OASIS DI ORBETELLO

ARCHITECTURE AS AN EDUCATIONAL TOOL FOR SUSTAINABILITY

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ABSTRACT

Humanity finds itself at a crucial moment in its history, one that will very much decide the future of life on the planet earth as we know it. The way we have lived thus far has been proven countless times that its impact on our ecosystems is not sustainable. It is a big issue that requires a big commitment from all of us to reach a healthier future.

One of the ways that human society has impacted the world is in its endless construction of shelter. The usage of resources for this pursuit hasn't been the best and architecture in general is partly responsible for it since most of the designs choices that affect the planet are made by architects with different ideas in mind, and only until recently with sustainability being considered.

What I want to explore with this research is the role of architecture not only in the production of more sustainable shelter but also has an educational tool, both for architects and users in general, to learn how to design and live in a more sustainable approach. With that goal in mind, I have participated in an architecture competition with a focus on sustainability and education to provide a practical work for which to explore these ideas.

The competition was for the Oasis di Orbetello, a nature reserve in the lagoon of Orbetello, Italy, belonging to WWF, an organization that focus on the preservation of nature, more specifically of fauna. The program involved two different but connected design requirements, observation cabins and a visitor center. For our purposes I will focus on the visitor center part of project, since its more relevant for this research.

The goal then is to design a building that is not only sustainable, with a proper material choices and design strategies to minimize its's impact on the environment, which I will analyze mostly by its thermal performance and energy usage, and then compare it to the normal Italian standard of this type of architecture to understand if I achieved a good result, but also a building that is able to provide an educational opportunity for fellow architects to learn better design ideas, and a place for general users to learn about nature preservation and sustainable living in an environmentally friendly project to hopefully gain more sustainable habits in their day to day lives.

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Before delving into this whole thesis, I want to tell the story of how it all came to be because I feel it deserves to be preserved and documented, a story of perseverance and good fortune in the midst of almost despair.

Let's start at the beginning.

I have come to study at Politecnico di Milano because I was fatigued with my academic life back in Portugal and I felt that I needed a change in mentalities, to evolve as a person and as an architect. In the first semester here I had a course named "Construction and sustainability studio" in which I met my future thesis coordinators, Alessandro Rogora and Mauro Piantoni, architects that would introduced me to a different way of seeing architecture from the one I had been thought thus far, focusing of the practicality and ecology more than the composition and aesthetics.

Come the second semester, February of 2020, and everything changed as we are all aware, and with that change came a lot of very difficult moments for me, moments we had to adapt and that eventually led into very deep reflections of my time on this earth and what my purpose is in it. To me after, was very clear what I wanted to pursuit for my personal and professional life here on after.

A year later and I was going to start this extensive process of developing of a Master's degree thesis, bad luck struck me and my entire family, by being infected with the famous disease of the last almost two years. Those were very difficult moments to deal with and things didn't seem to be looking to good for me, I was struggling to advance in the thesis and not feeling very optimistic about the future, feeling like I was going nowhere stuck at my parents' home sick and not being able to live my life in Milano.

But good fortune was right around the corner for me, slowly but surely things started to look brighter for me. I managed to get an internship in Lisbon with the help of my stepdad and that was truly a turning point for me in this bleak year, because a month after I've started I got a very good phone call from Mauro Piantoni offering me what I referred to as a "bóia salva vidas" or a life-saver, by giving me the chance to intern with his studio and at the same time work on the thesis with him, he suggest also to look for a international competition focused on sustainability to work from the studio and then use that as the basis for my own thesis. This was exactly what I looking for.

I was very happy after and eternally grateful for the opportunity. The stars aligned and here we are.

So it is important to understand that this thesis was developed, since the very first moment, with a more concrete mentality of making possible solutions for the real problems we have instead of the traditional way of thinking in architecture, as the composition comes first the building comes second.

PART I

THE OBSTACLES FUTURE GENERATIONS FACE IN THE CURRENT STATUS QUO

1. INTRODUCTION TO THE SUSTAINABILITY QUESTION

1.1 Introduction

The fear of death is a crucial instinct for the survival of any species, especially the human species. In the history of the evolution of the human civilization there have been many challenges, disease, hunger, thirst, war, challenges that we somehow manage to overcome, some ways better than others, with still more to be overcome.

In this moment my biggest fear for the survival of our society and way of living is the consequences of our own human activity on the planet that we call home, which if we maintain them as they are, we will possibly no longer see any form of life on earth, as most of the scientific community has been saying for the past forty years. Therefore, in my view, it is imperative that we don't ignore our most basic instinct of survival and we truly fight for our own and future lives to avoid the almost seemingly likely climatic disaster that lies in front of us.

The planet is heating up, every year it's the hottest year on record, due to the greenhouse effect the earth's temperature is getting higher which comes from the emission of gases such as Co2 or Methane, but everyone should know about this already, it has been known for a few years already.

I am however an optimist and I truly believe that if we all work together towards this common goal it is possible to achieve a more sustainable way of inhabiting this planet and that involves a fight in several different fronts, sustainability is not only putting solar panels in buildings and driving electric cars. Virtually everything we do in our daily lives has an impact, and we can and should have the power to decide the least amount of impact, the most sustainable way. These habits range from the transportation you take every day, to the food eat, and to the way you use and design a building.

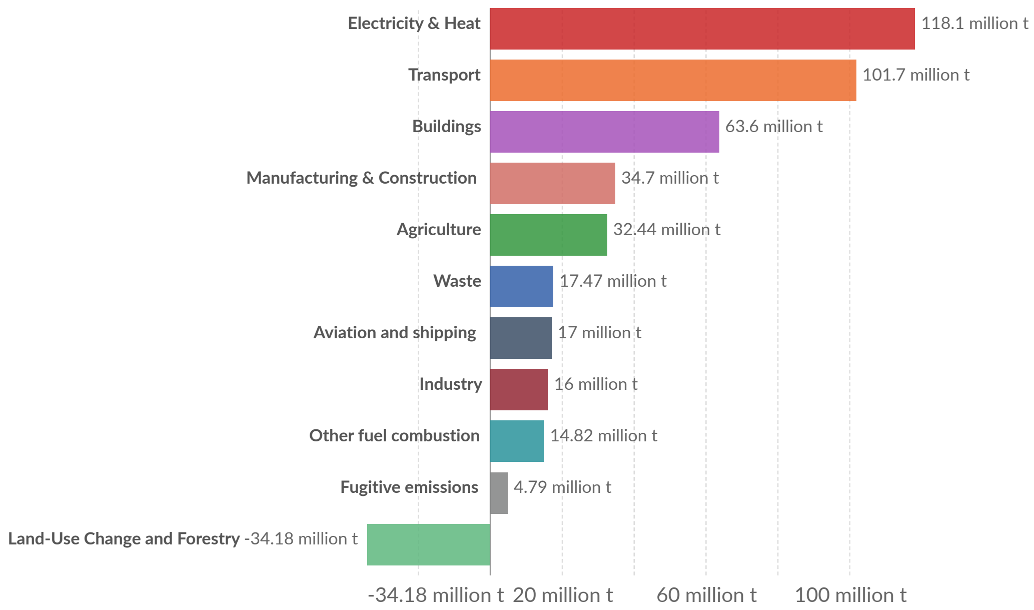
Architecture has an important role then in the fight, since everyone uses a building, it is extremely important that not only that building causes a minimal impact in its construction but also the users inhabiting them maintain a low impact throughout the course of its usable life.

Thus, in this thesis I will focus on a few habits to be improved and advocate for a more sustainable way of designing and of living said designs through the most practical way I could do, by learning and designing a proposal as


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

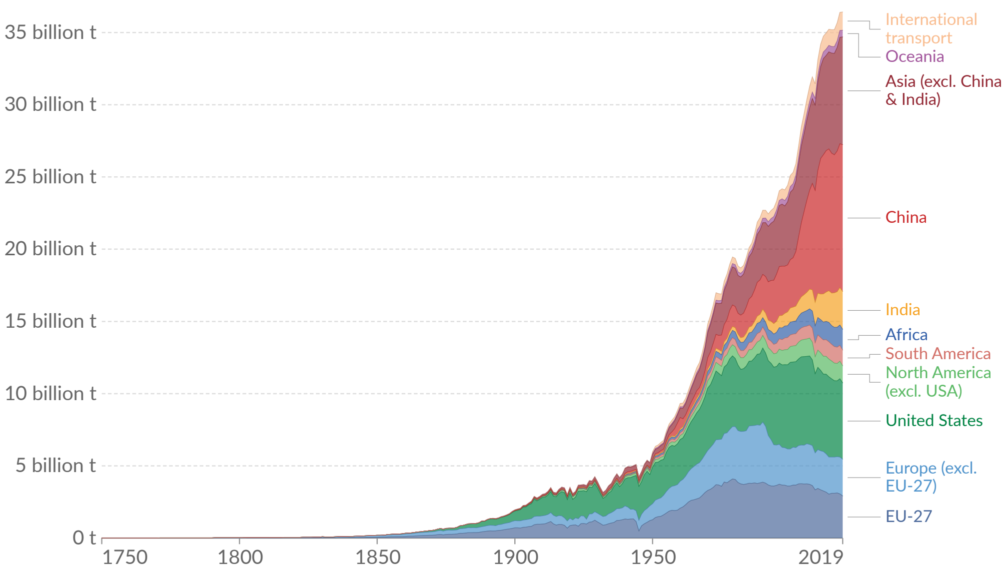
Greenhouse gas emissions by sector, Italy

Greenhouse gas emissions are measured in tonnes of carbon dioxide-equivalents (CO_2e).



Source: CAIT Climate Data Explorer via. Climate Watch OurWorldInData.org/co2-and-other-greenhouse-gas-emissions •

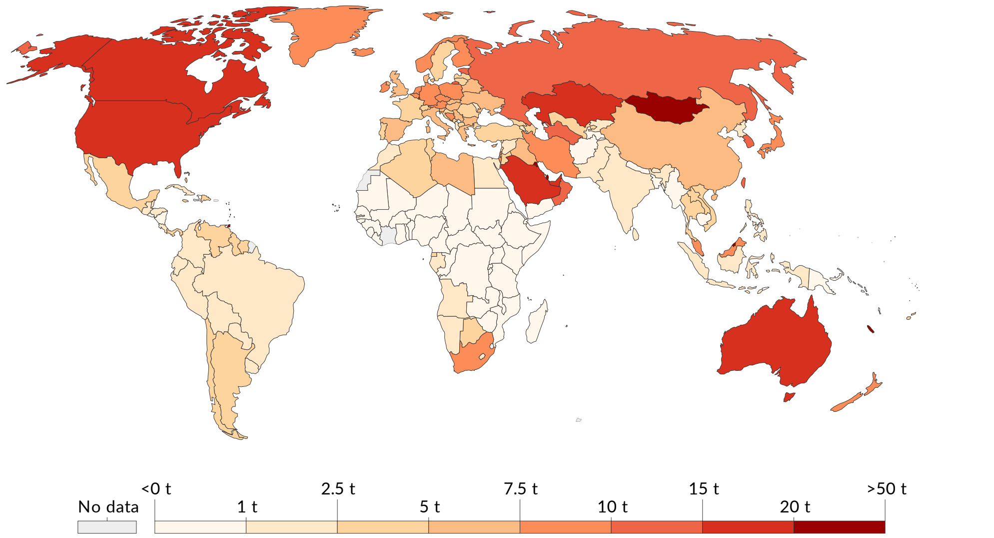
Annual total CO2 emissions, by world region



Source: Our World in Data based on the Global Carbon Project OurWorldInData.org/co2-and-other-greenhouse-gas-emissions •
Note: This measures CO_2 emissions from fossil fuels and cement production only – land use change is not included. 'Statistical differences' (included in the GCP dataset) are not included here.

Per capita CO2 emissions

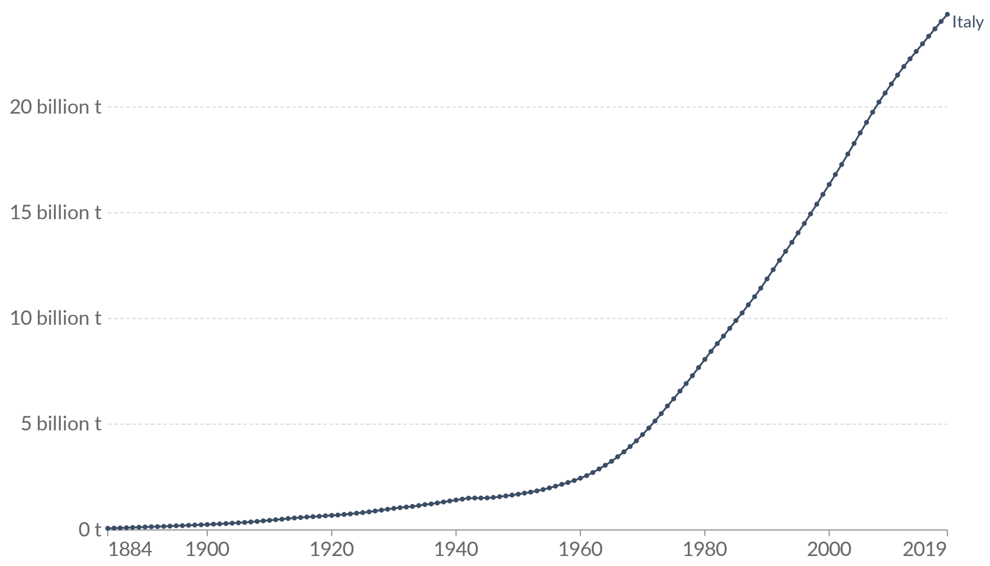
Carbon dioxide (CO_2) emissions from the burning of fossil fuels for energy and cement production. Land use change is not included.



Source: Our World in Data based on the Global Carbon Project; Gapminder & UN
Note: CO_2 emissions are measured on a production basis, meaning they do not correct for emissions embedded in traded goods.

Cumulative CO2 emissions

Cumulative carbon dioxide (CO_2) emissions represents the total sum of CO_2 emissions produced from fossil fuels and cement since 1751, and is measured in tonnes. This measures CO_2 emissions from fossil fuels and cement production only – land use change is not included.

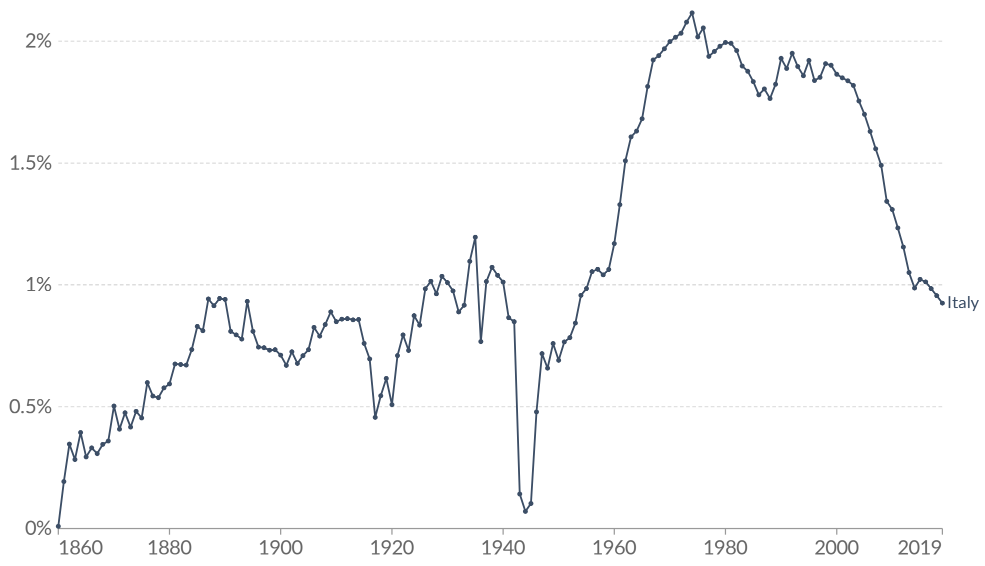


Source: Our World in Data based on the Global Carbon Project

Annual share of global CO_2 emissions

Our World in Data

Each country's share of global carbon dioxide (CO_2) emissions. This is measured as each country's emissions divided by the sum of all countries' emissions in a given year plus international aviation and shipping (known as 'bunkers') and 'statistical differences' in carbon accounts.

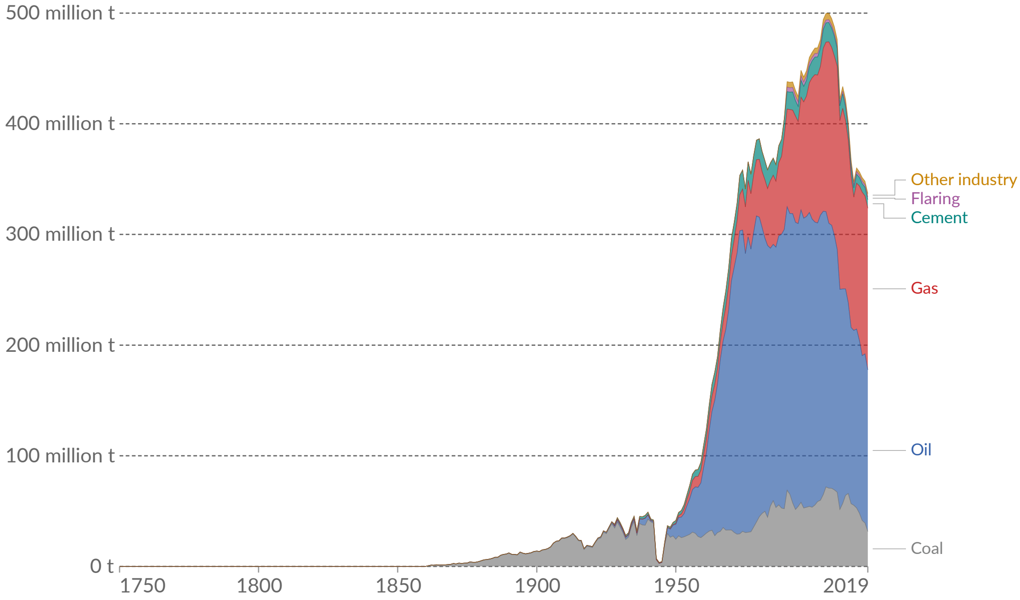


Source: Our World in Data based on Global Carbon Project

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

CO_2 emissions by fuel type, Italy

Annual carbon dioxide (CO_2) emissions from different fuel types, measured in tonnes per year.



Source: Global Carbon Project

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY an example and most importantly as an educational tool for architects and general users on how to live and design more sustainably.

To help me in this task I decided to participate in an international architecture competition, with the studio I was an intern at, with a focus on sustainability to be as practical as possible in an architectural project. The competition was sponsored and run by WWF, an international organization for the preservation of wildlife, in the natural reserve of the lagoon of Orbetello, the so-called Oasis di Orbetello, with the goal to design observation cabins for the reserve and a visitor center. For the thesis however I will focus mostly on the visitor center. But first let's try to understand what sustainability really means.

1.2 Defining sustainability

«sustainability
/səsteɪnəˈbɪlɪti/
noun
the ability to be maintained at a certain rate or level.
"the sustainability of economic growth"
avoidance of the depletion of natural resources in order to maintain an ecological balance.
"the pursuit of global environmental sustainability"»

It might seem to be an obvious concept to understand however a lot of people fail to truly understand it and think it only means to have electrical cars and solar panels everywhere. Everything the human species does can or cannot be sustainable, and it entirely depends on the decisions we make, both macro and micro, those decisions can both be collective and individual, and they are both very important, you cannot except collective change if you are not able to do personal change. It can be argued that one kind of action is more important than the other, but for me that's irrelevant, both must happen to see meaningful and positive change.

Therefore, I argue that, in architecture, there must be both kind of actions, the collective of the architectural community that make macro decisions in the design of any building, and equally importantly the people that will use the said buildings that make micro decisions in their everyday life. The architects and the users must work in tandem, to both design an operate in a more sustainable way than the one we do as of today.

Needless to say, that it I impossible to achieve a truly sustainable way of living, because for that to happen humans would probably need to return to the caveman era, which wouldn't be very comfortable, so with that in mind it's important to not lose hope and always look for a better option, it's a bit like science, any theory is great until a new comes to disprove it. My proposal to contribute for this fight is then to use architecture as an educational tool, both for architects and users, on how to live and design more sustainably, for architects on how to use better local materials, climate aware designs and passive strategies as part of the basis for any project and for users on to keep the lifelong carbon footprint of the building as low as possible. I know I cannot change the world all alone so that's why I want to use architecture as an inspiration for current and future generations.

Sustainability can be divided into three categories, environmental social and economic, and for the sake of brevity I will focus on the environmental aspect. In this category, the main point of it all is the way we use our resources, to put it simply, we must not use more than we can reproduce otherwise we will create a deficit and eventually run out said resource. Well, this is the most basic way of thinking about it but it's not enough since most of our climate change issues revolve around the byproducts of the relentless pursuit of more resources. We can use as good example the electricity production.

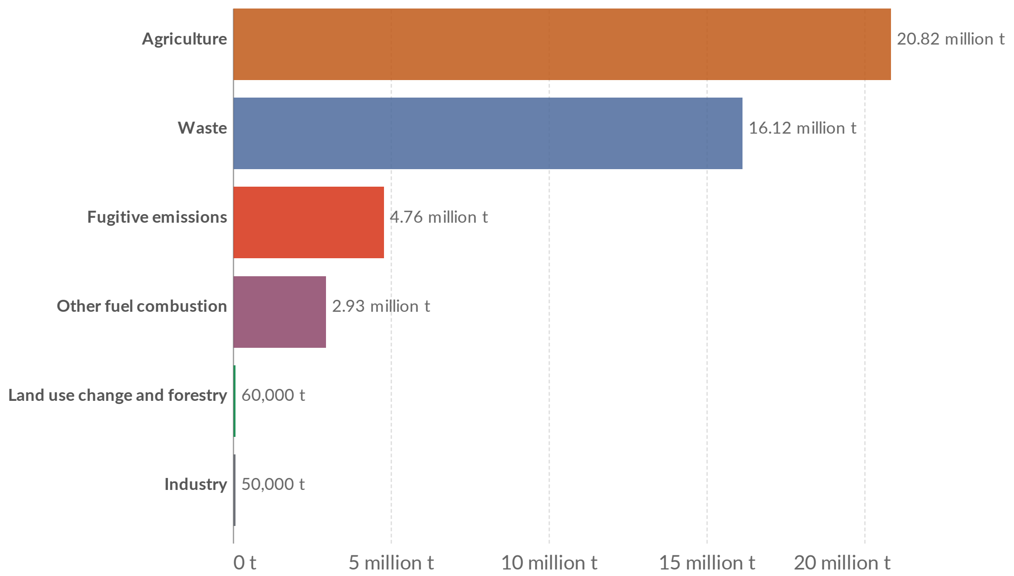
Almost everything in our modern life requires electricity, so to produce we need to explore a resource, and luckily, we have many options, some better than others, and one this resources that we use are called fossil fuels. These can be coal, natural gas or crude oil. These resources are considered unstainable for two main reasons, firstly because they are finite, they cannot be renewed at a faster pace than we use them, they are of course carcasses of dinosaurs from millions of years ago, and secondly their use in the production of electricity creates a byproduct, commonly known as the greenhouse gases, due to the release of the gases in the burning of the fuels, these gases create then a greenhouse effect in the atmosphere that results in a rise of the temperature of the earth and many more problems associated with it.

So, what does architecture have to do it? Well in this case there is not much that architects can do but there still is something to be done. The important thing here is to reduce the use of electricity in the buildings we design, which can come in many different forms that I will explain later.

These emissions don't come only from electrical production, there are many other factors that contribute, as the EU has reported it comes from (etc.). Out of all these factors the one architects have the most influence is

Methane emissions by sector, Italy

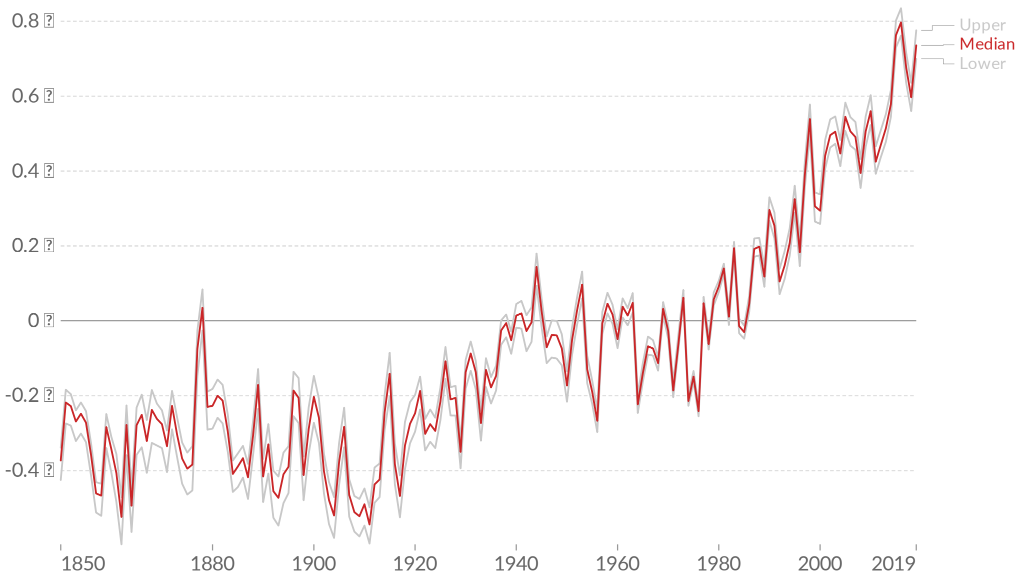
Methane (CH_4) emissions are measured in tonnes of carbon dioxide equivalents (CO_2e) based on a 100-year global warming potential value.



Source: CAIT Climate Data Explorer via. Climate Watch

Average temperature anomaly, Global

Global average land-sea temperature anomaly relative to the 1961-1990 average temperature.

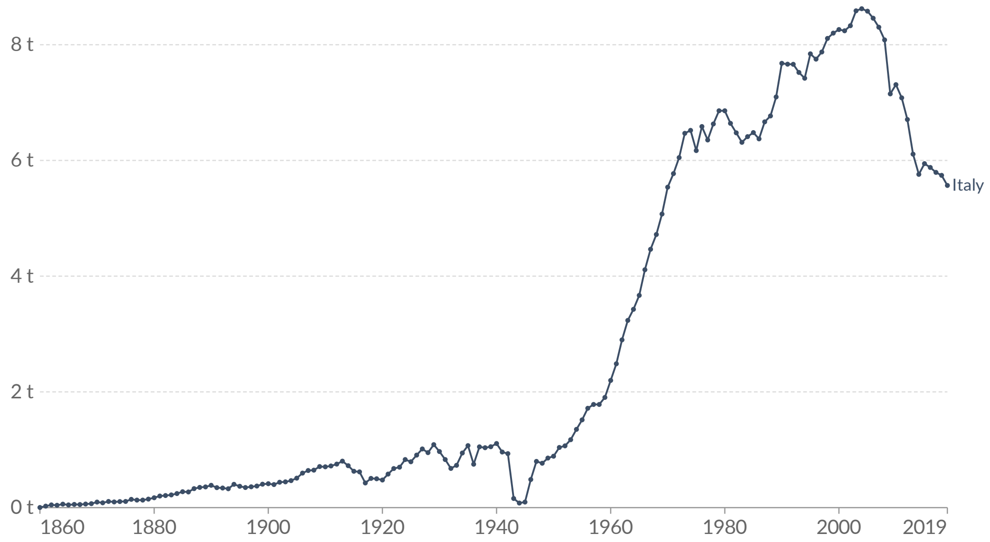


Source: Hadley Centre (HadCRUT4)

Note: The red line represents the median average temperature change, and grey lines represent the upper and lower 95% confidence intervals.

Per capita CO_2 emissions

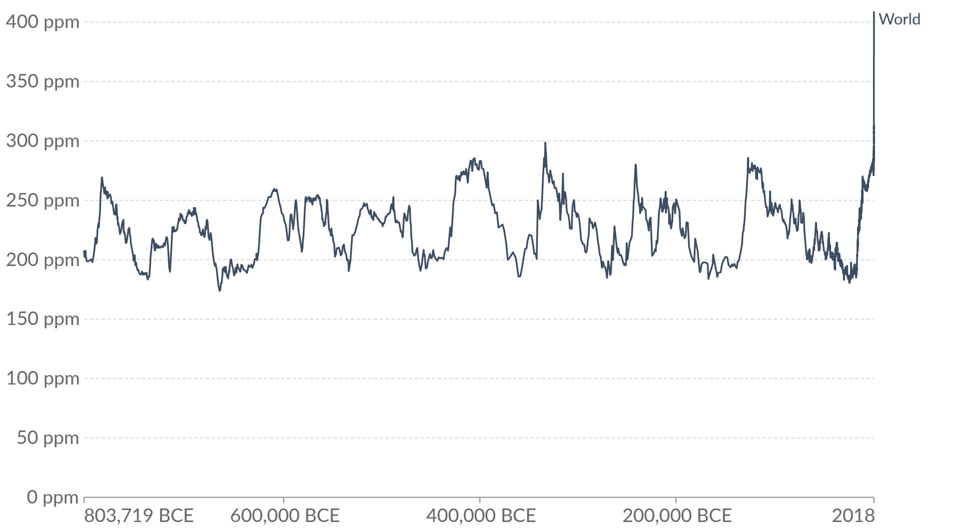
Carbon dioxide (CO_2) emissions from the burning of fossil fuels for energy and cement production. Land use change is not included.



Source: Our World in Data based on the Global Carbon Project; Gapminder & UN
Note: CO_2 emissions are measured on a production basis, meaning they do not correct for emissions embedded in traded goods.

Atmospheric CO_2 concentration

Global average long-term atmospheric concentration of carbon dioxide (CO_2), measured in parts per million (ppm). Long-term trends in CO_2 concentrations can be measured at high-resolution using preserved air samples from ice cores.



Source: EPICA Dome C CO_2 record (2015) & NOAA (2018) in the building construction industry, since we make the decisions in what resources to use in the projects, therefore I will focus a lot on the kind of materials that are more and less sustainable to build.

2. THE REAL IMPACT OF BUILDING CONSTRUCTION

2.1 Construction Materials

The second most important part of any architect's job, after of course the decisions of the shape of the buildings, is the choice of materials. A very important part of the architectural process that must not be taken lightly. There are always many options, dependent on client needs and wants, project budget, material availability and local climate. One aspect however that most architect don't put too much thought into is the sustainability aspect of any construction material.

Thus, I will look into the most common material options that exist in our modern times and evaluate which ones are more sustainable for which situations, because keep in mind that a material might be a great solution in one part of the global but completely impractical on the other side of the world. And to be more succinct we will consider the Mediterranean climate as the basis for this discussion, since there is where I have lived all my life and studied, and which lacks a little more comprehension of sustainability matters. The more commonly used types of materials utilized in construction are: reinforced concrete; steel; glass; bricks; ceramics; wood; stone.

2.1.1 Reinforced Concrete

The most commonly used material of the last one hundred or so years of construction. It is regarded by many has the best material ever conceived by the human species and it dates back thousands of years, all the way to Roman empire. Concrete has many advantages such as its very simple production, only takes three ingredients, water cement and gravel, which makes it one of the most abundant constructions resources that exist and practically unlimited.

You can shape concrete to almost any form you can imagine which made it very desirable for the architects in the modernist movement and for the rest of the industry since its relatively cheap to produce, however concrete alone is not enough to support heavy loads, that's why we needed to add something to it to make it stronger, and so we reinforce it with steel rebars, to add resistance to traction loads making a very strong material capable of handling extremely high loads, making it possible to construct massive bridges dams and skyscrapers.

Nonetheless, I believe that it is not the most sustainable material we could use in construction. Here's why, first I believe the production of concrete is very impactful on the environment, more specifically in the production of the cement, the glue that holds concrete together.

The mining of the materials for cement production is usually made in open-pit style of mines which is very destructive for any ecosystem, you are just opening one big hole and destroying everything that lived there, but not only that you are also making sure nothing will be able to ever live there after you have extracted all the resources you wanted. The same could be said for the steel rebars but I will go more in depth later. (fonte)

Another ingredient for concrete is water, fresh water. A resource as we know is very precious and increasingly more precarious with the constant rise of global temperature and the consequential climate change. I argue that it is not the most sustainable use of water since in the production of concrete you use a lot of water and don't get any real environmental benefit back, like wood for example (where you use water to grow the tree but get oxygen and Co2 capture in return).

And last but not least, the production process and transportation of concrete generates a lot of greenhouse gases emission, since the mining process requires heavy machinery that operate with fossil fuels, the process of cement creation itself also releases a lot of gases into the atmosphere, the pouring of concrete not only requires transportation to the site ,which obviously produces more gases until we have a better alternative, but also the trucks have to keep the concrete moving throughout the entire time of the pouring which in turn is more gases in the atmosphere. (fonte)

2.1.2 Steel

In a related note to reinforced concrete, lets discuss one of its important components, steel.

Steel is a metallic material that comes from iron, and as concrete, iron is very abundant in the world. As concrete, steel also as an historical importance since it was crucial in the rise of the modernist skyscrapers.

Since it could handle traction it was a very good material to handle the horizontal loads of the high-altitude winds that storm the skyscraper. Steel as a material only really became a commonality once it started being used to reinforce concrete, because before it was a more rarely used material.

An advantage that can be attributed to steel in comparison to reinforced concrete is that it is a much light material and in terms of sustainability, is a material that can be recycled and reused very easily. However, the advantages end there.

A lot of the criticisms I have of steel are very similar to the reinforced concrete, the emissions of its production are however much more intense than concrete, making concrete seem more sustainable.
(fonte)

2.1.3 Glass

Glass is a crucial material in any architectural project. It's responsible for letting light in but keeping everything else out such as intruders and keeping temperature in. There is not a single architectural project that doesn't utilize glass. The advantages of glass are that it can most of time be very aesthetically pleasing, it can be recycled and reused multiple times.

In terms of sustainability glass, ironically, is not very clear. Its production requires silica, also known as sand, which is a resource that is obviously abundant but it's mining usually can be very detrimental to coastal areas and similar ecosystems, however glass has the big advantage of being easily recyclable which helps a little. Another thing to consider is the emissions of its own production, since you have to heat silica to very high temperatures that means a lot of Co2 emissions, even in the recycling process, so that's something to seriously consider.

Glass is important though, especially for passive design strategies, that I will explain in more detail later, because without it we cannot have passive solar gains through greenhouses for example, so we cannot just eliminate glass from architecture, but I do believe we have to be more mindful of how we utilize it, as in the case of concrete I believe it is overused especially in skyscrapers that are completely covered in glass, and that create a very inefficient heating and cooling system.

In short, we must be more mindful of our glass use, since it's not the most sustainable material and we still don't have a viable alternative to it.

2.1.4 Ceramics

This building material also has a very long history, dating all the way back to the Roman times, it is mostly used in four ways in architecture, for roofing, bricks for walls, wall and floor tiles, and sanitary equipment.

