



**UNIVERSITY OF WEST ATTICA
SCHOOL: APPLIED ARTS AND
CULTURE
DEPARTMENT: INTERIOR ARCHITECTURE
MSc: 'INTERIOR ARCHITECTURE: SUSTAINABLE AND SOCIAL
DESIGN'**

Diploma Thesis

**Sustainable hotel renovation:
the case of Southwestern Serbia**

Student name and surname:

Tamara Milanovic

Registration

Number: 675/21675178

Supervisor:

Dr. Maria Sinou

**Co-supervisor from the
University of Pristina in**

Kosovska Mitrovica:

Dr. Mirjana Miletic

Athens, December 2022.



**UNIVERSITY OF WEST ATTICA
SCHOOL: APPLIED ARTS AND
CULTURE**


DEPARTMENT: INTERIOR ARCHITECTURE

**MSc: 'INTERIOR ARCHITECTURE: SUSTAINABLE AND SOCIAL
DESIGN'**

Title of Thesis

Members of Examining Committee:

The masters thesis was successfully examined by the following Committee:

A/α	Name/Surname	Affiliation	Digital Signature
1	Dr Maria Sinou	Associate Professor	
2	Dionysia Frangou	Assistant Professor	
3	Dr Mirjana Miletic	Assistant Professor	

ΔΗΛΩΣΗ ΣΥΓΓΡΑΦΕΑ ΜΕΤΑΠΤΥΧΙΑΚΗΣ ΕΡΓΑΣΙΑΣ

Ο/η κάτωθι υπογεγραμμένος/η Tamara **Milanovic** με αριθμό μητρώου **675/21675178** φοιτητής/τρια του Προγράμματος Μεταπτυχιακών Σπουδών Sustainable Design in Architectural Space του Τμήματος Interior Design του Πανεπιστημίου Δυτικής Αττικής, δηλώνω ότι:

«Είμαι συγγραφέας αυτής της μεταπτυχιακής εργασίας και ότι κάθε βοήθεια την οποία είχα για την προετοιμασία της, είναι πλήρως αναγνωρισμένη και αναφέρεται στην εργασία. Επίσης, οι όποιες πηγές από τις οποίες έκανα χρήση δεδομένων, ιδεών ή λέξεων, είτε ακριβώς είτε παραφρασμένες, αναφέρονται στο σύνολό τους, με πλήρη αναφορά στους συγγραφείς, τον εκδοτικό οίκο ή το περιοδικό, συμπεριλαμβανομένων και των πηγών που ενδεχομένως χρησιμοποιήθηκαν από το διαδίκτυο. Επίσης, βεβαιώνω ότι αυτή η εργασία έχει συγγραφεί από μένα αποκλειστικά και αποτελεί προϊόν πνευματικής ιδιοκτησίας τόσο δικής μου, όσο και του Ιδρύματος.

Παράβαση της ανωτέρω ακαδημαϊκής μου ευθύνης αποτελεί ουσιώδη λόγο για την ανάκληση του πτυχίου μου».

Ο/Η Δηλών/ούσα



Tamara **Milanovic**

Table of Contents

ABSTRACT.....	6
INTRODUCTION	7
Research topic	7
Scope aim	7
Methodology	8
Expected results:	8
Chapter 1: SUSTAINABLE TOURISM	9
1.1. The role of Tourism in Sustainable development	9
1.2. Sustainable Development Goals.....	10
1.2.1 Tourism Links with the SDGs	10
1.3. The concept of sustainable tourism.....	12
1.3.1 Sustainability of tourism.....	14
1.4. Impacts of Sustainable Tourism Development	14
1.4.1 Economic impacts of sustainable tourism	15
1.4.2 Environmental impacts of sustainable tourism.....	15
1.4.3 Social impacts of sustainable tourism	16
Chapter 2: SUSTAINABLE RENOVATION IN TOURISM FACILITIES.....	17
2.1. Rural, cultural tourism.....	17
2.2. Sustainable renovation in rural tourism	20
2.3. New trends.....	20
2.4. Good practices from all over the world.....	28
2.5. Sustainable renovation design parameters	40
Chapter 3: SOUTHWESTERN SERBIA	42
3.1. Climate and weather of Southwestern Serbia	42
3.1.1 The area of Southwestern Serbia, climate	42
3.1.2 Geography	43
3.1.3 Biodiversity	43
3.2. Rural tourism in Serbia	44
3.2.1 Rural tourism in mountain Golija.....	51
3.3. Legislation in the Republic of Serbia regarding energy efficiency.....	51
3.4. Examples of sustainable tourism in Serbia	53
3.4.1 Tourism in Serbia	53

Chapter 4: CASE STUDY BUILDING	57
4.1. Description	57
4.2. Used materials and construction	58
4.3. Environmental analysis of the building (Analysis of case studies).....	59
4.3.1 Site analysis	60
4.3.2 Analysis of weather conditions.....	60
4.3.3 Access analysis	62
4.3.4 Greenery and terrain analysis	62
4.3.5 Orientation analysis	62
4.4. Tabular presentation of building areas and technical description of rooms in building.....	64
4.4.1 Technical description of the room's areas in building	69
4.5. Environmental simulation	72
4.5.1 Solar analysis of the building and building plot.....	72
4.5.2 Wind analyses.....	75
4.6. Proposals-suggestions for sustainable improvement of the building according to performed analysis	80
4.6.1. Additional and wider windows	80
4.6.2. Greenhouse on the south-west side of building.....	81
4.7. Applied proposals-suggestions on the improved building based on performed bioclimatic analysis	84
4.7.1 Wider and additional windows	84
4.7.2. Greenhouse on the southwest	88
4.7.3. Windmills	88
4.7.4. Green walls with evergreen plants.....	89
4.7.5. 3D visualizations- renders of sustainable improved hotel.....	90
CONCLUSION.....	92
REFERENCES	94
References.....	94

ABSTRACT

Sustainable tourism means wider than architecture through environmental protection, and economic growth and is not just an aspect of construction. Through sustainable tourism, we observe the development of the whole district, where the existing hotel is located, which will undergo renovation into a sustainable hotel, located in southwestern Serbia, as well as the protection and promotion of rural tourism. Such, their reuse should be given priority over demolition and reconstruction according to modern standards. At the same time, take into account cultural tourism, which is a traditional and best-organized form for Serbia, while rural tourism is very promising. It is being considered how to grow rural tourism in such a way that the provision of tourist facilities and experiences is suited to the needs of the host community, the environment, and local producers, as well as the demands of tourists. Ecologically sustainable tourism emphasizes the value of natural and cultural resources in society's economic and social growth and helps to preserve them. As a result, the growth of cultural and rural tourism has significant socioeconomic implications for the country's economy. This study's goals include determining the economic effects of the development of rural tourism, as well as the potential of the sustainability of the rural settlement and the development of sustainable tourism through the analysis of the environment of the facility and, based on the results obtained, the improvement of the existing facility into a sustainable facility with the use of domestic materials.

Keywords: sustainable renovation, sustainable development, sustainable tourism, rural tourism, cultural heritage, environmental analyses

INTRODUCTION

Research topic

The starting point of sustainability should be the sustainable renovation of existing tourist facilities, in this case, the existing hotel. But at the same time, it remains consistent with its cultural heritage and identity, because that is the hotel's primary purpose, the preservation of traditions that are attractive to tourists and as part of business policy. Also considering it very important and especially worth protecting in a sustainable way. However, it is very important to simultaneously adapt to sustainability conditions and understand what changes the hotel needs to undergo, through an environmental analysis to adapt to the conditions.

Three fundamental aspects of sustainable development should be considered when planning and developing cultural and rural tourism in Serbia: The development of basic ecological processes, biodiversity, and biological resources is ensured by ecological sustainability. Social and cultural resilience ensures that people's lives, common culture, and values are properly preserved, as well as that cultural identity is further affirmed. Ecologically sustainable tourism shows the great importance of natural and cultural resources in the economic and social development of society and contributes to their protection. Thus, the development of cultural and rural tourism has deep socio-economic significance for the country's economy.

Scope aim

This research aims to investigate ways of sustainable renovation of buildings and focuses on the building type of hotels. It will emphasize identifying different sustainable design parameters within the goals of sustainable development and create a simple parametric tool that can assist decision-making in the early stages of design. Furthermore, a case study, which is a hotel in southwestern Serbia will be used in order to implement the tool and define the renovation sustainable strategies needed.

The study also focuses on determining the economic consequences of rural tourism development as well as the economic development of the local community and the potential of rural settlements and tourism development being sustainable. This causes a return to traditional and typical values and authenticity, diverse experiences, adventures, and deeper insights into new tourism products with new environmental, natural, and sustainable parameters.

Planning and development of cultural and rural tourism in Serbia should be done taking into account three main principles of sustainable development:

- Environmental sustainability ensures the joint development of basic ecological processes, biodiversity, and biological resources;
- Social and cultural resilience ensures a resilience in which people's lives, shared culture, and values are fully protected, and when cultural identity is further asserted.
- Economical sustainability ensures the economic efficiency of development when the chosen method of resource use guarantees the preservation of these resources for future generations. Some of the primary areas where sustainable development should come from, where the protection of the environment, economic growth, and social equity. It is essential that we progressively implement the necessary

adjustments in how we develop technologies and use them in order to safeguard our environment and expand our resource base.

Methodology

The methodology used for the study can be summed up into three sections:

- a. Literature review on the sustainable renovation of hotels
- b. The case study will be used to implement a sustainable strategy derived from the research through environmental simulation of the plot based on the analysis of climate, solar energy, wind, greenery, orientation, and analysis of the building (historical, different phases, technical description).

Defining the research topic through a detailed description of the formulation of research questions and hypotheses, through the collection and processing of data on the research topic, environmental analysis of the plot of the hotel located on the Golija mountain, in central Serbia, as well as the analysis of the condition of the existing hotel, which in addition has to go through sustainability changes, as well as interpretation of collected data. Working on the development of research methods and procedures, research problems are elaborated through concepts, theories, reputable models, and examples of new trends in the whole world.

Expected results:

The renovation of the hotel into a sustainable hotel and the materials used during construction are important factors in reducing energy consumption, improving the sustainability of the hotel through environmental and bioclimatic analysis, reducing the impact of the materials used on the environment, reducing harmful gases in the atmosphere and improving the internal environment. Some expected results are the reduction of the use of new resources, the reduction of pollution, the protection of biodiversity and the natural environment, the elimination of waste, and the elimination of health risks.

By defining the principle of the appropriate function, determining the purpose according to the spatial possibilities of the object, and harmonizing the purpose of individual objects with the purpose of the corresponding whole in a sustainable way, we will start the process of sustainable renovation of the hotel. . By applying new sustainable and renewable materials in order to renovate the hotel into a more sustainable and energy-efficient hotel with a reduction in energy consumption.

Any change must be necessary, minimal, and not diminish that place's cultural significance. And that by adding new sustainable materials, but in that way imitating the old and existing ones, while the old buildings are being renovated. The development of rural tourism is considered in a way where the offer of tourist facilities and experiences is in accordance with the needs of the host community, the environment, and local suppliers, and where it also meets the demands of tourists on the demand side.

Chapter 1: SUSTAINABLE TOURISM

1.1. The role of Tourism in Sustainable development

The idea behind sustainable development is to promote social and economic progress while preserving the health of the social and ecological systems that support the economy. It serves as the cornerstone of the Sustainable Development Goals (SDGs), the most important global framework for international collaboration, and the 2030 Agenda for Sustainable Development (United Nations, 2015). The phrase "sustainable development" is frequently associated with the book *Our Common Future*, which defined it as "paths of human progress that meet the needs and aspirations of the present generation without compromising the ability of future generations to meet their needs".

Since the 1990s, tourism has become more crucial to sustainable development both internationally and in specific nations and regions. Especially for developing nations, tourism has long been marketed as a low-impact, non-extractive option for economic development. Through the expansion of international tourism, many developing nations have been able to raise their level of participation in the global economy. The development of the tourism industry is widely seen as a crucial strategy for boosting economic growth, reducing poverty, and enhancing food security.

Communities with a rich history and cultural heritage can leverage their distinctive assets and resources for economic growth through tourism. More importantly, tourism provides an alternative to large-scale development initiatives such as dam building and extractive industries such as mining and forestry, all of which damage biodiversity and cultural values and emit pollutants.

There is a kind of relationship between tourism and the environment that will benefit both, as some forms of tourism, such as ecotourism, can help to protect ecosystem services and preserve biodiversity in travel destinations. Tourism and environmental quality are intricately intertwined because many vacations are often taken primarily for viewing and visiting natural areas.

There are many countries located in high-level protected areas with abundant natural resources that can be well aligned with the principles of sustainable development.

But there are a number of ways that tourism can negatively influence the environment, including releasing greenhouse gases, freshwater use, land use, and food consumption.

Topics that have been highlighted in assessments of the sustainability of tourism include:

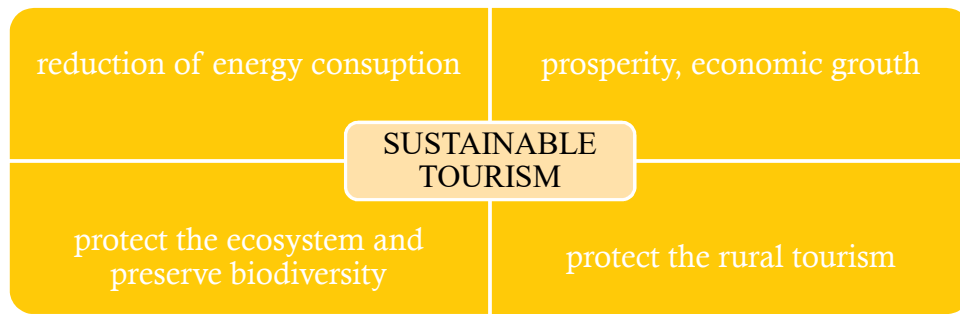
- parks, biodiversity, and conservation
- pollution and climate change
- prosperity, economic growth
- peace, security, and safety
- population stabilization and reduction

From a global aspect, tourism affects:

- changes in land cover and land use
- energy use
- biotic exchange and extinction of wild species
- exchange and dispersion of diseases
- changes in the perception of the environment (Richardson, 2021)

Table 1 shows the impacts of tourism on sustainability.

Table 1 Chart defining the impacts of tourism on sustainability, (Source: by author)



Research on the role of tourism in sustainable development is crucial in the field of environmental science in general and environmental economics and management in particular. Key contributions are spread throughout several interdisciplinary fields, including biodiversity protection, climate science, economics, and environmental science, among others.

The role of tourism in defining and expanding protected areas, improving environmental accounting techniques that quantify environmental impacts, and the implications of individual perceptions of responsibility in addressing climate change are just a few of the research priorities for sustainable development that tourism research has highlighted. (Richardson, 2021)

1.2. Sustainable Development Goals

Definition of Sustainable Tourism

Sustainable Tourism refers to sustainable practices in and by the tourism industry. Recognizing both the positive and negative effects of tourism is a goal. It seeks to maximize the good effects while minimizing the negative ones. A few detrimental effects on a destination include overcrowding, environmental harm, and economic leakage. Jobs are created, cultural history is preserved and understood, wildlife is preserved, the landscape is restored, and other positive effects are felt by a location. The UN Environment Program and UN World Tourism Organization describe sustainable tourism as "tourism that fully accounts for its current and future economic, social, and environmental implications, satisfying the requirements of visitors, the industry, the environment, and host communities."

Additionally, they say that sustainable tourism "refers to the environmental, economic, and socio-cultural aspects of tourism development, and a suitable balance must be established between these three dimensions to guarantee its long-term sustainability" (What is Sustainable Tourism?, n.d.)

UNWTO is a United Nations specialized agency and is the leading international organization in the field of tourism. They have created a platform that promotes sustainable tourism, a co-creation space for all, to make tourism matter on the journey to 2030. (Sustainable Development Goals, n.d.)

1.2.1 Tourism Links with the SDGs

The report highlights three SDG targets, in particular, that mention sustainable tourism, namely: SDG target 8.9 on devising and implementing sustainable tourism policies that create jobs and promote local culture and products; SDG target 12. b on developing and implementing tools to monitor sustainable development impacts for sustainable tourism; and SDG target 14.7 on increasing the economic benefits to small island developing States (SIDS) and the least developed countries (LDCs) from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture, and tourism.

The report also spells out tourism's links to each of the 17 SDGs:

SDG 1 (no poverty): tourism can be linked to national poverty reduction strategies and entrepreneurship through low skills requirements and local recruitment;

SDG 2 (zero hunger): tourism can spur sustainable agriculture by promoting production, supplies to hotels, and sales of local products to tourists;

SDG 3 (good health and well-being): tax income generated from tourism and visitors fees collected in protected areas can be reinvested in health care and services;

SDG 4 (quality education): capacity and skills need to be built to ensure the tourism sector can prosper and provide job opportunities for youth, women, and those with special needs;

SDG 5 (gender equality): tourism can empower women, particularly through the provision of direct jobs and income generation in tourism and hospitality-related enterprises;

SDG 6 (clean water and sanitation): tourism investment requirement for providing utilities can play a critical role in achieving water access and security, hygiene, and sanitation;

SDG 7 (affordable and clean energy): tourism can help reduce greenhouse gases (GHGs), mitigate climate change, and contribute to energy access by promoting clean energy investments;

SDG 8 (decent work and economic growth): decent work opportunities in tourism, particularly for youth and women, and policies that favor better diversification through tourism value chains can enhance tourism's positive socioeconomic impacts;

SDG 9 (industry, innovation, and infrastructure): tourism can influence public policies aimed at upgrading and retrofitting infrastructure to make it more sustainable, innovative, and efficient;

SDG 10 (reduced inequalities): sustainable tourism can engage local populations and all stakeholders in tourism development, and contribute to urban renewal and rural development;

SDG 11 (sustainable cities and communities): tourism can, inter alia, promote urban regeneration, and preserve cultural and natural heritage;

SDG 12 (responsible consumption and production): adopting sustainable consumption and production (SCP) models can help monitor sustainable development impacts for tourism, including for energy, water, waste, biodiversity, and job creation;

SDG 13 (climate action): tourism stakeholders can play a critical leading role in fighting climate change by reducing their carbon footprints;

SDG 14 (life below water): tourism development can help preserve marine ecosystems and promote a blue economy and the sustainable use of marine resources;

SDG 15 (life on land): sustainable tourism can help conserve and preserve biodiversity, and generate revenue as an alternative livelihood for local communities;

SDG 16 (peace, justice, and strong institutions): tourism can help foster multicultural and interfaith tolerance and understanding, and peace in post-conflict societies; and

SDG 17 (partnerships for the Goals): tourism can strengthen public-private partnerships (PPPs) and engage all stakeholders to work together to achieve the SDGs. (UNWTO Report Links Sustainable Tourism to 17 SDGs, 2018)

1.3. The concept of sustainable tourism

Sustainable tourism is a concept that incorporates the entire tourism experience, including economic, social, and environmental concerns, as well as enhancing the tourist experience and addressing the requirements of the host community. As a result of limiting unregulated and excessive use of mountain tourism resources and attractions in Sumadia and western Serbia, sustainable tourism has arisen. Environmental protection, social equity and quality of life, cultural diversity, and a dynamic, robust economy that offers jobs and well-being for all are all essential components of sustainable tourism.

Travel, leisure, business, and visiting friends and family are all examples of tourism, which can include tourism-related vehicles. This can include general transportation as well as local transportation to and from the dwelling as well as entertainment, leisure, eating, and shopping. There is now widespread agreement that tourism must be sustainable. In reality, if properly planned, developed, and managed, all forms of tourism have the potential to be sustainable.

Approximately 8% of the world's greenhouse gas emissions are linked to tourism. This figure includes air travel as well as other substantial environmental and social consequences that aren't always helpful to local economies. To offset the negative impacts of tourism's expanding impact, tourist development groups are encouraging sustainable tourism practices. Relocation and resettlement, environmental consequences, and the impact of the COVID-19 epidemic are all challenges facing sustainable tourism. Making locations more accessible to tourists may result in the resettling or resettlement of local inhabitants. Even if simply in camps, construction projects to build new roads and dwellings for tourists damage the natural world and local surroundings. (Sanagustín Fons, Moseñe Fierro, & Patiño, 2011)

Figure 1 shows a rural tourism as a sustainable alternative.

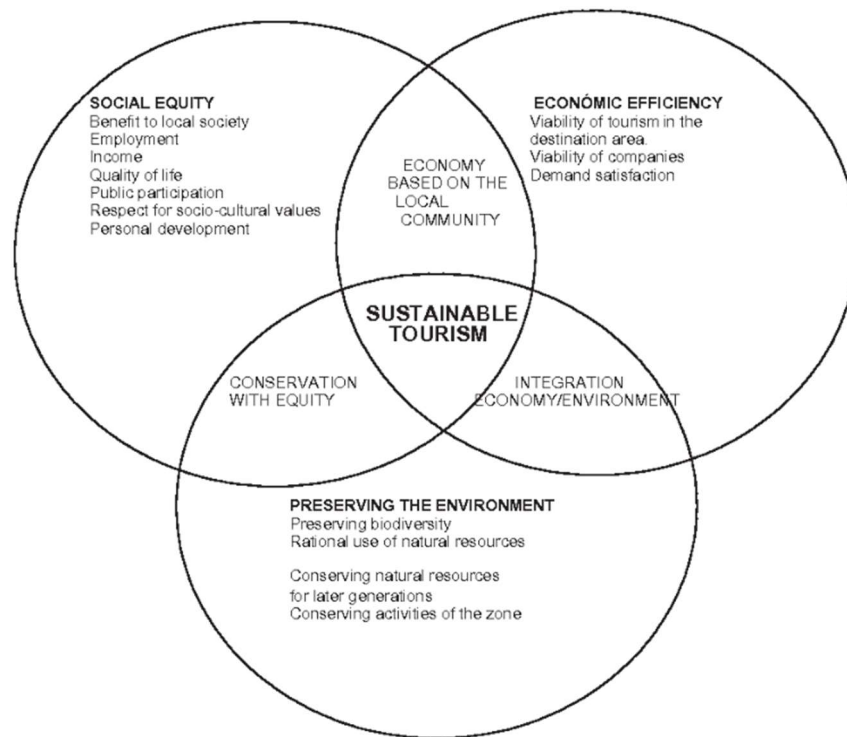


Image 1 Rural tourism a sustainable alternative, (Sanagustín Fons, Moseñe Fierro, & Patiño, 2011)

Through events like the International Year of Sustainable Tourism 2017, the United Nations World Tourism Organization has brought attention to these practices by promoting tourism as part of the Sustainable Development Goals (SDGs). As part of a broader development strategy, improvements in terms of good governance, particularly sustainable tourism, are expected.

Sustainable tourism encompasses the entire tourism experience, including economic, social, and environmental concerns as well as an emphasis on improving the visitor experience. Sustainable tourism is a concept that tries to mitigate the negative effects of tourism. It has almost universally been regarded as a desirable and politically important tourism development strategy.

