Session: Poster

FIOCRUZ CAMPUS CEARA

First public certified building in the Brazilian northeast region

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Abstract:

FIOCRUZ is a Brazilian institution part of the Minister of Health, reference in Latin America in the areas of public health, research and education. This project is the result of a working process, where the stakeholders were willing to innovate, beco ming a role model in this region of Brazil regarding how to conciliate a public bidding with a green building certification system, as well as how to apply sustainable, adaptatation and mitigation construction solutions in order to turn possible integrated goals. Successful strategies, like stormwater and runoff control; energy demand and potable water consumption reduction; and the capacity of being a sustainable knowledge multiplier among students and professionals, must be highlighted. For the first time in the country, a large scale project was developed integrating nature based adaptation strategies for stormwater and runoff control. The semi-arid conditions, typical of the country northeast region, were considered too. The main challenge was to guarantee the technical efficiency during the two seasons of this climate: a short period of intense tropical rains and stormwater events and, a second one, a long dry season. Both seasons presents high temperatures.

Keywords:

Built Enviroment, Climate Change, Construction Sector, Green Rating Systems, Sustainability,

FIOCRUZ Campus Ceará
Source: ARCHITECTUS S/S, 2017

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1 INTRODUCTION

1.1 Facts and Figures

FIOCRUZ (Fundação Oswaldo Cruz) is a Brazilian institution part of the Minister of Health. Founded in 1900 (FIOCRUZ, 2018), it is a solid and well-known reference in Latin America regarding public health, research and educational fields. All the projects of the Campus were developed by the architects and engineer's office ARCHITECTUS, located in the city of Fortaleza, Brazil. This case study reflects the interest and effort of a public institution and of a private office to encompass sustainability during the designing, construction and operational phases of a government building.

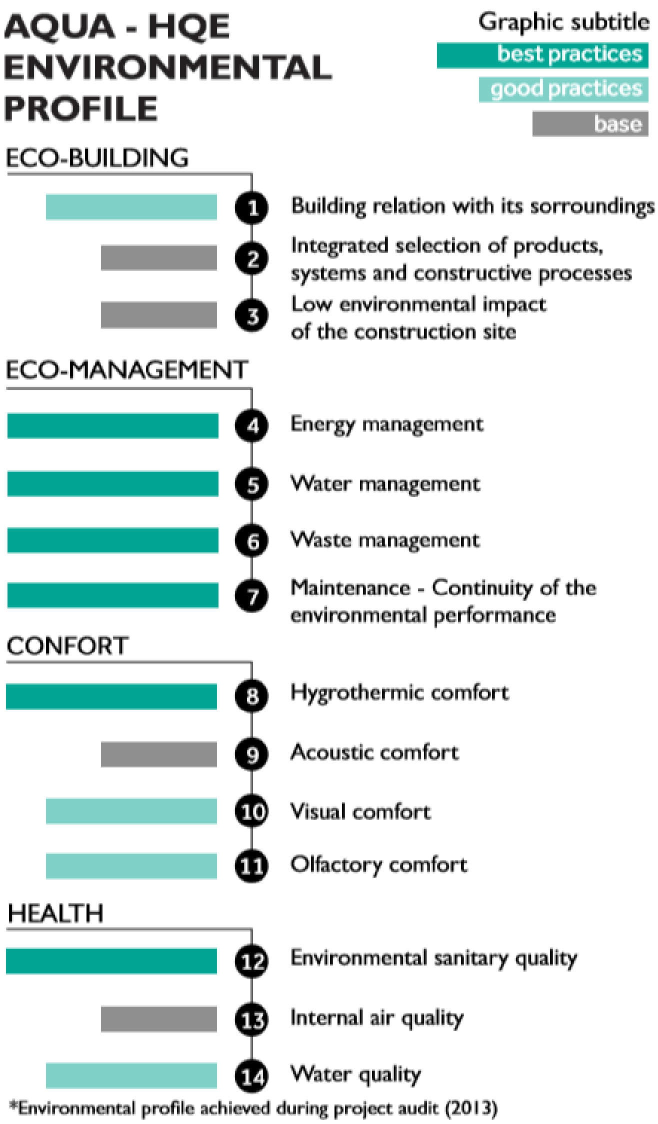
The Campus is located in the small city of Eusebio, which is part of the Metropolitan Region of the city of Fortaleza, capital of the state Ceará. Placed in the Northeast region of Brazil, Eusebio has a total area of 79 km² and 46,033 inhabitants, according to the last Brazilian census (IBGE, 2017). The average temperatures are 26 ^{o}C to 28 ^{o}C and the average rainfall is 1.379,9 mm, which is mainly concentrated during the months from January to May (IPECE, 2016). The Northeast region of Brazil concentrates the driest areas of the country, where rain characterizes by stormwater events.

