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NET ZERO ENERGY BUILDING

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ABSTRACT

The main objective of this project is to study and analyze the existing building and also to give an overview on an existing building to make it a perfect Net Zero Energy Building. As all we know that the building has significant impact on the energy use and the environment which in turn affects the development of present era. The acute problem of carbon dioxide emissions reduction into the atmosphere becomes more important due to the fact of the global climate change. Housing stock consumes 30 to 40% of all energy resources, according to various estimates. As the result it is possible to get carbon dioxide atmosphere emission reduction due to energy consumption reduction. The problem of housing stock energy efficiency improvement becomes very important.

***Keywords:* Energy Consumption, Energy resources , Non Renewable resources energy , Renewable energy sources , PV Solar Module.**

I. INTRODUCTION

The term of Net Zero Energy building is defined as the building with zero net energy consumption i.e; the total amount of energy used by the building on annual basis is roughly equal to the total amount of renewable energy created on the site. The concept of a net zero energy building (NZEB),one which produces as much energy as it uses over the course of year , recently has been evolving from research to reality. Currently, there are only a small number of highly efficient buildings that meet the criteria to be called "Net Zero". As a result of advances in construction technologies, renewable energy systems, and academic research, creating Net zero buildings is becoming more and more feasible.

In the history of our planet periodically climate change has happened before but for the first time these changes are associated with human activities. Carbon-dioxide (Co2) that is emitted during the combustion of fossil fuels changes the composition of atmosphere. The uncontrolled use of fossil energy leads to the depletion of world reserves of non-renewable energy resource. It is enough to increase regulatory requirements for insulation levels, to improve the degree of building automation when adjusting the parameters of the coolant that enter the building to install systems heat recovery of exhaust air and the more efficient heating system. In the future, to reduce emissions of carbon-di-oxide in the atmosphere of the planet and protecting the environment, mankind time will be force to do lot less energy for heating that uses its still. If we add to this that the stock of non-renewable energy resources is finite, it should be recognized that the main characteristics of the future buildings is ultra low energy consumptions and even energy consumption is close to zero. While the existing old buildings spend from 200 to 400 kWh/(m2year) thermal energy for heating, the need for heating energy for buildings o9f the future generation will be from 20 to 50 kWh/m2. And many countries establish similar standards of energy consumption.

II. ENERGY RESOURCES:

2.1 Non Renewable Energy Resources:

A non-renewable resource (also called a finite resource) is a resource that does not renew itself at a sufficient rate. Fossil Fuels such as Coal, Petroleum, Natural Gas are all considered as Non renewable Energy Resources.

2.2. Renewable Energy Resources:

The source of energy which can be used again and again without threatening the nature so much is known as renewable energy resources. Sunlight, wind, rain, tidal energy and geothermal heat are some examples of Renewable Energy Resources. The aim of this Research Paper is to focusing on the building to create it a Net Zero by using a Renewable Energy Resources instead of Non Renewable Resources. We can use Solar Energy, Wind Energy, Tidal Energy etc to make the building net zero. We cannot use Geothermal source of energy at a level due to lack of technology. We can use the Wind Energy when the velocity of air is very high. It works only in the open areas. The widely use Renewable Source of energy is Solar Energy. Solar Panel can be used as Solar Photovoltaic cell, solar thermal heater, etc

III. CONNECTIONS OF PV SOLAR MODULES:

There two types of connections which are given below

3.1. Grid Connection

A grid connected photovoltaic power system, or grid-connected PV power system that is connected to the utility grid. A grid-connected PV system consists of solar panels, one or several inverters, a power conditioning unit and grid connection equipment. When, conversely, on-site energy generation exceeds the building energy requirements, the surplus energy should be exported back to the utility grid, where allowed by law. The excess energy production offsets later periods of excess demand, resulting in a net energy consumption of zero. Due to current technology and cost limitations associated with energy storage, grid connection is usually necessary to enable the Net Zero Energy balance.