In general, all of these of ceramic products are produced in similar fashion. To produce ceramics you must, as with glass production, extract a resource from the ground which is clay and then heat to high temperatures to hardened it and make it useful for building.

And as in the glass production, this generates a lot of greenhouse emissions while not being as recyclable as glass, making it a not so sustainable option for construction.

2.1.5 Stone

This is definitely the oldest material known to mankind to be used in construction. It's commonly used for flooring or walls. It has the most straightforward way of production out of all the materials we have seen so far, since it doesn't require a lot of steps.

Stone itself is the resource that is extracted from the earth and its used mostly in its most natural form, after being execrated the only thing that can be made to it is to cut it and surface finish, to make more or less smooth.

So, in terms of emissions, it's not as bad as the other options we have seen so far but the most impacting aspect of its production is the mining of it, which again usually means open-pit mining that is very destructive for any ecosystem.

2.1.6 Wood

Another historically material that has the potential to give a lot of benefits for our future. Wood however has a bad reputation, a lot of people still believe that is a more dangerous material, due to fire safety, however with some advancements in the technology, we seem to be on a path to a viable alternative to traditional materials of the last century.

First let's understand the production process. To create this material, you must plant trees and once they have grown to a right size you cut them off and use them. This process has some advantages and disadvantages.

The first downside is that trees take a long time to grow, which means its complicated to scale its production to the demands we have in our current days for construction materials, secondly its production must be controlled in a responsible way to not contribute to the worlds problem of deforestation, and lastly it requires more attention in its installation in an architecture project, which for now is still low among the contractors and designers.

However, it has a big advantage in terms of sustainability in comparison to the others we have seen. In its production you actually get a positive net production of oxygen because trees are plants and therefore, they do the photosynthesis process, creating oxygen and capturing Co2 from the atmosphere, even compensating for the greenhouse gases emissions of the cutting and processing of wood, making it a way more sustainable material than the others.

Another thing about trees is that you can theoretically produced them until infinity, since with the seeds of any tree you can exponentially grow more trees creating a virtually infinite supply. The last advantage that I can think is that with a tree production you are not destroying the ecosystems as much as the normal for any mining exploration, since even after you cut the trees you can still plant more trees and allowing the natural cycle of life to occur.

To summarize, out of all the materials that are currently popular in architecture, I believe that the best option we have for the future of humanity is to invest and focus on wooden architecture, it has the best benefits out of all the options, and considering the extreme times we live in I think that we need a radical shift in the mentality of architecture, to move a little away of the aesthetic at any cost and to move towards a more mindful attention to the impact our industry truly has in the world and the future of our societies.

2.2 Energy Usage

However important it may be, construction materials are not the only relevant impact of the building industry, it also very critical to understand the energy usage of any building during its lifespan. To live our comfortable lives, we demand that a building is able to cool and heat to help regulate the environmental comfort of the users of the building, we also demand a lot of electricity production for our ever-increasing technological way living.

This all requires energy and its essential for everybody to understand how we produce energy and how we use our resources to produce it. Its also important to understand that in the construction of any building

there are a lot of indirect greenhouse gas emissions, due to two main reasons, the extraction and processing of any construction material and its transportation to any construction site.

2.3 Resource management

As I've been stating, considering the whole climate crisis we are going though, its increasingly important to understand how we as a society manage our own resources. Most of the resources we need for our daily lives are scarce, they are finite, which means if we are not careful, we can put ourselves in a very tough position where we will not be able to live in the same comfortable way anymore.

In the days we live in, the system of management of our resources is ruled by markets and profits, a very ineffective and unstainable way of doing it. It is important that all of us understand this, so we are not surprised by the lack of certain resources in certain parts of the global society, such as water and food for example. It's important then in my opinion to democratize these decisions, not only of resource management but also of investment in technologies to be able to utilize better and more efficiently our existing resources, we are all in the same boat and its critical we all get a saying in where this boat should go to.

PART II

UNDERSTANDING WHAT CAN ARCHITECTS AND USERS CONTRIBUTE TO SUSTAINABILITY EFFORTS.

3. THE ROLE OF THE ARCHITECT

With the context of our situation established, what can we do then you might ask, and I will give you some possible answers to this great conundrum in this next part.

From now on I will differentiate a bit more the two groups of people that have a part in all of this, the Architect and the User.

The architect is for me anyone that designs consciously any habitable space for humans, the Architect for me can then be from any sort of socio-economical background, it doesn't matter if it is rich poor educated or illiterate, if someone designs a space to live it is automatically an architect since it will affect any person that uses such space.

The User then can be classified as the rest of humanity since we all utilize spaces. The User however has more of an impact than he/she might think they have in the life and sustainability of building. And of course, an Architect can be also a User and that's very important to remember for Architects.

Let's start then with the role of the architect.

As I've explained before, an architect can be anyone that designs any living space concisely. Its someone that will have a direct and indirect impact in the design decisions of any architectural project and in the way of living in the Users of their own project. So, a lot a responsibility.

That responsibility means then that it is imperative that any Architect has a good comprehension of the location of the building, what are the best material options, what are the Users wants and needs, and the overall sustainability of the project both economically and sustainably.

Let's focus then on what can the Architect contribute for the fight against the imminent climate disaster.

There are two paths an Architect can follow, the practical one where you design real life projects and contribute with practical solutions and the theoretical one, where you can either teach these ideas to others or investigate and come up with more ideas to contribute, personally I prefer the practical approach in the main thing to remember is how can we be more efficient with our local and global resource management while creating comfortable living spaces for anyone. In my opinion there four crucial areas where the Architect can help the movement, the areas being: passive design strategies; material choices; net-zero building; re-use. Now I will explain these ideas more in-depth.

3.1 Passive design strategies

The idea of passive design in architecture is a simple one to understand but a more difficult one to implement, therefore one that requires proper attention and study to be able to properly apply it.

The main idea is to create a system in a building that self regulates its temperature without the intervention of machines to either heat it or cool it. As we have seen before, heating and cooling a building uses a lot of energy so this kind of strategy is important to keep that energy spending at a minimum possible.

Passive design strategies have two moments or components, that match with the warm season and with the cold season, they are the passive cooling and passive heating, and they work in slightly different ways but must be interconnected in the whole system to become the most efficient possible, you cannot just have passive heating and not the other and vice-versa.

Passive Heating requires that the building harnesses the immense solar radiation that the earth receives every day to heat itself up without the need to use electricity or fossil fuels. To achieve this there are four kinds of systems you can utilize, direct, indirect, semi-direct and independent, depending on the situation one can be more appropriate than others. For the sake of brevity, I will focus on the direct solar gains system, since that was the one I used for the Oasis proposal.

3.1.1 Direct solar gains system

To achieve a good design in direct solar gains system, you must combine a few key elements and ideas, such as a good knowledge of the location of the site, meaning the sun paths, landscape and local climate, a good design of overhangs to create shadows in the summer but allow the sun in the winter, thermal masses in the building that will store solar energy during the day and release it slowly during the night to regulate better the temperature inside a building, and last but not least a proper energy efficient thermal envelope design minimize the eventual energy losses through thermal bridges.

Firstly, you should orientate the building in a way that the longest facade is facing south, and with the landscape you should keep the south clear and shade the west and east façade more, considering of course if you are located in the northern hemisphere, if not then the opposite applies. For shading you can use porches decks and garages in alternative to vegetation. It is extremely important that the south façade has overhangs that stop the sun to enter directly during the summer but that are short enough to allow sun during the winter.

The thermal mass is any part of the building that can store and release the energy of the sun, which can be also part of the structure of the building. They can be in the walls or floors and be made of either concrete, stone, adobe, or bricks.

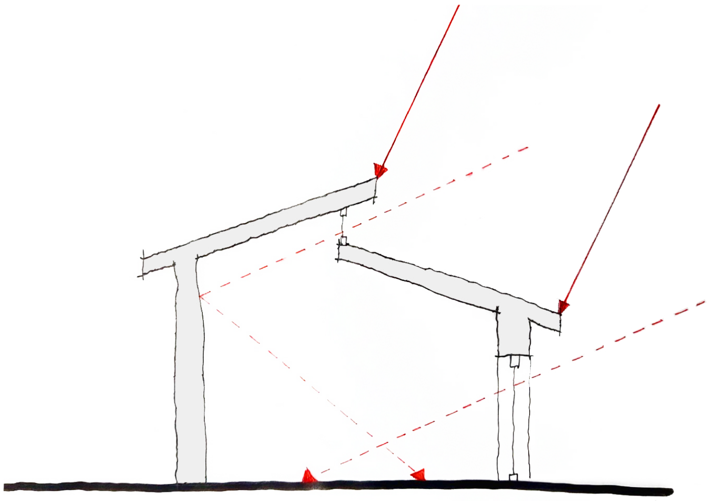
Another strategy used for this type of system is the clerestory window, which allows for the sun to come in even to other areas of the building that can't be accessed through the south façade, the northern spaces of the building. And of course, with the overhangs in these windows to make them efficient in the summer and not overheat the building.
To prevent overheating in this system it's important to have shading devices on the transparent surface to be able to control the amount of sun radiation entering the building.

The advantage of such system is that it is the simplest heating system to implement, the easiest to build and the least expensive. The limitations are that the large glass areas may cause glaring during the day and lack of privacy during the night, that's why it's important to always add some sort of shading control in the windows, UV light can degrade finishing textiles and pictures.

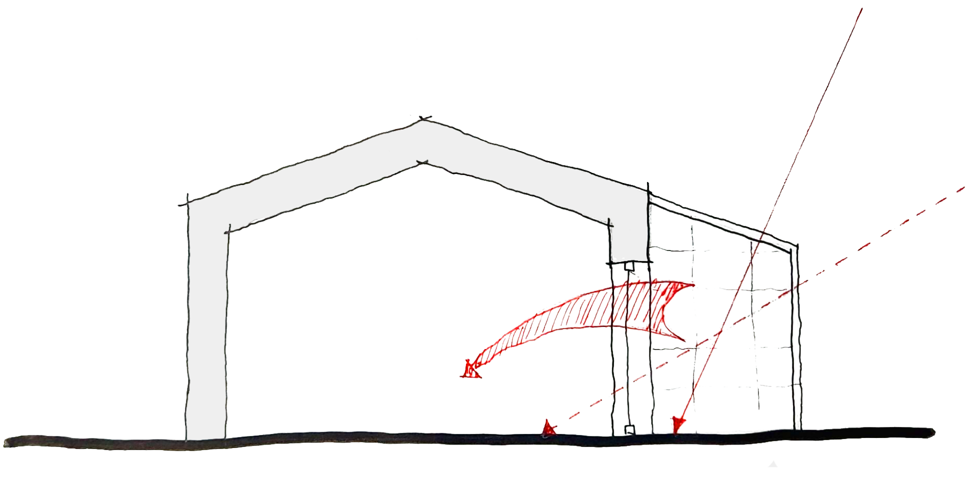
To finish it's also important o always think about natural ventilation, not only to provide passive cooling but also oxygen renovation. It's important to remember to have controllable openings in opposite sides of the building to create cross ventilations, you can also design passive ventilation systems with chimneys and openings in the roof.

3.2 Material choices

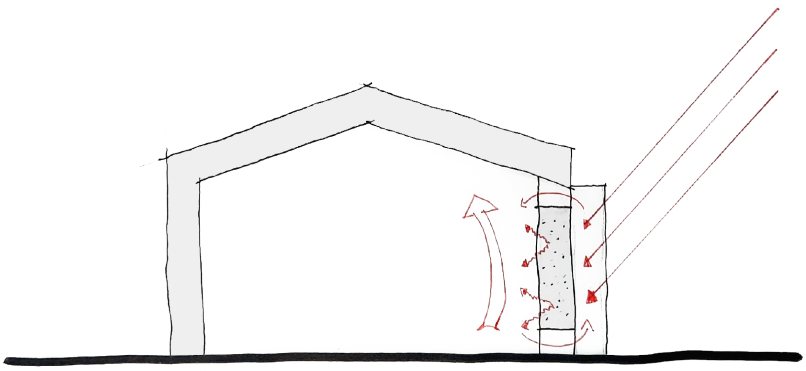
As we have seen before, different materials have different impacts in the environment, and the Architect must always be aware of which are the best options for each situation.



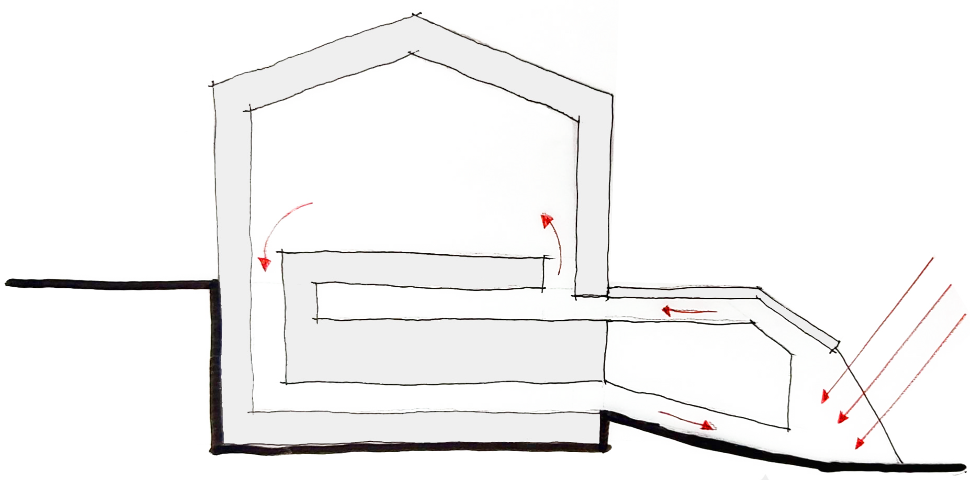
Direct Solar Gains System



Semi-Direct Solar Gains System



Indirect Solar Gains System



Independent Solar Gains System

In my opinion certain materials should be used in a more controlled way, such as reinforced concrete and glass, while I also believe we should explore more wood as a viable alternative material to build most of the building. So, for example, concrete could be used only for the foundations while wood can be used as a structural and divisor material.

3.3 Net-zero building

This concept is the idea when you design a building with a neutral carbon footprint, which means you don't consume more than you produce keeping the sum of carbon at zero.

For this to be able to happen its important that you design a building with proper insulation, which can be sometimes expensive, which is changing a little with the investment and encouragement of governments to implement better insulation systems, to keep the buildings from leaking heat and minimizing as much waste as possible.

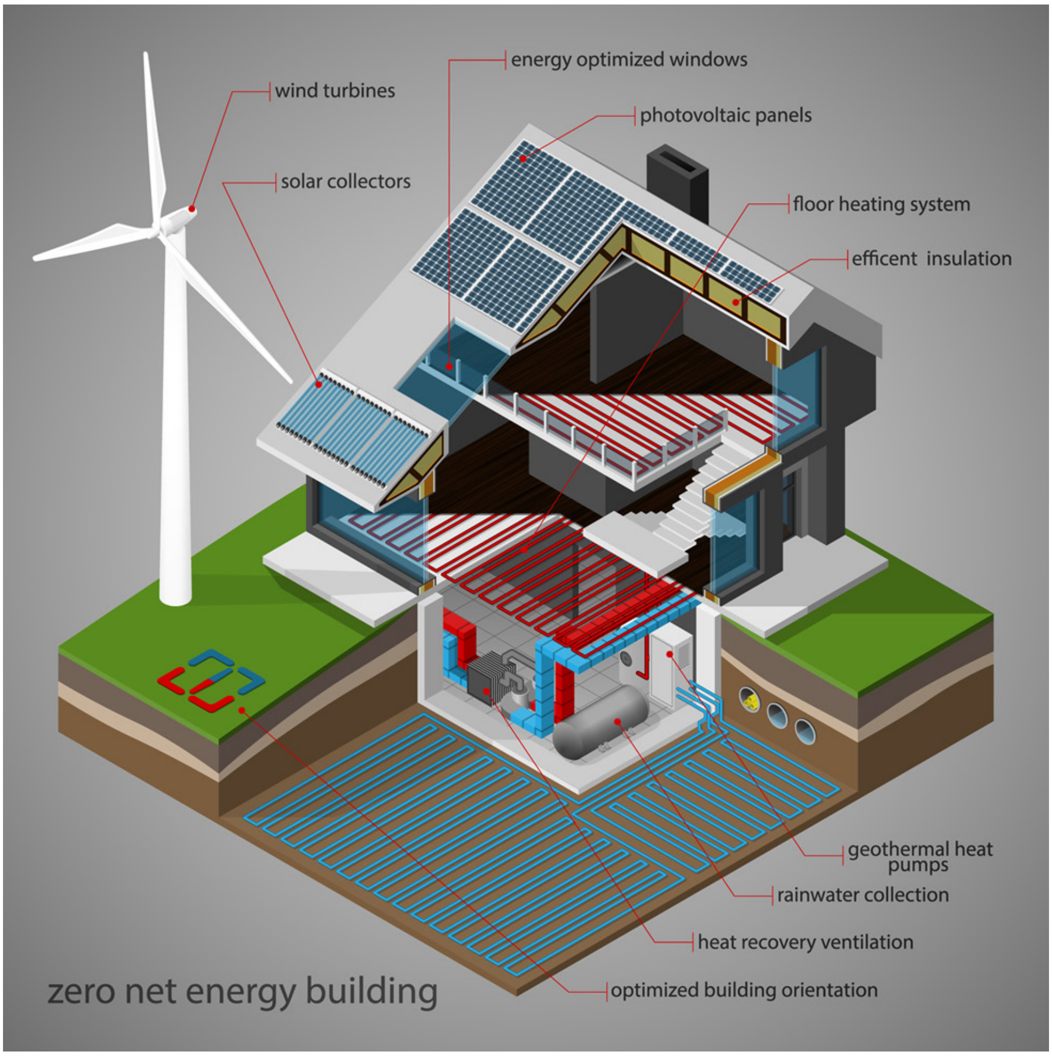
This idea is very common nowadays and it's starting to be written in many building codes around the world to improve the overall insulation of buildings, which conventionally is very weak

3.4 Re-use

Rehabilitation is the name of the game here. We already have more than enough buildings to house and accommodate every person in the world, with a lot of them being abandoned but still with potential use for renovating and being habitable, this phenomenon is very common nowadays in post industrialist cities, where former industrial buildings, such as warehouses and factories, are being retrofitted to allow for new uses, this topic would be enough for an entirely different thesis.

The main advantage for sustainability in reusing buildings, is that most of the resources have already been produced to build it, and if we just demolish the old to put something new on top, we would be wasting all those resources and contribute to the existing problems by exploring more of the same resources, making the whole process incredibly inefficient and unsustainable.

I believe this is very important for any Architect to understand, since we cannot keep up at the same rate of construction and development of the last century, there is not enough earth for all that growth, we need to be also mindful here and be smart about the way we renovate our buildings and cities.


energy optimized windows
wind turbines
photovoltaic panels
solar collectors
floor heating system
efficent insulation
geothermal heat pumps
rainwater collection
heat recovery ventilation
optimized building orientation
zero net energy building

4. THE ROLE OF THE USER

We are all in this together, and without a proper use of the building, you can design the most efficient building ever and still be unstainable if the user doesn't know how to live in it properly.

It's important for all of us first to understand what our own habits are when using any building, and then try to understand if any of them can be improved.

I will use myself as an example, when I was younger, I had a habit of leaving the lights on, but after years of complaining by my mother, due to the electricity bill being so high, I did some reflecting and started working on that bad habit, and nowadays I'm always closing the lights. This a simple and obvious example but it outlines the principle we should all follow as users of any building; our small presence can have a big impact in the long run.

So, what are usually the bad habits that Users tend to have. Obviously, as I did, the lights being always on is a big thins, even if now the LED lamps are more energy efficient, they still consume a lot of energy if you leave on all night and day.

Another thing people tend to do, is to waste a lot of water, not only in brushing your teeth with the faucet constantly running water, but also in cooking and showering. Who hasn't had a bubble bath where you fill a bathtub worth 300 liters of water just for one bath, or also long showers that could be made in 10% of time they took. What about cooking, washing dishes and clothes...

All of this can use a lot of water if we are not careful with it. To help with this lack of awareness of what users waste the Architect must come up with creative ideas to remind people of what they are using, and I will discuss some that I have thought about for our Oasis proposal further ahead.

Likewise, we as Users tend to abuse a lot of the mechanical heating systems, we have we own our houses, and sometimes even if no one is using them. Same for mechanical cooling systems such as air conditioners, that unfortunately are increasingly more in demand, with all the heatwaves. We tend to forget that they are working, and especially in big buildings where they must work with extra power to accommodate for the large floor areas. It is very important here that the architect and the User are in tandem because the Architect must design the passive cooling system and educate the user on the make the best out of it while maintain its own level of comfort.

Users are more important to a sustainability of a building than they think they are, and it's our responsibility as Architects to show and educate them on how best to live a building, which in fact is the whole point of my Oasis di Orbetello proposal, to make architecture an educational tool for sustainability, both for Architects and Users.

5. LEARNING FROM THE PAST

Certainly, all these ideas are not exactly new, architects have been thinking these concepts and strategies for a while now, which for a student as myself is great, because it gives me an opportunity to learn from others experience, to try to replicate their successes and avoid they're mistakes.

Some of these design techniques come from vernacular architecture from almost thousands of years ago, others are a bit more recent from last century and there are still a lot to come and improve.

Architecture is not made in a void, it is iterating, you always learn from the past to apply in the present and teach in the future, it's important we keep that in mind, because no design is truly original, we should all be open sourcing architecture, cooperating and learning from each other in order to improve everyone's lives in the long run.

That's why I will look and share some of the case studies that have helped me understand passive design strategies and have helped me design the most sustainable building I could possibly do.

5.1 Case studies

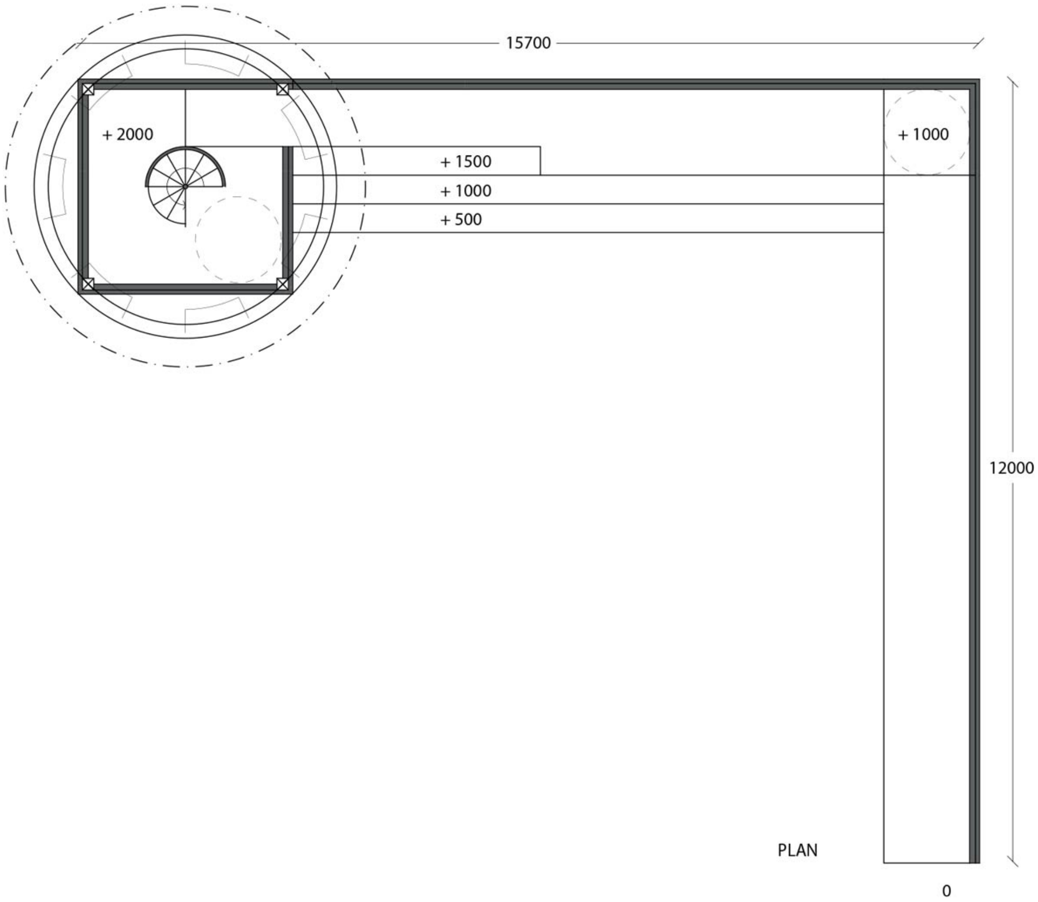
The case studies I will present here are the ones that served as a reference to design the proposal for the Oasis, being a mix of projects, with different kinds of functions, such as visitor's centers, nature reserves, museums and exhibition spaces.

Herdla Birdwatching Tower / LJB AS

The biggest strength of this project is the way of hiding the people in the watchtower while seeming to fit very well with the surrounding landscape.

It also quite valuable the fact that it allows for accessibility to the first level of the tower.

Text description provided by the architects. "The landscape of western Norway is not only characterized by precipitous mountain slopes, glaciers, deep valleys and fjords, but also by industrial areas and fertile agricultural land along the rough coastline. Located on the very tip of Askøy, an island north of Bergen, you find Herdla, an area representing these typical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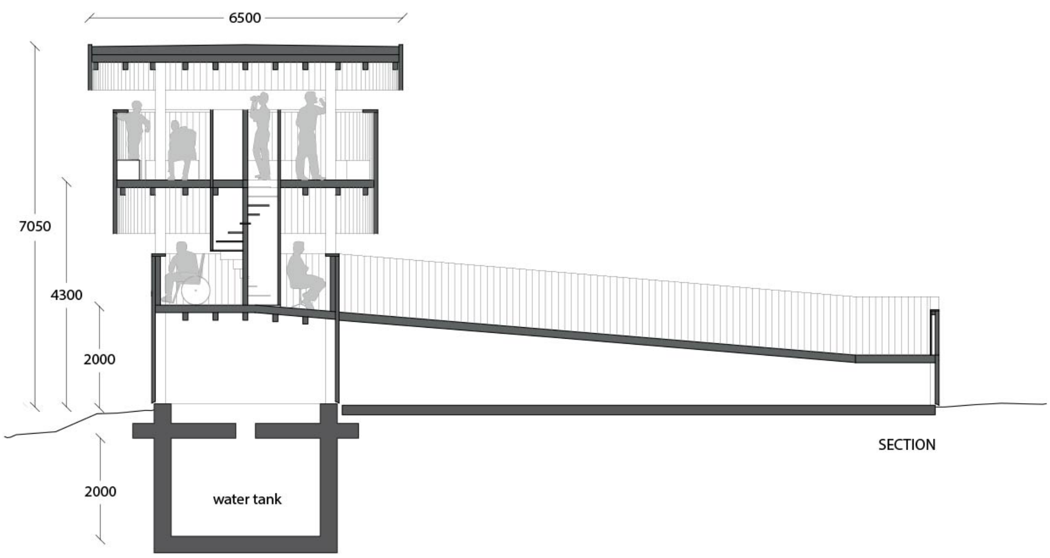
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water tank
SECTION

agricultural landscapes. The wide and open grasslands, surrounded by shallow sea and sweet water ponds, have become the perfect spot for birds to rest and nest, attracting birdwatchers from all over the world.
The most precious parts of the Herdla landscape is under conservation and managed by the regional authority for environmental protection, but also function as pasture land for a conventional farm with livestock and grass production. Here, consideration for agriculture, environmental protection and public outdoor life interests are all crucial, and as a way of making the richness of the area more accessible, a system of paths and a new bird observatory has been created.

Located close to the ponds and the beach, the steel and wood tower rises seven meters above the field. The concrete basement is hosting a pumping-station which functions as a draining facility for the agricultural fields as well as leveling the water in the ponds. Outside, on the ground floor, an amphi for sitting has been established, together with a footpath creating accessibility for wheelchairs to the tower. The amphi and the footpath are surrounded by a wall to the west, protecting the space from wind. The tower has two public floors; an accessible lower -and a top floor, which is accessed by a spiral stair at the center of the tower. As a way of hiding the visitors from the birds, both floors are cantilevering, also creating shadow and weather protection for the birdwatchers.

The shape of the upper parts of the tower is an answer to the wish for 360-degree views, while the lower part respond to the 2nd World War concrete foundations that was already on the site, creating an integration between the historical aspects of the surrounding and the new function on the site, as well as keeping the cost of the project low. The architectural intention was to assemble a "safe" and stable basement with an aerodynamic and directional independent observatory above it. The precisely mounted wooden cladding adapts and changes colour in response to the weather conditions, creating a soft and nature-like overcoat to the strong and geometrical form."

House of Grain / Reiulf Ramstad Arkitekter

The way this project uses wood as the main material is absolutely inspiring and very well crafted. It shows what is possible with this kind of materiality. The composition of the building allows for the creation of a very cozy "piazza", almost like a half patio, making a good connection between the outside and inside.

Text description provided by the architects. "The Jutland region, with *its diversity of landscapes and long history, is in many ways the most continental region in Denmark. Hjørring has some of the oldest traces of settlements nationally and an established cultural landscape. The Kornets Hus – or grain house, is the realization of a new centre for the dissemination of the region's rich food and farming culture.*

Located on the land of an existing farm and bakery, the new inspiration centre will offer visitors, locals, and employees alike a facility for activity-based learning centered around the importance of grain both to Jutland and human civilization. The building is organized around a simple and flexible plan, which allows for a wide variety of activities and functions to take place.

The architectural form is derived from research into the region's rich landscape, folk culture, and agricultural heritage – the centre being defined by its two brick-clad light wells, which reinterpret baker's kilns. The interior is planned to open up to the vast expanse of wheat fields to the west – framing views outward and opening to terrace.

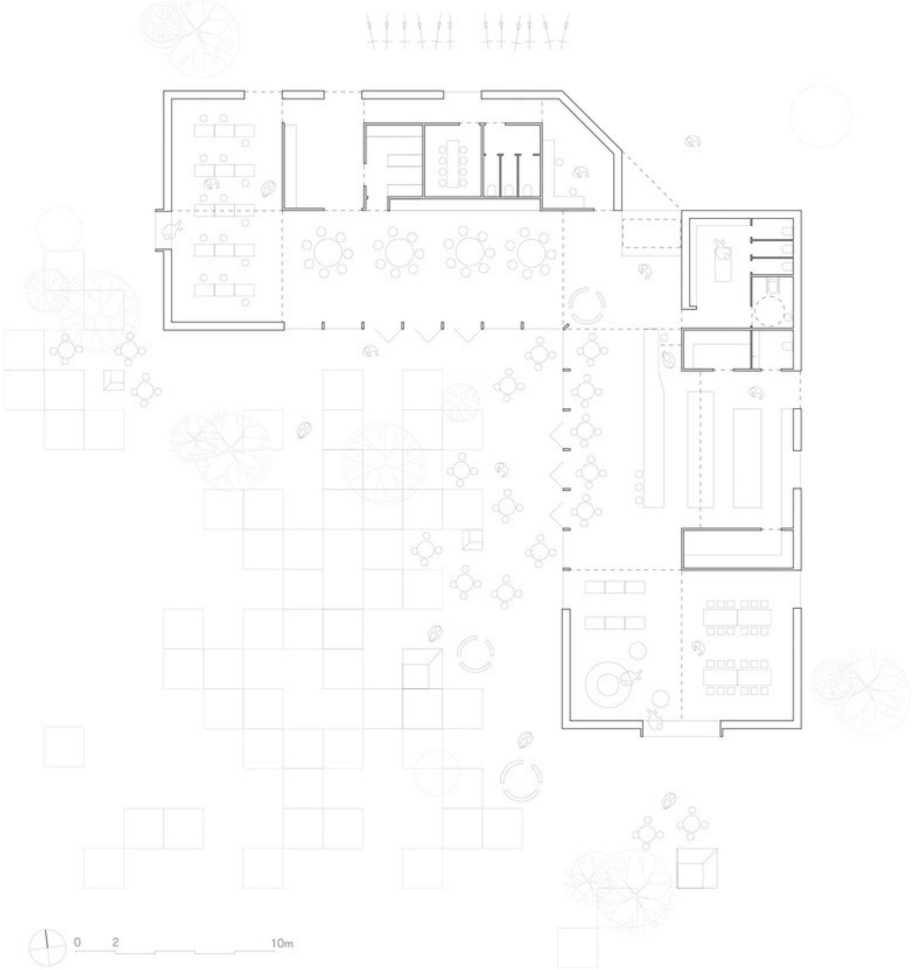
The public spaces are centered around a large bread oven while teaching and exhibition spaces are demarked by the natural lighting and increased volume of the skylights."

The Bobrowisko Nature Enclave / 55Architekci

There is a very dynamic composition present in this project that allows for a very creative way of designing openings for the visitors to look at the animals. I quite enjoy this observation cabin design.

The great thing about this project is that is allows for the natural aging of the wood material making it incredibly dynamic and, in a way, less impactful in the long term, to a day when humans are no longer here it will not be an impediment on the natural way of evolution.

Text description provided by the architects. "The "Bobrowisko" project was created to make unique space - the area of a former gravel pit, transformed by natural succession - accessible. The concept of the footbridge located above the beaver lodges, together with two observation structures, is a response to the noticeable scarcity of public places in suburban areas, on the border of urbanization, immersed in attractive landscapes, available to both residents and visitors, walkers, people less abled and disabled and families with small children.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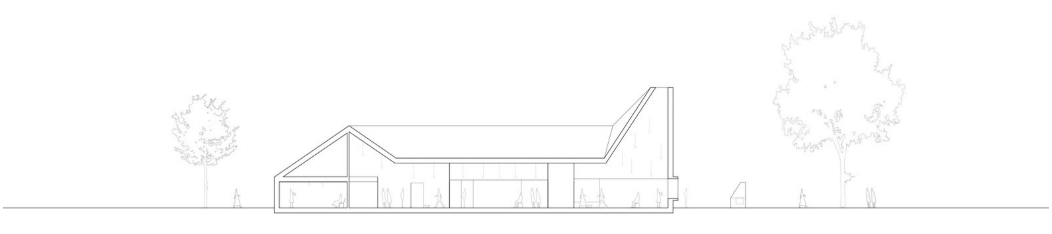
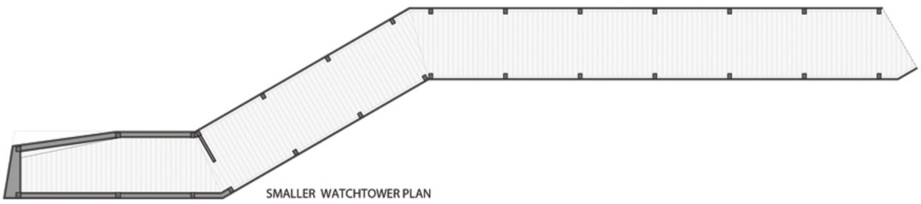
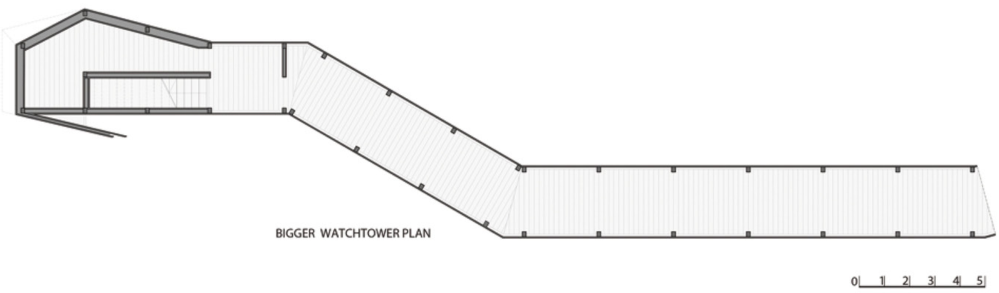
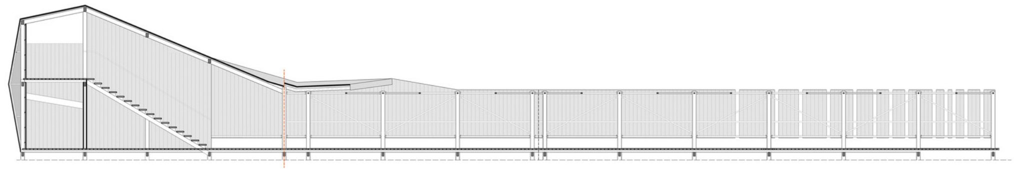




SMALLER WATCHTOWER PLAN



BIGGER WATCHTOWER PLAN



BIGGER WATCHTOWER - SECTION

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The place is located off the beaten track, in the fork of mountain rivers, and in the intention of the initiators should play an educational role, sensitizing to the beauty of nature and raise awareness of its power (even in the face of anthropogenic damage). A characteristic feature of the space is its intimate, non-invasive nature, which has been preserved thanks to architectural solutions.

