REGENERATIVE GRID

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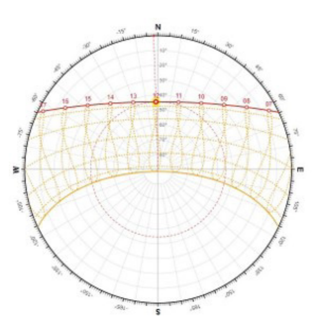
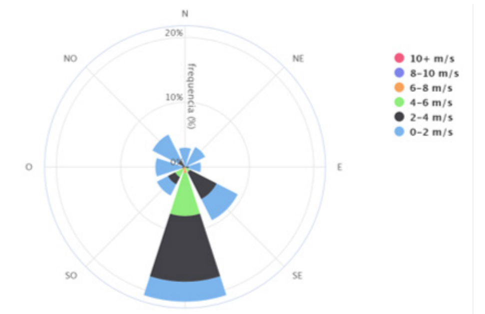
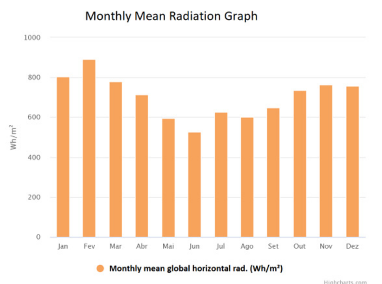
Statistical data of weather registers on the region
For the monthly data we used the means calculated and registered at a station (A627) in the city of Niterói from the Instituto Nacional de Meteorologia (INMET) that is the national meteorological organization of Brazil, using data from 2019 and 2020:

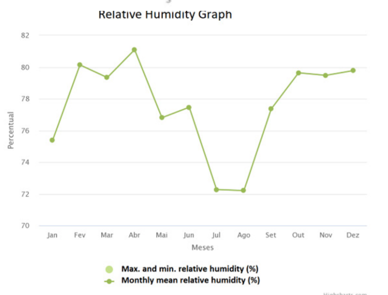




Monthly Mean Radiation Graph



Relative Humidity Graph



Choosing the materials to a low carbon building includes analyzing all the fases of this process.
On our project, we wanted to focus on the total life cycle energy of the building. Increasing awareness of how important it is every step of the design.

ADOBE BRICKS:
This is a traditional option for constructions, developed locally for traditional populations, but left out many years ago. It consists in using local selected soil, water and fibers to mold the brick and then leave it drying by the sun.
As Niterói is a warm city from Rio de Janeiro's state, this technique is useful but also needs attention on the application. That happens because this material has a low water resistance, and in order to resist a very humid area, we are developing walls that don't get so much exposure to the possible rains of the region.
From the architectural point of view, this brick helps lower the temperature on the inside of the buildings, once it hasn't been exposed to artificial heating. And also decreases it's the carbon footprint, because as it is developed in loco, these natural bricks have a low (or almost zero) embodied carbon index.
Tickness: 20cm
Termal Transmittance (U): 1,43 W/m2K
Termal Delay: 15,6h

