1. INTRODUCTION

In the era of air pollution and too large production of carbon dioxide, the emphasis is put on energy-saving construction. [1] One of the types of such a trend in the construction industry is passive construction [2]. This paper presents the analysis of a kindergarten building project to show whether an object can be described as a passive building. It also includes a kindergarten user satisfaction survey to confirm the thesis about the comfort of the use of energy-saving and passive objects. A lot of emphasis in the research is put on demonstrating the compliance and differences between the construction project of the building and the components of passive construction.

A detailed analysis of the construction design in terms of comparison of individual coefficients and indicators, among others, thermal insulation and tightness was made. The focus was also on the energy performance of the building. The project assumptions were correlated with the actual state of the kindergarten that was built and put into use.

2. SIGNIFICANT ISSUES AFFECTING THE DESIGN OF THE OBJECT

Kindergarten in Zloty Potok, the commune of Janow was designed with the components of passive construction (Fig. 1). The building has not obtained the certification of a passive building. In 2015, the architekciPL, Gliwice company, designed a kindergarten building. Designers sought to make the building meet the requirements of passive construction and its assumptions.
No attempt was made to obtain a passive house certificate due to:

- Very characteristic shape of the plot and its location in relation to the world sides. An elongated narrow plot, significantly narrowing towards the south-east. The neighbourhood with existing facilities and the related requirements of Polish fire regulations determined the location and shape of the facility.

- The construction design was developed on the basis of the winning competition work, which did not establish a kindergarten as a passive building. The competition took place in 2007, the construction project was created in 2015. The facility was built and commissioned in February 2018.

These two issues are crucial. The initial design phase is very important when it comes to meeting the requirements for certification. The error made when determining the assumptions results in the lack of fulfilment of all parameters. Sometimes obtaining parameters is possible, but economically unjustified [3].

2.1. Assumptions of passive construction

In Poland, promotion and certification of passive buildings is carried out by the Polish Institute of Passive Construction and Renewable Energy named after Günter Schlagowski [4]. Research on passive housing is carried out by the Passive House Institute in Darmstadt [5]. The first passive building constructed, metered and tested is a residential building Kranichstein Darmstadt [6].

Passive construction is the term used to describe energy-efficient construction with an extremely low heating demand for warmth. Heating in such facilities is usually made only by warming the building's ventilation air [7]. In countries with a milder climate – western, e.g., in Germany, this definition is correct. In Poland, due to the climate, applicable norms and law, in some facilities such solution is impossible to implement. The standard calculations often indicate that additional heating is necessary. They are usually made in the form of central heating with radiators or underfloor heating. This additional heating sometimes only has to comply with the normative conditions [8]. To a large extent, heating is not used.

Another element distinguishing passive buildings is the tightness and the use of mechanical ventilation with heat recuperation [9]. The use of such a solution eliminates the need to open windows. In passive construction, window opening is not necessary due to the supply of sufficient amount of filtered air through mechanical ventilation. Opening windows is not recommended because of the escape of valuable heat. In the kindergarten, the State Sanitary Inspection recommended daily airing of rooms by opening windows. It is based on the Regulation of the Minister of National Education and Sport of December 31, 2002, on health and safety in public and non-public schools and facilities. § 12 reads: “Rooms in which classes are held should be aired during each break, and if necessary also during classes” [10]. Because mechanical ventilation has been used in the building, it is not necessary to ventilate the rooms. The regulation is not adapted to new technical solutions. On this basis, the inspectors recommended airing the rooms.

This results in an increase in the energy demand needed to heat the building, however, the building is still very economical in this respect.

In order for the building to obtain a passive house certificate, it must meet certain criteria. Thanks to the well-chosen components of the passive building, it is possible to meet the criteria. It is possible not to use all components, but to obtain results that meet the criteria of passive construction. You can, for example, use fire-resistant joinery. It has much worse insulation parameters. It is necessary to install it in the wall, which generates significant thermal bridges. However, using other components, e.g., better recuperation, better tightness, better location in relation to the world sides, better insulation, it is possible to meet the criteria of a passive building and to balance the negative effects of using inferior parametrically joinery, but meeting the requirements related to fire protection of the building.

