ESTABLISHMENT OF A WATER CONSERVATION PROGRAM AT TECHNOLOGICAL SCIENCE CENTER FROM SANTA CATARINA STATE UNIVERSITY

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ABSTRACT

The concern with issues such as sustainability and water conservation was the propeller for the studies to establish a Water Conservation Program at Santa Catarina State University (UDESC). The proposal, based on studies published by the University of São Paulo (USP), aims to manage water consumption through technological oriented activities and behavioral actions. The behavioral actions begin with the analysis of the users of hydraulic and sanitary systems, their needs and desires regarding the use of water at the campus area, and also, through educational campaigns. The technological activities involve the proposition of optimizing water consumption systems, either by replacing conventional equipments for water saving equipments or through water reuse projects. Another technological action is the development of a submetering system at Technological Science Center (CCT) campus area. This paper presents the methodology proposed for the establishment of this Water Conservation Program, and the results achieved so far.

Keywords: water conservation, university campus, sustainability.

1 INTRODUCTION

Water scarcity has been studied in various parts of the world and increasingly the importance of this resource is evident in relation to sustainable development. Water conservation is part of the overall objectives of sustainable development, since it seeks a lower consumption of water and contributes to maintain the ability of future generations to use this resource (Silva, 2004). Water conservation can be defined as an optimization of water consumption, preserving consumer activities normal in quality and quantity (Gonçalves, 2002). Thus, through planning with the aim of reducing losses and waste, this optimization can be achieved (Oliveira; Gonçalves, 1999). A Water Conservation Program – WCP - is, therefore, a management tool that involves planning and implementation of actions in order to save water by minimizing losses and promoting a discerning use of this resource.

Knowing the physical and functional characteristics of the building system helps in the detection of possible problems. It is necessary for future planning and implementation of activities with less cost and with greater impact in water consumption minimization, waste reduction and therefore, better achieving the needs of users (Oliveira; Gonçalves, 1999).

The program described is based mainly on the Water Conservation Program of University of São Paulo (USP), implemented in 1995, and the Water Conservation Program of the University of Campinas (Unicamp), implemented in 1999.

Various publications describe different methods of implementation of a WCP. Among many of those methods one of the first that stands out is the proposal prepared by Oliveira and Gonçalves (1999), structured on the following steps:

- *Observation of water consumption*: monitoring of functional and physical characteristics of the building through a preliminary diagnosis of water consumption and other data relative to hydraulic and sanitary systems;
- *Diagnosis of water consumption*: based on the systematic evaluation of data collected in previous step including specific actions for each type of building;
- *Execution plan*: from previous step, a set of specific strategies are settled for controlling of water intake and correction of problems identified. Some of the strategies are: consumption submetering system, awareness campaigns, equipment replacement and repair of leaks;
- *Assessment of the impact of water consumption reduction*: this is the phase in which the quantitative results obtained by the implementation of the program are discussed. For that a Consumption Indicator (CI) is evaluated as a way to highlight the impact achieved.

Silva (2004) proposes the division of the methodology of totally completion of a WCP in four stages: planning, pre-implementation, implementation and operation, which can be seen in the diagram in Figure 1.

