# BIM'S IMPROVEMENTS OF BUILDING IN SOLAR STUDY OPTIMISATION IN ALBANIA'S ARCHITECTURE, ENGINEERING AND CONSTRUCTION

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BY

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**Approval sheet of the Thesis**

This is to certify that we have read this thesis entitled **"BIM's improvements of building in solar study optimisation in Albania's Architecture, Engineering and Construction"** and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

______________________

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**I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.**

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# ABSTRACT

## BIM'S IMPROVEMENTS OF BUILDING IN SOLAR STUDY OPTIMISATION IN ALBANIA'S ARCHITECTURE, ENGINEERING AND CONSTRUCTION

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Countless buildings are being developed daily, countless of them are being designed, and so are being inaugurated. Considering we are live in the age of technology and competitiveness, we are constantly being challenged to develop new ways of executing our ideas in the most efficient ways possible, and BIM has definitely been the move to do so. We now are capable of simulating our projects in a computer system before we have to build it physically, so we can precede any challenges or unexpected miscalculations.

Computers have now advanced to a point where they can calculate millions of information in just a few milliseconds. Having that, we get a huge aid when it comes to calculating the countless required data to fully cover a building's necessity.

With BIM technology, we make it possible to build the object in 3D. And based on this 3D, the computer generates accurate data for the construction, fabrication and analysis needed to give and the best solution to realize the building. BIM performs all the functions needed for a complete cycle to complete a project, enabling the interaction of all characters involved in the project and making changes in real time. The benefits of BIM bring the incorporation of design with implementation by reducing the time and cost of the project as a whole.

***Keywords:*** *BIM, BIM Dimensions, Sustainable Development, BIM use in sustainable development.*

# ABSTRAKT


## PËRMIRËSIMET E BIM NË STUDIMET DIELLORE SË NDËRTESAVE NË SHQIPËRISË NË FUSHAT E ARKITEKTURËS, INXHINIERISË DHE NDËRTIMIT



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Ndërtesa të panumërta janë duke u zhvilluar çdo ditë, shumë prej tyre janë duke u dizenjuar, dhe kështu po inaugurohen. Duke marrë parasysh se jemi duke jetuar në epokën e teknologjisë dhe konkurrencës, ne vazhdimisht po sfidohemi për të zhvilluar mënyra të reja të ekzekutimit të ideve tona në mënyrat më efikase të mundshme, dhe BIM ka qenë padyshim lëvizja për ta bërë këtë. Tani jemi të aftë të simulojmë projektet tona në një sistem kompjuterik para se të duhet ta ndërtojmë atë fizikisht, kështu që të mund t'i paraprijmë çdo sfide ose llogaritje të gabuar të papritur.

Kompjuterët tani kanë përparuar në një pikë ku ata mund të llogarisin miliona informacione në vetëm disa milisekonda. Duke pasur këtë, ne kemi një ndihmë të madhe kur bëhet fjalë për llogaritjen e të dhënave të panumërta të kërkuara për të mbuluar plotësisht nevojën e një ndërtese.

Me teknologjinë BIM, ne bëjmë të mundur ndërtimin e objektit në 3D. Dhe bazuar në këtë 3D, kompjuteri gjeneron të dhëna të sakta për ndërtimin, fabrikimin dhe analizën e nevojshme për të dhënë dhe zgjidhjen më të mirë për të realizuar ndërtesën. BIM kryen të gjitha funksionet e nevojshme për një cikël të plotë për të përfunduar një projekt, duke mundësuar ndërveprimin e të gjithë personazheve të përfshirë në projekt dhe duke bërë ndryshime në kohë reale. Përfitimet e BIM sjellin

përfshirjen e dizajnit me implementim duke zvogëluar kohën dhe koston e projektit në tërësi.

***Fjalët kyçe:*** *BIM, Dimensionet e BIM, Zhvillimi I qëndrueshëm, Përdorimi I BIM në zhvillimin e qëndrueshë*

# LIST OF ABBREVIATIONS

***2D*** *Two dimensions; x, y*

***3D*** *Three dimensions; x,*

***AEC*** *Architecture, Engineering, Construction industry*

***BIM*** *Building Information Modeling*

***BIM*** *Building Information Management*

***CAAD*** *Computer Architectural Aided Design*

***CAD*** *Computer Aided Design*

**GIS** *Geographic Information System*

***UN*** *United Nations*

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# CHAPTER 1

# INTRODUCTION

## 1.1 Background Information

Looking back at human history, architecture has been an important companion. Construction over the years has undergone significant changes, both in the method and materials of construction, but also in the way of designing an object. The first buildings were constructed from the need to be protected from natural hazards, but later evolved reflecting the cultural and social level of different stages of humanity. Previously, the creator of the buildings sketched buildings on the site. The first 2D plans were made in monochrome style, and had no precision sketches.

With the spread of the computer technology in elite society, they tried to find ways to facilitate it in architecture. It was constantly sought to achieve a better way of introducing and automating the design process. Since the commercialization of the first CAAD (Computer Architectural Aided Design) software for our profession in the '80s, initially born to aid the production of drawings, software has progressively begun part of designer's tools. *[1]*

We have come a very long way from the beginning of computers that were the size of a refrigerator that could process very limited information, to what we are now, microscopic computer chips that can process a then-unimaginable amount of information and execute millions of commands in a click of a button, and construction fields capitalized as effectively as they possibly could.

BIM is a new technology in which building model is accessible to all working groups, they finalize the project through all stages of the project more efficiently. BIM builds the object in 3D, and each element has its own data. These data are parametric, and the elements interact with each other. This new way of modeling gives everyone the opportunity to have a clearer panorama of the whole object from the outside and from the inside. And the final result is faster and more accurate.

## 1.2 Problem Statement

The benefits of technology are quickly embraced by the needs of mankind, the same is true of BIM. But BIM is in the first steps of its development in Albania. Not all objects that are built, are modeled in BIM. This makes it even more difficult to draw an accurate analysis of the energy consumption of buildings.

First of all, in Albania the project documentation continues to be done in specific 2D programs, and then the project is presented in 3D softwares. Without using a single program to realize 2D and 3D at the same time, which would save more time and more accuracy.

Secondly, the digital project is not used for energy calculations, to increase energy efficiency. The Law on Energy Efficiency was published for the first time in 2015, this shows that until now there has been no regulator for sustainable construction in Albania. As a conditional state for the EU, it will have to take stronger legal initiatives to incorporate BIM for higher energy efficiency.

Furthermore, the basic knowledge about the possibilities of BIM and the attachment of plugins should be disseminated through various design companies, and the standardization of architectural design in Albania increases.

The road is long, but as the new generation of AEC is more adaptable to technology, progressive steps are being taken.

## 1.3 Objectives of the research

The main objective of this study is to highlight the advantages of BIM in solar studies in the field of construction with Albania. BIM gives us the opportunity to perform detailed analysis, to increase energy efficiency. In Albania, as a developing country, construction is being carried out at a rapid pace. To have quality constructions in longevity, it is good to use BIM. The problem is that the knowledge and use of it is not where it should be. At the end of this thesis, we want to reach some convincing proposals and conclusions to increase sensitivity to this topic.

## 1.4 Research questions

The main question that arises on this thesis that we are willing to give them an answer are:

- Will BIM give a positive impact on achieving the basic objectives of sustainable development?
- Will BIM in the near future be a working method for the design of all new buildings in Albania?
- Will it be possible to benefit from the energy analysis obtained from BIM?
- Will we have an increase in the energy efficiency of buildings in Albania?

## 1.5 Hypothesis

- Albania has low uses of BIM in design, but in the future it is predicted to increase the use of higher BIM.
- BIM will increase the quality of buildings in Albania, as energy efficiency analyzes will be more in-depth and accurate.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 BIM

We have come a very long way from the beginning of computers that were the size of a refrigerator that could process very limited information, to what we are now, microscopic computer chips that can process a then-unimaginable amount of information and execute millions of commands in a click of a button, and construction fields capitalized as effectively as they possibly could.

Now, the number of the architects, engineers, etc. are using BIM. The reason to this is because of the global competition that is becoming rapidly more and more complex in the world of AEC (Architects, Engineers and Constructions), and BIM makes the work a lot more efficient and effective.

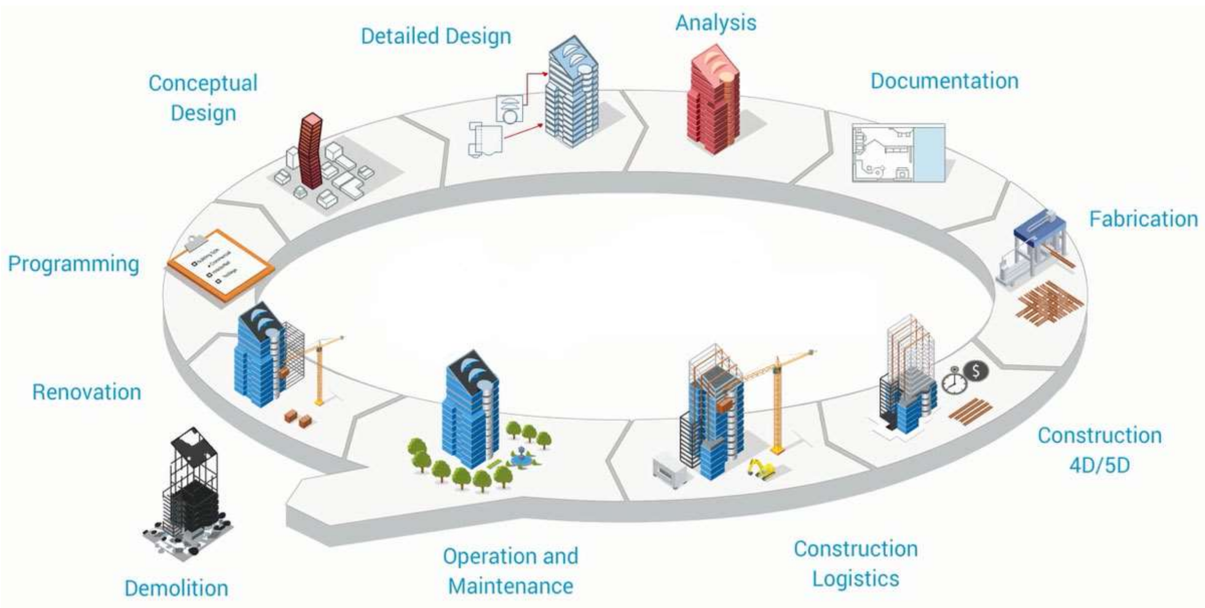



***Figure 1***. BIM *[2]*

### 2.2.1. Understanding BIM

BIM is an intelligent model-based process that connects AEC professionals so they design, build and operate buildings and infrastructure more efficiently. *[3]* BIM offers the realization of the object in digital format through computer data. This data can be easily accessed by all working groups in the project, giving a more detailed picture of the project and leading to higher productivity. The data in the model are standardized, and interrelated with each other. When a data is changed in the building, the update is automatically refreshed in section, views and renders. It would take a lot more time in a 2D program like AutoCAD. Changes made while working on the building, we have to manually do it one by one in the technical drawing sheets. The information you can get from the model is great, and the opportunity to improve the building is higher. The time to work on an object is greatly shortened and the accuracy is higher. BIM provides insight into the design's buildability, improving the efficiency and effectiveness of the construction phase, and also providing a better understanding of the building's future operations and maintenance. *[4]* BIM enables the division of labor into phases, for example conceptual phases, current phase or proposed phase, this is very good for projects that are for renovation, or need maintenance. It gives us an accurate picture of the changes that need to be made, the risks, the cost of renovation and the most optimal solution possible. Design studios by increasing time efficiency with BIM, to complete more projects, to project with more complex design. BIM grows projects sales faster, as we have the opportunity that in real time, we can render our model.

### 2.2.2 BIM Dimensions

BIM dimensions – 3D, 4D, 5D, 6D & 7D, each has its own purpose and is useful in finding out how much a project would cost, its timeline, when it would be completed and how sustainable it would be in the future. *[5]*

#### 2.2.2.1 6D – BIM 6th Dimension

6D BIM is that window that analyzes the consumed power of a building and finds out how much money the investor will spend in the various stages of implementation. The calculation of the energy of the structure in different phases, gives a more accurate forecast of the energy consumption that the building needs. This is a step forward, as it predicts the real cost it will take to achieve sustainability and the minimum cost into environmental for the best solution. As mentioned above, BIM divides the project into development phases, making it possible to adapt various mechanical systems or not to turn an existing building towards energy optimization. The data from the systems used in the object, have technical data incorporated in the model, from the installation phase, the configuration detail to give the best effect to the building, the energy necessary to put them to work, as well as the necessary of periodic maintenance. Through software it is possible to analyze the energy in the building with the systems used, in the physical-environmental conditions that we have our building built.

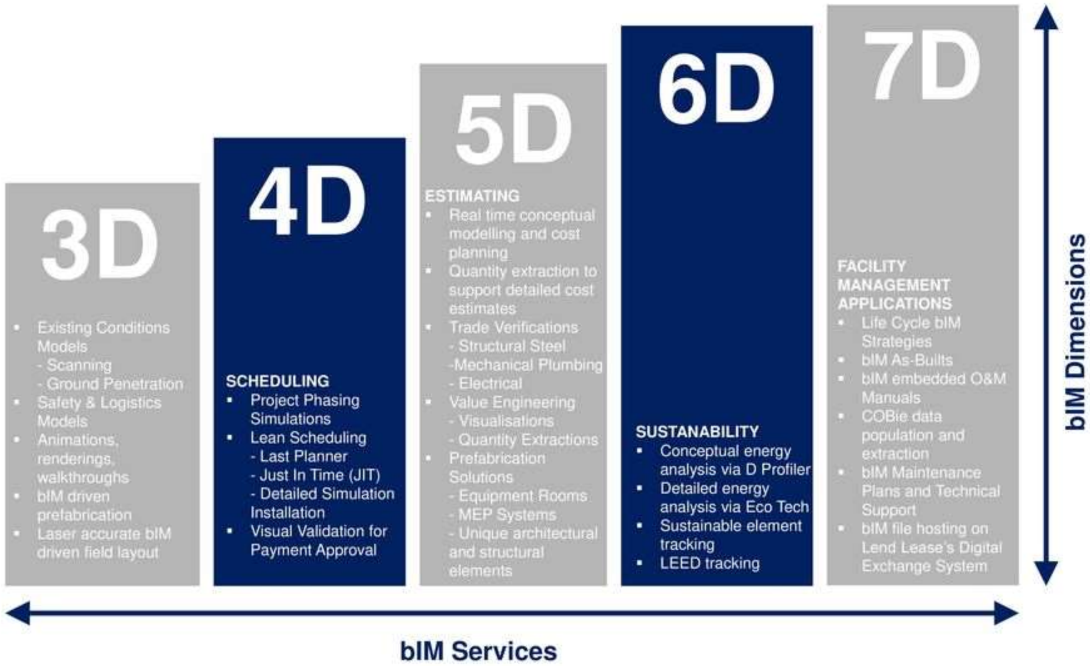



***Figure 2***. BIM Dimensions *[2]*

### 2.2.3 Future of BIM

Obviously, there is always room for improvement when it comes to technology. We can sometimes experience errors, bugs, and other technical difficulties when we are a computer software. We can have difficulties identifying specific issues that could take us days to successfully point out and fix.

We can get hacked, and have our projects stolen, manipulated, modified or even totally destroyed, that could lead to months if not years of working for nothing sometimes.

These are a few of the problems that we can encounter, however, with the right education on the matters, and with the right steps, we can avoid all of these if we are well prepared and well-informed prior, so we can take good measures such as making copies to separated memory units such as USBs or other type memory hardware.

### 2.2.4 BIM in Albania

Albania, specifically Tirana, has seen a rapid increasing in the utilization of BIM across the city. We can see residencies starting from “The Sunny Hill” in Komuna e Parisit, to the complexes being built around the Artificial Lake of Tirana where buildings with such complex design are being developed day by day, and to continue with “Eye Of Tirana” in the middle of the capital, by Skanderbeg Square, as well as anything between this area, in Rruga Kavajes, Myslym Shyri, and just about everywhere.

All these complex designs are being developed by BIM, and that is exactly what makes building these very sophisticated buildings so “easy” and fast.

We are not seeing an end to the potential reach of this huge advantage with, quite frankly, that is characterized by the lack of downsides, that is BIM and its utilization in Albania, and more remarkably in Tirana.

The objective of this research is to briefly introduce the readers to the idea of BIM, and make sure they are educated on the matter, and spark them the fire of interest so they apply these efficient and effective methods of working into their working plan, studying curriculum or even completely devout their careers to this branch of technology, considering how successful it has been so far, with little-to-no doubt that it will ever stop having this accelerated development and endless potential.

## 2.2 Sustainable Development

### 2.2.1. Sustainability

If you are looking for the definition of the word "sustainability", the first definition that shows up is "the use of natural products and energy in a way that does not harm the environment" and the second one is: "the ability to continue or be continued for a long time". *[6]*

The most commonly used and widely adopted definitions of sustainable development is "meeting the needs of the present generation without compromising the ability of future generations to meet their own needs." *[7]* The rapid development that humanity has had, has directly affected the environment. What we wanted to be formed for thousands of centuries is being destroyed in a very short time. Sustainability is the concept that is being taken under consideration by everybody, in different areas of life. Immediate steps must be taken before they go to the destruction of natural resources and biomass. Natural balance can be damaged, and humanity can go into short supply of food. Environmental pollution is causing the extinction of bee populations in metropolises. If all the bees in the world were extinct, the pollination of the flowers would not be done, and forests with considerable surface would be destroyed. As temperatures rise sharply, glaciers are melting, and large areas of land are being flooded. Reducing the supply of products needed by man, leads to social problems, conflicts between states, and even wars.

### 2.2.2 Sustainable Building

A sustainable building, or green building is an outcome of a design philosophy which focuses on increasing the efficiency of resource use — energy, water, and materials — while reducing building impacts on human health and the environment during the building's lifecycle, through better siting, design, construction, operation, maintenance, and removal. *[8]* Sustainability is something that lasts over time. So a building to be sustainable, must be able to meet the needs of users for a long time while minimizing the negative effects on the environment. Sustainable buildings aren't just about the environment, but consider all three pillars of sustainability: environment, people, and cost. *[9]*

Buildings are built to meet human needs, so they are the users. The main purpose is for the building to meet the conditions of human thermal comfort in the various work processes that that building serves. The building should not only meet the conditions of direct users, but also not endanger natural resources for other individuals or cause negative effects on the environment. The concrete example of "Disney Hall" by Frank Gehry, whose facade reflected sunlight on the surrounding objects, causing them to overheat.

The principles of sustainable buildings taking into consideration the environment aim to not harm the environment, not to exhaust its resources, and reducing pollution in the environment. This was achieved by maximizing the potential of the terrain where we are building, the use of new construction technologies, ecological building materials without side effects, the provision of electricity through solar panels, etc.