Passive construction involves the application of six basic components [7] (Fig. 2):

- good thermal insulation of the object \[ U \leq 0.15 \, \text{W/(m}^2\text{K)} \]
- correct location of the object relative to the world sides
SELECTED ANALYSIS OF ENERGY-SAVING KINDERGARTEN IN ZŁOTY POTOK

At the initial stage of the construction project of the kindergarten, the PHPP program was carried out, the building then had energy consumption for heating at 21 kWh/m²a. Due to the resignation from applying for building certification as a passive object, calculations in this program have been ended at this stage. The above parameters can be checked at the design stage thanks to the use of tools such as the PHPP calculation program, modeling program and calculation of THERM linear thermal bridges, PH design program – 3d visualizer on the base of SKETCHUP – a design and analytical tool for developing the concept of passive buildings, [13] and a program that has a module for calculating and energy juxtaposition like archiCAD.

3. RESEARCH METHODS:
The research methods used in architecture applied in this paper are: [14]
a) logical argumentation – analysis and logical construction
b) experimental (research)
c) qualitative and quantitative, including statistical (survey)
d) case studies

Applied techniques:
Ad. a) description, explanation, logical interpretation, scaling of grades
Ad b) Observation, measurement, virtual modeling, parametric techniques
Ad c) Measurements, questionnaires, data analysis, observation, testing of traces of use and user behavior, local vision, documentation examination, interviews, survey
Ad d) Viewing the research object, documentation analysis, description, explanation, interpretation, measurement, survey, interview.

Due to the nature of the problem, the paper is based on indirect and direct studies. They use a method based on a critical analysis of the subject literature and project documentation. Direct research consists of conducting a survey.

The study method used a research method – a case study, allowing to draw conclusions referring to the characteristics of the selected building being charac-
terised. Technical conditions and other causes and results regard its energy efficiency. This description is intended to indicate solutions that are worth using, and possible errors that should be avoided. The features of this method are analysing the issue in a broader context. In this paper, the “case study” concerns a kindergarten building, implemented in a standard similar to a passive building, taking into account the comfort of users.

In order to demonstrate the aptness of building objects in the passive construction standard, an analysis was carried out based on the documentation of the construction and executive project of the kindergarten [15].

The analysis aimed at demonstrating the compliance of the project with the passive construction assumptions.

In the first part of the analysis, it was examined whether all components of the passive building were used in the project. The heat transfer coefficients through the partitions were examined and their levels in correlation with the requirements of passive construction were checked. The location of the object relative to the world sides has been analysed, taking into account the number of glazings on individual elevations. The results of leak–proofness measurements made on the constructed object were confronted. The window joinery parameters were checked. Architectural details were examined for tightness and elimination of thermal bridges.

Experiments were carried out related to the comparison of the attic detail used in the building with the traditional approach to the construction of such a detail.

Then, it was checked whether passive building criteria had been met after using these components. The values declared in the project resulting from the energy performance of the building were examined. The results of energy demand were compared. The results of the object tightness test were cited.

The detailed design was a continuation and detailing of the construction project, due to the very conscious Investor, no changes were made during construction, except for changing the lighting fittings. The change consisted in the use of lighting fittings with the same technical parameters, but with other aesthetic parameters.

A survey was conducted among users and the quality of use and satisfaction with pre-school were determined.

3.1. Assessment of project assumptions with passive housing components

Warming and heating of domestic hot water is guaranteed by a solid fuel boiler (pellets) with an automatic 50 kW hopper with high efficiency control. Mechanical ventilation is designed based on air handling units with recuperation (recovery efficiency in winter 87% in summer 84%). They are also used for space heating. In order to prevent overheating of rooms in the summer, in addition to the use of passive blinds, the investor also decided to perform air conditioning in the form of split cassette units installed in classrooms.