Tourism includes the actions of individuals who travel and stay in areas beyond their typical environment for a period of not more than one year for leisure, business, or other objectives," according to the United Nations World Tourism Organization. Depending on the location, global economists forecast a consistent increase in international tourism. This continued growth will place significant stress on the remaining biodiverse environments and local cultures, as it is one of the world's largest and fastest expanding industries. Tourism in its broadest sense Large-scale visitor movements to popular places such as amusement parks, national parks, beaches, and cruise ships. To attract a huge number of tourists at once, mass tourism offers standardized packaged leisure products and experiences. (Sanagustín Fons, Moseñe Fierro, & Patiño, 2011)

1.3.1 Sustainability of tourism

When a system or process demonstrates resilience, durability, and adaptability, it is considered to be sustainable. The global tourism system doesn't meet these criteria for sustainability, by most measures. Tourism is not resilient because it is vulnerable to threats and disruptions like economic shocks, pandemics, war, and other humanitarian crises. Tourism is not durable in that it does not rapidly recover from losses, such as natural catastrophes or civil instability. Additionally, tourism lacks adaptability because it commonly cannot change in response to environmental factors. Tourism's reliance on fossil fuels for transportation and energy, which are critical inputs for tourism development, does not fit the criteria for sustainability. And sustainability of tourism is questionable because its dependence on itself is not sustainable.

The demand side, which is particularly vulnerable to social and economic shocks, has been disregarded in research on the role of tourism in sustainable development, which has focused more on the ideas of sustaining tourism resources. Tourism is susceptible to both localized and global shocks. Disaster vulnerability in coastal Thailand, wildfires in northern Victoria, Australia, and wildfires in British Columbia, Canada are only a few examples of studies on tourism's susceptibility to localized shocks. Also, earthquakes can negatively impact tourism, especially in places with less earthquake-resistant infrastructure. Extreme weather conditions might affect tourism. And it has shown itself to be vulnerable to natural disasters. Whatever their source, oil spills have a huge impact on the tourism industry, and they don't need to release a lot of oil to cause big financial losses. Future studies on the vulnerability of tourism sites to oil spills should also consider freshwater ecosystems, where pipeline ruptures occur more frequently, such as lakes, rivers, and streams. Assessing the exposure of tourist locations to terrorism and the effects of terrorist strikes on local tourism economies have received a lot of attention. It should also be emphasized that both local and global economic crises can have a negative impact on the tourism industry. Last but not least, research has demonstrated that the sustainability of tourism is susceptible to the spread of infectious diseases. Some studies have focused on how the COVID-19 pandemic's lessons can prepare international tourism for the kind of economic transition that is required to lessen the effects of climate change. (Richardson, 2021)

1.4. Impacts of Sustainable Tourism Development

By considering the economic, environmental, and social effects of tourism, the role of tourism in sustainable development may be evaluated. Travel, recreation, food consumption, accommodation, entertainment, sightseeing, and other activities that simultaneously affect the lives of local people, businesses, and communities are all included in the global phenomena of tourism. All groups are affected by the costs and benefits of tourism, some of which are difficult to quantify. However, they have been thoroughly researched in the literature, which offers some context for how these advantages and disadvantages are spread. (Richardson, 2021)

Table 2 shows the impacts of sustainable tourism developments.

Table 2 Impacts of sustainable tourism developments (Source: by Author)



1.4.1 Economic impacts of sustainable tourism

Tourism significantly contributes to sustainable development economically. In contrast to many other businesses, tourism in many developing countries has the ability to play a special role in the development and distribution of income. This is in part due to the strong multiplier impact and consumption of local goods and services that tourist generates. However, analysis of the financial effects of tourism has revealed that this potential is rarely reached on its whole. The effect of tourism expenditure on GDP, income, employment, and revenue has been the subject of numerous studies. (Richardson, 2021)

1.4.2 Environmental impacts of sustainable tourism

The effects of tourism on the environment are significant, ranging from regional effects to contributions to climate change. Tourism affects both local and global freshwater consumption and is depending on water resources. Water is used by tourists for drinking, taking showers, and using the restroom, as well as when they take part in activities like winter ski tourism (snowmaking) and use swimming pools and spas. Additionally, maintaining hotel gardens and golf courses requires fresh water, producing food and fuel as well as developing tourism infrastructure (such as lodging, laundry, and eating) all including the usage of water. In many cases, land used for tourism includes roads, airports, railways, lodging, trails, footpaths, shopping areas, car parks, campsites, vacation homes, golf courses, marinas, ski resorts, and indirect use of land for food production, solid waste disposal, and wastewater treatment. Land clearing and conversion are crucial to the development of the tourism industry. Due to the quantity of food consumed in the context of tourism, there are direct and indirect links between catering and almost all elements of food production, preparation, and consumption. Given the rising worldwide demand for food, the production of food has significant implications for sustainable development. Land conversion, biodiversity losses, modifications to the cycling of nutrients, and contributions to greenhouse gas emissions linked to global climate change are some of the effects. (Richardson, 2021)

1.4.3 Social impacts of sustainable tourism

The social effects of tourism are challenging to quantify, and the majority of published research focuses more on the effects on the host communities than on the visitors themselves. (Richardson, 2021)

Chapter 2: SUSTAINABLE RENOVATION IN TOURISM FACILITIES

2.1. Rural, cultural tourism

Tourists benefit from cultural tourism in cognitive, educational, recreational, and other ways. It is thought to be a highly profitable field for developing cities and regions. The economic benefits that cities and their citizens can harvest as a consequence of investments in firms, rent of buildings, rent of individual residences, and sales of crafts and handicrafts demonstrate the positive effects of tourism development (etc.). As a result of strengthening the infrastructure of towns and areas, the population's quality of life is improving at the expense of house restoration or reconstruction. The tourism sector helps to solve a variety of societal issues: It raises the local population's employment rate, provides jobs, and shares values.

Cultural tourism has two important components: natural and cultural heritage, which include special cultural landscapes, historic towns, and villages, architectural monuments, various types of museums, archaeological excavations, crafts, festivals, and traditional folk cuisine. All this is in abundance in the villages and cities of Serbia, which have a rich history and cultural traditions. But for some parts of Serbia, the development of tourism seems premature today. This is due to the weak infrastructure of cities and rural areas: the lack of hotels, food and recreation facilities, as well as the unpreparedness of the population to work in this field of culture and business, the lack of qualified management staff, poor awareness of heritage and cultural programs.

The second circle of the problem is related to the commercialization of culture and the development of tourism (as a commercial activity). First of all, the administration of cities or rural settlements can not influence the formation of tourist flows, tourism, and cultural programs. At the same time, tour operators use the city's infrastructure, and cultural facilities, and do not make any profit in the city budget.

In the historical areas, where the developed architectural spatial and tourist infrastructure is developed, real subjects of cultural activities and tourism have already been established. These are travel companies, museum reserves, the Serbian Orthodox Church, and the local population. Each of them has its own goals and objectives, however, they work very weakly in partnership with the unified city and district development program. (Sanagustin-Fons, Lafita-Cortés, & Moseñe, Social Perception of Rural Tourism Impact: A Case Study, 2018)

Figure 2 shows Rural Tourism concept by WTO.

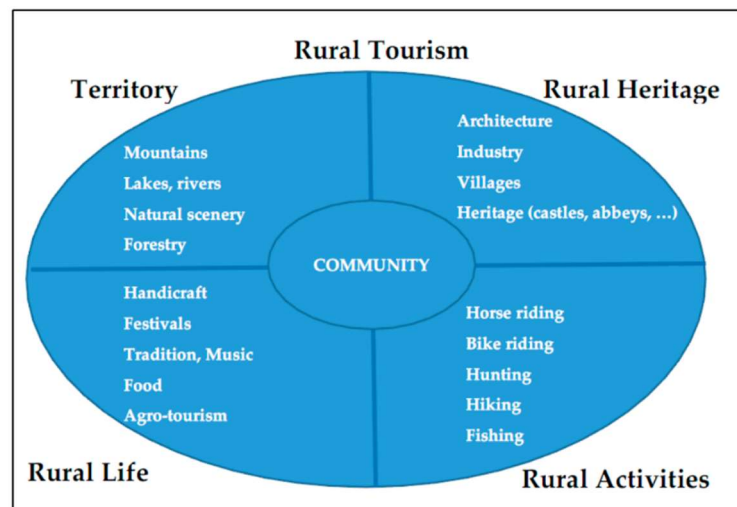


Image 2 Rural Tourism concept by WTO (Sanagustin-Fons , Lafita-Cortés, & Moseñe , *Social Perception of Rural Tourism Impact: A Case Study*, 2018)

It is obvious that specific transfers from the city budget (including transfers from the tourism industry) should be used to preserve and rebuild historic structures and the city environment. The more cultural and natural resources, as well as historical monuments, a city has, the more services it can provide to visitors. The economic benefits from such tourists (at the cost of using hotels and eating facilities) are several times more than the benefits they receive from visiting the city for a day or two. As a result, one of the issues whose resolution has an impact on a city's economic development is the expansion of tourist infrastructure and the number of attractions: rebuilding and renovation of old buildings in the local style, new regions being developed, private boarding houses are being built, and hotels are being built. Furthermore, the emergence of small private cafés and restaurants serving national cuisine, the increase in the entertainment industry, holidays, festivals, exhibitions, concerts, and other events will catalyze the city's overall development. This will result in the return of young people (as qualified employees) to the areas, as well as job opportunities. (Bramwell, 2009)

The organizational-managerial aspects of tourist growth are crucial and necessitate specific attention. With a single event, several events can be strategically directed and future-focused to the greatest extent possible (including holidays, festivals, sporting events, and other organizations). Such future-oriented activities should include the establishment of an appropriate municipal government in the city's historic district, which would coordinate the efforts of future local tourism enterprises and hotels, as well as analyze tourism resources, assess the market, formulate tourism requirements, and conduct advertising, among other things. All of this is important for tiny communities with unrealized cultural potential and tourism offerings.

The link between culture and tourism (also known as "cultural tourism") has the potential to be a significant factor in the development of historical regions and to connect various cultural activities. This occurs when various segments of the people, as well as public and private institutions, are participating in these activities under the supervision of state-administrative entities. Other organizations are joining new programs aimed at promoting cultural tourism in historic cities and rural areas.

It is important to develop cultural tourism development programs on the spot, which should be an integral part of the urban, rural, or district development program.

Such programs are created as a tool for the economic renewal of the area. They are focused on the spread of tourism from the already established centers to the new and so-called. Such programs - this is a tourism product that primarily offers the natural and cultural heritage of the area, traditional handicrafts, folk festivals, and more. Therefore, the development of such a product is considered as a unifying cultural factor for the development of the whole region.

A differentiated tourism product must integrate a particular amount of natural and cultural components, tourism infrastructure, and forms of active activities to give the visitor a choice. The program's goal is to attract tourists to the city, town, and district by providing them with a range of routes to choose from. Simultaneously, the local population's living standards are rising without radically altering or eliminating the current culture or way of life. (Lane, 2004)

Rural areas are difficult and small towns where rural tourism is growing: how to identify, use, or construct a tourism resource:

- a. Cultural sights, village houses, cottages, tent city squares near monasteries, etc.
- b. Construction of special facilities - for the accommodation of tourists, such as: "National Villages", "Hunter / Fisherman's Houses", "Cultural Centres", campsites, etc., which perform the functions of a hotel.

Table 4 Chart A shows the construction of tourism resources (Source: by Author)

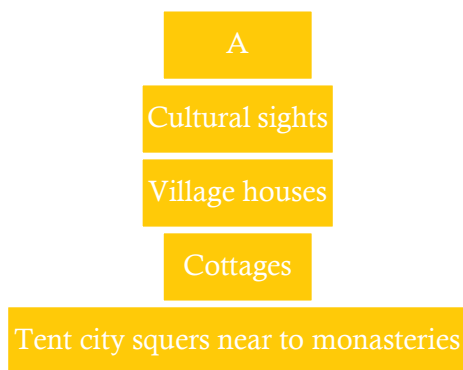


Table 3 Chart B shows special facilities for the accommodation of tourists (Source: by Author)

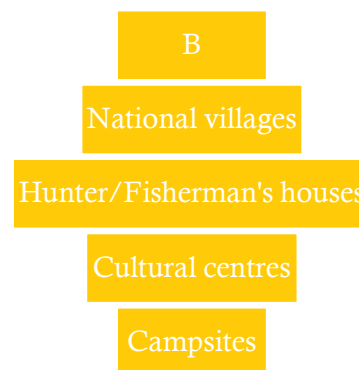


Table 4 shows the construction of tourism resources. Table 3 shows special facilities for the accommodation of tourists.

Cultural or rural tourism should be deemed an alternative activity (a type of small family company.) Cultural and rural tourism can coexist in a given geographical setting while ignoring and undermining the location's historical-cultural value. Its foundational collaboration has a territorial, local, interregional, and international scope. This form of tourism has the potential to solve a variety of problems in the area. Unfortunately, there has been a gap between the possibilities given by cultural and rural tourism and the actual outcome. (Sanagustin-Fons, Lafita-Cortés, & Moseñe, Social Perception of Rural Tourism Impact: A Case Study, 2018)

2.2. Sustainable renovation in rural tourism

Why are rural areas so important in sustainable development tourism, with its emphasis on preserving ecological and cultural diversity and quality? Many developed countries place a premium on which village is preserved: it is regarded as unique and so worthy of conservation.

Existing structures with significant architectural, artistic, historical or cultural significance must be preserved. These objects show the history and culture of people and countries. Renovating heritage structures has huge potential for future generations to maintain a sense of identity and continuity in a rapidly changing environment. Renovation of heritage buildings has become a popular strategy to improve sustainability while protecting the historical importance and quality of these structures. It provides economic, cultural, social and environmental benefits to the city's population.

The results suggest that renovating existing buildings can result in significant energy savings, with total energy consumption in the EU falling by 5-6 percent and CO₂ emissions falling by roughly 5%. Furthermore, there is a controversy concerning the conflict between the principle of "minimal intervention" and modern energy-efficiency targets, which have a significant impact on architectural values that should be protected through restoration intervention.

A broad variety of influencing factors depend on the long-term viability of a cultural renovation project. The rehabilitation task, given a building, is selecting how to update or improve building components and sections, such as by replacing windows, insulating the building envelope, or even changing the building's use. On the one hand, this frequently gives clients (or owners) a plethora of options to choose from when deciding what intervention levels and renovation solutions to pursue. On the other hand, when generating acceptable restoration scenarios, the design team must cope with increasing needs for energy demand and indoor environment while also addressing architectural features and quality. (Joldžić, Batrićević, Stanković, & Paunović, 2018)

2.3. New trends

1. Harvesting drinking water with fog nets, Cloud fisher

Each FogCollector is quick and simple to install and needs no service. Due to their energy-free operation, the collectors are carbon-neutral. All components are food-safe. FogCollectors can offer water for agriculture and forestry as well as high-quality drinking water (authorized by WHO criteria).



Image 3 Cloud fisher, fog nets (Floating springs, Harvesting drinking water with fog nets, n.d.)

Three different textiles make up one fog collector. $8 \text{ m}^2 \times 3 = 24 \text{ m}^2$ is the total net surface.

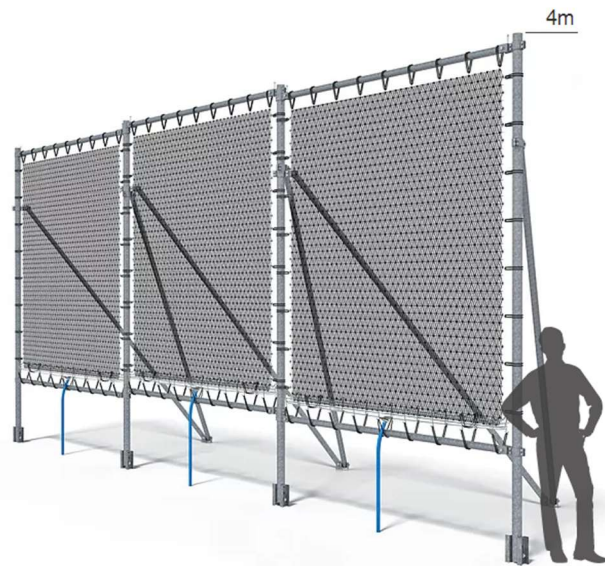


Image 4 FogCollector Concrete (Floating springs, Harvesting drinking water with fog nets, n.d.)

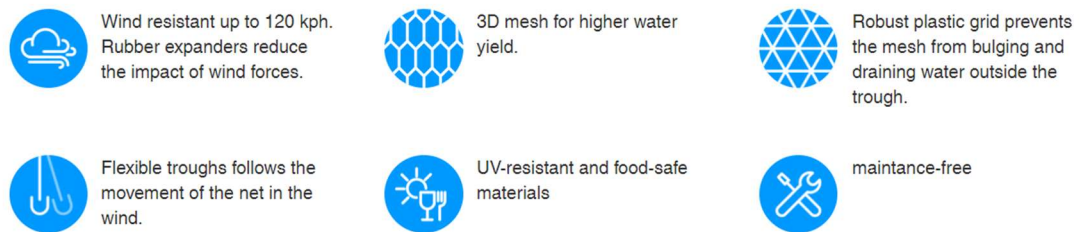


Image 5 A pictorial explanation of how the fog nets work (Floating springs, Harvesting drinking water with fog nets, n.d.)

How do fog collectors work?

Fog is forced into the vertically strung nets by the wind. The smaller droplets become trapped in the 3D mesh and combine to form larger drops that fall into the collecting trough below. The fog water is then fed into a reservoir from there.

Depending on the region and season, different volumes are produced each fog day. For instance, on a day with fog, we collect an average of 22 liters per square meter in Morocco. This translates to a water volume of 528 liters every fog day with one Fog Collector (mesh area 24 m^2). An extremely effective rain collector is a fog collector. This is because the rain that has been thrown by the wind usually hits the nets at an angle.



Image 6 Fog nets, Clous fisher (Floating springs, Harvesting drinking water with fog nets, n.d.)

By the time it is worked on improving fog nets, so now there are some improved fog nets with more capacity for collecting water, which is visible in the examination of the picture.

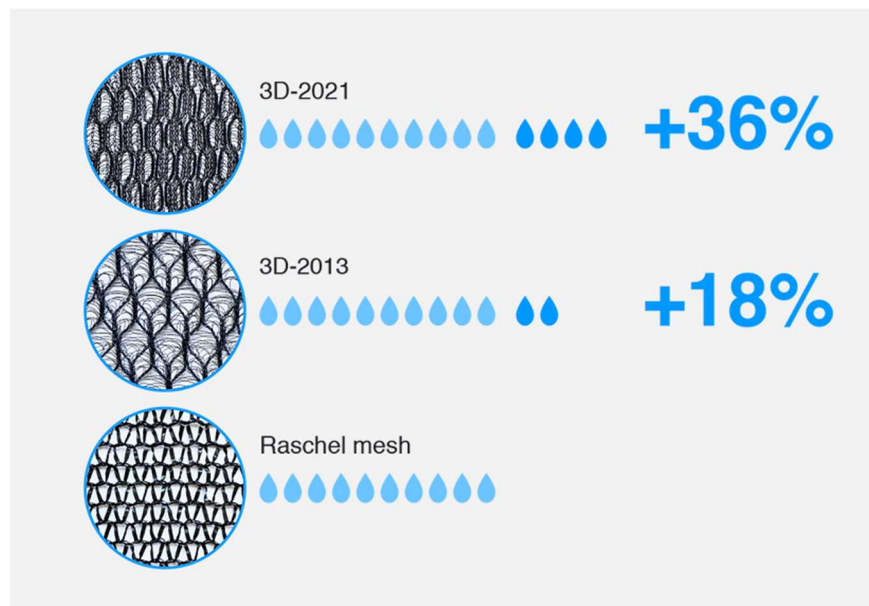


Image 7 Mesh research and development (Floating springs, Harvesting drinking water with fog nets, n.d.)

To ascertain whether the site is ideal for fog harvesting, each project starts with research. The analysis is based on discussions on fog frequency with the local populace. When a foggy area is discovered, the process of gathering meteorological data on wind direction and speed, temperature and relative humidity, precipitation, and water accumulation begins. Using these results, it is determined whether the area is suitable for a huge fog water production system.

Locate the right place:

To determine how much water is accessible and during which season, an evaluation with multiple tiny fog catchers (net surface: 1m²) is required first. The yield amounts can be calculated empirically using a water canister and a measuring rod or with meteorological tools. It is good to expand to a large plant if the yield averages 6 liters or higher.

*Image 8 An explanation of how the fog nets works
(Floating springs, Harvesting drinking water with fog
nets, n.d.)*

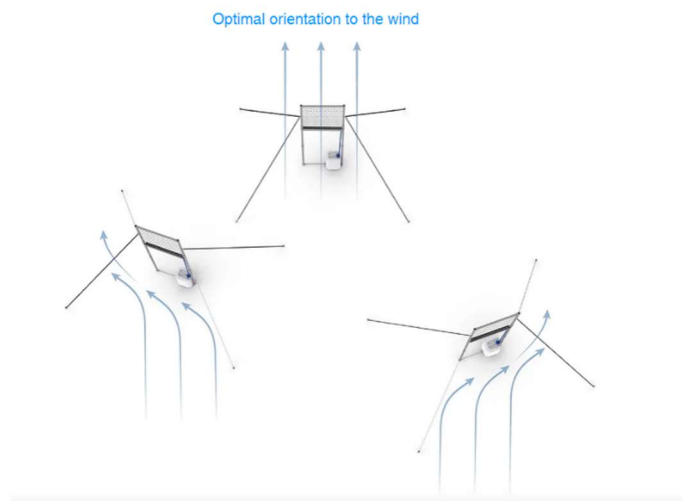
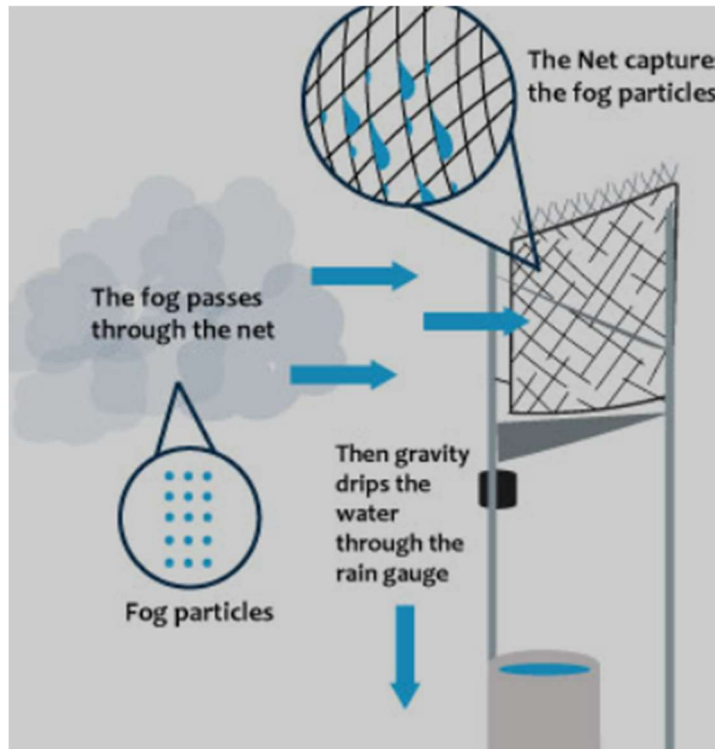


Image 9 Optimal orientation to the wind (Floating springs, Harvesting drinking water with fog nets, n.d.)