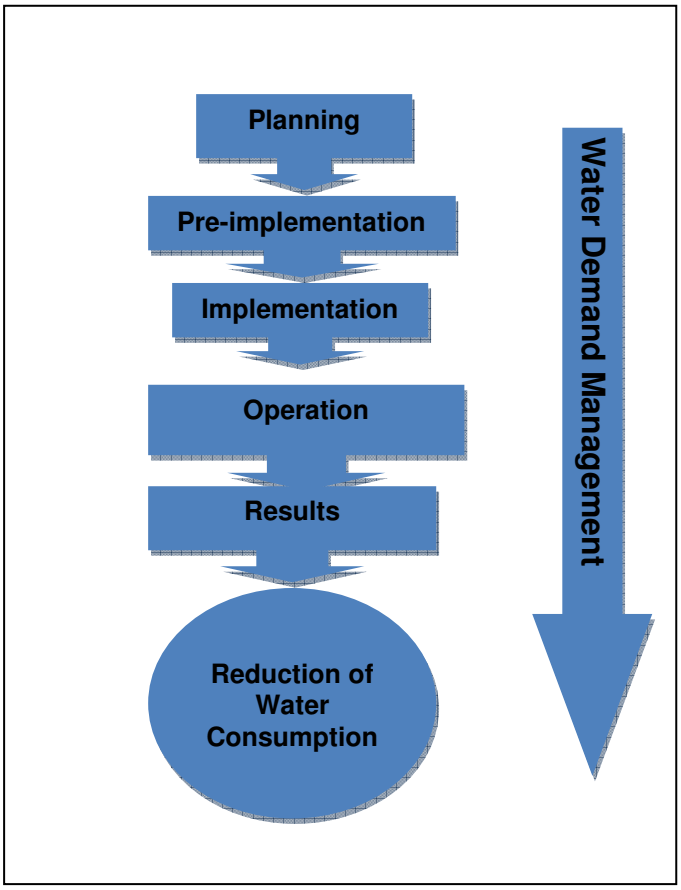

Figure 1 - Flow chart proposed for a Permanent Water Conservation Program.
(Source: Silva, 2004)

In the pre-implementation stage, activities defined as strategic with a higher reduction potential are defined as priority. The Water Conservation Program of CCT-UDESC is in the implementation phase, which can be structured in five steps:

- General diagnosis: data collection for the beginning of actions;
- Reduction of physical losses: leaks correction;
- Reduction of consumption at water use points;
- Habits characterization and rationalization of activities that consume water;
- Awareness campaign and users training.

The Water Conservation Program of CCT-UDESC was created based on the work of Sangiao (2004) and began in 2005. The proposed methodology for the implementation stage of the Water Conservation Program of CCT-UDESC is described in this paper.

2 METHODOLOGY

The main objective of the WCP of CCT-UDESC is to implement activities of behavioral and technological nature in an integrated manner in order to optimize the water consumption on campus.

Among the behavioral oriented activities are awareness campaigns for users of the hydraulic and sanitary systems, through posters and informative lectures that focus on the dissemination of the importance of water conservation. Technological activities promoted by WCP involve research and investments in new technologies. Therefore, the methodology for implementation of the program is divided into the steps described below.

2.1 General Diagnosis

At this first step registration of water use points and reservoirs is carried out, and organized into a database for future data analysis. In this survey the items analyzed are: number and characteristics of the hydraulic equipment, aspects related to the reservoirs (such as accessibility, reliability, and maintainability), location of pipes and all water use points on campus and also important aspects with regard to metering systems.

Data concerning user's behavior are also surveyed by means of appropriate questionnaires adapted according to each group on campus (lecturers, faculty staff, students and visitors). Questions are made in order to prevent that the real behavior concerning water usage in the campus is not disguised.

2.2 Specification of a Submetering System

This proposal includes a project in which the campus is divided into units with a water submetering system installed in each unit, allowing monitoring of water consumption in each different sector. The installation of such system will make possible the detection and identification of anomalies in consumption more effectively, and as consequence carrying out the appropriate corrections faster.

2.3 Replacement of Equipment

The focus of this stage is the replacement of conventional equipment for water saving equipment. The choice for the appropriate equipment is a result of studies based on data collected in the general diagnosis step. The study led to the possibilities of equipment exchange at each water use point, according to type of utilization. This preliminary analysis is done using spreadsheets to identify where existing equipment were registered and also the questionnaires carried out about the use of equipment on campus.

2.4 Awareness Campaigns

At this step, workshops on the optimization of water consumption, preparation of lectures and posters, leaflets and other means of dissemination on the importance of using water rationally are some of the actions taken. Moreover, there is further dissemination of quantitative results already achieved by the program.

3. RESULTS

The program is permanent and most of the steps occur in parallel, in a continuous manner. The results achieved so far, either completed or under implementation, are detailed as follow.

3.1 General Diagnosis

3.1.1 Registration of the campus hydraulic system

The main difficulty in carrying out this step of the program is due to the absence of the hydraulic and sanitary systems projects. There is no precise information on the path of pipes, number and characteristics of reservoirs, water use points and metering system. All the information obtained is result of field visits and interviews with maintenance sector staff.