Buildings should be easily adaptable and for functions other than the original, for example an object intended for a shopping center, to be easily adaptable to an office center, at no additional cost. Green or sustainable building is the practice of creating healthier and more resource-efficient models of construction, renovation, operation, maintenance, and demolition. *[10]*

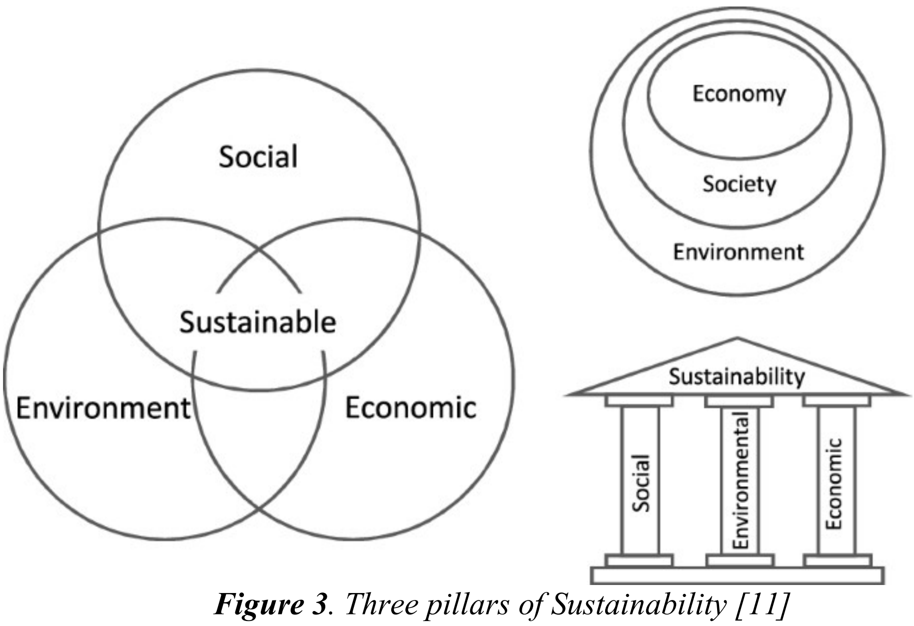



***Figure 3**. Three pillars of Sustainability [11]*

### 2.2.3 Use of BIM for sustainable construction in Albania

BIM will play a key role in achieving as close as possible to all the goals of sustainable development in construction and the slowdown of global warming. The highest energy consumers in a building are heating-cooling systems, ventilation, lighting, refrigerators, heating and water transport and other systems in the case of buildings of special importance. Most important is the achievement of thermal comfort for its users. This is achieved by optimizing the natural conditions as much as possible and by reconciling it with the mechanical heating-cooling systems. Through the tests in the model generated by BIM, we choose the system that gives the best result, placing it in the specific climate conditions of our project. Maximizing natural light is also done with BIM programs, doing solar analysis of the 3D model. The BIM can contain data used for innovative planning, changing the function of a building when its maintenance is necessary. In many cases, the destruction of the building must be done, but with BIM we specify, if we should demolish or there are elements that can be saved. If all these principles and the benefits of BIM were used in Albania, new constructions would be more energy efficient.

## 2.3 Case Study

### 2.3.1. BIM in Urbanism

BIM is specialized with the lifecycle of individual buildings. One the other hand in Albania, more and more application is finding Geographical Information Systems (GIS). GIS is used for residential areas, a group of buildings. Its data are mainly in the form of various maps, numerical data and it is possible to import other formats. The problems that GIS solves are for urban areas, it determines the risks and problems that can arise from the natural conditions of the environment. The problem is that although GIS involves the consideration of raster, vectors, points and polygons with related information, it usually does not have data about the material of each building structure or urban public space and the availability of materials is limited. The aim is to incorporate BIM and GIS to achieve City Information Modelling (CIM). It is new concept that is gaining popularity each year around the world, but it is finding difficulty being used in Albania.

#### 2.3.1.1 The Tsisngua University

*Referenced: Xinzheng Lu 1, Donglian Gu, Zhen Xu 3, Chen Xiong 4 and Yuan Tian (2020) CIM-Powered Multi-Hazard Simulation Framework Covering both Individual Buildings and Urban Areas [10]*

A case study we took from the literature is one on a university campus in China. The campus stretch is exactly 1.9 by 2.3 km. The functions and heights of the surrounding buildings are presented in *Figure 4*. Most of the buildings have a residential function, but there are other functions such as commercial, health, industrial. Less than 5 floors are about 78% of buildings.

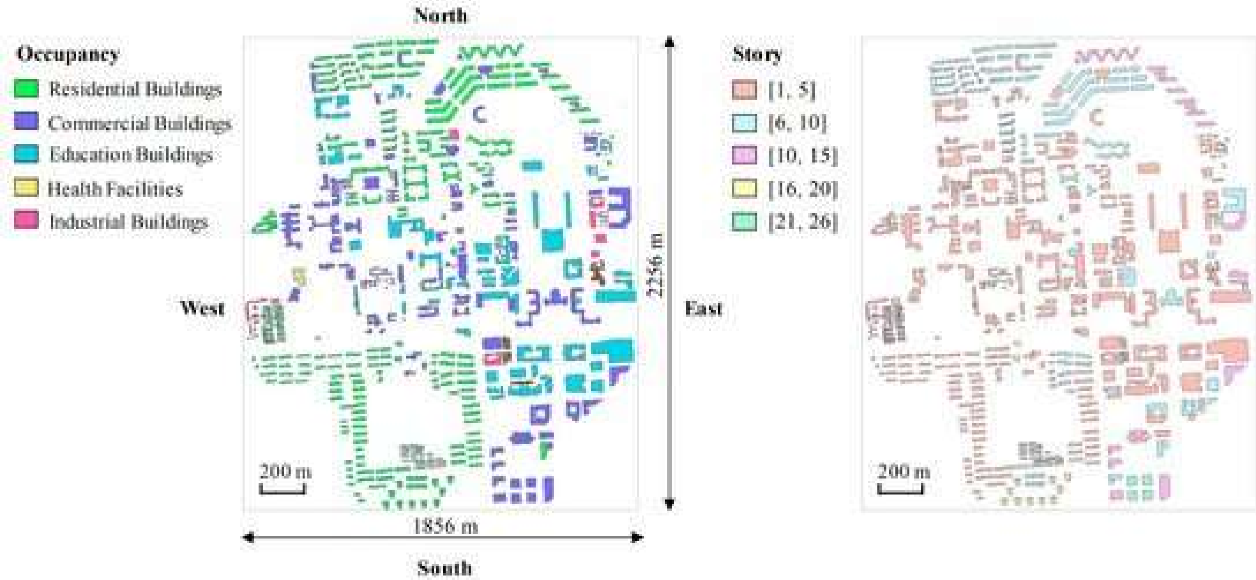



***Figure 4***. Buildings in the Tsinghua University campus *[10]*

**Earthquake Simulation**

Earthquake stimulation is very important for areas with high seismic activity. In the program was recreated, the situation in the current conditions of the surrounding buildings. The data were generated by GIS and 3D BIM models of some buildings, of 619 buildings in total. It was selected in a 4-storey building to demonstrate earthquake stimulation. The building was 17.5 m high, and located in the center of the campus

(*Figure 5a*). the building was built in 1997 and its model in BIM, we have presented in *Figure 5b*.

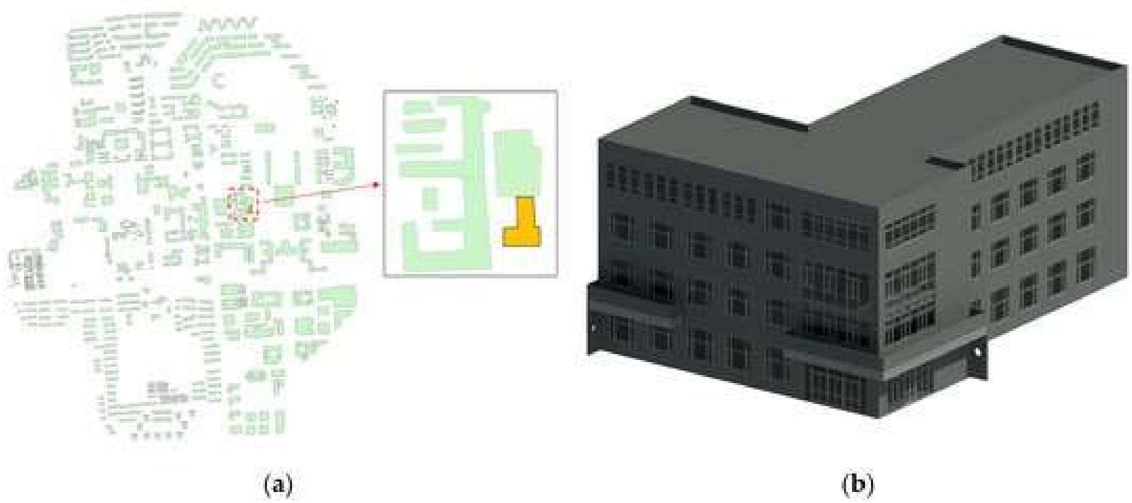



***Figure 5.*** (a) Location and (b) BIM of the four-story office building. *[10]*

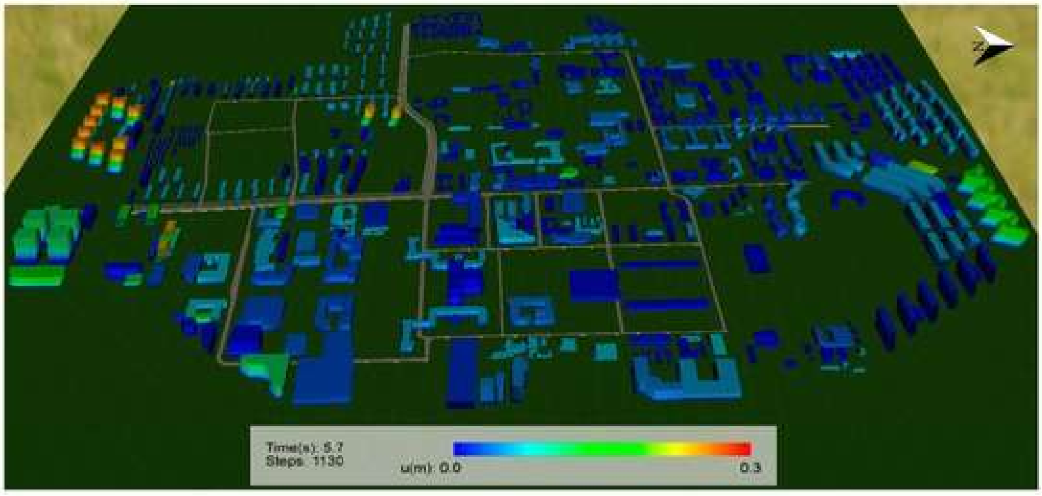



***Figure 6.*** Deformation results of the buildings in the Tsinghua campus. *[10]*

**Fire Simulation**

Random selection of buildings, to see different cases of fire stimulation in different conditions (*Figure 7*). The main reason for this choice was to understand more precisely how the fire spreads throughout the campus, how it is the best way to manage the fire, what are the most difficult points for extinguishing the fire.

This result was achieved with SmokeView (*Figure 8*), which shows in real time how fire smoke spreads. These analyzes serve to find efficient and faster tactics for managing these disasters.

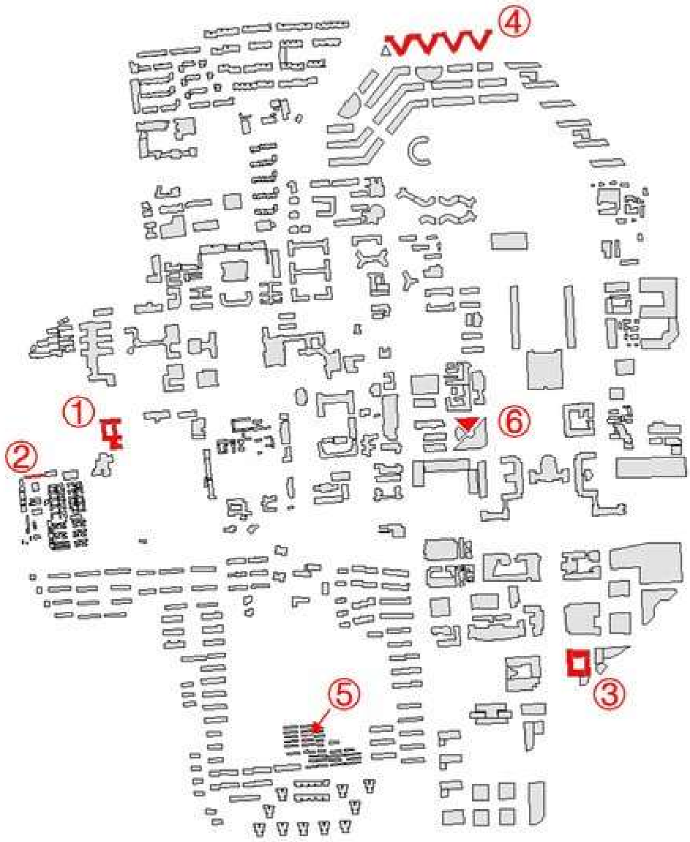



***Figure 7.*** Locations of the ignited buildings *[10]*

***Figure 8.*** Smoke effects displayed in Smokeview (wind speed = 12 m/s). *[10]*

**Wind Simulation**

Wind is a very important element in achieving the energy efficiency of the building. The wind directly affects the natural ventilation and cooling of the building. But winds with high atmospheric pressure can also cause significant damage. In the stimulation, (Figure 9 and Figure 10) shows the wind pressure on the facade of the building and the wind speed at a height of 10 m. The maximum value achieved was 420 Pa and -1183 Pa. Non-structural elements of the building can be damaged at these atmospheric pressures, demonstrates HAZUS results. The wind speed distributed throughout the campus is shown in Figure 10. Some people have it lower speed, some higher speed, due to the wind properties. Buildings create shaded walls, where no wind passes and create voids. Access roads and empty spaces create wind channels that increase wind speed.