The windows are designed to be largely fixed, due to their greater insulation and smaller thermal bridges. In the upper expansions, the possibility of tilting the windows by means of electric actuators has been designed. In this way, the natural ventilation of the object takes place.

Natural lighting has been designed in every room intended for permanent stay of people, sanitary facilities next to the rooms and in the cloakroom.
Table 1. Assessment of project assumptions with passive housing components – analysis, discussion of results and evaluation

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<tr>
<th>Analysis</th>
<th>Discussion of results and evaluation</th>
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<tr>
<td><strong>3.1.1. LIGHTNING CONDITIONS AND SOLAR ENERGY EFFICIENCY</strong></td>
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<td>Location of the object relative to the sides of the world, heat gains from solar energy [15] (Fig 3). Kindergarten is a single-storey building with a usable area of 387.06 m² located in Złoty Potok, Janów commune. It has an elongated tapered shape inscribed in the shape of a plot. Despite the specific shape of the building plot, a longer facade was designed with the largest glazing on the south-eastern side. It is a beneficial system that allows obtaining solar energy. Other facades from the unfavourable sides of the world – north and east, have smaller glazing. In this way, the heat escape has been minimised due to the minimum required glazing requirements. Despite the specific shape of the building plot, a longer facade was designed with the largest glazing on the south-eastern side. It is a beneficial system that allows obtaining solar energy. Other facades from the unfavourable sides of the world – north and east, have smaller glazing. In this way, the heat escape has been minimised due to the minimum required glazing requirements.</td>
<td>The object was correctly located in relation to the sides of the world. The rooms were arranged in accordance with the rules of passive construction. Technical rooms from the north and east, rooms with large glazing from the south and west. The location of the rooms favourable to the sides of the world and the appropriate selection of the size of the window joinery made it possible to obtain solar profits and reduce heat losses [16].</td>
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Location of classrooms located on the south-west side (Fig 5). Each room has the possibility of enlarging its area. Sanitary units and rooms for halls’ deckchairs were located from the north and south-east. At the main entrance from the north side there is a cloakroom for pre-school groups and a waiting room for parents. From the north-east there is a pellet boiler house with a fuel depot. Social space for teachers, an individual work room with a child, an office room, catering and washing rooms are located on the north-eastern side. Large glazing was located from the south-west side. Other facades have minimal window openings. Solar gains are obtained thanks to the use of special glazing with a coefficient of g at the level of 58% with the coefficient L₇ = 70% and L₉ = 16%. The ratio of glazed walls to full ones for the facade: \- north-west is 0.87 at the glazing area of 15.99 m²; \- north-eastern 0.94 at the glazing area of 9.03 m²; \- south-west 0.71 at 46.50 m² of glazing area, \- south-eastern 0.84 at the glazing area of 14.90 m². Thanks to the glazing, direct solar gains are obtained. To prevent the object from overheating, blinds were used on the south-west facade. |

**3.1.2. THERMAL INSULATING PROPERTIES OF THE OBJECT** |

The object has been designed taking into account the following values of the parameters of the heat transfer coefficient through the partition U: \- floor on a foundation slab with XPS insulation (λ = 0.038 W/mK) with a thickness of 40 cm, has a U-value of 0.093 W/(m²K) \- external reinforced concrete walls, with mineral wool insulation (λ = 0.036 W/mK) 30 cm thick, has a U-value of 0.151 W/(m²K) \- reinforced concrete roof, with a mineral wool insulation (λ = 0.037 W/mK), 40 cm thick, has a U-value of 0.09 W/(m²K) Scheme of thermal insulation is shown in Fig. 6. |

All building compartments meet the requirement U ≤ 0.15 W/(m²K).

