USE OF SUSTAINABLE CRITERIA FOR WATER MANAGEMENT IN HIGHER EDUCATION BUILDINGS: A CASE STUDY OF THE UFG/JATAÍ'S LIBRARY

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INTRODUCTION

- Development x sustainability
- Construction Industry – high consumption of natural resources
- Sustainable building certifications: Leed; SBTool, AQUA
- Federal buildings (Federal Universities) – New buildings must be certificated
  - Economical Crisis in 2014/2015 – reduction of investments

INTRODUCTION - LEED

- USGBC created the certification system LEED in 1998 in the United States.
- It evaluates the following categories: Sustainable sites, water efficiency, energy & atmosphere, materials & resources, indoor environmental quality, innovation in design or innovation in operations, and, finally, regional priority credits.
- To the audition, the buildings must provide pre-requisites in seven categories, which will secure the achieved score, ranging from 40 to 110 points, giving the building respectively, from the approved label to Platinum label.
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INTRODUCTION - AQUA

- Created in October 2007, AQUA - High Environmental Quality - was the first Reference Technician Certification of Sustainable Building from Brazil.
- It is based on HQE - *Haute Qualité La Environmentale*, its French correspondent and the Foundation Carlos Alberto Vanzolini implemented it.
- Divided into 14 categories, which are inserted in four different bases of action: eco-construction, eco-management, comfort and health.
- The categories are also divided into criteria (or sub). Each of these categories or criteria can be classified as: Good (B), Superior (S) and Excellent (E).
- To obtain the AQUA certified, the enterprise must submit a maximum of seven categories with a good performance level and at least three categories with a level of excellent performance

INTRODUCTION – SBTool

- Flexible international method that can be adapted to different contexts.
- In 2009, iiSBE Association Portugal - International Initiative for the Sustainable Built Environment - in collaboration with the LFTC- a and the Ecochoice adapted it to Portuguese reality, creating the SBTool^{PT}.
- Three dimensions of sustainable development: environmental, social and economic. These dimensions are divided into nine categories, which are divided into 25 criteria.

METHODOLOGY

Criteria Analysis

Case Study – Library of the UFG Campus Jatai

- Original design verification related to the criteria
- Design changes to accomplish criteria

Economical evaluation

	LEED	AQUA	SBTOOL^{PT}
Reduction of the consumption of potable water	Reduction of 40% of the building´s potable water consumption compared to the certification reference values (1A).	Use of saving systems to ensure a reduction of drinking water consumption up to 50% of the reference project (2A).	Reduction of the annual volume of water consumed within the building for up to 23m³/person.year (3A).
Reduction of the operating pressure		Use of pressure relief valves, if the pressure is greater than 300 kPa (2B)	
Wastewater management	50% reduction in the generation of wastewater (1B)	Replace 50% of the drinking water demand on devices that do not require it (cisterns, urinal,s cleaning, watering) by any source non- potable-water (2C)	A greywater system Reuse (3B).
Plot rainwater management			A rainwater harvesting system (3C).
		Pre-treatment of rains occurring strictly greater more often than the standard occurence (2D)	
		The overall imperviousness coefficient after realization is lower than 65% (2E).	
		The soil-sealing ratio should be less than 60%. For highly urbanized areas, the percentage of improved waterproofing coefficient should be greater than 10% (2F).	

	LEED	AQUA	SBTOOL^{PT}
Irrigation management	The potable water consumption must be 50% less than a typical scenario (1C)		
	It must have a Landscape that does not require permanent irrigation or the irrigation that uses only non-potable water (1D).		
miscellaneous	Do not use cooling towers (1E)		
	The building can´t have any food crushers (1F).		
	The building can´t have any special equipments that use a lot of water (1G)		

RESULTS – POTABLE WATER REDUCTION

- Default consumption to this kind of building - 50 l/person*day = 14,4 m^3 / person*year.
- Library´s floating population – 538 people
- Average - 24 days/month
- Total consumption 5,1 m^3 / person*year – reduction of 64,58%
- Criteria 1 A , 2 A and 3 A - accomplished

RESULTS – POTABLE WATER REDUCTION

Appliance	Flow	Frequency of use		OBS
		Jan, Feb, Jul	Rest of the year	
Flusing toilets [11]	6.8 l/flush	0.9 use/day	0.9 use/day	
Washbasin taps [11]	0,1 l/s	1.75 uses/day	1.75 uses/day	Each use 7.34 sec.
Irrigation [11]	2.4 l/m^2	It won´t happen	Mondays, Wednesday, Fridays	
Cleaning [11]	0.5 l/ m^2	It won´t happen	Monday through friday	
	1 l/ m^2	Saturday	Saturday	