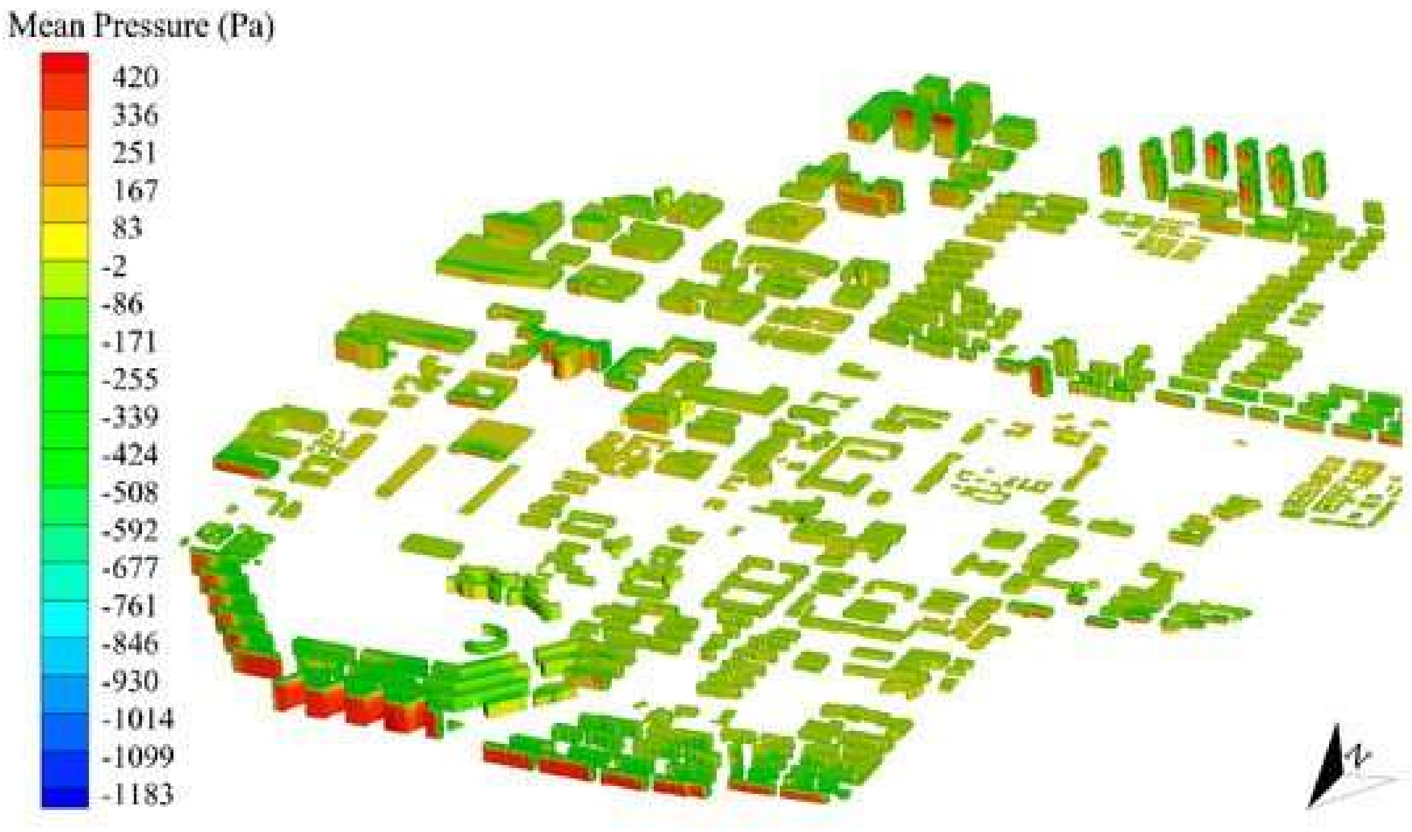



***Figure 9.*** Wind pressure on the exterior surfaces of buildings in the Tsinghua campus. *[10]*

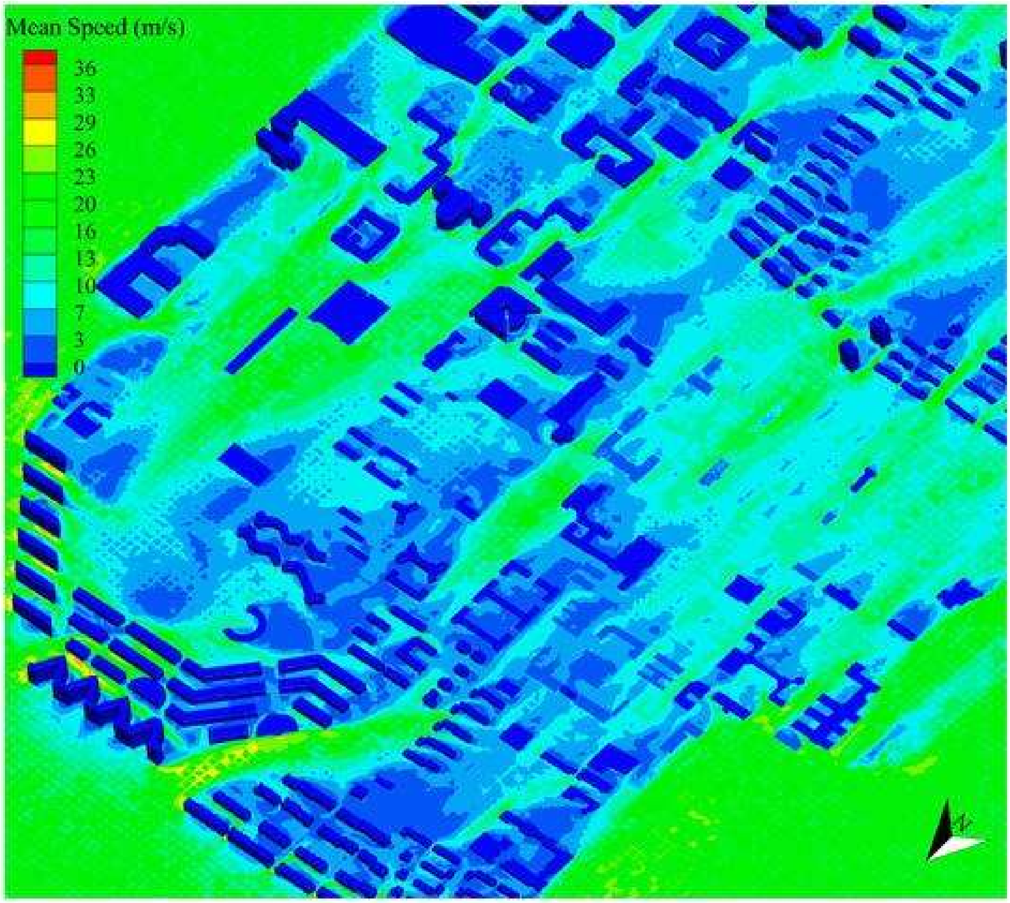



***Figure 10.*** Wind speed at a height of 10 m. *[10]*

### 2.3.2. BIM in Architecture

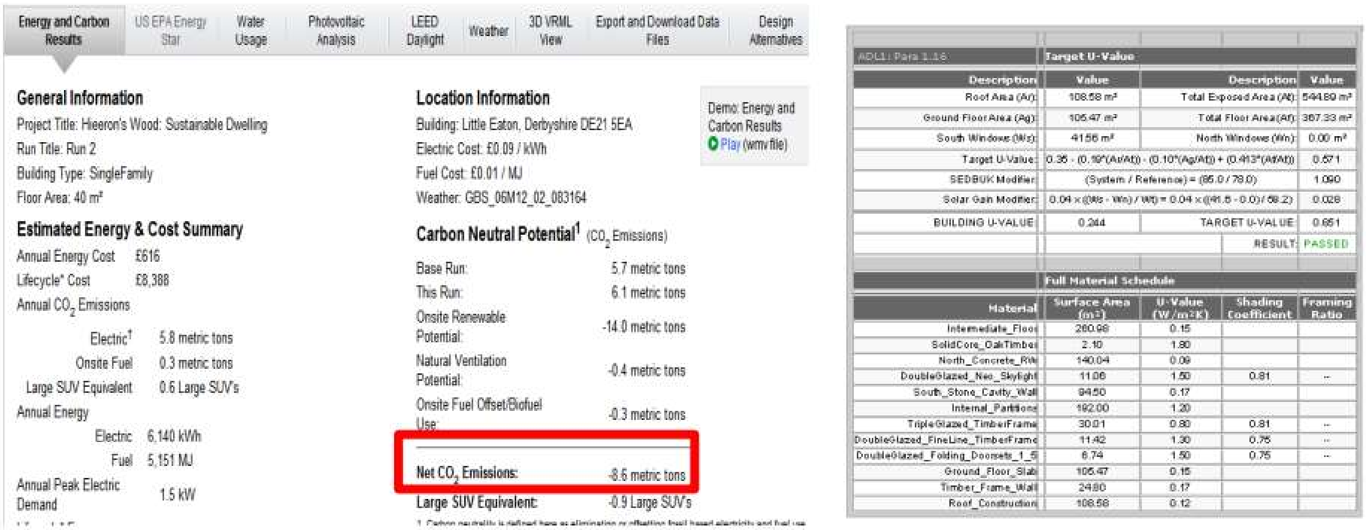
#### 2.3.2.1 Case Study - Energy Plus House, Hieron's Wood, UK

*Referenced: • Author: Dr. Boris Ceranica, Derek Lathamb, Angela Deanc (2015) Tittle: Sustainable Design and Building Information Modelling: Case Study of Energy Plus House, Hieron's Wood, Derbyshire UK [11]*

The building we took as an example is located in a green area. The main goal was to build a building with low traces in the area, to connect with the whole historical, physical and visual context. The selection and use of materials used should be in line with the area. In the beginning of the analysis, it was required that the object produce passive energy, rather than consuming the active one. The use of new advanced technologies, tests performed on new materials that have ecological work processes

and are found in the surrounding environment. The project is developed in three main directions: the use of new materials and technologies; analysis and monitoring of the energy performance of the building for all its functions and throughout the year; and a detailed and well-conceived constructive and architectural project with the area.
The building incorporates both types of energy, passive for saving energy and active for what can't be fulfilled by passive energy. The cellar buried in the ground, does not need electricity to carry out the cooling, as it does the soil itself. This design has entirely the concept of a very private building, which is achieved by hiding in the natural environment, but at the same time to be open to nature, to be transparent, with windows and glass doors. The construction was done with local materials, reducing the damage to the environment, and the costs for transportation. And the stone materials to place on the wall, are protected in your environment. The location of the building is on the hill, to get the most out of the ground where it is located for energy, but also for the best visual appearance.
Figure 8 presents the evolution and cycle of the entire search for this building. This was achieved through the initial human concept, and then the evolution of the idea into programs **like Autodesk © Revit, Green Building Studio** and **Ecotect** to achieve best options possible for the current project. *[12]*
In the initial stages, a simple model was modeled from hand drawings and diagrams. In-depth analysis was done in the environment, to determine the exact positioning, shape and orientation of the building. To generate the first thermal analysis and total energy consumption, various constructive solutions and different materials were made. Thus many BIM models were analyzed and tested until a conclusion was reached for the best possible benefit (*Figure 12*).


***Figure 11.*** True Cycle of Sustainable Design *[11]*




| ADL1: Para 1.16 | Target U-Value | | | |
|---|---|---|---|---|
| Description | Value | | Description | Value |
| Roof Area (Ar): | 108.58 m² | | Total Exposed Area (At): | 544.89 m² |
| Ground Floor Area (Ag): | 105.47 m² | | Total Floor Area(Af): | 367.33 m² |
| South Windows (Ws): | 41.56 m² | | North Windows (Wn): | 0.00 m² |
| Target U-Value: | 0.35 - (0.19*(Ar/At)) - (0.10*(Ag/At)) + (0.413*(Af/At)) | | | 0.571 |
| SEDBUK Modifier: | (System / Reference) = (85.0 / 78.0) | | | 1.090 |
| Solar Gain Modifier: | 0.04 x ((Ws - Wn) / Wt) = 0.04 x ((41.6 - 0.0) / 58.2) | | | 0.028 |
| BUILDING U-VALUE: | 0.244 | | TARGET U-VALUE: | 0.651 |
| | | | RESULT: | PASSED |

| Full Material Schedule | | | | |
|---|---|---|---|---|
| Material | Surface Area (m2) | U-Value (W/m2K) | Shading Coefficient | Framing Ratio |
| Intermediate_Floor | 260.98 | 0.15 | | |
| SolidCore_OakTimber | 2.10 | 1.80 | | |
| North_Concrete_RW | 140.04 | 0.09 | | |
| DoubleGlazed_Neo_Skylight | 11.06 | 1.50 | 0.81 | -- |
| South_Stone_Cavity_Wall | 94.50 | 0.17 | | |
| Internal_Partitions | 192.00 | 1.20 | | |
| TripleGlazed_TimberFrame | 30.01 | 0.80 | 0.81 | -- |
| DoubleGlazed_FineLine_TimberFrame | 11.42 | 1.30 | 0.75 | -- |
| DoubleGlazed_Folding_Doorsets_1_5 | 6.74 | 1.50 | 0.75 | -- |
| Ground_Floor_Slab | 105.47 | 0.15 | | |
| Timber_Frame_Wall | 24.80 | 0.17 | | |
| Roof_Construction | 108.58 | 0.12 | | |

***Figure 12.*** (a) Carbon Neutral Potential Analysis; (b) Initial Thermal Analysis *[11]*

The design process continued in extracting energy consumption and cost, including water use and carbon emissions (Figure 12). Then the thermal areas of the building were tested to understand which spaces need improvement. Then, based on the BIM model, it was seen how the shadows penetrate the building and how the sunlight passes, how these rays create warm and cold areas, what is the natural light reflector, and how much artificial lighting is needed for achieve comfort, and other solar exposure analyzes (Figure 13).

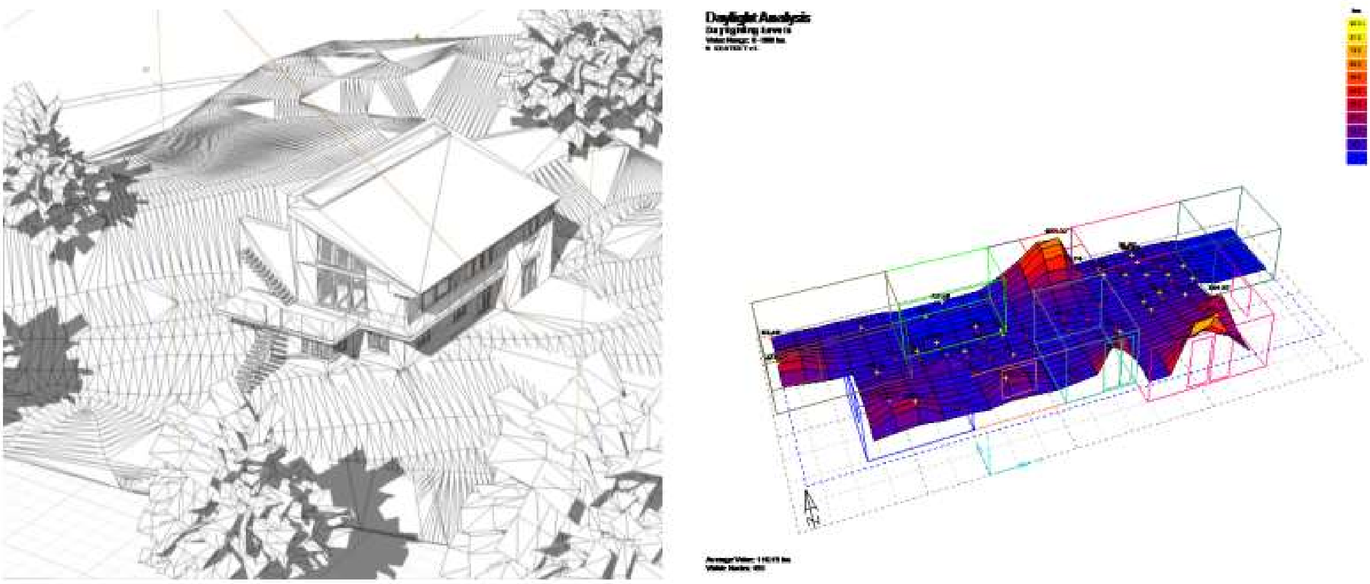



***Figure 13.*** *(*a) Solar Analysis Example, Summer Solstice 21st June, 16:00pm ; (b) Standard Overcast Daylight Analysis Example *[11]*

2.3.2.2 Case Study: Fiori Di Bosco Residence

One of the latest residencies in Tirana, also known as one of the most prestigious ones, is called “Fiori Di Bosco” which is located in the end of Don Bosco Street, has been a complete success, with 95% of the apartments inside being sold before the building was even ready. This was possible because of many factors, such as marketing, huge funds, big investment, promising location, and so on. But, the most important feature of this complex was its very modern-like design and its very comfortable interior organization. This was done by a group of very good engineers and architects which all have shared their experiences with BIM technology. All of them, have stated that they have mastered the use of BIM software which made it rather easy and fun for them to design a near-perfect environment for the eye as well as the commodity. The reason that this residence has so many demands is due to the technology used and production and the criteria of sustainable development that have been used.

***Figure 14.*** Fiori Di Bosco Residence

# CHAPTER 3

# METHODOLOGY

## 3.1 Introduction

As shown in the title, in this chapter I will highlight the methods I have used to conduct this research. Information on this topic is evolving every day and more. Thesis and research continue to be done on how buildings affect the surrounding environment, and the building is treated as a biological organism. In more detail, I will describe the way of collecting information, collecting data to search and analyze this data, comparing examples of analysis of energy models in examples from the literature, and comparing with an example an energy model realized by myself.

## 3.2 Research strategy

The main strategy why these methods have been used is to achieve the most effective and convincing result to fulfill our goal of this thesis. As we have mentioned above, highlighting the benefits of BIM in energy efficiency and their implementation in the Albanian construction industry market. Doing studies, comparisons with different methods, and deriving a more optimal final result.

## 3.3 Research methods

For this research, the methods used were numerous, but we divided them into 2 main groups, getting the best of them.

### 3.3.1. Qualitative methods

To achieve the research objective, traditional qualitative methods have been used. For this Research Proposal document was collected from different platforms and websites across the Internet. As a start I studied how BIM works, the basic concepts and different dimensions of BIM. Information found on the official websites of the products offered in the market. Most information was studied, analyzed and collected by searching the keywords "BIM SOFTWARE" in Google Scholar which brings a lot of online books and PDF files that are accessible for every reader.

Ethnography (participant observation) was also an important part. This method consisted of observing the working method individually in architecture firms and studios. Also conducting unstructured interviews, in order to understand the opinion on BIM in a more spontaneous way of AEC approach to BIM. And because they were unstructured interviews, I had practically made a few points in my head about the topics I was going to discuss, and I made notes in my notebook as soon as I finished the interview.

Reviewed the current state of sustainable development and the objectives set by the UN. Software has evolved to analyze the operation of the building, and how this is best achieved with BIM. These are researches done comparing buildings built with BIM and without BIM.

Information was also carefully selected and observed on the regular Google searching engine method as well as few educative Youtube videos on the matter. Further research will basically concentrate on the incorporation of BIM, Sustainable Design Analysis for a long-term performance monitoring, by using the aspects of sustainable development as a ‘test bed’.

### 3.3.2. Quantitative methods

Quantitative methods emphasize objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques. *[19]*

3.3.2.1 Experiential Data

Obtaining studies of ready-made 3D BIM models analysis from the literature and conducting a detailed analysis of a residential complex by my own. The first example was **the Tsisngua University** stimulating natural disasters. The complex and surrounding neighborhood were upgraded to 3D BIM models, and natural terrain data were retrieved from GIS. Tool used for stimulation of natural disasters were realized by HAZUS. HAZUS is a nationally applicable standardized methodology based on the geographic information system (GIS), containing the models for estimating the potential physical, economic, and social impacts of earthquakes, fires following earthquakes, floods, and hurricanes *[20]*.

Another study that was taken as an example to understand more about the link between BIM and sustainable development was **Energy Plus House, Hieron’s Wood, UK.** At the beginning was analyzed studied the terrain where it would be built and the conceptual diagrams were drawn on how the object proposal would be. The object was modeled in the 3D Revit program, and the plugins used to perform the building's energy consumption analysis were Green Building Studio and Ecotect.

Residential Complex were initially modeled in REVIT, and then generated in the energy model of the building with data from the building materials. Then we use

Autodesk Insight to optimize the energy consumption of our building. It was also ensured that the location of our project was specifically updated where it will be built, to have exact compliance with the climate data.

#### 3.3.2.2 Surveys

In the end of the document, I reached important conclusions by doing some in different design and construction firms. In the conducted, our main goal was to collect data to draw some conclusions on the knowledge and use of BIM software in their work. And as for the benefits it receives from BIM to achieve energy efficiency. The questionnaire was answered by about 50 people, from different fields of construction, with random selection in different firms. The questions in the questionnaire were divided into three main directions:

- Collecting a general information from the background's person who completed the questionnaire;
- His knowledge about BIM in the building industry in the Albanian;
- His knowledge of the basic principles of sustainable development.

The questionnaire:

“ I would be very grateful if you would complete this questionnaire to help me with my thesis entitled "BIM's improvements of building energy efficiency in Albania's Architecture, Engineering and Construction". The information in this questionnaire is completely private, and your data will not be shared.

1.Are you:

oStudent
oArchitect
oUrban planner
oConstruction engineering
oCivil engineering
oDeveloper

2.Your age is:

o20-25 years old.
o26-40 years old.
o41- 65 years old.
o+66 years old

3.Have you studied:

oAlbania
oAboard

4.Are you familiar with BIM:

oYes
oNo

5.Do you use BIM for modeling:

oYes oNo

6.Do your colleagues work with BIM:

oYes oNo

7.Do you make practices/ workshops on topics related to BIM:

oYes oNo

8.Do you know the principles of sustainable development:

oYes oNo

9.Do you make practices/ workshops on topics related to sustainable development:

oYes oNo

10.Do you know the benefits of modeling in BIM to achieve sustainable development:

oYes oNo

11.Have you used software stimulation to develop building analysis:

oYes oNo

12.Do you think BIM is widely used in Albania:

oYes oNo

13.Are we building sustainable in Albania:

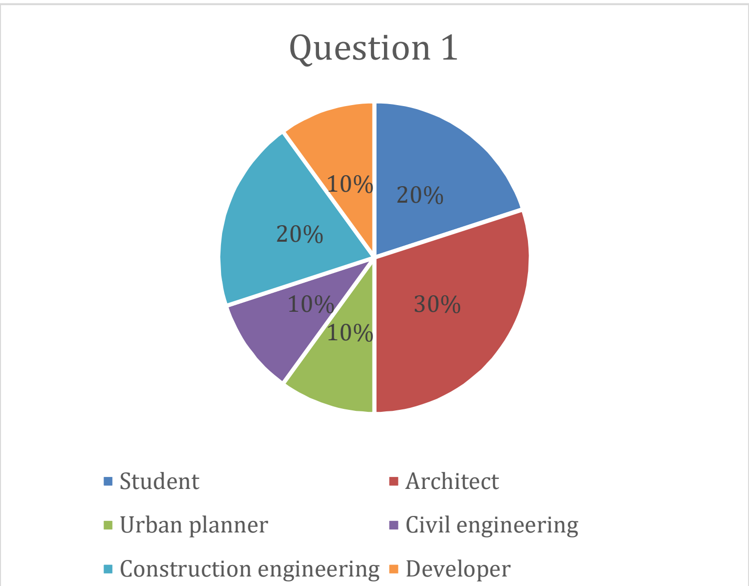
oYes oNo

14.Do you think that there is more room for improvements in Albania towards sustainability:

oYes oNo

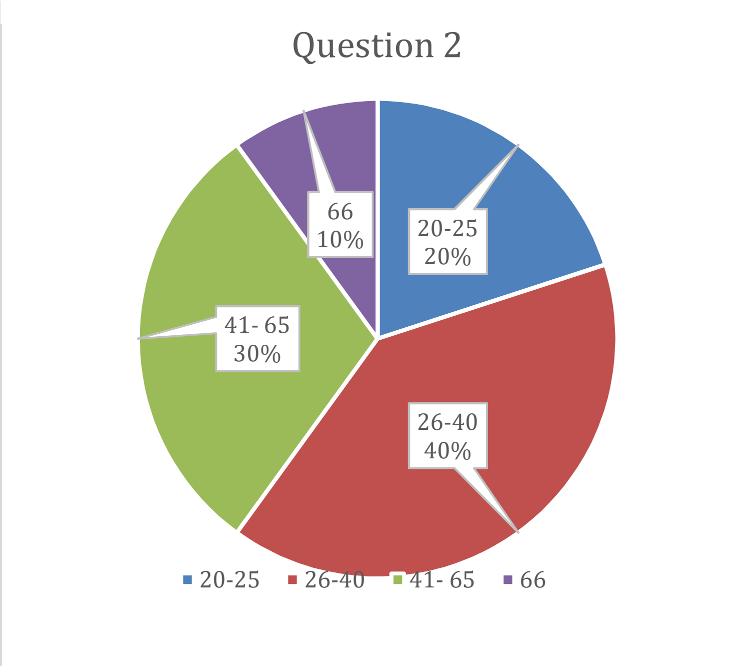
Thank you so much for your time!"