The solutions adopted, such as the planned course of the footbridge overlapping wetlands and water, the lack of balustrades - to force the mindfulness of visitors and vigilant observation of the environment. An organic footbridge allows gradual assimilation of the views from different perspectives. The designed route allows to familiarize oneself with the natural phenomenon of Bobrowisko. The planned course and form of the footbridge allow direct contact with nature, emphasize its strength and expansiveness, but also show the viewer its variability and changeability.
The planned approaches to observational structures by wooden paths are part of the scenario of dispensing impressions to the visitor - they are intended to calm the perception briefly, evoke a state of waiting, to immediately awaken it, directing to the most important phenomena - from within. Both watch rooms are located and oriented to previously observed places liked by "residents" - beavers and swans. The irregular form of the observational structures corresponds to the visible natural exhibits, indirectly indicating the direction of interest. Irregular openings in the sheathing allow to hide - small and large - enthusiasts of wild nature from the observed species.

A certain difficulty was the need to enter the route between the animal habitats and the shallowing of the former excavation, and to take account of fluctuations in the water table. Observation objects were tried to be kept relatively small, with complex geometry - reacting to changing lighting, offering various visual access points. Their plating is to undergo slight, but continuous changes, giving in to the organic environment. Watch rooms provide shelter during inclement weather, in addition, they play the role of an open museum with dioramas illustrating the stages of the creation of the place and the most important elements of the natural context.

Raw wood, modest, local material used for construction integrates the object with the environment, physically interacting with its forces by, for example, immersion of plating structures in water, thus undergoing partial - planned decay. Engraved boards bring the richness of fauna, flora and local culture hidden from the untrained eye, providing the necessary information for contemplative and independent experience of the place at any time."

National Tourist Routes Projects / 70ºN Arkitektur

"Text description provided by the architects. These projects are part of the National Tourist Routes, unique drives through the most spectacular countryside Norway has to offer. The National Tourist Routes are being developed and operated by the Norwegian Public Roads Administration as a nationwide project. Its goal is to provide a network of such routes throughout Norway by 2015.

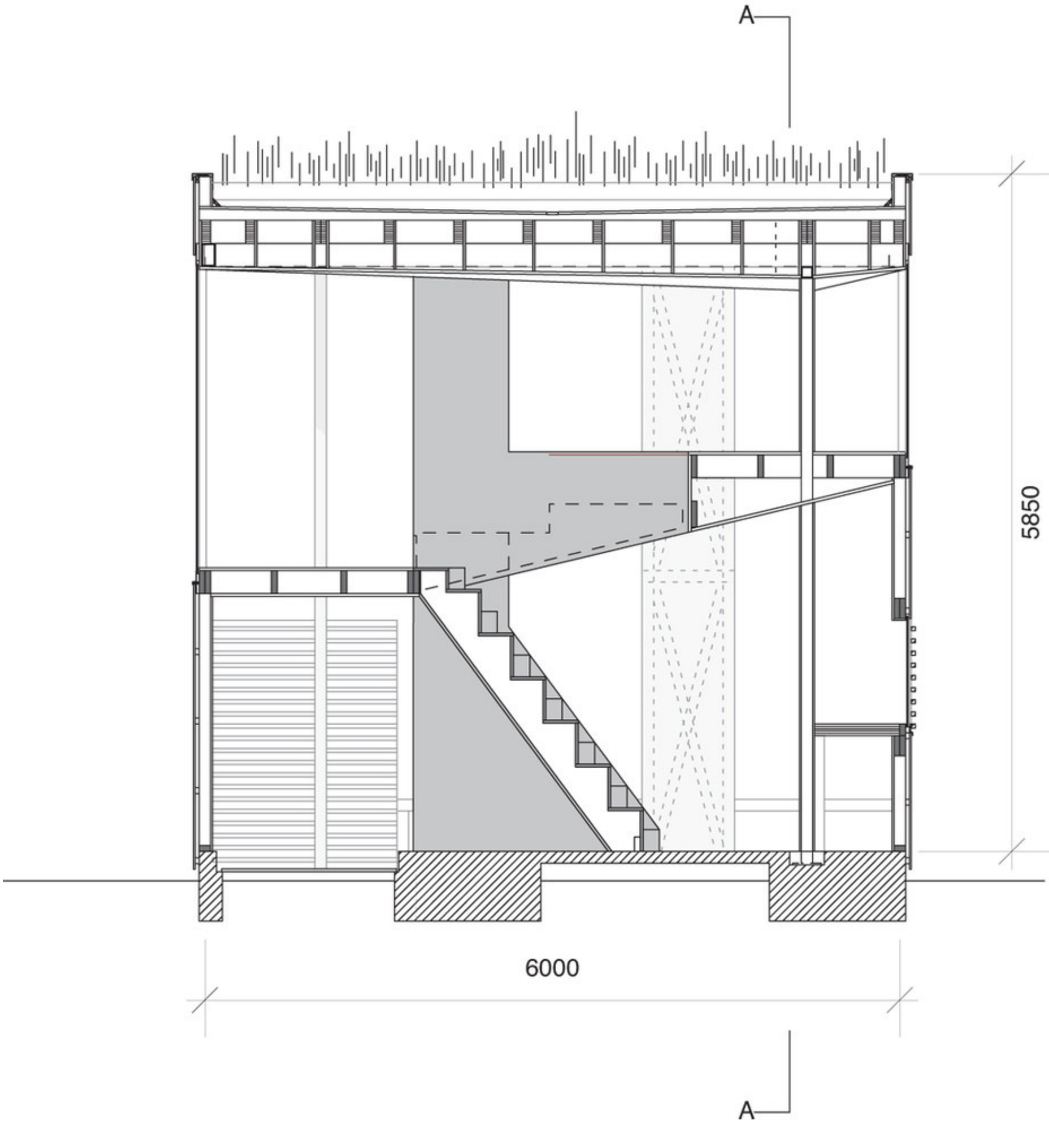
Two 6,5m high bird watching towers are erected at the bird reservations Skjerpenvatnet and Gårdsvatnet in Vestvågøy, Lofoten.
The entrances to the towers have been screened off with high walls and the observation platforms are formed so that no silhouettes of the bird-watchers are cast in order not to disturb the birds during the breeding season. At the entrance level there is a weather-protected room with a narrow glass observation opening. The upper level has large open areas for the best possible views. The tower is a robust steel construction with secondary wooden construction of untreated wooden fronts. The stability is important, so that the tower can withstand strong winds without affecting vibration sensitive binoculars.

The bike shed is situated at Grunnfør on Austvågøy in northern Lofoten with an open northwards view towards Vesterålen and a grand southwards view towards the mountains in the south. Here the visitor can seek shelter from the wind, which can be extremely cruel, and also have a magnificent experience of the nature.

Your bike might be parked on the entrance level, where you also can prepare food in a simple but nicely protected space. On the upper level, you can encounter the breath taking nature in a 360° panorama. It is built with a load-bearing framework construction of steel, combined with wooden bolts. The wood clad steel construction elements create intimate shielded spaces within the view space. The chosen construction also permits an all glass façade with a 360° view.

The lower level has a concrete floor and the upper level has a wooden floor (OSB). The interior is made of plywood and the façades have a wooden cladding.

The rest area is situated in an old leftover road bend with a most spectacular view from the wild ocean and mountains of Eggum in the west, to the calm farmland of Borg in the south. Borg vas the Chiefdom of Lofoten from 500AD, and hosts now a Viking museum. After taking off from the main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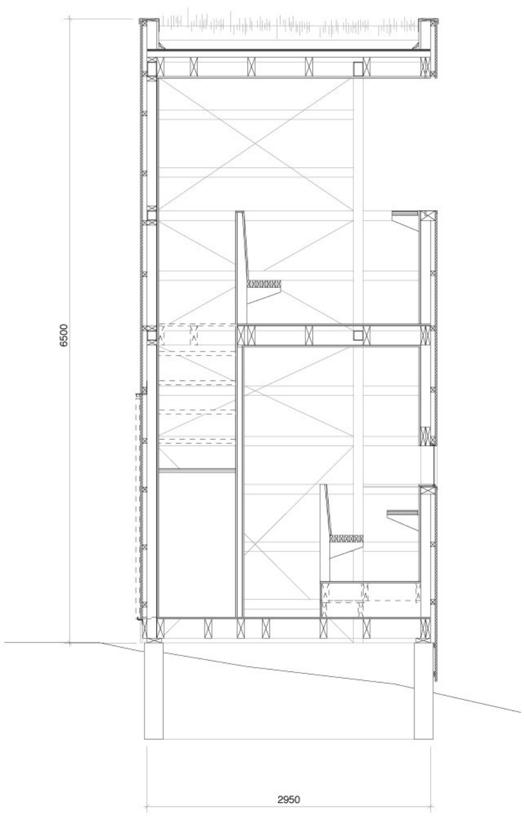
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road, you pass through the site to reach the parking space. From east to west the 60m long-wall is cut into the ground and separates the parking area from the rest area, the sun and the view. The rest area is constructed to give space for several buss loads of people. At the same time comfort and quiet is given to other travelers resting and eating. The sheltering wall is made of a steel construction covered with wooden laths and boards.

Ramps and steps along the south side of the wall are following the terrain. The steps also function as seats and they are sheltered by low walls covered with dark boards that will be heated up by the sun. The horizontal direction of the wooden laths continues, and with cuts and folds, they are turned into tables and benches."

RENTAL SPACE TOWER / SOU FUJIMOTO ARCHITECTS

Probably the most impactful of the references for the Oasis di Orbetello proposal, is this project by Sou Fujimoto Architects, that creates almost a labyrinth from the building itself, utilizing a very beautiful materiality, that has inspired me to design the visitor center following this idea.

Text description provided by the architects. "The theme of residential leasing and management company Daito Trust Construction and architect Sou Fujimoto is "redefining the rental house". Rental housing had always been configured so that space for exclusive occupancy is maximized while common areas are confined to passageways. But what if private spaces are minimized to provide spacious shared spaces, such as kitchens, baths, theater rooms and gardens? One can have a luxurious kitchen to enjoy cooking skills, a spacious bathtub in which to stretch your body, and an extensive library to read books for diversion. Unlike house sharing, where the living room and other spaces outside of one's own room are shared with others, the private and shared areas here are clearly divided, and then recombined anew to provide a glimpse of a comfortable and relaxing rental housing. If elderly people with time on their hands or people with gardening skills manage the shared gardens, then everyone can enjoy them too. The dull corridors are transformed into vibrant composite spaces."

Eco-Cabana Majamaja Wuorio / Littow Architectes

The functionality of the cabin is what makes it stand out, the ability to be truly off grid and sustain itself on its own is quite remarkable and makes a good example of the kind of architecture we should all be thriving to, one that has the least amount of impact possible.

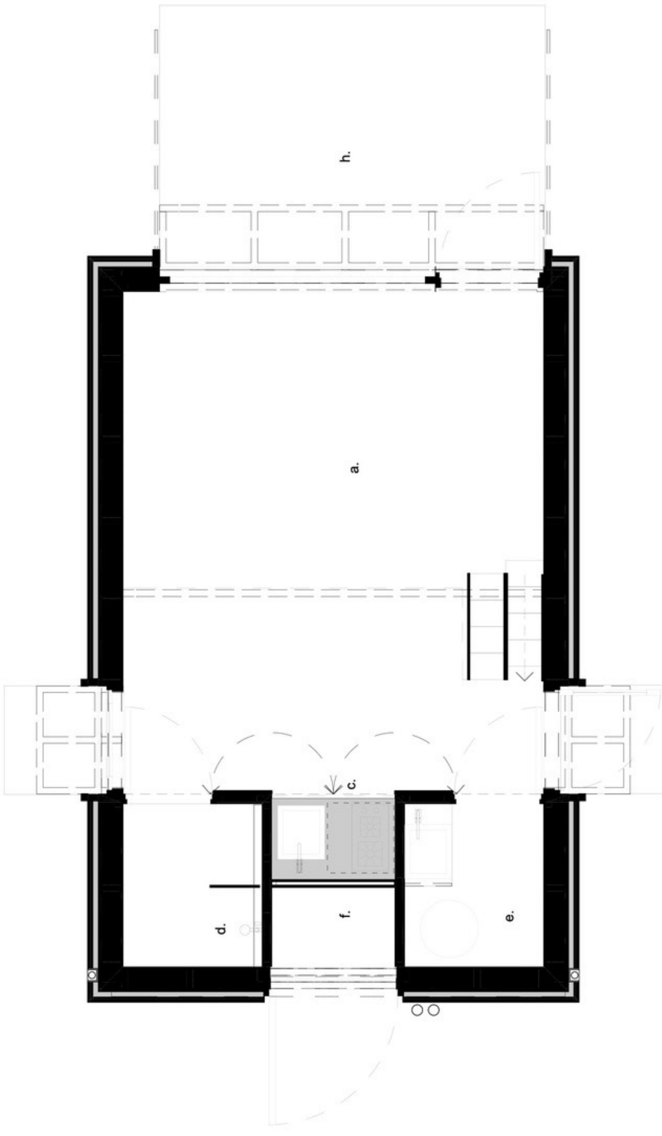
Text description provided by the architects. "Majamaja is a housing unit that operates fully off-the-grid. The unit is prefabricated, transportable, and can be assembled in the most isolated of places. This solution is built around a patented technology module with green energy storage and a closed-circuit wastewater treatment system. The unit is scalable and can be dismantled and moved to new sites.

The first Majamaja off-grid village development project is now underway in Helsinki and Majamaja will open the pilot designer cabins accessible for short-term rentals in 2021. Additionally, Majamaja is expanding internationally, working with owners and developers on a sustainable off-grid village project in France.

For Pekka Littow, the Finnish architect based in Paris who initiated the concept, The Majamaja concept is driven by the need to radically rethink and minimize our environmental impact on the environment. And to show how small scale architecture and small scale technology can replace big volumes and vulnerable centralized grid systems... This project is inspired by life in the Finnish archipelago, its traditional habitat, its human-sized buildings, and its way of life in which man is in harmony with nature. In accordance with these principles, the project is intended to be global.
Majamaja is committed to sustainable spatial planning projects with light infrastructure. The self-contained unit prevents environmental damage caused by pre-construction work, including connecting to potable water systems, sewers, or road construction.

The units are built from prefabricated wood elements that can be assembled without the need for heavy construction equipment, which allows an installation in the most isolated environments. Multiple units can be assembled to create larger sets. The units can also be disassembled and moved as needed.

The water autonomy is based on the collection of rainwater and greywater filtered by a purification system. The system operates in a closed circuit where all greywater is collected and recycled, and nothing is discharged to nature. The waste from the dry toilets is composted and reused as fertilizer.
Majamaja uses off-grid technologies for energy storage. The energy is provided by solar panels and a fuel cell. A high-performance battery powers the filter system and the basic electrical equipment, which includes a light, refrigerator, microwave, and an optional TV or air conditioning. The building is heated by non-polluting natural gas. The long-term goal is to make an example solution for all future housing solutions."



a. Livingroom
b. Mezzanine
c. Kitchen
d. Shower
e. Dry toilet
f. Technical space
g. Storage
h. Terrace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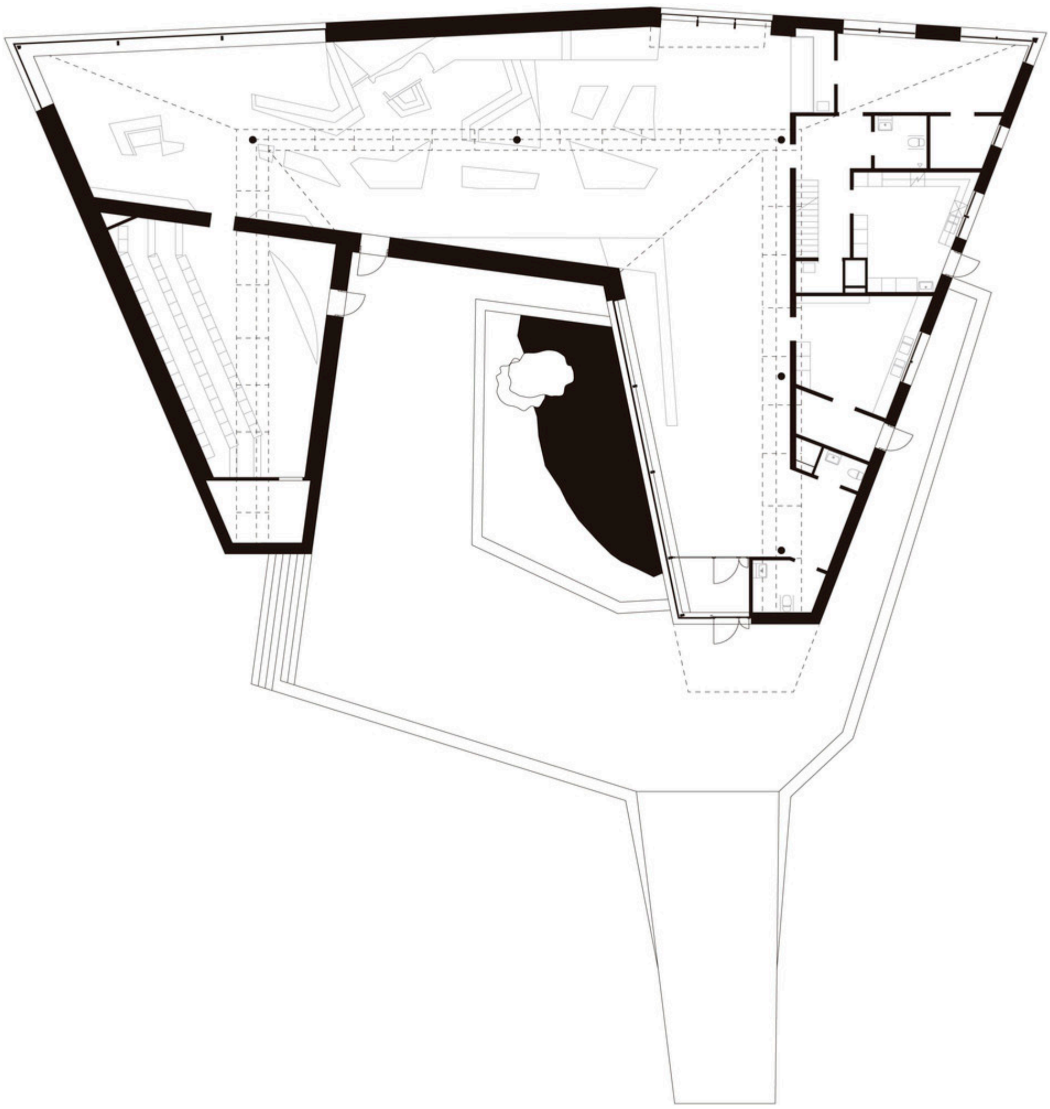
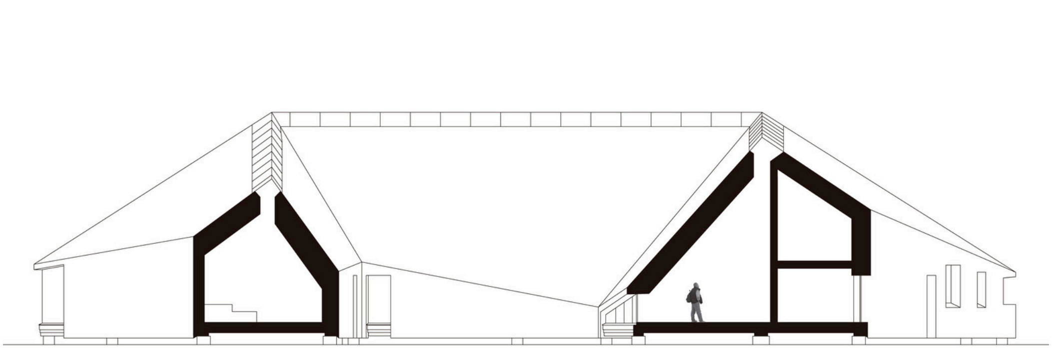




Facts Tåkern Visitor Centre / Wingårdh Arkitektkontor AB

In this case what I've found the most interesting is the innovative use of straw as the roofing material for the building (and at the same time not so much since it's probably the first material to be used as roofed in primitive architecture).

The way the building is lit on the inside using the skylights at the top of the roof is a very clever solution, that allows for a very comfortable living of the building and can also be very useful in the gathering of solar radiation in the winter.

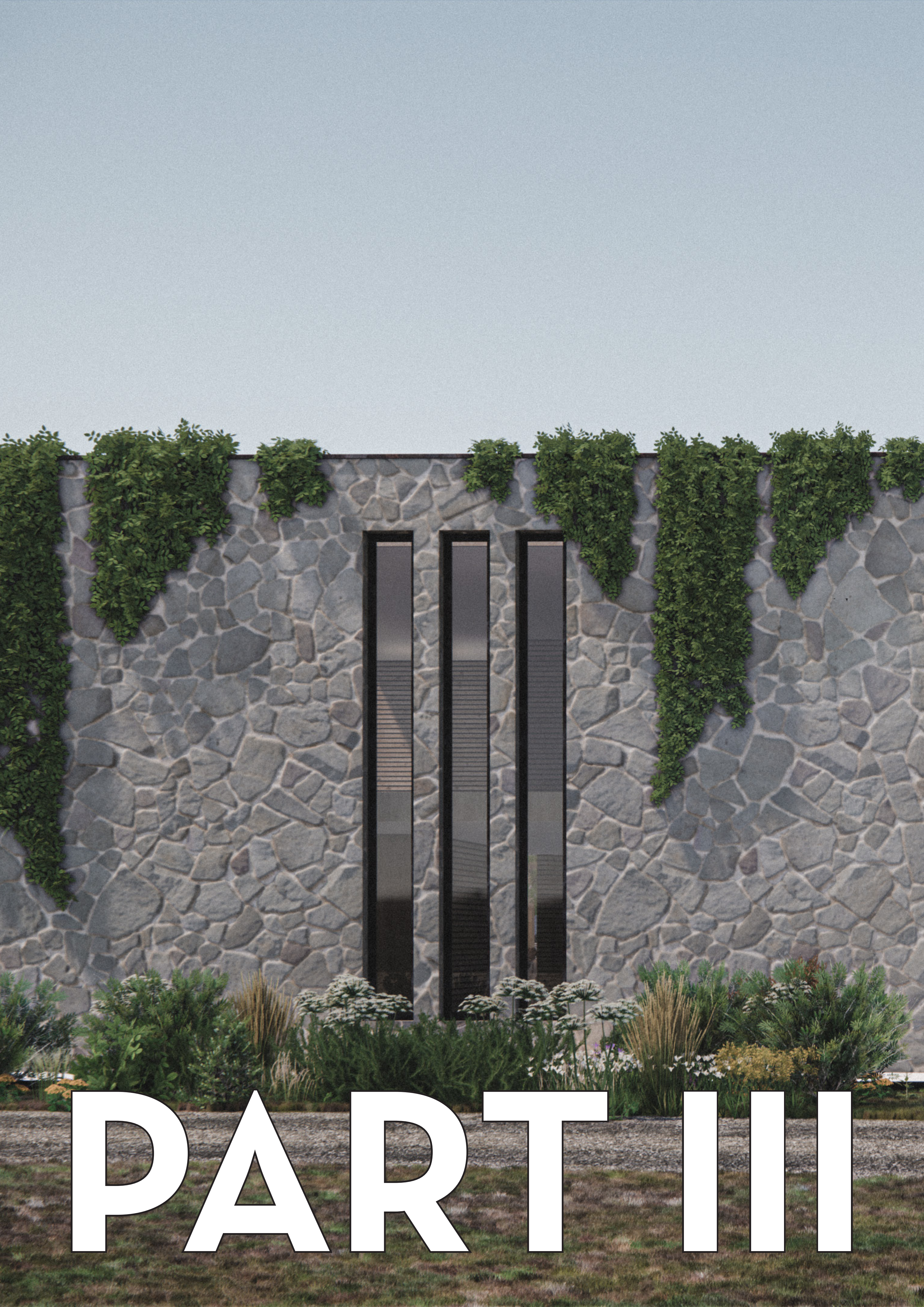
Lastly is quite interesting the way they made the watchtower accessible on the first floor of the tower.

Text description provided by the architects. "All the way out where the forest ends and the reeds begin, a visitor center hovers low on piles set carefully into the water's edge. The building is clad in thatch, camouflaged like a birdwatcher's blind, hiding its contents from the natural world that surrounds it. This is quiet architecture, using traditional local materials to break new ground with its crystalline geometry. Steep roofs transition seamlessly into walls. The steep pitch gives them longevity. The ridge, where a thatched roof is most vulnerable, is transformed into a glazed skylight.

The visitor center is the main feature of a series of measures that celebrate Tåkern's qualities. The path to the building passes a number of landscape exhibits that reveal, for example, changes in the environment. A short distance away stands a bird-watching tower, designed as a sibling to the visitor station. The whole scheme is interconnected by boardwalks that make the terrain accessible for all. A 140 meter long ramp makes it possible to reach the five meter level by wheels.

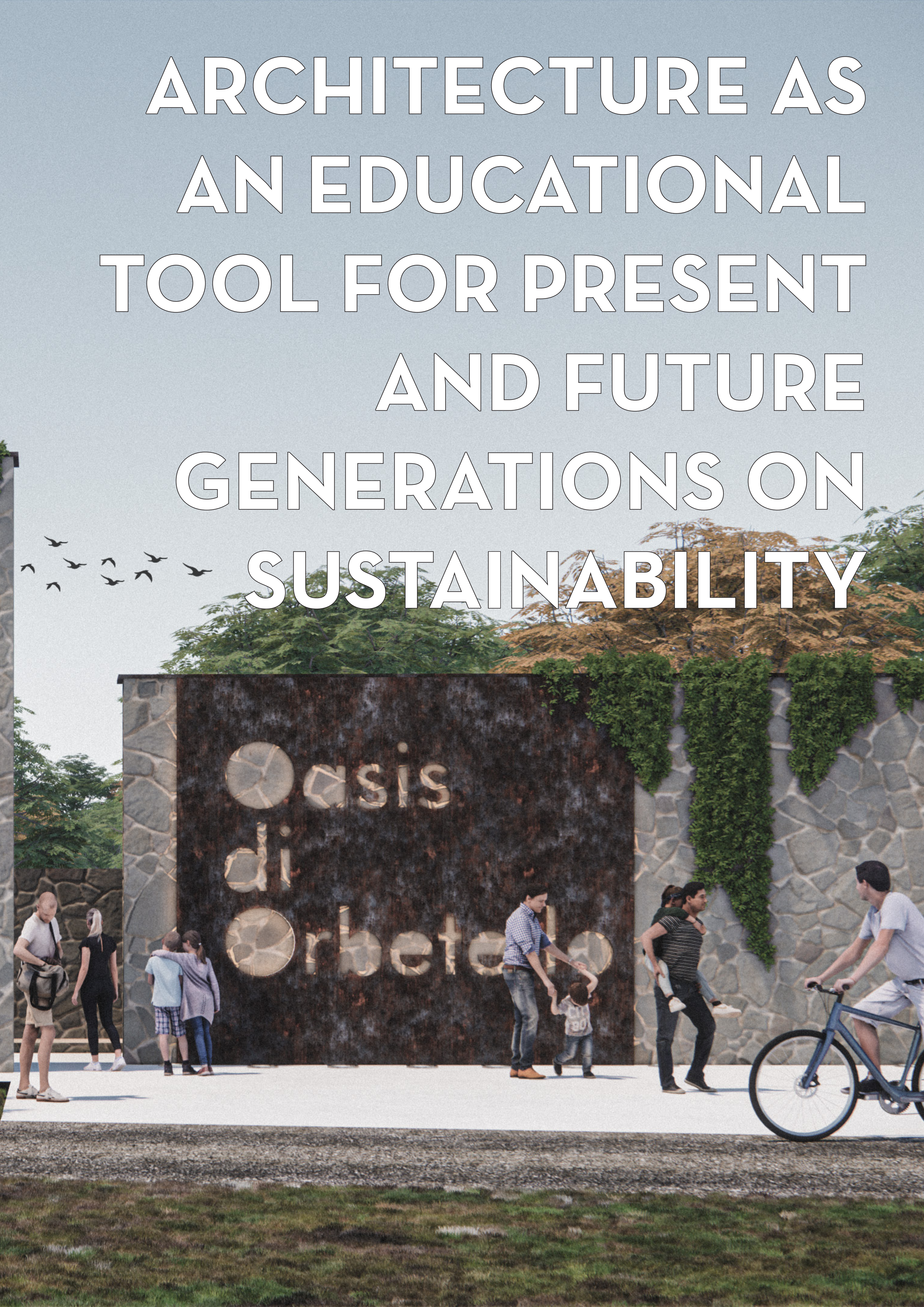
Among the many exhibits is an aquarium that joins the interior of the visitor center with the pond that has been advantageously exposed next to the building. The center has a closed, sheltering form, resulting in minimal energy consumption. A few strategically placed generous openings connect the building with its surroundings.

The bird-watching tower was inaugurated in 2009. The opening was overlooked by shovelers, gadwalls, teals, pintails and by an old white-tailed eagle. Next year they will most likely return for a preview of the visitor centre."



PART III

ARCHITECTURE AS AN EDUCATIONAL TOOL FOR PRESENT AND FUTURE GENERATIONS ON SUSTAINABILITY



6. THE OASIS DI ORBETELLO

After understanding the whole problem and what we can do about it as Architects and Users, here is my contribution to the community, architecture as and educational tool for sustainability through the design proposal of the WWF architectural competition for the Oasis di Orbetello in the Lagoon of Orbetello in Italy.

I have decided to participate in this competition because it presented itself to me as an excellent opportunity to my ideas of sustainability in practice in a real setting, giving me more of approachable perspective, instead of a more theoretical one if I had to find and think about my own program. Not only but was also an opportunity for me to internship and work in something that truly interested me for this thesis.

The way we approached this competition, something that we have discussed since the first day, is that we wanted to make not only the sustainability of the project very apparent and emphasized but also its practicality and ability to actually be constructed, instead of the typical aesthetically sculptural approach that a lot of architecture firms sell these days.

We wanted it to be clear that we perfectly understood the needs of the "client" in this case WWF and the needs of the User for such a building as these ones. It was imperative for us to truly understand who was going to use this to be able to design the best possible proposal.

I believe that the idea is always more important the aesthetic and we went into this competition with a clear goal in mind, to create a design proposal that could be used as an architectural educational tool for sustainability and that's what I am confident we did.

6.1 WWF competition – The program

The program outlined by WWF in this competition was fairly simple but with some diverse needs. Firstly, the competition location was in the natural reserve belonging to WWF in the Lagoon of Orbetello, Italy, also known as the Oasis di Orbetello.

This location is very important for a reason, each year thousands of migratory birds come to rest in their migratory travel to north or south


WWF
15th Mar 2021 - 09th Jun 2021
WWF
OBSERVATION
CABINS
15.000€


TOYOTA

of the planet, which means that there is a lot of biodiversity in this nature reserve. The Oasis is in what's called a "wetland" a sort of swamp, where a lot of fauna also comes to reproduce themselves, which means there is a lot of biological value in preserving the nature of this site. Therefore, it was of extreme importance to design a proposal that did not interfere too much with all this natural activity of the lagoon, something that was in harmony with its surroundings.

WWF then defined in their program three areas of intervention within the reserve all with different functions. In area A, located closer to the water coastline, is the place they defined to locate the observation cabins, for visitors of the reserve to be able to enjoy watching the animals without disturbing and scaring them.

They requested three types of what they called observation points: one at the ground level with a maximum capacity of 10 people, one floor and window openings at 1.6m of height; another at water level, to be able to observe near the water at the coastline of the wetlands, these point could be either fixed to the ground or be floating in the lagoon, they could be buried or above ground, had to be waterproof with window openings at a maximum of 30cm height and a maximum capacity of 5 people; and lastly a watchtower to have a more panoramic view, maximum two floors and 7 meters of eight, capacity of maximum 5 people per floor and again window openings at 1.6m of height. All these cabins should be able to be replicated in the future and could located anywhere along the coastline.

In regard to all the cabins there were some general requirements such as: the cabins did not need to be camouflage since according to the organizers, animals are not afraid of standing objects just moving people, so it was important to maintain the observers "invisible" to the animals; all the windows need to be able to open and close for security reasons; all the structures must have a roof; all construction must be of easy maintenance and have a harmony with the lake.

In area B and C would be located the visitors center, with a specifically defined location to be erected in the reserve, where the existing visitors center lay but that are to be demolished anyway. Area B would encompass the ticket office and reception desk to the whole Oasis, training center for current and future guides and caretakers of the reserve, a bookshop and an exhibition space. The C area would then be composed of a guest house and a restaurant.

Other general demands by the competition organizers were; the buildings had not limits in dimensions other that what was already defined; existing buildings in the reserve were to be demolished, the buildings in area B and C could only have a maximum height of 6 meters; There could be no excavations for any construction, which meant no basements; there was a possibility to propose an exterior space for the visitors center; accessibility to every person must be guaranteed; the functions on the visitors center must access from the outside.