3.2. Off Grid Connection

An off grid photovoltaic is when your solar photovoltaic system is not connected to the utility grid and you are producing your own electricity via solar, wind, generator, etc. This system will generally have a battery bank in order to store the electricity for use when needed.

IV. CASE STUDY

First experience in the construction of buildings with low energy consumption The German scholar Wolfgang Feist from the Institute für Wohnen und Umwelt GmbH and the Swedish Professor Bo Adamson of London University are the first who proposed the concept of building energy passive houses. In 1990, in Germany, in Darmstadt, the first house was constructed, it gave rise to the development of new technology in the construction of energy-passive houses. The experiment was a success, and to conduct further research, the Passive house Institute was founded by Dr.Fastom in Darmstadt in 1996. For 17 years of the Institute working approximately 15 thousand buildings has been constructed that correspond the definition of a passive house.

V. PROSPECTS FOR THE CONSTRUCTION OF A BUILDING WITH LOW ENERGY CONSUMPTION IN RUSSIA

Most of the existing Russian buildings have low energy efficiency according to European standards. This occurs because of three main factors:

- colder climatic conditions in comparison with most European countries
- lower regulatory requirements to the level of thermal insulation of building envelopes
- lower regulatory requirements to the level of consumption of thermal energy in buildings

Energy intensity of two identical buildings in different climatic zones, may differ significantly from each other because of differences of degree-days of heating season. For most Russian's cities the climate is colder in comparison with Western European neighbors. To compensate for additional losses caused by climatic conditions of our country, it would be appropriate to assume the necessity of introducing higher regulatory requirements for thermal insulation or heat recovery of exhaust air. But in this respect we are lagging behind our Western neighbors, for example, from the Scandinavian countries. Under similar climatic conditions regulatory requirements for insulation levels in Finland are in times higher than in the North-West region of the Russian Federation. A restrain factor is also the prevailing belief about the high cost of energy efficient houses' construction. Calculations show that the cost of 1 m2 energy efficient building only 8-10% higher than average cost of standard building. Additional costs are paid back within 10-20 years due to the reduction of operating costs, for example, by reducing heat loss through the external walls. The analysis of domestic and foreign information, design experience, construction and operation demonstrates the technical ability and economic efficiency of energy-efficient building's construction. The maximum power saving effect can be achieved by an integrated assessment of urban planning, space planning, engineering, design solutions and using of engineering power systems.

VI. CONSTRUCTIVE SOLUTIONS, INSULATION:

The basic requirements for structural parts of the building are as follows:

- High level of thermal insulation of building envelopes (with a coefficient of heat transfer U: walls - no more than 0,09 W/(m2 K), the coating is not more than 0.07 W/(m2 K), the floor is not more than 0,09 W/(m2 K);
- Maximum the exception of thermal by passes in the nodes and the abutting joins of selected design solutions;
- Installation of translucent cladding structures with low-e coated glass (with a coefficient of heat transfer U ≤ 1 W/ m2 K)
- High air tightness of building envelopes 7. Constructive solutions, insulation
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- Maximum, the exception of thermal by passes in the nodes and the abutting joins of selected design solutions.
- Installation of translucent cladding structures with low-e coated glass (with a coefficient of heat transfer U ≤ 1 W/ m2 K)
- High air tightness of building envelopes high air tightness of building envelopes
- Reliable insulation system, ensuring the caulking of butt joints and seams enclosing structures and components during the lifetime of the building (over 30 years)
- Frame design scheme based on the LVL beams is accepted for our building.

