AREA OF ENVIRONMENTAL EDUCATION OF APPROPRIATE TECHNOLOGIES FOR INTEGRATED WATER MANAGEMENT IN RURAL COMMUNITIES AND MARGINALIZED PERIURBAN

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Abstract

The attention of marginalized groups in rural communities is a major technical and social challenge. As alternative solutions, the Mexican Institute of Water Technology (IMTA) integrated appropriate technologies for supply, use and sanitation water and alternative technologies for the efficient use of energy in a demonstration area. Generated by the impact was felt necessary to create a demonstration area under the concept of "eco-home model", which integrates all technologies and can show sustainable management and reuse of water resources and energy in the home environment.

Introduction

In Mexico, 63% used water from surface sources and the remaining 37% comes from aquifers. The intense population growth and internal migration to arid and semi arid regions result in an overexploitation of water resources in Mexico (CONAGUA, 2007). The over extraction of groundwater represents almost 40% of the total use of this. Currently, only 30% of sewage receives any treatment. The CONAGUA estimates that 52% of the total surface water resources are heavily contaminated, while 39% are moderately polluted and only 9% is of acceptable quality.

The lack of clean water and sanitation has a direct impact on the health of the population causing gastrointestinal diseases prevail within the main causes of morbidity and mortality especially in children, addition to the environmental impact caused by wastewater discharges or open defecation . In Mexico, there are 184 748 rural communities with fewer than 2 500 inhabitants, whose mountainous terrain and dispersion result in severe obstacles to providing potable water service, sewerage and sanitation to more people.

For several years, the Mexican Institute of Water Technology (IMTA) has researched, developed, adapted and transferred a range of appropriate technologies forming a package that comprehensively solve the problems of water supply, disinfection, treatment, reuse and water use. The main idea is to integrate the package generally an eco-home model sustainable for a family in rural and marginalized peri urban areas.

Covering their basic needs of energy, water and sanitation and food production for own consumption at home.

Today, it has installed an eco-home model in the state of Morelos, and due to its diffusion was generated interest to replicate under a cultural and educational scheme, as an environmental education area that includes appropriate technology, this in the towns bordering the lake Patzcuaro basin, Michoacan, and Apatlaco River Basin, Morelos; in the state of Michoacan have 2 of 4 models installed education, and the state of Morelos will be 10 models.

Methodology

Environmental education spaces are designed for rural, indigenous and marginalized peri-urban as work areas (classrooms) with capacity to accommodate 24 people; are designed using common materials and construction techniques. The space was raised according to the minimum requirements recommended by the National Institute of Physical Infrastructure in Education (2009) for classrooms in rural areas. Implemented appropriate technologies to capture, supply, disinfection, sanitation and water management. To design the demonstration area were taken into account weather data as: wind direction, solar radiation, temperature and rainfall.

The harvesting and use rain water was done according to procedure COLPOS-CIDECALLI (2007). For water treatment and sewage, this is dimensioned to comply with the Official Mexican Standard NOM-001-SEMARNAT-1996 establishing the maximum permissible limits of pollutants in wastewater discharges in water and national assets.

As a demonstration area for food production for subsistence, was implemented in a kitchen garden with the minimum dimensions of 4 x 10 m, which is intended to provide education on water reuse for food production and food production at household level. Another feature of the garden is to teach the operation Flush Tank Fund (TDF) as a self-operating device for watering small areas by gravity (such as a kitchen garden) intermittently from small flows.

For the power supply and taking into account that in some rural areas not reached by service lines, the demonstration area used photovoltaic cells that convert sunlight energy into electricity. The energy required is calculated to feed a television, computer, video projector, a refrigerator, a blender, a microwave and seven-saving lamps.

Results and discussion

The educational demonstration area of the town of Patzcuaro is located within the Sports Centre facilities and consists of an adobe wall construction, which is inexpensive

and easily accessible since they are generally removed from the site will be use, producing significant savings in the purchase and transport. Moreover the material properties and construction techniques used provide additional benefits such as thermal and acoustic insulation, due to its low heat conductivity and sound absorption in the thickness of the walls (Figure 1). Finally, this material is often developed and used by the inhabitants of rural communities and is not necessary to use energy to transform it into useful material.

The dimensions of the system for capturing rainwater that can guarantee an dotation of 45 l / person / day throughout the year, including the 5-month dry period in the study area, resulted in a catchment area of 95 m2, for which is available tile roof. The collected water is piped through PVC gutters and pipes into a ground storage tank (tank type capuchin) of 30 m3 (Figure 2).

Figure 1. Educational demostration area

Figure 2. Rain water harvesting.

Wastewater treatment and sewage is a combined system that integrates a pre-treatment and two biological processes (anaerobic-aerobic) in series. Grey water from the personal toilet, washing dishes and clothes are sent to a grease trap. Water from the toilet passes through a septic tank. These two effluents are combined and subsequently passing through the upflow anaerobic filter and finally through a horizontal subsurface flow wetland (Figure 3).

The family garden has an area of 40m2 (4m x 10m), which is generally intended for food production for self-consumption at household level and / or community (figure 4). Among the advantages it provides are: the small-scale intensive production, low demand for labor because the work is distributed throughout the year, sustained production, high species diversity and variety of production cycles, plus it encourages family integration as it takes care to cultivate.

The family garden is watered through an intermittent irrigation system self-operative called Downloading Tank Fund (TDF), which is composed of a 200 liter tank, a device for opening and closing and a gated pipe. This system can take advantage of low flows for irrigation (from 0.2 l / s and up), is low cost, easy construction and minimal maintenance requirements and operation, requires no external power to operate, greatly decreases the work of watering, reduces irrigation time compared to traditional irrigation by gravity and can ensure irrigation efficiencies above 75%. Requires no external power to operate, greatly decreases the work of watering, reduces irrigation time compared to traditional irrigation by gravity and can ensure irrigation efficiencies above 75%.

The electricity supply is provided through 4 panels (CONDUMEX) of 125 W each one. The system includes all components: solar array, charge controller, power inverter, storage battery bank and can provide up to 1,000 W. Addition have a second independent panel that feeds a ¾ hp pump (figure 5), this pump is used to transport water from the cistern capuchin to tank demonstration area.

Figure 3. Wastewater treatment.

Figure 2. Family garden

Figure 5.Photovoltaic system

Conclusions

Incorporate a demonstration area for environmental education respecting the surrounding environment and using construction techniques and materials appropriate to the site location: the use of natural insulation materials, recycling and rational water management, the use of types suited to the rural, indigenous and marginalized peri-urban, low economic and social cost and energy savings by the use of renewable energy, allow to show sustainable water management and energy. This model is being replicated in several municipalities that have requested it.

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