After understating the bases of the competition I began with the process of investigation into the most important aspects and stakeholders of this competition, which for me were: WWF the organizer of the whole competition, understanding what do they stand for and what do they exactly do; the greater ecosystem of the Lagoon of orbetello where the reserve was a part of and the town of Orbetello and its history; and finally but most importantly understanding who the users of the Oasis are and what do they need, which is an audience that included birdwatchers, biologists and researchers, teachers and students, parents and children, campers, local guides and WWF staff.

Therefore, let's first understand what the purpose of the Oasis di Orbetello is, and quoting their own website:

"The WWF Oasis of Orbetello is the most important lagoon of the Tiyrrhenian sea.
Due to its geographical location the WWF Oasis of Orbetello sees the concentration of thousands of birds, especially in winter.
The WWF Oasis of Orbetello is the most important lagoon of the Tiyrrhenian sea. Here it is possible to see the common stilt that in 1964 inspired Fulco Pratesi and Hardy Reichelt's actions to create one of the first WWF protected areas. For WWF, Orbetello is a historical Oasis as well as one of its most famous and important protected areas.

About Orbetello Lagoon

Lagoon, Mediterranean maquis, coastal dune, meadows, pinewood... The Oasis of Orbetello is the perfect habitat for many species of birds.
A wetland of international importance (Ramsar Convention) the Oasis of Orbetello protects 300 hectares of salty lagoon where at times small silt islands covered with swamp vegetation emerge. The Tombolo della Giannella that runs along the coast is covered by a luxuriant Mediterranean maquis while inside the lagoon there is a large carpet of clasping leaved sea purslane. Further inland there are woods of aspen, cork oaks, ash

and elms. Southward is the Patanella Woodland characterized by a large extension of heather. Its extension is about 850 hectares.

Flora and Fauna

The Orbetello lagoon Oasis is characterised by three main habitats: Mediterranean maquis dominated by mastic, phillireas, myrtle and strawberry trees; dune vegetation including rushy wheat grass, othanthus maritimus, European beachgrass, medicago marina, sea hollyand sea daffodil; and by a lagoon area with a large carpet of clasping leaved sea purslane.

The conservation status and position along the migratory routes favors the concentration of thousands of birds, especially in winter, like flamingos, common stilts, great egrets, grey herons, ospreys, northern shovelers, Eurasian spoonbills, pied avocets etc. Furthermore, the Oasis of Orbetello is also the only breeding site of the common tern and little tern along the Tyrrhenian coast.

Exceptional is the presence of the rare tiger beetle Cicindela majalis. In addition to Orbetello the species is found exclusively in the Camargue (Rhone delta, France).

In the Orbetello nature reserve it is quite easy to spot tracks of several mammal species including the Red Fox, the Badger and the Porcupine.
Visiting the Laguna di Orbetello nature reserve
The Oasis of Orbetello includes three itineraries:

- *The first trail is a birdwatching path. It is accessible from September to April either independently or with a tour guide; along this path are 9 hideouts for birdwatching. The path is about 1.2 km long.*

- *The second trail leads into Patanella Woods. The path includes some observation points and is about 1km long. Accessible all year long through advance booking (guided tours available).*

- *The third path is a hiking trail that connects the visitor center (Ceriolo) to Patanella woodland: the path is about 3 km and crosses various habitats. Accessible year-round by booking a guided tour.*

There is also a small nature trail next to the Giannella farmhouse where it is possible to see an exhibition on wetlands and the butterfly garden.
Paths are equipped with information boards that provide information on

the oasis and species identification guidelines.
Orbetello Oasis is managed by WWF Italy in collaboration with the Italian Ministry for the Environment; part of the area is owned by WWF Italy.

Facilities

The Giannella farmhouse hosts the Environmental Education Centre (Centro di Educazione Ambientale – CEA) "Aurelio Peccei" with a conference room, classrooms, educational laboratories and theme-based shows.
At the CEA "green weeks" or permanent activities for school groups are organized. Moreover, during the months of June, July and August summer camps or holidays for both youngsters and families take place.

At the Giannella farmhouse there are guest rooms for about 60 people giving school groups the opportunities to participate in different activities.
Part of the energy used by the buildings derives from photovoltaic panels.
During summer the guest rooms hosts summer camps and "green weeks".
The guest room service is active for groups on reservation or in conjunction with special events organized by the Oasis.

History of Laguna di Orbetello Oasis

From the discovery of the nesting common stilts to the extension of the Oasis with the aid of partners and private donations:
In 1965 Fulco Pratesi and Hardy Reichelt discovered that the rare common stilt was nesting again in the Orbetello Lagoon and launched a campaign to save the species;

In 1971 the Department for Environment, Food, and Rural Affairs created the protected area;

In 1977 the area was designated a wetland of international importance according to the Ramsar convention.

In 1980 the presence of more than 10.000 wintering ducks led to the creation of a State Nature Reserve;

In 1988 Orbetello lagoon became a provincial nature reserve;
In the meantime, WWF acquired Patanella woodland and later a small pond with a semi-arid meadow;

In 2000 a forest campaign led to the acquisition of a further 100 hectares"

And what is exactly the WWF, or the World Wildlife Fund, really about and again according to their website:

"The mission of the World Wildlife Fund is to conserve nature and reduce the most pressing threats to the diversity of life on Earth. Our vision is to build a future in which people live in harmony with nature.

We seek to save a planet, a world of life. Reconciling the needs of human beings and the needs of others that share the Earth, we seek to practice conservation that is humane in the broadest sense. We seek to instill in people everywhere a discriminating, yet unabashed, reverence for nature and to balance that reverence with a profound belief in human possibilities. From the smallest community to the largest multinational organization, we seek to inspire others who can advance the cause of conservation.

We seek to be the voice for those creatures who have no voice. We speak for their future. We seek to apply the wealth of our talents, knowledge, and passion to making the world wealthier in life, in spirit, and in living wonders of nature."

And finally it's important to understand the people will actually be the Users of this architectural project, which are: birdwatchers, biologists and researchers, teachers and students, parents and children, campers, local guides and WWF staff; Out of this group of people the ones I understood the least were the birdwatchers, so it was extremely important to me to research a little bit what they are about, and here is the main idea, according to Wikipedia:

"Birdwatching, or birding, is a form of wildlife observation in which the observation of birds is a recreational activity or citizen science. It can be done with the naked eye, through a visual enhancement device like binoculars and telescopes, by listening for bird sounds, or by watching public webcams.

Birdwatching often involves a significant auditory component, as many bird species are more easily detected and identified by ear than by eye. Most birdwatchers pursue this activity for recreational or social reasons, unlike ornithologists, who engage in the study of birds using formal scientific methods.

Birding, birdwatching, and twitching

The first recorded use of the term birdwatcher was in 1891; bird was *introduced as a verb in 1918. The term birding was also used for the practice of fowling or hunting with firearms as in Shakespeare's The Merry Wives of Windsor (1602): "She laments sir... her husband goes this morning a-birding." The terms birding and birdwatching are today used by some interchangeably, although some participants prefer birding, partly because it includes the auditory aspects of enjoying birds.*

In North America, many birders differentiate themselves from birdwatchers, and the term birder is unfamiliar to most lay people. At the most basic level, the distinction is perceived as one of dedication or intensity, though this is a subjective differentiation.

Generally, self-described birders perceive themselves to be more versed in minutiae like identification (aural and visual), molt, distribution, migration timing, and habitat usage. Whereas these dedicated birders may often travel specifically in search of birds, birdwatchers have been described by some enthusiasts as having a more limited scope, perhaps not venturing far from their own yards or local parks to view birds. Indeed, in 1969 a Birding Glossary appeared in Birding magazine which gave the following definitions:

Birder. The acceptable term used to describe the person who seriously pursues the hobby of birding. May be professional or amateur.

Birding. A hobby in which individuals enjoy the challenge of bird study, listing, or other general activities involving bird life.

Birdwatcher. A rather ambiguous term used to describe the person who watches birds for any reason at all and should not be used to refer to the serious birder."

After all this investigation, I made a list of the most important needs of all of the potential User groups of this Oasis, which I called the public needs:

Birdwatchers/scientists

Ability to spend a long time in the oasis, usually a few months, in terms of hospitality they don't need much other food and a place to sleep and shower and to store all of their birding equipment such as cameras and recorders, a lot of observation places with good accessibility, since some of them usually come in a rush to see a rare animal, these people also do a lot of trips around to world and go to specific places at specific times of the year to see specific animals, so it's possible they don't stay long

Schools

For the schools is important to have a safe and controlled environment for the children to learn, they need large places to put many kids, they need a place to park a big bus, enough space to feed the kids if they are to spend an entire day there, a place where children can play more freely without going too far and get lost.

Families

They need good accessibility to the oasis, either by car, bike or bus. They also need a place for their children to play and explore freely, and of course they should have a place to eat as well. They usually need a place to come to relax on the weekend and if their kids also learn along the way it's a win-win situation.

Campers

They need a place to sleep and to eat, it could be a place to put up tents or just some rooms.

Local guides

They need a place to be trained and train other people, to be able to change into outdoor prepared clothes, a place to shower and relax after a long hike.

WWF staff

They need a place to sleep and to eat, to store preservation and maintenance equipment, a place to train future staff and guides, a place for WWF events.

6.2 Design strategies, goals and decisions

After understanding the entire context and research of the competition, I drafted a first idea of what our mission with this proposal should be and it goes as follows:

"In a few decades, hopefully, society will look back at these significant moments in history as the turning point in our fight to preserve the beautiful spaceship we all live on. This is the moment to do our part, to use our resources in the best way we can, to preserve the nature that is so important for life as we know it to survive.

And what better way to do so then by showing to the world what mother nature is capable of, by teaching the younger generations the importance of preserving nature and by convincing older generations that the turning point is still possible to achieve if we all work together for that goal.

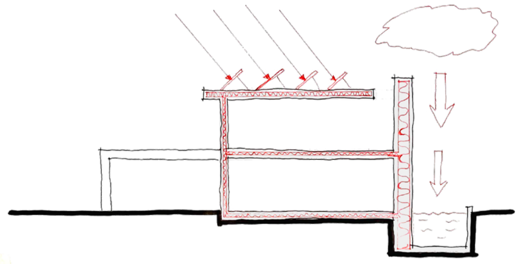
With this project we want to do just that, provide an educational opportunity for children to start having a care for the planet and to show the wonders of Orbetello to people who may not live long enough to see the potential climate disaster but that can still have a positive impact in the fight against such events.

The architecture should then reflect this idea, this need for change of the status quo, a change that can be manifested through more sustainable construction technologies that are appropriate for each location, by design in a way that consumes less resources in terms of electricity and heating, but never forgetting the comfort of the nature and people that will use it every day to teach and to learn. The architecture should not intrude on nature but compliment it, adding a new value to the whole system.

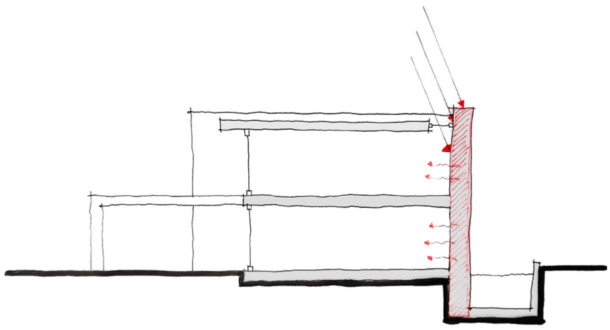
The mission of this project is to give hope for a better future for all of us."

From the very beginning I understood that the biggest potential of our proposal was to be an educational tool, and to achieve that it was crucial to understand the best possible solution for the whole reserve, hence I also thought of a concept for the entire reserve that would connect everything together.

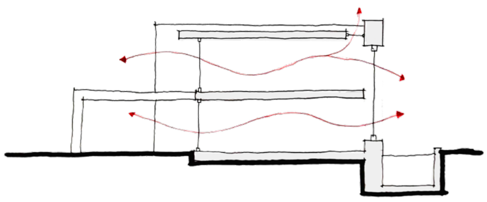
Photovoltaic Panels
Rainwater collection
Proper thermal envelope



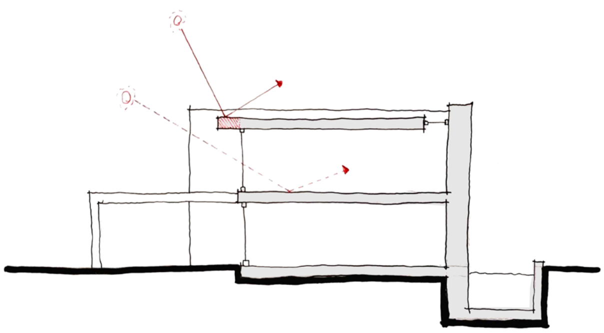
Stone wall as thermal mass



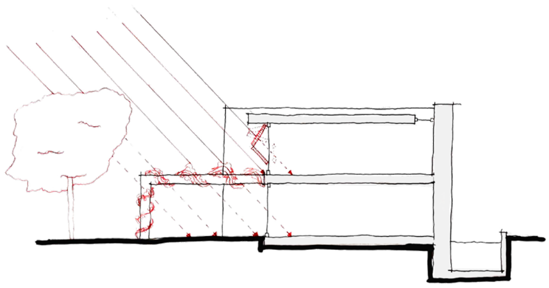
Natural ventilation

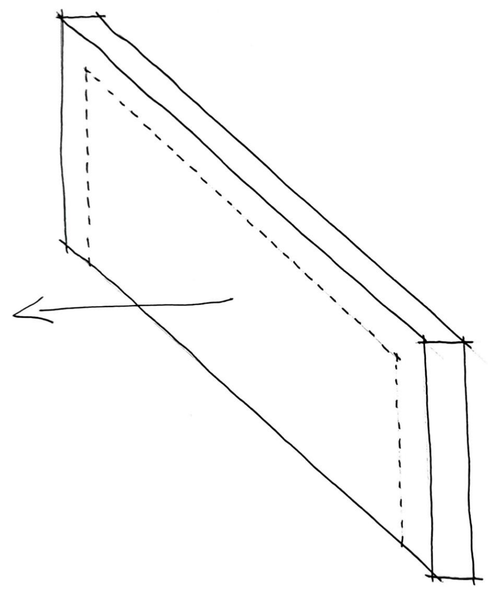


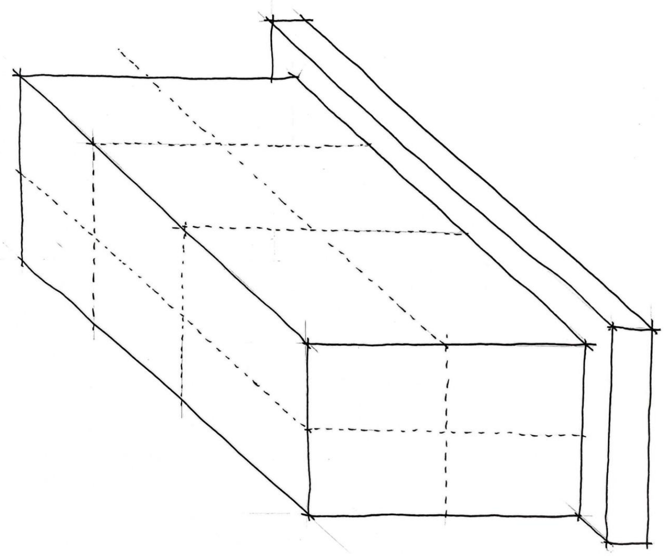
Overhangs to provide shade

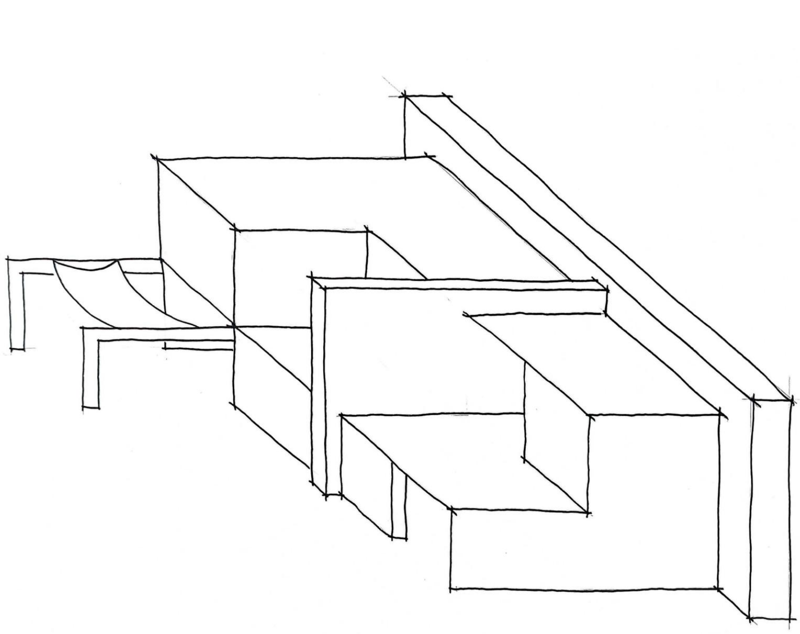


Mechanical and vegetation shading









The concept works in three phases, from “louder” to more “silent”. The first area is called **Nature’s Piazza**, where people first arrive at the oasis will be a more active area, as the visitors center will have a lot of functions and act sort of the downtown of the oasis, the near outdoor areas will be flexible to have picnics, shows, events, school days and summer camps and a general nice park for families to enjoy the free time.

In a second phase, the idea is to have a transition from a more intense human activity to a quieter one so nature can be at peace and show itself, this area as the intent to be an exploration area where you can get lost, in a good way, one that you can learn new things, a so-called **Exploration Labyrinth**.

To finish you arrive at the “gold pot”, one where you must be **Hidden In Plain Sight** to observe the majestic life of the local fauna, where the observation points are not completely hidden but where humans must be mostly hidden to not frighten the animals.

This transitional concept was key then to the design strategies I decided to implement on the buildings and observation cabins, always a transition from human to nature. The whole idea revolves around harmony with nature, how can we humans live with more respect with the world around us, having less impact while living a purposeful live.

My long-term vision for this proposal is that I believe the oasis of Orbetello should be an example on how to preserve nature and how to educate people to do the same every day. In a first phase of its life, it would be more focused on the observation of nature, the most essential part of the oasis, on a concurring posterior phase of its life it should gradually become a place of learning for all people, to be able to see things they wouldn’t normally see in their daily lives, making it as accessible as possible.

And in the longest term, after humans have passed these lands, the architecture should not stop nature from running its course, making sure it can thrive without any help or intervention from humans, and the architecture is crucial is this part to not leave a lasting destructive mark.

We imagine a place that will not only be used to observe nature but will also have the possibility to host events such as educational or scientific, or just recreational such as concerts or shows, a sort of “nature’s piazza”. The architecture should eventually get lost in nature and not the other way around.

Subsequently, I proposed to myself a few goals for our proposal such as:

- An architectural composition that not only fits and belongs in the context but also provides an additional intangible value;

- Utilize building technology that is more sustainable than the traditional;

- Enable guests to appreciate and value nature more to inspire them to become more active in preserving it;

- Design a building that will be able to stand the test of time and that has low maintenance, a passive building;

- Simple, clean and elegant yet cozy;

- Balance between public and private areas;

- Functionality for the whole year, not just summer.

Essentially, the keywords to keep in mind for my proposal were: Curiosity, Learning, Discovery, Fun, Health, Nature, Ecosystem, Labyrinth, Exploration, Peace, Sustainable, Silent, Singing, Flexibility, Trail, Path, Embracing, Open, Connection, Inspiring, Ignorance, Knowledge, Ingenuity, Hidden, Consciousness, Earthship, Hope.

Let me then explain each part of the project in more detail and each design decision for the competition, starting with area B where the visitor center was located, and for me and this thesis the most important part of the project.

In this area, to remind you, it was requested to have the following functions: ticket office/reception desk; training center; exhibition space; bookshop. This means that it was important to design an intuitive composition of these spaces, since this was most locally the are to have the most human activity, since it was the official entrance to the natural reserve of the Lagoon of Orbetello.

With this mind, from the very first moment, I decided that the visitor center, the place I called Nature's Piazza, would be divide into three parts, that wound up to be three different volumes, going from the most public to the least, first obviously, the ticket office and the entrance to the whole site, secondly the exhibition space and bookshop and lastly the training center.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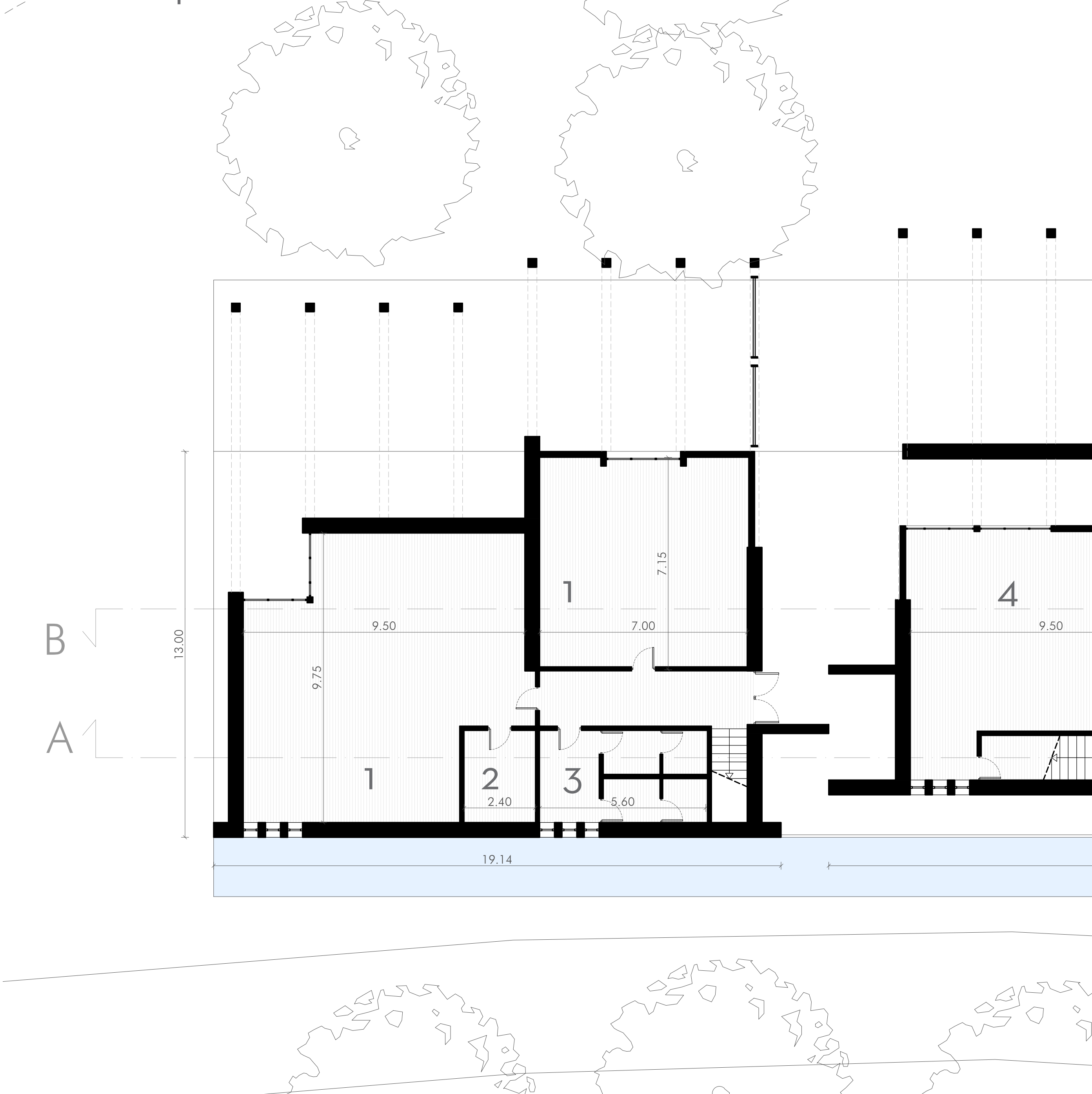
Legenda:
1.Training Center
2.Visitor Center
3.Ticket Office
4.Nature's Piazza
5.Restaurant
6.Guest House
7.Exploration Labyrinth
8.Earth Observation Point
9.Water Observation Point
10. Air Observation Point
General Masterplan
Scale: 1:500

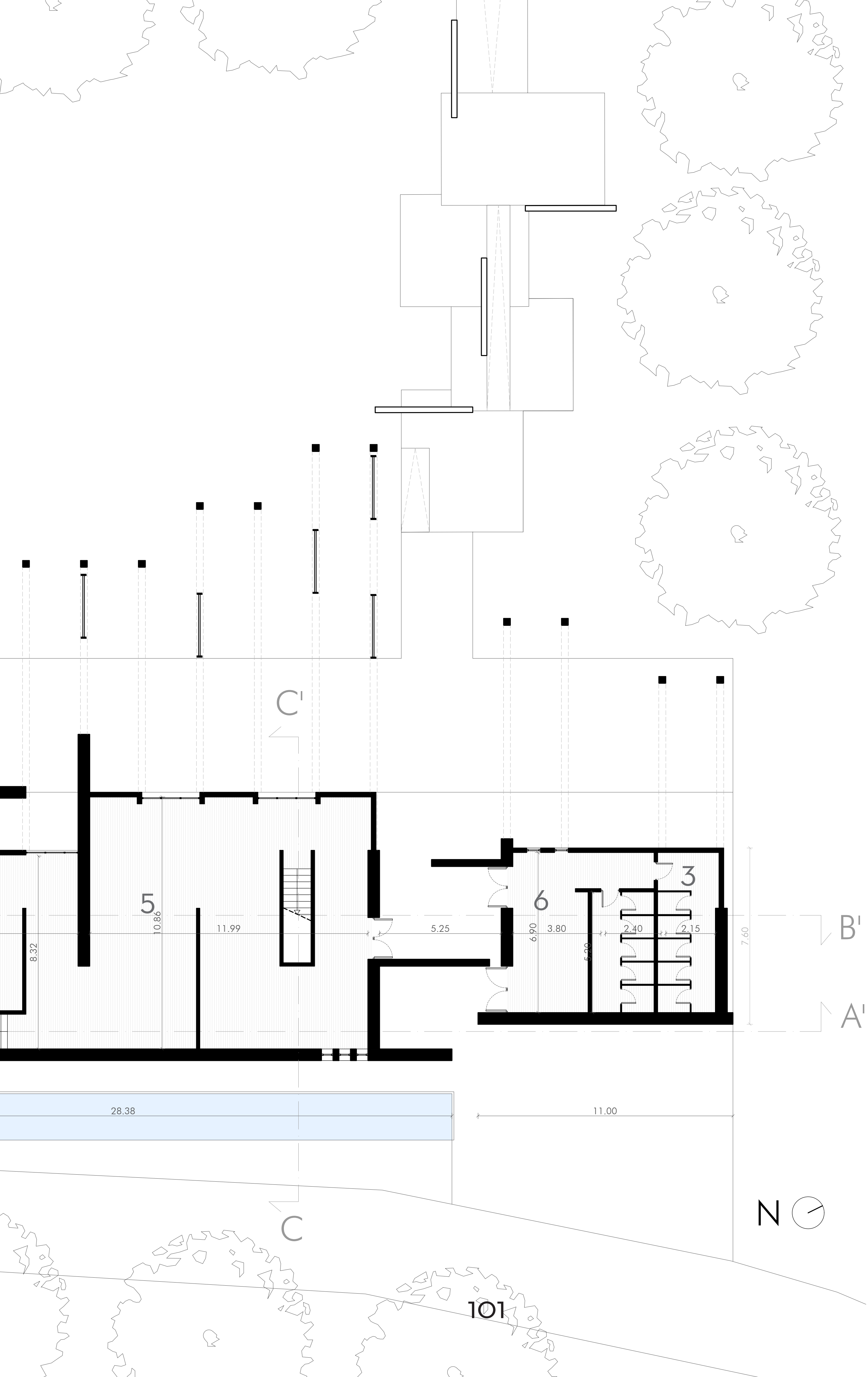
Observation Points Masterplan

Visitor Centre Ground floor plan 1:200

Legend:

1. Training Room
2. Storage Room
3. Toilet
4. Bookshop
5. Exhibition Space
6. Reception Desk





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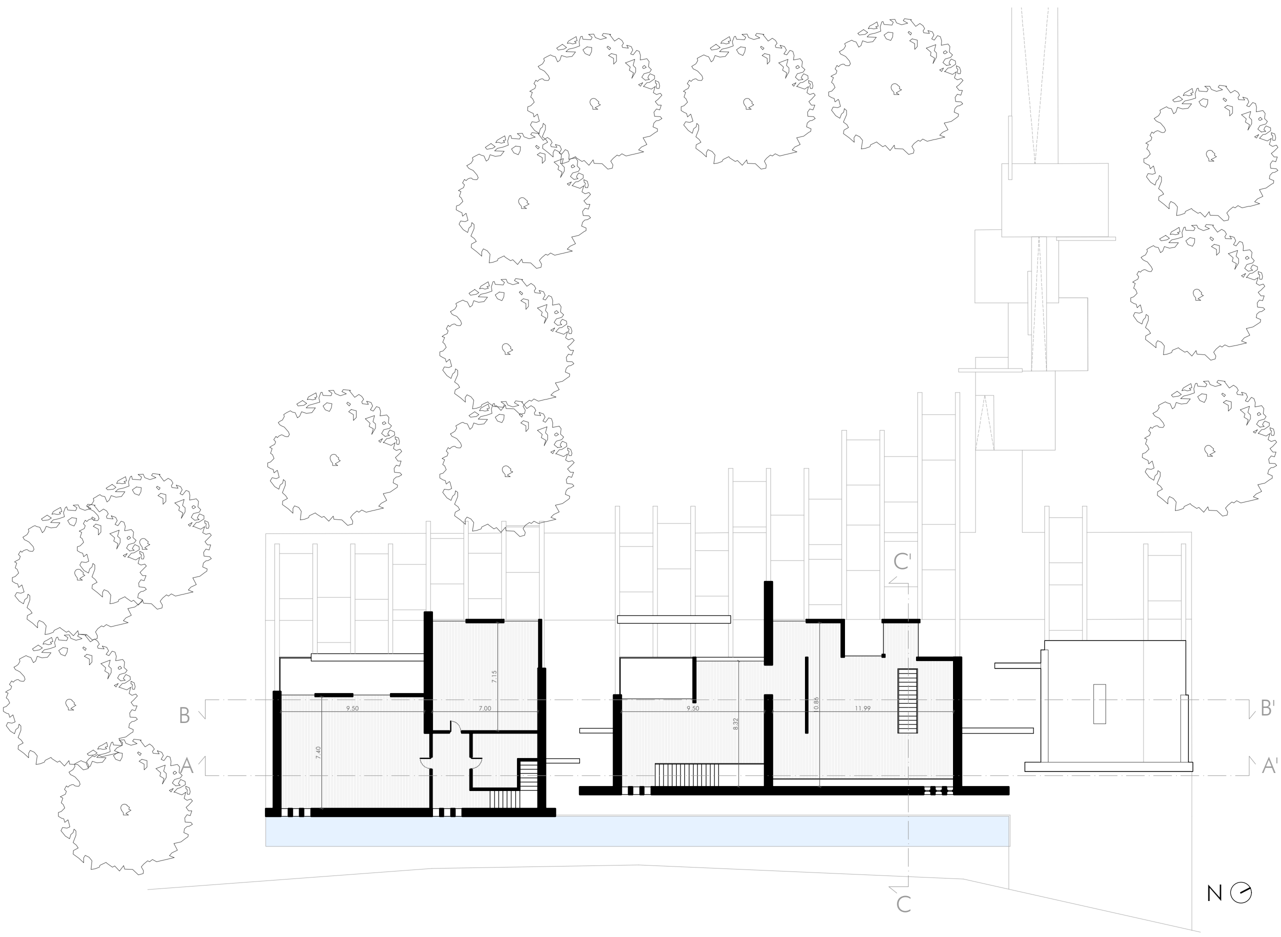
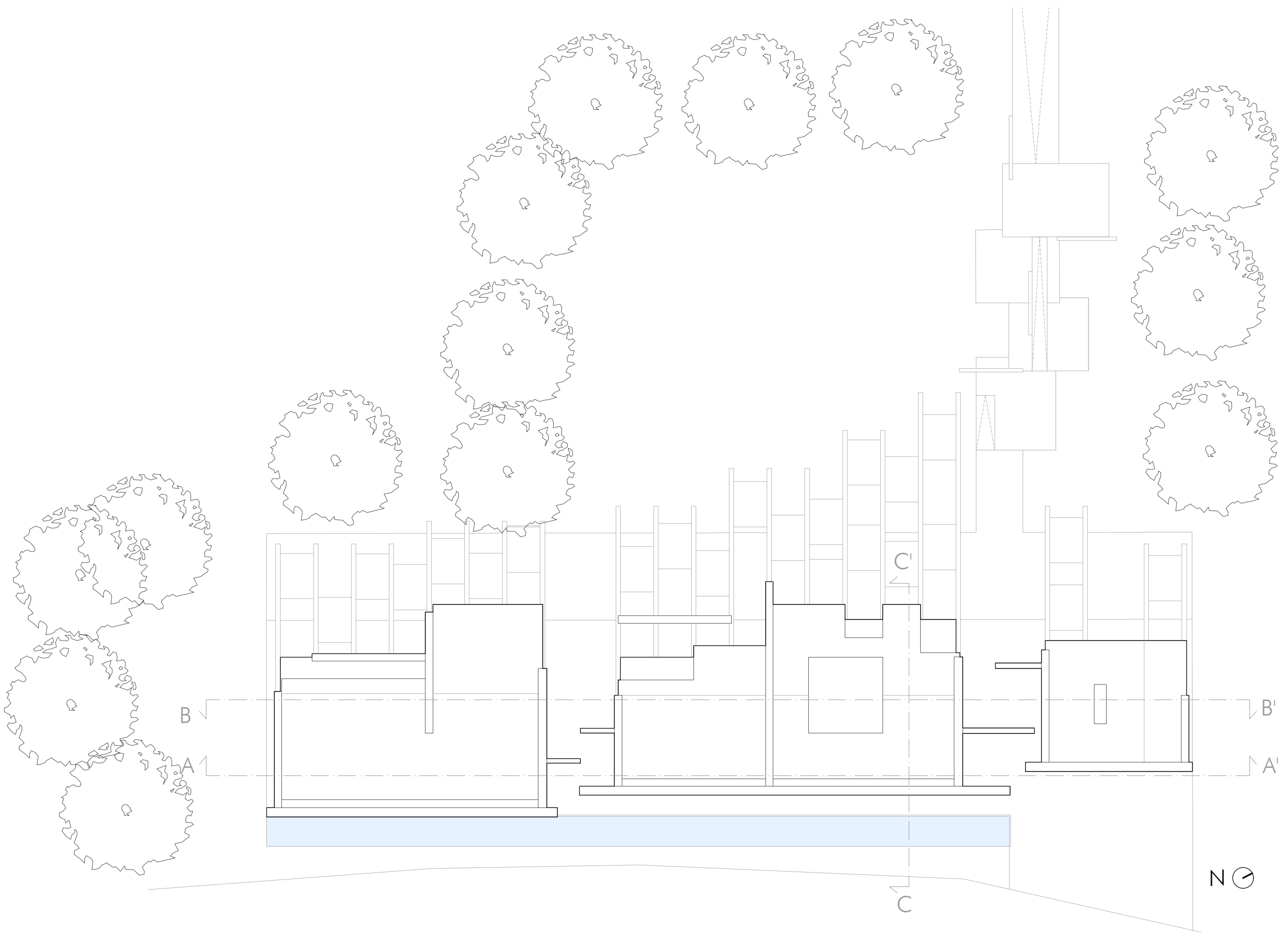
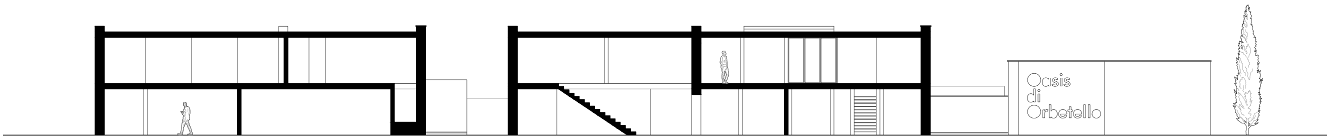
First floor plan 1:500