***Table 1.*** Question 1



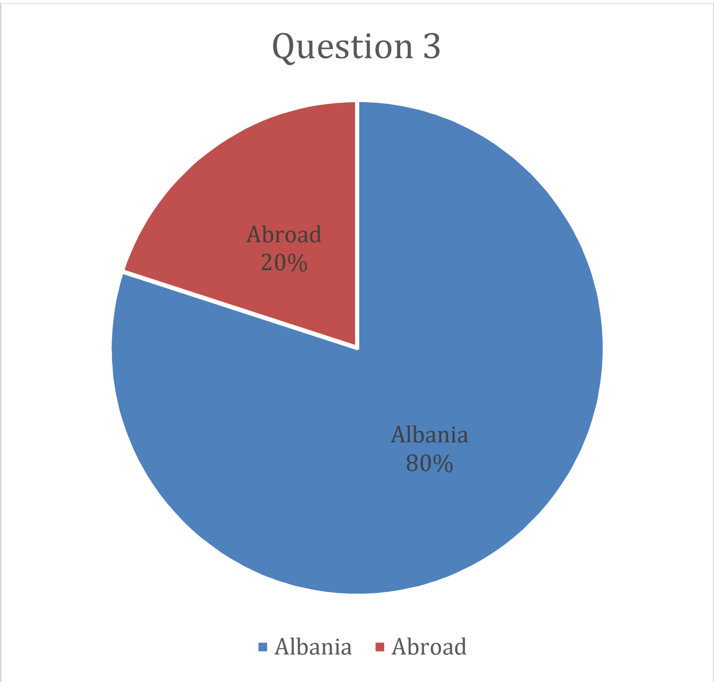

In the first question we understand that BIM is not only good for designers, but for all persons operating in the field of construction. Shortens time in the conception, drafting, and development of the project, both for the architect and for the civil engineer to develop the project in the most efficient way. For this reason, the surveys were addressed to different people, with different backgrounds.

*Table 2*. Question 2



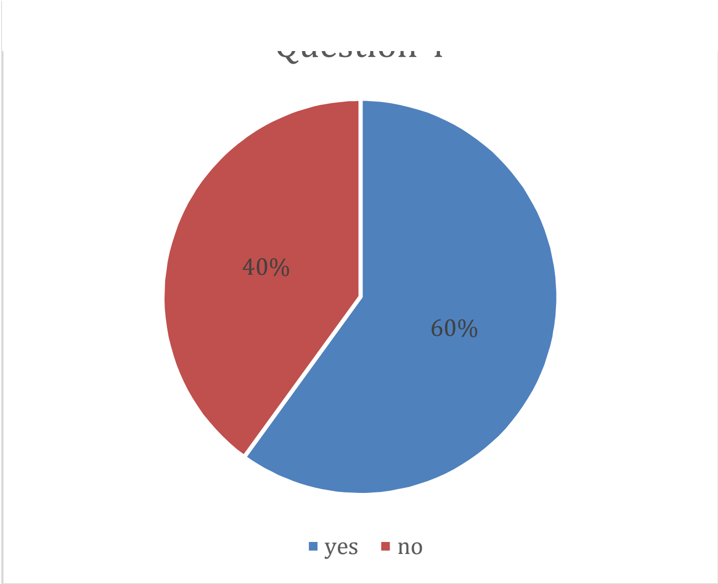

Going deeper into the thesis, age had a very large impact on the number of BIM users. This is because older people have difficulty adapting to the new technology that is advancing day by day. Adults, have higher professional skills, this is not always true, and instruct BIM users by guiding them in solving problems that arise in the field. Younger people learn modeling programs faster, adapt more quickly to technology.

***Table 3.*** Question 3




An influential factor was the place where the studies were conducted. In developing countries, norms and laws have the most decisive force in construction. Also during the school years, the study program is more structured trying to adapt to the technology both in BIM, and in the technology of new building materials to increase energy efficiency.

***Table 4.*** Question 4




About 60% are familiar with the concept of BIM, but only 40% are users of BIM into their work. This shows the low prevalence of BIM programs in the Albanian market. 30% of respondents answered that their colleagues or the place where they work, model in BIM. In Albania recently, the demand for users of REVIT, Rhino and other BIM programs has increased, this shows that many studios are recognizing the best of BIM in architecture and construction.

Asked if at work or school they have developed professional internships or seminars on modeling in BIM, 80% of them answered yes. In Albania recently, the demand for users of REVIT, Rhino and other BIM programs has increased, this shows that many studios are recognizing the best of BIM in architecture and construction. Design studios are also developing various modeling courses at BIM, to increase the work efficiency of their working groups, and to get all the benefits of BIM.

***Table 5.*** Question 5

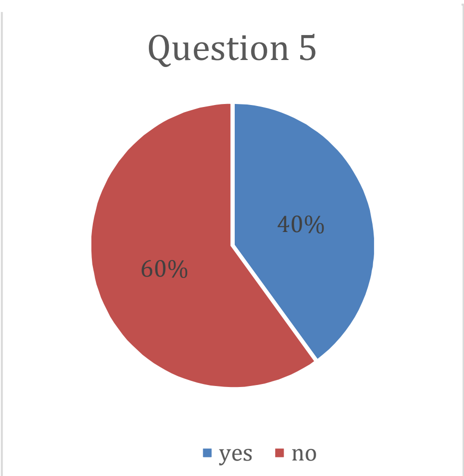



***Table 6.*** Question 6

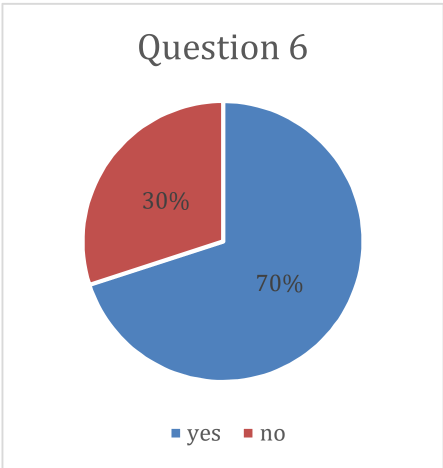



***Table 7.*** Question 7

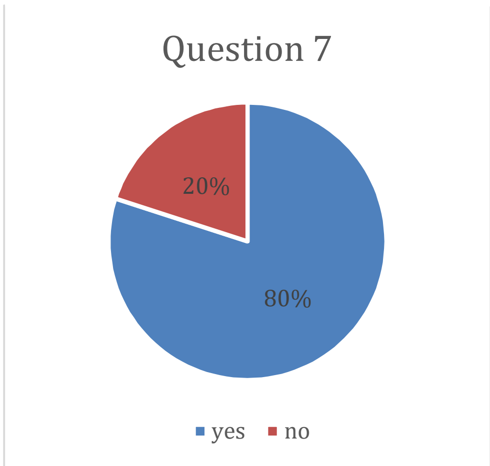
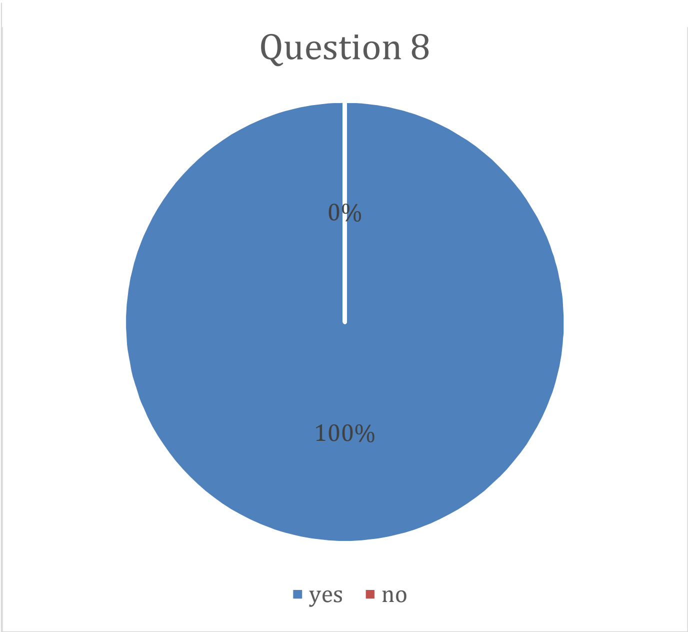


***Table 8.*** Question 8




If you ask about the principles of sustainable development, everyone says they are familiar with the principles. But few know how to implement it. Sustainable development in construction is not only related to the ventilated facade and the use of green terraces. A wrong concept encountered in Albania. Probably because the investor has an impact on the quality of construction. Higher quality leads to higher costs of the building. Professional internships and workshops are organized and 80% of the respondents confirmed. This is because the subsidiaries of companies that supply the market with materials, occasionally hold open lectures, in order to present new products. Building materials technology, as much as possible are going to minimize the negative effects on the environment, both during the production process, but also for the consumer, to bring energy efficiency. Modeling in BIM, processes these data, produces a detailed analysis of the energy consumption of the facility, but only 50% of respondents know the benefits and also use them for energy analysis.

***Table 9.*** Question 9

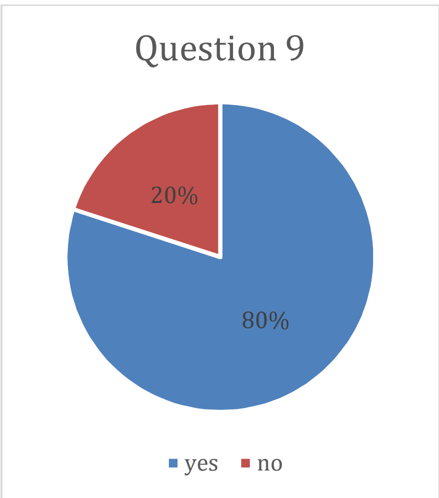



***Table 10.*** Question 10

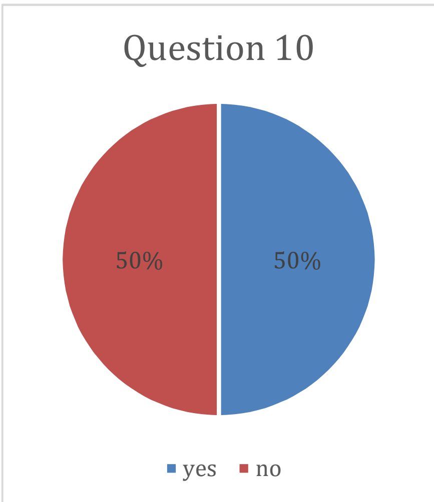
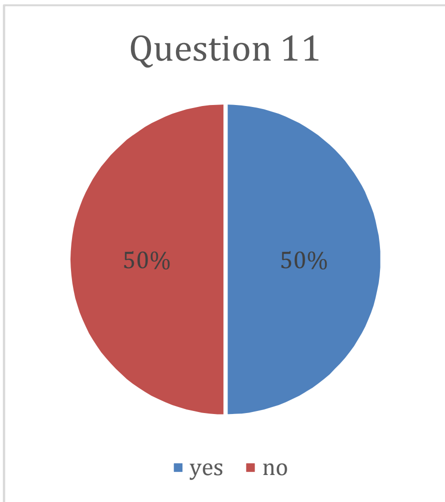



***Table 11.*** Question 11



Almost everyone says that BIM is not widely used in Albania or all its benefits are not used. 70% say that new constructions in Albania are being made with higher quality and considering energy efficiency strategies. This is because the norms for constructions in Albania have been legally strengthened.

Everyone says that even more is needed to improve sustainable development in Albania.

***Table 12.*** Question 12

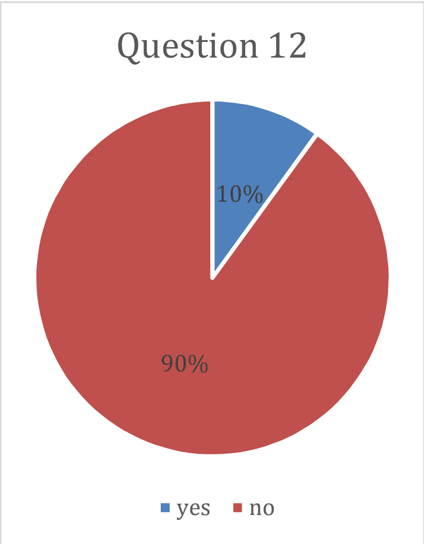



***Table 13.*** Question 13

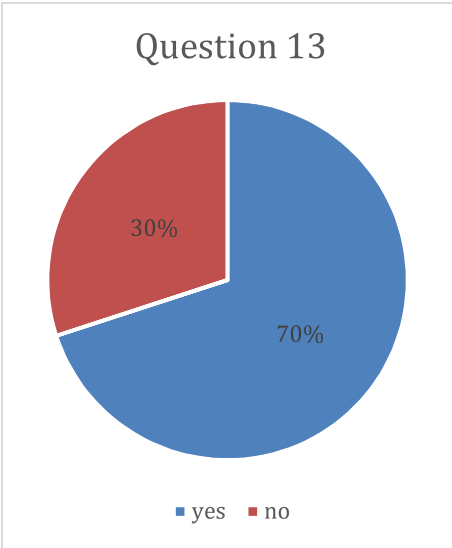
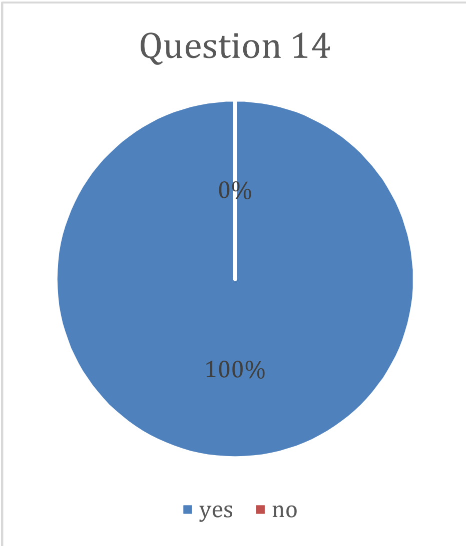



***Table 14.*** Question 14



# CHAPTER 4

# PROPOSAL

## 4.1 Residential Complex

The site where the facility is located is located in the area known as “Kthesa e Yzberishtit” or American Hospital 3 which is bordered by the roads “Koferenca e Peza” in the South-East. “3 Dëshmoret” Street in North-east, “Feti Gjilani” Street in South-West, “Agim Safa” Street in North-West. Next to the square is the 9-year school Kongresi i Manastirit.

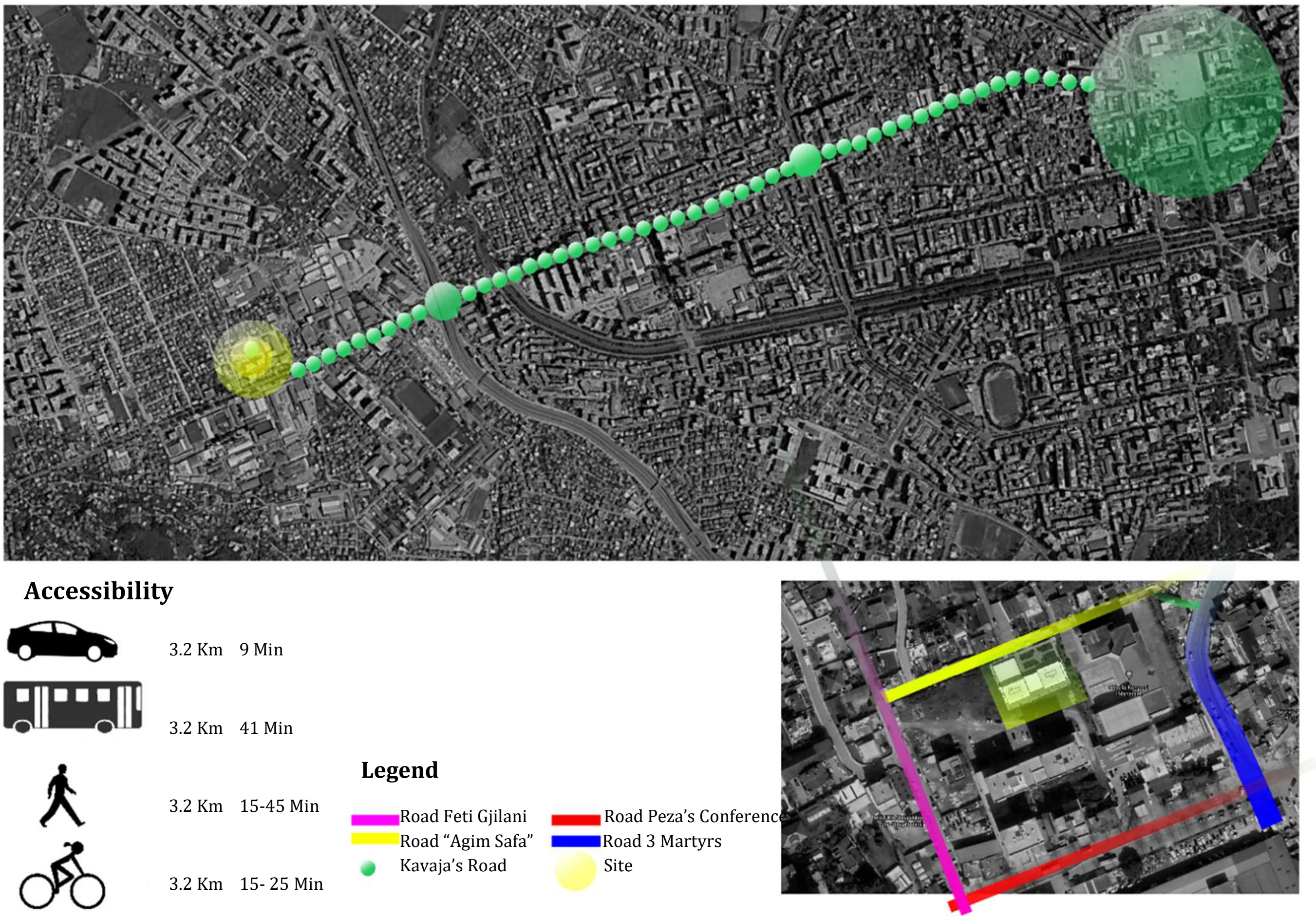


***Figure 15.*** Case Study

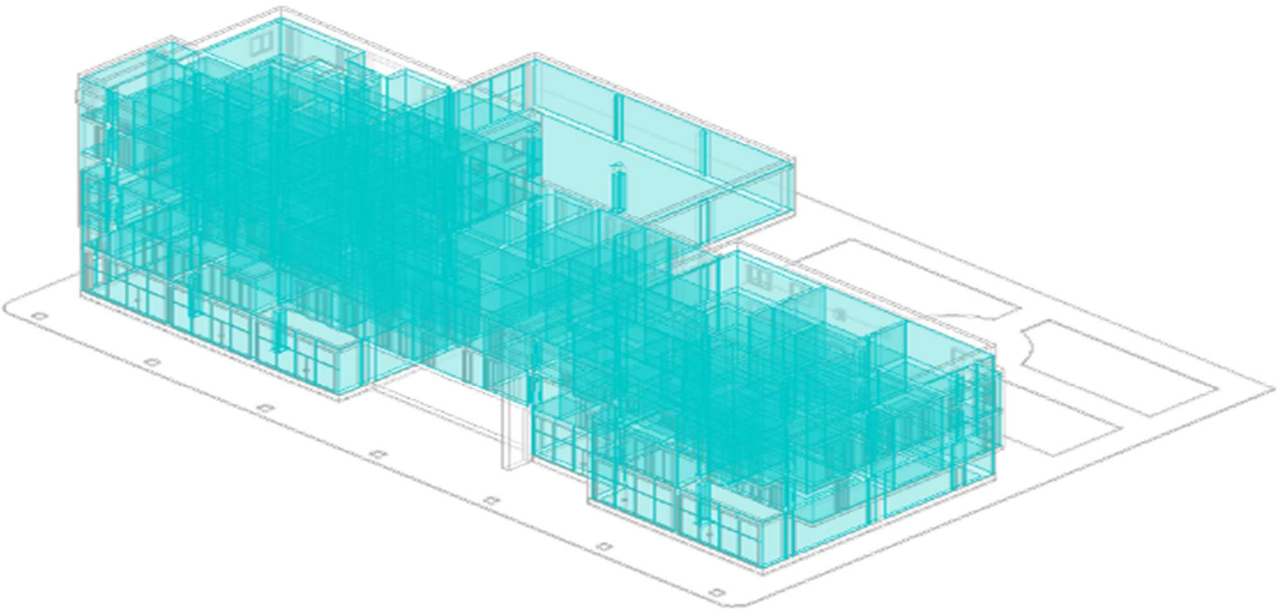


***Figure 16.*** Energy Model of the building

## Albania fuel prices, electricity prices

The table below shows the most recent prices per liter of octane-95 gasoline, regular diesel, and other fuels. These are retail (pump) level prices, including all taxes and fees. The information is updated weekly.