Since their construction, most buildings have not suffered any significant intervention. Figure 2 shows, in a simplified form, the arrangement of blocks at the campus area.

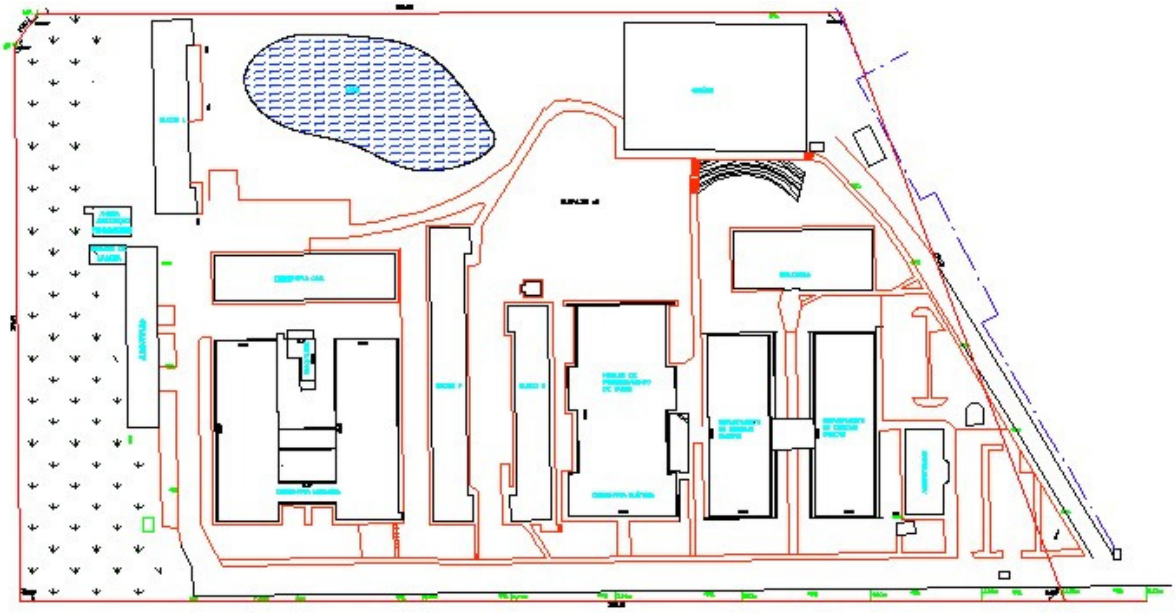

Figure 2 - Technological Science Center Campus (CCT-UDESC)

Water supply on the entire campus is provided by municipal public service, and there is no alternative source of supply installed. The quality and quantity required for each type of water use on the campus are varied.

During registration of the existing water metering system, it was found that the campus has only three links to local water supplier and one of those was out of order. The municipal office was contacted, the problems were officially reported and the equipment repaired.

In water use points registration the aspects observed were: location, type and sanitary operating conditions. The campus has some water saving equipment such as self-closing taps, self-closing urinals and low volume toilets. A comparison between saving and conventional equipments preexisting in campus is shown in Figure 3.