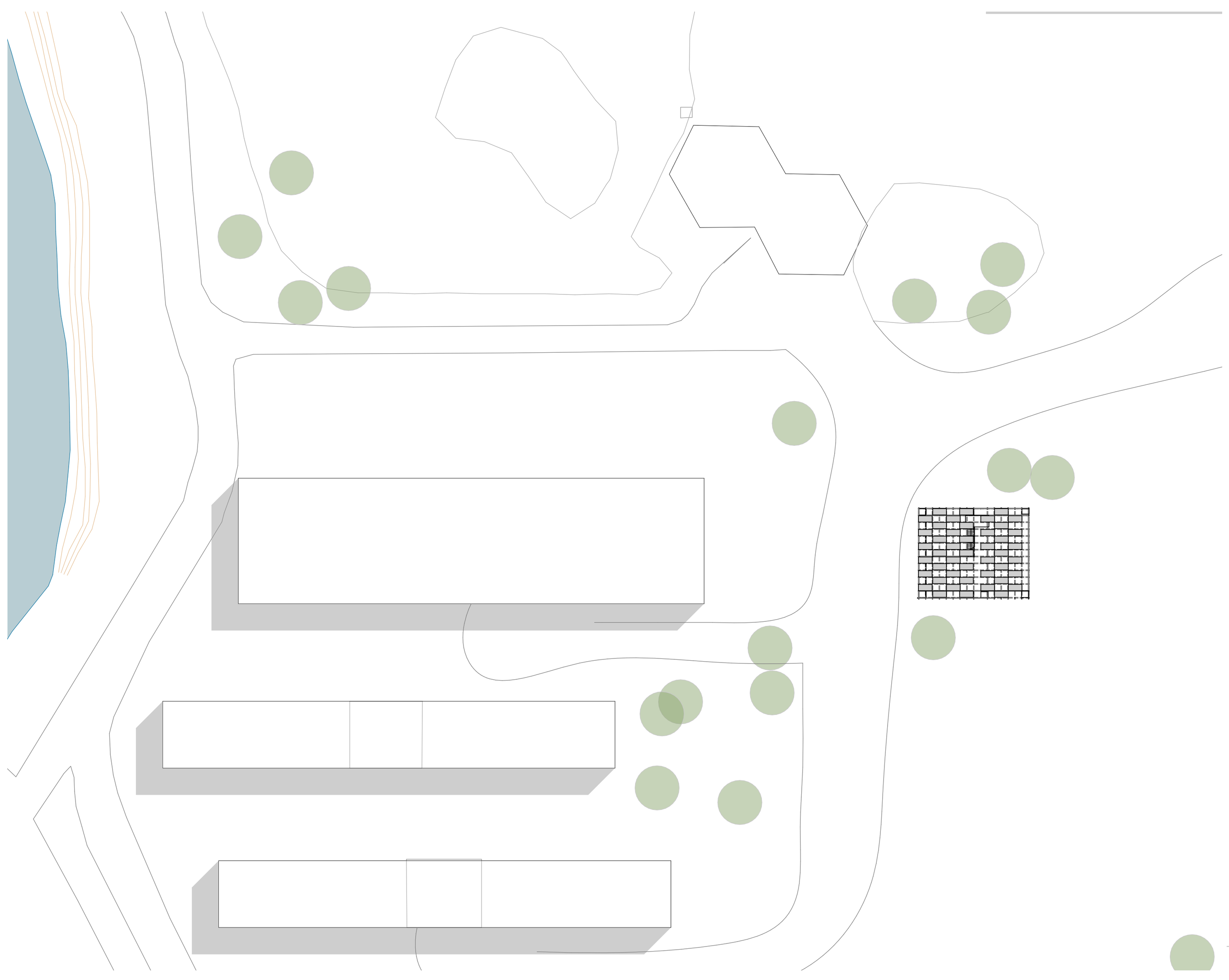
BAMBOO:
Bamboo is the material we have chosen for the structural infrastructure. It is easily found in any region of Brazil, and it requires less energy and emits less carbon to meet the same functional requirements as a traditional concrete infrastructure.

GREEN ROOF:
The green roof has a great variety of implementing advantages. The reasons why we have chosen it for out specific pavilion are the possibility of using the water of the typical tropical rains, having another green space for the students to be, decreasing the temperature into the pavillion and using it as a way to storage water for other non-potable uses, once the green roof acts like a biofilter, so the captured water can go directly to storage.
The reuse of rainwater in the urban area is important not only from the ecological point of view, in terms of decreasing the exploration of the hydrological resources, but It is also important from the urban management point of view, in terms of decreasing the superficial running water on extreme events, avoiding possible flooding. If we manage to reuse the rainwater to water the plants and flush toilets, the other water supply is going to be needed only for the sinks and the kitchen.
From Robert et al. 2005, the runoff e coefficient for rains over 39 mm is 0,55 in green roofs.
Resistance: 0,05
Termal Transmittance (U): 2,0 W/m2K
Termal Delay: 5h