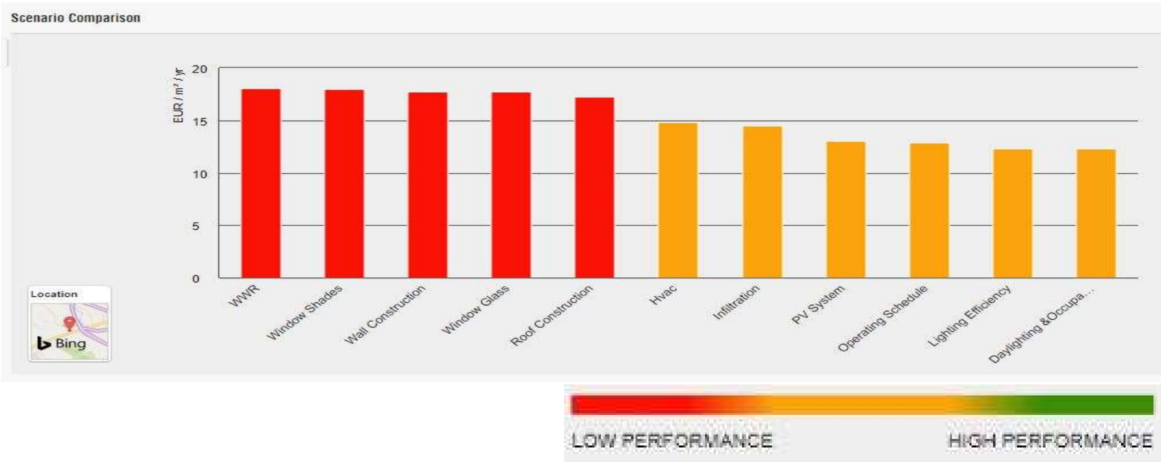
| Fuels, price per liter | Date | ALL | USD |
|---|---|---|---|
| Gasoline prices | 14.06.2021 | 145 | 1.429 |
| Diesel prices | 14.06.2021 | 140 | 1.38 |
| LPG prices | 14.06.2021 | 45 | 0.444 |

The next table shows the electricity rates per kWh. In the calculations, we use the average annual household electricity consumption and, for business, we use 1,000,000 kWh annual consumption. More recent data are available for download.

| Electricity prices per kWh | Date | ALL | USD |
|---|---|---|---|
| Households | 01.09.2020 | 11.4 | 0.112 |
| Business | 01.09.2020 | 12.65 | 0.125 |

***Figure 17***. Service rates https://www.globalpetrolprices.com/Albania/

***Table 15.*** Scenario Comparison 1



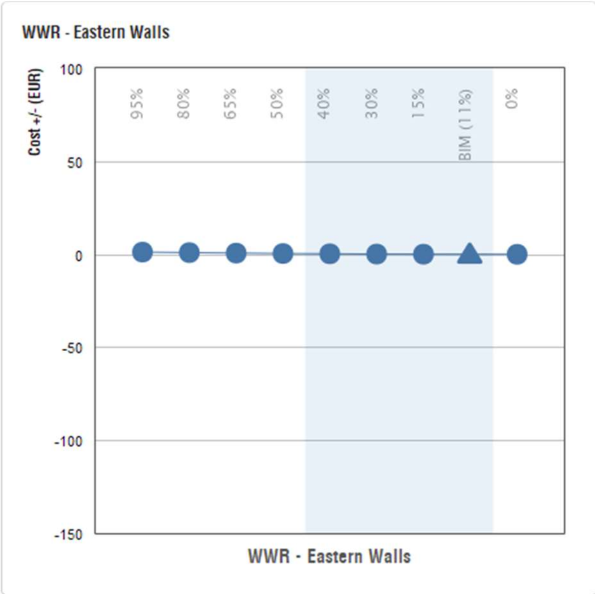

In this project we have realized the energy study of the building. As a start, based on Albanian laws and norms, I found the price of energy to determine an energy cost than my facility needs. I received the service rate per kWh from GlobalPetrolPrices for Albania. object I propose changes of values in the respective graphs (walls, windows, lifespan of the building, transparent spaces, etc.) from which we conclude that the object now has an average energy performance (Graph 3). Buildings should be easily adaptable and for functions other than the original, for example an object intended for a shopping center, to be easily adaptable to an office center, at no additional cost. Green or sustainable building is the practice of creating healthier and more resource-efficient models of construction, renovation, operation, maintenance, and demolition. *[13]*

***Table 16.*** Scenario Comparison 2


*Table 17*. Scenario Comparison 2

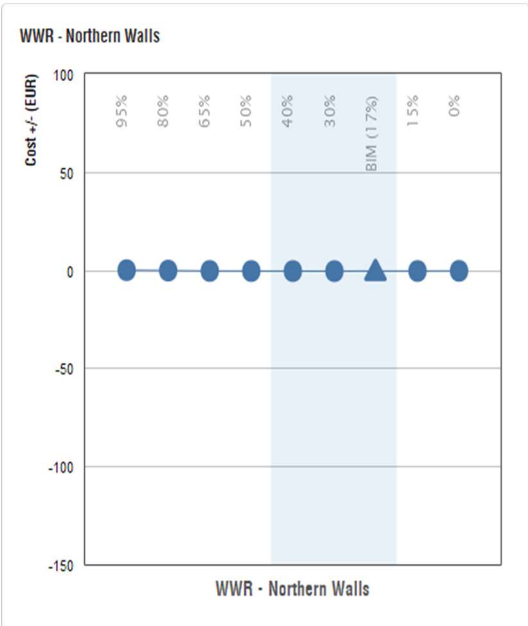

***Table 18.*** WWR -

Easter Walls



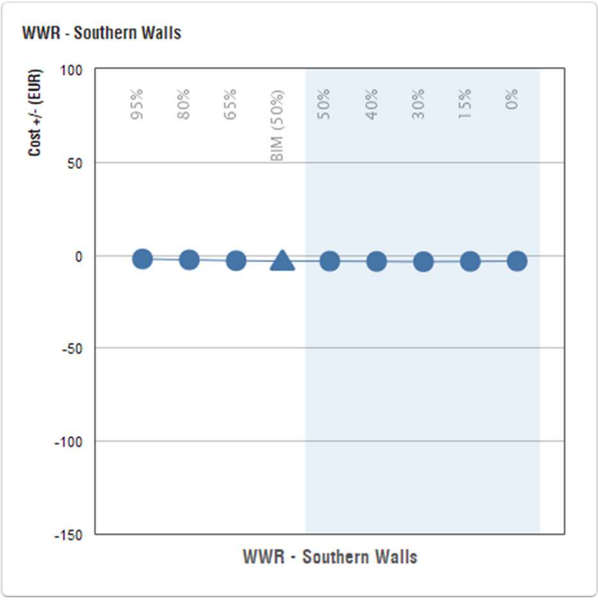

We study the structural elements of the building, in this graph is presented the eastern wall, this wall to have a better energy performance based on the service rate per kWh received from GlobalPetrolPrices for Albania its performance must be between the values 11 % to 40%.

***Table 19***. WWR - Northern Walls



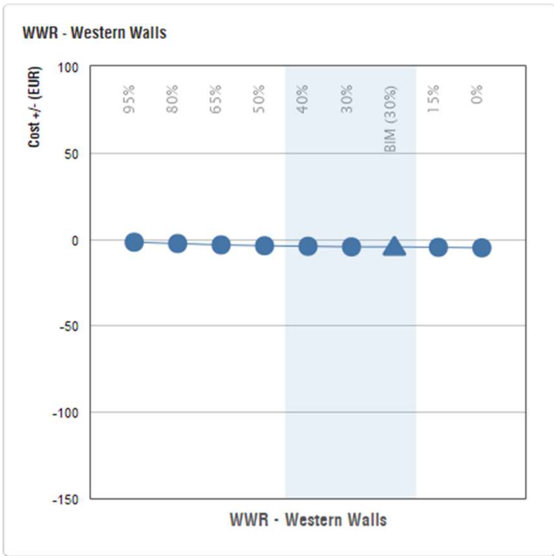

In this graph is presented the northern wall, this wall to have a better energy performance based on the service rate per kWh received from GlobalPetrolPrices for Albania its performance must be between the values 17% to 40%.

*Table 20.* WWR - Southern Walls



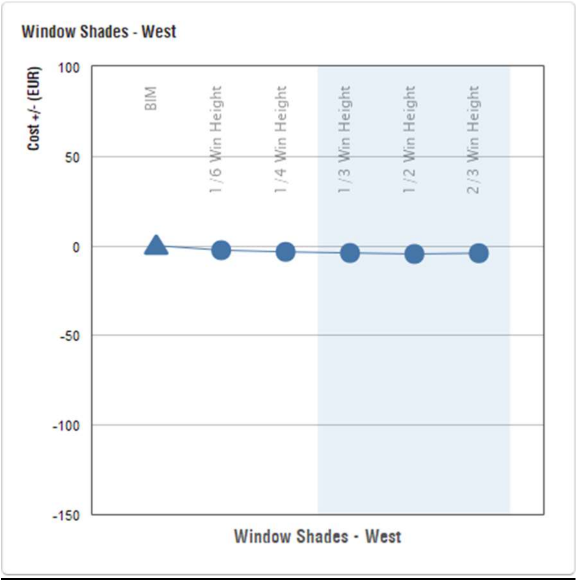

This graph shows the southern wall of the building under study, this wall to have a better energy performance based on the service rate per kWh received from GlobalPetrolPrices for Albania its performance must be between values 0% to 50%. This is because this wall is affected by many positive environmental factors such as the sun.

*Table 21.* WWR - Western Walls



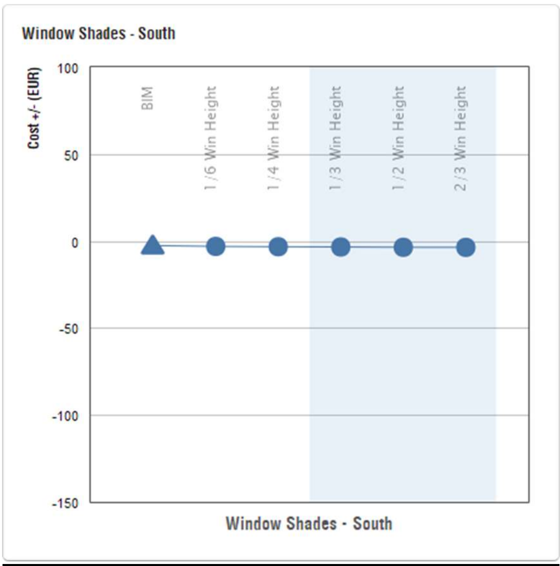

This graph shows the western wall of the building under study, this wall to have a better energy performance based on the service rate per kWh received from GlobalPetrolPrices for Albania its performance must be between values 30% to 40 %.

***Table 22.*** Window Shades - West



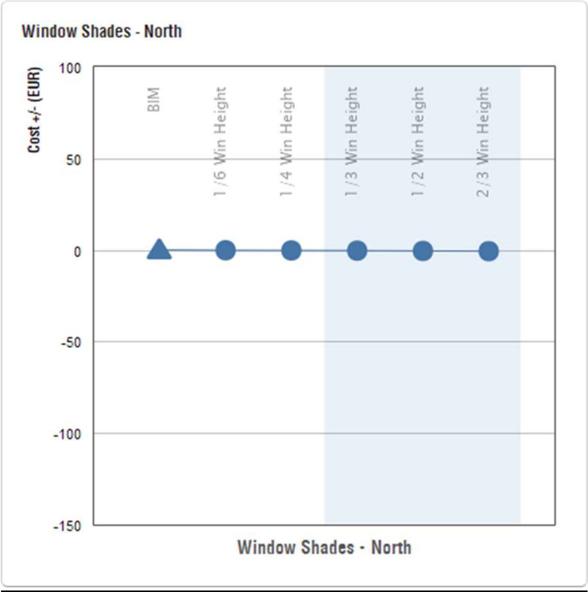

In the study we take other structural elements of the building, in this graphic is presented the shades of windows in the west and to have a better energy performance in this element based on the service rate per kWh obtained from GlobalPetrolPrices for Albania window shades to the west should be between the values 2/3 of the height to 1/3 of the height.

***Table 23.*** Window Shades - South



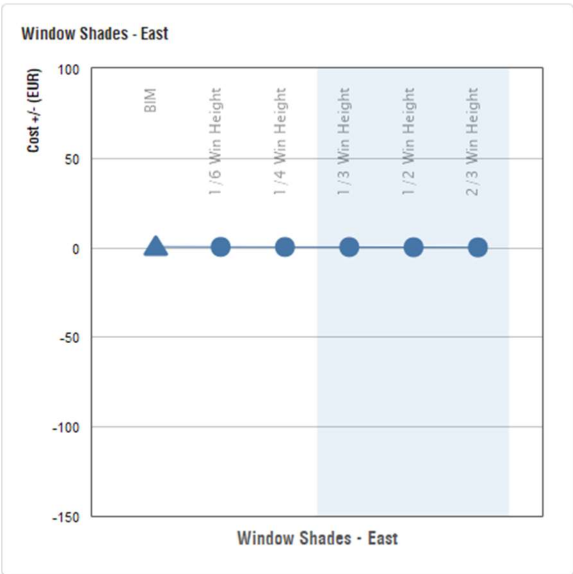

This graph shows the shades of windows in the south and to have a better energy performance in this element based on the service rate per kWh obtained from GlobalPetrolPrices for Albania the shades of windows in the south should be between the values 2/3 of height up to 1/3 of height.

***Table 24.*** Window Shades - North



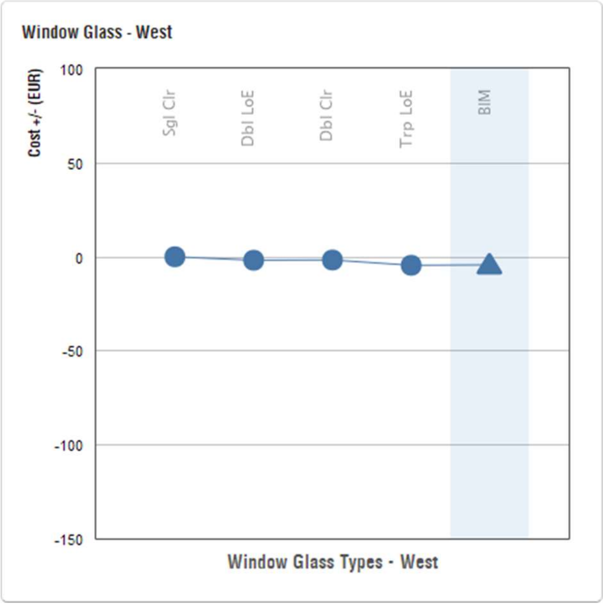

This graph shows the shades of windows in the north and to have a better energy performance in this element based on the service rate per kWh obtained from GlobalPetrolPrices for Albania the shades of windows in the north should be between the values 2/3 of height up to 1/3 of height.

***Table 25.*** Window Shades - East



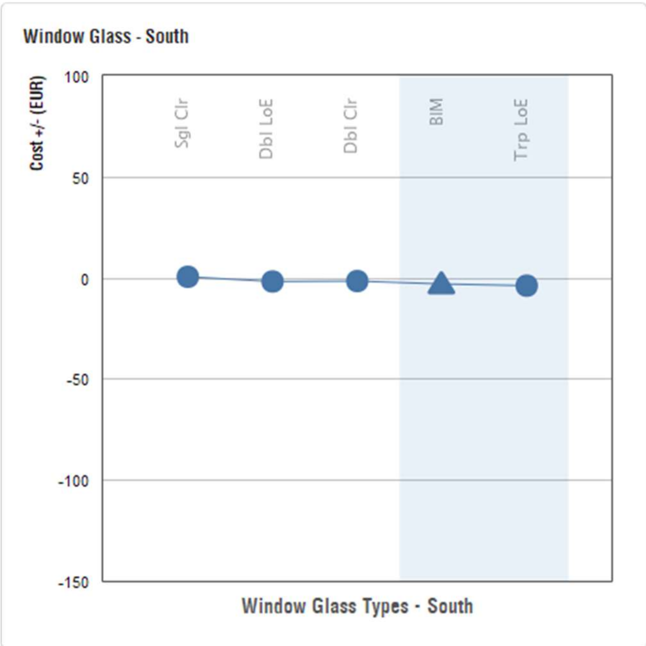

This graph shows the nuances of the east windows and to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania the nuances of the east windows should be between the values 2/3 of height up to 1/3 of height.