As the insulation for exterior opaque enclosing structures are adopted articles of isocyanate plastics with a thermal conductivity not higher than 0.023 W/(m2·K) and diffusion-tight layer, which provides air tightness of the outer shell. The gaps of 10-15 mm between the frame members (ceiling supporting truss in the roof structure) and isocyanate plastics insulation slabs are filled one-component of isocyanate plastics. The insulation is made in two layers. One layer of insulation is continuous, the joints of the slabs also are filled with isocyanate plastics. Adopted a constructive solution on the one hand provides the required tightness of the shell, with other addresses through thermal by passes, which in this case are the frame uprights (of external walls) and ceiling supporting truss (cover design) of building In solution that is presented in additional layer is arranged of insulation thickness 40 mm in the rim zone around the perimeter of the building. It’s device is due to the fact that heat loss are highest in the rim zone of the building compared to the inner part of the floor. This is because

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of the temperature of the ground increases from the edge of the building to the central part. The width of the rim zone with additional insulation around the perimeter of the building should be 1 meter.

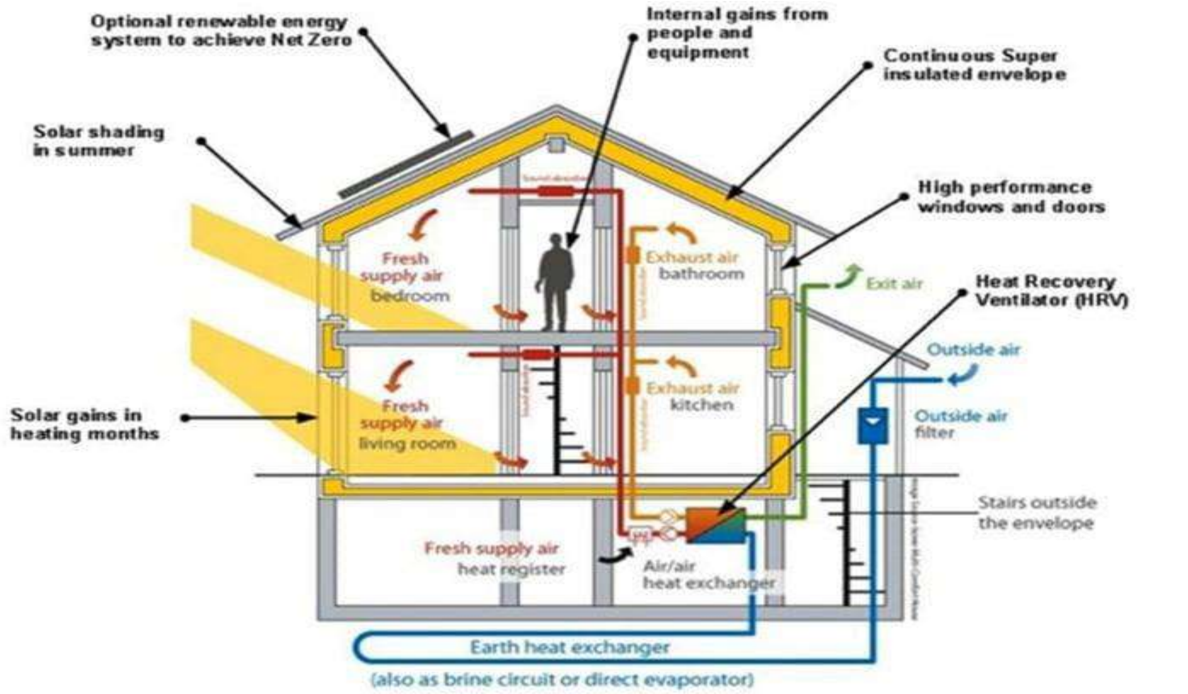

Fig 6.1: Constructive Solutions, Insulation

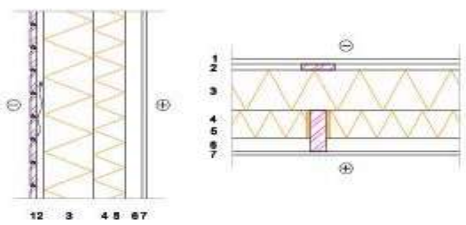

Fig. 3. ZEB wall composition: 1 – gel coating; 2 –ventilated gap; 3 – slab SPU AL 150 mm; 4 – slab SPU AL 100 mm; 5 – rack wooden frame; 6 –space for laying of engineering communications; 7 –interior finishing layer.

