Harvesting Water for the Future – Rainwater Harvesting Systems in San Miguel de Allende, México

SWIG AWARD 2015 entry from Engineers Without Borders UCL: International

Context

Engineers Without Borders (EWB-UCL) is a student society that aims to facilitate human development through sharing engineering and technical expertise in the developing world. We work with local NGOs in different locations around Latin America, Africa and Asia to implement efficient engineering solutions to specific social problems, such as lack of water security, energy, sanitation and shelter. In 2010, the society became an affiliated branch of Engineers Without Borders UK. This has led to an incremental expansion in the number of projects, from one during its first year to five in 2013-14 (out of a total of ten in UK), and nine in 2014-15.

In 2013, EWB-UCL started Harvesting Water for the Future Project in partnership with IRRI-Mexico, a Mexican NGO specialized in eco-technologies for both the city and the countryside. During the summer 2014, three volunteers went to San Miguel de Allende Mexico to repair and reinstall 13 rainwater-harvesting systems in 11 rural schools and a rural clinic. The systems were developed and originally installed by Dr Ilan Adler, from the CEGE Civil, Environmental and Geomatic Engineering department at UCL. They provided quality drinking water to users, most of whom were primary school children, who didn't have access to safe water.. Nevertheless, by 2013 all the systems required maintenance and some were not being used. This was due to the lack of involvement of the local authorities and the high rotation of system users, such as head teachers and municipal leaders.

The need

The rural areas of San Miguel de Allende, Mexico, have a population of over 60,000 people, from which over 60% live under the poverty threshold. Since most of the rural communities do not have the economical or infrastructure resources to obtain drinking water, the only source available is ground water. However, the levels of fluoride and arsenic in this area go from 2 to 20 times the acceptable limits based on international WHO guidelines and local regulations. The consumption of high levels of these minerals can have major effects on public health, such as recurrent cases of fluorosis, renal and cardiac problems.

Implemented innovations

The rainwater-harvesting systems consist of a mechanism that catches, drives, stores and filters water so that users are able to drink it all year long after the raining season. First, rainwater falls to the roofs of the building. In spite of the low volume of rainfall in San Miguel (approx. 600mm a year), it is possible to catch one liter per m^2 of roof in less than a minute. The water is directed from the roof to a first flush, which takes away dirt and sediments by mechanical means, and then stored in a cistern. The volumes of the cisterns used in the project go from 5 to 40 m^3, according to the size of each school. Finally, when the tap is opened a pump pushes the water from the cistern to the filtering system, composed by a cellulose pre-filter, a micrometric stainless steel filter, an active carbon and KDF filter and silver ions for disinfection. Technical details are available as part of the investigation done in Dr Adler's doctoral research at UCL as well as in two peer-reviewed journal publications. Water quality testing done over the summer 2015 by a new EWB UCL volunteer's team showed that water provided by the systems was safe to drink even one year after the original visit.

Results and Benefits

From the work of the EWB-UCL volunteers in 2014 and 2015,, all the rainwater-harvesting systems installed in 2007 were upgraded and 4 new systems were installed. These are located in some of the most marginalized areas of the San Miguel de Allende communities. In total, over 450 people have now access to drinkable water.

This way to obtain, store and purify water presents several benefits. For instance, the electrical consumption is low (the pumps used are only 0.8 hp), the storage capacity is enough for users to have drinkable water during the dry season (from October to April), allowing the communities to become independent from centralised or commercial water services that need important amounts of energy and infrastructure to bring water from elsewhere.

Project Sustainability

. Once the systems are installed, it is possible to keep them working efficiently for many years as long as they are regularly cleaned and maintained. Among other activities, the EWB UCL teams provided installation and maintenance workshops to users and local NGOs in order to provide the technical knowledge needed to allow the users to have safe drinking water for many years to come. It was calculated that the installation of a new system with 5m3 storage capacity was around £1000, while replacing the parts that need to be replaced once a year is less than £50. While the installation and initial repair of the systems were subsidised by EWB UCL, the communities are currently doing the required maintenance by themselves, up to a high standard. This is possible thanks to the technical knowledge they've been given and the low cost of the replaceable parts.

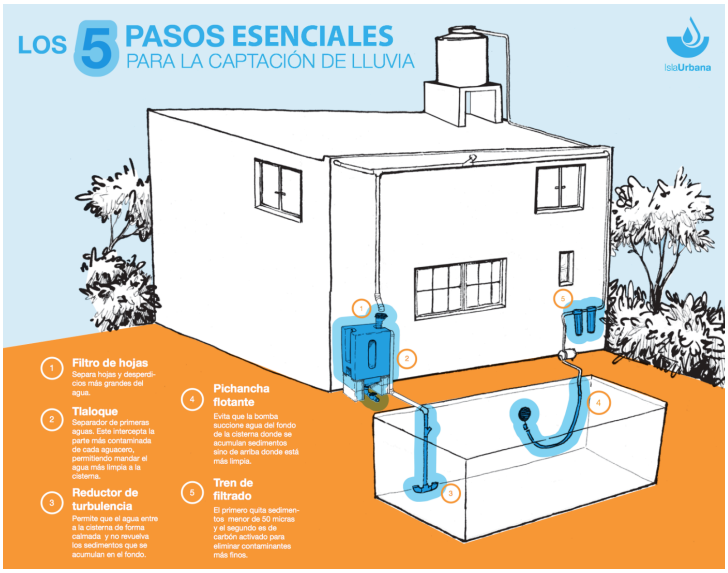
Possible applications in the UK

The same technology could be applied in UK buildings in order to get water from a sustainable source. Moreover, since the rainfall volume in the UK can reach up to 5 times the volume in San Miguel, the storage space needed per building would decrease significantly, making the installation even more efficient. This would allow both UK domestic and non-domestic buildings to be independent from centralised services and to decrease significantly the resources used to transport and treat drinkable water.

Useful Links

EWB UCL: http://www.engineering.ucl.ac.uk/engineers-without-borders/
IRRI Mexico: http://www.irrimexico.org/
Documentary 'Harvesting Water for the Future': https://www.youtube.com/watch?v=-qClMJJe9oc

System Diagram (Domestic version, picture created by Isla Urbana)



Examples of Stakeholders and installed systems