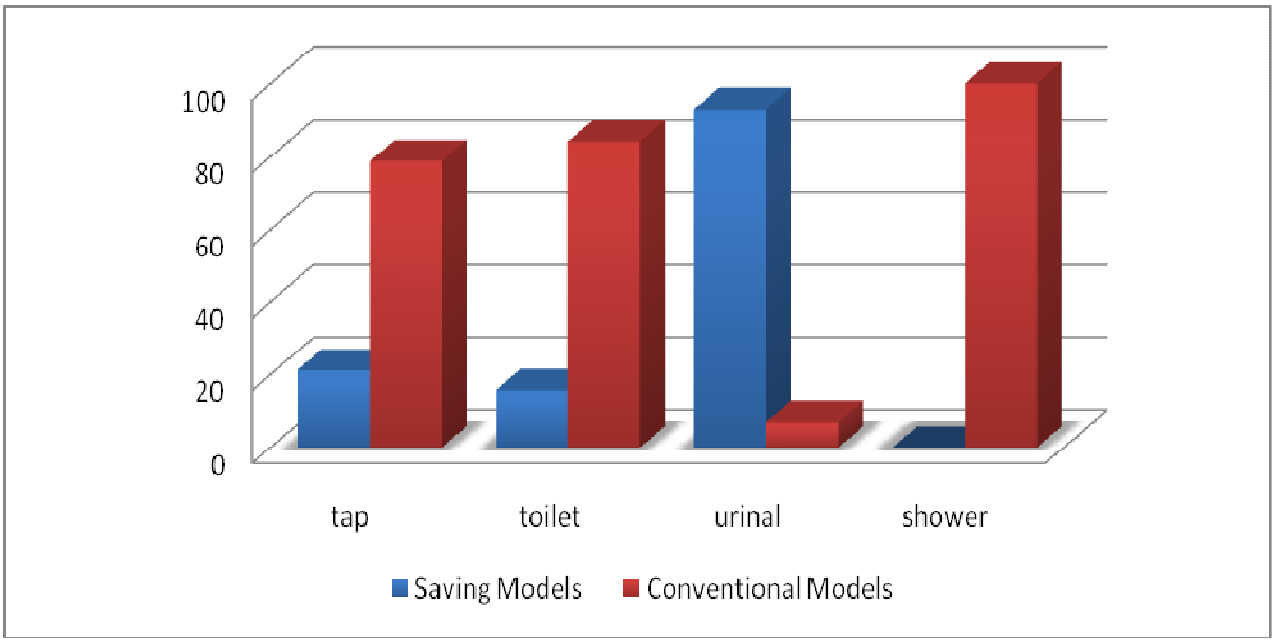

Figure 3 - Comparison between water saving and conventional equipments preexisting in campus of the Technological Science Centre (CCT-UDESC)

Through registration, functioning conditions of water use points were observed and the main problems were detected, as follow:

- *Toilet*s: most of toilets located on campus require adjustments with regard to water quantity and pressure, presenting problems of splashing and no carrying of waste;
- *Self-closing taps*: in most cases, they need regulation of water jet duration and flow. Many of them present splashing or leaks;
- *Conventional taps*: some of them present difficulties in opening and closing, drips, leaks or even in the form of fillets of water, causing high wastage;
- *Showers*: all showers installed on the campus are of electric and most of them do not work properly;
- *Urinals*: some urinals present obstructions while others have problems with operation (after pressing the valves they do not close automatically);
- In general, most of the equipment used is not standardized and there is a great diversity regarding to its types, brands and materials, which cause difficulties in maintenance.

3.1.2 Characterization of users' behavior in respect to water use on campus

The characterization of users' behavior regarding water usage on campus has been accomplished through the processing of data obtained with the application of a questionnaire. The goal was to verify users' profiles, activities, behaviors, and level of awareness of each group concerning use of water. Some actions have been defined in developing the questionnaire. Questions should be as objective as possible in order to facilitate its completion. Moreover, it was not asked any identification, thus ensuring reliability in the answers. Some results are presented in Figures 4, 5 and 6 referring to some of the data collected through the questionnaires to the various users groups on campus.