Requirements are:

Fog, geographical factors, and wind are three factors that affect the effectiveness of fog nets.

Fog

A cloud that hits the earth creates fog. It develops as humid, warm air cools. Millions of minuscule water droplets with diameters ranging from 1 to 40 micrometers (m) are created as a result.

Condensation is the term for this.

Both alpine and coastal regions frequently experience fog. Numerous high-elevation continental sites frequently experience fog because of orographic clouds (clouds that form in reaction to the forced lifting of air by the earth's topography) or the transport of upwind clouds. The distance to the coast is meaningless in these situations. For fog harvesting, higher elevations close to the shore are typically favored locations.

Geographical factor

Hills must have a height where it is possible to intercept clouds. Windward locations should be given preference. It's necessary to be away from sources of dampness, like the seaside. There is less risk of dissipation or evaporation the closer the distance.

Wind

Fog collects best in persistent winds, such as trade winds coming from one direction. If they transfer clouds from the ocean to the land, the conditions are favorable. Within a few kilometers upwind of the site, the wind must not encounter any significant obstructions. Fog harvesting requires winds between 4 and 10 m/s.



Image 10 Cloud fisher, fog nets (Floating springs, Harvesting drinking water with fog nets, n.d.)

Communities with acute water shortages in arid, misty coastal or mountainous areas can get a sustainable and economical source of clean water through CloudFisher. (Floating springs, Harvesting drinking water with fog nets, n.d.)

2. Solar panels made from food waste

Carvey Ehren Maigue, an engineering student is the first-ever global sustainability winner for his AuReus system, which uses waste plants to create cladding that can produce renewable energy from ultraviolet light. The translucent AuReus material captures energy from invisible UV rays that flow through clouds, unlike conventional solar panels that can only function in clear conditions and must face the sun directly. According to preliminary testing, it is therefore capable of producing energy close to 50% of the time, as opposed to 15 to 22% with conventional solar panels.



Image 11 The material is made using waste crops (Hahn, 2020)

AuReus may convert entire structures into vertical solar farms when used as a fluorescent covering on windows or facades to absorb UV rays that are reflected off of nearby buildings and pavement. By doing this, the amount of energy that can be produced is maximized.

The aurora borealis serves as the inspiration for AuReus, which gets its name from the physics behind the northern lights. High energy particles like ultraviolet or gamma rays are absorbed by luminescent particles in the atmosphere before being degraded and reemitted as visible light.

Similar to this, Maigue's technique makes use of luminous particles made from leftover crops. Maigue goes through a process of smashing the fruits and vegetables, extracting the juices, and filtering, distilling, or steeping the fluids to draw out the bioluminescent particles.

Before the substrate is molded into the cladding and clamped onto walls or sandwiched between the two panes of the double-glazed windows down, the particles are suspended in resin.



Image 12 Maigue says the system could be applied to entire buildings such as the Montreal Convention Centre (Hahn, 2020)

The visible light produced as a result of these particles is reflected in the panel's very edges. In order to self-correct and direct itself toward the emitting edge, the light depends on the material's internal reflectance, according to Maigue, a student at Mapua University in Manila, the capital of the Philippines. This can also be managed by particular laser etching patterns. The outside of the cladding is surrounded by a row of standard photovoltaic (PV) cells, similar to those found in standard solar panels, which may then be used to collect and transform this visible light into electricity.

This electricity can then be either stored or utilized right away thanks to integrated regulating circuits.

In that way, he explained to Dezeen, "it may be utilized directly as a stand-alone or can be combined in groups to provide a higher output." Since its electrical output is appropriate for existing solar photovoltaic systems as well, it may also be simply integrated into those systems.

The crops utilized come from local farmers who have been adversely impacted by severe weather disturbances brought on by climate change. A quarter of the population of the Philippines depends on the agricultural sector for employment, but because of climate change, this sector is being negatively impacted by more frequent and extreme weather events, which between 2006 and 2013 damaged more than six million hectares of crops worth an estimated \$3.8 billion. Maigue utilizes an untapped waste stream by reusing part of the crops that were withering on the fields and provides farmers with a method to recoup their lost produce. (Hahn, 2020)



Image 13 The fruits and vegetables are crushed and filtered to extract bioluminescent particles (Hahn, 2020)

2.4. Good practices from all over the world

1. HOTELS, SPA, ADAPTIVE REUSE •MONEMVASIA, GREECE

The project was done by Diversity Architects, located in Monemvasia, Greece.



Image 14 Kisterna Hotel and Spa / Diversity Architects (Kinsterna Hotel & Spa / Diversity Architects, 2016)

In the Peloponnese, next to the Byzantine citadel of Monemvasia, there is a five-star hotel called Kinsterna Hotel. The 17th-century estate, which is surrounded by citrus and olive orchards, has a rich heritage that spans the Byzantine, Ottoman, and Venetian periods. The restoration of the home and its transformation into a country hotel and spa depended heavily on revealing these layers of history. Our goal to restore this long-forgotten relic included developing a self-sufficient and sustainable community.



Image 15 Memory is embedded in the textured surfaces of the building (Kinsterna Hotel & Spa / Diversity Architects, 2016)



Image 16 The successive phases of construction are rendered visible in contrasting stonework and thick plastic facing (Kinsterna Hotel & Spa / Divercity Architects, 2016)

Greek for "cistern," Kinsterna is the name of the water feature at the center of the property. Water has been supplying this fertile terrain with life for ages from a spring high in the mountains, trickling down a creek before being directed into the cistern. The main component of the design concept is water, which integrates nature into the architecture and unites the old and new structures. Water supports the hotel's environmental culture by irrigating the nearby orchards, vineyards, and kitchen gardens. This allows for the rebirth of old-fashioned pursuits that were formerly essential to the estate, such as the manufacture of wine and olive oil.

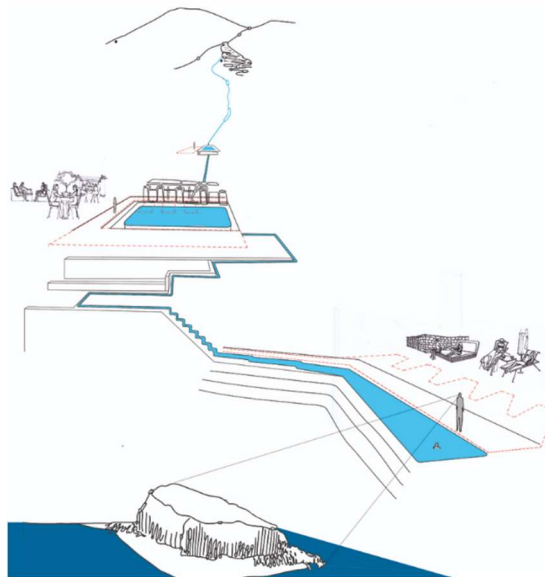


Image 17 Diagram (Kinsterna Hotel & Spa / Divercity Architects, 2016)

It was supposed to develop a sizable addition in phase two to make room for more common rooms. It was difficult to design a contemporary structure next to a historic mansion and maintain environmental sensitivity. The tiled, sloping roofs of the Byzantine Monemvasia served as inspiration for the solution. To create an abstract

roofscape that speaks to the region's rolling hills as well as the visitors' journey around the property, this distinctive design has been developed and enhanced. The new building's huge volume nearly vanishes when viewed from the pool due to the meticulous thought given to its placement and design. (Kinsterna Hotel & Spa / Divercity Architects, 2016)



Image 18 The natural flow of water spills gently into the cistern and pool (Kinsterna Hotel & Spa / Divercity Architects, 2016)



Image 19 The swimming pool meanders through the grounds like a river (Kinsterna Hotel & Spa / Divercity Architects, 2016)



Image 20 The outdoor dining area, a series of raised platforms floating above the original cistern (Kinsterna Hotel & Spa / Divercity Architects, 2016)



Image 21 Local construction methods and materials capture the atmosphere of the original building. Ceilings feature exposed stone vaults, cypress beams, or traditional woodwork (Kinsterna Hotel & Spa / Divercity Architects, 2016)

2. HECKFIELD SPACE / SPRATLEY AND PARTNERS

The project was done by Architects: Spratley & Partners in 2018. Located in Hook, United Kingdom, taking up an area of 63000 ft².



Image 22 Heckfield place / Spratley and partners (Heckfield Place / Spratley & Partners, 2018)

'Heckfield Place,' formerly the residence of antiquarian Horace Walpole, has been delicately transformed into an 'effortlessly stylish' country hotel with lovely bedrooms, two restaurants, a private cinema, a Little Bothy spa, a wine cellar, gardens, and Home Farm, a farm based on sustainable and biodynamic farming practices.



Image 23 Heckfield place / Spratley and partners (Heckfield Place / Spratley & Partners, 2018)

After an extensive program of restoration work that started in 2009 for a private investment company, Morningside Group, Spratley & Partners finally finished the spectacular transformation of the 430-acre site in Hampshire into the UK's most anxiously awaited, premium hotel in 2018.



Image 24 Heckfield place / Spratley and partners (Heckfield Place / Spratley & Partners, 2018)



Image 25 Heckfield place / Spratley and partners (Heckfield Place / Spratley & Partners, 2018)

The facility, which was being used as a conference center and a wedding location, later received modern modifications, which were largely unsympathetic and out of step with the original form and layout; the house was extended in the 1980s with a block of bedrooms and conference facilities, but they were small, subpar, and needed significant upgrading. The old home's rooms have also been partitioned, leading to claustrophobic areas and upsetting the house's original design. This beautiful, Grade II listed Georgian house and the estate have been brought back to life and tastefully incorporated into its remote countryside settings after years of careful repair and collaboration. (Heckfield Place / Spratley & Partners, 2018)

3. CONVERSION OF A FORMER BREWERY TO A HOTEL / KÜHNLEIN ARCHITEKTUR

The project was done by KÜHNLEIN Architektur with the leading architect, Michael Kühnlein in 2018. Located in Sinzing, Germany.



Image 26 Conversion of a Former Brewery to a hotel / KUHLEIN (Conversion of a Former Brewery to a Hotel / KÜHNLEIN Architektur, 2018)

Together with the church and taverns, the structure serves as the settlement of Eilsbrunn's urban core. Here it was demonstrated that even a dead candidate without heritage protection may be brought back to life with a very economical implementation after 50 years of decay and vacancy. Solid rooms with solid wood furnishings and floors in the former brewhouse are offered at the hotel. (Conversion of a Former Brewery to a Hotel / KÜHNLEIN Architektur, 2018)



Image 27 Conversion of a Former Brewery to a hotel / KUHLEIN (Conversion of a Former Brewery to a Hotel / KÜHNLEIN Architektur, 2018)



Image 28 Conversion of a Former Brewery to a hotel / KUHLEIN (Conversion of a Former Brewery to a Hotel / KÜHNLEIN Architektur, 2018)



Image 29 Conversion of a Former Brewery to a hotel / KUHLEIN (Conversion of a Former Brewery to a Hotel / KÜHNLEIN Architektur, 2018)



Image 30 Conversion of a Former Brewery to a hotel / KUHLEIN (Conversion of a Former Brewery to a Hotel / KÜHNLEIN Architektur, 2018)

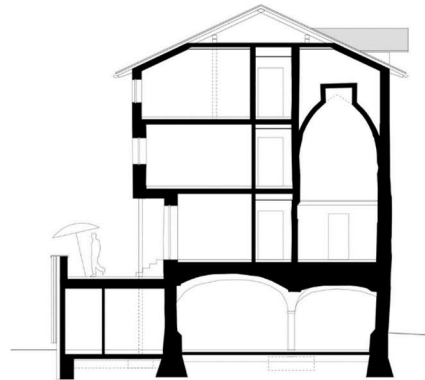


Image 31 Conversion of a Former Brewery to a hotel / KUHLEIN (Conversion of a Former Brewery to a Hotel / KÜHNLEIN Architektur, 2018)

4. The Arc at Green School, Bali

The project was done by studio Ibuku. Located in Sibang, Bali taking up an area of 760m².

The Arc at Green School, the first structure of its sort ever created, is made up of a sequence of bamboo arches that span 19 meters and are joined by anticlastic grid shells that gain their strength from curving in two directions.

The Arc is an engineering marvel that took months of planning, development, and fine-tuning of specially created features. (The Arc at Green School, 2021)



Image 32 The Arc, an educational building at Green School in Bali, with its undulating bamboo roof (Stathaki, 2021)

With an emphasis on creativity, the arts, and ecological responsibility, The Green School in Bali is renowned for its carefully crafted curriculum that follows students from their early years through secondary education. The school was established in 2006 by John and Cynthia Hardy and has a distinctive approach to teaching; it is now able to boast a brand-new building in its vicinity. With its innovative, green bamboo roof, The Arc, created by the local design and architecture firm Ibuku, led by Elora Hardy, offers a new visual interpretation of educational architecture and the school's green identity. The facility was planned to house a gym and wellness center for the school's campus. The roof is thin and balanced, feels organic and connected to nature, is solid but whimsical, wonderfully undulating, as well as light and dynamic - almost like the bamboo equivalent of a boat's billowing sails in the wind. The secret was fusing modern technology with time-honored, conventional bamboo construction methods.



Image 33 THE-ARC-Evening-Shots (The Arc at Green School, 2021)

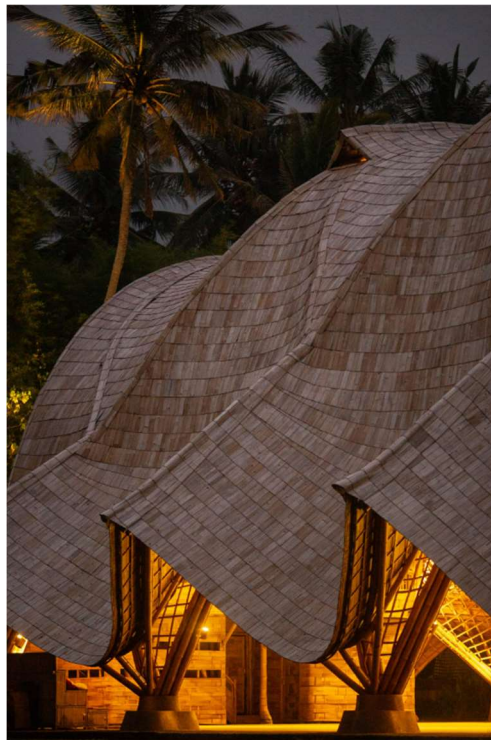


Image 34 THE-ARC-Architectural-Drawing_upd2020.10.09-9-scaled (The Arc at Green School, 2021)

The building is an engineering marvel that elevates bamboo architecture via the use of custom components and precisely thought-out construction techniques. The Ibuku team explains that it is made of "a sequence of overlapping 14-m-tall bamboo arches spanning 19-m, joined by anticlastic grids hells that receive their strength from curving in two opposite directions." The exquisite designs were perfected in association with Atelier One, a structural engineering firm, and German carpentry expert Jörg Stamm.

The Arc at Green School in Bali is an eco-friendly design that proudly displays the strength and beauty of geometry and local vernacular architecture. It also draws inspiration from the organic design and cutting-edge engineering while blending both into its structure. (Stathaki, 2021)

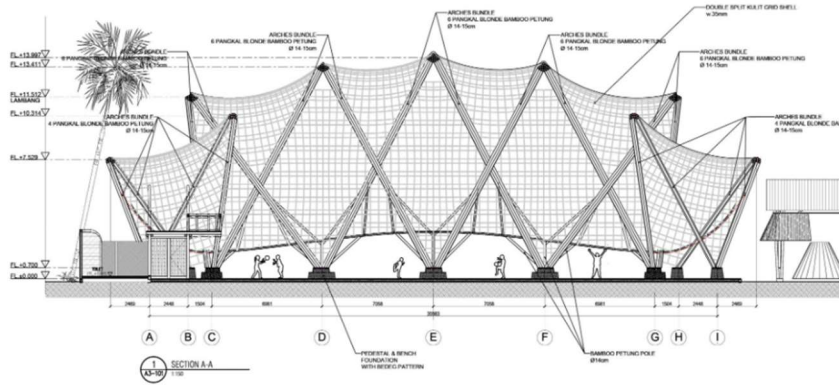


Image 35 THE-ARC-Architectural-Drawing_upd2020.10.09-10-scaled (The Arc at Green School, 2021)

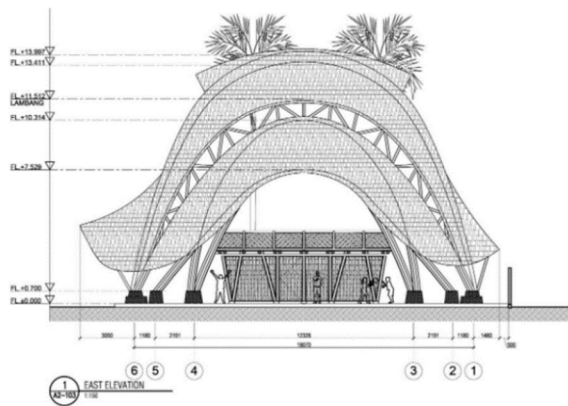


Image 36 THE-ARC-Architectural-Drawing_upd2020.10.09-9-scaled (The Arc at Green School, 2021)

2.5. Sustainable renovation design parameters

Sustainable construction is not only a wise but also a vital choice for our future. Before we reach a point of irrevocable damage to our life-supporting systems, the construction sector must adopt environmentally friendly procedures and materials. Before it's too late, the construction sector must take the initiative and identify alternative ways to build, utilizing green, renewable energy resources and adopting non-polluting processes and materials that reduce, recycle, and reuse. The different sustainable construction materials and processes available to the industry, ranging from extremely large complicated goods to small basic items, will be explored in this chapter. These are:

Sustainable renovation design parameters tool:

- Participatory design

Biomass roofing

- Energy

Solar Water and Electric

Wind power

Insulation materials

Heat pump

- Green

Green roofs

Green walls vertical

Green walls horizontal

Greenhouse

- Materials

Reclaimed materials

Lime

Non-toxic paints

Using locally sourced materials

Cob building

- Water management

- Lighting

Table 5 shows the design parameters tool for sustainable renovation.

Table 5 Sustainable renovation design parameters tool (Source: by Author)

Sustainable renovation design parameters tool			
Participatory design	Energy	Green	Materials
Biomass roofing	Solar water and electric	Green roofs	Reclaimed materials
	Wind power	Green wall	Lime
	Lighting	Greenhouse	Non-toxic paints
	Water management		Locally sourced materials
	Solar thermal technology		Cob building

The expanding market for biomass roofing has sparked a rebirth of traditional, natural building methods, as well as a recognition of the necessity to use renewable resources. Thatch and wood tiles are not only attractive, but they are also long-lasting and biodegradable. However, if the materials have been imported or manufactured and treated with chemicals, their sustainability value is reduced. Biomass roofing is only truly sustainable if the materials come from a local, renewable source and are grown, harvested, and made in an environmentally friendly manner.

Solar panels, which are used to heat water, and PV cells, which are used to generate electricity, are two types of solar energy systems. A heating system typically costs roughly 2,000 € to install and can give enough hot water all year; however, the problem from a cost standpoint is that it only costs around 100 € per year to provide this. PV cells generate more electricity, which means you might be able to sell part of the energy you've generated back to the grid.

In tourist hotels, heating and cooling are frequently the most energy-intensive procedure. Improving the thermal insulation of a building's envelope is the most effective way to reduce energy demand. Indeed, providing strong roof and wall insulation, installing sun shading devices, or greening the outside by using nature-based solutions (trees, living walls, green roofs, etc.) can greatly improve the energy performance of tourist accommodations. (Kosanović, Klein, Konstantinou, Radivojević, & Hildebrand, 2018)

Chapter 3: SOUTHWESTERN SERBIA

3.1. Climate and weather of Southwestern Serbia

3.1.1 The area of Southwestern Serbia, climate

Golija (Serbian Cyrillic: Голија, pronounced [gõljija]) is a mountain located between the cities of Ivanjica and Novi Pazar in southern Serbia. It is a mountain range in the Dinaric range. The mountain is densely forested and home to a diverse range of wildlife. It is home to the Golija-Studenica Biosphere Reserve, Serbia's first UNESCO-MAB-designated biosphere reserve. It also has a small ski resort as well as a number of historical monuments and monasteries. Jankov Kamen, at 1,833 meters, is the highest peak (6,014 ft). Golija has three distinct climate zones: a valley climate below 700 meters with a moderate continental temperature, a transitional climate (700–1300 meters) with short harsh winters and frequent snowfall, and a highland climate (above 1300 meters) with severe winters and a short summer. [<https://en.wikipedia.org/wiki/Golija>] Winters on Golija are long and harsh, with air temperatures as low as -20°C , and summers are brief and rainy. The area surrounding the hotel is noted for its numerous springs, mountain springs, and therapeutic water. (Hotel "Golub Golija" i turistički-ski centar "Odvraćenica", n.d.)

Figure 36 shows the location of the mountain Golija.



Image 37 Location of Golija (Golija, 2022)

3.1.2 Geography

Between Novi Pazar and Raška on the south and Ivanjica on the north, Golija spans north-south in an S-shaped pattern. It is 750 square kilometers in size (290 sq mi). Jankov Kamen (1,833 meters) is the highest point (6,014 ft). Sibirjanin Janko, a Serbian idealized version of Hungarian medieval warrior John Hunyadi, was the inspiration for the name. When he returned to Hungary after the Second Battle of Kosovo in 1448, according to local legends. To signify his presence, he set a stone on top of the mountain, which became known as "Janko's stone" in Serbian. Radulov (1,785 meters (5,856 feet) is the highest mountain, followed by Bojevo Brdo (1,748 meters (5,735 feet) and Crni Vrh (1,725 meters (5,659 feet) as the next highest peaks. On the peaks, there are several options for sightseeing. On Golija, there are about 100 water springs. This mountain is the source of the Moravica and Studenica rivers. Studenica cuts a deep valley across the mountain, with other smaller gorges. The Izubra tributary contains three waterfalls and multiple cascades, with a total height of roughly 20 meters (66 feet). On the mountain, there are four lakes. On the Crepuljnik's northern slopes, the Koanin Lakes are associated at an elevation of 900 meters (3,000 feet). A natural phenomenon in which water rescinds during rainy periods and rises during dry ones. Great and Little Koanin Lakes are the two lakes in the area. They were named after Nedeljko Kooninn, a scientist who studied Golija in general. Because it is completely enveloped in bog vegetation, the Great Lake has just a little open surface area. Small Lake has a length of 90 meters (300 feet) and is partially saline. Third, although been protected since the late 1960s, Dajiko Lake has been reduced by half over time. Algae and bog vegetation cover it as well. It is also known as Tiar Lake since it is located on the northwestern slope of Golija. Formerly encompassed by a lofty spruce forest that only permitted sunlight during the zenith, the trees thinned out with time, resulting in vegetation changes both around and within the lake. The grazing of livestock around the lake is prohibited. The lake, which was once the site of several traditional rites, is the subject of numerous folk stories. The lake has been described as a gathering place for the most beautiful fairies, as well as a popular narrative of a wedding party that perished in the lake. After the 1977 Vrancea earthquake, the fourth Neberska Suza ("heaven's teardrop"), developed and is the least explored. Despite being the newest, it is the largest natural lake in the area. (Golija, 2022)

3.1.3 Biodiversity

Golija-Studenica Nature Park has a total size of 538.04 km² (207.74 sq mi). The plants of Golija make up almost 25% of Serbia's flora. There are 1091 plant species reported in the park, including 117 varieties of algae, 40 moss species, 7 lichens, and 75 fungal species. Many of the species are extinct or endemic to the area. The Heldreich's maple is the mountain's symbol, and the mountain's deciduous and mixed-type forests are among of Serbia's best preserved. In addition, there are 225 therapeutic plants. Golija's herbs were reportedly utilized in the first hospital in medieval Serbia, which was established in the Studenica monastery in 1207.