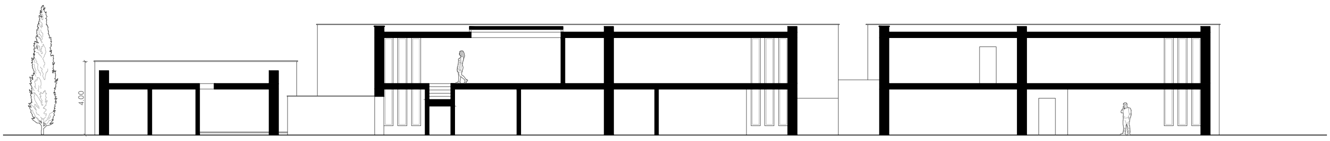
Roof plan 1:500



Visitor Centre



Section AA' 1:200



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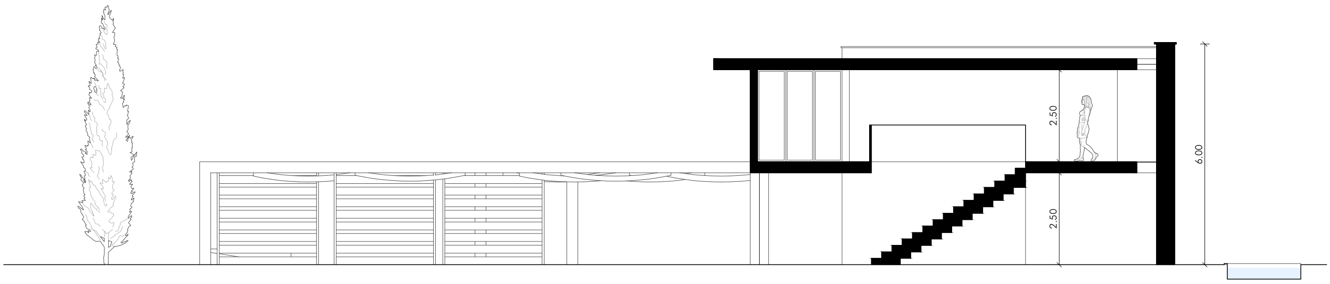
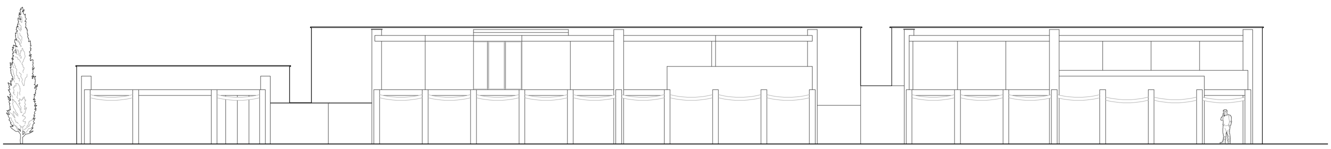
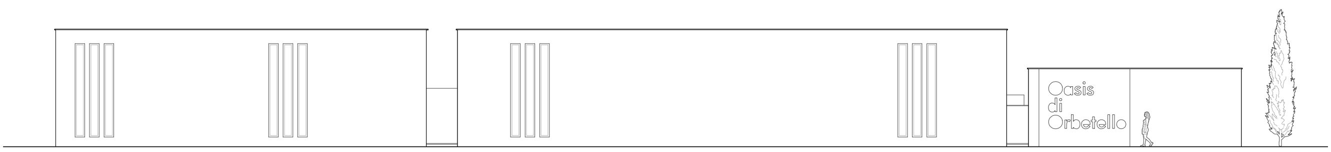


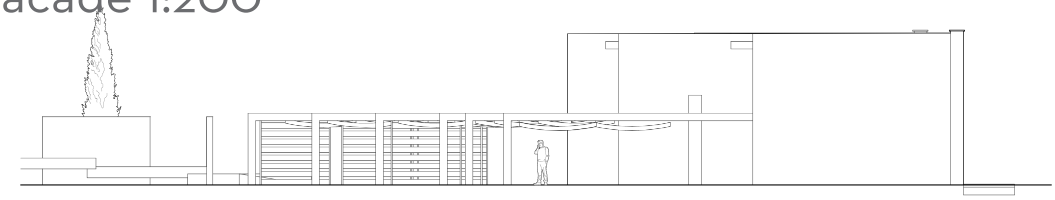
Section CC' 1:100



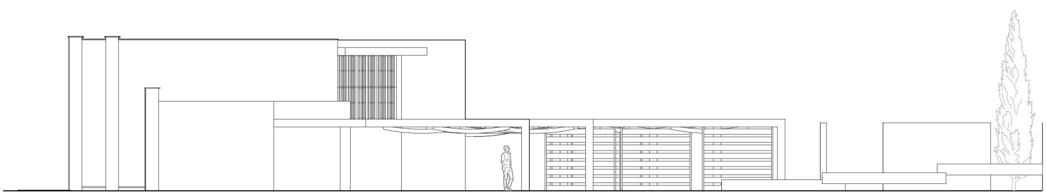
West Facade 1:200



East Facade 1:200

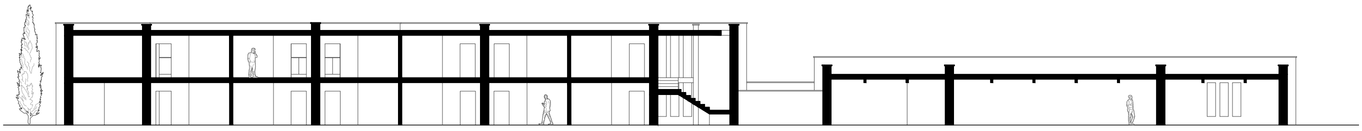


South Facade 1:200



North Facade 1:200

Guesthouse + Restaurant



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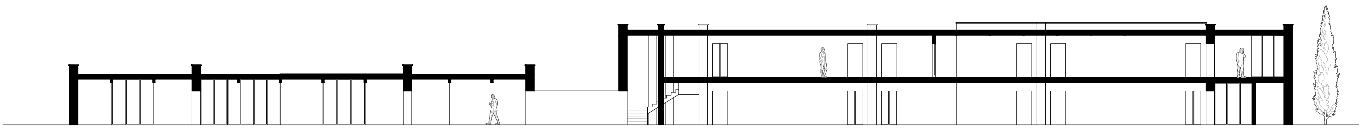

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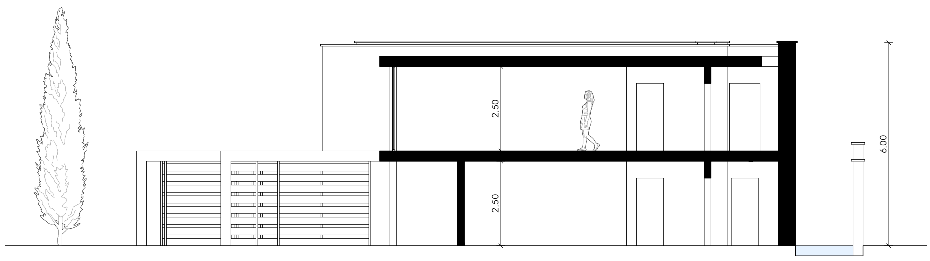

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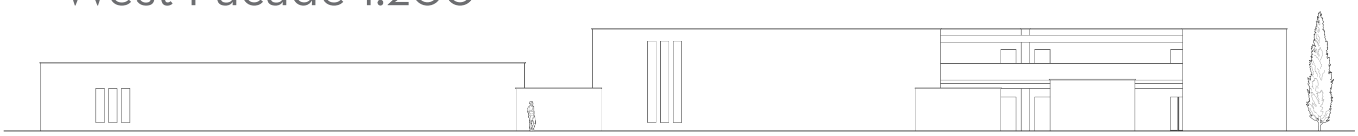
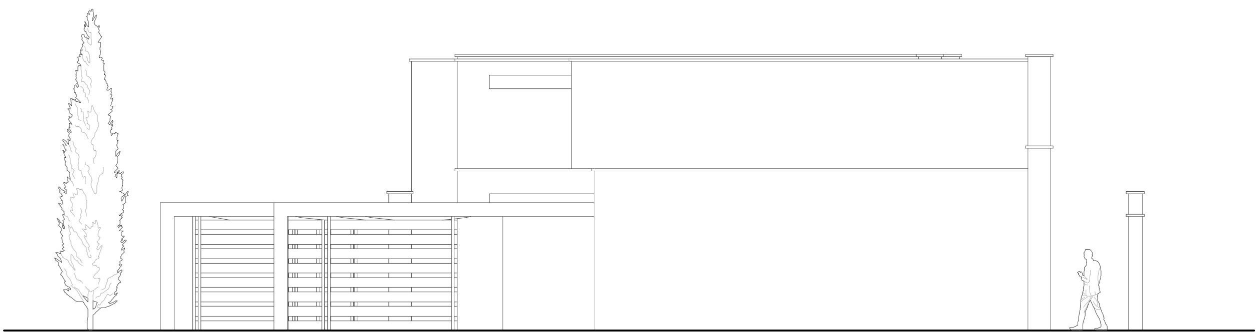
West Facade 1:200



East Facade 1:200



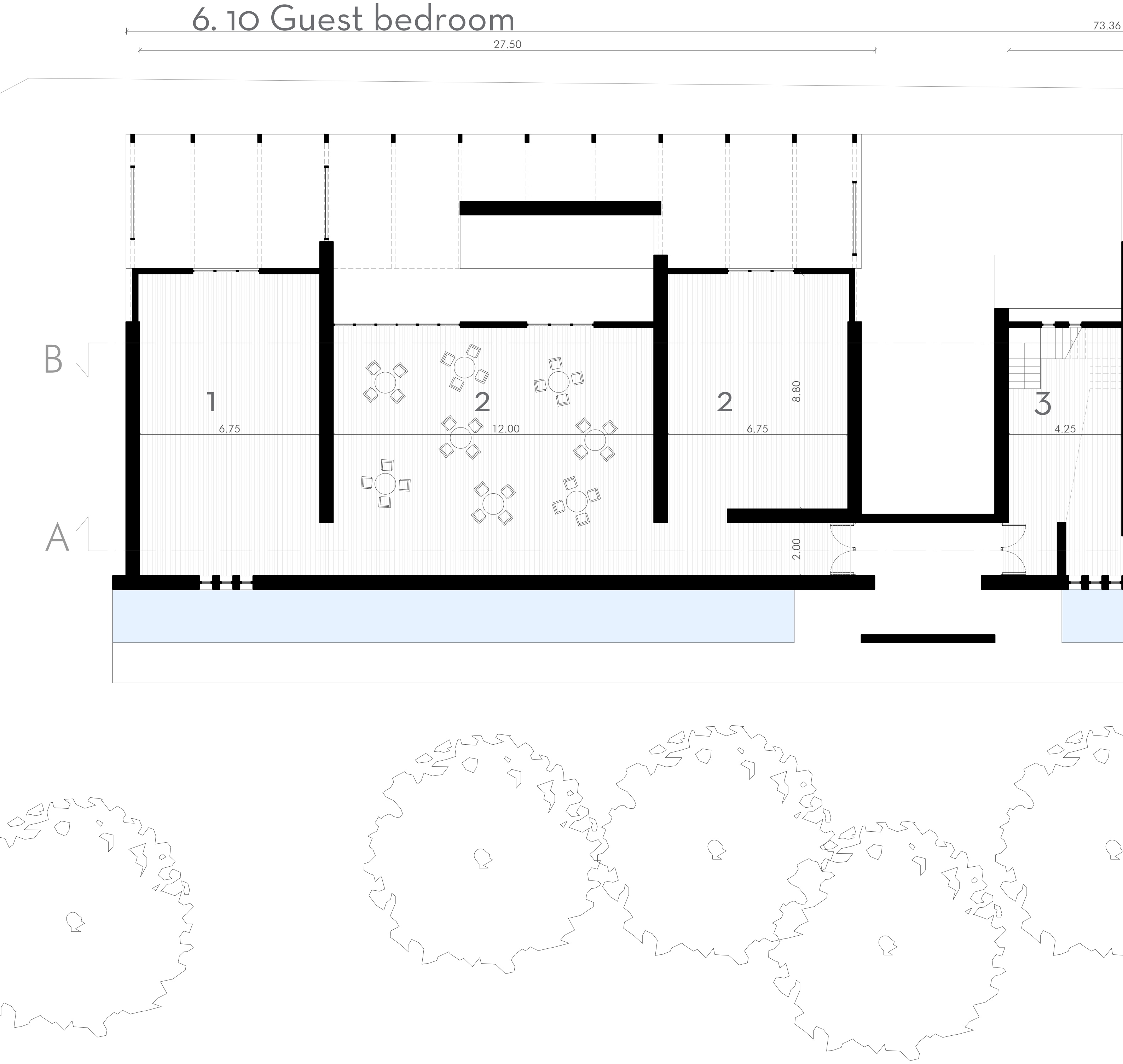
South Facade 1:200

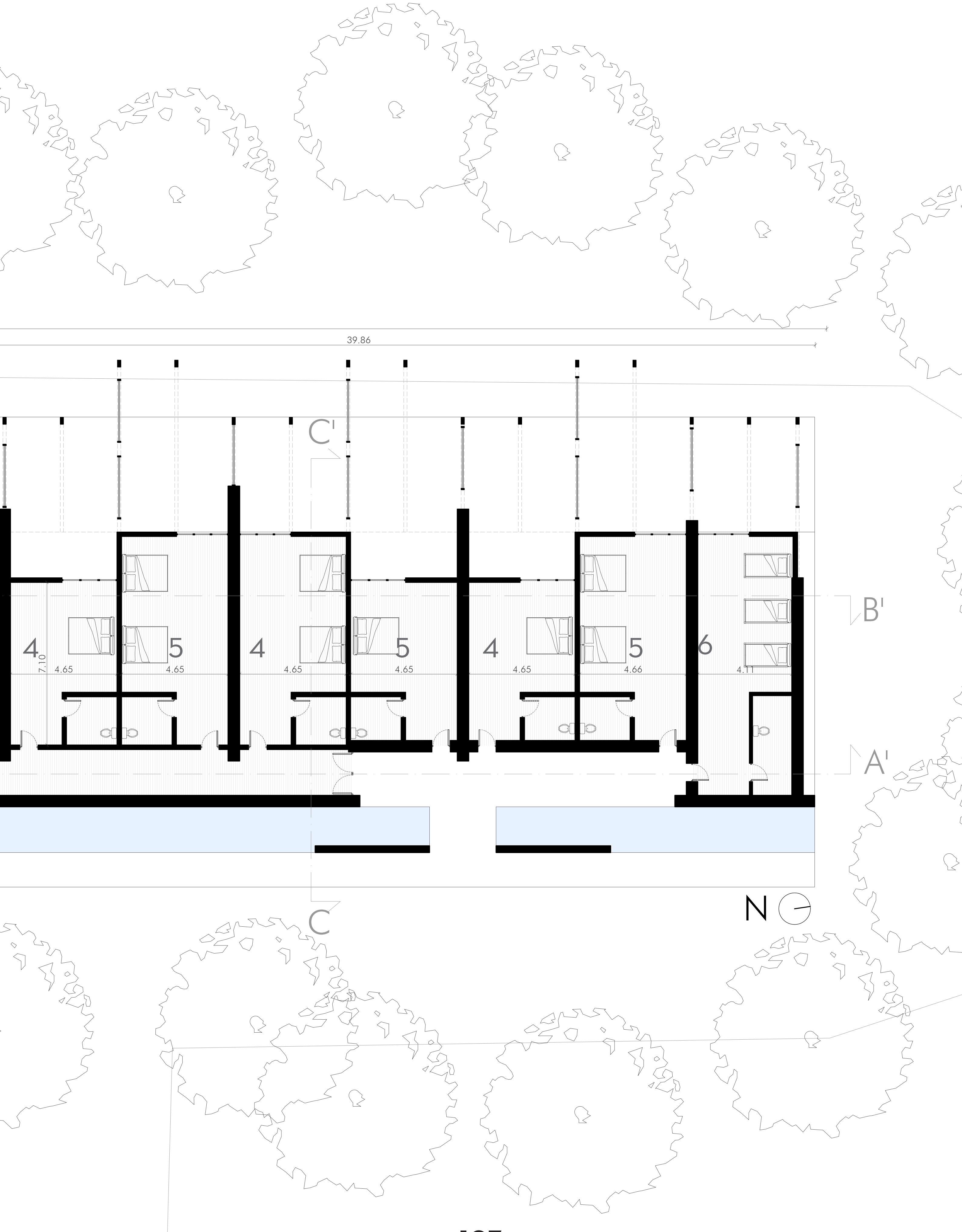
Guesthouse + Restarurant Ground floor plan

1:200

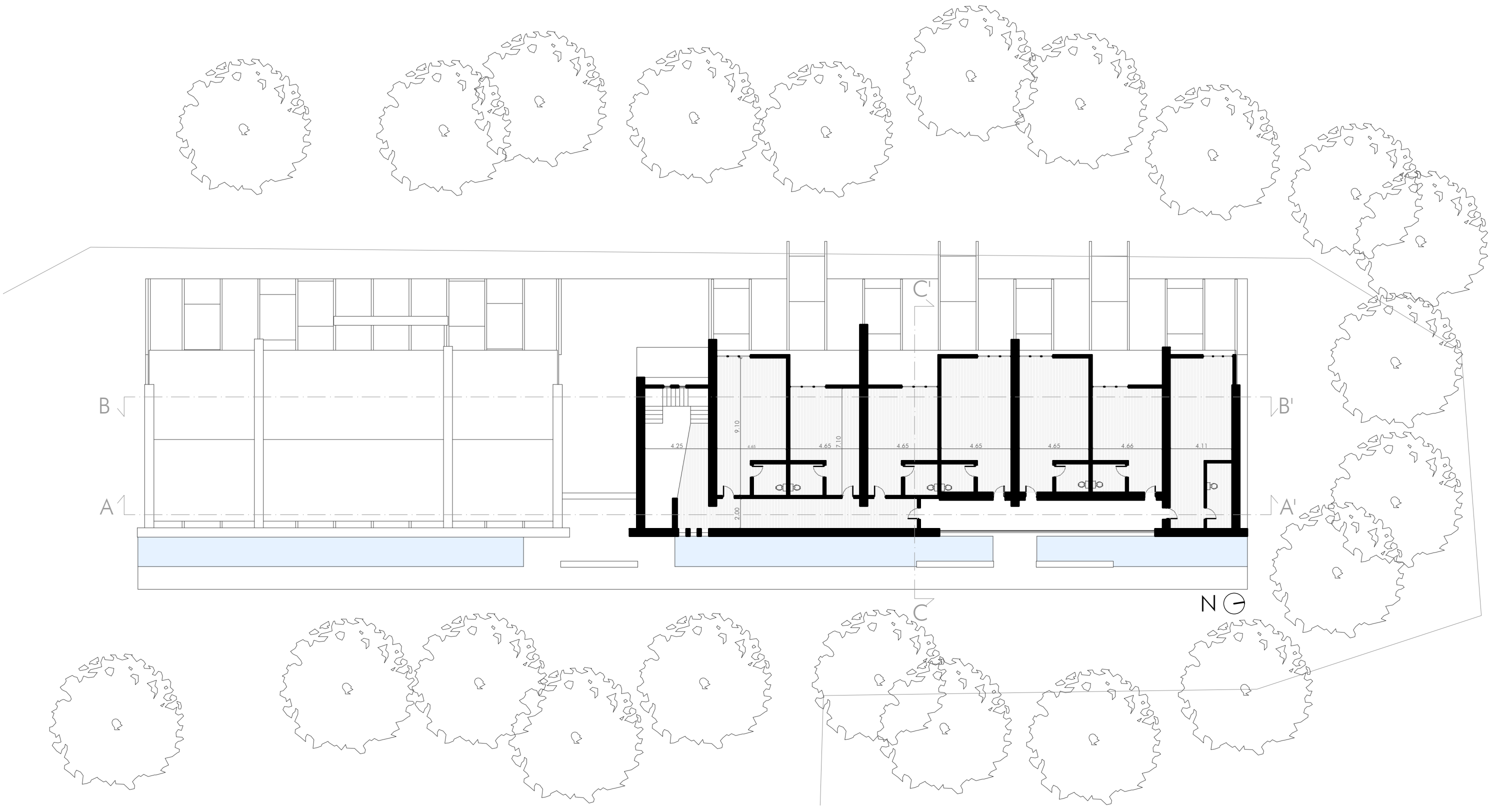
Legend:

1. Kitchen
2. Dining Room
3. Reception desk
4. 2 Guest bedroom
5. 4 Guest bedroom
6. 10 Guest bedroom

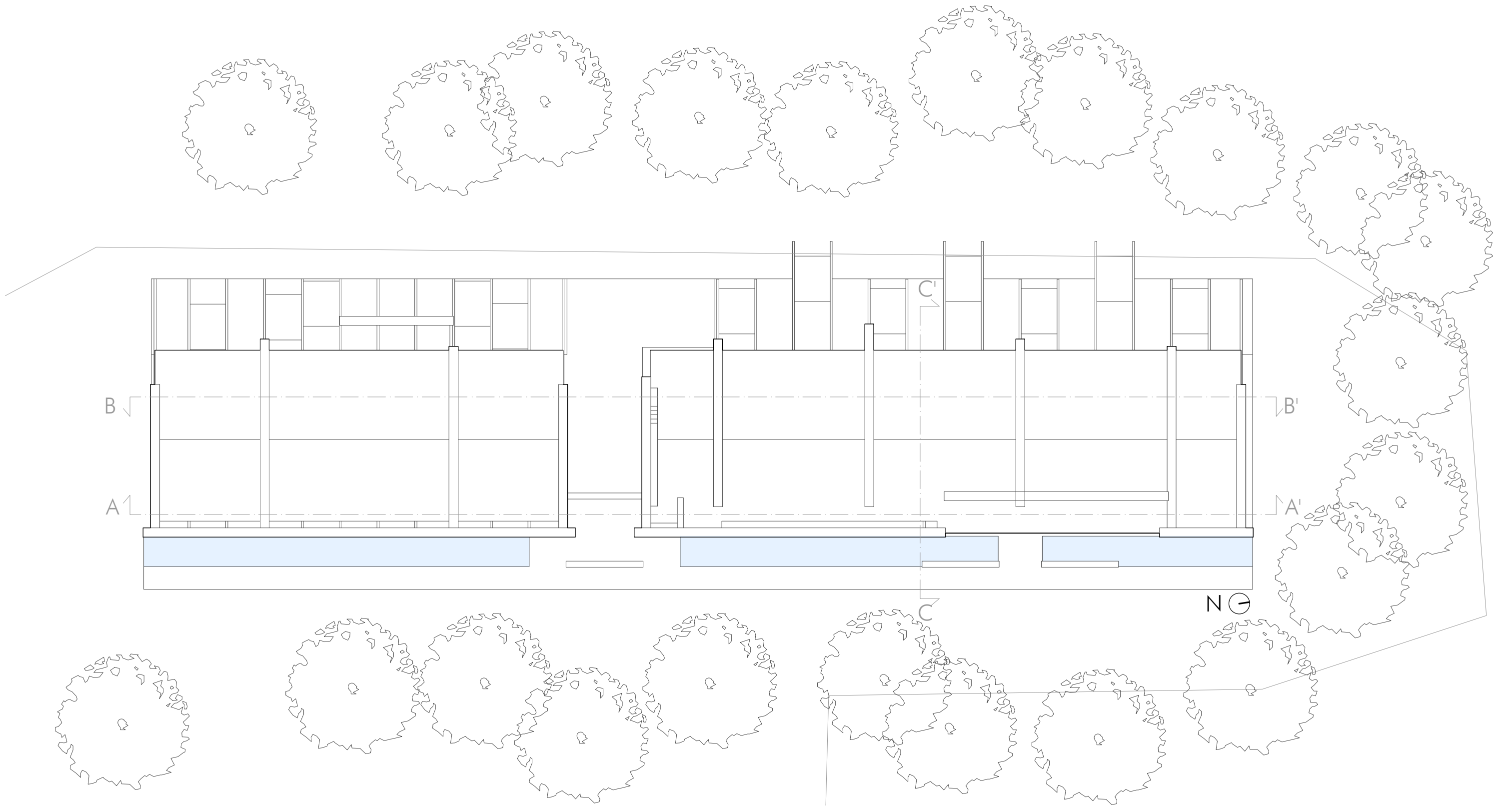



39.86
C'
B'
A'
C
4
5
6
7.10
4.65
4.66
4.11
N

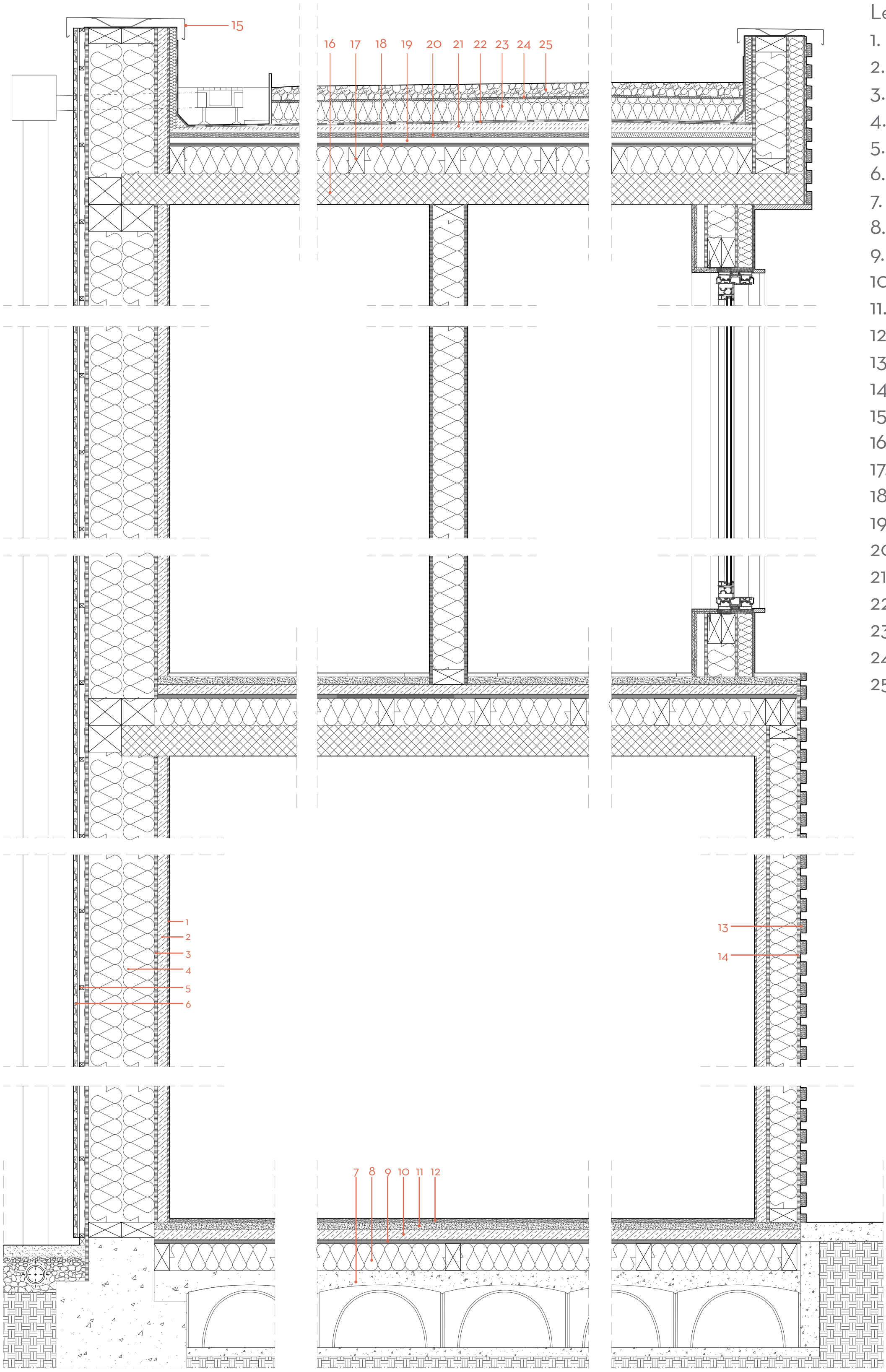
First floor plan 1:500



Roof plan 1:500

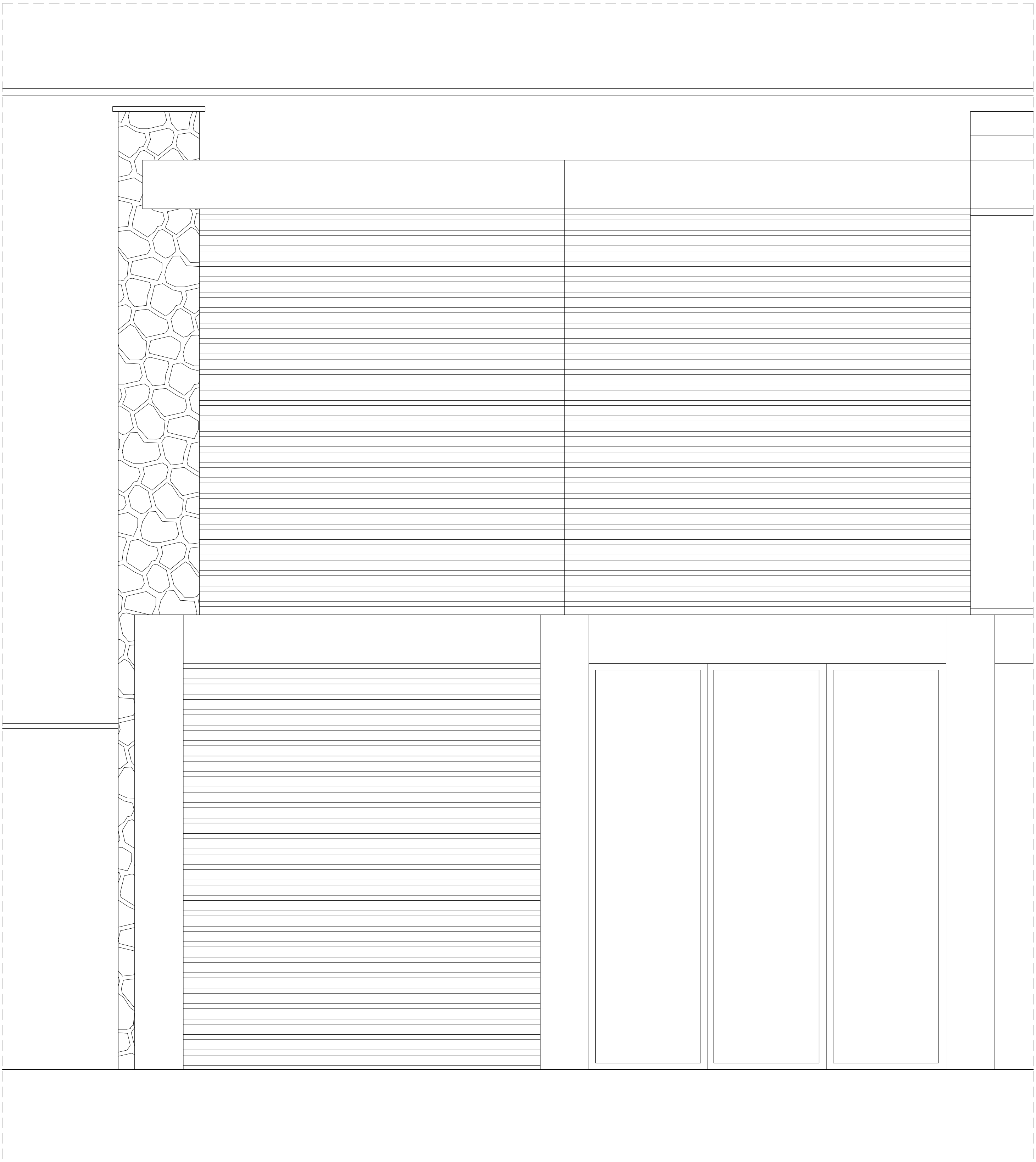


Detail ground to roof section 1:20



Legend:
1. Drywall 12.5mm
2. Wood wool 50mm
3. OSB Board 18mm
4. Cellulose insulation 340mm
5. Aluminum struc./ventilated
6. Tuscan stone finish 60mm
7. Concrete foundation 400mm
8. Cellulose insulation 140mm
9. OSB Board 20mm
10. Wood wool 50mm
11. Foam pad 40mm
12. Hard wood flooring 20mm
13. Wood siding finish
14. UV protection sheath
15. Corten steel protection 50mm
16. Laminated wood panels XLAM 160mm
17. Vapor barrier
18. OSB Board 20mm
19. Strips for slope creation 50mm
20. Wood board 24mm
21. Wood wool 20mm
22. PVC sheet
23. Cellulose insulation 110mm
24. Geo-textile 10mm
25. Gravel

Detail correspodent facade 1:20




Oasis
di
Orbetello
WWF


Oasis
di

The whole composition would then follow an idea of a path through the building, keeping in line with the idea of the exploration labyrinth, where you could get a bit lost within building but always finding something new to explore, hence forth the entire composition of the building assimilates the idea of a labyrinth, both from the outside when you arrive at the Oasis and in the interior of the exhibition space mostly.

The idea is that the building itself makes a transition from the urbanity of human life to the peace of natural life, from one side looking very cold and metropolitan but as soon as you get in you feel the coziness of nature, and this is also reflected in the material choices for this building, in the more urban side it seems as if the building is a stone labyrinth, stone that is the typical of the region, the Tuscan stone, and on the other side the wood gives the coziness and resemblance to nature, making even more apparent the transition between the two states.

So, from one side the building almost completely closes itself to urbanity with only a few openings for strategic ventilation and light, while on the other side, with big window openings, is more open to nature and to the Nature's piazza, an outdoor space designed to have events, families on the weekends, picnics and meals, and all sort of public nature activities.