FIOCRUZ Campus Ceará location.
Source: Own adapted from google images, 2018

In 2012, the project of FIOCRUZ Campus for the state of Ceará started to be developed having sustainability as main guideline for the process. The institution aimed to include sustainability in the 3 levels (social, environmental and economic) and, at the same time, assume an educational role within the sustainability field and share this knowledge in this region (Fiocruz, 2017). Through several tools, such as bidding terms, public innovative procurement framework, more sustainable contract terms, use of AQUA-HQE certification system, monitoring and evaluation of the project development and construction, FIOCRUZ was able to reach the goals.

All the processes and projects were developed in the light of the French-Brazilian building certification system AQUA-HQE. This system was selected once it is tailored to a Brazilian context, it allows the public institutions to hire different companies in each project phase (design and construction), it has a stronger social engagement and was a way to promote the use of a national certification system. In addition, this system is divided in 14 categories that cover sustainability through a broad range of fields and strategies (Fundação Vanzolini, 2015). Due to the location (surrounded by a permanent protected environmental area and in front of a lagoon), stormwater runoff control was vital to ensure a minimum impact in the environment and developed an important role complying with several of the AQUA-HQE mandatory requirements.

1.2 The Green Building Certification system - AQUA-HQE (High Environmental Quality)



FIOCRUZ Campus Ceará AQUA-HQE profile achieved during the 2013 audit
Source: ARCHITECTUS S/S, 2014

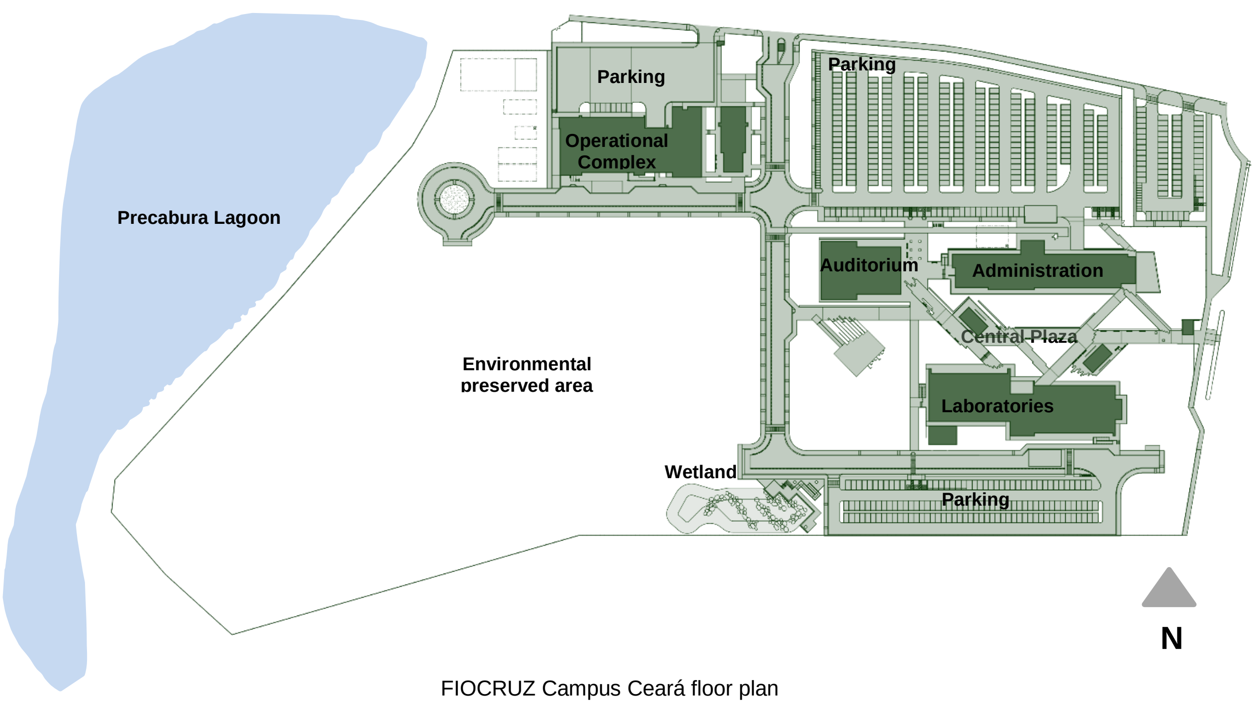
The AQUA-HQE (High Environmental Quality) is a green building certification system adapted, or tropicalized, to the Brazilian needs and context based on the French certification system *Démarche HQE (Haute Qualité Environnementale*). It started in 2008 as a voluntary one, thought it became mandatory for several types of building across the years. Divided in two main parts, it gives the possibility to cover the whole process of a building or construction, from the designing phase, to the construction and operational phase.