**3.1.3. AIR TIGHTNESS OF THE BUILDING** |

According to the project, the kindergarten’s air tightness was assumed to be 0.6 h⁻¹. After commissioning the facility, an air tightness test was carried out in accordance with PN-EN 13829. The test showed that the air exchange rate is n₅₀ = 0.39 h⁻¹[17]. The test was came out by PRUSDIS engineering services. Report from a ventilation test of a building’s air-tightness in accordance with PN-EN 13829, performance date 22/08/2017. The building’s volume of 1900 m³ (estimated accuracy of the +/− 5% volume) was tested in accordance with the method B. The ventilation and sewer ducts were closed during the test. The test was carried out in underpressure and overpressure in the full required pressure range. The author of the study is Ing. Slawomir Prus. As shown in the pictures (Fig 6 and 7) and based on the technical specification of execution and acceptance of construction works [18], the project has solutions that enable leak tightness at such a high level. These solutions include: the building structure made of reinforced concrete, the use of plaster for joining reinforced concrete elements, the use of butyl tapes for the assembly of windows and doors, the use of special leakproof gaps for installation of installation ducts. The project assumed that construction errors would appear on the construction site, resulting in insufficient gullibility. Bearing in mind the experience from various construction sites, designers have set the tightness level as the minimum required for passive housing. Thanks to the careful implementation of the project on the construction site, the intended values were achieved, and even higher parameters were achieved than expected. |

The Blower-Door-Test tightness test showed much better results than the required building air tightness n₅₀ <= 0.6 h⁻¹.
3.1.4. WINDOW JOINERY [2]

The object has windows with a coefficient of:
- from the north side on the level $U_g = 0.5 \text{ W/(m}^2\text{K)}$,
- from the south side on the level $U_g = 0.7 \text{ W/(m}^2\text{K)}$

The windows in the building have the $U_w$ coefficient compliant with the joinery table between 0.68 and 0.84 W/(m²K).

Technical windows – fire resistance at 1.3 W/(m²K).

Worse glass parameters were obtained due to the necessity of using fire and technical joinery in the building. The coefficient of window heat transfer should be $U \leq 0.7 \text{ W/(m}^2\text{K)}$. Condition not met.

3.1.5. ELIMINATION OF THERMAL BRIDGES

Continuous thermal insulation of the object was used, under the foundation slab, on the walls and roof. The attic of the main cause of thermal bridges has been abandoned. The building is simple and compact. Thermal bridges connected with overhanging, balconies, concave corners, etc. were excluded due to this. Window joinery was installed in the insulation layer creating a uniform insulation. A freestanding steel structure was used for the installation of the shutter. In this way, thermal bridges created during the installation of blinds in insulation were eliminated (Fig. 7).

The only bridges that appear in the facility are bridges formed during the installation of fire-resistant joinery. Due to fire approval, the installation of such joinery is necessary in the wall, in the construction element.

The facility is efficient, with elimination of most thermal bridges (Fig. 6 and Fig. 7, Fig. 10).

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Figure 3. Diagram of the location of the object on the building plot with reference to the world sides and other building objects. Source – own study based on a construction project and an executive project called “Construction of a kindergarten in Złoty Potok – Janów Commune, plot No. 910/2” made by a design studio architekciPL Jerzy Hnat [15]

Figure 5. Function diagram. Source – own study Southeastern elevation, fragment of the drawing taken from the detailed design under the name “Construction of kindergarten in Złoty Potok – Municipality of Janów, plot No. 910/2” made by the design studio architekciPL Jerzy Hnat [15]
Figure 4.
a) North-west elevation; b) North-eastern elevation c) South-west elevation d) Southeastern elevation
fragments of the drawing taken from the detailed design under the name “Construction of kindergarten in Złoty Potok – Municipality of Janów, plot No. 910/2” made by the design studio architekciPL Jerzy Hnat [15]
Figures 8, 9, 10 show how the correct solution of the attic detail affects the elimination of the thermal bridge. In the traditional solution the attics of the building made with the use of reinforced concrete technology, the structure is extended to the attic height. Most designers try to insulate such an attic from every side, thinking that the problem has been solved. This is not a good solution (Fig 8).
The following picture shows how the thermal bridge changes when using insulating material as a filling (Fig. 9). However, the constructor does not build up the attic without braces in the form of a reinforced concrete frame. In the place of reinforced concrete poles thermal bridges will occur as in Fig. 8.