This outdoor space also serves as a transition to the Exploration labyrinth and the cabins in the reserve, by having long pergolas made of wood that would help with controlling sunlight in the building, with the possibility to have vegetation on top of them to help with natural shading of the building, helping the passive design strategy, to regulate better the temperature inside during the summer months.

Inside the building, the exhibition space is design in a way to be a circular maze, so that it seems you may get lost, but you are always exploring and learning in the process and you will always get back to the start.

Located very close to area B is area C, where the restaurant and guest house are the main components, in this case they follow a very similar compositional design but with a less emphasis on the labyrinth idea since the functions demand a slightly different layout composition.

Both, however, share the same concept of the stone walls facing the urban side and the wooden "boxes" facing the natures side, in this this case the guest has a bit of an opening on the stone wall to break a little bit the intensity of that wall, making it a bit more balanced. As in the visitor center the stone walls have some green vegetation going on them to show how nature is the one in charge here. The restaurant has two main dining rooms and a kitchen, of the two rooms one is bigger and the other one can be used for special events with a bit more privacy, and of course both have big window opening to the outside, where the same pergolas as the visitor center exist for the same design reasons and for outdoor dining.

The restaurant is in a separate volume from the guest house, to provide some independent to both, and create more privacy for the guesthouse, but connected since they have the entrance point very close together.

The guest house as a total of fourteen guest rooms in three different types, in an almost symmetrical organization of the layout. The first type allows for 2 people inside, the second on for four people and the third one allows for 8 to ten people in bunk beds. There are 6 rooms of first type, 6 rooms as well for the second type and two rooms for the third type. The guest house can then accommodate a max capacity of 56 guests.

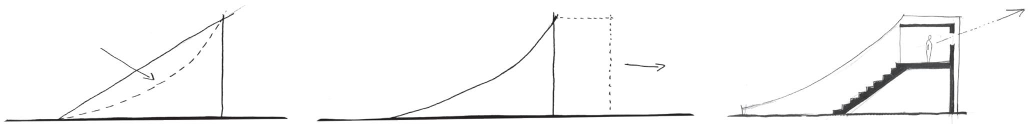
Divided into two floors, all the rooms on the ground floor have a private balcony with the same pergola design as the other buildings and on the top floor only the smaller rooms have a balcony. The rooms are identified with a local bird species instead of a number.

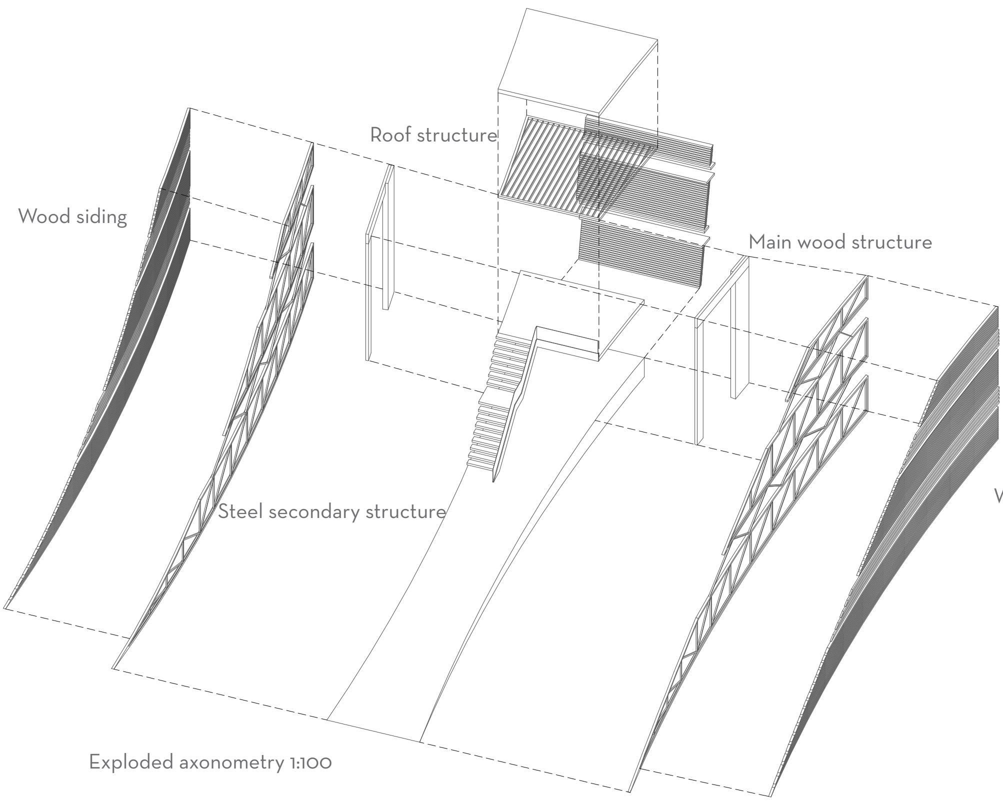
Last but not least, the area A of the natural reserve, what I have called the "Hidden In Plain Sight" area, is where you are in true contact with nature, where the cabins are located and where the human activity has to be kept to a minimum, to preserve the nature of the site and to not disturb the local fauna. But first I need to explain an important part of my general concept, the transition to this place from the "Nature's piazza".

This place I have called the "Exploration Labyrinth", it's the area of the natures reserve between the visitor center and the coastline, a place that would be filled with different paths for anyone to get lost in, in the good way, in a way that you're learning along the way and that slowly but surely you get yourself more into the nature of the place so that when you arrive at the cabins you are in the perfect state of mind to truly appreciate the beauty of this place.

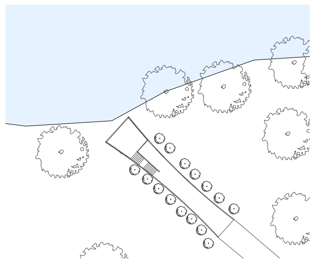
When you do have to hide in plain sight you will have then three options, which I have called, "Air", "Earth" and "Water". At the "Air" observation point, you will find a watchtower for which to ascend to the skies and appreciate the whole reserve, literally, from a bird's eye perspective, with a design that as well serves as a transition from the ground to the air, launching you metaphorically into the clouds. While at the "Air" point you

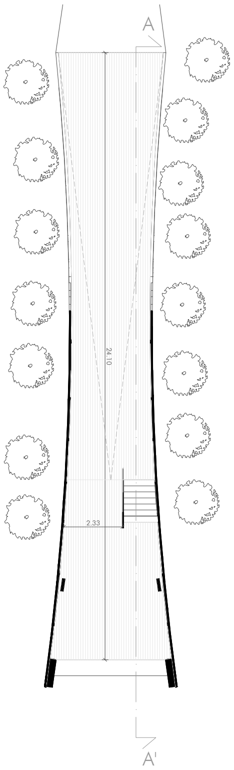
Air Observation Point



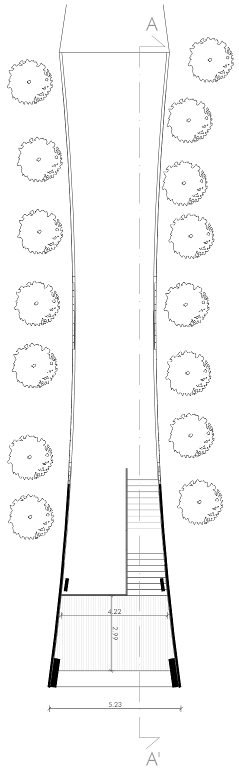


Exploded axonometry 1:100

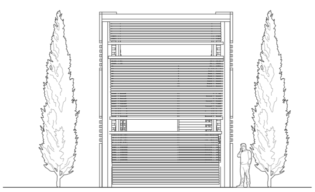

Site plan 1:1000

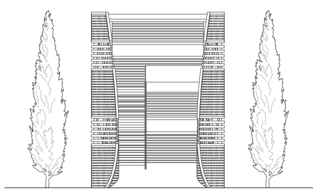


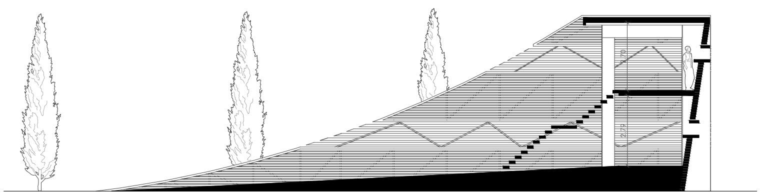
Ground floor plan 1:100

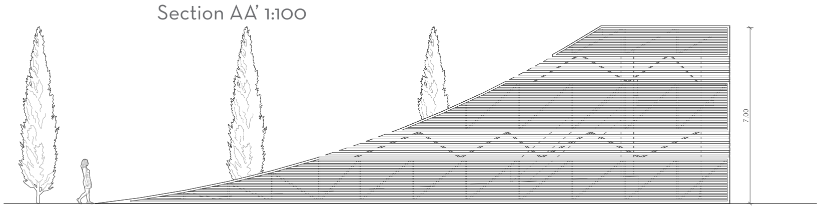


First floor plan 1:100

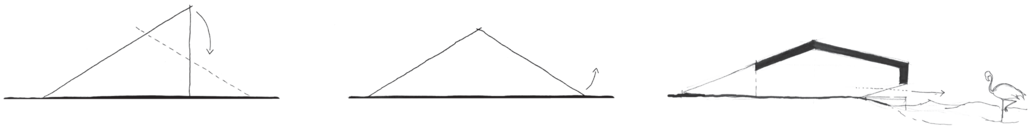

Front facade 1:100

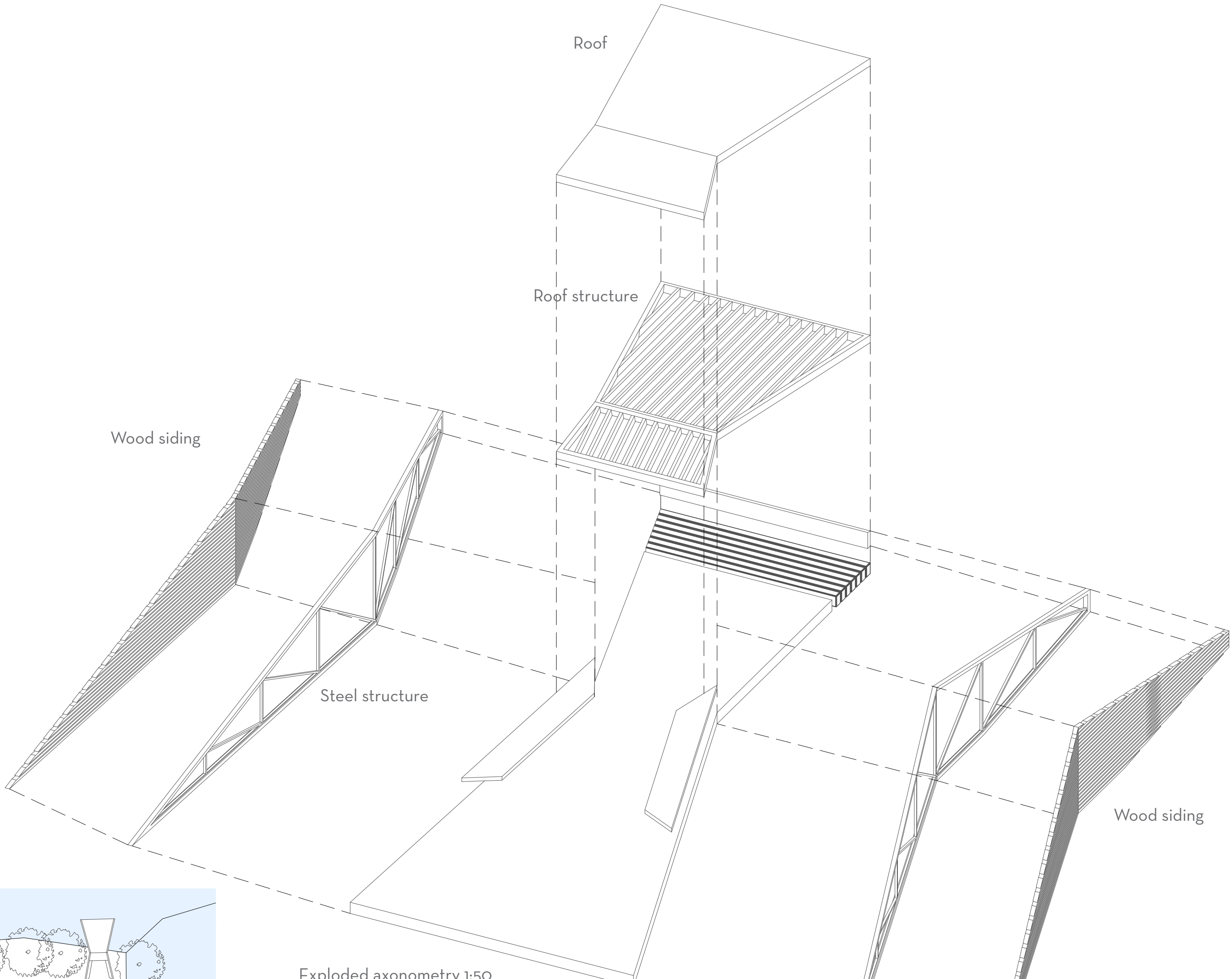

Back facade 1:100


Section AA' 1:100

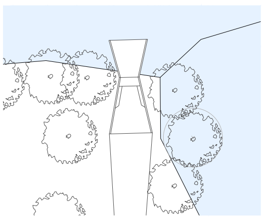

Side facade 1:100

Water Observation Point



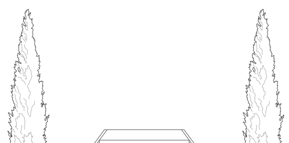


Exploded axonometry 1:50



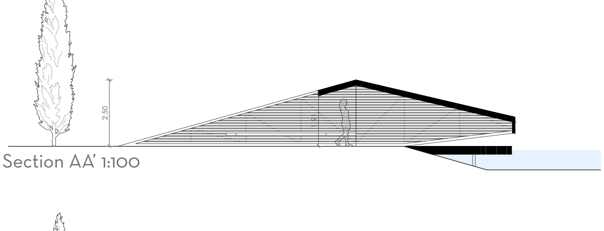
Site plan 1:1000

Front facade 1:100

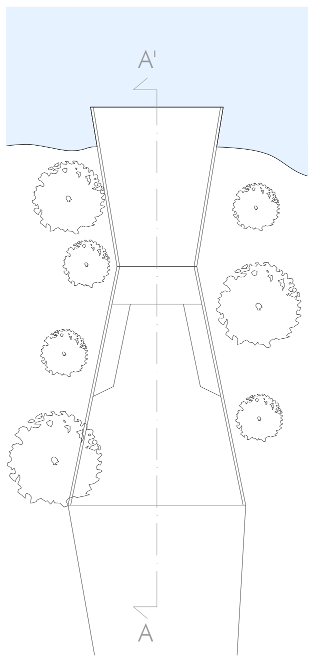


Back facade 1:100

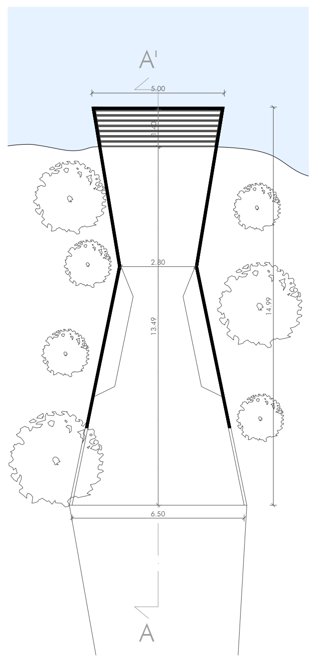
Section AA' 1:100



Side facade 1:100

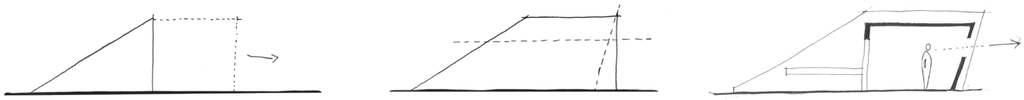


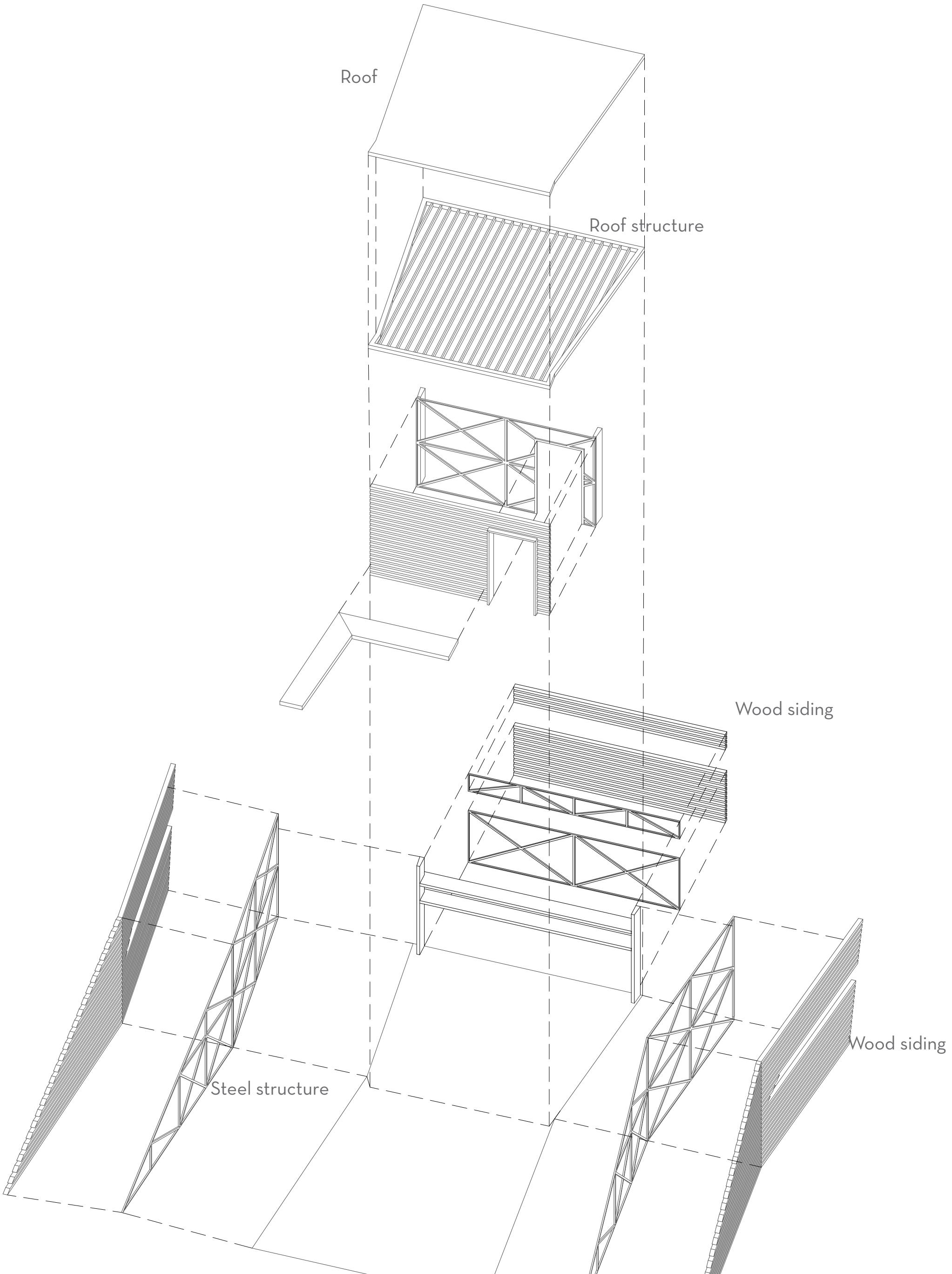
Roof plan 1:100



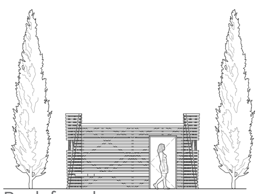
Ground floor plan 1:100

Earth Observation Point

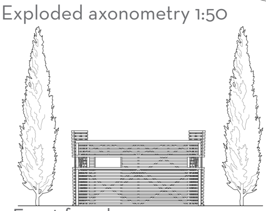




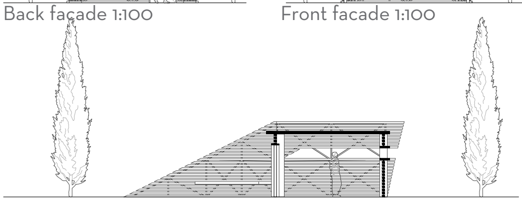
Exploded axonometry 1:50



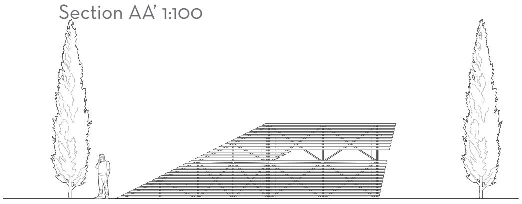
Back facade 1:100



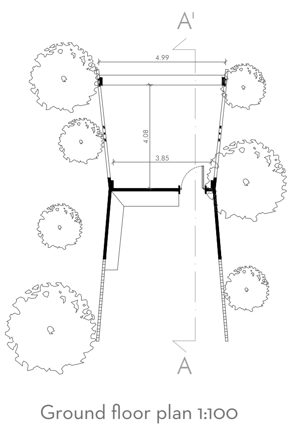
Front facade 1:100



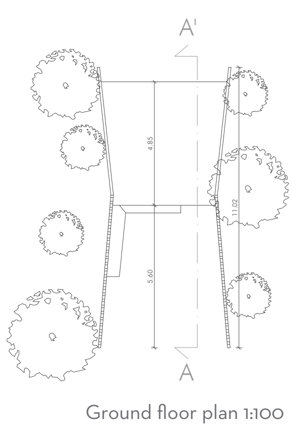
Section AA' 1:100



Side facade 1:100



Ground floor plan 1:100



Ground floor plan 1:100

will elevate yourself to the bird realm.

In the “Water” point you will have to get yourself down to the land of the fish and crawl into the point again literally to be able to observe nature from an unusual perspective, the architecture of the observation forces the visitor to have to crawl down to the viewing spot, making you feel like you are truly hiding from the animals and becoming a silent observer of the world around you.

It’s an instance where the User has to adapt to the architecture unlike the usual of architecture adapting to the User. The goal is to make humans less of the protagonist of this environment allowing the User to become in a sense smaller and less impactful in the surroundings.

And finally at the “Earth” point you just must keep quiet and enjoy nature as usual. This a place of learning patience, a place to truly immerse yourself in the nature of the Lagoon of Orbetello natural reserve and enjoy the life around you.

This a point designed for people to stay as along as they wish, with an architecture that allows you to see almost in a 360º perspective, it’s prepared for any kind of nature observer, since the most skilled bird watcher to the most curious nature enthusiast.

The way the cabin is designed is to also allow for a sort of transition from the outside to the inside, that is covered on two sides by the wooden structure, a structure that allows for the growth of vines that day by day will make the cabin fit in more with its surroundings.

6.3 Architecture as an educational tool

Finally, besides the whole competition aspect, we arrive at the most important contribution that I believe this thesis can have for the whole community.

And has in the second part of this thesis, I will split in two parts this sub-chapter, education for the Architect and education for the User. My hope is other people will look at the value of designing sustainably and understand that it is possible to improve most design with some of these basic ideas.

6.3.1 Educational tool for Architects

Let's first then talk about the passive design strategies that I decided to implement in this proposal, then we will move on to the material choices and the reasoning behind them, and lastly, I will share some of the more technical details of the interesting nodes of the proposal.

The strategies I wanted to implement were simple but important, some were easier to implement over the others, of course due to program restrictions, such as for example the orientation of the building, since it was delineated already the area of construction of the building which didn't leave much space to orientate properly south the building.

What I was able to implement over was, big opening glass opening in the southwest façade to provide as much solar gains as possible, while the northeast façade was more closed. The implementation of massive thermal masses to store the suns energy and then release them during the night, which in this case are the stonewalls that are located mostly on the north and east façade.

Not only these walls will act as thermal masses but also due to their thickness we would be able to attach technical equipment to them and run easily throughout the building, leaving the wooden walls a bit lighter and more focused on insulation.

To prevent overheating in the building I have three strategies, first all the big windows in the southwest façade have overhangs above them to allow sun in the winter but keep it from entering directly in the summer, making the building more conformable to live, secondly we have two different kinds of shading in the façades, vegetation shading and mechanical shading, the vegetation that I chose for this is the kind that the leaves fall in the winter again the sun can come in and heat the building while in the summer the leaves grow back and give some important shading to the building to prevent overheating, the mechanical shading works in more simple way such as with a blind system in the big windows to allow for manual control on the amount of sunlight entering the building to again help control the temperature inside.

For passive cooling in the building, I have designed some strategic skylights and window openings in t eh northeast façade that can be open and closed manually to cross ventilate the spaces and, in that way, help with the temperature control but also giving important sunlight to the interior spaces that would have otherwise.

Other strategies to help with sustainability of the buildings was considering the roof, which not only included photovoltaic panels to help with the energy consumption of the building and for the use of heat pump but also is a green roof that acts as a thermal masses for the building to absorb more of the heat during the summer but also act as water collection system to be used by the whole building and then stored in the water mirror near the entrance so there is a visual understanding for visitors of how much water can be collected by a building.

One thing that I kept in mind during the whole process was how to keep the building affordable and possible to be constructed by most contractors of the region, having more traditional materials such as the stone mixing with the more innovative ideas and techniques of wooden architecture. In other words, I try to keep the stone walls as the more conventional part of the building so that they are easily made by local contractors and be able to attach to them with maybe other contractors the wooden parts in a sort of modular sense, where the building can easily be erected in different phases.

Considering the technical details in this proposal, the stone walls actually have inside a wooden structure, and they're just finished with local Tuscan stone, the interior has a timber structure, cellulose insulations drywall, OSB panels, woods fiber and UV resistant sheets. The wood walls have the same exact structure but with a wood cladding finish instead of stone one, and of course all these resources would be sourced as locally as possible.

The educational tool here comes from the design for the building itself, hopefully showing and teaching how to design in a sustainable and practical way, without forgetting the comfort of the Users.

That idea comes along with real implementations in the project, what I mean by this is that the building itself can open it's "insides" to the public, by having either some strategic points where some construction details are slightly exposed for the public understand how the building works, but also having maybe as part of the exhibitions parts that explain how the building works with for example models, real size or conceptual, to help everyone understand why it is designed in such a way.

6.3.2 Educational tool for Users

The way I want to educate Users, is by making them realize exactly how much they consume, where the resources they consume are coming from, and how if they change their habits in this building, they can make a lesser impact on the earth.

The strategies then have to be something not only give information and awareness to the Users but also force them to have to live in a different way than what they are used to enable them to learn by doing and living more sustainably. Therefore there is an active education and a passive education.

In terms of active education for the users, the same ideas can be applied from the Education for architects regarding on the building works as a system, which can be a permanent exhibition in the visitor center for example. Another idea is to have a panel in each room giving live information of the let's say "vitals" of the room, for example the temperature inside, the amount of Kwh of electricity being consumed and the air quality of the room to give a visual and more accurate depiction of what is happening in each room.

At the entrance can be a bigger panel where is presented information on many other aspects of the whole building such has the totals of consumption of the building, where did all the materials in the building came from, the amount of hours it took to build, the total budget of the building, how much does the building consume in terms of water and electricity every day month year and total of its life, and how much it has saved in comparison to a conventional building of the same size and function.

To show all visitors the advantages of building in such a way. In the restaurant, there can be information on the menu about the distance travelled by the food to arrive the restaurant and therefore the subsequent greenhouse gases emission, and not only that but also information on the production of the food itself such as the amount of water used, and the amount of greenhouse gases emitted.

For the guests at the guest house some more passive but direct strategies can be adopted, such as for example each guest has single rate fee for the room and at the end of the stay, they must pay for each liter of water they consumed during their stay, and the same can be applied to the electricity they have consumed, making the guests be more mindful of their living habits, to hopefully when they return home, they have improved their own habits. Another idea is to make things less automatic inside the rooms to force the guests to consume less electricity in mundane tasks, such as for example opening and closing the window mechanical shades, the blinds.

As always, the goal is to make people more aware of the impact they can have in the planet and help them understand how to improve as whole, not only their own self's but also the beautiful spaceship we all live in.

7. CHALLENGING THE OASIS

Well after the entire explanation of this proposal, let's understand its efficiency and challenge my own designs to see if they hold up against the previously set standard for typical architecture.

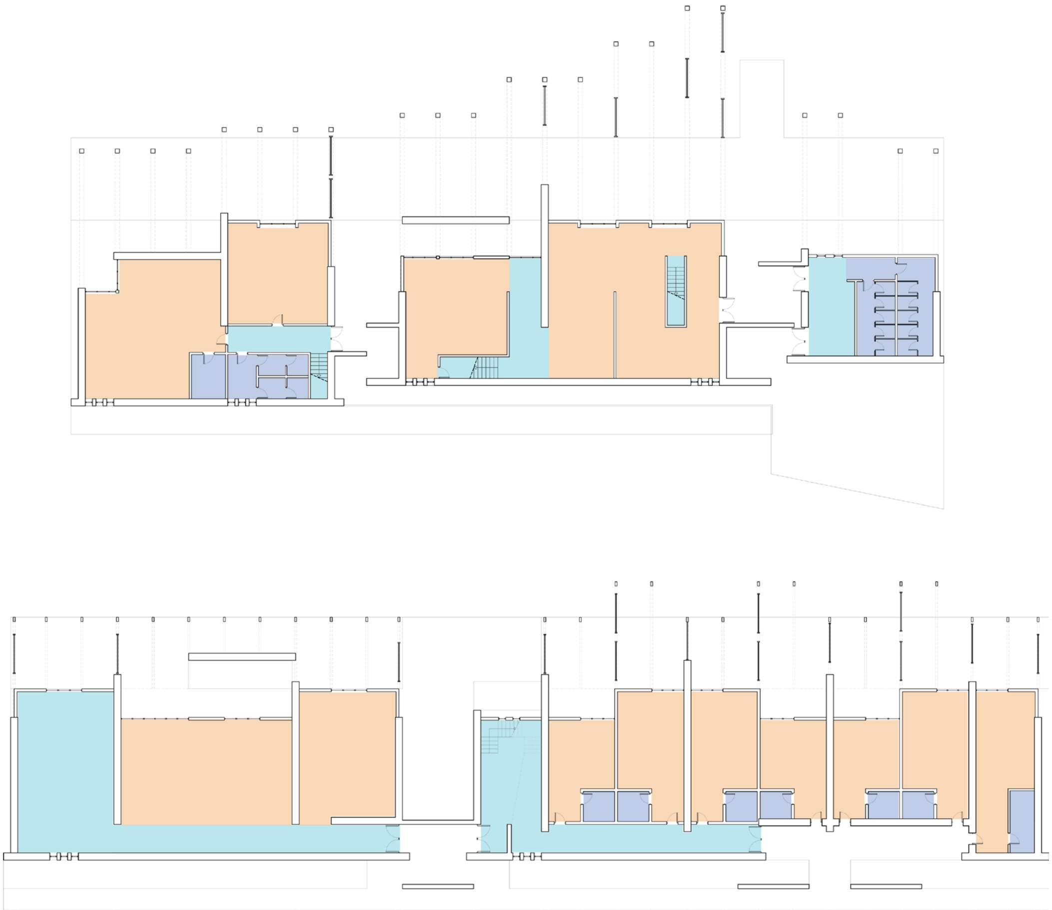
I will then first do a performance analysis on the project for the Oasis di Orbetello and then I will compare it to the an hypothethical normal version of the building using the average numbers of U-Values and most common materials seen nowadays.

7.1 Performance analysis of the Oasis

The biggest difference one can discern in this analysis is due to the fact that the materials used, and the design used in the Oasis, in comparison to the average, create a much lower U-value than what is set as standard average in this region of Orbetello, thus creating a huge impact in the difference of zero energy hours, where our proposal has to spend much less energy maintaining the comfortable interior temperature. This difference comes mostly from a proper insulation of the building, which can be made out of cellulose which is quite the sustainable alternative to XPS or EPS due to its recyclability and mentality of zero-waste. We can see a difference of U-value from the normal 0.40/0.50 to a U-value of 0.18.

Therefore to conduct this analysis, I have inputted the basic data of the proposal of the Oasis di Orbetello, such as the dimensions, the U-values of the walls roof and floor, the location of the project, the amount of glazing in each wall, the percentage of shading of the windows, and much more, into a software called CASAnova in which it then provided some graphical information from the data inputted, from which we can draw some conclusions on the efficiency of the building. I have also entered the data for the hypothetical building, in which I have altered the U-values for the average values in Italy and changed the amount of shading and glazing in the building to show more typical construction.