The first part is named Enterprise Management System (free translation). It allows the planning, operationalization and control of all stages of the development process. Moreover, it is the base to define and commit with the second part of the system. The second part is called Building Environmental Quality (free translation) is organized in 4 main groups: eco-building, eco-management, comfort and health. Each one of them is subdivided in categories, accounting 14 in total. Together, all these categories provide the building profile. This profile reflects the commitment level toward the pillars of AQUA. The 14 categories can be classified according to their performance in: basic, good practices or best practices. Furthermore, several reference guides are available, encompassing different types of constructions. Through 3 face-to-face audits (one per stage), the construction and process can achieve the green building certification award (Fundação Vanzolini, 2007).

2 OBJECTIVES

The Campus was the first building to be constructed in a new industrial and technological complex dedicated to health-related topics. The local government of the city of Eusebio and the state government of Ceará aimed to develop this region and create new working and studying opportunities. The selected area is surrounded by a permanent protected environmental area and the Precabura lagoon. This location turned to be the first challenge.

The project total constructed area is 43.147 m^2, which includes the edifices of laboratory, administration, education, auditorium, operational complex and small kiosks distributed in the central plaza. All these buildings have a total green roof area of 641,05 m2 and are located in a 103.683,83m2 site area, creating a remarkable permeable area and open space of 19.976,85m2 (ARCHITECTUS,2014).



FIOCRUZ Campus Ceará floor plan
Source: ARCHITECTUS S/S, 2014

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Focusing on project process, construction techniques, the requirements of the green building certification system and the integration of mitigation and adaptation strategies, the Campus project aimed to encompass the following objectives and principles:

- Apply the Integrated Project Delivery methodology, in order to obtain the maximal collaboration among the team members, solve most problems during the project phase and reduce rework and unexpected problems during the construction phase
- Fully integration of architectural, urban planning and constructive aspects to ensure the minimum impact in the permanent protected environmental area and lagoon
- Stormwater, drainage water, greywater and blackwater catchment, treatment and reuse on site
- Integrated strategies between urban, drainage and landscape projects to control stormwater and runoff impacts and flooding
- Local and adapted landscape species
- Solid waste proper sorting and recycling
- On site infrastructure for composting gardening waste
- Maximum use of natural lighting and ventilation
- Renewable energy on-site production (wind power and solar panels)
- Green roofs to reduce urban heat islands
- Regional and sustainable construction materials and techniques
- Buildings designed following a modular and flexible structure, granting future expansions

Source: ARCHITECTUS S/S, 2017

- Internal spaces that highlight and provide visual access of the natural surroundings
- Accessible humanized spaces and vast green areas which embrace social gatherings and contemplating nature activities

Narrowing down to adaptation objectives, the project goal was to develop, in a semi-arid region, an ecosystem-based adaptation strategies integrated with blue/green infrastructures, stormwater runoff and non-source pollution control solutions. Although, these technologies are commonly applied in developed countries, in Brazil they are incipient. The country has few examples constructed in the last decade, which are the first experiences of blue/green infrastructure adaptation to the Brazilian environmental conditions. In the Northeast region of the country, this project was the first one to incorporate such solutions.

The city average rainfall is 55mm per month (IPECE, 2016). However, when each month is analyzed separately, it is possible to identify the potential for developing such strategies, once during the rainiest months the maximum rainfall can reach 320mm. For these reasons, solutions as rain gardens, wetlands, water ponds or other type of non-conventional urban drainage and infiltration techniques are stigmatized as not feasible or viable to apply (Lima, 2016). In addition, there is a mindset that the system would not adapt to the two opposite conditions of amount of rainfall water (stormwater events and drought).