On Fig. 10 a design solution is presented. The elimination of the attic and the design of an interesting architectural form without the attic allows the elimination of the thermal bridge.

### 3.2. Analysis with evaluation of project assumptions and research results of the object commissioned for use in terms of meeting passive building criteria

In order for an object to be certified, it must meet the criteria of a passive building. Not all of the components must be fully used, provided that the criteria of such a building are met. If the criteria are met, the building should be considered passive. Due to the decision not to attempt to certify the building as passive, no detailed calculations were made in PHPP programme. For comparison, the energy performance of the object was prepared for the purposes of the construction project based on regulation on the methodology for determining the energy performance of a building (Figure 11).

The table below shows the parameters of the kindergarten building declared in the project documentation in the left column, and the right column contains the parameters that should be met by the passive building.

### 3.3. Survey with results

A survey was conducted among the users of the facility. The respondents were employees including child carers, management and people involved in the maintenance of the facility and equipment. Ten people were examined. They knew the previous location of the kindergarten in a traditional building. The survey was conducted after several months of using the facility. The following answers were received to the questions asked.

20% of respondents rated the object as 4 on a scale of 1 to 5. 5 was the best, 80% of the respondents rated the quality of use of the new kindergarten as the best (Fig. 11).

When asked about the lower illnesses incidence of children, 60% estimated that it was difficult to assess due to the short time of using the facility (the kinder-
A. Kołodziejczuk-Kęsół

A kindergarten has been operating since February 2018. 40% of the respondents confirmed the reduction of illnesses, of which 20% defined a reduction in incidence of 80% (Fig. 12). The level of morbidity was given by the educators and people employed in the kindergarten on the basis of their own observations of the respondents. Lack of access to presence logs prevents direct testing. The above is based only on the survey carried out. The reduction in the incidence rate was determined by the respondents, in relation to previous years, where the classes were held in an old building built in a traditional method with gravitational ventilation.

100% of respondents noticed the lack of draughts in the facility and positively assessed this fact.

Heating with ventilation, thanks to the use of a temperature control system in the facility using temperature sensors is set at a constant temperature of 200°C. The questionnaire asked about the subjective feeling of temperature. Heating and ventilation work automatically. In addition, each user can change the temperature setting – increase and decrease the room temperature.

When asked about turning on the heating in the winter period, 100% of respondents said that heating was turned on all the time. This answer is probably caused by two issues. The first is the responsibility of one