Golija is one of Europe's most important mountain ornithology reserves, with 95 bird species listed, including the Eurasian sparrowhawk. Wolves, brown bears, least weasels, dormice, red squirrels, red foxes, wild boars, and water shrews are among the 22 animal species.

As the mountain communities go away, the wildlife returns and flourishes. Due to the spread of wild boars, the production of potatoes, wheat, and corn came to a near-

complete halt. Bears initially arose during the Bosnian War in the early 1990s. They began to display a shift in their behavior in the 2020s, failing to hibernate when they should have. During these times, they destroy beehives, break fruit trees (plum, apple, and pear), and raid communities, breaking into barns and slaughtering sheep and pigs.

UNESCO designated a portion of the Golija-Studenica nature park as Serbia's first biosphere reserve in September 2001. (Golija, 2022)

3.2. Rural tourism in Serbia

Protected nature and the environment in rural areas have always drawn, and notably in recent years, a huge number of urban residents, which is why interest in visiting the village is growing. According to statistical data showing that rural tourism accounts for 10% to 25% of all tourism activities, it can be concluded that "the story of rural tourism began in the rural area and will continue to rise in the future," and that rural tourism is an important tool for rural economic development. Tourists are drawn to these locations because of the benefits of the rural environment, which includes historical traditions as well as ethnic and geographical qualities.

Rural Tourism - This is a new sector of the tourism industry, as explained by Edward Inskip, a professor at the World Tourism Organization and a professor at the University of California, Berkeley.

Small groups of tourists go on a journey known as rural tourism to rest in rural environments, sometimes in historical sites far from the city, to learn about the cultures and way of life there.

Due to a lack of tourism infrastructure, tourist resources, relevant employees, and a program, this sort of tourism is almost non-existent in Serbia today. Each region of Serbia has a significant tourist potential (resource), but it has yet to be effectively examined and utilized. Each of these tourism resources requires a unique development program, which is currently only available in Serbia in general and is insufficient for the expansion and development of rural tourism demand.

The development of tourism in Serbia at the regional level should coincide with the development of rural tourism. Many districts and cities have natural and recreational advantages that allow locals to rely on buildings for rent (for vacationers) during the summer. It is the potential to promote sporecological, children and youth, ethnographic, and health-healing tourism in these locations, along huge rivers or snug and charming tiny rivers (both in summer and winter).

Rural tourism can be tailored to fulfill the demands of persons with "average" and "below average" financial means, as this sector of the tourism industry is defined by low-cost enjoyment (this is the main motivation for rural tourism - cheap, less comfortable, but environmentally friendly and pleasant, recreation in the environment). All of this adds to the number of jobs available in small towns and villages (renting accommodation, serving guests, producing and selling food products, handicrafts).

Rural tourism has the potential to revitalize the district's development. The subject of forming a unique sort of future partnership for the growth of rural tourism remains unanswered. (Stepanov, Jovičić, & Jovičić, 2018)

Figure 38 shows the symbols of rural tourism in Serbia.



Image 38 Symbols of rural tourism in Serbia (Stepanov, Jovičić, & Jovičić, 2018)

Some villages that were able to maintain their way of life and way of life grew to resemble cities. Villages could open up to tourism trends that differ greatly from present tourist trends in terms of volume and quality by transforming original village values into tourist values. These activities would inject vitality into a monotonous rural existence, stabilize the village's further layers, and provide a plethora of work and income alternatives for the rural populace.

The culture of the Serbian village is one of the factors that contribute to the attraction of rural tourism offer, which includes:

- A culture of dressing,
- A culture of living,
- Spiritual culture (Folklore, traditional and contemporary creativity in the countryside).

Because authentic rural tourism reflects the core of the Serbian soul, a tourist destination's positioning plan must include both physical and spiritual features. As a result, tourists and visitors would be invited to come and go to personally discover the soul of the Serbian people, explore their cultural history, and discover the uninvited beauty of the Serbian hamlet. These physical and spiritual elements must be enhanced as part of the rural accommodation capacity and rural activity plan. (Stepanov, Jovičić, & Jovičić, 2018)

In the early twenty-first century, analysis and synthesis of talks, expert opinions, scientific articles, and acceptable application difficulties of tourism in rural regions have evolved into the "assault" category, which includes both negative and positive criteria. ' Farm tourism, ecotourism, rural tourism, nature tourism, green tourism, and rural tourism are examples of synonyms for the same phrase. There are differences in all of these analyses, as follows: - First, the differentiation is based on income distribution within rural communities; - Second, the distinction is based on deals.

The alignment of goals, vision, and mission, as well as the formulation of appropriate strategies, provides well-designed tourist management. As a result, the most competent definition of tourism in rural areas comes from WTO documents: „The term rural tourism is used in cases where rural culture is a key component of the offered tourism product, the product of rural tourism characteristic effort to ensure the visitor personal contact, feeling the physical and human environment in rural areas, and, to the extent possible, to be given the opportunity to participate in the activities, traditions, and lifestyles of local people.”

Tourism in rural areas challenges economic and social categories, as well as cultural, political, and post-modern categories. As a result, Serbia's rural areas face challenges in terms of attractiveness and socioeconomic feasibility in the development and acceptance of various forms of tourism.

We can draw conclusions about the problematic qualities of rural areas to precisely characterize the physiognomy of rural tourism in Serbia based on all that has been stressed in previous tourism and other workers' actions in the development of rural tourism in Serbia. These are the functions:

- Economic challenges, which are classified into two categories: direct and indirect. Direct functions of the challenging rural and tourist areas in Serbia related to the creation of income from rural tourism development, i.e., whether the tax incentive should accumulate in the form of increased investment activity in the rural area, or simply maintain the existence of those involved in rural tourism in this area? In our current circumstances, is still active in the other, i.e., existential function, whereas investment is almost non-existent. All of this is based on the fact that rural tourism in Serbia still generates nearly overflowing cash from urban to rural areas, while international effects are almost non-existent.

The impact of rural tourism on regional development in Serbia's rural areas is the next big, direct challenge. That his influence was primarily tied to the natural elements of the studied area (about 70% highland type), and the anthropogenic tourist potential of rural locations in Serbia's regions was less valued. It may be more useful to consider the background of individual clusters defined in Serbia's Strategy of Regional Development (2007) and Tourism Development Strategy (2005), as the clusters are increasingly attracting international interest, as they are already "tourist players" in many European countries (Austria, Slovakia, Hungary - Cluster Land), reflecting their impact on the development of rural tourism in Serbia.

Also, the growth of rural tourism in Serbia's so-called "border" rural area (which was on the verge of economic viability and was threatening permanent depopulation) can revitalize the economic activity that it creates income brackets, but which is constantly rising. In those parts of Serbia's rural areas where ethnic identity is currently dominant, i.e. in six spatial units that cover tourist clusters (Vojvodina, Eastern Serbia - Vlach identity, Southeast - Šopskotorlački identity, Kosovo and Metohija, Central and Western Serbia), regional development provides market valorization of ethnographic characteristics of these areas in economic terms.

The multiplying effects of tourism on the area are the most significant economic and tourism difficulties facing rural areas in Serbia. This is especially true in space flight when it comes to multiplicative compensation and the conversion of inefficient agricultural produce. In many villages that promote rural tourism, additional employment multipliers have also become the principal source of income, which is steadily rising. This improves the quality of human labor while also boosting the quality of life and the quality of tourism products. The multiplier of tourist growth in Serbia's rural areas plays a stimulating and challenging function and is similar to the constantly rising output in other economic sectors, which realizes surpluses in the tourism market with favorable economic impacts.

Our indirect functional consequences of rural tourism in other activities that are a subsidiary portion of the tourism industry are another economic difficulty. The following are examples of the impact in Serbian rural areas:

- The construction industry will be impacted, mostly through the adaption of existing ancient buildings. In order to sustain ethno-style construction and the use of local ecological resources, this construction must meet this need for rural tourism in the long run. It must also pay attention to Serbia's rural areas. All structures for rural tourism should blend nicely with the area's natural surroundings. However, it is acceptable that the tourist value of certain buildings in rural areas cannot dominate, but it does not violate (for example, the monastery, monuments, and so on), and that all objects that violate ethnic identity and the natural tranquillity of rural space should be removed from the premises. All the more important that every tourist village in a rural area is supported by the color, which is characterized by plants in the complex (e.g., sunflower yellow – colors of all buildings), and the integrity of the supply, i.e., that tourists can be stored in one village and lunch and dinner in another, all of which are in the same rural catchment area. In the end, construction must primarily involve individuals from the local community in tourism development.
- Indirectly, agriculture's challenges are reflected in all rural areas through the exchange of goods in tourism and agriculture (food and drink), intangible impact on rural tourism (preserved natural environment), and housing market surpluses materialized space and other resources, employment, redundancy, and the raising of cultural tourism in the local community;
- Traffic transport to and from rural places is most effective when contemporary transportation infrastructure is available, which is sadly a major negative in Serbia's tourism and rural areas.
- Wholesale and retail trade, tourist supply diversity of goods, homemade items, and crafts products applied, subject to the most so-called "foreign" lobby, which means not encouraging domestic consumption and manufacture of tourist things, with more than 80% imported. This implies that tourist growth in Serbia's rural areas may face an economic stimulation difficulty.
- We will simply mention the social challenges of tourist development in Serbia's rural areas because they are insufficient to become active in Serbia. First and foremost, raising living standards and maintaining a steady growth index of quality of life, permanent education of the rural population and its adaptation to permanent changes in duties in modern rural tourism, cultural tourism growth through the constant reduction of so-called absolute abstainers, and travel faster relative growth of tourism abstainers, which means the growth of real and potential tourism demand and supply, energization level of culture, identity cation level of culture.
- Rural cultural difficulties obtain their normal accreditation in tourist development by completing more tourism, a marketing presentation of the area's population features, and activation of a rising number of

individuals to deal with both amateur, professional, and cultural activities; and

- Rural areas face greater environmental challenges, which are more typical of tourism development, notably through the rebirth of eco-tourism activities. To become a demanding rural area of Serbia with the potential for rural tourist growth on environmental grounds, it must use typical eco-lodgings in all portions of the accommodation units. As a result, given our circumstances, eco-lodging must portray the rural character of Serbia from the outside while allowing for modern technical and technological use from the inside. It must meet the following criteria:
 - a. -protecting natural and cultural elements of their environment during construction
 - b. -having a low environmental effect, fitting into a given environmental context
 - c. -excellent cooperation with the local population, including the use of alternative, sustainable water consumption methods and proper waste and wastewater management.
 - d. -excellent cooperation with the local population, including the use of alternative, sustainable water consumption methods;
 - e. -excellent cooperation with the local population, including the use of alternative, sustainable water consumption
 - f. -implements environmental education and training initiatives for staff and visitors
 - g. -contribute to the long-term development of communities through research initiatives

Everything points to the fact that a Serbian rural environment offers challenging activities in the following directions:

- challenge of the independent tourism offers, with complete rural-tourist facilities;
- challenge of the compatibility of the rural-tourist area with mountain centers, spas, urban and similar forms of tourism;
- challenge of the marketing mix of the rural-tourist area, with the promotion of tourism products and facilities in rural areas of Serbia;
- challenges of the transition rural-tourist area, through the valorization of tourism adjacent to tourist traffic corridors in the area;
- challenges to the specific integrity of Serbia's tourist-rural areas, such as diffuse resorts, didactic farms, ethnic villages, and bio-tourism gardens, as well as identified "the country" (e.g., Italy's fifth country), etc.;
- all other challenges, such as a mix of forms and subforms of tourist activities with "the central leader" rural tourism in Serbia's rural areas. (Joldžić, Batrićević, Stanković, & Paunović, 2018)

Table 6 shows the most important resources necessary for the development of rural tourism.

Table 6 The most important resources necessary for the development of rural tourism (Source: by Author)

The most important resources necessary for the development of rural tourism
The preserved nature
Clean and unpolluted water
Ethno content
Hospitable local population
Traditional gastronomy
Rich flora and fauna
Rural Councils
Developed agriculture
Excess of housing accommodation for tourists
Beer and Wine Trail
Other (roads, swimming pools, professional staff, healthy food, etc.)
Unproductive areas

In Serbia, agriculture and tourism in rural areas make a unique co-existential whole, because the basic resource for the development of rural tourism in rural areas of Serbia is, preserved natural environment. This implies that rural areas in Serbia have significant hurdles, not only for rural tourists but also for a variety of other forms of selected tourism (most notable ecotourism. (Milenkovic & Utvic, 2013)

Table 7 shows the forms of rural tourism that Serbia should develop.

Table 7 Chart showing the forms of rural tourism that Serbia should develop (Source: by Author)



3.2.1 Rural tourism in mountain Golija

The most important tourism on Mount Golija is rural tourism because nature is still untouched by human hands, and not too many changes have been made. The inhabitants of this place produce local products, live off natural resources that they sell, and promote their customs, which is very attractive to tourists who want to feel the real untouched nature and tradition.

The mountain features a number of ski resorts nearby Ivanjica and Novi Pazar, as well as two hotels built on the mountain itself. Roe deer, boar, and hare can be found in hunting areas at Emernica, Grabovica, and Golija.

At the Daićko Lake, there is a memorial drinking fountain, dedicated to the forestry pioneer on Golija, Vlastimir Parezanović. It holds a carved inscription: "If every man would know which tree is his own, he would never cut it". (Golija, 2022)

3.3. Legislation in the Republic of Serbia regarding energy efficiency

In Serbia, there are a number of documents that should regulate the reduction of pollution, the increase of energy savings, and the mitigation of the impact of climate change on the environment.

National Strategy for Sustainable Development (2008)

Although this documentation is already being used, a certain amount of time is needed in order to see the effectiveness of its use.

One of the five basic priorities when it comes to increasing energy efficiency in the production, distribution, and use of energy is defined in the Energy Development Strategy of the Republic of Serbia until 2015. As in the National Environmental Protection Program (2010), Serbia imposed the corresponding obligations under the Agreement on the Energy Community of South-Eastern Europe (2006).

Energy Development Strategy of the Republic of Serbia until 2015 (2004)

By signing this Agreement, the parties agree to establish a legal framework that will allow the introduction of the European model of market elements in the gas and electricity industries, thereby facilitating access to mobile networks. The Agreement lists several incentives through energy and environmental protection investments in energy and environmental protection as its primary goals. The new legal framework in the energy sector is being implemented in large part thanks to the Agency for Energy and the Agency for Energy Efficiency.

Law on the Spatial Plan of the Republic of Serbia from 2010-2020 (2010)

The topic of urban areas is covered in the section of the law dealing with the energy efficiency of buildings. It draws attention to the excessive usage of power in homes as well as in businesses and other public spaces. The deterioration of the infrastructure, poor management and repair of the energy systems, and a lack of the human and material resources that would be required to address the entire issue were noted. Environmental pollution is a further issue that is either directly or indirectly tied

to operations in the building, industrial, and transportation sectors. The spatial plan emphasizes the necessity of employing renewable energy sources, the growth of citizen ecological awareness, and the significance of local government throughout the process.

Law on efficient use of energy

The Law on Efficient Use of Energy, which is the most significant legal document, governs local energy planning. The provisions of Article 10 of this Law specify the obligations and areas of application in the field of energy efficiency. It is required that the local self-government entity develop an energy efficiency program. The energy efficiency program includes planned energy-saving objectives that are in line with the objectives of the Action Plan for Energy Efficiency and the Energy Development Strategy of the Republic of Serbia as fundamental acts that establish the policy on the efficient use of energy. The program includes an overview and assessment of the annual energy needs and an assessment of the energy properties of buildings and proposes measures and activities that will ensure efficient use of energy, of which we highlight: the plan for energy rehabilitation and maintenance of public buildings used by local self-government units, public services, and public companies. Other legal acts that are important for energy efficiency in general are:

- Law on energy,
- Law on communal activities,
- Law on Planning and Construction,
- Rulebook on conditions, content, and manner of issuing energy certificates properties of buildings (2011),
- Rulebook on the energy efficiency of buildings (2011).

Law on Energy

This law is indispensable in terms of energy and energy efficiency. It gives general guidelines for research. According to this Law, the local self-government is obliged to perform the following tasks: At the request of the Ministry, submit data for the preparation of an Energy strategy program and energy balance, and within the framework of its plans, plan the energy needs in its area as well as the conditions and method of providing the necessary energy capacities in accordance with Strategy and Program.

Law on communal activities

The law on communal activities prescribes the performance of the following activities: production and distribution of thermal energy, provision of public lighting, urban and suburban transport and chimney sweeping services, supply of drinking water, and municipal waste management.

Law on Planning and Construction

This Law enacts a number of measures related to high-rise buildings and concerns the design, use, and maintenance of buildings in accordance with the prescribed energy properties, which are defined based on the type and purpose of the object and are determined based on the energy properties certificate issued by an authorized organization. In this way, the certificate on energy properties issued by an

authorized organization becomes a mandatory part of the technical documentation necessary for issuing a use permit.

Rulebook on the conditions, content, and manner of issuing certificates on the energy performance of buildings (2011)

This Rulebook envisages the creation of energy passports for buildings where energy consumption has been determined within a certain category of buildings, their class, and recommendations for improving energy properties for new buildings as well as for those that are reconstructed, adapted, rehabilitated, or energy rehabilitated.

Rulebook on Energy Efficiency of Buildings (2011)

The rulebook prescribes the energy properties and the method of calculating the thermal properties of high-rise buildings but also formulates energy requirements for new and existing buildings. In this Rulebook, the methodology for calculating the required energy for heating and cooling in buildings is given, it shows the energy performance of buildings and the emission of CO₂ that occurs during the operation of technical systems in buildings. The existence of all the mentioned documents shows that planning practice in Serbia is approaching modern European tendencies, promoting elements of sustainable development and energy efficiency. (Miletic, 2019)

3.4. Examples of sustainable tourism in Serbia

There are no comprehensive economic and socio-cultural development initiatives in many Serbian cities, in which tourism plays an important part. Insufficient attempts are being made to promote the region's "good image" in the Serbian and international tourism sectors. Difficulties in reorganizing the management system result in a halt in tourism development and, as a result, a worsening of cities' economic woes (Ekološki turizam, n.d.).

3.4.1 Tourism in Serbia

Serbia is a relatively new destination in terms of global tourist trends, and its growth strategy aims to capitalize on a good position in the tourism sector. There are good opportunities for tourism development, which should be directed in the right direction for several reasons: leveraging good and bad experiences from other countries, market positioning in line with current trends, leveraging inherited tourism infrastructure and tourist organization, and leveraging a critical mass of knowledge and Internet capabilities for a quick entry into international tourism competition.

Real opportunities for tourism development of the Republic of Serbia derive from (Tourism Development Strategy of the Republic of Serbia 2006, 3): - The global turn of tourism development according to the principle of accelerated entry into the tourist map of a larger number of smaller destinations;

- Potentials of tourism products;
- Changing the profile of tourists;
- General market growth. (Stepanov, Jovičić, & Jovičić, 2018)

This suggests that the problems of Serbia's rural areas are incredibly appealing, but tourism is still little understood. With all of the theory and practice of one of the most popular definitions of tourism in rural areas, the organization, whose name itself implies its success: „Rural tourism was initially located in a rural area and is primarily a function of agriculture. It is primarily based on the agricultural world and outdoors, in contact with nature, agricultural heritage, and society. Rural tourism must be in agreement with the environment and the community in which it occurs.”

Serbia's rural area is a densely forested, anthropogenically diverse environment. This creates a tremendous challenge for the multipurpose use of rural tourism's numerous subtypes. (Milenković & Utvić, 2013)

Andricgrad-eco municipality

One of the centers of cultural events in our country and in the region, which attracts a large number of visitors, especially because it is about a wider ecological context, as well as a sustainable construction approach, is the city of Andrićgrad, whose appearance is not only contributed by the stone on the building facades, but also by the roof covering made of ceramic tiles, which brought the settlement closer to nature. Andrićgrad was created as an idea of a medieval town inspired by the works and characters of the Nobel laureate Ivo Andrić, after whom the town was named. Andrić's unforgettable novel "On the Drina bridge" consistently wrote the chronicle of this region and in that way, we are familiar with the region through at least 500 years of history.



Image 39 Andricgrad-eco municipality (Ekološki turizam, n.d.)

Eco-tourism is a trip to nature by environmentally conscious tourists who protect the environment by trying to reduce the negative effects of classic tourism. With this three-day ecological excursion, among other things, we achieved a profit for the local population in the ecological, cultural, al and economic sense. (Ekološki turizam, n.d.)



Image 40 Andricgrad-eco municipality (Ekološki turizam, n.d.)

Passive solar house Andromeda

Passive solar house Andromeda, built in the period from 1982 until today in more than 100 locations around the world, on terrains that are in slight decline. This type of house is designed to be self-heating solar. The facade walls are covered with brick and glass on the south side of the building. The building is designed in half levels, and the form creates the impression of a symbiosis of the house and nature. Furthermore, this was achieved by the inclined windows, which introduce light into the building to greater depths, influencing the internal temperature. The solar energy that passes through the glass goes to the thermal storage located under the ground floor. Therefore, this principle shows the method of heating the entire house, but also floor heating. The architecture of this building is accentuated by the southern facade, which also houses the Tromb wall.



Image 41 Passive solar house Andromeda (Održiva arhitektura-pasivna solarna kuća Andromeda, n.d.)



Image 42 Floorplans of passive solar house Andromeda (Održiva arhitektura-pasivna solarna kuća Andromeda, n.d.)

In picture no. 9, the way in which the southern facade absorbs the sun's rays is shown, given that the angle of incidence changes with the change of seasons. The slope and transparency in combination with the thermal storage make this house not burdened by temperature, but pleasant to live in, yet self-sustainable and justify the principles foreseen in the project for the sake of thermal comfort. And as the principle of construction of this object is the configuration of the terrain that will enable the construction of this type of house so that it looks integrated with nature, the possibility of greening one of the facade walls is perhaps an option that should be taken into account, and in this way, visually this kind of house would coexist with terrain and nature. (Održiva arhitektura-pasivna solarna kuća Andromeda, n.d.)