Based on the rainfall regime, AQUA-HQE requirements, local demands and constraints, the challenge was to develop, within an integrated approach, a resilience system able to: retain stormwater during events, a landscape project just with natives and adapted species, as well with low cost maintenance. In addition, one of the main challenges was to design a garden with vegetal species resistant to the humidity annual variation and with low irrigation water demand during drought periods.

FIOCRUZ compromised to monitor and assess, looking forward to developing this technology and create a role model for the region.

3 RESEARCH QUESTION

Having in mind the general and specific objectives, two main research questions guided the work along the years:

- How to successfully integrate sustainable construction strategies along the phases of a public building project, considering local technologies, managing efficiently natural resources and reducing the environmental impacts of a new construction?
- How to adapt the international concepts and technologies of water urban sensitive design to the Brazilian semi-arid climate conditions, in order to control stormwater events?

4 METHODOLOGY

When it comes to the methodology applied regarding the designing and construction process, in a simple way, the process can be summarized through the following steps:

- Mandatory sustainable bidding terms and public innovative procurement framework
- Green Building Certification System selection and technical reference guide
- Vast research regarding the existence, application, limitations and success of the aimed technologies and materials, which included literature and site visits to prototypes in Brazil and USA. Final assessment and selection by SWOT and MCA methodologies.
- AQUA-HQE rating system applied along the conception, designing and construction phases
- Intensive Monitoring and Evaluation during design and construction phase (3 Audits, monthly visits, weekly reports)

Zooming into the green and blue infrastructure looking forward to adaptation, a vast research of aimed technologies was conducted, which included literature and site visits to prototypes in Brazil, Netherlands and USA. Afterwards, a water flows analysis and comparison required by the AQUA-HQE was developed. A baseline was built considering a project without sustainable features. Then, all the water efficient strategies developed were accounted and a new scenario was provided. The analysis included volumes demands, rainwater harvesting, greywater treatment and reuse, irrigation, runoff control and water sensitive design elements. After comparing both situations, the new project reduced 66% of potable water consumption.

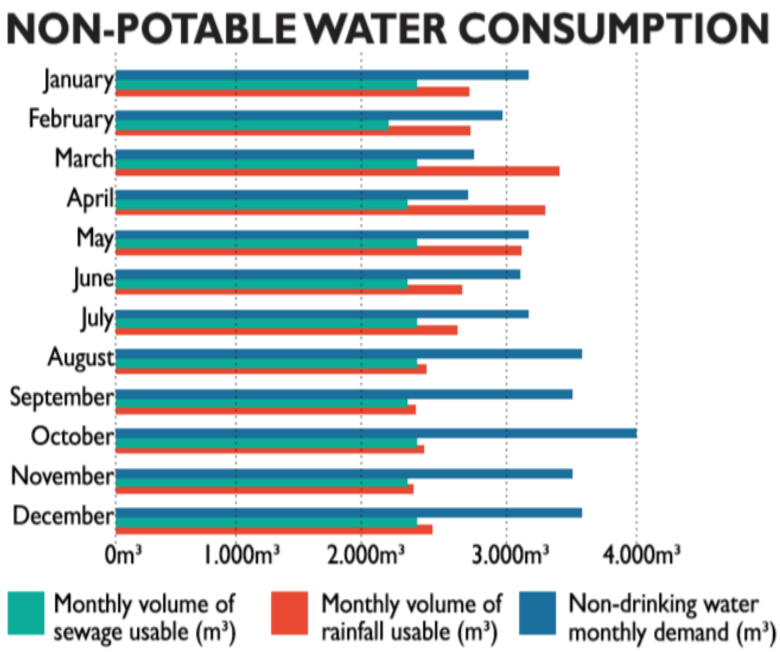
The construction site was constantly visited and evaluated. Since June 2016, when it was ready, the efficiency and performance of the blue/green infrastructure elements had been monitored. Finally, these infrastructure elements were studied in one of the author's M.Sc. thesis.

5 OUTCOMES

The Campus and it process represents a paradigm shift among the stakeholders, due to the innovative working experience and new technologies developed for the local climate context. It was also possible to identify and reduce the gap between the construction sector and environmental protection legal framework.