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<tr>
<td><strong>3.2.1. WARMTH DEMAND FOR HEATING</strong></td>
<td>The criterion of warmth demand for heating ≤ 15 kWh/m²·a or thermal load of the building ≤ 10 W/m² was met.</td>
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<td>According to the energy performance of the building, the demand for usable energy for heating and ventilation developed for this project was calculated at 1.41 kWh/m²·a [15].</td>
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<td><strong>3.2.2. PRIMARY ENERGY DEMAND</strong></td>
<td>The admissible value of primary energy for the building has been exceeded. The criterion assumes primary energy demand of ≤ 120 kWh/m²·a. The criterion was exceeded by 38.22%, the overrun is 45.86 kWh/m²·a.</td>
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<tr>
<td>According to the energy performance of the building, primary energy was calculated at 165.86 kWh/m²·year. The increase in the value of this criterion was influenced by the decision to use the air-conditioning in the facility.</td>
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<td><strong>3.2.3. AIR TIGHTNESS OF THE BUILDING</strong></td>
<td>The Blower-Door-Test leak study showed much better results than the required building integrity n₅₀ ≤ 0.6 h⁻¹.</td>
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<td>Tightness of the building in accordance with the construction project was established at the level of 0.6/ h. After commissioning the facility, an air tightness test was carried out in accordance with PN-EN 13829. The test showed that the air exchange rate is n₅₀ = 0.39 h⁻¹ [17].</td>
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<tr>
<td><strong>3.2.4. FREQUENCY OF EXCESSIVE TEMPERATURES &lt;= 10%</strong></td>
<td>No measurements or calculations have been made regarding the frequency of excessive temperature. Both shading and air conditioning were used. The use of air conditioning will not allow rooms to overheat. The criterion of the occurrence of excessive temperatures 10% has been met. However, it has not been achieved in a passive way, and in an active way, i.e. using air conditioning, which increased the demand for primary energy.</td>
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<tr>
<td>A special freestanding frames for external blinds has been used. Blinds protect the kindergarten from overheating. A cooling system was designed to eliminate the possibility of excessive temperatures, which increased the demand for primary energy in the building.</td>
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boiler for space heating and domestic hot water heating. To provide hot utility water, continuous boiler operation is essential. It is often confused by users that the boiler works with real heating of underfloor heating. The second issue is the recommendation of the State Sanitary Inspection regarding the need to ventilate – opening windows, despite the use of mechanical ventilation of rooms with a heat recovery function with a 90% efficiency. The outside air cleaned additionally by the filters provides enough fresh air. Unnecessary heat loss results from needless, but in accordance with the regulations and recommendation, ventilation of rooms.

When asked about the need to increase the temperature in the rooms, 20% of respondents replied that the temperature in the rooms was always constant. 40% of respondents increased the temperature in the room several times, 40% of respondents said that once, while the outside temperature was – 20°C (Fig. 13) and half of the people who answered so said that the increase in temperature these days turned out to be unnecessary.

100% of the respondents confirmed that the technical use of the building is simple.

100% of respondents said that due to the recommendations of the State Sanitary Inspection, the rooms are air-conditioned every day by opening windows. Also all respondents confirmed comfort in air breathing in the kindergarten rooms.

100% of respondents confirmed the use of blinds on sunny days and when using multimedia devices.

They were asked to give 3 features of the new facility which are better than the old ones, in which classes were held so far. Respondents indicated the following features related to comfort of use in relation to the subject of this paper:
– bright, sunny rooms, 60% of respondents
– the right temperature in the rooms, heating, warmth – the same temperature of 80% of respondents
– possibility of changing the size of rooms, changing arrangements, functionality of rooms 40% of respondents
– modern boiler house, 20% of respondents

When asked about the discomfort in using the object, the respondents indicated (Fig. 14):
– 20% of respondents can not open windows in the director’s office and social room
– 40% of respondents answered that they do not feel any discomfort while using the facility.

Other responses concerned minor inconveniences related to the equipment of the kindergarten that did not affect the contribution to this article.

Discussion of results and evaluation

THE RESULTS OF THE CONDUCTED SURVEY

The survey shows that users are very satisfied with the use of the object. They assess it positively and have no serious comments about it. The results of the survey also confirm the design assumptions – the facility exhibits high energy efficiency. Despite the short lifetime of the facility, a positive impact of the building's tightness on children’s illnesses has been noticed. The elimination of draughts was the one of the cause of the decrease in number of diseases. Thanks to the fact that the interior has an even temperature, there is no discomfort of use. This effect was obtained due to the use of continuous insulation, windows with appropriate thermal insulation and thermal bridges removal. The respondents’ answers regarding the need to raise the temperature are satisfactory. They show that the building has been properly insulated, and achieves solar profits sufficient to cover losses. The myth that the technical use of an energy-saving facility is difficult is also disproved. The survey revealed that due to the recommendations of the State Sanitary Inspection in the matter of airing the object unforeseen heat losses arise. The respondents themselves gave the feature of the object, better than the one previously occupied, which is the right temperature – the same temperature. A not implied response appeared in as many as 80% of respondents.