Temperature plan



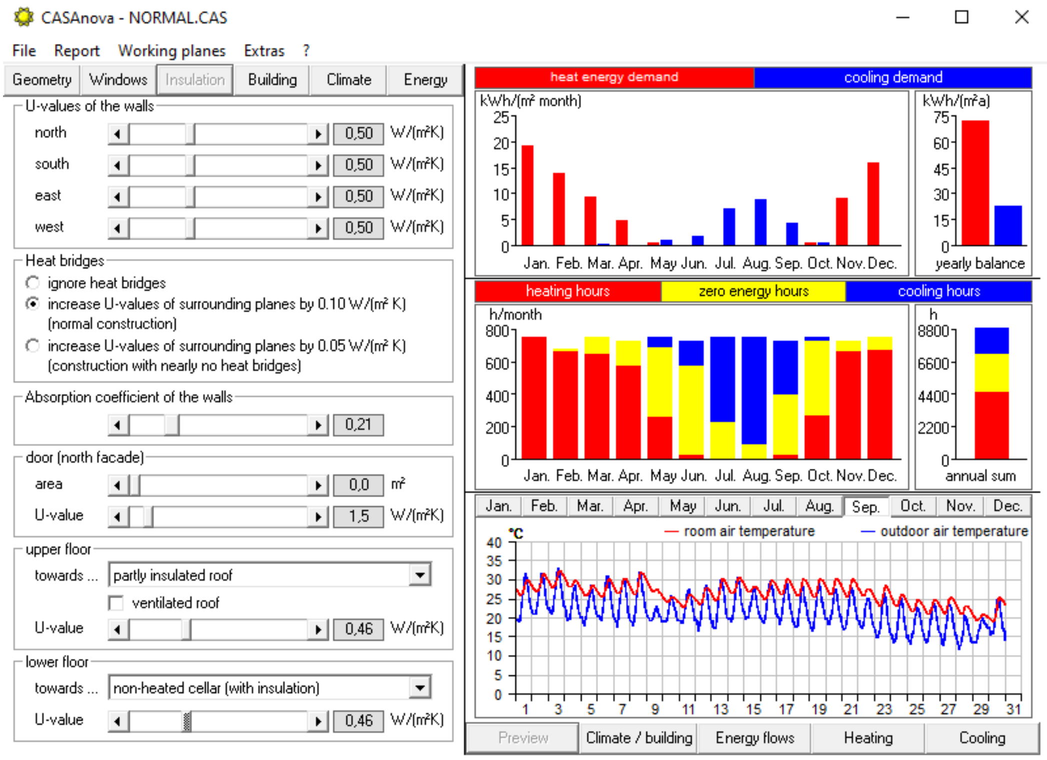
Legend:

Hot zone - 23Co

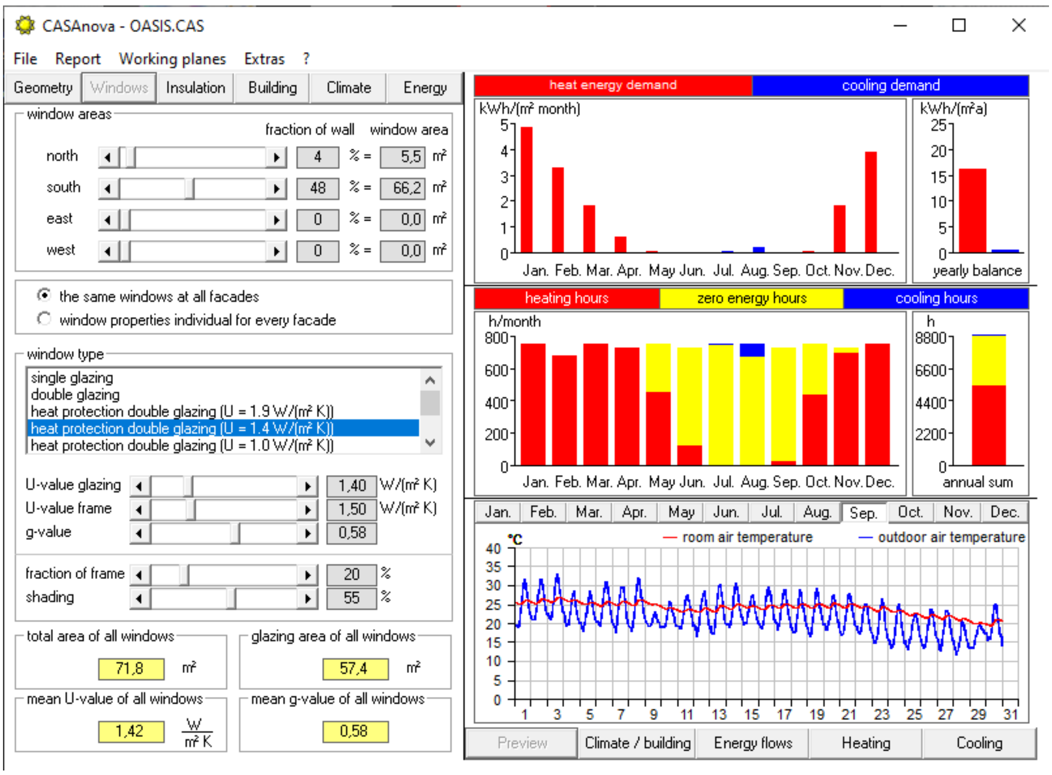
Medium zone - 20Co

Cold zone - 18Co

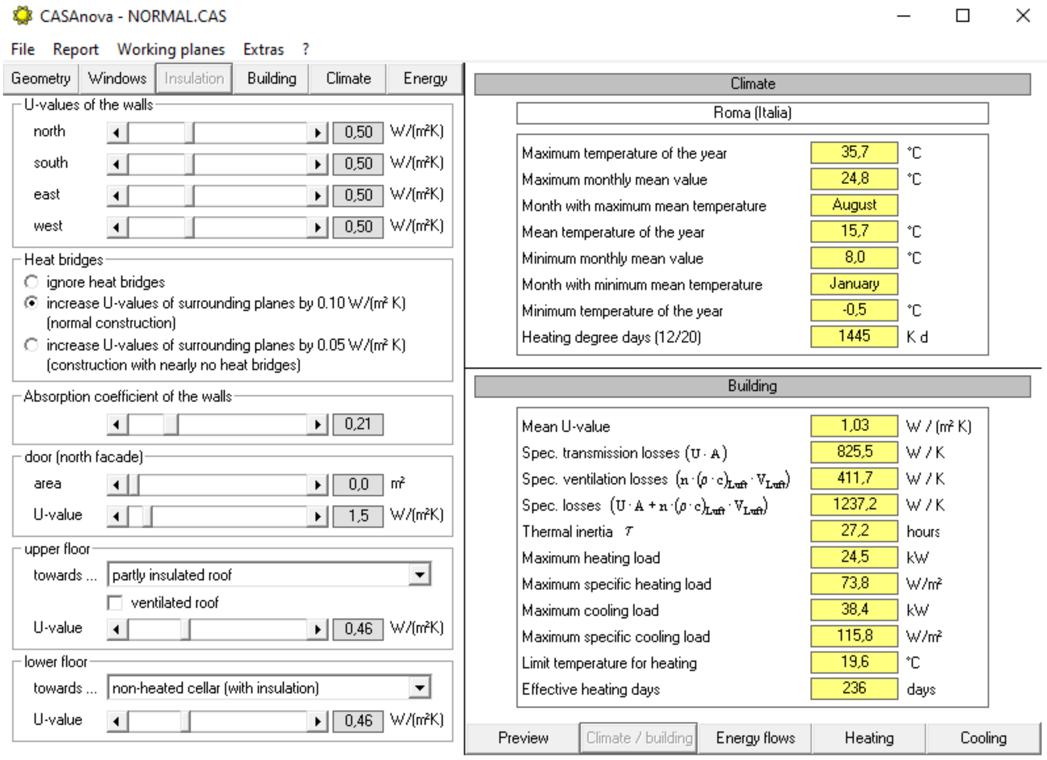
Normal building



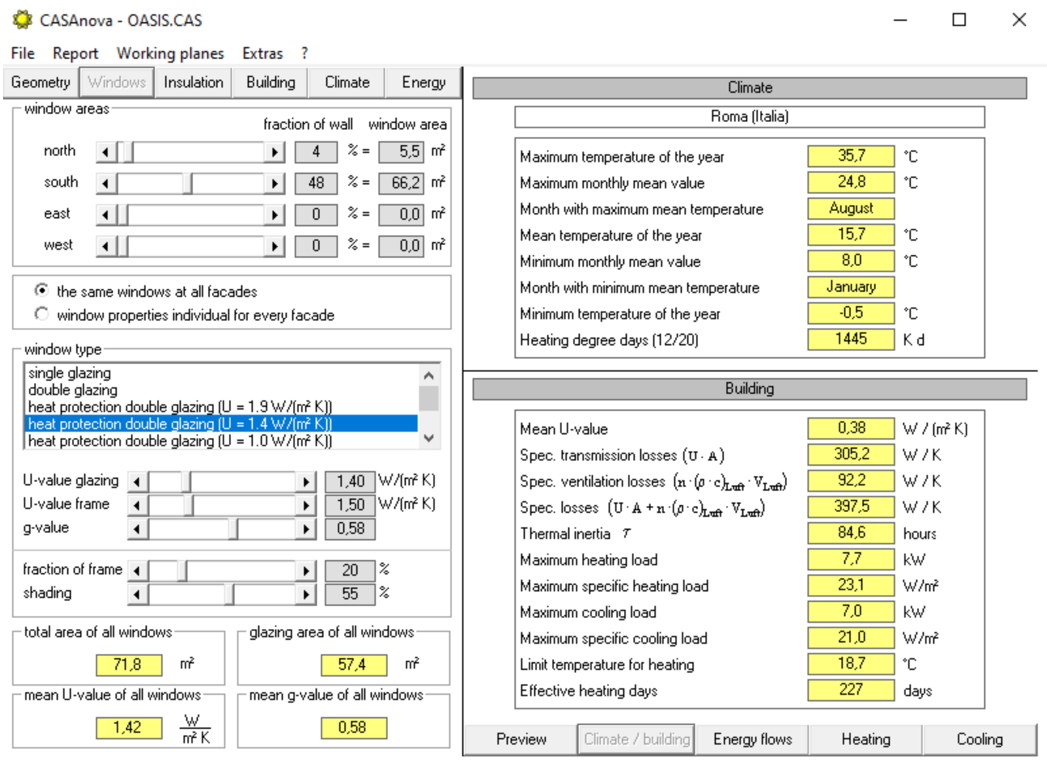
Oasis proposal



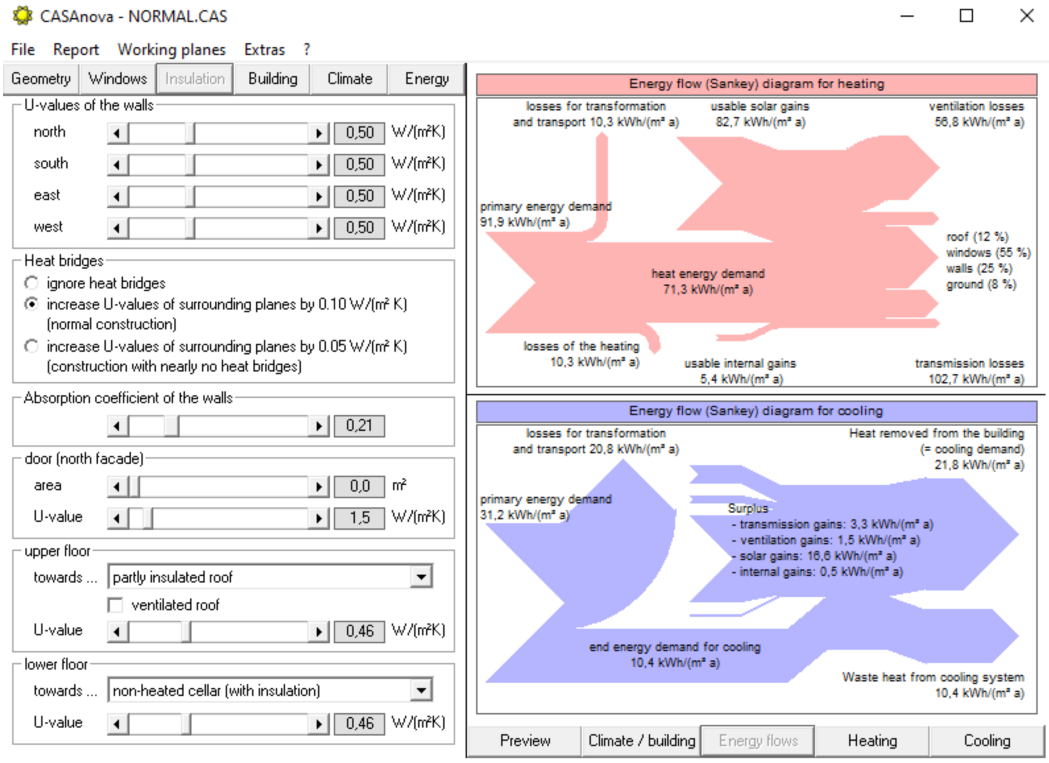
Normal building



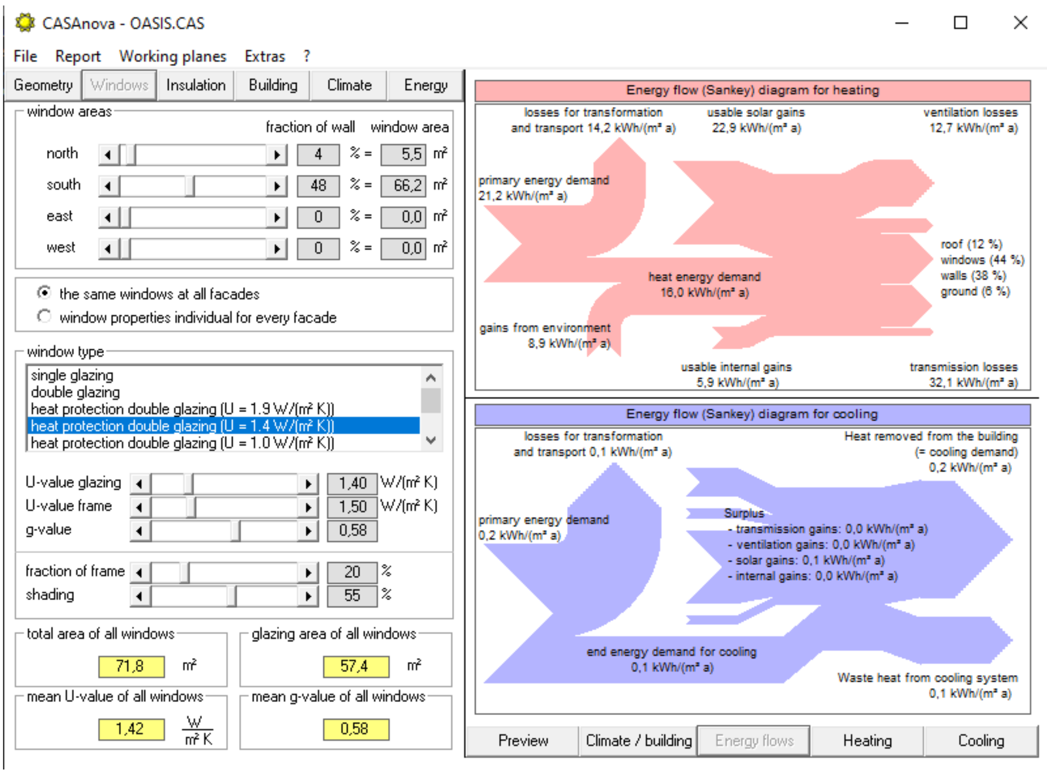
Oasis proposal



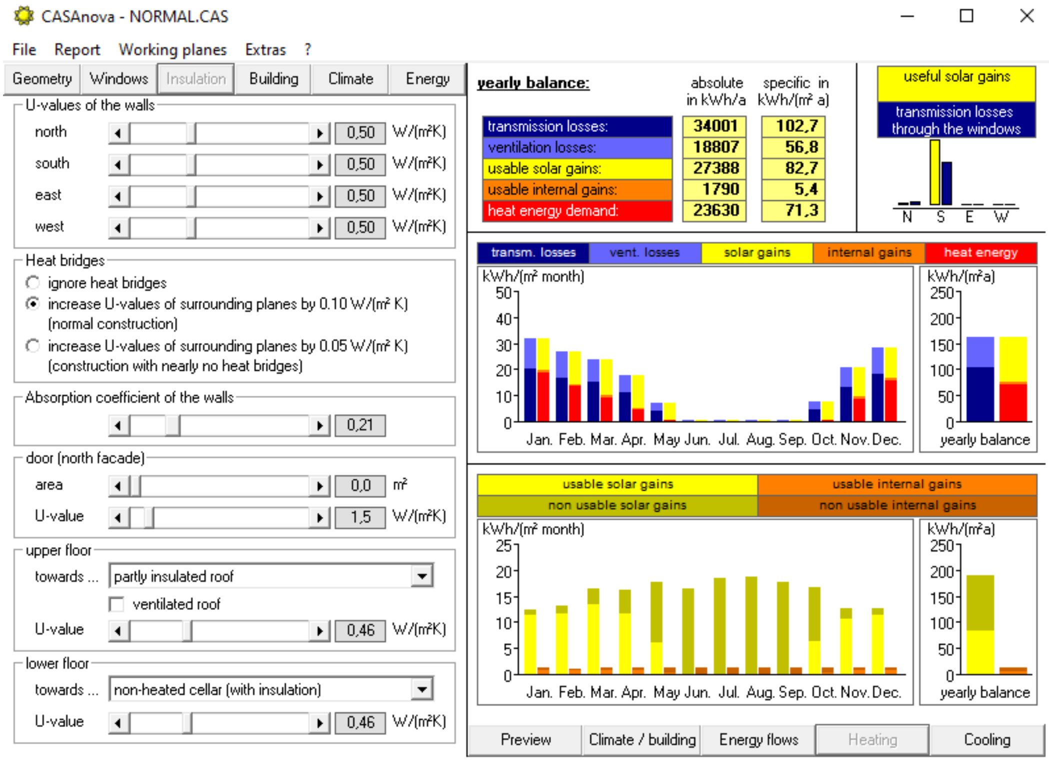
Normal building



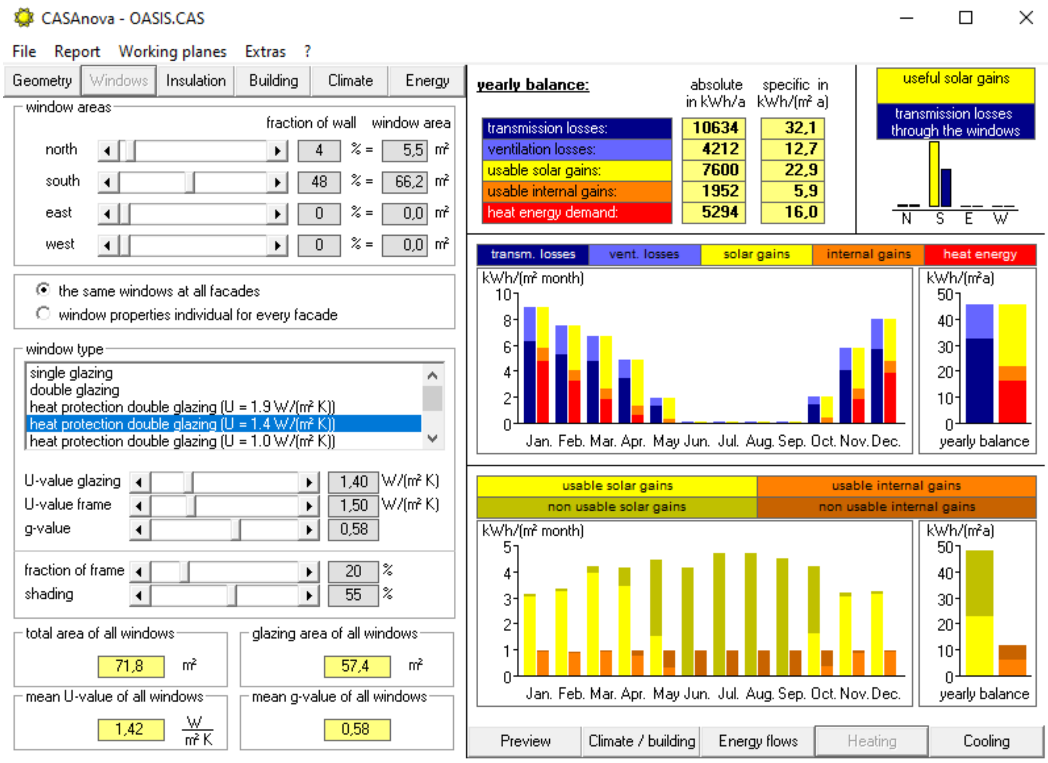
Oasis proposal



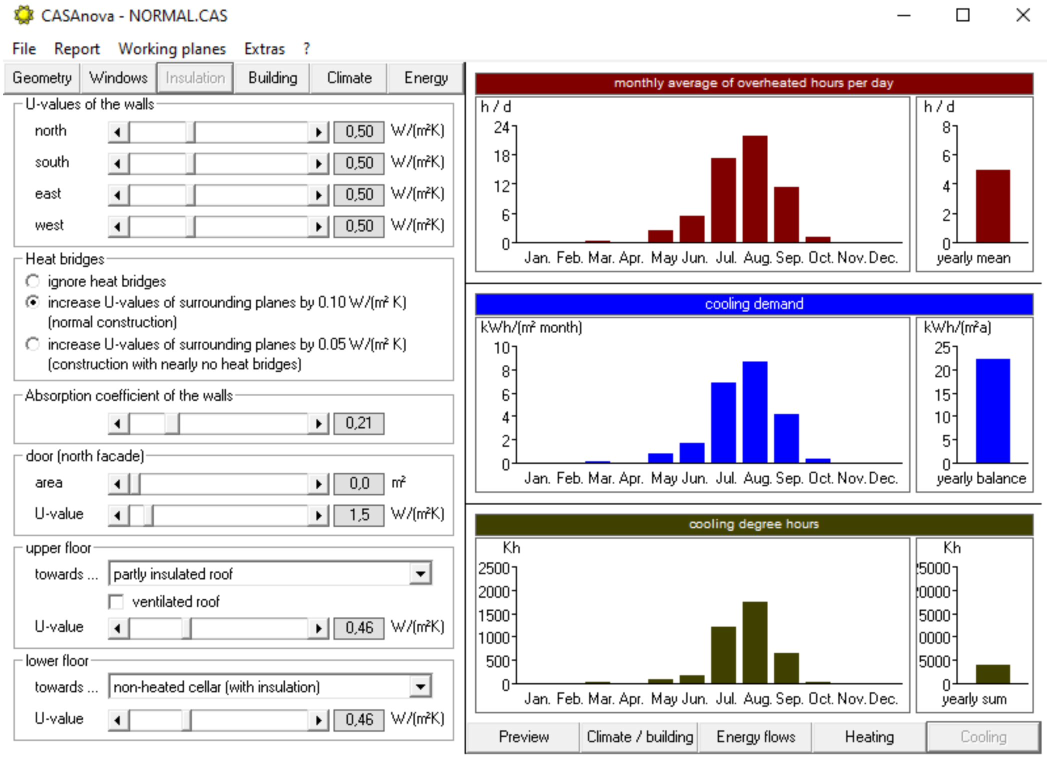
Normal building



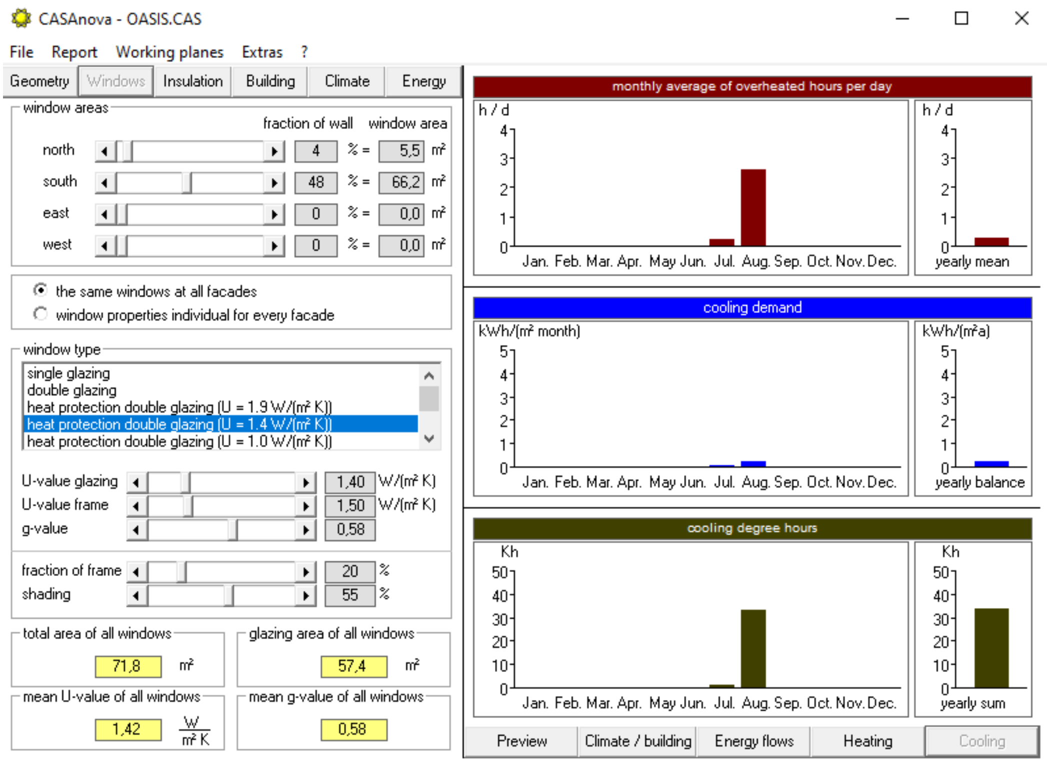
Oasis proposal



Normal building



Oasis proposal



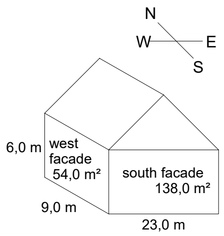
***CASA*nova**

Data sheet (1):

Geomerty:

Length (North-South):	23,0 m
Width (West-East):	9,0 m
Height (without roof):	6,0 m
Number of floors:	2
Deviation from South direction (west positive):	26 °
Useful area:	331,2 m²
Air volume	993,6 m³
A/V - value	0,64 1/m
Facade North/South:	138,0 m²
Facade West/East	54,0 m²

Sketch:



Insulation:

U value walls:	
North:	0,18 W/(m² K)
South:	0,18 W/(m² K)
East:	0,18 W/(m² K)
West:	0,18 W/(m² K)
Absorption coefficient of the walls:	0,5
Upper floor towards:	totally insulated roof ventilated roof
U value upper floor:	0,18 W/(m² K)
Lower floor towards:	soil (with border insulation)
U value lower floor:	0,18 W/(m² K)
Door area:	0,0 m²
U value door	1,50 W/(m² K)
Heat bridges:	increase U-values of surrounding planes by 0.10 W/(m² K) (construction with nearly no heat bridges)

Building:

Interior temperature:	20,0 °C
Limit of overheating:	27,0 °C
Natural ventilation (infiltration):	0,00 1/h
Mechanical ventilation:	0,70 1/h
Heat recovery (only mech. ventilation):	63 %
efficiency factor of air conditioning:	2,5 kWh(cool)/kWh(electr.)
Internal Gains:	11,0 kWh/(m^2 a)
Kind of indoor walls:	medium construction
Kind of outdoor walls:	medium construction

Climate:

Climatic data:	Roma (Italia)

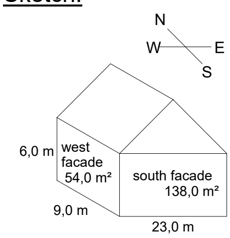
***CASA*nova**

Data sheet (1):

Geomerty:

Length (North-South):	23,0 m
Width (West-East):	9,0 m
Height (without roof):	6,0 m
Number of floors:	2
Deviation from South direction (west positive):	26 °
Useful area:	331,2 m²
Air volume	993,6 m³
A/V - value	0,64 1/m
Facade North/South:	138,0 m²
Facade West/East	54,0 m²

Sketch:



Insulation:

U value walls:	
North:	0,50 W/(m² K)
South:	0,50 W/(m² K)
East:	0,50 W/(m² K)
West:	0,50 W/(m² K)
Absorption coefficient of the walls:	0,21
Upper floor towards:	partly insulated roof
U value upper floor:	0,46 W/(m² K)
Lower floor towards:	non-heated cellar (with insulation)
U value lower floor:	0,46 W/(m² K)
Door area:	0,0 m²
U value door	1,50 W/(m² K)
Heat bridges:	increase U-values of surrounding planes by 0.10 W/(m² K) (construction with nearly no heat bridges)

Building:

Interior temperature:	20,0 °C
Limit of overheating:	27,0 °C
Natural ventilation (infiltration):	0,56 1/h
Mechanical ventilation:	0,84 1/h
Heat recovery (only mech. ventilation):	29 %
efficiency factor of air conditioning:	2,1 kWh(cool)/kWh(electr.)
Internal Gains:	11,0 kWh/(m^2 a)
Kind of indoor walls:	medium construction
Kind of outdoor walls:	medium construction

Climate:

Climatic data:	Roma (Italia)

***CASA*nova**

Data sheet (2):

Windows

North:

Windows area:	5,5 m²
Fraction of windows area at the facade:	4,0 %
Kind of windows:	heat protection double glazing (U = 1.4 W/(m² K))
U value glazing:	1,40 W/(m² K)
U value frame:	1,50 W/(m² K)
g value glazing:	0,58
Fraction of frame:	20,0 %
Shading:	55,0 %

South:

Windows area:	66,2 m²
Fraction of windows area at the facade:	48,0 %
Kind of windows:	heat protection double glazing (U = 1.4 W/(m² K))
U value glazing:	1,40 W/(m² K)
U value frame:	1,50 W/(m² K)
g value glazing:	0,58
Fraction of frame:	20,0 %
Shading:	55,0 %

East:

Windows area:	0,0 m²
Fraction of windows area at the facade:	0,0 %
Kind of windows:	heat protection double glazing (U = 1.4 W/(m² K))
U value glazing:	1,40 W/(m² K)
U value frame:	1,50 W/(m² K)
g value glazing:	0,58
Fraction of frame:	20,0 %
Shading:	55,0 %

West:

Windows area:	0,0 m²
Fraction of windows area at the facade:	0,0 %
Kind of windows:	heat protection double glazing (U = 1.4 W/(m² K))
U value glazing:	1,40 W/(m² K)
U value frame:	1,50 W/(m² K)
g value glazing:	0,58
Fraction of frame:	20,0 %
Shading:	55,0 %

Energy:

Heating system:	soil heat pump, buffer storage and distribution inside the thermal zone
Heat transfer / system temperature:	radiators (outside walls), thermostatic valves (layout temperature: 1K), system temperature: 55/45°C
Source of energy:	electricity

***CASA*nova**

Data sheet (2):

Windows

North:

Windows area:	5,5 m²
Fraction of windows area at the facade:	4,0 %
Kind of windows:	single glazing
U value glazing:	5,80 W/(m² K)
U value frame:	3,50 W/(m² K)
g value glazing:	0,92
Fraction of frame:	6,0 %
Shading:	5,0 %

South:

Windows area:	66,2 m²
Fraction of windows area at the facade:	48,0 %
Kind of windows:	single glazing
U value glazing:	5,80 W/(m² K)
U value frame:	3,50 W/(m² K)
g value glazing:	0,92
Fraction of frame:	6,0 %
Shading:	5,0 %

East:

Windows area:	0,0 m²
Fraction of windows area at the facade:	0,0 %
Kind of windows:	single glazing
U value glazing:	5,80 W/(m² K)
U value frame:	3,50 W/(m² K)
g value glazing:	0,92
Fraction of frame:	6,0 %
Shading:	5,0 %

West:

Windows area:	0,0 m²
Fraction of windows area at the facade:	0,0 %
Kind of windows:	single glazing
U value glazing:	5,80 W/(m² K)
U value frame:	3,50 W/(m² K)
g value glazing:	0,92
Fraction of frame:	6,0 %
Shading:	5,0 %

Energy:

Heating system:	low temperature burner, boiler and distribution inside the thermal zone
Heat transfer / system temperature:	radiators (outside walls), thermostatic valves (layout temperature: 1K), system temperature: 70/55°C
Source of energy:	fuel oil

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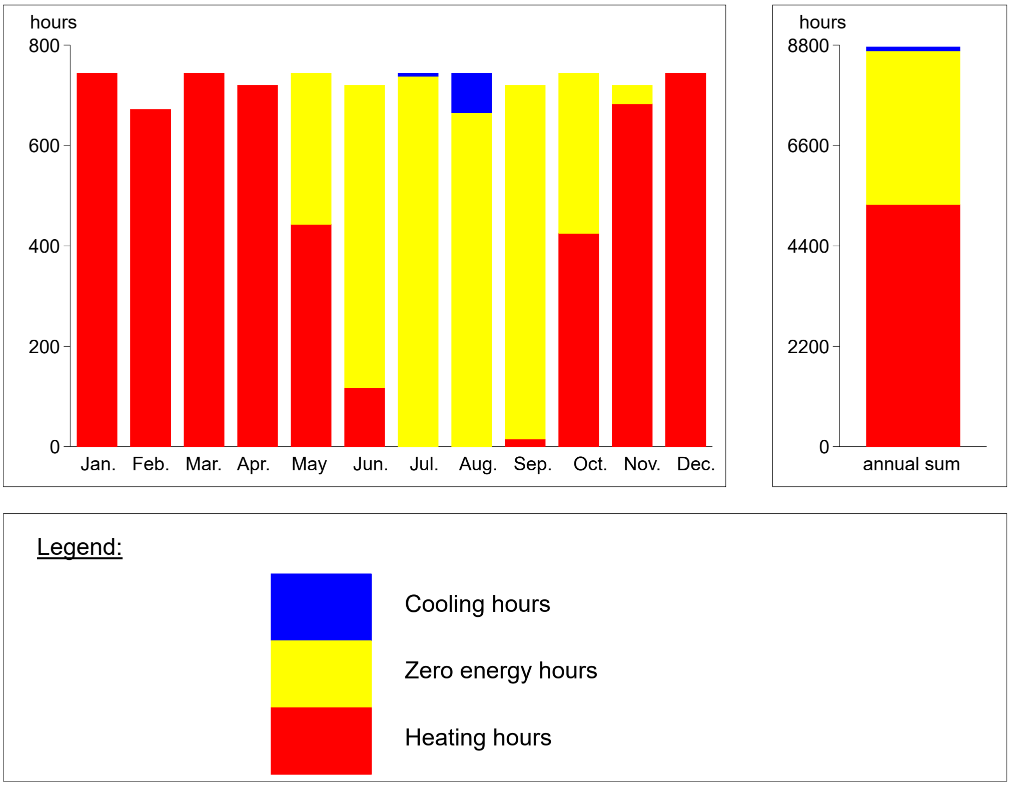
Output: Heating and cooling hours

	Heating hours in h	Zero energy hours in h	Cooling hours in h
January	744	0	0
February	672	0	0
March	744	0	0
April	720	0	0
May	443	301	0
June	117	603	0
July	0	738	6
August	0	665	79
September	15	705	0
October	425	319	0
November	683	37	0
December	744	0	0
Total in h	5307	3368	85
Total in %	60,6	38,4	1,0



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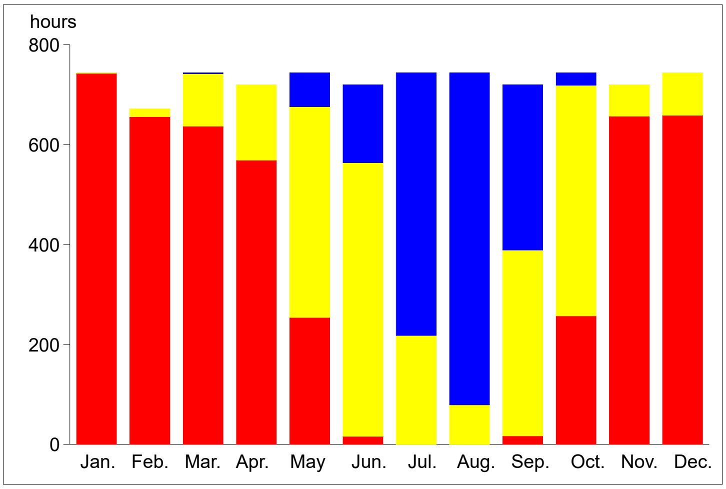
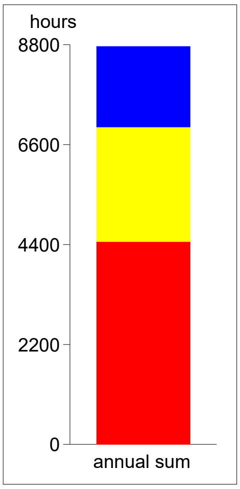
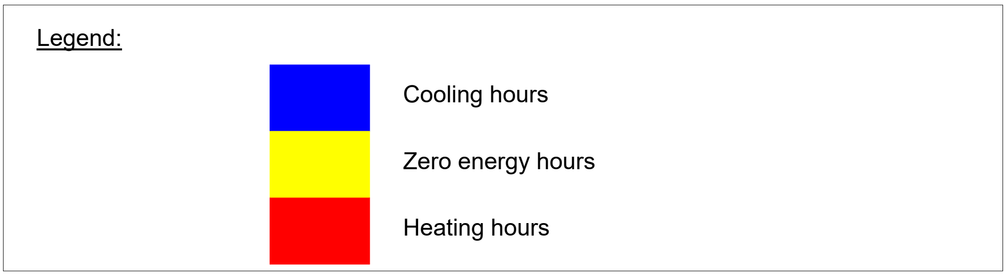
Output: Heating and cooling hours