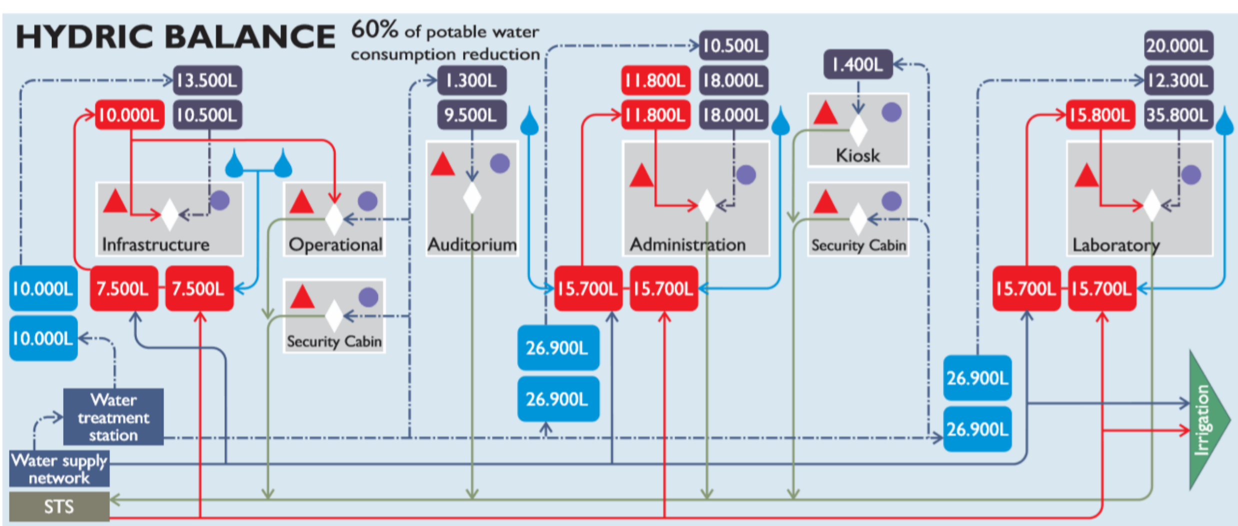
Regarding environmental outcomes, the energy efficient simulation pointed an energy demand reduction of 24%; the water offers and demand balance showed a potable water consumption reduction of 66%; stormwater and runoff control proved during the 2016´s rainy season (ARCHITECTUS, 2017).

Once landscape, drainage and urbanism integrated projects construction were completed in June 2016, it was possible to verify that the water flows estimations were accurate, and the rain gardens and wetlands system were responsible for the runoff coefficient reduction. After several stormwater events, , these blue/green urban infrastructure solutions were able to retain the volume predicted, without leakages, and retain pollution, such as non-source and solid waste. In addition, the native plants selected for the wetlands landscape demonstrated their resilience capacity after surviving a 6 months drought period.



FIOCRUZ Campus Ceará Non-Potable Water Consumption graphic
Source: ARCHITECTUS S/S, 2014

Facing the challenge of implementing the first blue/green urban infrastructure for stormwater management in the context of the Brazilian semi-arid provided the opportunity to adapt international technologies to a local context and develop an on-site research. It was an innovation regarding the urban drainage solutions that are plausible and efficient to apply in these regions.



FIOCRUZ Campus Ceará Hydric Balance dor AQUA- HQE
Source: ARCHITECTUS S/S, 2014

Besides adaptation strategies, the project comprised successful CO2 mitigation strategies. By installing solar and wind power; leveraging natural lighting and ventilation in most of the building inner spaces; use of low energy consumption lighting features and equipments; limiting the use of air condition to the laboratory areas; sorting the waste properly; prioritizing use of local materials, to reduce transportation emissions, selection of construction materials with renewable share; integrating bicycle lanes and bicycles racks to the complex; promoting use of electric vehicles and providing their infrastructure.

Concerning educational result, since the construction phase, the Campus is considered a laboratory and field study for architects, engineers, researchers and students. The reason is it integrates the building daily use and on-site research and provide the opportunities of new research areas. The project was case study of several final graduation works and of a landscape master thesis. Finally, based on the results achieved and on environmental protection awareness, other buildings of the industrial complex are under the green building certification system process. These last facts prove the importance of being a knowledge multiplier as well as reinforce the role model aimed.

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To ARCHITECTUS S/S for untapping our potential, believing that both of us could manage the challenge, change local mind sets, inspire and engage other professionals towards environmental causes. Their continued support, even when one of us left the team years ago, most be celebrated.

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