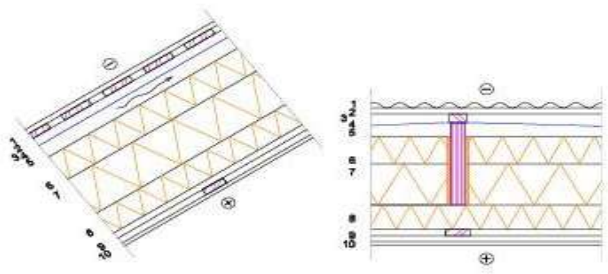

Fig. 4. Section of ZEB's slab roof: 1 – roof cladding; 2 –solid deck; 3 – wood roll; 4 – anti-condensation membrane; 5 – ventilated gap ≥ 50 mm; 6 – ceiling supporting truss; 7 – slabs SPU AL 150+100 mm (the outer layer); 8 – slabs SPU AL 40 mm (internal continuous layer); 9 –space for laying of engineering communications; 10 – interior finishing layer .

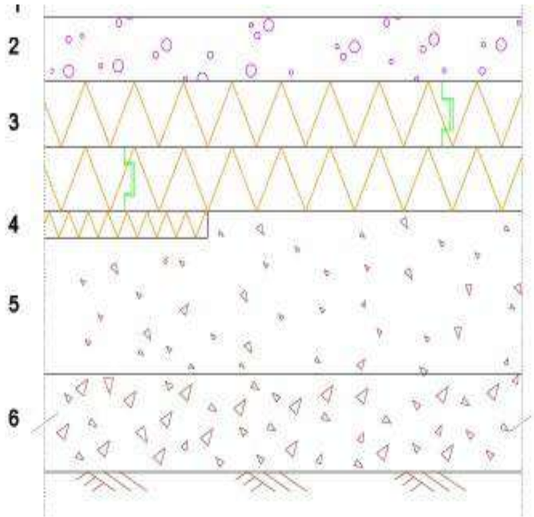

Fig. 5. Section ZEB's floor: 1 – flooring; 2 – floor cement screed; 3 – slabs SPU AL 100 + 100 mm; 4 – slabs SPU AL 40; 5 – foundation slab; 6 – pebble dash .

VII. OPTIMISATION OF TECHNICAL SOLUTIONS ENGINEERING SYSTEMS

Design solutions should provide control and monitoring of equipment within an integrated environment with the use of modern solutions in field of information technology, automation ,digital audio and video systems and engineering equipment .Building systems that must be integrated into a single system management and monitoring :

Heating

Ventilation

Air conditioning

Heat supply

Power supply

Lighting , including automatic and automated control of lighting

Fire protection

Video surveillance

Telecommunications (telephone ,LAN building with access to a global network, television)

The reliability of the system is achieved by a complex of organizational and technical measures which ensure resource availability, manageability, and serviceability. Organizational measures to ensure the reliability aimed at minimizing the errors of the stuff of operating and carrying out maintenance work of complex technical means of the systems, minimizing the time of repair or replacement of failed components. The project provides

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distribution control devices (Switches, Knobs) that allows users to manage in-house systems, to receive emergency and informational messages.

VIII. HEAT SUPPLY

As heating sources project should provide alternative .The temperature control of the coolant should be in accordance with the temperature schedule , depending on the outside temperature . Circulation pumps of heating systems and heat supply are provided with the frequency control . Control and monitoring of the heating system includes on :

Remote data transmission

The ability to remotely change the settings of the heating system (setting modes , time programs and curves of heating)

Quick and detailed information about the occurred fault in the form of emails or SMS messages (notification code fault)

There are has the metering of thermal energy in the building. In cases achieving the minimum desired temperature of the internal air in the building staff should be notified.