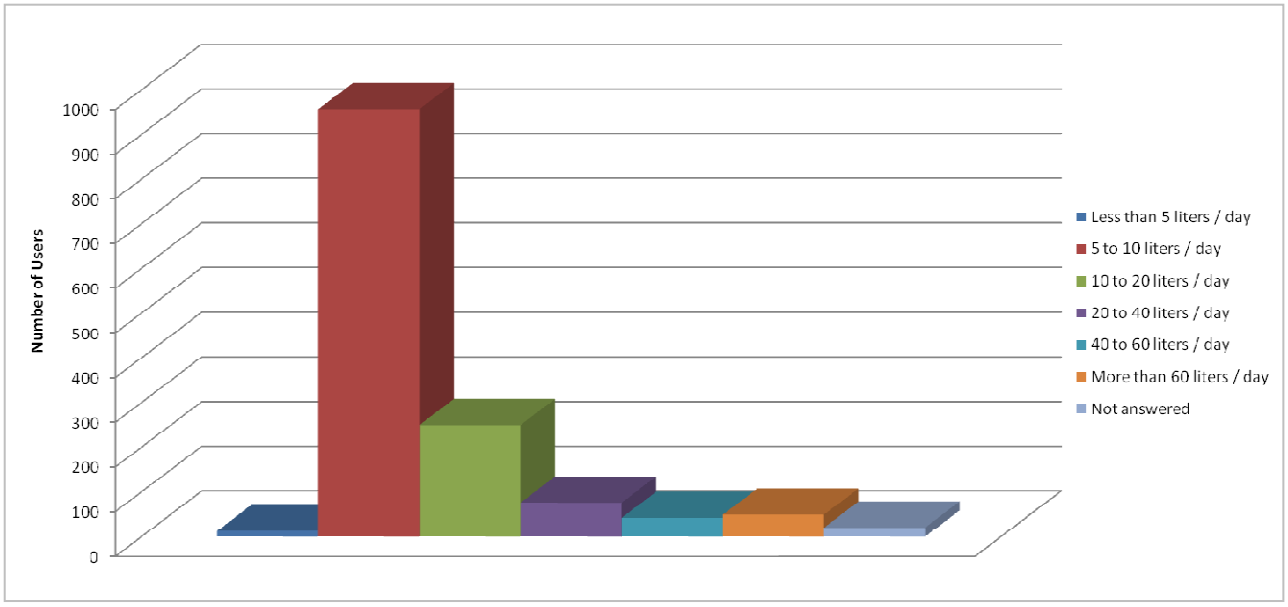

Figure 4 - Individual use of water on campus according to users' perception
(Source: Silveira Junior, Ramos, Kalbusch, 2007)

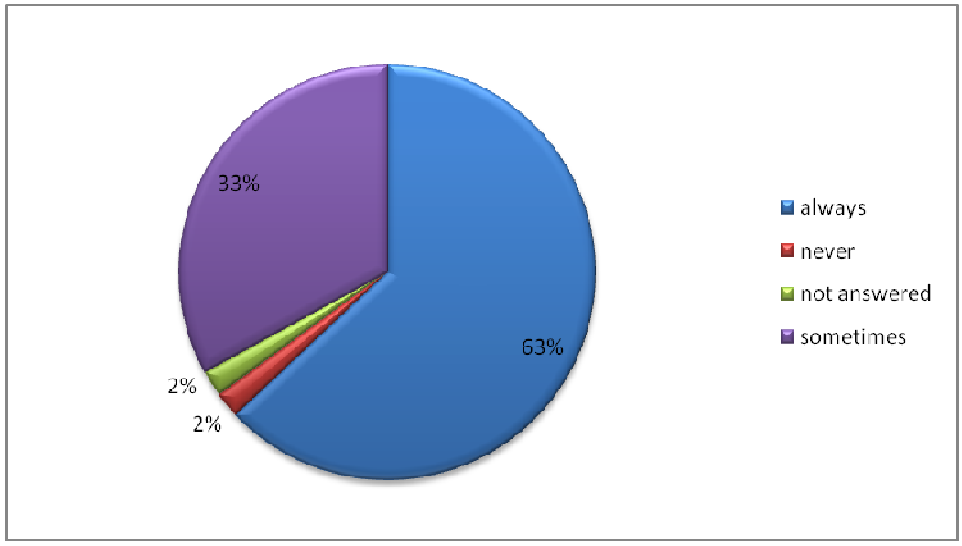

Figure 5 –Answer to the question: “flushing toilets once is sufficient?” according to users’ perception (Source: Silveira Junior, Ramos, Kalbusch, 2007)