RESULTS – POTABLE WATER REDUCTION

Month	Weekdays	Total Daily Demand (L/person.day)	Apliance Daily Demand (L/person.day)	Irrigation Daily Demand (L/person.day)
January and February	Monday .- Friday	5.56	5.56	0
	Saturday	6.75	6.75	0
March	Monday .- Friday	11.13	11.13	0
	Saturday	13.51	13.51	0
April, May, June, August, September, October , November and December	Monday, Wednesday and Friday.	31.14	11.13	20.01
	Tuesday and Thursday	11.13	11.13	0
	Saturday	13.51	13.51	0
July	Monday, Wednesday and Friday.	25.58	5.56	20.01
	Tuesday and Thursday	5.56	5.56	0
	Monday, Wednesday and Friday.	6.75	6.75	0

RESULTS – original design

- **Operating pressure –** under 300 Kpa
- **Irrigation System-** It doesn´t have any irrigation system designed. As well, there isn´t concern about the selection of species for the gardens.
- **Rainwater harvesting -** there isn´t any rainwater harvesting system
- **Greywater Reuse System –** There isn´t any greywater harvesting system

MODIFICATIONS OF THE ORIGINAL DESIGN

- Implementation of a Rainwater harvesting system
- Installation of double flush toilet
- Irrigation system using rainwater

Double Flush toilet

- Regular flush (6.8 liters/flush) was at the original design
- The double flush toilet considered
  - 75% of the use will be 3.4 liters/flush
  - 25% of the use will be 6.8 liters/flush
- Reduction of the 37,5% of the water used for toilet flushing and 16,5% of the total water used at the building.

Rainwater harvesting system

- Volume of 21. 5 m^3 , sized using the Netuno Software – 69,09% 69.09% of the predicted use will be supplied with rainwater along the year
  - Use predicted toilet flushing, irrigation and cleaning

Greywater reuse system

- The demand for water to toilet flushing and urinals in the modified project will be 2057.85 liters/day.
- To a reuse system for this building, only water from the water basin and sinks could be reused, what would give us a total of 203.4 liters/day.
- The amount of water for reuse is less than 10% of the demand and it does not justify the implementation of greywater reuse.

IRRIGATION SYSTEM

- We used rainwater to irrigate the landscape
- This system will reduce 33.05% of potable water that was used for irrigation.
- This result is lower than required by LEED certification, which requires 50% reduction in consumption of potable water.
- In addition, for the garden, we suggested plant species with low irrigation demand

TOTAL CONSUMPTION

Month	Original Design (liters/ person. day)	Design with installation of saving appliances (liters/person. day)	Reduction (*)	Design with installation of saving appliances and rainwater use (liters/person.day)	Reduction (*)
January	5,76	4,13	28,30%	2,2	61,81%
February	5,76	4,13	28,30%	2,2	61,81%
March	11,53	8,26	28,36%	4,48	61,14%
April	21,53	18,26	15,19%	12,81	40,50%
May	21,53	18,26	15,19%	15,87	26,29%
June	21,53	18,26	15,19%	17,28	19,74%
July	15,77	14,13	10,40%	13,67	13,32%
August	21,53	18,26	15,19%	17,08	20,67%
September	21,53	18,26	15,19%	15,09	29,91%
October	21,53	18,26	15,19%	12,54	41,76%
November	21,53	18,26	15,19%	10,46	51,42%
December	21,53	18,26	15,19%	8,6	60,06%
Avarage	17,59	14,73	16,25%	10,61	39,70%

ECONOMICAL FEASIBILITY

- Lifetime 20 years – Brazilian Standards
- Investment – US$ 13,044.96 (R$ 34,047.34)
- Water Savings – Around 90 m^3/month
- NPV – US$ 16,673.54 (R$ 43,517.95)
- Payback – 83 months

December 10th 014 – 1 US$ = R$ 2,61

CONCLUSIONS

- Most of the criteria related to water conservation are achievable
- From the original design, a significant amount of criteria is already accomplished.
- The number of criteria satisfied increases significantly with a relatively small investment.
- The net present value and payback demonstrate the economic viability of the system. Thus, in addition to environmental impacts, the use of these technologies can bring economic benefits to the university community.
- Guidelines of plumbing system design and water management at this campus building and any other campuses contemplate these actions, making higher education institutions a place where sustainable practices occur every day.

THANK YOU – OBRIGADO

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