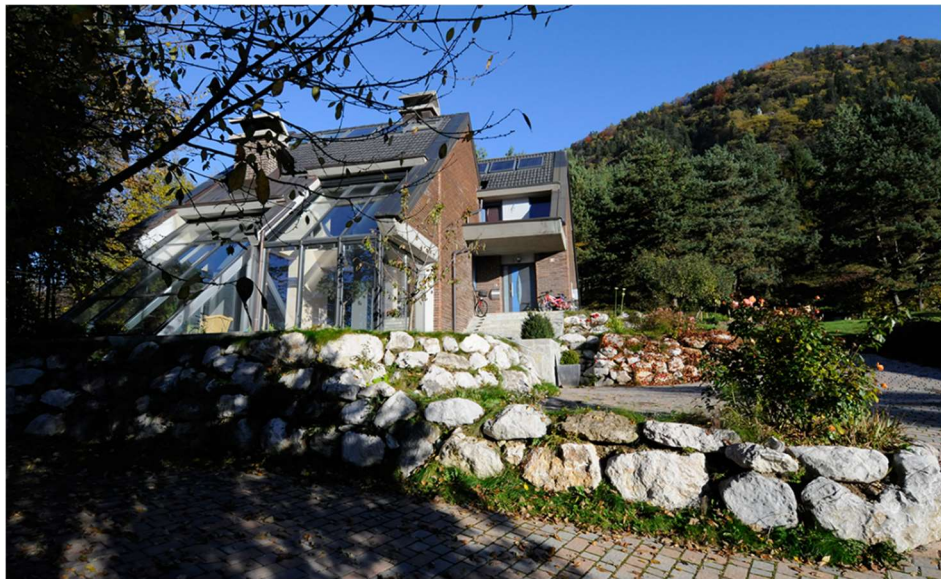


Image 43 Passive solar house Andromeda (Održiva arhitektura-pasivna solarna kuća Andromeda, n.d.)

Chapter 4: CASE STUDY BUILDING

4.1. Description

Tourist center ODVRAĆENICA "GOLLIJA" owned by Pendić Golub from Raška, is located in Golija, on cadastral parcel number 17, KO Novi Pazar, at Radaljica bb. In the immediate surroundings of this building, there are also residential and catering facilities built in different ways periods and without accentuating stylistic characteristics. They have similar shapes and positions on their plots. The plot is accessed from Radaljica Street on the east side of the plot. The building has a business and catering character. In relation to the elevation of the terrain, the elevation of the ground floor is raised by 120 cm. The staircase and the entrance platform lead to the central corridor from which you can directly access the restaurant, reception, bathroom, office, backyard, and stairs leading to the floors with rooms. The conference hall and the office on the first floor are accessed by a staircase from the reception. The restaurant is combined with a kitchen that has a storage room, and access to the terrace towards Radaljica Street. The building has 26 rooms spread over the floors and attic. It has a restaurant and a large terrace. Considering the usage for recreational classes, there are fields for sports and recreation, a children's park path, and s for running and hiking. The hotel is intended to be used as a business and tourist facility and was created by expanding the existing building, built around 1956, with an extension carried out in the period from 2000-2003. This hotel is the first building built in this area. It is a one star hotel. Based on visual detection, the object is stable. All construction works have been performed on the building. The facility is in operation.

Figure 43 shows the facade of the building in the northeast, existing condition.



Image 44 The facade of the building in the northeast, existing condition (Source: by Author)

4.2. Used materials and construction

The building is built of materials that ensure durability and safety of the building.

FOUNDATIONS

The foundations are AB strips made of concrete prepared on-site. Fittings MAR 500/600, RA 400/500. There is no certificate for embedded materials.

AB PILLARS AND VERTICAL CIRCUITS

They are concreted with concrete prepared on the spot. Armature RA 400/500. No certificate.

AB BEAMS AND HORIZONTAL CIRCUITS

They are concreted with concrete prepared on the spot. Armature RA 400/500. No certificate.

WALLS

The walls of the façade filling are made of stone and "TERMO-BLOK" is 25 cm thick, the thermal insulation is stone wool, plastic, red, and decoratively painted with facade paint. Facade walls are plastered and, on some surfaces, finished with wooden boards. The interior walls are 12 cm thick, finished depending on the purpose of the room (plastered and painted or covered with ceramics).

THE FLOOR JOISTS

MK FERT with beams and fillers. In the upper zone Q188. Concrete prepared on the spot. No certificate

ROOF CONSTRUCTION

The roof construction is wooden and made of class II pine. The roof is covered with folded tiles. The roofs are single-pitched and double-pitch and, the orientation of the ridge is northeast-southwest west.

Figure 44 shows the facade of the building in the north, existing condition.



Image 45 The facade of the building in the north, existing condition (Source: by Author)

Figure 45 shows the facade of the building in the southwest, existing condition.



Image 46 The facade of the building in the southwest, existing condition (Source: by Author)

4.3. Environmental analysis of the building (Analysis of case studies)

Environmental analysis are including:

- Site analysis
- Analysis of weather condition
- Access analyses
- Greenery and terrain analysis
- Orientation analysis

It will show the condition of the plot on which the facility is located and based on which we will draw conclusions on how to improve the sustainability of the hotel.

Figure 46 shows a geodetic survey of installations.

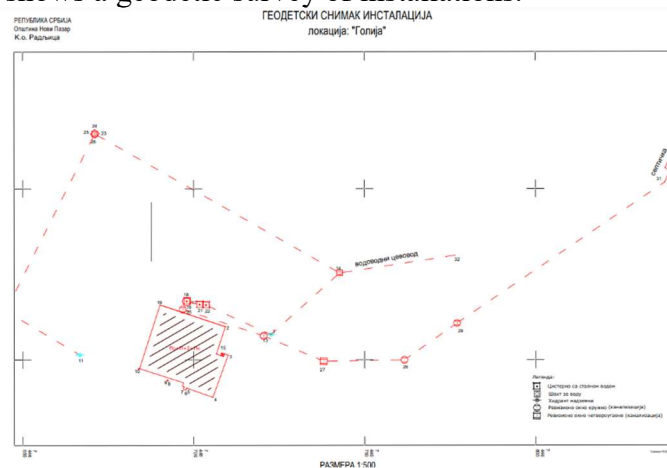


Image 47 Geodetic survey of installations (Personal archive)

4.3.1 Site analysis

The ODVRACENICA "GOLIJA" tourist attraction is situated in Golija on cadastral lot number 17, KO Novi Pazar, at Radaljica bb. There are residential and catering buildings nearby that were constructed at various times without drawing attention to particular aesthetic elements. They are situated in similar locations and have similar forms. There are fields for sports and recreation, a children's park, and trails for running and hiking, taking into account the usage for recreational classes. There are several springs, mountain springs, and healing water in the area close to the hotel.

4.3.2 Analysis of weather conditions

There is plenty of snow on this mountain and it stays for a long time. However, its summers are not particularly warm either. On Golija, summers are short and rainy, and winters are harsh and long with air temperatures as low as -20°C .

Table 8 shows average temperatures and precipitation.

Table 8 "Average daily maximum" (brown solid) shows the average daily value for each month for Golija. Likewise, the "average daily minimum" (orange line) shows the average daily minimum temperature. (Source: by Author)

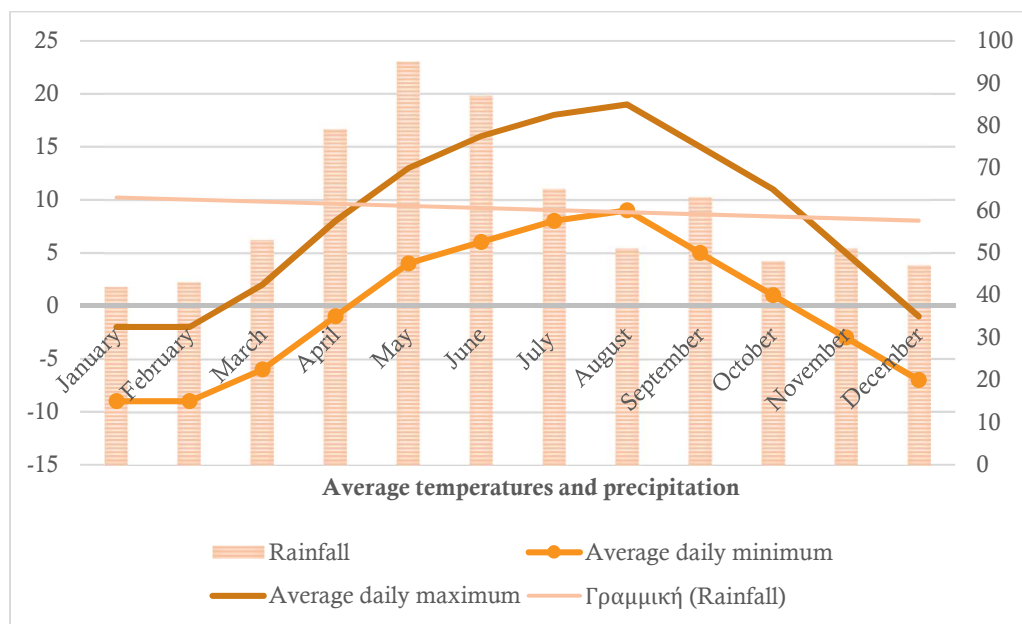


Table 9 shows cloudy, sunny, and rainy days.

Table 9 Chart shows 'Cloudy, sunny and rainy days' and how many days are cloudy sunny, or rainy per month (Source: by Author)

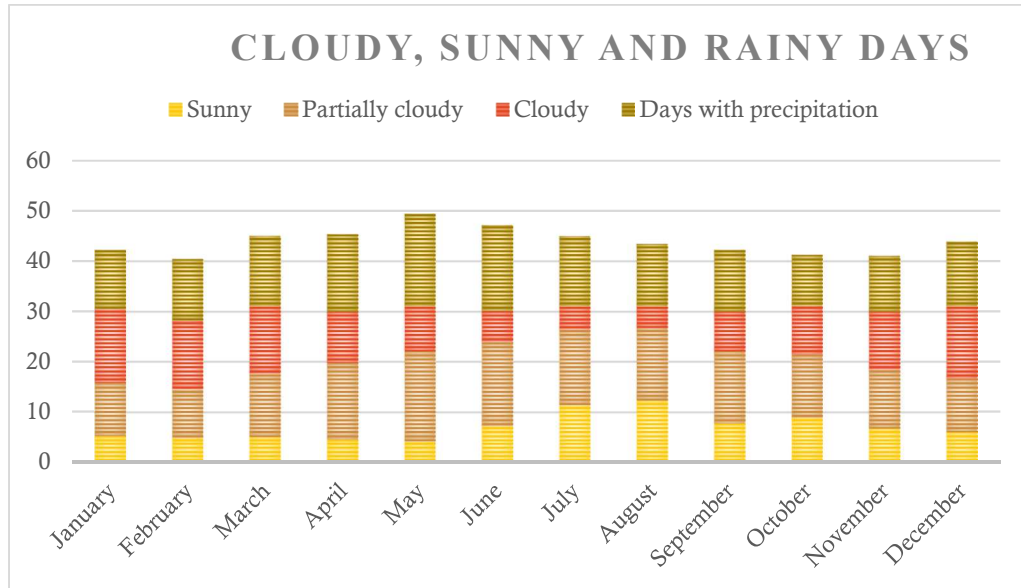
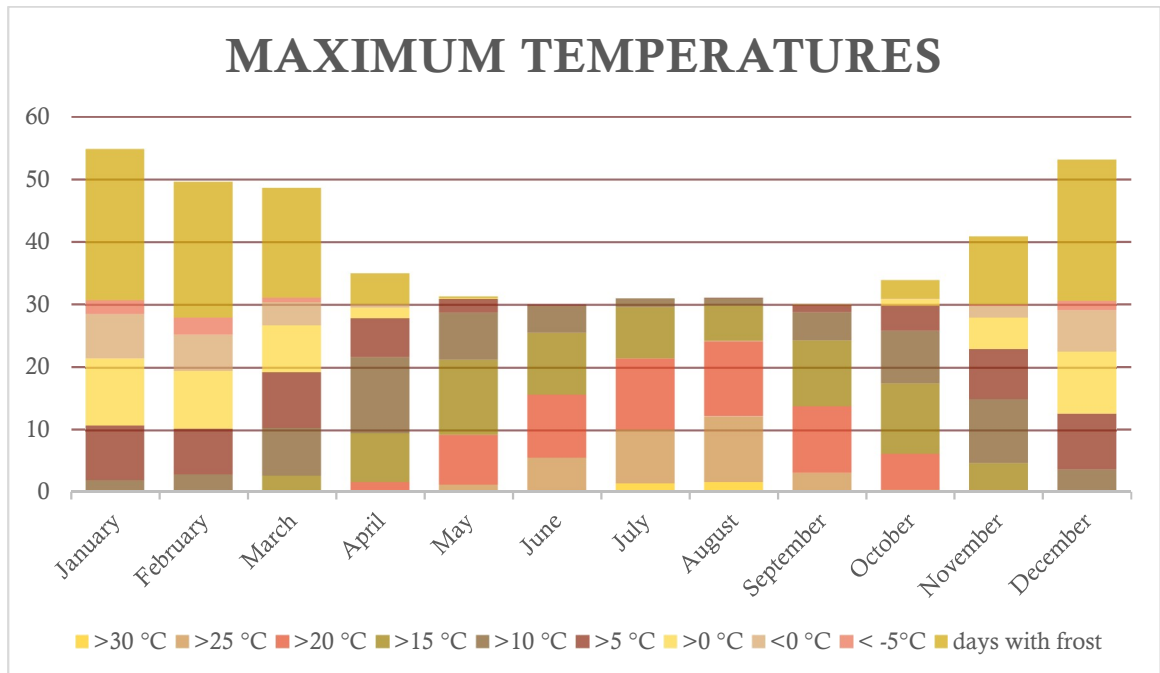


Table 10 shows the maximum temperatures.

Table 10 The maximum temperature diagram for Golija shows how many days per month reach certain temperatures. (Source: by Author)



4.3.3 Access analysis

The plot is accessed from Radaljica Street on the east side of the plot. On the north side, there is a hilly forest area. Through research, sketches, and analysis, the best approach is to organize a pedestrian entrance from the east side of the building, while the north and south entrances are less favorable. While the vehicular access can be organized both as a north and a south entrance.

Figure 47 shows access analysis.

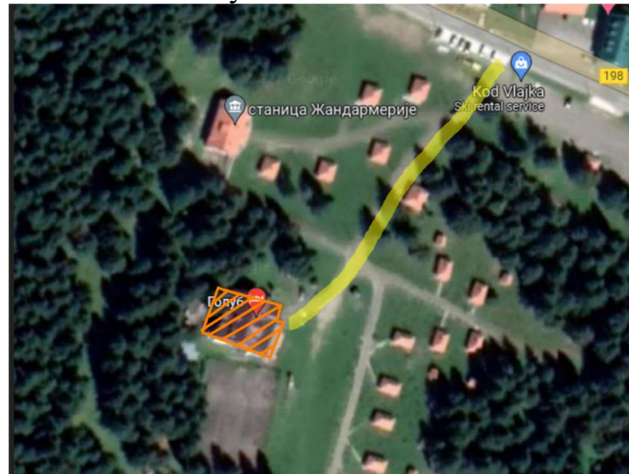


Image 48 Access analysis (Golub, n.d.)

4.3.4 Greenery and terrain analysis

On the plot itself, there is mostly low vegetation and grass. There are tall trees, but there is also a forest area nearby. The terrain is slightly raised from the east to the west side and slightly falls from the north to the south side. In relation to the elevation of the ground, the elevation of the ground floor was raised by 120 cm.

4.3.5 Orientation analysis

Access to the building from the east side, which is also the access car side, imposed the entrance to the building from the east side. The orientation of the building is very beneficial for the use of the rooms because all of the rooms that require natural lighting are in the south and southeast, whereas the rooms with utilitarian functions and wet areas are in the north, where people don't spend a lot of time and don't need a lot of natural lighting.

Figure 48 shows the orientation of the ground floor plan with areas.

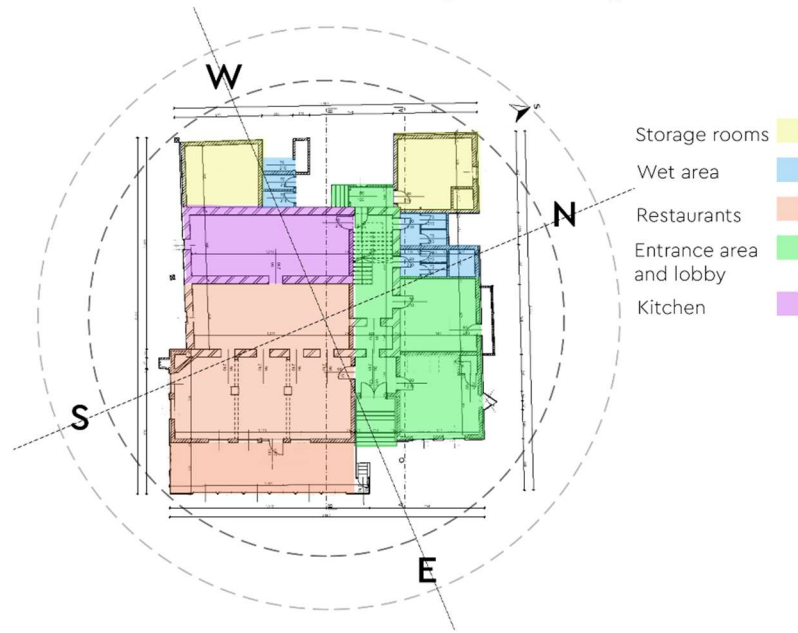


Image 49 Orientation of the ground floor plan with areas (Source: by Author)

Figure 49 shows the orientation of the first-floor plan with areas.

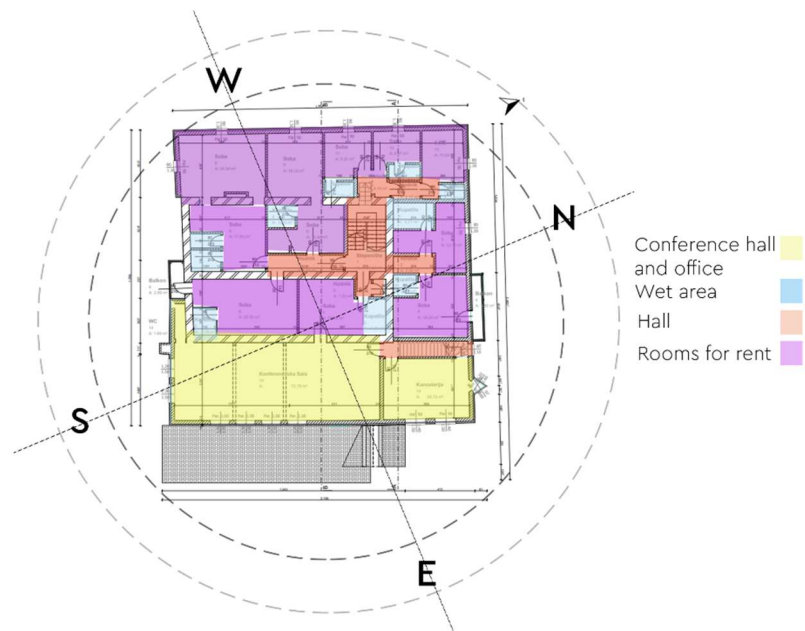


Image 50 Orientation of the first-floor plan with areas (Source: by Author)

4.4. Tabular presentation of building areas and technical description of rooms in the building

Figure 50 shows the basement floor of the existing building.

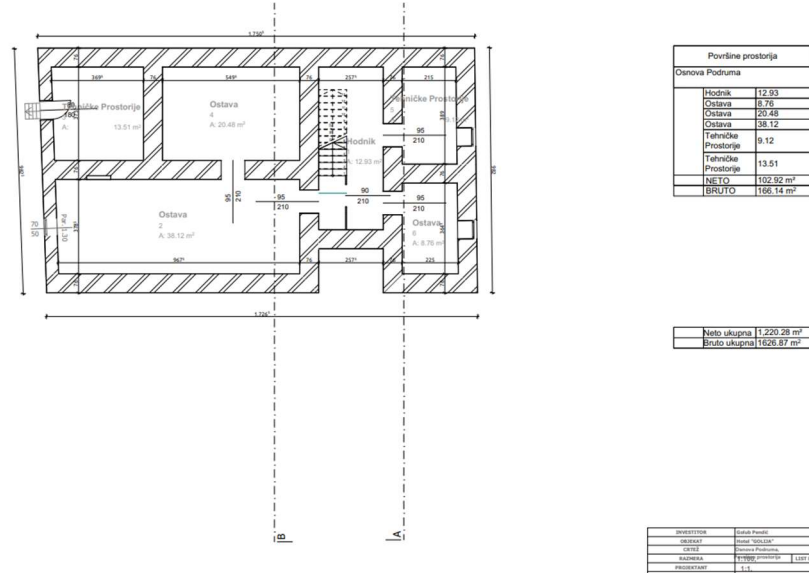


Image 51 Basement plan 1:100 (Personal archive)

Figure 51 shows the ground floor of the existing building.

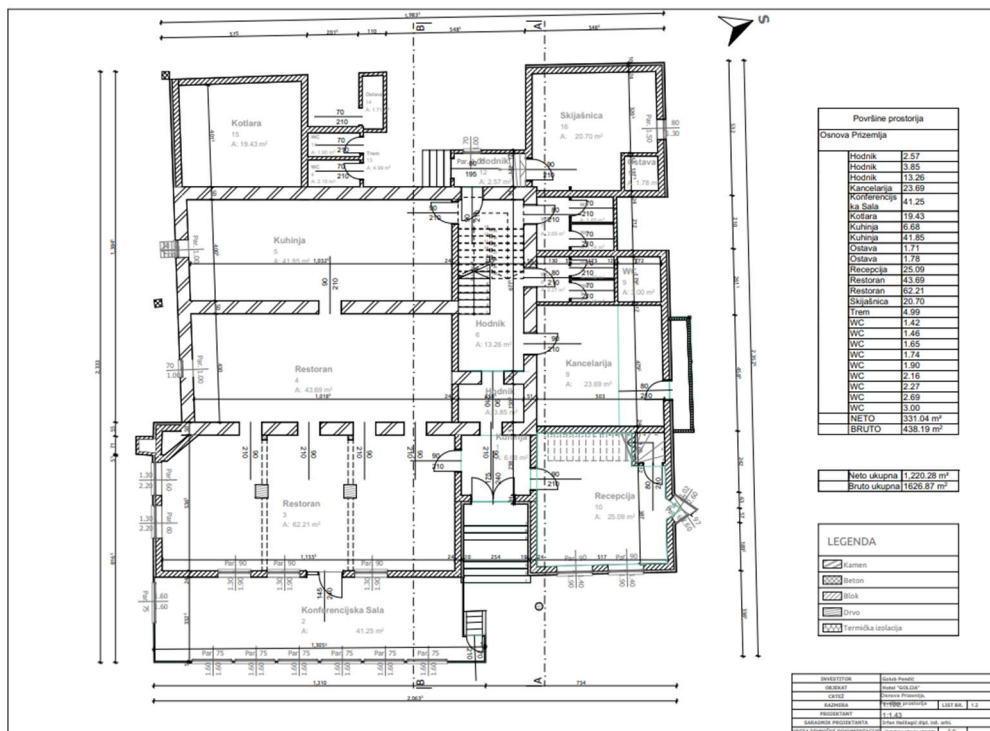
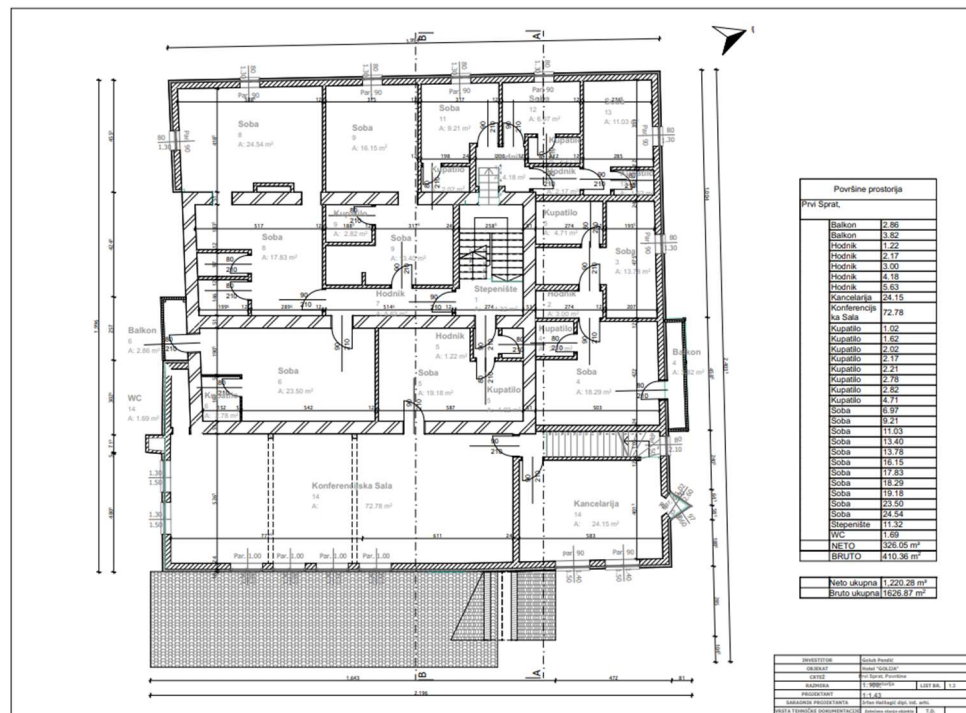


Image 52 Ground floor plan 1:100 (Personal archive)

Figure 52 shows the first floor of the existing building.