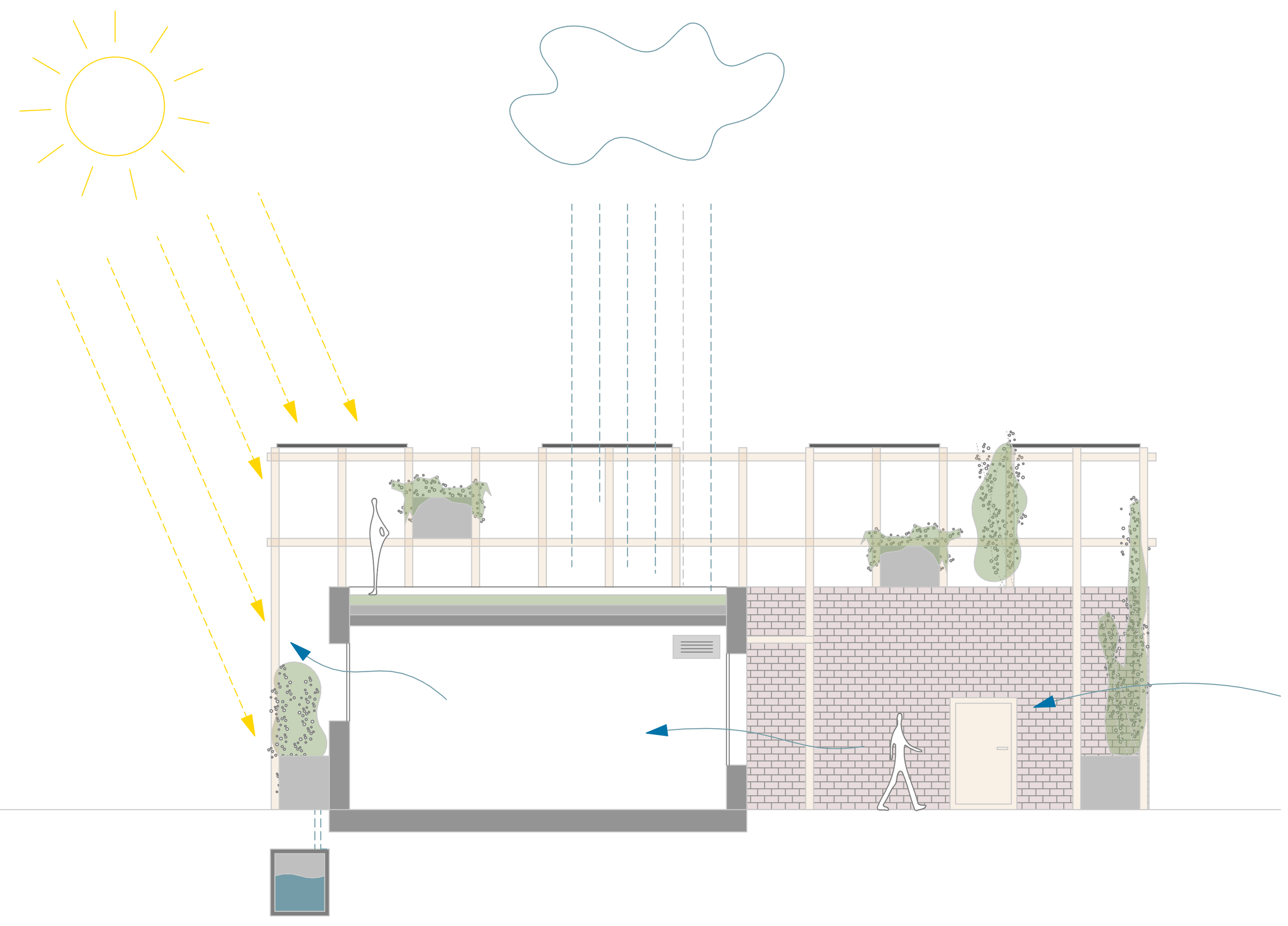
WATER STORAGING
The method used for dimensioning the water reservoir was the Practical English method: it is a methodology that uses annual historical series, considers the ideal volume of storage to be 5% of the volume of water collected on the roof, and disregards the variable water demand, and the volume obtained is obtained independent of this (ABNT, 2007; DORNELLES et al., 2010).
DAIANE BERTOLDI; ESTUDO DE IMPLANTAÇÃO DE COBERTURA VERDE ASSOCIADA À CAPTAÇÃO DE ÁGUAS PLUVIAIS; Universidade Federal de Santa Catarina 2017.
$V = 0,05*P*$; $P = 1103mm$; $A = 132\ m^2 \rightarrow V = 0,05*1,103*132 = 7,28m^3$
We considered an underground water reservoir with 10000 liters of storage capacity.

ELECTRICITY SYSTEM and CO2E EMISSIONS
Niterói, according to the carma.org data, has 50,9% of its energy supplied by a fossil matrix and the other 49,1% from hydropower sources. As in Brazil the fossil fuels energy production is from oil, natural gas and coal. But as the most used one is oil, that is the emissions mean we are going to consider.
With the pavilion's electricity demand being supplied by the solar pv panels system we are saving 5,74 tons of CO_2 equivalent per year. Relative to the building's consumption, which is approximately 20 MWh/year. The intention of this project is to produce more energy than the building needs so it can be distributed to the rest of the campus. Initially, supplying more energy to the universitary restaurant, that stands next to our pavilon's site.
Our system has 42 panels installed and produces per year an amount of 28 MWh/year. This extra 8 MW would save an extra amount of 3 tonnes of CO_2e per year.
This difference is only to illustrate the size of the changes that can be provided with some local infrastructure improvements. We have chosen 42 panels because it fits our building, but there is more space available that could be used for this purpose.