3.4. Compare the object with other passive building

In Germany there was the Cepheus program [19] for the construction, measurement and observation of passive structures [5]. All buildings described in the Cepheus program turned out to be components and criteria for passive buildings. Their users have positively evaluated these objects. Thanks to the comments of users gathered since 1998, many errors and inconveniences have been eliminated. That is why buildings made 20 years later are already well-finished and do not contain negative comments in the surveys.

The most questionable for the first users in Germany was the issue of opening windows. It is possible to ventilate rooms by opening windows, however, it is not needed. Mechanical ventilation provides enough fresh air. Uncontrolled heat loss is created by opening windows.

Such a situation took place in the first nursing home for seniors in the passive house standard – the house of Caritas Neuwerk. The building has openable windows. For a passive house, it is better not to open them during the winter. Residents needed three months to get used to the new situation where ventilation through window opening is no longer necessary. Inhabitants with dementia did not change their habits. Based on the experience from the use of the house, despite an incorrect procedure regarding ventilation and window opening, it was found that the additional energy consumption was 15.2%, very small in relation to the calculated value. The 0.54-liter house has become a 0.62-liter house [20].

In Germany, a passive kindergarten was designed in Heidenau. The facility is located in a park, on a hill. Its shape fits into the terrain. It is a one-storey wave-shaped building. Building walls have U-value 0.11 W/(m²K). The windows and curtain wall have low energy triple glazing. The building meets low heating consumption of 15 kWh/m²a. The building is mainly heated with ventilation air with 90% recuperation efficiency. In addition, it also has heating surfaces, if necessary [21].

Also in Germany, in Lengdorf, a kindergarten with a heat demand of 15 kWh/m²a and a primary energy consumption of 80 kWh/m²a was built [22].

In Poland, more residential buildings and public utility buildings are being built in an energy-efficient manner [2, 23, 24, 25].

Kindergarten in Zloty Potok has very similar results in terms of the heat transfer coefficient through the U-partition for baffles as well as joinery and tight-
ness. There are some slight differences due to the total primary energy consumption. This is due to the difference in function and method of heating. In the Hannover housing estate there was a wind power generator in the estate, which significantly reduced the level of primary energy. Different ratios for different energy sources are used.

In comparison with German investments, heat consumption compared to the requirements in a passive building is 15 kWh/(m²). Annual heat consumption in real estate in Hannover is lower than in the Polish kindergarten. This is basically related to the milder climate of Germany. When, during the implementation of the project, the kindergarten object was placed in the PHPP computer program in Germany, it obtained 15 kWh/(m²), but in Poland 21 kWh/(m²).

4. CONCLUSIONS

In reference to the experience in the first nursing home for seniors in the passive house standard – the house of Caritas Neuwerk, [20] one can observe analogies in window opening reluctance. The analyzed object also shows the resistance of people – inspectors of the State Sanitary Inspection. Recommendations were issued in the kindergarten, but not airing regulations based on an unadjusted legal provision [10].

In Germany, they have already accepted this state of affairs. Users only needed three months to get used to it. Polish regulations still do not keep pace with new technologies. Regulations still have provisions, e.g. regarding the need to ventilate educational institutions [10].

The analysis of the project documentation shows that the kindergarten building in Złoty Potok can be classified as energy-efficient building built using the components of passive construction. Users are satisfied and indicate numerous amenities and positive aspects of the use of the facility. Particularly satisfaction with the comfort of staying in the facility and improving the health of preschoolers is especially evident. Even after such a short period of time, users noticed a reduction in children’s illnesses in comparison to the situation in the old building. The causes of it were: lack of draughts, constant temperature throughout the room even in small distance to the windows. In addition, filters in mechanical ventilation treat the air that the users of the facility breathe. It should be stated that the use of a building designed and built to meet passive building guidelines is assessed positively and the components of this construction should be applied in all construction projects. Buildings that have different destiny and function, such as households, education buildings, hospitals and even sports halls all can be easily build in passive way. This sort of building should be applied in all European countries. In Germany and Austria this passive building is well known and used. In whole world this simple and energy-saving way of building should be applied.

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