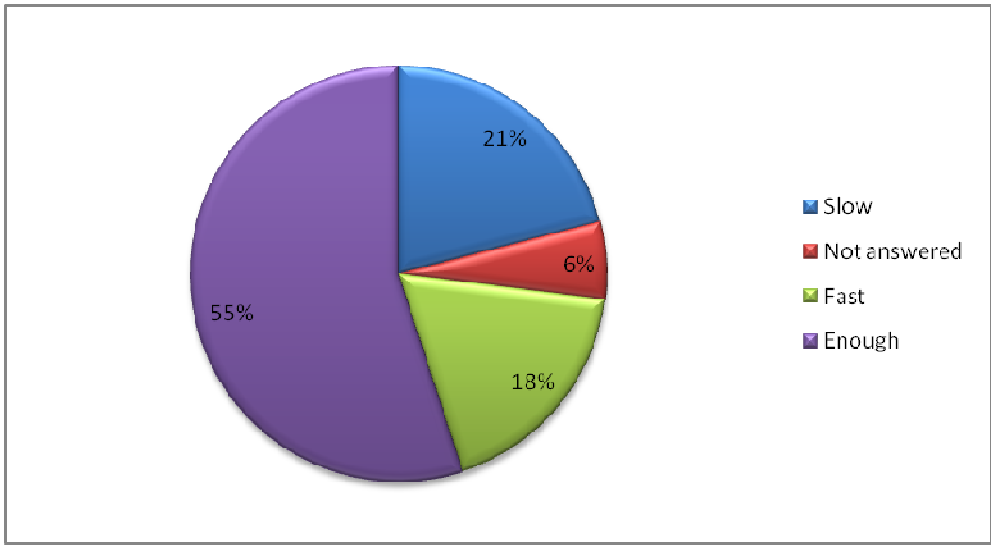

Figure 6 –Perception about the closing time of the urinals (Source: Silveira Junior, Ramos, Kalbusch, 2007)

The questionnaires were answered by 54% of the campus users which makes the result of the survey valid and satisfying, with an error less than 2%, favoring the development of subsequent stages of the program.

3.2 Specification of a Water Submetering System

The proposed plan for a submetering and monitoring system was structured so that each sector of the campus may have their consumption profile verified individually. According to the plan, as shown in Figure 7, the three metering counters of the municipal supplier still concentrate the registering of the whole consumption of water in the campus.

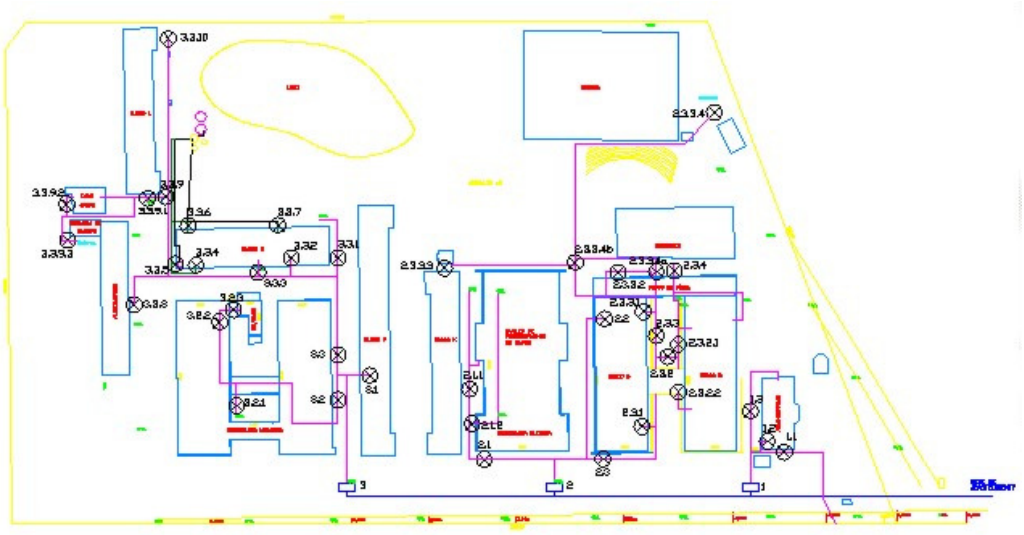

Figure 7 - Proposal for a water submetering system on campus.

To make the proposed plan viable, the municipal water supplier lent hydrometers which will not be billed to the program. The continuity of the work involves the installation of this equipment to implement the monitoring of the sectored water consumption.