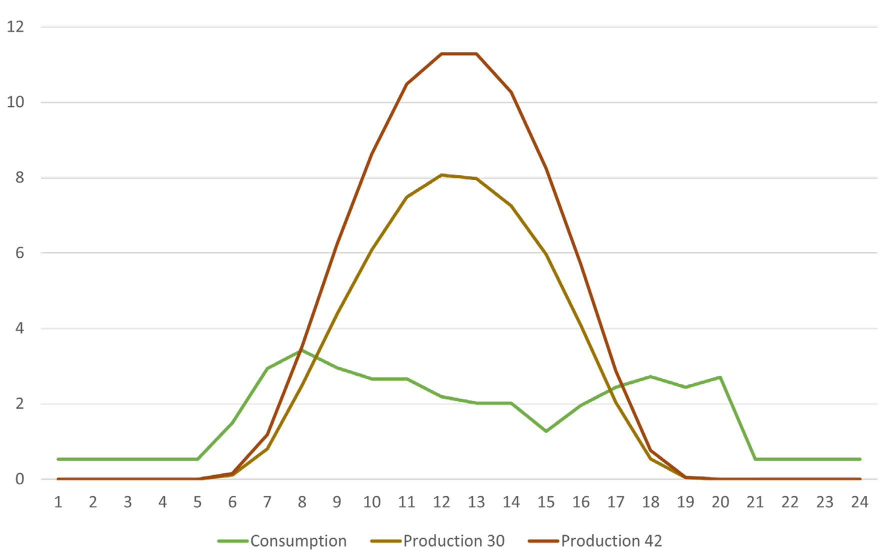
OUR DESIGN:
Our design is characterised by a grid, which is made of local sustainable bamboo. The grid takes on various functions. It covers the café and the exhibition area and serves to shade the entire building. The result is a pleasant outdoor area for the café and a shaded green roof. On its roof are the solar cells for energy generation, which also serve as shading. Furthermore, the Bamboo grid is extensively planted with vegetation and contributes to a pleasant atmosphere and good air. These plants could supply the café with food and be used for teaching purposes. As an extra, seating possibilities can also be integrated into bamboo structur.
The cafe and the exhibition space are separated termally to provide a smaller volume and more surfaces for better ventilation. both are constructed of adobe bricks. the windows are oriented south/north to capture the winds coming primarily from the south. The windows in the north are higher and smaller than those in the south to allow the warm air to flow out, as well as for less solar heat gain from the north. The outdoor area of the cafe is orientated to the South.
We have tried to integrate the climatic, technical, social and architectural aspects in our pavilion, the regenerative grid.

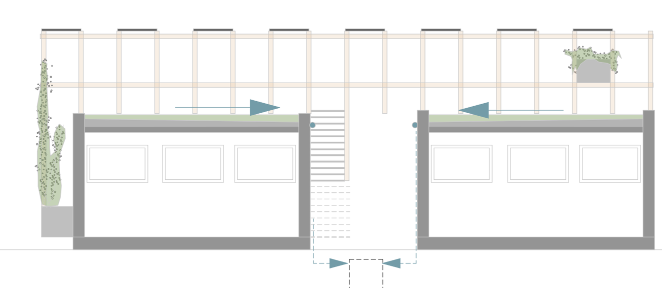


site plan I 1:1000

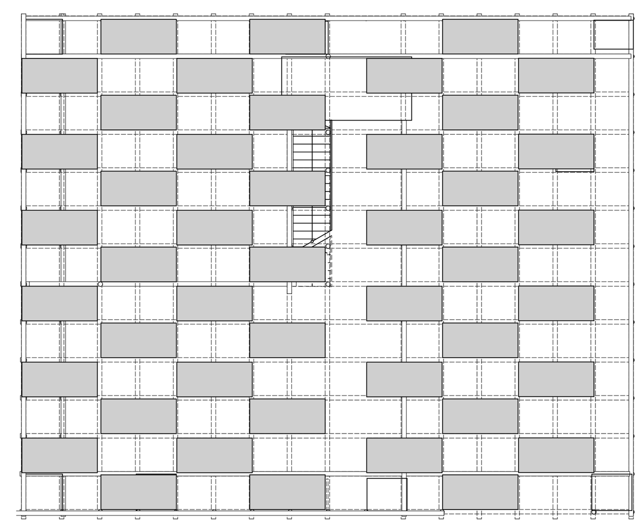


Hourly Production/Consumption Capacity [kW]