S

Image 53 1th Floor plan 1:100 (Personal archive)

Figure 53 shows the second floor of the existing building.

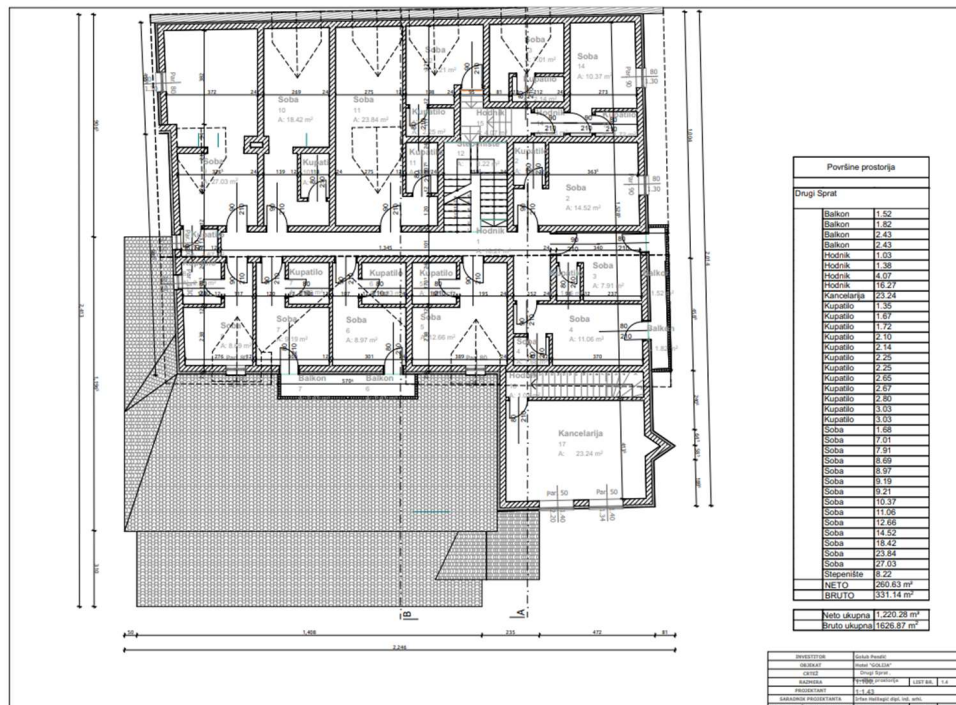


Image 54 2nd Floor plan 1:100 (Personal archive)

Figure 54 shows attic 1 of the existing building.

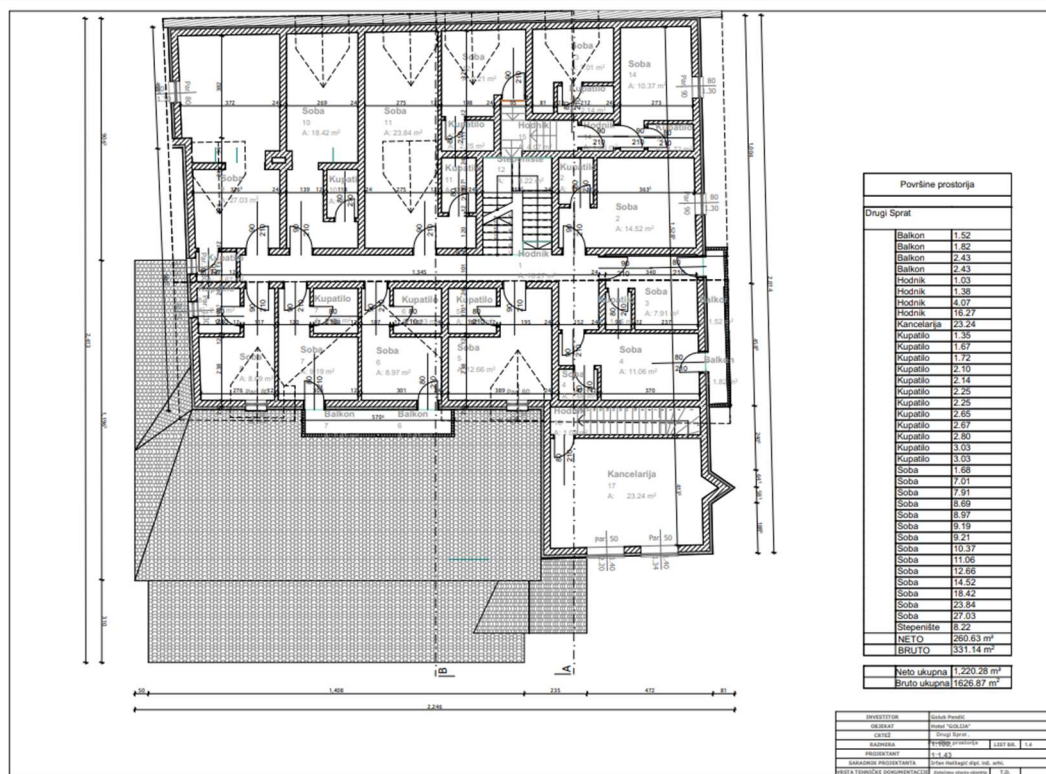


Image 55 Attic 1 plan 1:100 (Personal archive)

Figure 55 shows attic 2 of the existing building.

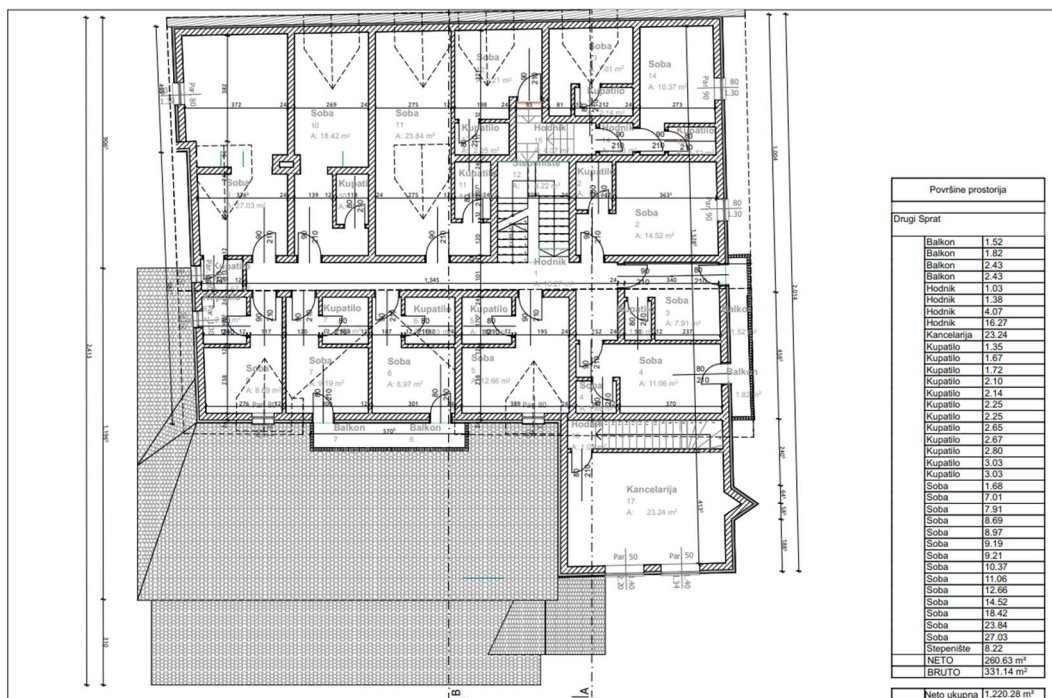


Image 56 Attic 2 plan 1:100 (Personal archive)

Figure 56 shows the east facade of the existing building.



Image 57 East facade 1:100 (Personal archive)

Figure 57 shows the west facade of the existing building.

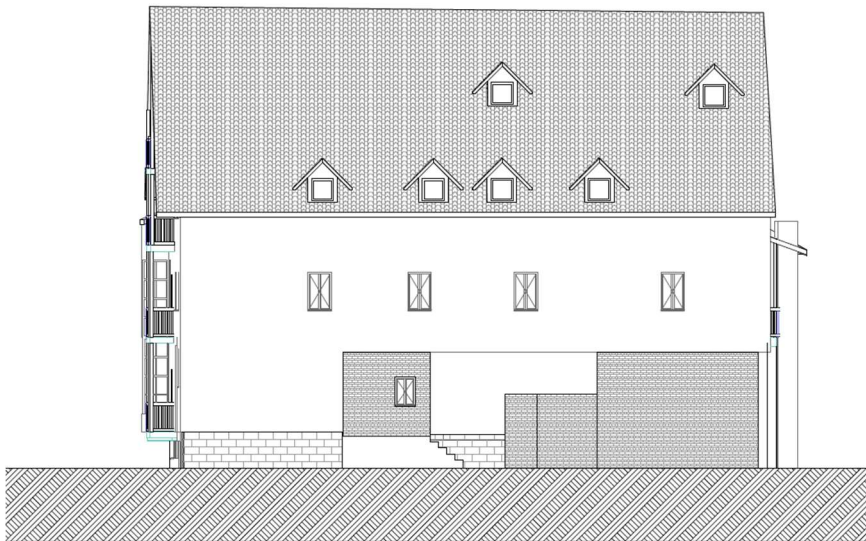


Image 58 West facade 1:100 (Personal archive)

Figure 58 shows the south facade of the existing building.

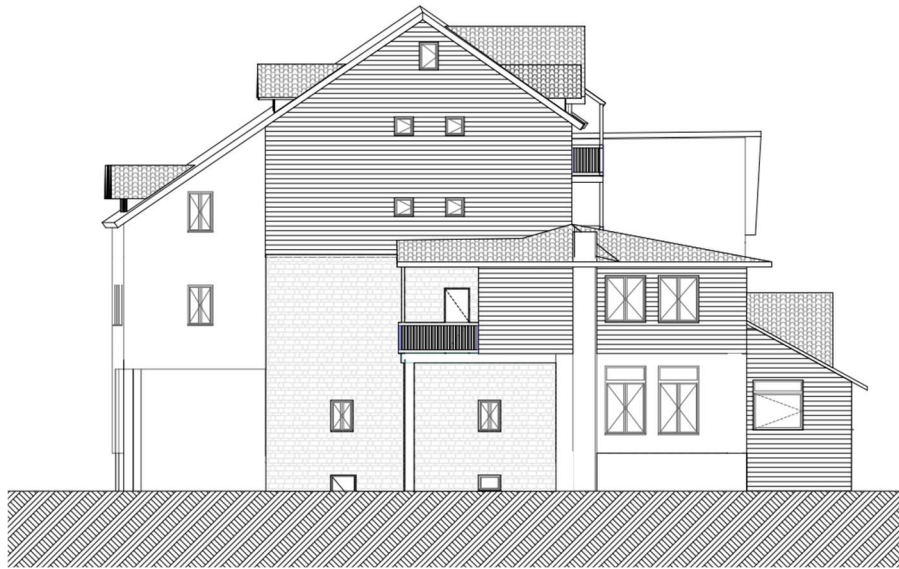


Image 59 South facade 1:100 (Personal archive)

Figure 59 shows the north facade of the existing building.



Image 60 North facade 1:100 (Personal archive)

4.4.1 Technical description of the room's areas in the building

Table 11 shows the concept of the basement and ground floor the and area of each.

Table 11 Room areas of basement and ground floor presented in m² (Source: by Author)

Room areas			
Basement		Ground floor	
Hallway	12.93	Hallway 1	2.57
Storage room 1	8.76	Hallway 2	3.85
Storage room 2	20.48	Hallway 3	13.26
Storage room 3	38.12	Office	23.69
Technical rooms 1	9.12	Conference room	41.25
Technical rooms 2	13.51	Koltara	19.43
NETO	102.92 m ²	Kitchen 1	6.68
BRUTO	166.14 m ²	Kitchen 2	41.85
		Storage room 1	1.71
		Storage room 2	1.78
		Reception	25.09
		Office	23.69
		Conference room	41.25
		Kotlara	19.43
		Kitchen 1	6.68
		Kitchen 2	41.85
		Storage room 1	1.71
		Storage room 2	1.78
		Reception	25.09
		Restaurant	43.69
		Restaurant	62.21
		Ski resort	20.70
		Porch	4.99
		WC 1	1.42
		WC 2	1.46
		WC 3	1.65
		WC 4	1.74
		WC 5	1.90
		WC 6	2.16
		WC 7	2.27
		WC 8	2.69
		WC 9	3.00
		NETO	331.04 m ²
		BRUTO	438.19 m ²

Table 12 shows the concept of the first and second floors and area of each.

Table 12 Room areas of the first and second floors are presented in m² (Source: by Author)

Room areas			
First floor		Second floor	
Balcony 1	2.86	Balcony 1	1.52
Balcony 2	3.82	Balcony 2	1.82
Hallway 1	1.22	Balcony 3	2.43
Hallway 2	2.17	Balcony 4	2.43
Hallway 3	3.00	Hallway 1	1.03
Hallway 4	4.18	Hallway 2	1.38
Hallway 5	5.63	Hallway 3	4.07
Office	24.15	Hallway 4	16.27
Conference room	72.78	Office	23.24
Bathroom 1	1.02	Bathroom 1	1.35
Bathroom 2	1.62	Bathroom 2	1.67
Bathroom 3	2.02	Bathroom 3	1.72
Bathroom 4	2.17	Bathroom 4	2.10
Bathroom 5	2.21	Bathroom 5	2.14
Bathroom 6	2.78	Bathroom 6	2.25
Bathroom 7	2.82	Bathroom 7	2.25
Bathroom 8	4.71	Bathroom 8	2.65
Room 1	6.97	Bathroom 9	2.67
Room 2	9.21	Bathroom 10	2.80
Room 3	11.03	Bathroom 11	3.03
Room 4	13.40	Bathroom 12	3.03
Room 5	13.78	Room 1	1.68
Room 6	16.15	Room 2	7.01
Room 7	17.83	Room 3	7.91
Room 8	18.29	Room 4	8.69
Room 9	19.18	Room 5	8.97
Room 10	23.50	Room 6	9.19
Room 11	24.54	Room 7	9.21
Stairs	11.32	Room 8	10.38
WC	1.69	Room 9	11.06
NETO	326.05 m ²	Room 10	12.66
BRUTO	410.36 m ²	Room 11	14.52
		Room 12	18.42
		Room 13	23.84
		Room 14	27.03
		Stairs	8.22
		NETO	260.63 m ²
		BRUTO	331.14 m ²

Table 13 shows the concept of the first and second attics and area of each.

Table 13 Room areas of attic 1 and attic 2 are presented in m² (Source: by Author)

Room areas			
Attic 1		Attic 2	
Balcony	2.43	Bathroom 1	1.49
Hallway	15.14	Bathroom 2	1.75
Bathroom 1	1.35	Storage room 1	1.00
Bathroom 2	1.68	Storage room 2	2.01
Bathroom 3	2.25	Storage room 3	3.15
Bathroom 4	2.61	Room 1	12.64
Bathroom 5	2.65	Room 2	21.79
Bathroom 6	2.67	NETO	43.83 m ²
Bathroom 7	3.03	BRUTO	81.93 m ²
Bathroom 8	3.03	Bathroom 1	1.49
Room 1	2.43	Bathroom 2	1.75
Room 2	7.91	Storage room 1	1.00
Room 3	10.94	Storage room 2	2.01
Room 4	11.06	Storage room 3	3.15
Room 5	12.66	Room 1	12.64
Room 6	12.89	Room 2	21.79
Room 7	14.52	NETO	43.83 m ²
Room 8	17.34	BRUTO	81.93 m ²
Room 9	20.91		
Stairs	8.81		
NETO	155.81 m ²		
BRUTO			

4.5. Environmental simulation

Environmental simulation in this sustainable development aims to draw conclusions from the system under study to similar systems under different conditions, for example, predicting the impact of different measures on a similar environmental system. (Brun, Reichert , & Kfinsch, 2001)

In this study case, within the environment simulation, we will observe the analysis of the sun, and wind, as well as the green simulation of the building and building plot.

4.5.1 Solar analysis of the building and building plot

The solar analysis of the building and the building plot is made in ArchiCAD. The solar simulation is performed for four different dates, that is summer and winter solstice and spring and autumn equinox, and three different hours for each day, morning, noon, and afternoon.

Figure 61 shows solar analysis.

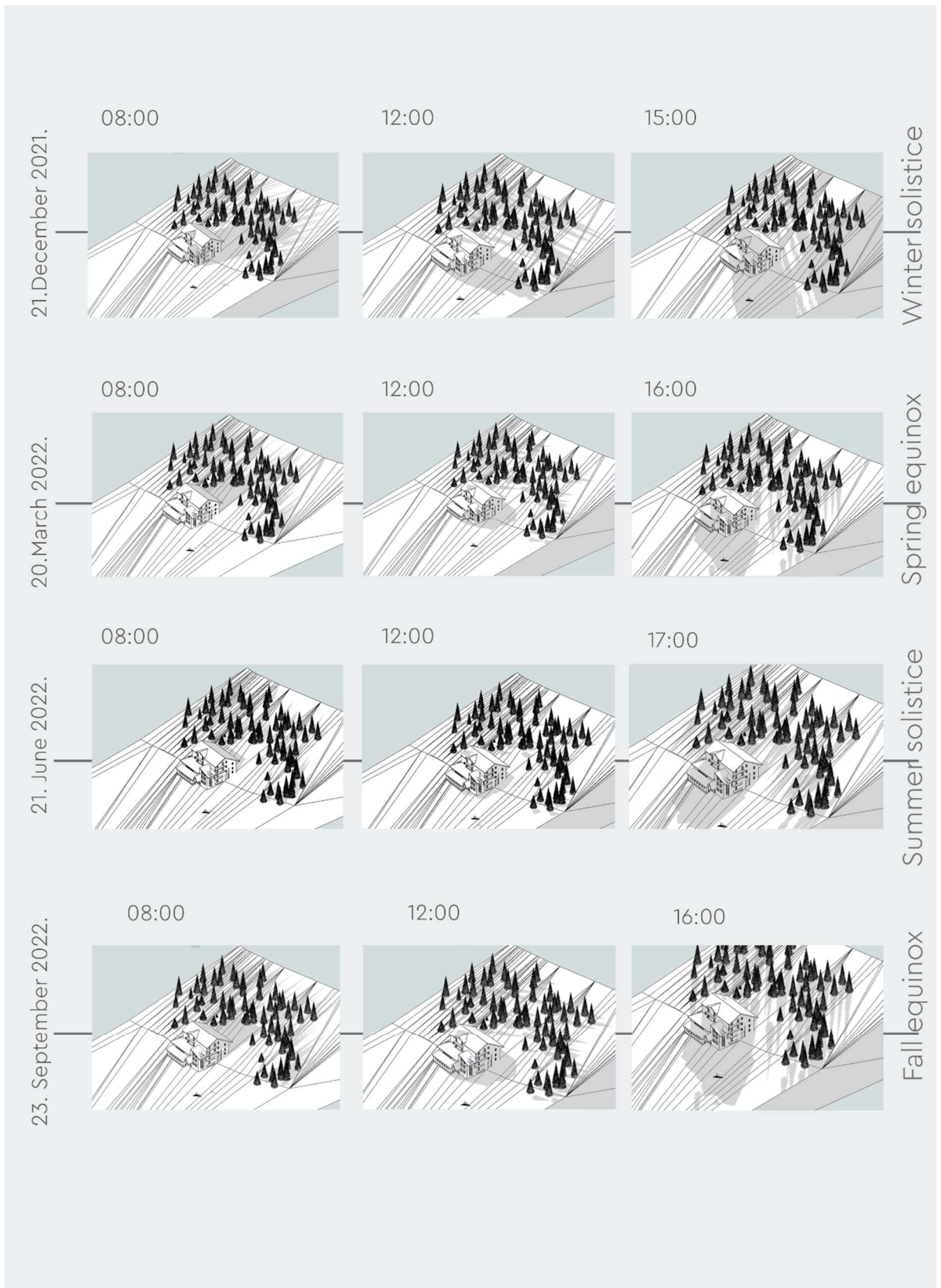


Image 61 Solar analysis (Source: by Author)

The observation regarding the solar analysis:

During the winter, on the winter solstice, the length of the day is shorter, and the sunrise and sunset are earlier. The building is not sunny enough due to excessive shade in winter. The greenery in the northwest creates a large shadow, especially in the afternoon, something that can be accounted for as a negative aspect. In the morning and noon, the plot is in the sun beside the part behind the north elevation. Based on the results made by ArchiCAD approximately 60% (mostly northwest and northeast) of the building is shaded during the winter throughout the day, and the rest of the building is exposed to sunlight in the first half of the day.

During the summer, on the summer solstice, the length of the day is longer, and the sunrise and sunset are later. The building is exposed to the sun for several more hours during the day. Greenery in the northwest contributes to thermal comfort since it created shading on the west side of the building. The rest of the hours shading is not enough and possibly a shading device might be needed for accommodating outdoor functions. Based on the results made by ArchiCAD approximately 30% (mostly northwest and northeast) of the building is shaded during the summer throughout the day, and the rest of the building (southwest and southeast) is exposed to sunlight throughout the day.