	Heating hours in h	Zero energy hours in h	Cooling hours in h
January	743	1	0
February	656	16	0
March	637	105	2
April	569	151	0
May	254	422	68
June	16	548	156
July	0	218	526
August	0	79	665
September	17	372	331
October	257	462	25
November	657	63	0
December	659	85	0
Total in h	4465	2522	1773
Total in %	51,0	28,8	20,2







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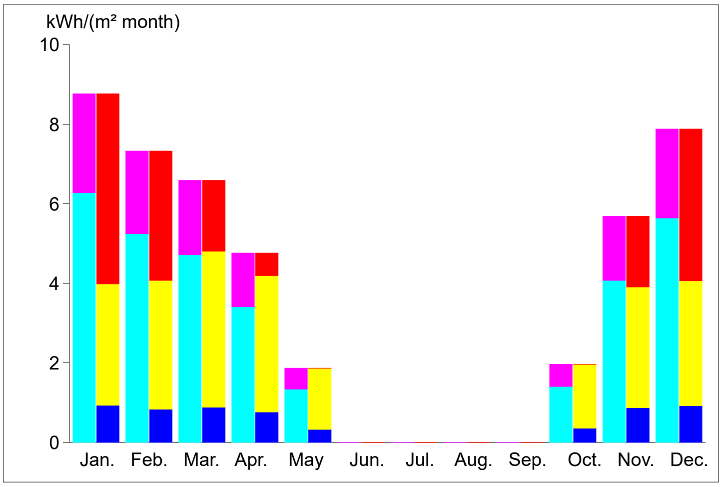
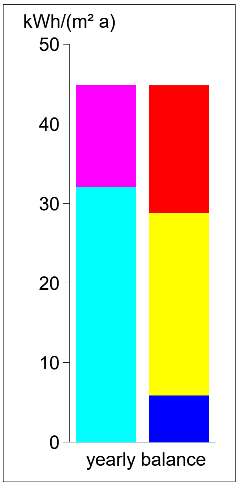
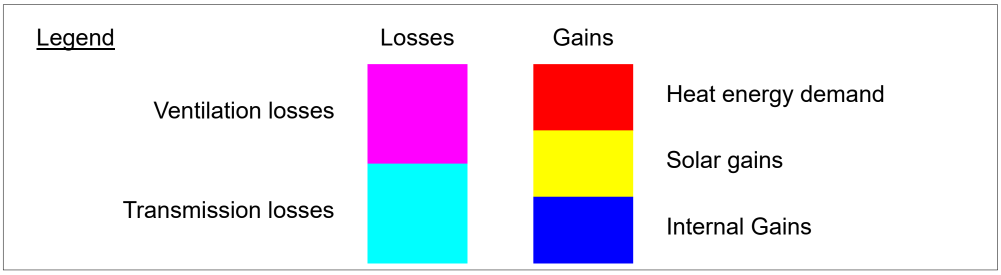
Output: Heat balance

	Transmis-sion losses in kWh/m²	Ventilation losses in kWh/m²	Total heat losses in kWh/m²	Internal gains in kWh/m²	Solar gains in kWh/m²	Usability factor	Heat energy demand in kWh/m²
January	6,3	2,5	8,8	0,9	3,1	1,00	4,8
February	5,2	2,1	7,3	0,8	3,2	0,99	3,3
March	4,7	1,9	6,6	0,9	3,9	0,95	1,8
April	3,4	1,4	4,8	0,8	3,4	0,84	0,6
May	1,3	0,5	1,9	0,3	1,5	0,35	0,0
June	0,0	0,0	0,0	0,0	0,0	0,00	0,0
July	0,0	0,0	0,0	0,0	0,0	0,00	0,0
August	0,0	0,0	0,0	0,0	0,0	0,00	0,0
September	0,0	0,0	0,0	0,0	0,0	0,00	0,0
October	1,4	0,6	2,0	0,4	1,6	0,38	0,0
November	4,1	1,6	5,7	0,9	3,0	0,96	1,8
December	5,6	2,2	7,9	0,9	3,1	0,99	3,8
Total (absolute) in kWh/a	10634	4212	14846	1952	7600		5294
Total (specific) in kWh/(m² a)	32,1	12,7	44,8	5,9	22,9		16,0





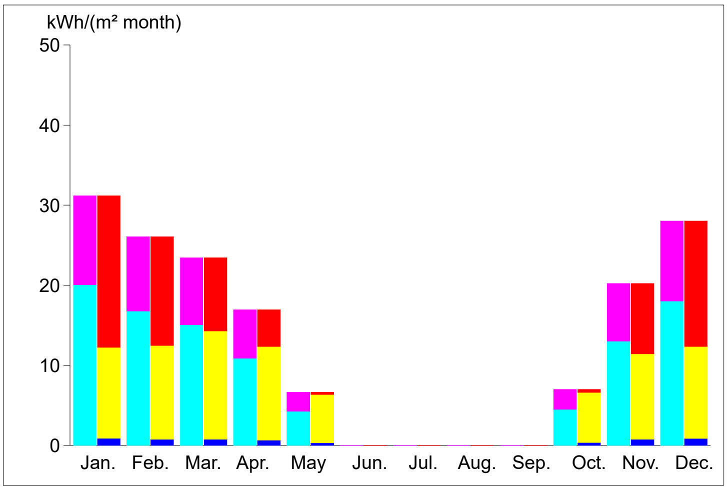


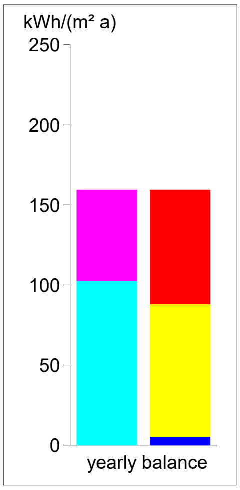
Normal building

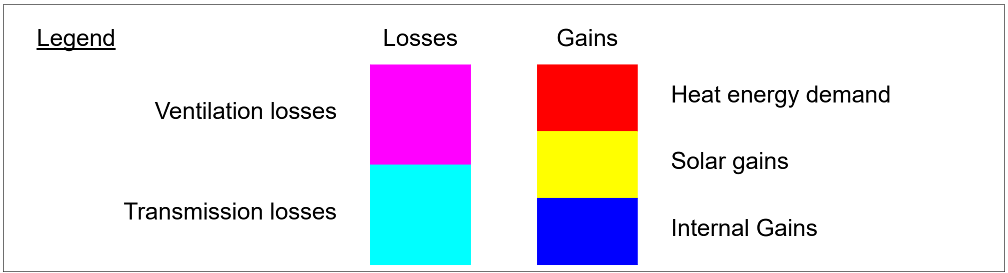
CASAnova

Output: Heat balance

	Transmis-sion losses in kWh/m²	Ventilation losses in kWh/m²	Total heat losses in kWh/m²	Internal gains in kWh/m²	Solar gains in kWh/m²	Usability factor	Heat energy demand in kWh/m²
January	20,1	11,1	31,2	0,9	11,4	0,94	18,9
February	16,8	9,3	26,1	0,8	11,7	0,91	13,6
March	15,1	8,3	23,4	0,8	13,5	0,83	9,1
April	10,9	6,0	16,9	0,7	11,7	0,73	4,6
May	4,3	2,4	6,6	0,3	6,0	0,35	0,3
June	0,0	0,0	0,0	0,0	0,0	0,00	0,0
July	0,0	0,0	0,0	0,0	0,0	0,00	0,0
August	0,0	0,0	0,0	0,0	0,0	0,00	0,0
September	0,0	0,0	0,0	0,0	0,0	0,00	0,0
October	4,5	2,5	7,0	0,4	6,3	0,38	0,4
November	13,0	7,2	20,2	0,8	10,7	0,86	8,8
December	18,0	10,0	28,0	0,9	11,5	0,92	15,7
Total (absolute) in kWh/a	34001	18807	52808	1790	27388		23630
Total (specific) in kWh/(m² a)	102,7	56,8	159,4	5,4	82,7		71,3







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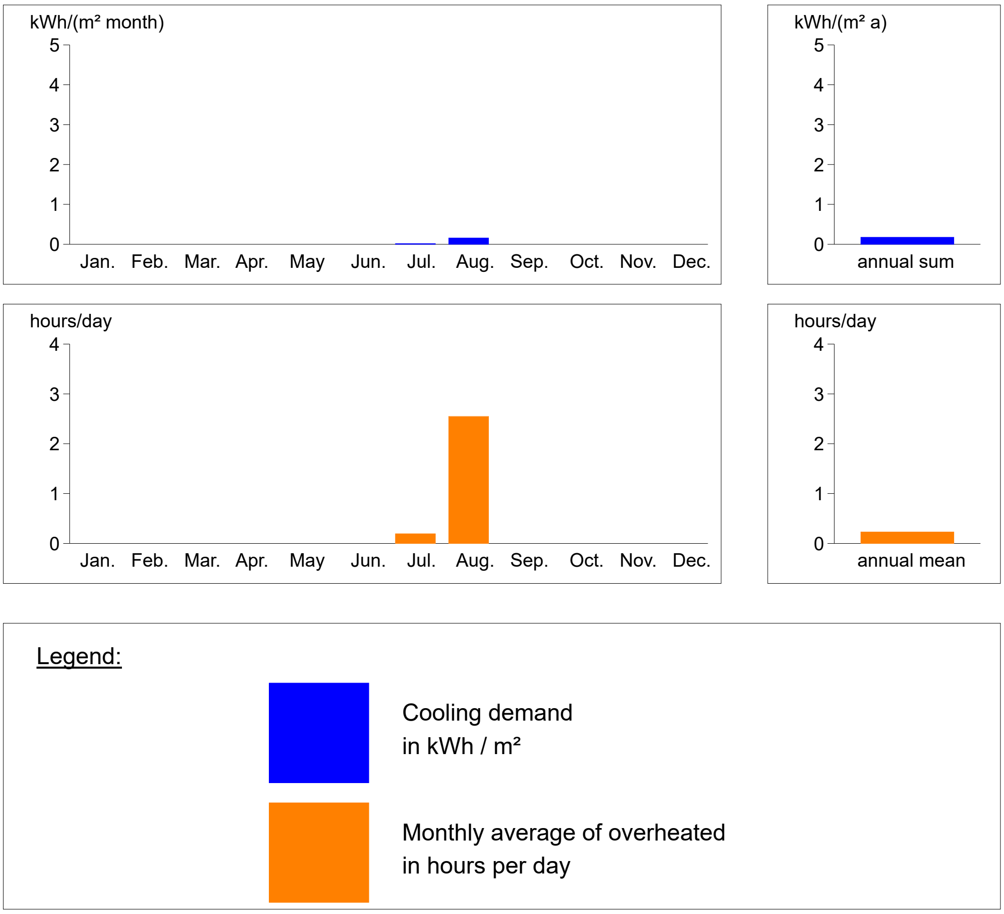
Output: Cooling balance

	Cooling demand in kWh/m²	Overheating (hours per day)	Cooling degree hours in Kh
January	0,0	0,0	0,0
February	0,0	0,0	0,0
March	0,0	0,0	0,0
April	0,0	0,0	0,0
May	0,0	0,0	0,0
June	0,0	0,0	0,0
July	0,0	0,2	0,7
August	0,2	2,5	32,4
September	0,0	0,0	0,0
October	0,0	0,0	0,0
November	0,0	0,0	0,0
December	0,0	0,0	0,0
Mean value / yearly sum	0,2	0,0	33,2

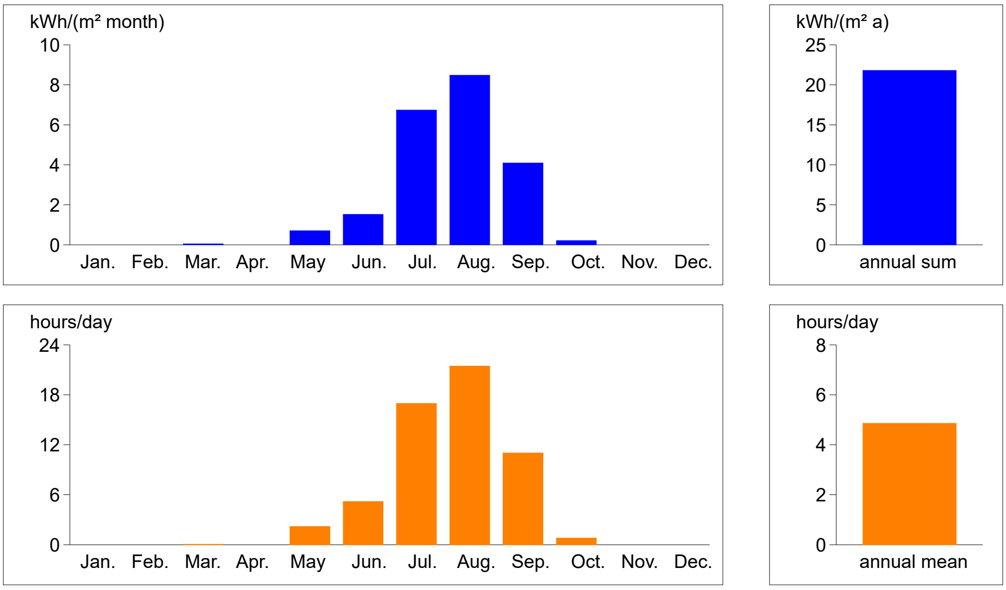


Normal building

CASAnova

Output: Cooling balance

	Cooling demand in kWh/m²	Overheating (hours per day)	Cooling degree hours in Kh
January	0,0	0,0	0,0
February	0,0	0,0	0,0
March	0,0	0,1	0,5
April	0,0	0,0	0,0
May	0,7	2,2	64,4
June	1,5	5,2	151,5
July	6,7	17,0	1173,7
August	8,5	21,5	1711,0
September	4,1	11,0	620,8
October	0,2	0,8	9,0
November	0,0	0,0	0,0
December	0,0	0,0	0,0
Mean value / yearly sum	21,8	0,2	3730,9



Legend:

Cooling demand in kWh / m²

Monthly average of overheated in hours per day

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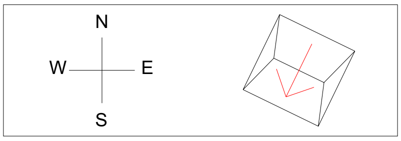
Output: Balance of windows

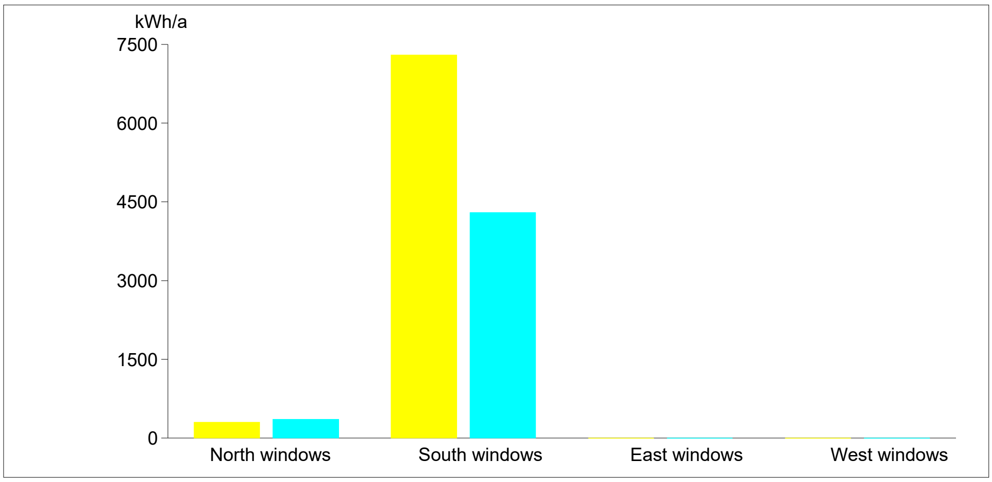
Orientation:

Deviation from South direction: 26 ° to West



Gains / losses:

	North in kWh/a	South in kWh/a	East in kWh/a	West in kWh/a	Total in kWh/a
Usable solar Gains	302,8	7297,5	0,0	0,0	7600,2
Transmission losses of windows	358,0	4296,6	0,0	0,0	4654,6
Balance	-55,3	3000,9	0,0	0,0	2945,6



Legend:

Solar gains

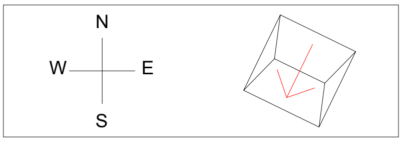
Transmission losses of windows

CASAnova

Output: Balance of windows

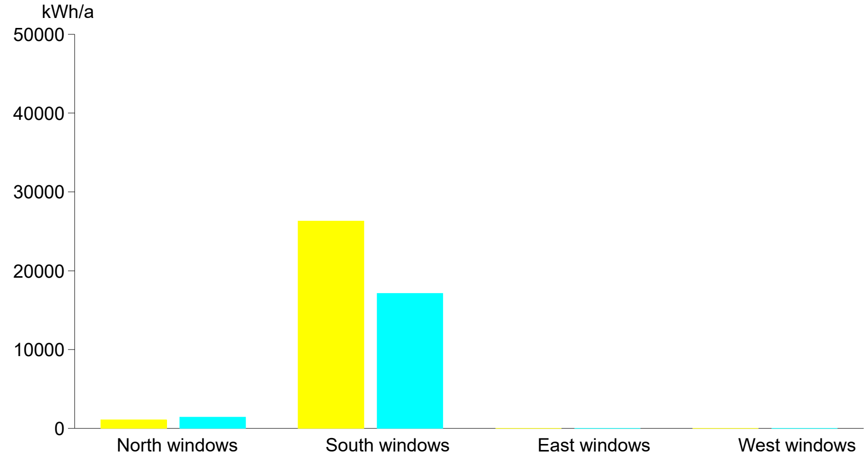
Orientation:

Deviation from South direction: 26 ° to West



Gains / losses:

	North in kWh/a	South in kWh/a	East in kWh/a	West in kWh/a	Total in kWh/a
Usable solar Gains	1090,9	26297,1	0,0	0,0	27388,0
Transmission losses of windows	1427,7	17131,8	0,0	0,0	18559,5
Balance	-336,8	9165,2	0,0	0,0	8828,5



Legend:

Solar gains

Transmission losses of windows

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Output: Primary and end energy demand for heating

Heat:

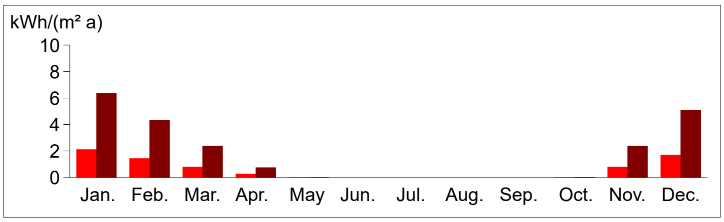
Heat energy demand:	16,0 kWh/(m² a)
Losses of the heat storage:	0,1 kWh/(m² a)
Heat losses from the distribution:	1,5 kWh/(m² a)
Looses at the transmission to the rooms:	1,1 kWh/(m² a)
Expense number of heat generation:	0,27
End energy demand electricity:	5,0 kWh/(m² a)

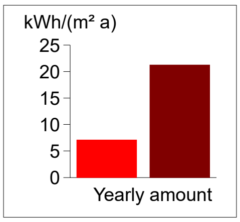
Auxiliary energy (electricity):

Auxiliary energy for heat generation:	1,1 kWh/(m² a)
Auxiliary energy for heat storage:	0,2 kWh/(m² a)
Auxiliary energy for heat distribution:	0,7 kWh/(m² a)
End energy demand auxiliary energy (electricity):	2,0 kWh/(m² a)

Primary energy factor electricity:	3,0
Primary energy demand electricity:	21,2 kWh/(m² a)

	End energy demand demand	Primary energy demand demand
January	2,1	6,4
February	1,4	4,3
March	0,8	2,4
April	0,3	0,8
May	0,0	0,0
June	0,0	0,0
July	0,0	0,0
August	0,0	0,0
September	0,0	0,0
October	0,0	0,0
November	0,8	2,4
December	1,7	5,1
Sum specific in kWh/(m² a)	7,1	21,2
Sum absolute in kWh/a	2344	7033





Legend:

End energy demand electricity

Primary energy demand electricity

<u>***CASAnova***</u>

Output: Primary and end energy demand for heating

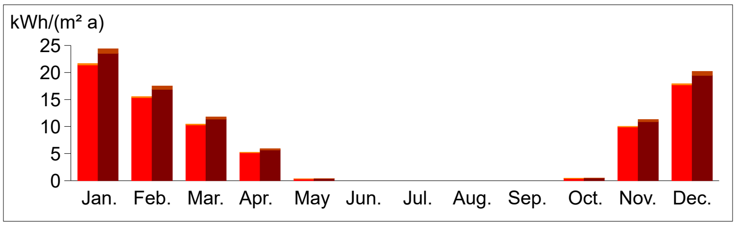
Heat:

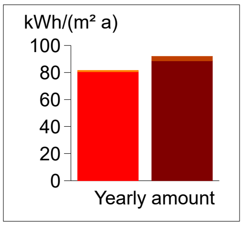
Heat energy demand:	71,3 kWh/(m² a)
Losses of the heat storage:	0,0 kWh/(m² a)
Heat losses from the distribution:	2,1 kWh/(m² a)
Looses at the transmission to the rooms:	1,1 kWh/(m² a)
Expense number of heat generation:	1,08
End energy demand fuel oil:	80,5 kWh/(m² a)
Primary energy factor fuel oil:	1,1
Primary energy demand fuel oil:	88,5 kWh/(m² a)

Auxiliary energy (electricity):

Auxiliary energy for heat generation:	0,5 kWh/(m² a)
Auxiliary energy for heat storage:	0,0 kWh/(m² a)
Auxiliary energy for heat distribution:	0,6 kWh/(m² a)
End energy demand auxiliary energy (electricity):	1,1 kWh/(m² a)
Primary energy factor electricity:	3,0
Primary energy demand auxiliary energy (electricity):	3,3 kWh/(m² a)

	End energy demand in kWh/m²	End energy demand in kWh/m²	End energy demand in kWh/m²	Primary demand in kWh/m²	Primary demand in kWh/m²	Primary demand in kWh/m²
January	21,4	0,3	21,7	23,5	0,9	24,4
February	15,3	0,2	15,5	16,9	0,6	17,5
March	10,3	0,1	10,5	11,4	0,4	11,8
April	5,2	0,1	5,2	5,7	0,2	5,9
May	0,3	0,0	0,3	0,3	0,0	0,4
June	0,0	0,0	0,0	0,0	0,0	0,0
July	0,0	0,0	0,0	0,0	0,0	0,0
August	0,0	0,0	0,0	0,0	0,0	0,0
September	0,0	0,0	0,0	0,0	0,0	0,0
October	0,4	0,0	0,4	0,5	0,0	0,5
November	9,9	0,1	10,0	10,9	0,4	11,3
December	17,7	0,2	17,9	19,5	0,7	20,2
Sum specific in kWh/(m² a)	80,5	1,1	81,6	88,5	3,3	91,9
Sum absolute in kWh/a	26659	369	27028	29325	1106	30431





<u>Legend:</u>

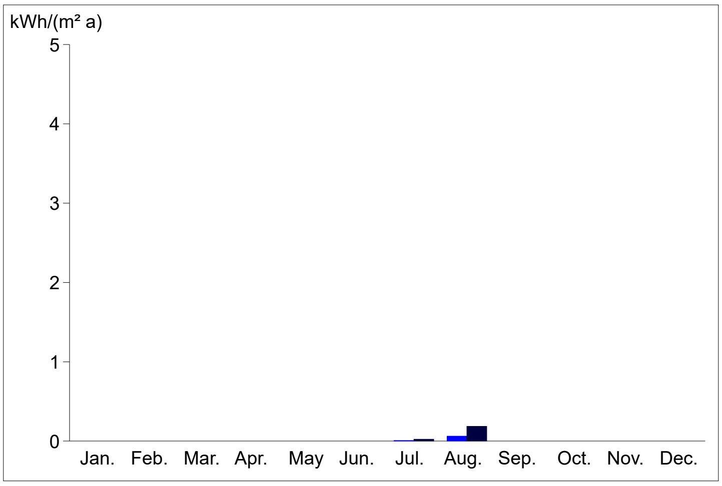
- End energy demand electricity
- End energy demand fuel oil
- Primary energy demand electricity
- Primary energy demand fuel oil

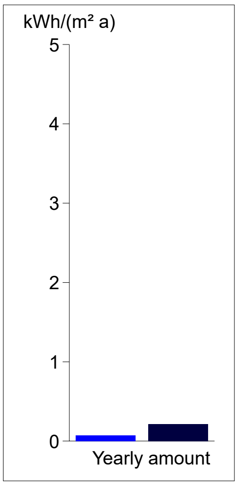
CASAnova

Output: Primary and end energy demand for cooling

Efficiency factor air-conditioning: 2,5 kWh cooling / kWh electricity

	Cooling demand in kWh/m²	End energy demand cooling (electricity) in kWh/m²	Primary energy demand (electricity) in kWh/m²
January	0,0	0,0	0,0
February	0,0	0,0	0,0
March	0,0	0,0	0,0
April	0,0	0,0	0,0
May	0,0	0,0	0,0
June	0,0	0,0	0,0
July	0,0	0,0	0,0
August	0,2	0,1	0,2
September	0,0	0,0	0,0
October	0,0	0,0	0,0
November	0,0	0,0	0,0
December	0,0	0,0	0,0
Sum specific in kWh/(m² a)	0,2	0,1	0,2
Sum absolute in kWh/a	58,2	23,3	69,9





Legend:

Cooling energy demand

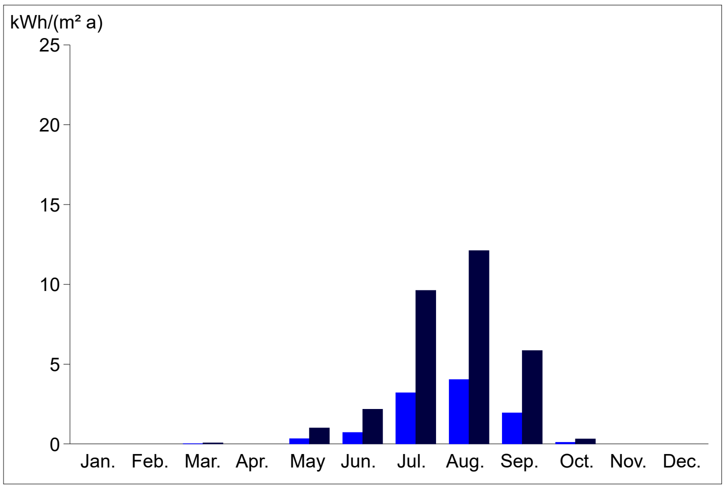
Primary energy demand

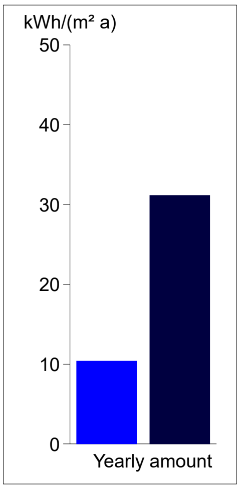
CASAnova

Output: Primary and end energy demand for cooling

Efficiency factor air-conditioning: 2,1 kWh cooling / kWh electricity

	Cooling demand in kWh/m²	End energy demand cooling (electricity) in kWh/m²	Primary energy demand (electricity) in kWh/m²
January	0,0	0,0	0,0
February	0,0	0,0	0,0
March	0,0	0,0	0,1
April	0,0	0,0	0,0
May	0,7	0,3	1,0
June	1,5	0,7	2,2
July	6,7	3,2	9,6
August	8,5	4,0	12,1
September	4,1	2,0	5,9
October	0,2	0,1	0,3
November	0,0	0,0	0,0
December	0,0	0,0	0,0
Sum specific in kWh/(m² a)	21,8	10,4	31,2
Sum absolute in kWh/a	7222,4	3439,2	10317,7





Legend:

Cooling energy demand

Primary energy demand

Let's see then the results that came out of the program.
As you can see, our proposal shows much better results with just the difference in u-values, meaning the usage of proper thermal envelope (insulation) and the materials used in the design, proving that this kind of architecture is a better option than just keeping doing things as we have so far.

8. CONCLUSION

I believe the project is a success, and I firmly believe architecture has the power to not only inspire but also educate for the current and future generations to live a better life for all life on earth. It is crucial we all reflect and change our habits to the better. It's essential that we organize and demand our leaders to take proper measures against the climatic disaster that's is already here. And in the meantime, we should all do our part in the fight, social change starts with individual change.

The architecture field needs to reflect deeply on what our priorities should be in the future, to align ourselves with a hopeful future, one that guarantees future generations the ability to live prosperously in this planet, the only place we can truly call home. We must adapt our approach, to design in a sense to prevent any more damage to our environment, we must understand the true needs of the people instead of the needs of the magazines and awards or the wants of the already powerful.

There are already much better options to design more sustainably, to do truly good architecture, something that doesn't need to be inherently innovative since there is already such good knowledge of how to build better, but never closing ourselves to innovative ideas, thinking critically about them to understand as much as possible while not being afraid to be wrong and change our minds, its important all of us have an attitude of constant learning, no matter what we do in life, all of us should strive to be better than what we were before individually and socially.

No matter how much one individual makes, the true power of positive change comes from the collective actions we take as a society, which we can no longer ignore and expect to magically change. However bleak it may seem we must remain hopeful that a better future is possible because hope is the last to die, and if we are pessimistic then definitely nothing will change, and we will have lost the war. We should not be afraid to confront the higher powers to demand for a better life for all of us, we all have a part to play in this fight, and if we manage to find a way to "row the boat" all in the same direction, towards a better future, I believe it is a possible and you all should too, otherwise what is the point of even trying if you don't believe a better future is possible, in the end we have no other option than fighting with all our strengths for what is right.

In my career and life I will hopefully play a positive role in this, I wish for a better life for all of us, and the way I see more fitting to do it is through design the best possible environment to largest amount of people possible, and hopefully through that inspire more people to take their stand in the struggle and work together to improve everyone's lives and not of just a few.

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Ever since I have started studying architecture, I always believed that my purpose in life would be to give back to society, and I also believe through architecture is the most efficient way I have of doing so for now, I don't know what the future holds which makes it a little scary but at the same time exciting, there are so many possibilities for the future that I must remain optimistic otherwise I will close myself to great opportunities that might come my way.

To finish I want to live you with a message that brings me hope andhopefully it will bring you too:

"Optimism is a strategy for making a better future. Because unless you believe that the future can be better, you are unlikely to step up and take responsibility for making it so."
- Noam Chomsky

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BIBLIOGRAPHY

Rogora, Alessandro. Progettazione bioclimatica per l'architettura Mediterranea by Alessandro Rogora (2012-01-01). ↰ :↰ Wolters Kluwer Italia, 1855

Lechner, Norbert. Heating, Cooling, Lighting: Sustainable Design Methods for Architects, 4th Edition. Wiley, 2014

Olgyay, Victor. Design with Climate: Bioclimatic Approach to Architectural Regionalism.↰ :↰ Princeton UP, 1963

"2019 Global Status Report for Buildings and Construction | World Green Building Council." World Green Building Council, 13 Sept. 2021

Mazria, Edward. The Passive Solar Energy Book: A Complete Guide to Passive Solar Home, Greenhouse and Building Design.↰ :↰ Rodale Pr, 1979

"Urbach Tower | Institute for Computational Design and Construction | University of Stuttgart." 13 Sept. 2021

"EURIMA - U-values in Europe." 13 Sept. 2021, www.eurima.org/u-values-in-europe.

"Climate change: now is the moment to rebuild better - EU Science Hub - European Commission." EU Science Hub - European Commission, 14 May. 2020, ec.europa.eu/jrc/en/news/climate-change-now-moment-rebuild-better.

Ritchie, Hannah and Max Roser. "CO↰ and Greenhouse Gas Emissions." Our World in Data, 11 May. 2020, ourworldindata.org/co2-emissions.

Aghemo, Cristina Azzolino Chiara. Illuminazione naturale: metodi ed esempi di calcolo.↰ :↰ CELID, 1995,

Contributors to Wikimedia projects. "Birdwatching - Wikipedia." 2 Sept. 2021, en.wikipedia.org/w/index.php?title=Birdwatching&oldid=1041896253. "Laguna di Orbetello | Oasi WWF | Pagina ufficiale." WWF Italia, 8 Sept.

2021, www.wwf.it/dove-interveniamo/il-nostro-lavoro-in-italia/oasi/laguna-di-orbetello.

“Sou Fujimoto Architects, Vincent Hecht · Rental Space Tower.” Divisare, 2 Sept. 2016, divisare.com/projects/325092-sou-fujimoto-architects-vincent-hecht-rental-space-tower.

Saieh, Nico. “National Tourist Routes Projects / 70ºN Arkitektur.” ArchDaily, 24 Oct. 2019, www.archdaily.com/6499/national-tourist-routes-projects-70%25c2%25ban-arkitektur.

Abdel, Hana. “The Bobrowisko Nature Enclave / 55Architekci.” ArchDaily, 2 Mar. 2021, www.archdaily.com/956388/the-bobrowisko-nature-eenclave-55architekci?ad_source=search&ad_medium=search_result_all.

Pintos, Paula. “House of Grain / Reiulf Ramstad Arkitekter.” ArchDaily, 29 Jan. 2021, www.archdaily.com/953820/house-of-grain-reiulf-ramstad-arkitekter.

Sagredo, Rayen. “Herdla Birdwatching Tower / LJB AS.” ArchDaily, 4 Aug. 2021, www.archdaily.com/888565/herdla-birdwatching-tower-ljb-as.

Caballero, Pilar. “Eco-Cabana Majamaja Wuorio / Littow Architectes.” ArchDaily Brasil, 25 Jan. 2021, www.archdaily.com.br/br/955113/eco-cabana-majamaja-wuorio-littow-architectes.

Gaete, Javier. “Facts Tåkern Visitor Centre / Wingårdh Arkitektkontor AB.” ArchDaily, 23 Apr. 2021, www.archdaily.com/297108/facts-takern-visitor-centre-wingardh-arkitektkontor-ab.