and artificial light control (figure 6).

Figure 6 – Building with the natural and artificial light control

Solar energy usage might be passive, if it is used for surface warming and active, if it used for electricity and heat production (thermal pump).

Natural air can cool, if it is used in the opposite direction of the wind. If it is necessary, this process can be mechanized.

General system development based on principle analyses with layers.

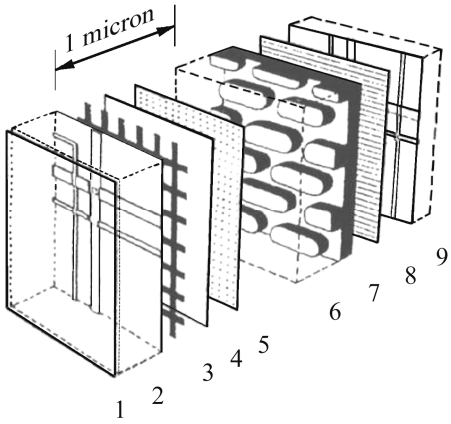

Figure 7 – New glass product

Technologies of energy-saving elements and comfortable conditions ensuring develop in two directions: profitability increase by changing the characteristics (thermal, acoustic, optical) and development of general systems, based on the analysis of layers.

Nowadays, a new multifunctional glass product with modern characteristics such is spectrophotometer, made with reflecting over-layer, splice layer, frames glass + membranes / layer with a special function / holographic / reflecting membrane, photo element (figure 7) has been created for glass facades [8].

Development of glass structures.

Connected elements are glass structures with holes and membranes, thermal isolation. Also they can have different forms and composition.

Special modern glass structures, which differ from ordinary with thermal characteristics and photometric properties: reflecting glass surfaces; colored, absorbing, selective, thermo-isolated, electro chromic, photo chromic, thermo chromic and liquid glass structures.

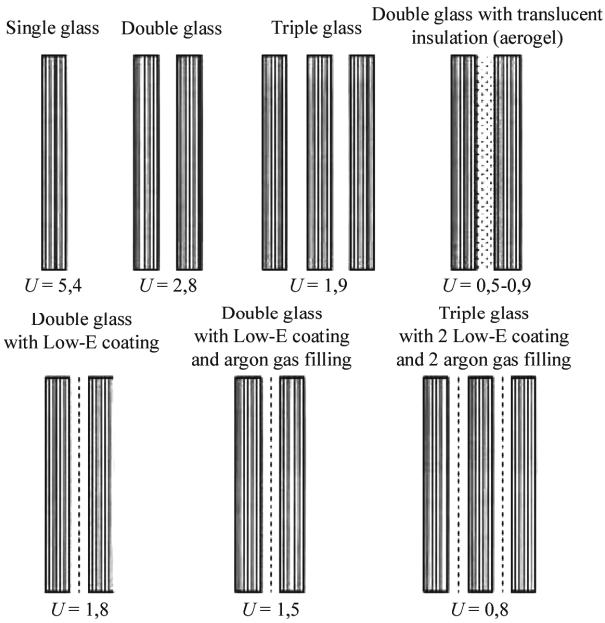

Figure 8 – *U* values for different types of glass

Glass constructions, stained-glass windows and the importance of the building energy efficiency (Conclusions).

According to new regulatory requirements the rationality of using modern constructions should be obligatory during the planning process of constructing and operation of high-quality buildings. Besides, the materials, used in constructions, should be produced from the renewable raw materials.

The main advantages of these innovations are: reduction of the energy amount, which is used for the building operation; reduction of maintenance costs; reduction of negative impacts on the environment.

Modern translucent structures have enormous potential, that's why they should get massive sales and support in such modern areas as energy and environmental design, green architecture and etc.

In addition, there are two reasons of the expected increase of the translucent structures usage within the rapid technological development in the field of energy saving. Firstly, energy efficiency of buildings will increase sharply by using modern methods of thermal insulation and environmental design. Secondly, these constructions will be used as a natural source of energy. So, translucent constructions combine these features and will be the rational elements for the innovative solutions.

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АЛЮМИНИЕВЫЕ И СТЕКЛЯННЫЕ КОНСТРУКЦИИ. ЭНЕРГЕТИЧЕСКОЕ ПЛАНИРОВАНИЕ

Рассмотрены особенности учета влияния различных конструктивных параметров ограждающих конструкций зданий на эффективность теплоизоляции. Предложены пути усовершенствования конструкций оконных проемов с целью обеспечения требуемой теплопередачи между помещениями зданий и окружающей средой.

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СОПРОТИВЛЕНИЕ ДВИЖЕНИЮ ПРИ ПЕРЕМЕЩЕНИИ ГРУЗОВ НА КАТКАХ И КОЛЕСАХ

При рассмотрении перемещения различных грузов на катках получено, что сопротивление при перекатывании цилиндра на 30 % больше, чем для плоского груза. Также показано, что при проектировании узлов качения роликоподшипникам следует отдавать преимущество по сравнению с шарикоподшипниками.