Table 14 shows positive observations for the south and north side during the summer and winter.

Table 14 Positive observations for the south and north side during the summer and winter (Source: by Author)

Positive observations			
Summer		Winter	
South	North	South	North
Sunny throughout the day	Moderate shade throughout the day	Moderate sun during the first half of the day	Rooms in the north do not require much natural light due to their use
Rooms that require natural lighting are illuminated throughout the day	Rooms in the north do not require much natural light due to their use		

Table 15 shows negative observations for the south and north side during the summer and winter

Table 15 Negative observations for the south and north side during the summer and winter (Source: by Author)

Negative observation			
Summer		Winter	
South	North	South	North
It is not shaded throughout the day	Not enough sun throughout the day	Not enough sun during the second half of the day	The building is shaded throughout the day
Intense sun, the building is exposed to the sun for many hours a day			Not enough sun throughout the day

Result:

The orientation is beneficial since the rooms that receive the most natural light, such as the entry hall, lobby, restaurant, and living room, are on the side that receives the most sunlight throughout the year, while the wet area and utilitarian rooms that do not require much natural lighting are on the most shaded side (northwest, northeast). Except for the ground floor in the south, which has wide windows and receives natural light from the sun throughout the day, the building is lacking with window openings on other floors that could receive natural light, almost all rooms that need sunlight, even in the winter, should be solarized. Because it provides thermal comfort in the afternoon and shade from the northwest in the summer, vegetation in the northwest is convenient. In the winter, it shields from northern winds. Northeast and northwest are the most unfavorable position because the building has the least amount of natural sunlight throughout the year.

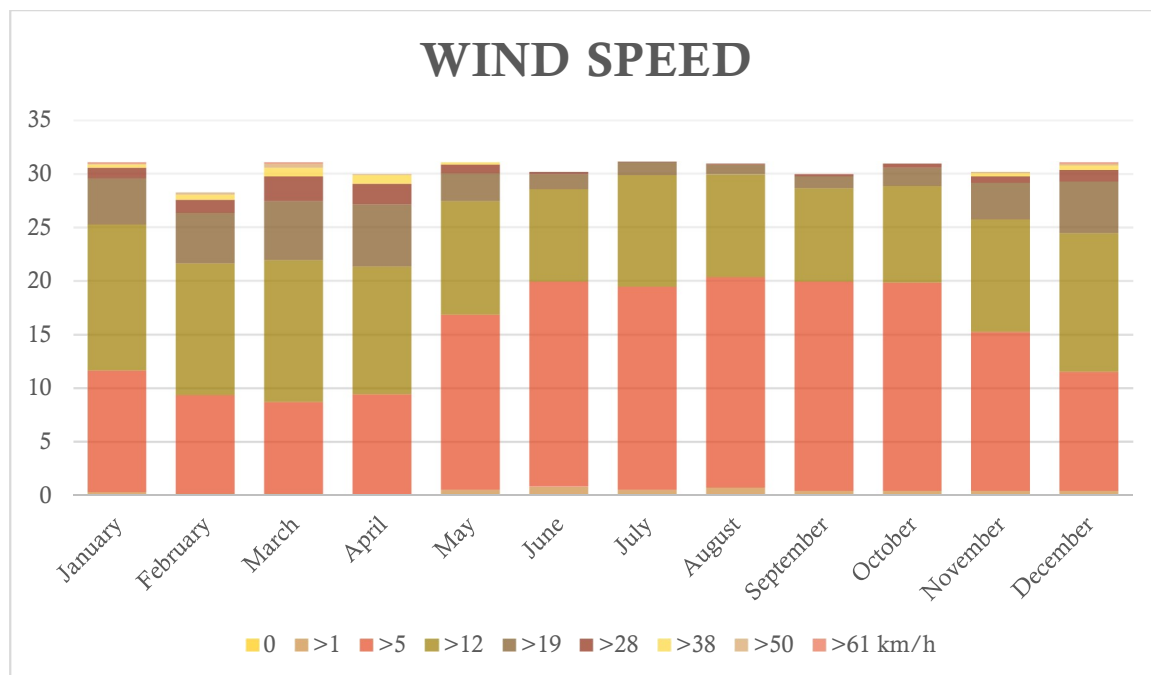
4.5.2 Wind analyses

Wind speed

The chart for Golija shows the days per month during which the wind reaches a certain speed. Most often it prevails at a speed of more than 5 km/h from June to November with about 20 days per month, and winds of 12 km/h that occupy about 11 days per month throughout the year.

Table 16 shows wind speed according to the number of days in months (km/h).

Table 16 Wind speed according to the number of days in months (km/h) (Source: by Author)



Wind rose

The wind rose for Golija shows how many hours a year the wind blows from certain directions. For example SW: The wind blows from the direction of South-West (SW) to North-East (NE).

The prevailing winds blow from the southwest, south, and north during the year. From the southwest, winds blow most often at a speed of 5 km/h and which is 483 hours a year, while the average speed of 19 km/h is even 221 hours a year, but there are also high wind speeds of 38 km/h 5 hours a year. While from the north, winds blow most often at a speed of 5 km/h and which is 430 hours a year, while the average speed of 19 km/h is even 149 hours a year and high wind speeds of 38 km/h occupy 2 hours a year (Image 56).

Figure 62 Annual wind rose and floor plan.

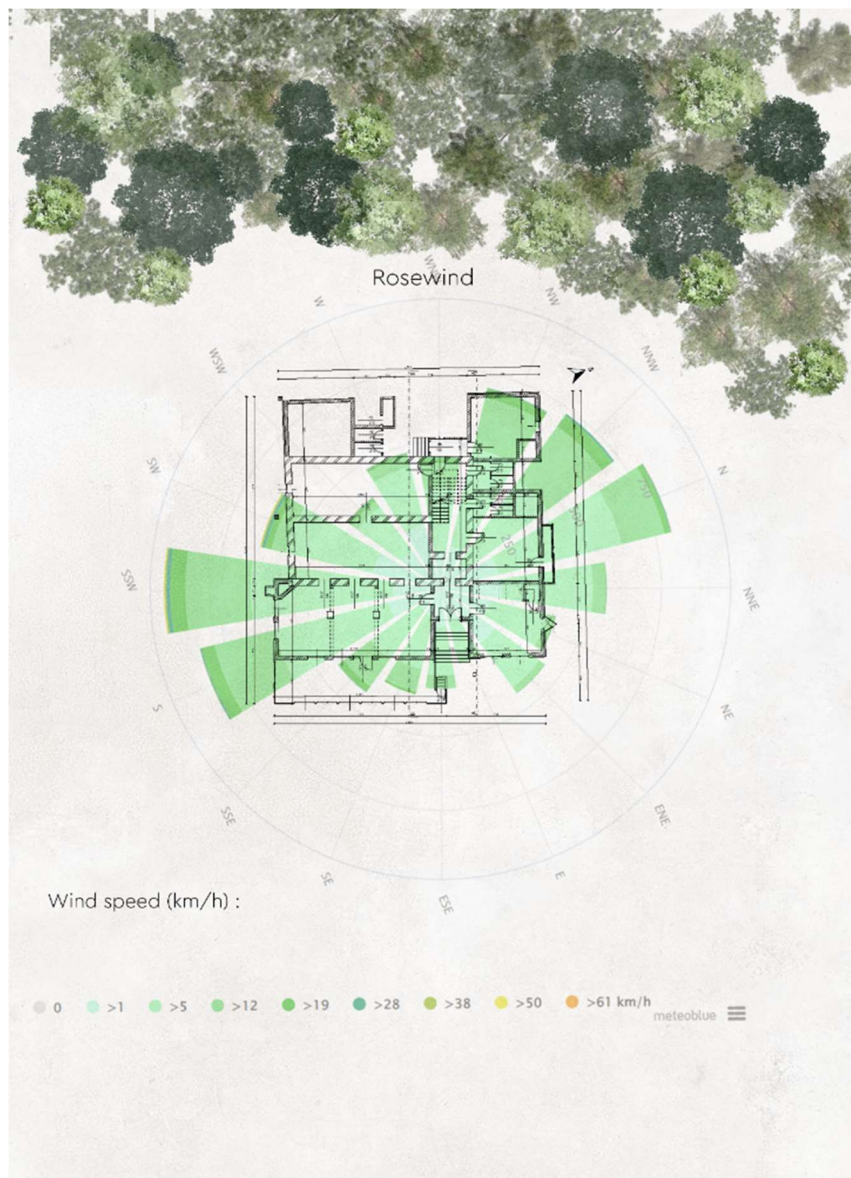


Image 62 Annual wind rose and floor plan (Source: by Author)

Wind analysis – prevailing winds entering the building.
Prevailing winds that enter the building are from the southwest, south, and north.

Figure 63 shows the wind entering the building from south-west.

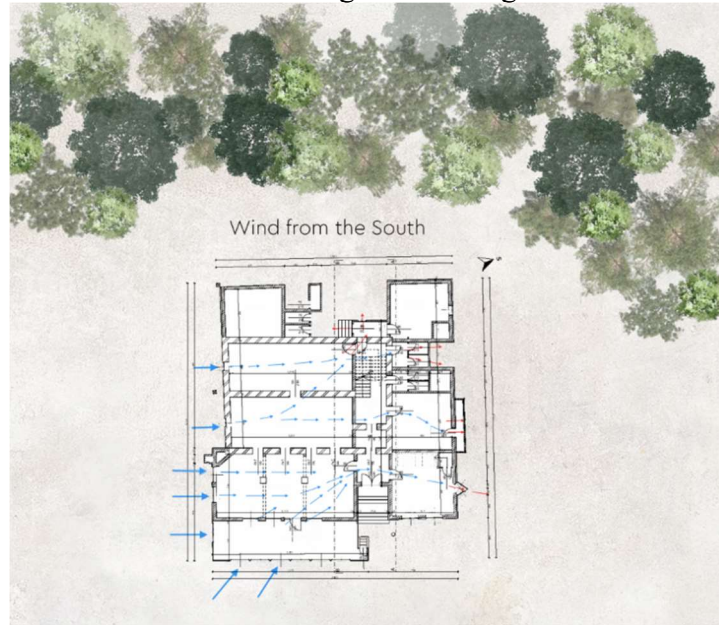


Image 63 The wind entering the building from the south-west (Source: by Author)

The wind enters the building at an angle, taking into account the southwest and south winds. The south-facing restaurant with large window openings is well naturally cross-ventilated when the internal doors are open. But the rest of the building has insufficient window openings for natural ventilation. The outdoor space in the southwest needs the necessary wind protection in the form of vegetation, in order to redirect the wind to the outdoor spaces. The synopsis of the result can be found the following table 17.

Figure 64 showa the wind entering the building (ground floor) from the north.



Image 64 The wind entering the building (ground floor) from the north (Source: by Author)

The wind enters the building at an angle, taking into account the north wind. The ventilation of the building is vertical. Most north-facing rooms do not have enough window openings for cross ventilation. Greenery in the northwest protects the outdoor space of the building from strong northerly winds. The synopsis of the result can be found the following table 17.

Figure 65 shows the wind entering the section AA from the north.



Image 65 The wind entering the section AA from the north (Source: by Author)

The prevailing wind from the north enters the building vertically and causes cross ventilation due to open internal doors. The building receives stack effect ventilation through doors, up an open staircase, and outside through open roof lights. The majority of north-facing rooms don't have enough cross-ventilation window openings. The building's outside area is shielded from strong northerly winds by vegetation in the northwest. The synopsis of the result can be found the following table 17.

Figure 65 shows the wind entering the section AA from the north.

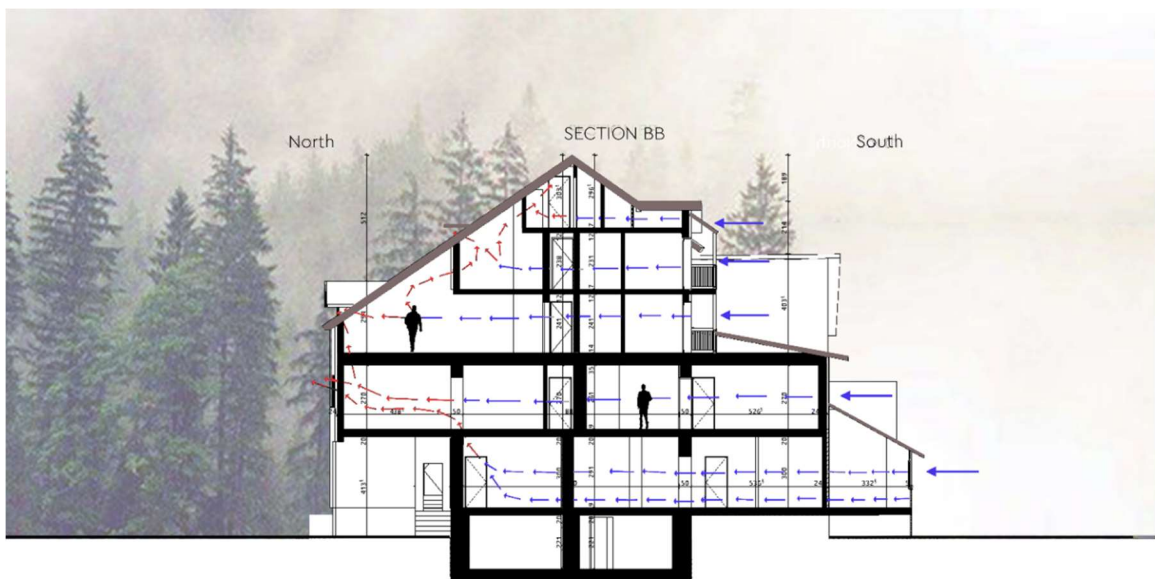


Image 66 The wind entering section BB from the southwest and south (Source: by Author)

Due to open internal doors, the dominant wind from the southwest and south enters the building vertically and creates cross ventilation. Through open roof lights, an open staircase, and doors, the building obtains stack effect ventilation. When the internal doors are open, the south-facing restaurant's huge window openings provide excellent natural cross ventilation. However, there aren't enough window openings for natural ventilation in the rest of the building. To divert the wind to the outdoor spaces in the southwest, the outdoor space needs the requisite wind protection in the form of vegetation. The synopsis of the result can be found the following table 17.

Table 17 shows observations regarding the wind analysis:

Table 17 Observations regarding the wind analysis (Source: by Author)

Positive observations	Negative observations
The wind enters the building at an angle, taking into account the prevailing winds.	Insufficient window openings for natural ventilation.
The ventilation of the building is vertical.	The necessary protection of the outdoor space in the southwest from the winds in the form of vegetation is to redirect the wind to the outdoor spaces.
The south-facing restaurant with large window openings is well naturally cross-ventilated when the internal doors are open.	Most north-facing rooms do not have enough window openings for cross ventilation.
Good orientation of the building about the winds.	
The building receives stack effect ventilation through doors, up an open staircase, and outside through open roof lights.	

4.6. Proposals-suggestions for sustainable improvement of the building according to performed analysis

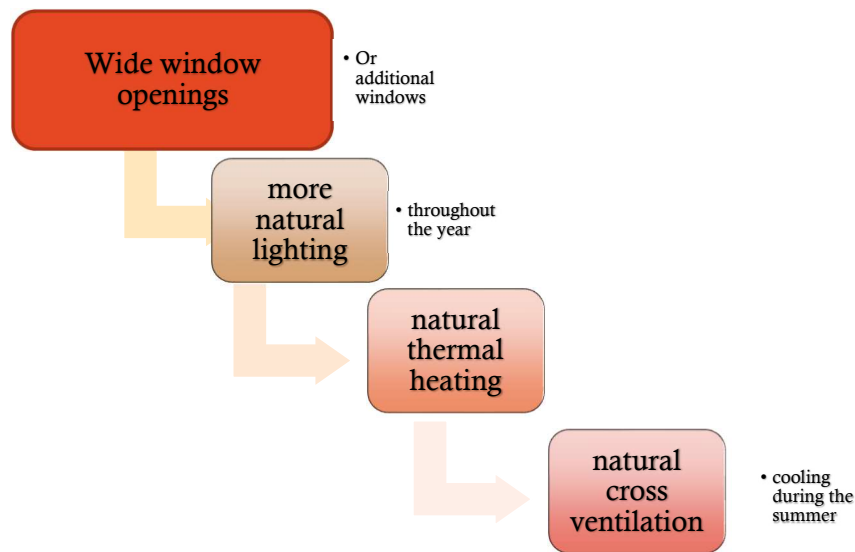
Based on the performed analyses, the conclusion was reached that the proposals for measures of sustainable improvement of the facility suitable for this area and the climate of the area could be:

4.6.1. Additional and wider windows

The building needs additional window openings on all floors that could receive natural light, especially on the south side, which is exposed to sunlight throughout the day and year, which would also ensure more natural lighting and natural thermal heating of the building throughout the year, while in the summer it would provide cooling and natural cross ventilation of the building. But also on the other facades, larger window openings are necessary. Based on previous analyses, the building lacks openings that can receive solar energy into the building and provide natural cross-ventilation of the building by winds from the southwest and north. The synopsis of the

result can be found the following table 18 which shows the benefits of the proposal for sustainable improvement: Wide window openings.

Table 18 Graph showing benefits from proposal for sustainable improvement: Wide window openings (Source: by Author)

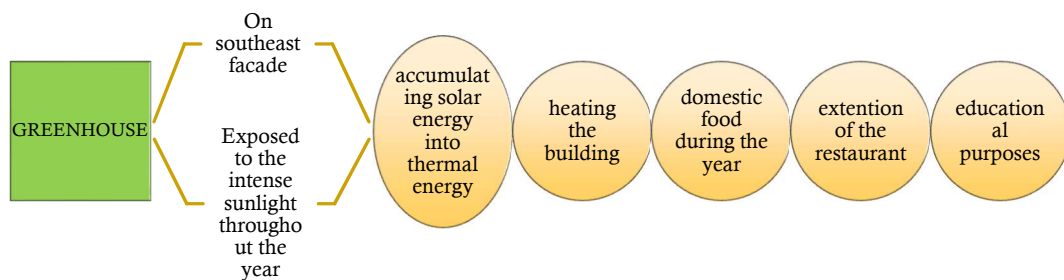


4.6.2. Greenhouse on the south-west side of the building

One of the proposals is a greenhouse oriented to the southwest or southeast, the sunnier facade of the building, which is exposed to sunlight throughout the year, especially under the intense sun in the summer months, and can accumulate solar energy into thermal energy and heat the building in the winter months when heating is necessary according to the climate data of the region. One of the benefits of this proposal is that they can serve domestic food throughout the year produced in a greenhouse and at the same time it is an extension of the restaurant to be used as a restaurant during autumn and spring when it is not under the intense sun like during summer and when it is not too cold like in winter. Also using the greenhouse for educational purposes for children about local food production and products.

The synopsis of the result can be found the following table 19 which shows the benefits of the proposal for sustainable improvement: Greenhouse.

Table 19 Graph showing benefits from proposal for sustainable improvement: Greenhouse (Source: by Author)

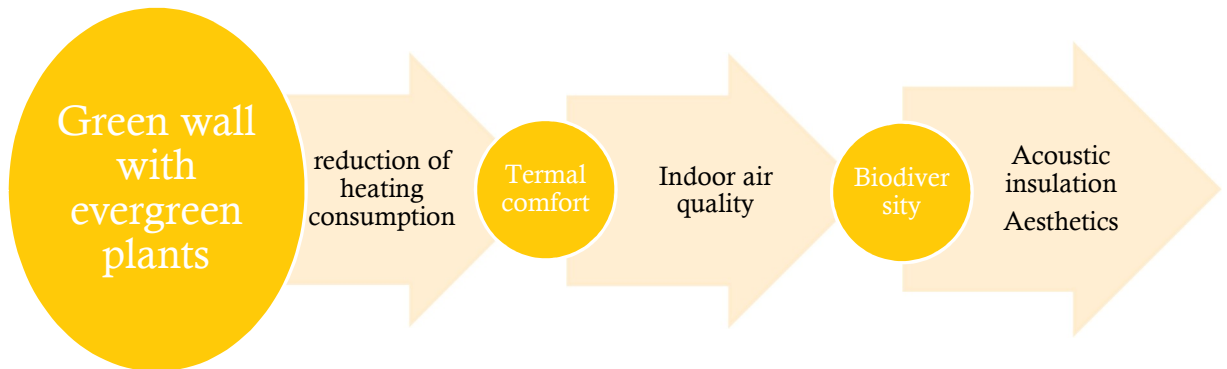


Green wall with evergreen plants

In winter, the most thermal energy is lost on the northeast facade, which is also the most shaded facade during the day and year, so it's concluded that the best improvement measure would be a green wall with evergreen plants, suitable for this climate and mountainous area.

The synopsis of the result can be found the following table 20 which shows the benefits of the proposal for sustainable improvement: Green wall with evergreen plants.

Table 20 Graph showing benefits from proposal for sustainable improvement: Green wall with evergreen plants on northeast façade (Source: by Author)

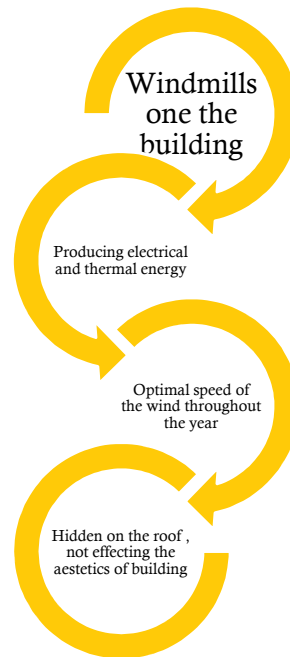


Windmills

In accordance with the climate, the mountainous area, and the analysis of the wind in that area, it was concluded that the possible measures of sustainable improvement of the building would be windmills on the building that would accumulate the wind into thermal energy for heating the building and electrical energy throughout the year.

The synopsis of the result can be found the following table 21 which shows the benefits of the proposal for sustainable improvement: Windmills.

Table 21 Graph showing benefits from proposal for sustainable improvement: Windmills (Source: by Author)



4.7. Applied proposals-suggestions on the improved building based on performed bioclimatic analysis

4.7.1 Wider and additional windows

Additional window openings and wider windows on all floors are receiving more natural light, especially on the south side, which is exposed to sunlight throughout the day and year, which would also ensure more natural lighting and natural thermal heating of the building throughout the year, while in the summer it would provide cooling and natural cross ventilation of the building.

Figure 66 shows the window improvement on the ground floor.