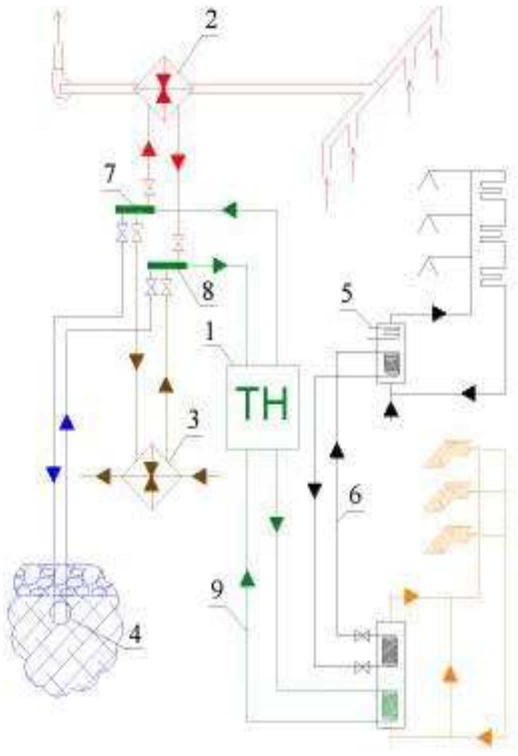

Fig. 6. Schematic diagram of (excess) heat pump system [22]: 1 – heat pump; 2, 3, 4 – heat exchangers of heat collection (remove the ventilation air, relatively clean wastewater, soil); 5 – backup heat source (heater) DHW; 6 – intermediate DHW circuit; 7, 8 – collectors (combs) of the first circuit heat pump system; 9 – second circuit heat pump system.

IX. VENTILATION SYSTEM

The project provides the scheme with a regulated air supply and exhaust mechanical ventilation with heat recovery of the ground and the exhaust air the ventilation system is equipped with sensors CO2 (carbon dioxide) and RH (humidity) inside air in the premises of the building . The ventilation rate in the working time in the presence of staff is provided in the amount of :0,5/1 h-1. In the winter time if necessary extra fresh air to tint =18-19oc as the heat source should be used the carrier geothermal heat pump systems (heat-insulated floors.

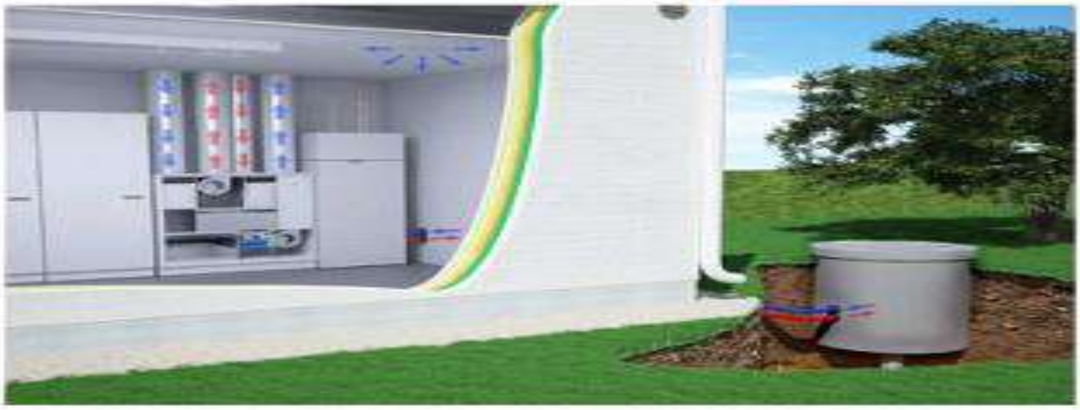

Fig. 7. Schematic diagram of ventilation systems with geothermal heat pump.