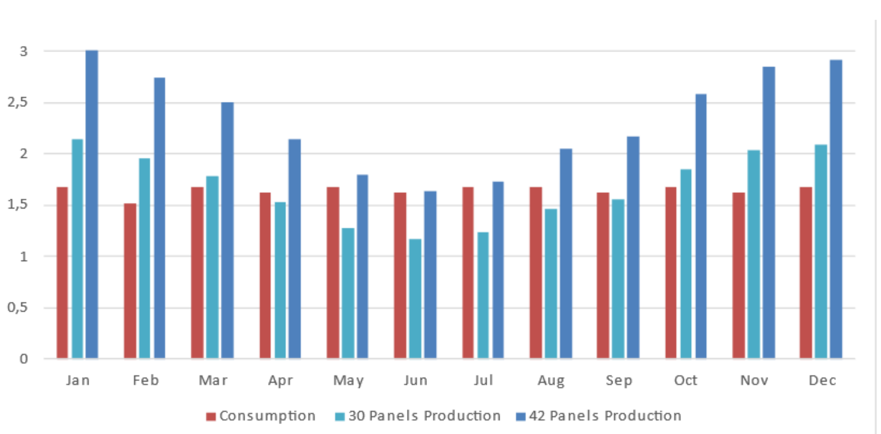


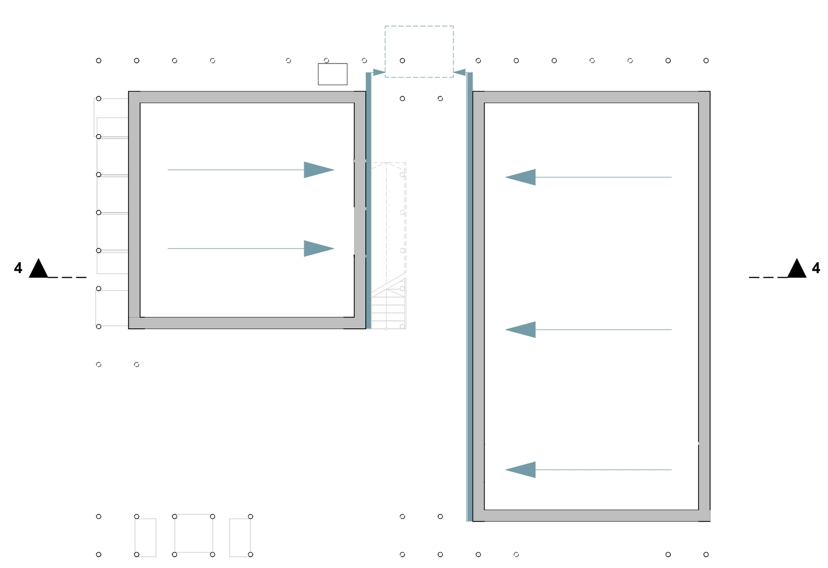


cut 1:200 Waterstorage system

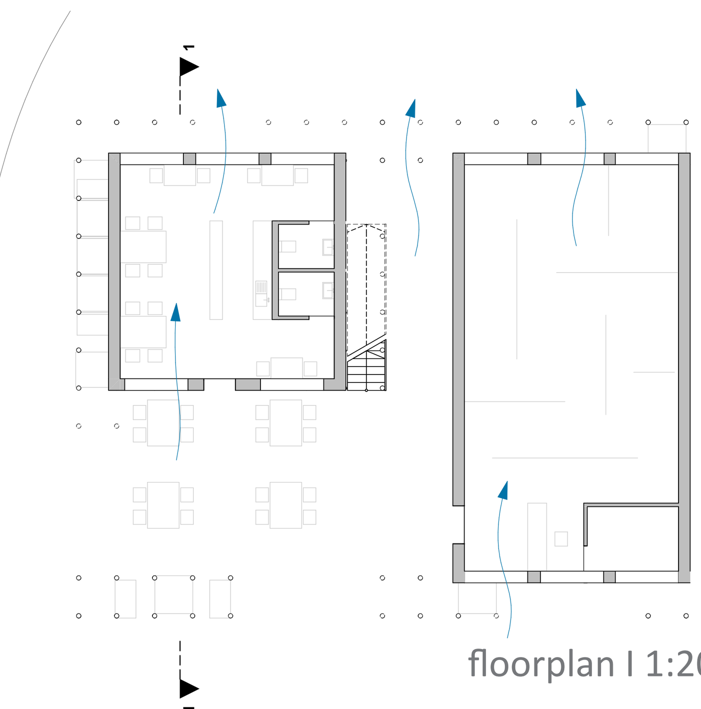


roof supervisionl 1:200





Roof 1:200: Waterstorage system



floorplan I 1:200