***Table 26.*** Window Glass - West



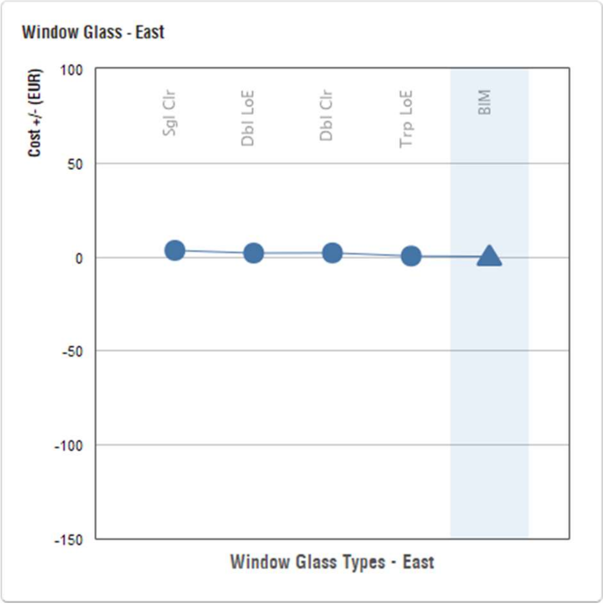

This graph shows the type of window glass in the west and to have a better energy performance in this element based on the service rate per kWh obtained from GlobalPetrolPrices for Albania the glass used in the west must be at BIM values.

***Table 27.*** Window Glass - South



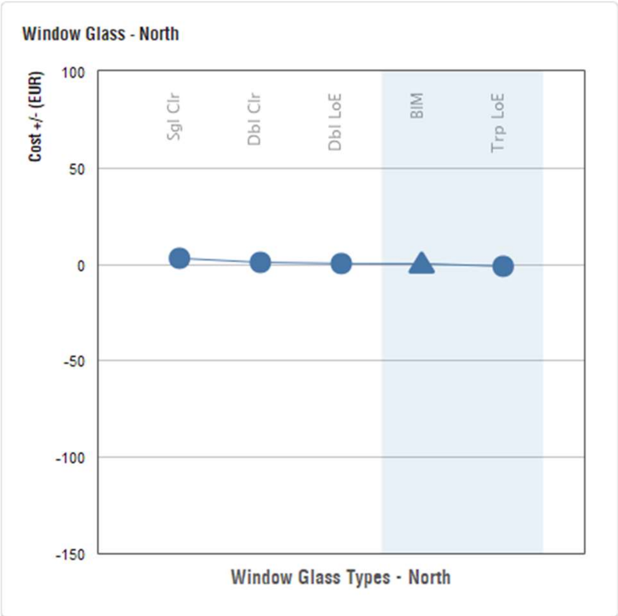

The graph shows the type of window glass in the south and to have a better energy performance in this element based on the service rate per kWh obtained from GlobalPetrolPrices for Albania the windows used in the south must be in the values Trp LoE to BIM.

***Table 28.*** Window Glass - East



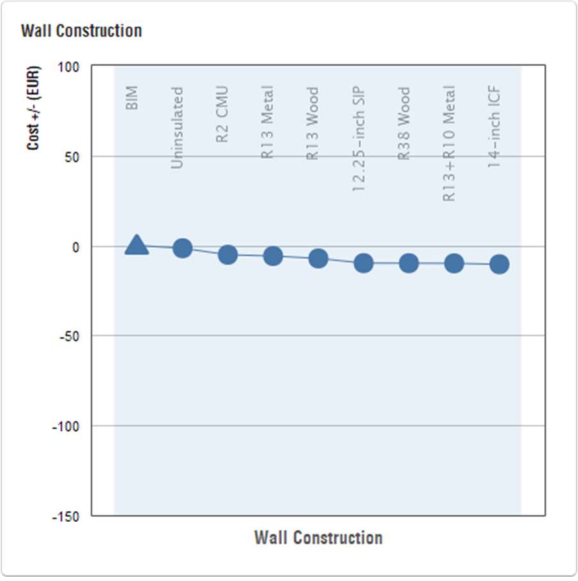

The graph shows the type of window glass in the east and to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania the windows used in the east must be in BIM values.

***Table 29.*** Window Glass - North



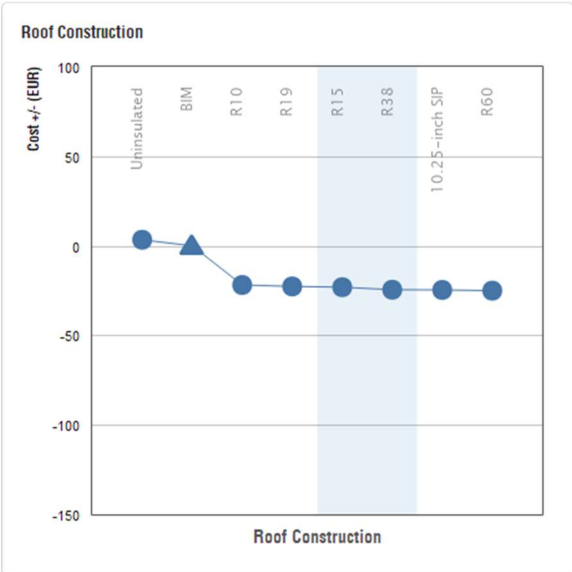

The graph shows the type of window glass in the north and to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania the windows used in the north must be in the values Trp LoE to BIM

***Table 30.*** Wall Construction



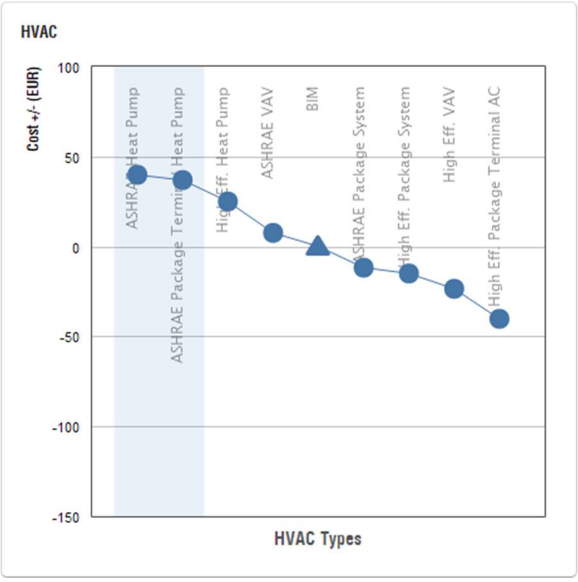

In this graph is given the wall construction and to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania the wall construction must be in the values of 14-inch ICF up to BIM.

***Table 31.*** Roof Construction



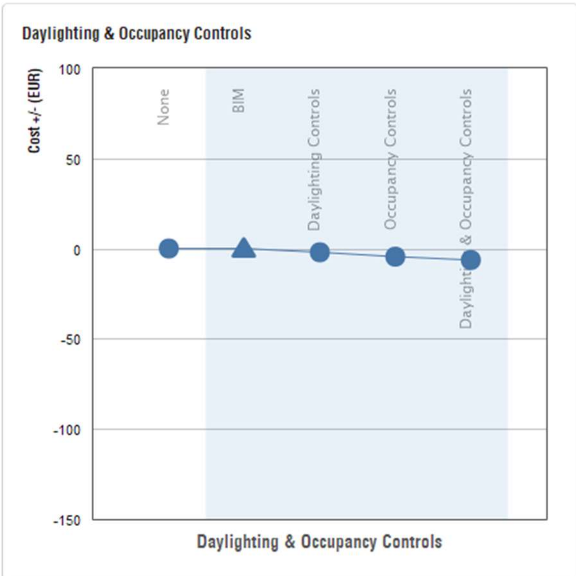

In this graph is given the roof construction and to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania the roof construction should be in the values R38 to R15.

***Table 32.*** HVAC



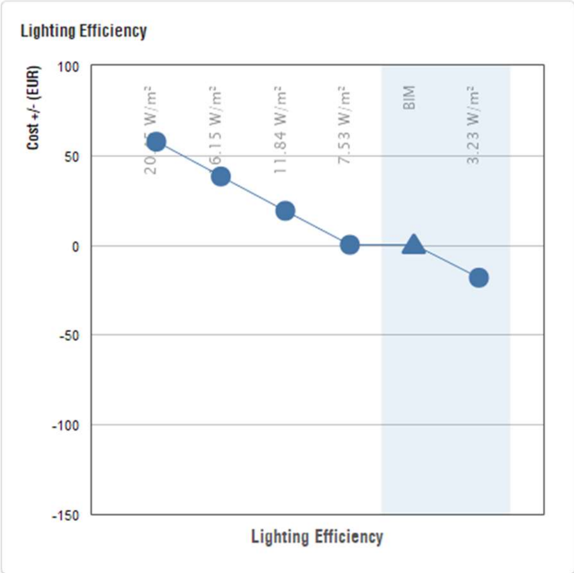

In this graph the type of HVAC is given and in order to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania the type of HVAC must be in the values ASHRAE Package Terminal Heat Pump up to ASHRAE Heat Pump.

***Table 33.*** Daylighting & Accupancy Controls



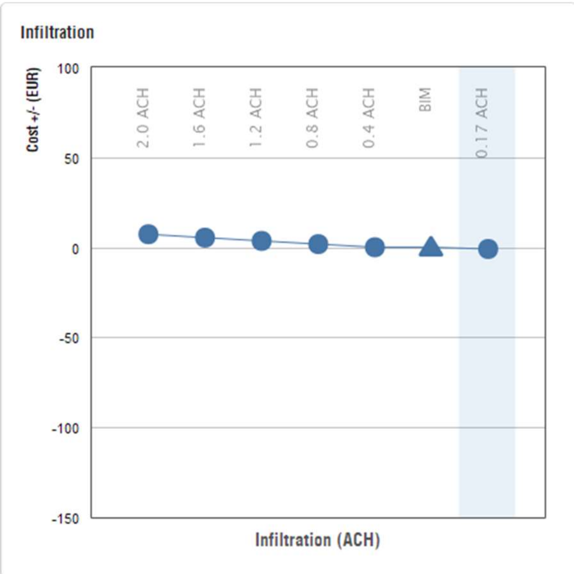

In this graph is given the daylight and housing controls and to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania daylight and housing controls should be in the values Daylight And Housing Controls up to BIM.

*Table 34.* Lighting Efficiency



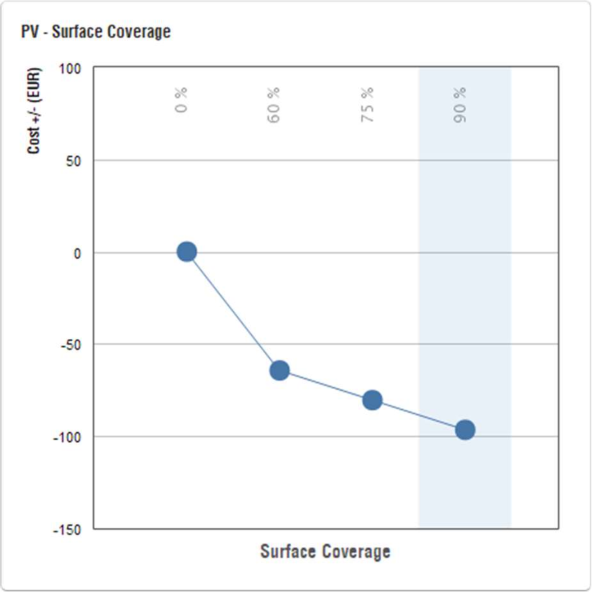

In this graph is given the lighting efficiency and to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania the lighting efficiency should be in the values of 3.23 W / m2 up to BIM.

*Table 35.* Infiltration



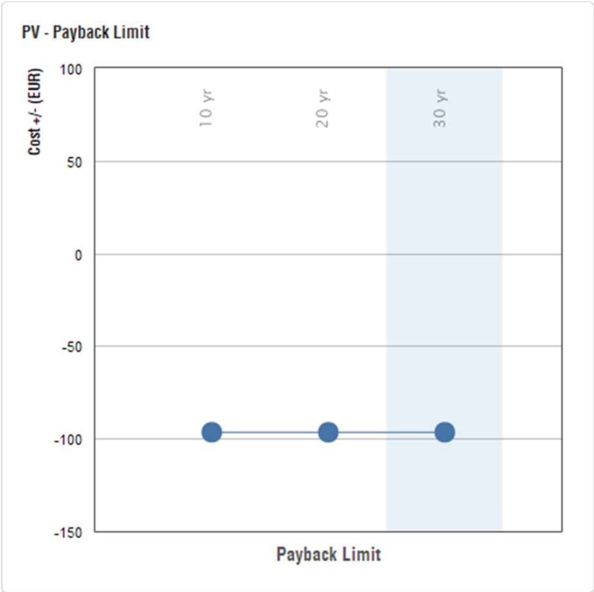

In this graph is given the infiltration and to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania the infiltration must be in the values of 0.17 ACH.

*Table 36.* PV- Surface Coverage



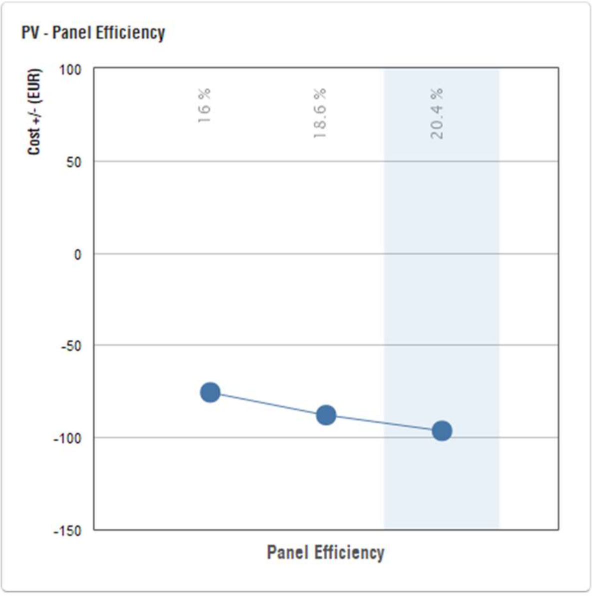

In this graph is given pv- surface coverage and to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania pv- surface coverage should be in the values of 90%.

*Table 37.* PV - Payback Limit



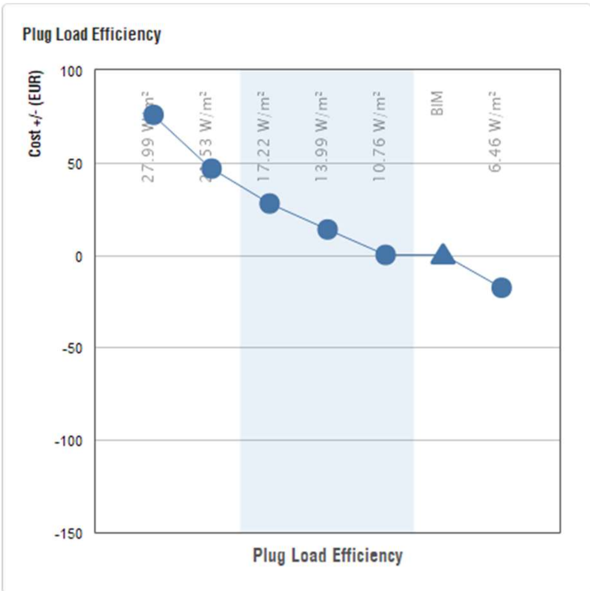

In this graph is given the pv limit and to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania the pv limit must be in the values of 30 yr.

***Table 38.*** PV - Panel Efficiency



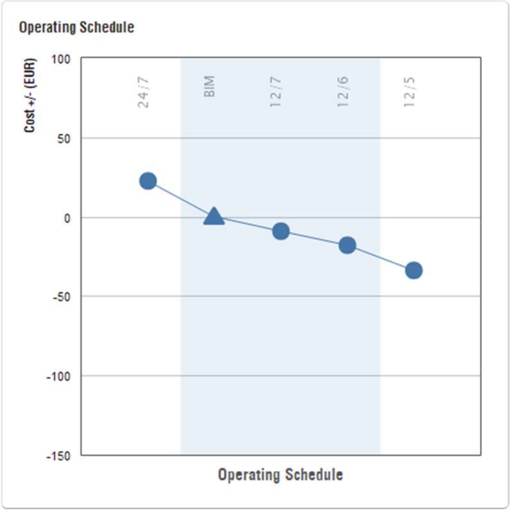

In this graph is given the efficiency of the panels and to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania the efficiency of the panels must be in the values 20.4%.

***Table 39.*** Plug Load Efficiency




In this graph is given the efficiency of the load on the outlet and to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania the efficiency of the load on the outlet must be in the values of 10.76 w / m2 up to 17.22 w / m2.

***Table 40.*** Operating Schedule




In this graph is given the operating schedule and in order to have a better energy performance in this element based on the service rate per kWh received from GlobalPetrolPrices for Albania the operating schedule should be in the values 12/6 up to BIM.