X. CONDITIONING SYSTEM:

The air conditioning system of the building during the warm period of operation must be combined with the scheme of ventilation is presented to give heat in summer mode of operation back into the soil .The air conditioning system should meet the following requirements:

1. The low power consumption
2. The high reliability
3. The ease of management

10.1. Advantages

- Reduces the maintainence of destruction of the non-renewable conventional energy resources .
- The cost of energy of a NZEB does not increase with time relative to the similar non-renewable energy building .
- Future legislative restrictions and carbon emissions taxes/ penalties may force expensive retrofits to inefficient building .
- It is an area of contractionary technique which requires a less area for the installation of setup
- By improving the energy efficiency it reduces the total cost of ownership as well as the total cost of living.

10.2. Disadvantages:

- Initial cost is much higher i.e. a money blockage technique which recovers after a few years .
- Variation of weather plays a vital role for that the PV solar system is not sufficient for all type of weather.
- High skilled labour is required of having necessary information for the installation of setup
- Solar energy system using the house envelope only works in locations unobstructed from the south. The Solar energy capture cannot be optimized in facing shade or wooded surroundings.

XI. LOW AND ZERO ENERGY BUILDING EXAMPLES

For the purpose of developing a low energy consumed environment it must be necessary to study and analyzing the nearly about to net zero energy buildings. A study of the impact of less consumed energy of these buildings is taken in to account. Each was designed to minimize energy and environmental impacts and used a combination of low-energy and renewable energy technologies. Understanding the energy performance of the current stock of high-performance buildings is an important step toward reaching the ZEB goal.

The designing and construction of these building is based on the phenomenon of energy conservation improvement and enhancement of PV power generation in the building.

(1)Passive House Ebner: Am Eichengrund 16, 8111 Judendorf-Straßengel: Residential Non-residential Public New Renovated X X Single-family house with a small integrated office

(2) KBC Gooik Zero Energy Office Edingsesteenweg, 1755 Gooik Residential Non-residential Public New Renovated X X Office building

(3) Technical University – Sofia, University Research Centre8 Climent Ohridski blvd., blok 8, Sofia 1000 Residential Non-residential Public New Renovated X X University research centre building.

(4) Multifamily building Lenišće East; "Šparna hiža" Zvonimira Goloba 1,48 000 Koprivnica Residential Non-residential Public New Renovated X X Multi-family house.

(5) Sems Have, Roskilde, Denmark Parkvej 3-5, 4000 Roskilde.

(6) Indira paryavaran bhawan – New Delhi , India

XII CONCLUSION

In conclusion, we decided that for our Zero Energy Project using solar energy is the best energy source in regards to saving energy and cost efficiency. After brainstorming and researching we came to an agreement that photovoltaic solar panels are the best solution for generation of the electricity in Moradabad Institute of Technology. The installation of the solar panels initially would be costly, but in the long run the owner of the building would save money on their energy bill. More importantly, in the scarcity of natural resources we would be providing a self-sufficient, energy saving, non-polluting, Zero Energy building. The solar panels that would be installed would be on the back side of the building, which would be facing south. This would allow for

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the most direct sunlight to be absorbed by the panels. So. according to us it is most efficient to install the PV Solar system in the MIT campus. We need 275 PV Solar panels in the Campus to equalize the present scenario of Energy Consumed in the Campus and 5.15 years are required to recover the installation cost of PV system.

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BIOGRAPHICAL DATA:

Prof. Mahadeva M is working as Assistant Professor in Civil Engineering Department form last 3 years in Shri Pillappa College of Engineering and he also worked as Assistant Professor in K S Institute of Technology. He received is **B E in Civil Engineering** and **M.Tech** with specialization in **CAD Structures** from Visvesvaraya technological university. He is national advisory board member and Conference Convener for international conference and he secured "***Active Young Research Award"*** in international journals for his continuous contribution in research field. He is Indian Institute of remote sensing outreach program college coordinator. He is member of AMIE, MIRED,MNG,MISTE. His research interest is in the field of soil structure interaction, structural engineering, earth quake engineering.

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