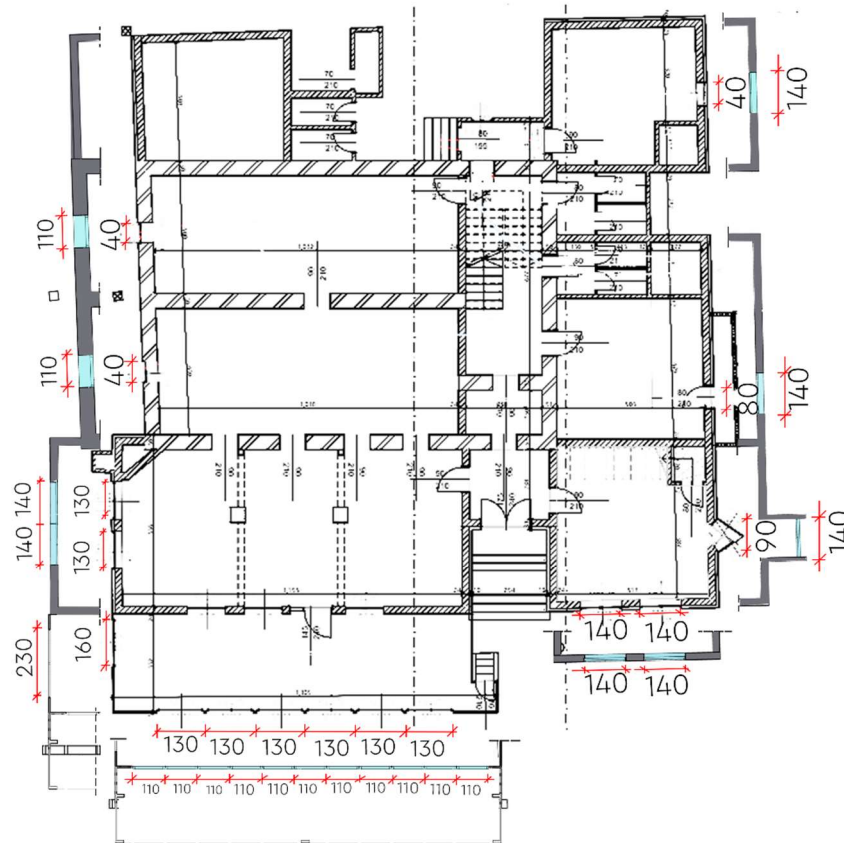


Image 67 Schematic diagram of the window improvement on the ground floor (Source: by Author)

Figure 67 shows the window improvement on the east façade.



Image 68 Schematic diagram of the window improvement on the east façade (Source: by Author)

Figure 68 shows the window improvement on the north façade.



Image 69 Schematic diagram of the window improvement on the north façade (Source: by Author)

Figure 69 shows the window improvement on the south facade.



Image 70 Schematic diagram of the window improvement on the west façade (Source: by Author)

Cross ventilation is the main goal of the summer ventilation strategy. Cross ventilation is encouraged by pressure differences, which also cools the building. Heat recycling is the main component of the winter ventilation plan. South windows accept direct sunlight light and warm the building interior from the low winter sun.

Figure 70 shows the hotel improvements, the wind entering and the sun lighting up the section from the southwest and south.

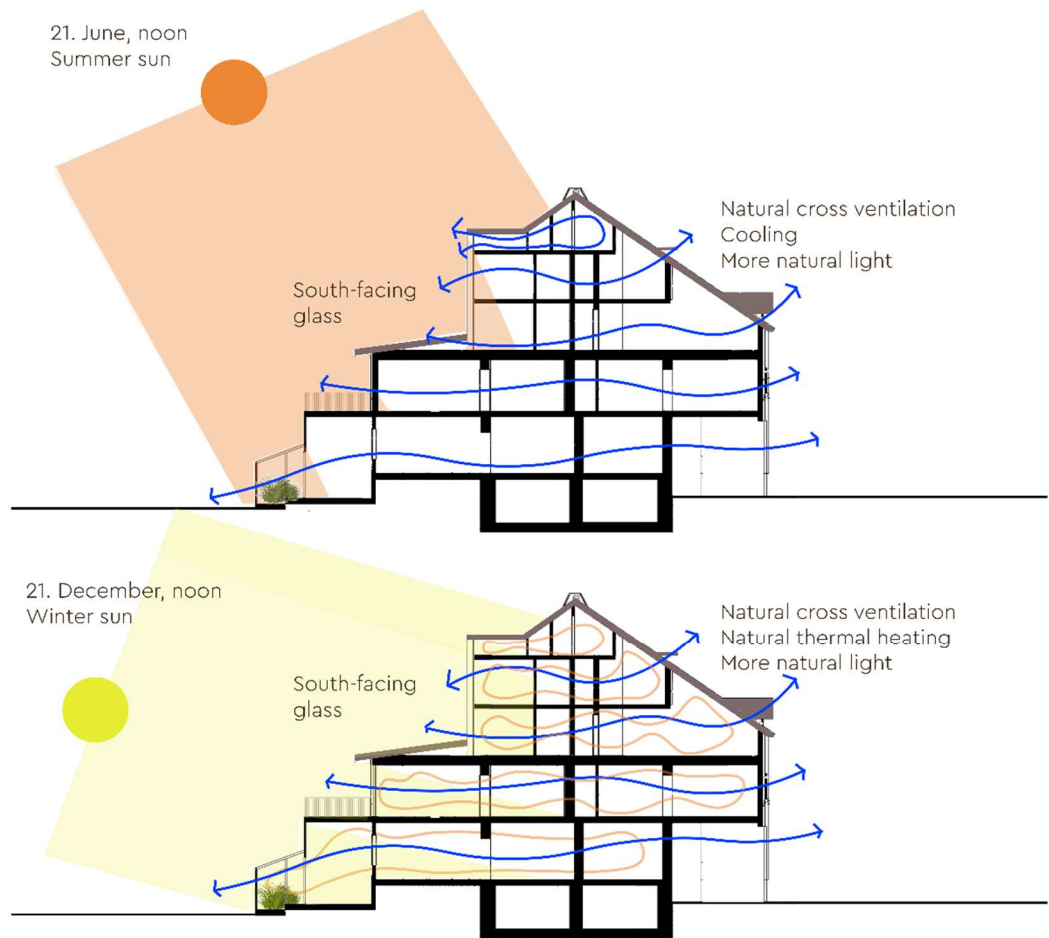


Image 71 Graphic representation of hotel improvements, the wind entering and sun lighting up the section from the southwest and south (Source: by Author)

4.7.2. Greenhouse on the southwest

Short waves heat the ground. Infrared rays radiate from the ground and cannot pass through the glass. The warm air rises and heats the greenhouse.

Figure 71 shows the hotel improvements, greenhouse on the southwest

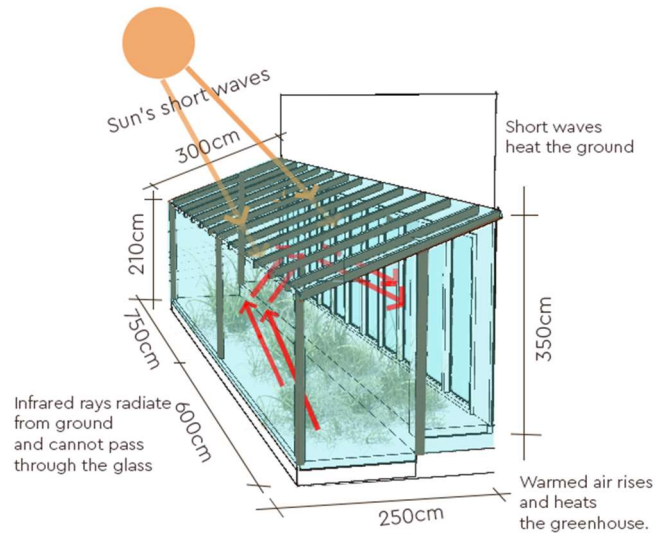


Image 72 Graphic representation of hotel improvements, greenhouse on the southwest (Source: by Author)

4.7.3. Windmills

According to the examples from areas with similar climate conditions, this kind of windmill had been applied. At the same time, it does not affect the exterior of the hotel with their appearance and fits into the external appearance of the building.

Figure 72 shows Ridgeblade Wind Generator.

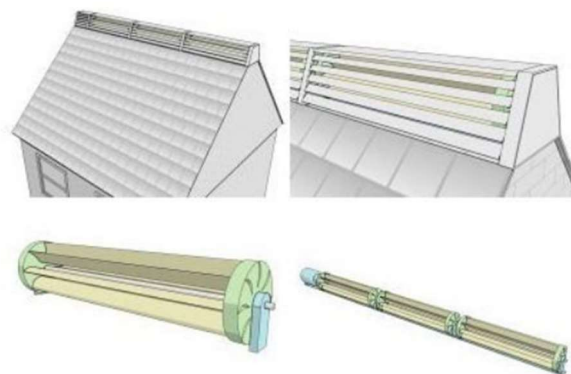


Image 73 Ridgeblade Wind Generator (Ridgeblade Wind Generator, n.d.)

4.7.4. Green walls with evergreen plants

Image xx shows how the applied green wall with evergreen plants on the northeast side of the sustainable improved hotel affects the reduction of heat consumption in winter and helps recycle warm fresh air in the building, which occurs mostly in the northeast, and reduces the impact of wind at the same time.

Figure 73 shows the hotel improvement, a green wall with evergreen plants on the northeast.

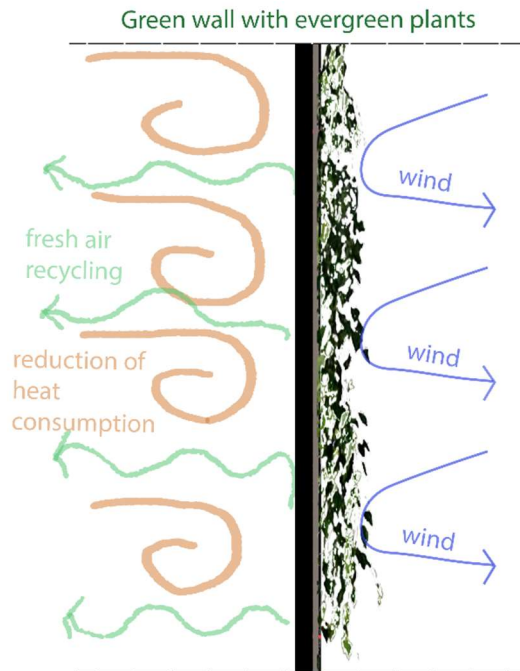


Image 74 Graphic representation of hotel improvements, a green wall with evergreen plants on the northeast
(Source: by Author)

Inspired by the example from Figure 74 which shows how the green wall is applied on the northeast side of the sustainable improved hotel.

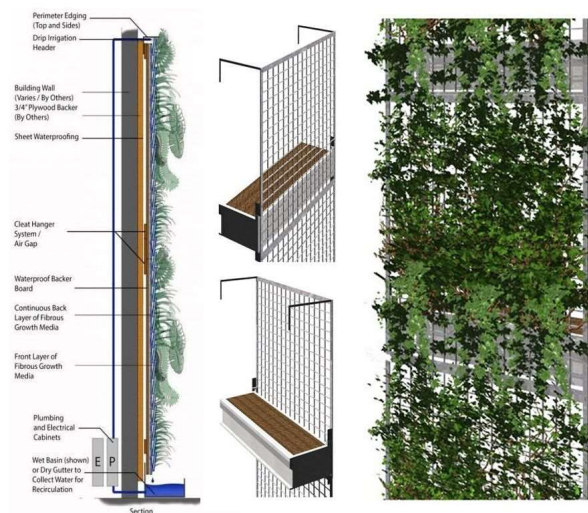


Image 75 Green wall example (htt)

4.7.5. 3D visualizations- renders of sustainable improved hotel

The materials used to improve the sustainability of the hotel based on the results obtained are materials obtained from nature and the environment of the object itself, such as stone, material from the immediate environment, highly resistant to external influences, durable and stable, an additional layer of insulation, but at the same time, it has the effect of the facade of the building blends into nature and the environment. The most commonly used material for a sustainably improved facade is glass as a renewable ecological material, insulating layer, attractive appearance, and light transmission. The color of the facade is white, to reduce as little light and heat as possible in the summer period and absorb as much light and heat as possible in the winter.

3D visualizations of the sustainable improved hotels based on the performed analysis. Done by author in ArchiCAD and Lumion program.



*Image 76 3D visualization of a sustainably renovated hotel with applied suggestions obtained from the analysis
(Source: by Author)*

3D visualizations of the sustainable improved hotels based on the performed analysis. Done by author in ArchiCAD and Lumion program.



*Image 77 3D visualization of a sustainably renovated hotel with applied suggestions obtained from the analysis
(Source: by Author)*

3D visualizations of the sustainably improved hotels based on the performed analysis. Done by author in ArchiCAD and Lumion program.



Image 78 3D visualization of a sustainably renovated hotel with applied suggestions obtained from the analysis (Source: by Author)

3D visualizations of the sustainably improved hotels based on the performed analysis. Done by author in ArchiCAD and Lumion program.



Image 79 3D visualization of a sustainably renovated hotel with applied suggestions obtained from the analysis (Source: by Author)

CONCLUSION

Tourism's sudden and sometimes chaotic development must be controlled according to the concept of sustainable development. Sustainable tourism is a concept of development that will bring a balance of environmental, socio-cultural, and economic components of the environment and tourist satisfaction. This concept allows the development of an optimal model of tourism improvement that will not degrade the resources of future generations and that would satisfy their overall needs, as well as in the tourist context.

Application of the principles of sustainable tourism in practice encounters many obstacles. It is sustainable tourism that limits current and future economic, social and environmental impacts, and optimally provides for the needs of tourists, those employed in the tourism industry, and local communities with a conservation environment. The term "sustainable tourism" is applied tourism based on nature, and ecotourism, which is not acceptable. Sustainability must be a characteristic of all forms of tourism, especially mass tourism because it has potentially the greatest impact on the economy, environment, and cultural heritage.

Sustainable tourism has a wider aspect than sustainable architecture although it's been an integral part. It means tourist aspect, social, economic, and environmental aspects. Having all of that in mind development of the specific area can be observed through sustainable tourism.

Exemplary external influencing factors of sustainable architecture are the environment, i.e. the relation between natural and built environment. Key objectives of construction, built environment responses to:

- 1) Energy efficiency, which at the building level refers to reduced consumption of non-renewable energy sources and intensified use of the so-called "green energy" i.e. Energy obtained from renewable resources;

- 2) Ecological preservation and improvement of the external environment (conscientious and rational disposal resources, prevention of pollution - ensuring the appropriate quality of air, water, and land, noise prevention);

- 3) Formation of a healthy internal environment through meeting the conditions of thermal, air, sound, and visual comfort of the users of the space (this goal corresponds to the greatest extent of bioclimatic architecture.

These goals are achieved through three basic principles of sustainable architecture and pollution prevention:

Economizing of resources, which includes savings in the consumption of energy, water, and materials during the construction and use of the building;

Designing according to the whole life of the building, in which everything is taken into account especially performance, as well as environmental and energy characteristics of materials and buildings during construction, use/maintenance, and destruction.

Human design includes environmental protection through the natural preservation of environmental conditions (topography, water, flora, and fauna), urban planning aims to reduce the negative impact of the built environment on the natural environment, and design to satisfy the user's comfort conditions.

This principle of sustainable architecture (unlike the previous two) is at the same time the principle of bioclimatic architecture.

As mentioned, Sustainable construction is not only a wise but also a vital choice for our future. Before we reach a point of irrevocable damage to our life-supporting systems, the construction sector must adopt environmentally friendly procedures and materials. Before it's too late, the construction sector must take the initiative and

identify alternative ways to build, utilizing green, renewable energy resources and adopting non-polluting processes and materials that reduce, recycle, and reuse. The different sustainable construction materials and processes available to the industry, ranging from extremely large complicated goods to small basic items, will be explored in this chapter. These are:

Participatory design, reduced energy consumption by the implementation of active facilities, implementation of green strategies in vertical and horizontal positions of the buildings, and use of traditional eco materials.

These strategies have been implemented and analyzed in a case study hotel in Southwestern Serbia. It is been expected that renovation created a sustainable hotel and the materials used during construction are important factors in reducing energy consumption, improving the sustainability of the hotel through environmental and bioclimatic analysis, reducing the impact of the materials used on the environment, reducing harmful gases in the atmosphere and improving the internal environment.

Additional window openings and wider windows on all floors are receiving more natural light, especially on the south side, which is exposed to sunlight throughout the day and year, which would also ensure more natural lighting and natural thermal heating of the building throughout the year, while in the summer it would provide cooling and natural cross ventilation of the building.

Cross ventilation is the main goal of the summer ventilation strategy. Cross ventilation is encouraged by pressure differences, which also cools the building. Heat recycling is the main component of the winter ventilation plan. South windows accept direct sunlight light and warm the building interior from the low winter sun. Green walls and wind production facilities are implemented as well.

Calculations are left for some other research although all of the mentioned analyses in the paper are showing positive results.

Some change must be necessary, and minimal and must not diminish the cultural significance of that place by adding new sustainable materials, but in that way imitating the old and existing ones, while the old buildings are being renovated. The development of rural tourism is considered in a way where the offer of tourist facilities and experiences is in accordance with the needs of the host community, the environment, and local suppliers, and where it also meets the demands of tourists in the area.

REFERENCES

References

- (n.d.). Retrieved from
<https://i.pinimg.com/originals/25/93/16/259316c28506e6761a31d09ef6a04b15.jpg>
- Bramwell, B. (2009). Rural tourism and sustainable rural tourism. *Journal of Sustainable Tourism*, 1-5.
- Brun, R., Reichert, P., & Kfinsch, H. R. (2001). Practical identifiability analysis of large environmental simulation models. *WATER RESOURCES RESEARCH*, 1015-1030.
- Conversion of a Former Brewery to a Hotel / KÜHNLEIN Architektur*. (2018, March 22). Retrieved from ArchDaily:
<https://www.archdaily.com/891108/conversion-of-a-former-brewery-to-a-hotel-kuhnlein-architektur>
- Ekološki turizam*. (n.d.). Retrieved from Ekokuca:
<https://www.ekokucamagazin.com/stil-zivota/ekoloski-turizam/>
- Ekološki turizam*. (n.d.). Retrieved from ekokuca:
<https://www.ekokucamagazin.com/stil-zivota/ekoloski-turizam/>
- Floating springs, Harvesting drinking water with fog nets*. (n.d.). Retrieved October 2, 2022, from Aqualonis: <https://www.aqualonis.com/>
- Floating springs, Harvesting drinking water with fog nets*. (n.d.). Retrieved from Aqualonis: https://s.w-x.co/51593851_1014615062058656_4597594698880647168_o.jpg
- Floating springs, Harvesting drinking water with fog nets*. (n.d.). Retrieved from Aqualonis: <https://www.aqualonis.com/>
- Golija*. (2022, May 10). Retrieved from Wikipedia:
<https://en.wikipedia.org/wiki/Golija>
- Golub*. (n.d.). Retrieved from Google Maps:
<https://www.google.com/maps/search/golub/@43.2762687,20.3359737,892m/data=!3m1!1e3!4m8!2m7!3m6!1sgolub!2sGolija!3s0x4757cfc7b41227c3:0xf2d07ef24e7eb49f!4m2!1d20.2819443!2d43.3333333>
- Hahn, J. (2020, November 27). *Solar panels made from food waste win inaugural James Dyson Sustainability Award*. Retrieved from Dezeen:
<https://www.dezeen.com/2020/11/27/aureus-carvey-ehren-maigue-james-dyson-awards-sustainability/>
- Heckfield Place / Spratley & Partners*. (2018, December 6). Retrieved from ArchDaily: https://www.archdaily.com/907011/heckfield-place-spratley-and-partners?ad_source=search&ad_medium=projects_tab

- Hotel "Golub Golija" i turistički-ski centar "Odvraćenica",*. (n.d.). Retrieved from Hotel Golub Golija: <http://www.golija-turizam.com/index.php>
- Joldžić, V., Batrićević, A., Stanković, V., & Paunović, N. (2018). Solving the Problems of Rural Development as Environmentally Desirable Segment of Sustainable Development. *SCIENTIFIC REVIEW*, 79-91.
- Kinsterna Hotel & Spa / Divercity Architects.* (2016, December 7). Retrieved from ArchDaily: <https://www.archdaily.com/781550/kinsterna-hotel-and-spa-divercity>
- Kosanović, S., Klein, T., Konstantinou, T., Radivojević, A., & Hildebrand, L. (2018). Sustainable and Resilient Building Design _ Approaches, Methods and Tools. In *Reviews of Sustainability and Resilience of the Built Environment*. TU Delft Open.
- Lane, B. (2004). Sustainable rural tourism strategies: A tool for development and conservation. *Journal of Sustainable Tourism*, 102-105.
- Milenkovic, S., & Utvic, S. (2013). THE CHALLENGES OF RURAL AREAS IN SERBIA PROMISING TOURIST ACTIVITIES. *Economics of Agriculture*, 65-76.
- Milenković, S., & Utvić, S. (2013). THE CHALLENGES OF RURAL AREAS IN SERBIA PROMISING TOURIST ACTIVITIES. *Economics of Agriculture*.
- Miletic, D. M. (2019). Energy optimization in the process of refurbishment of universal sport halls built in Belgrade from 1960-1980. *Doctoral Dissertation*. Belgrade.
- Održiva arhitektura-pasivna solarna kuća Andromeda.* (n.d.). Retrieved from Ekokuca: <https://www.ekokucamagazin.com/arhitektura/odrziva-arhitektura/#>
- PASIVNA SOLARNA KUĆA ANDROMEDA.* (n.d.). Retrieved from ekokuca: <https://www.ekokucamagazin.com/arhitektura/odrziva-arhitektura/#>
- Richardson, B. R. (2021). The Role of Tourism in Sustainable Development. *Community Sustainability, Michigan State University*, 2-19.
- Ridgeblade Wind Generator.* (n.d.). Retrieved from ideaconnection: <https://www.ideaconnection.com/new-inventions/ridgeblade-wind-generator-02980.html>
- Sanagustín Fons, V. M., Moseñe Fierro, J. A., & Patiño, M. (2011). Rural tourism: A sustainable alternative. *Applied Energy*.
- Sanagustín Fons, V. M., Moseñe Fierro, J. A., & Patiño, M. G. (2011). Rural tourism: A sustainable alternative. *Applied Energy*, 551-557.
- Sanagustin-Fons , V., Lafita-Cortés, T., & Moseñe , J. A. (2018). Social Perception of Rural Tourism Impact: A Case Study. *Sustainability*, 1.

- Sanagustin-Fons, V., Lafita-Cortés, T., & Moseñe, J. A. (2018). Social Perception of Rural Tourism Impact: A Case Study. *Sustainability*.
- Stathaki, E. (2021, November 10). *Ibuku's The Arc at Green School in Bali raises the bamboo roof*. Retrieved from Wallpaper*:
<https://www.wallpaper.com/architecture/the-arc-at-green-school-bamboo-roof-ibuku-bali-indonesia>
- Stepanov, S., Jovičić, M., & Jovičić, M. (2018). STRATEGIC POSITIONING SUSTAINABLE DEVELOPMENT. *4th International Rural Tourism Congress, Congress Proceedings*, 240-252.
- Sustainable Development Goals*. (n.d.). Retrieved April 15, 2022, from Tourism for SDGs: <https://tourism4sdgs.org/>
- The Arc at Green School*. (2021). Retrieved from IBUKU:
<https://ibuku.com/project/the-arc/>
- UNWTO Report Links Sustainable Tourism to 17 SDGs*. (2018, June 6). Retrieved from IISD: <https://sdg.iisd.org/news/unwto-report-links-sustainable-tourism-to-17-sdgs/>
- What is Sustainable Tourism?* (n.d.). Retrieved April 10, 2022, from GSTC:
<https://www.gstcouncil.org/what-is-sustainable-tourism/>