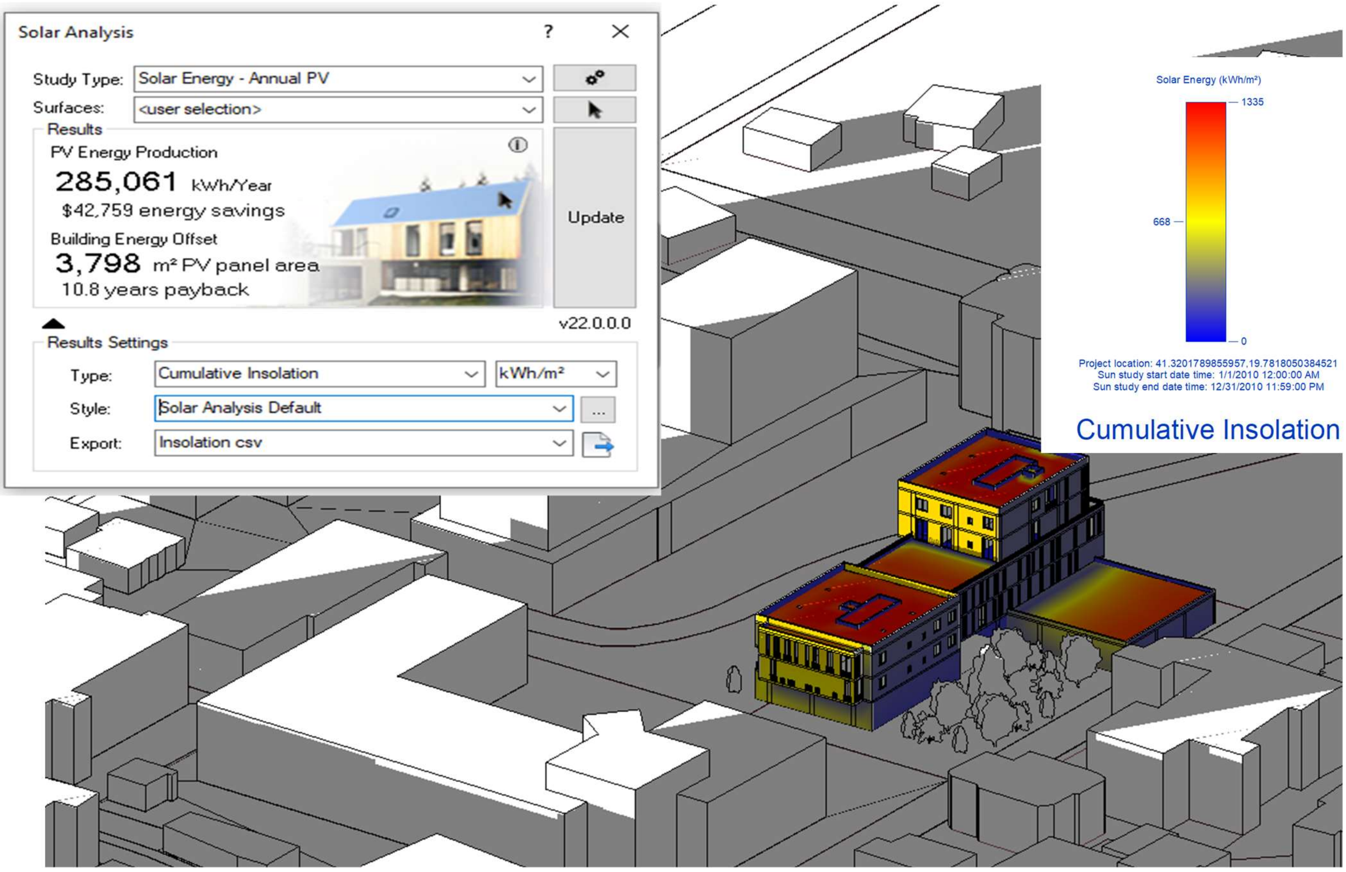



***Figure 18.*** Solar Analysis 1

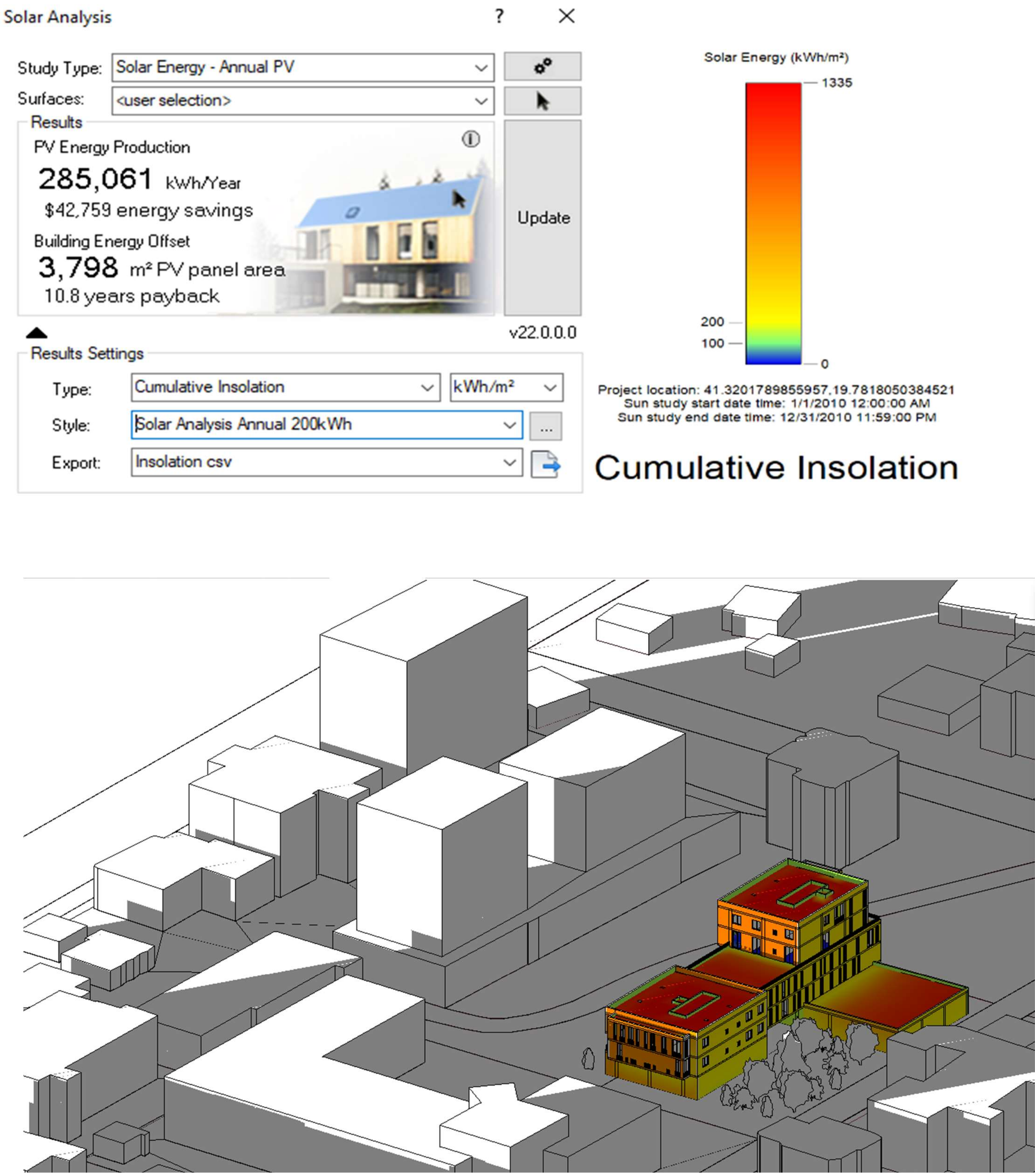



***Figure 19***. Solar Analysis 2

**Solar Analysis**

Accumulated energy in the building for 200 kWh

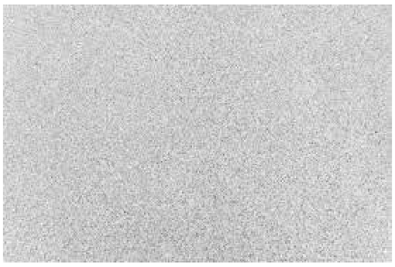
**Proposal of materials**

Reflectivity of materials

The materials should have high albedo, the materials of the paved surfaces should have light colors in order to reflect more sunlight and not absorb it, creating the risk of heat island.

According to table 4, in parking spaces, it is advisable to use light-colored asphalt.

According to table 4 showing the albedo values for green spaces, fresh green or yellow grass can be used.



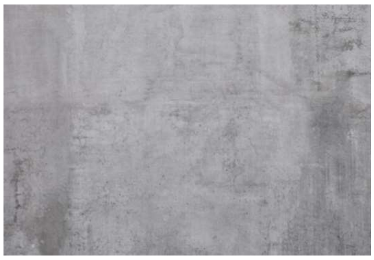
WHITE ASPHALT

LONG GREEN GRASS

SAND

ASPHALT

CRUSHED RED BRICK



POLISHED CONCRETE

***Table 15.*** Albedo

| Table 9. Albedo of selected surfaces† | |
|---|---|
| **WALLS MADE OF CONCRETE AND ADOBE BLOCKS** | |
| *Burnt adobe block, running bond, tooled light grey mortar joint* | *0.36* |
| *Burnt adobe block, running bond, raked light grey mortar joint* | *0.34* |
| *Colored slump block, running bond, concave mortar joint, Tan* | *0.43* |
| *Colored slump block, running bond, concave mortar joint, Plain* | *0.44* |
| *Colored slump block, running bond, concave mortar joint, Buff* | *0.39* |
| *Colored slump block, running bond, concave mortar joint, Palo Verde* | *0.33* |
| **PAINTED AND COATED WALLS** | |
| *Painted slump block, running bond, concave joint, Pearl White* | *0.74* |
| *Painted slump block, running bond, concave joint, White* | *0.71* |
| *Painted slump block, running bond, concave joint, Spanish White* | *0.68* |
| *Painted slump block, running bond, concave joint, Eggshell White* | *0.65* |
| *Painted concrete masonry unit, running bond, concave joint, Bone White* | *0.72* |
| *Painted concrete masonry unit, running bond, concave joint, Sea shell Beige* | *0.55* |
| *Painted concrete masonry unit, running bond, concave joint, Pearl White* | *0.69* |

Table 12. Albedos of parking lots (Clear and calm day, 5-23-91).

| Description | Time (DST) | Albedo |
|---|---|---|
| Black asphalt, ~3 years old, Powell Street Plaza, Emeryville | 10:35 | 0.08 |
| Black asphalt, ~3 years old, Powell Street Plaza, Emeryville | 10:45 | 0.07 |
| Black asphalt, ~2 years old, Market Place, Emeryville | 11:25 | 0.05 |
| Black asphalt, ~2 years old, Market Place, Emeryville | 11:35 | 0.06 |
| Gravel-topped, moderate light, over 5 years old, Market Place | 11:50 | 0.14 |
| Lighter asphalt with speckles, ~4 years+, CH2M Hill parking lot | 12:00 | 0.13 |
| Asphalt, light-colored, 6 years+, Berkeley Marina | 12:46 (spot A) | 0.15 |
| Asphalt, light-colored, 6 years+, Berkeley Marina | 12:51 (spot B) | 0.14 |
| Asphalt, dark-colored, 1 year, El-Cerrito Plaza | 13:05 | 0.06 |
| Asphalt, light-colored w/speckles, El-Cerrito Plaza | 13:15 | 0.12 |
| Asphalt, old, black, cracked, El-Cerrito Plaza | 13:20 | 0.06 |
| Asphalt, old, light w/speckles, El-Cerrito Plaza | 13:25 | 0.13 |

Table 13. Albedo of grass areas (UCB Campus, Clear/calm day, 6-5-91).

| Description | Time (DST) | Albedo |
|---|---|---|
| 3" long, moist, deep green | 11:00 | 0.22 |
| 3" long, moist, yellowish | 11:10 | 0.22 |
| 2" long, dry, moderate green, patchy | 11:17 | 0.20 |
| 1" long, wet, moderate green, patchy, w/debris | 11:27 | 0.19 |
| 2" long, dry, moderate-deep green w/ pink clovers | 11:45 | 0.21 |
| 3" long, dry, moderate green | 11:59 | 0.17 |
| 2.5" long, dry, moderate green, wide blade | 12:07 | 0.18 |
| 2" long, dry, yellowish, old | 10:40 | 0.20‡ |
| 2" long, dry, yellowish, patchy | 10:45 | 0.19‡ |
| 1" long, dry, patchy w/exposed soil | 10:55 | 0.17‡ |
| 3" long, dry, deep green, wide blade | 11:00 | 0.20‡ |

| GROUND SURFACES | |
|---|---|
| *Weathered asphalt driveway* | *0.19* |
| *Concrete slab, grey, smooth* | *0.36* |
| *Crushed used brick, red, decorative landscape* | *0.30* |
| *Desert soil, natural* | *0.29* |

*Resource: High-Albedo Materials for Reducing Building Cooling Energy Use [14]*

The selection of the quality of the glass should be the largest transmission component and the smallest radiation and absorption component. KR + KA + KT = 1 it is calculated that the absorbed component releases energy of the abs. *[15]* KT + 1/3 KA what enters inside (solar factor). For the system to function well, the materials used must have a high thermal capacity.

Glass with air intercaps are used to increase thermal resistance and reduce losses. This air must be dehydrated to avoid condensation. This reduces thermal losses by about 50%.

The air between the two walls of the glass is argon or air that has thermal resistance and the window has shutters, thermal energy losses are reduced.

***Table 16.*** Thermal resistance factor

| MATERIAL | THICKNESS (mm) | tdif | L10°C (W/ m²K) |
|---|---|---|---|
| Single glass | | | |
| normal float | 4 | 0.78 | |
| low iron | 4 | 0.84 | |
| Double glazed window | | | |
| float | 16 | 0.67 | 5.20 |
| low iron | 16 | 0.76 | 5.20 |

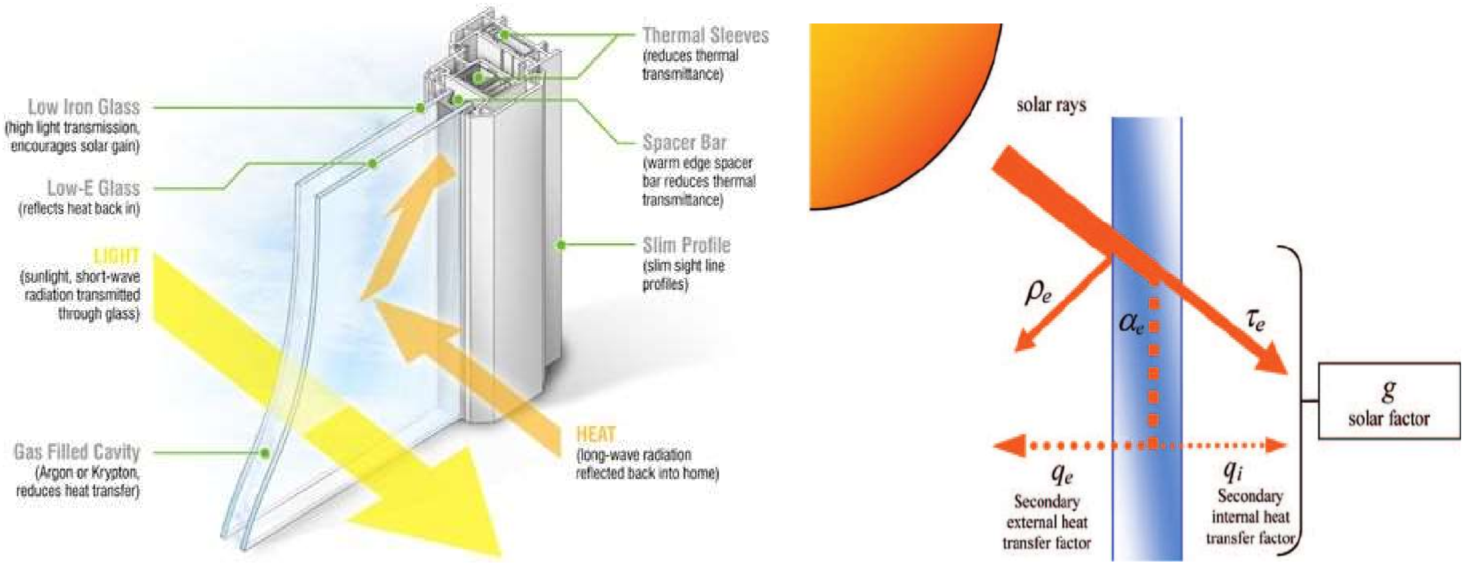



***Figure 20***. Glass with air intercaps

### Average Factors For Light Reflection

Lighting should be given a lot of importance for each activity area as it is a key element to create a warmer environment. The quality of the light should make children feel at home. Large lighting is more suitable for spaces where motor activities are performed; while lighting with a focus on a specific task is needed for manipulative activities; dimmer lighting should quiet and sleepy drivers. The amount and orientation of natural light should be taken into account in the design and variation in light level. A maximum of 500 lx is allowed in rooms with poor natural light. Rooms that do not have ceiling windows or exterior windows should be equipped with natural light transmission pipes. Light spaces that penetrate deeper into the interior can be used on all sides from the south. Designers can refer to the table for minimum light values for different functions.

***Table 43.*** Material Reflection

| **Materials** | % |
|---|---|
| Gypsum | 85 |
| White paper | 84 |
| White paint | 75 |
| Cement | *55* |
| Gray stones | 50 |
| Natural wood material (light color) | 33 |
| Red brick | 20 |

### Colors And Their Use

Colors affect the perception of the size of the environment, comfort. In the case of a small environment, light colors with cool tones should be used. For this reason, their use in kindergarten is necessary, but their impact on children must also be taken into account.

• Red binds to the sun and can increase heart rate. It is a very stimulating color and symbolizes activities and desire for life, as well as warmth.

• Orange is a less strong version than red. It is compared to the joy that yellow evokes. Gives joy and helps overcome trauma. Represents sunny and beautiful nature.

• Blue in color therapy is known as the color of transition, Blue offers support and protection and is the color of peace, tranquility and intelligence.

• Rose like blue has a calming effect and suggests warmth and soothing.

• Green is the color of youth, growth, hope, joy, life and freshness. It is also the color of harmony and balance.