3.3 Equipment Replacement

According to Oliveira and Gonçalves (1999), actions of technological nature of a WCP include implementation of new methods and technologies. The campus Water Conservation Program is still raising funds to promote the replacement of conventional to water saving equipment, based on the previous diagnosis presented in 3.1. Other activity developed by the program was the project of a recycling water cooling system for the thin films laboratory, in the Department of Physics, aiming to reuse water. Figure 8 shows the layout and operation of the system.

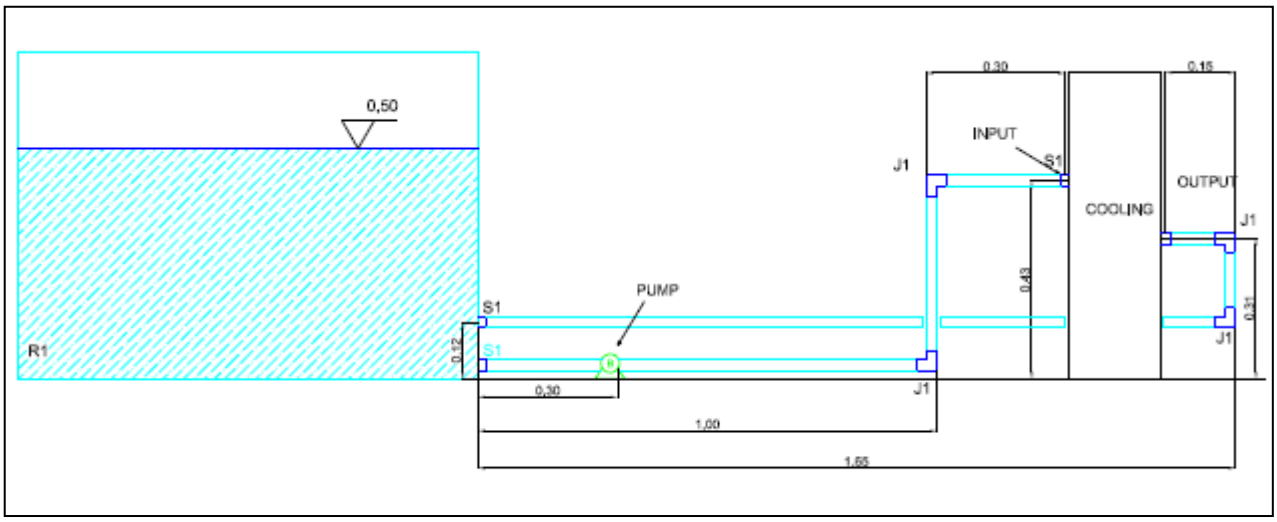

Figure 8 - Scheme of a recycling water cooling system for the thin films laboratory.

The system designed will generate a water saving consumption of up to 1080 liters of water each time it is used. Once the system is operating there will be a significant reduction in water consumption in this laboratory. This reduction is estimate as seen in Figure 9.

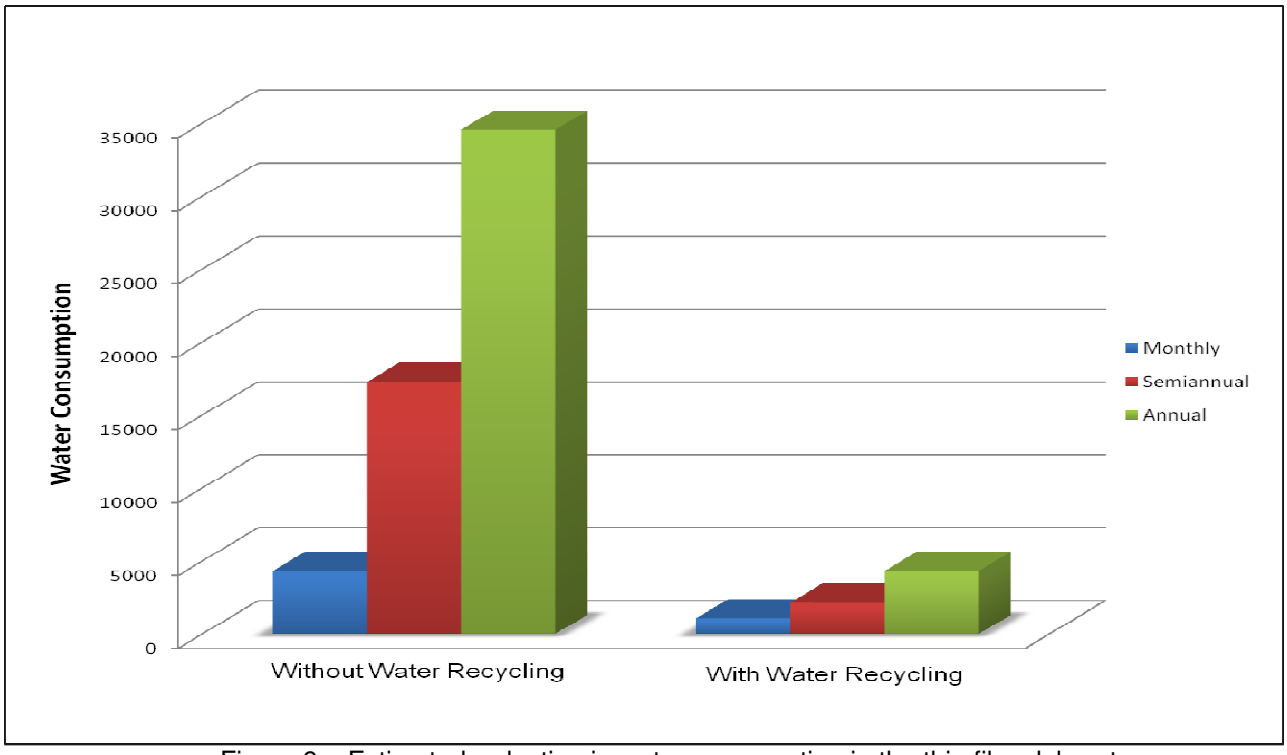

Figure 9 – Estimated reduction in water consumption in the thin films laboratory.

3.4 Educational Campaigns

The campaign was structured to meet the different users of the hydraulic and sanitary systems of the campus: lecturers, faculty staff, students and visitors.

Topics to be addressed in a campaign to raise awareness of the users are (Oliveira; Gonçalves, 1999):

- Reasons of using water rationally;
- Advantages of reducing the volume of water and treating sewage;
- Reduction of expenditures of water bills and energy;
- Achieving the largest possible number of users.

For the launch of the CCT-UDESC campaign, a contest was planned - involving all campus users - in order to choose the program logo. The disclosure of the contest result (Figure 10) was done at the opening of the Civil Engineering Week, in October 2008.

Figure 10 - First place in the contest logo for the CCT-UDESC WCP campaign.
(Source: Kalbusch, Ramos, Steffen, 2010)

An e-mail was also created so that users could alert the program staff about leaks in the hydraulic and sanitary systems in the campus: **pura@joinville.udesc.br**. This email address has been disclosed in the program informative posters and all information is reported to the Campus Maintenance Sector - which deals with the investigation and repairing of those problems.

Specific posters were made and distributed in all water use points of the campus. They present information about how to proceed in case of leaks or any malfunction is found, with the possibility of communication through e-mail or phone. Figure 11 illustrates a model of one the posters made, in this case, specifically for urinals.

Figure 11 - Example of information posters about procedures once a water leak or malfunction is detected.

4 FINAL DISCUSSIONS

Water has economic, social and strategic value. It is essential to the existence and welfare of human being and ecosystems equilibrium (Spricigo, 2006). Water is important for multiple activities; this is where the justification for the establishment of a Water Conservation Programs lies.

The continuity of the program intend to achieve the goal of reducing water consumption allied to quality maintenance, expected by users of hydraulic and sanitary systems on the campus of CCT-UDESC. This goal is expected to be achieved through actions such as detecting and fixing of leaks or any other malfunction, specification and installation of water saving technologies, and, educational efforts to encourage rational use.

The activities implemented so far by the program have disseminated among users of hydraulic and sanitary systems, either on campus or outside it, the main goals of the campaign launched, increasing the chances of its success with a progressive implementation of the whole program.

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