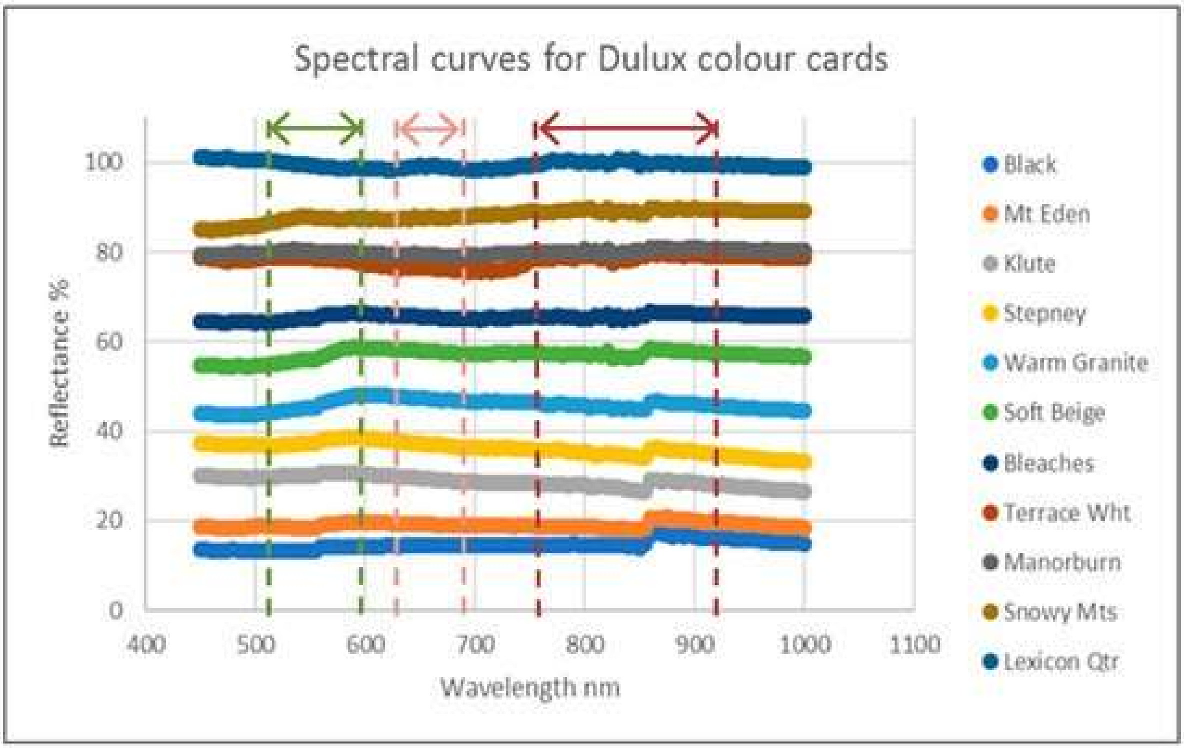



***Figure 22***. Sepctral curves for Dulux colour cards *[16]*

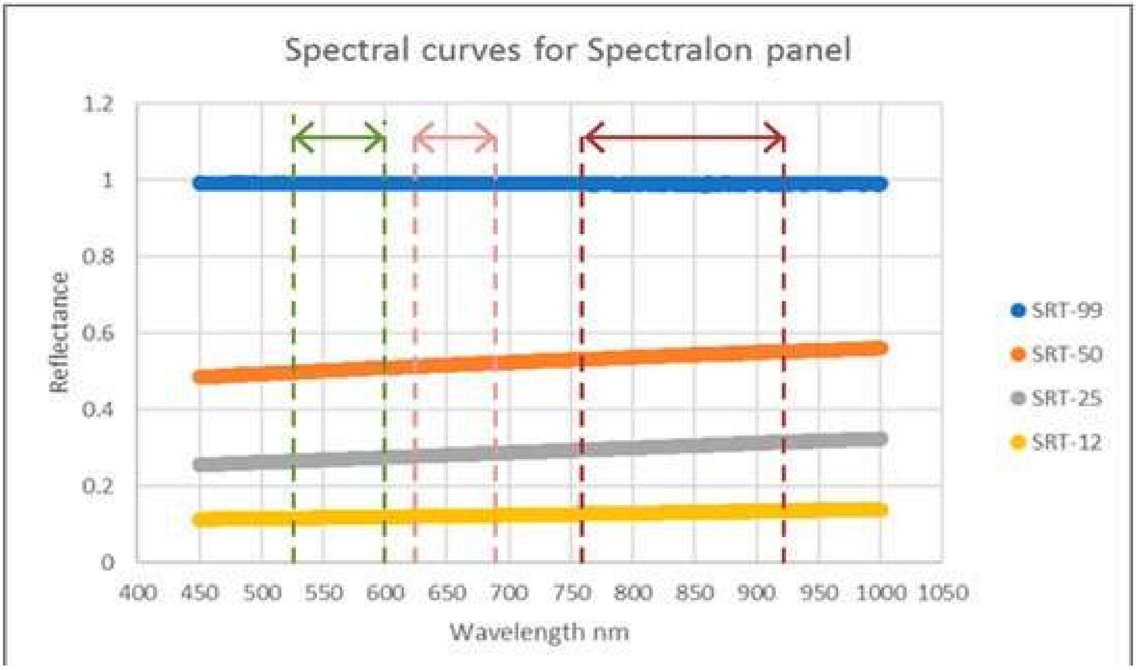



***Figure 1.*** Secptral curves for Spectralo panel *[16]*

**Wind Analysis**

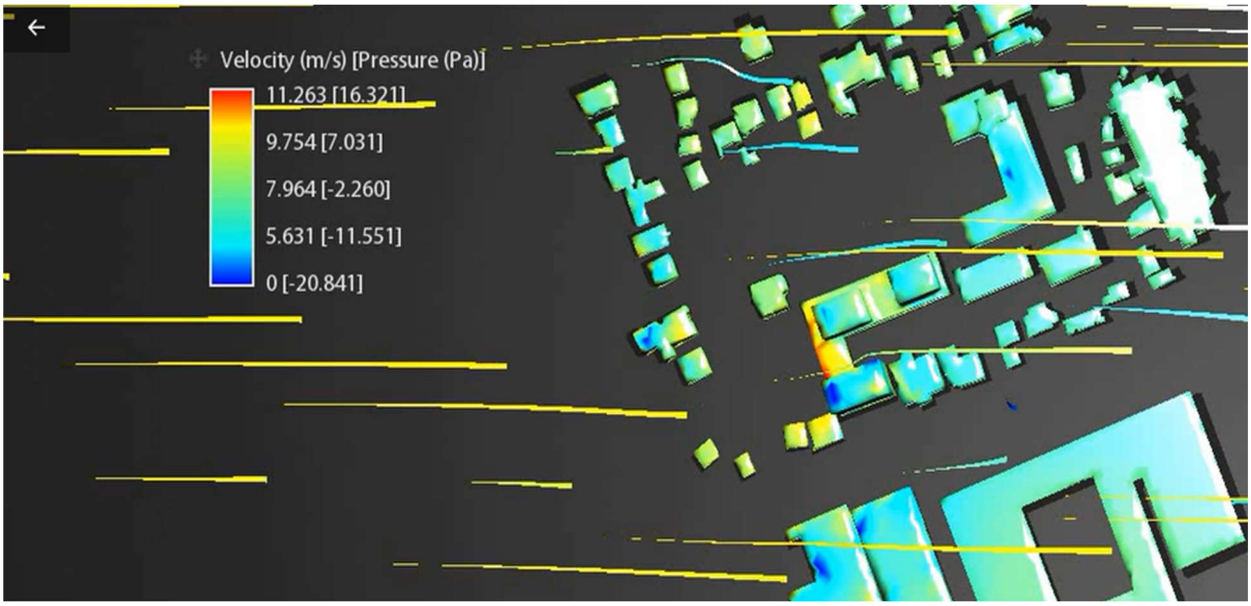



***Figure 23.*** Wind Analysis

**Analysis**

In the study area, the wind blows at a speed of 1.6 m / s in the direction Northwest-South East, a speed that is insensitive, which provides ventilation, but can not be used in terms of energy, as it does not pose a problem related to aerodynamics. of the new building that is proposed to be built.

**Conclusion**

The wind speed in this area is relatively small, a fact that makes its use for energy effect non-existent. Area untouched by wind impact.

**Recommendation**

The fact that the wind speed is low, means its neutral impact on the design of an efficient building, as it not only does not give any efficient product, but also in terms of aspect it plays a zero role, which eliminates any kind of conditioning by it.

**Climate Analysis**

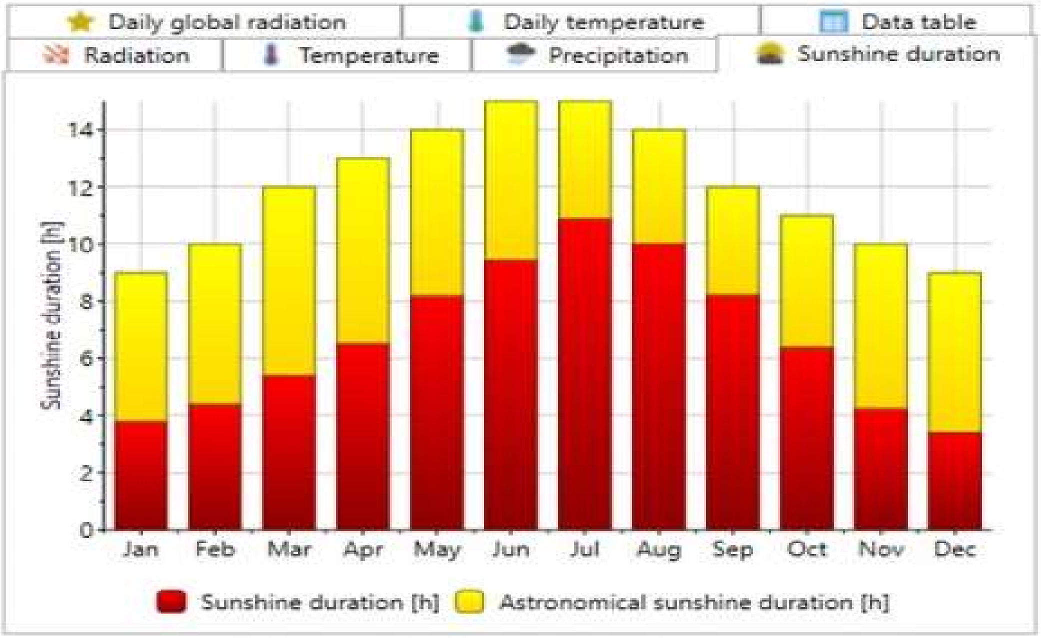



***Figure 2.*** Sunshine duration (h) *[17]*

-Duration of the sun Astronomical duration of the sun - July is the month where the sunlight is 11 hours a day. -In December the sunlight is very little about 3.8 hours a day -Conclusion: We must use artificial heating during the period November to February Annual values: Gh = 4%, Bn = 8%, Ta = 0.3 00 Gh = Horizontal global radiation ("GHI") * Bn-Normal direct radiation (DNI, radius) emanating from a narrow solid angle of 6 ° centered around the solar disk Ta = Air temperature (2 m above ground )

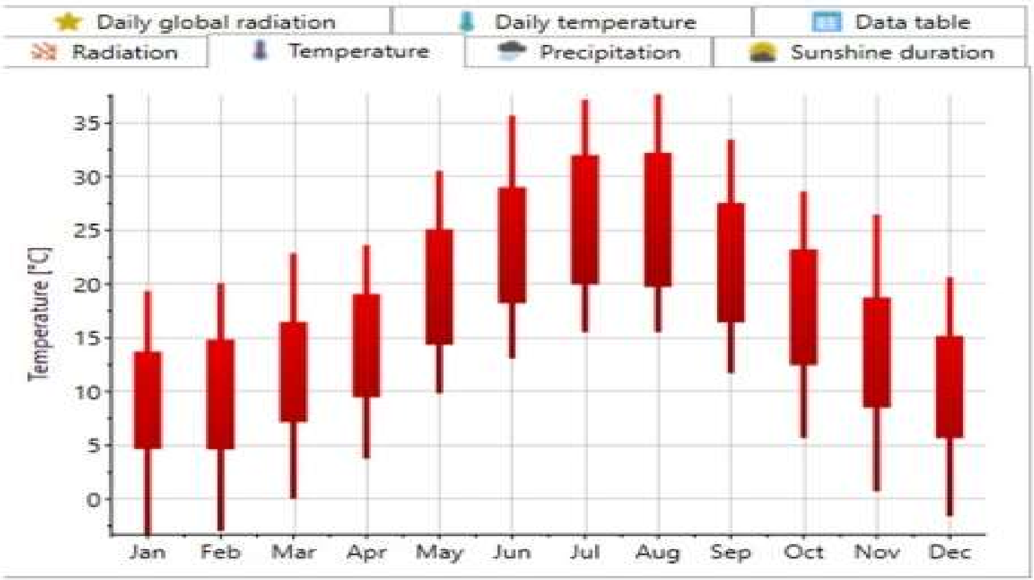



***Figure 3.*** Temperature ˚C *[17]*

- The maximum temperature in the selected square is in August 32.5 °C - The minimum temperature in the selected square is in January -3 °C to 19 °C -Conclusion: During the development of the children's stay in the kindergarten months December, January, February are cold we have to take measures for warmth.

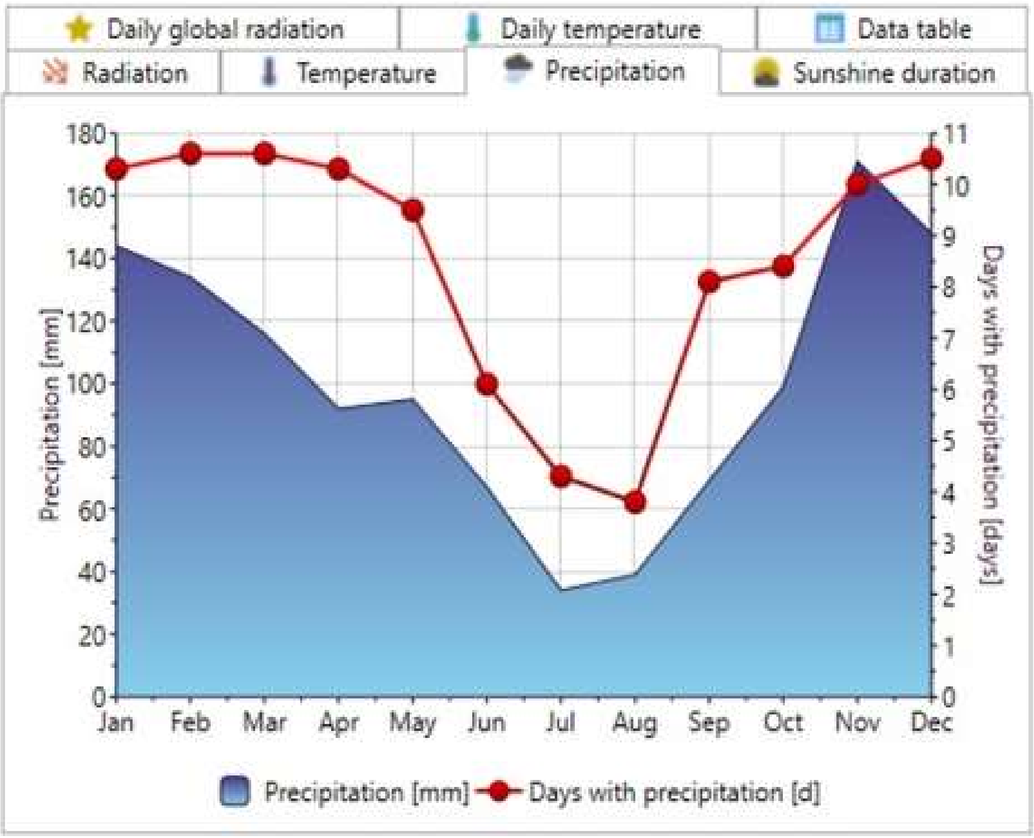



***Figure 4.*** Precipitation (mm) *[17]*

-Rainy days in the square.

-In our square about 11 days are rainy in January February March, December. Where precipitation reaches from 140-145 mm of rain. -The maximum rainfall in the square reaches in November with 170 mm of rain where the rainy days are 10 days a month.

-The minimum rainfall in the square is in August about 38 mm of rain where there are about 2 rainy days per month.

-Conclusion: We have the presence of rainfall 140-145 mm during the period of population of the garden, we can use the catchment system to use it for maintenance

**Analysis**

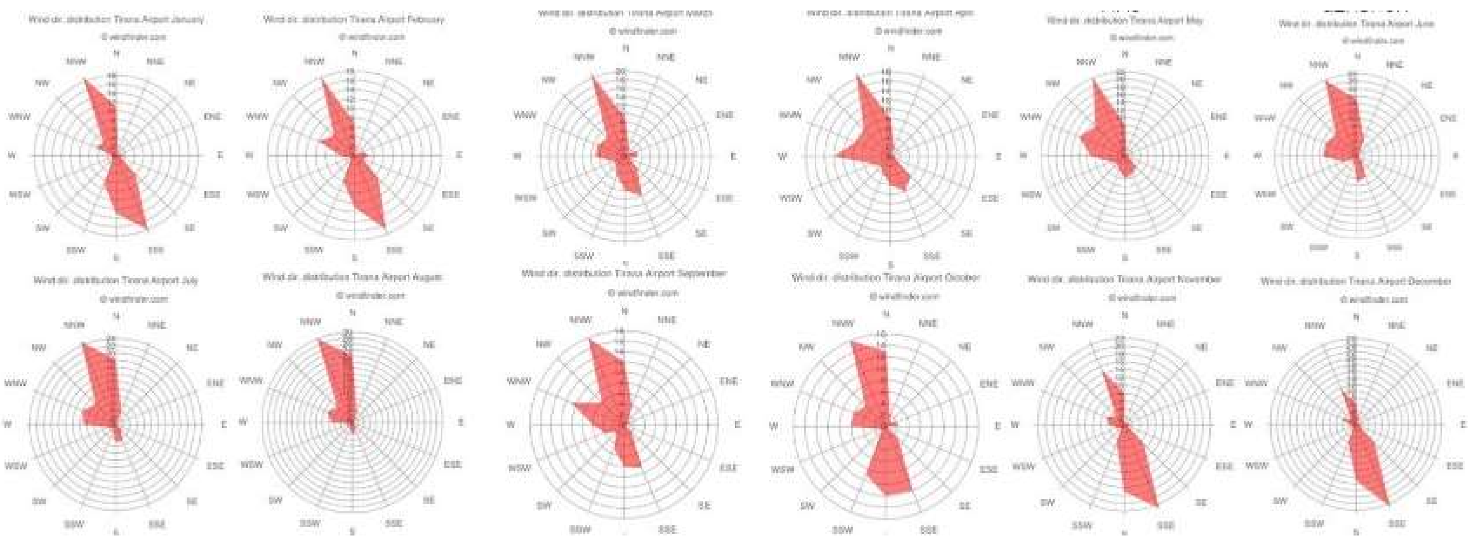


***Figure 27.*** Wind Rose *[18]*

In the study area, the wind blows at a speed of 1.6 m in the direction Northwest-South East, a speed that is insensitive, which provides ventilation, but can not be used in terms of energy, as it does not pose a problem regarding the aerodynamics of the new building that is proposed to be built. www ENE ES w 35W

**Conclusion**

The wind speed in this area is relatively small, a fact that makes its use for energy effect non-existent. Untouched area but at the same time unsupported by the influence of the wind.

**Recommendations**

The fact that the wind speed is low, means its neutral impact on the design of an efficient building, as it not only does not give any efficient product, but also in terms of aspect it plays a zero role, which eliminates any kind of conditioning from it.


***Figure 28.*** Shadow analysis for solar energy potential

The study of the sunrise was made on December 21, at different times, the shortest day of the year, when the sun is at its southernmost point and the shadow emitted by objects is longer.

**Conclusions**

Problems arise in the winter period, where buildings south of the square partially shade the square during the day, in the morning.

**Recommendations:**

Orientation of the building in such a way as to make maximum use of the sunshine in the square.

# CHAPTER 5

# RESULTS AND DISCUSSIONS

From the analyzes performed and from the data collected from the questionnaires performed, we reach some important results. Experiments performed with the example taken from the residential complex confirm our hypotheses, that BIM radically improves the negative effects on the environment. It significantly increases proximity to sustainable targets set by the UN. In the end, it improves the life of the users of the buildings with immediate effect, but also the life of the inhabitants on the land in the long run as the consumption of natural renewable resources decreases.

From the questionnaires it was noticed that in Albania the spread of this way of work is still in the first steps, and there is no widespread use. AECs are not yet fully aware of the positive effects of performing BIM energy analysis. Those individuals who have basic knowledge about this thesis, seek to deepen in use and knowledge, but often find conflicts with other links of project completion.

# CHAPTER 6

# CONCLUSIONS

## 5.1 Conclusions

I believe, that resources need to be invested heavily into this “time machine” that could make our world develop 1000 worth of years in the next 100 years, only because of how effective, efficient, time saving and money saving technology this really is. I think that we should implement this as an academic specialization in every AEC University as a course on its own and give it its own value, because it definitely is immense.

Take into consideration the need for a sustainable development that grows day by day, with BIM we find the most optimal solution. From many more external factors, we get the best solution to meet the needs of our building, to minimize the negative effect on the environment, and to reduce the monetary costs of the building.

As it is easily observed, BIM has brought huge aids to Albanian as well as worldwide when it comes to the world of engineering, architecture and construction, and it will continue to escalate the evolution of these fields with higher and higher rates, leading us to insane facility and maneuverability to make any product we will ever have cross our minds.

## 5.2 Recommendations for future research

Concluding with all the many benefits that BIM offers to achieve sustainability in our buildings, wider launches need to be taken to expand the use of BIM in the construction industry.

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