

# Water saving and reuse for a greener economy

**Professor Antonio Lopez** provides an introduction to an innovative bilateral project devising solutions to enable sustainable reuse of wastewater and efficient water use in agriculture



**As one of the largest current Indo-European projects, how are you coordinating Water4Crops (W4Cs) to ensure that its objectives are carried out effectively?**

The key factor in ensuring the effective coordination of the two W4Cs projects is the simplicity and the similarity of their structures. The projects mirror one another with an identical structure in terms of both work packages (WPs) and topics. This means that the partners of each twinned WP speak the same language and have shared competencies, which facilitates their organisation and the project as a whole. Periodic WP meetings and joint project meetings are specifically scheduled to help

coordinators monitor developments and, in some cases, adjust activities.

**Could you discuss the main challenges presented by the two project locations and the ways in which W4Cs will overcome them?**

The main challenges are rooted in the differing economies and educational systems of the regions. The average Indian income is lower than that of Europe, as is the level of the technological development, particularly in agriculture. Although continuously decreasing, such differences are still significant. Our research has been designed with such differences in mind, thus ensuring we are not aiming towards unrealistic goals.

Within the agricultural sector – where the results of our work can be most easily implemented – the two issues we are facing are limited fresh water resources and the excessive use of water for irrigation due to the overestimation of crop water requirements. We are aiming to utilise non-conventional water resources by developing innovative and sustainable techniques to treat wastewater, so that it can be safely used in agricultural production while safeguarding the environment. This could save huge amounts of fresh water resources for drinking and domestic use.

In terms of using natural resources more efficiently, we are developing new techniques

that precisely measure the amount of water that the plant and soil require. By doing so, we are able to obtain a maximum yield so that excessive use of such limited water resources may be avoided. Using new technologies to determine exactly when and the extent to which we should irrigate will enable us to produce more crops per drop and unit area.

**How would you define your approach and what makes it so innovative?**

In practice, we apply a modular multistep approach that brings together wastewater treatment and reuse with its valorisation by recovering compounds of high or moderate value. First, organic products originally occurring in the wastewater are converted into valuable products, such as organic acids or bioplastics, through dedicated biotechnological processes. After their separation, a final treatment is applied to obtain high quality irrigation water containing fertilising matter such as the nutrients commonly occurring in wastewater. The novelty of the approach mainly lies in the maximal recovery of chemicals and nutrients.

**What practical solutions will be in effect by the project's completion in 2016?**

By 2016, we plan to have developed the following solutions:



# Developing solutions together

In an effort to reduce the amount of freshwater used in crop irrigation, Water4Crops – an Indo-European research project – has been set up to investigate alternatives that will boost the green economy in both regions

- Innovative biotechnological wastewater treatments for improved water reuse in agriculture
- Alternative combinations of bio-treatment, recycling of high value elements and bioproducts, leading to better commercialisation of biotechnology and agricultural products in Europe and India as a basis for green growth
- Best practices for improving water use efficiency in agriculture through agronomics, plant breeding and locally adapted new irrigation technologies, and accurate crop water requirement measurement techniques
- Enhanced involvement among stakeholders (technology producers, technology users, retailers and regulators) for exploiting the outputs of the projects as means towards food and water security, and enabling mutual steps towards a green economy in Europe and India

## Are there any forthcoming events or workshops related to W4Cs that you would like to mention?

Three events will be held in Italy during the first week of December. On 2 December, at the Italian Parliament, one event will celebrate the technical-scientific cooperation between Italy and India. W4Cs has been selected to present there as a model of cooperation in the field of biotechnologies and agriculture. On 3 December, the first INNOVA-platform meeting will be held in Bari, Italy. Finally, from 4-6 December, the first joint-W4Cs meeting will be held. This meeting is one of two planned over the course of the project and will be attended by all partners of both consortia.

**FROM PROVIDING SANITATION** to feeding the population, water is critical to the meeting of several basic human rights and is thus intrinsic to international security. Yet there are still significant issues with how we use and distribute this valuable resource – today, billions of people are still affected by water scarcity, poor water quality and/or a lack of basic sanitation.

The exponential growth of the world's human population – which, according to forecasts by the Food and Agricultural Organization of the United Nations (FAO) will stand at 9.3 billion people in 2050 – will continue to place a huge amount of pressure on an already stressed system. The UN's World Water Development Report (WWDR) predicts that, as a result of this population surge, there will be a 70 per cent increase in demand for food and drinking water. Furthermore, the movement away from fossil fuels towards green energies complicates matters further, with biofuel-producing crops also requiring a significant share.

## THE SEARCH FOR ALTERNATIVES

The WWDR cites that between 70-90 per cent of freshwater is used in agriculture-related irrigation – an amount that is unsustainable, especially given that demand will only increase. A number of researchers around the world are looking to nonconventional water resources, such as wastewater, as viable alternatives.

However, a number of challenges must still be addressed before communities around the world can fully benefit from wastewater reuse. The practice suffers from an often negative perception in the media – most likely linked to reports of individuals suffering from gastrointestinal illnesses contracted through the use of untreated wastewater in irrigation – which can prove problematic. In addition, less developed and rural countries are hampered by

expensive treatment costs, as well as a host of complicated technological issues.

## AN INDO-EUROPEAN PARTNERSHIP

Water4Crops (W4Cs) is a major bilateral research project that sets out to contribute to the green economies in both Europe and India through the integration of wastewater valorisation and reuse with improved water-use efficiency through agronomics, plant breeding, locally adapted new irrigation technologies and accurate crop water requirement measurement techniques. Run as two linked projects based in each constituent region, the European W4Cs consortium comprises 22 partners from eight countries, and includes a range of universities, research institutes, agro-industrial companies, spin-off companies and consultants.

This multidisciplinary nature of the W4Cs consortium is a clear strength of the project as Professor Antonio Lopez, Project Coordinator of W4Cs-EU explains: "The partnership is enhanced by the fact that it encompasses many competencies belonging to different disciplines. Though, of course, this makes the coordination of W4Cs rather complex". Among the sectors covered, the consortium has expertise in environmental and process engineering; agronomy and water resources management.

## TREATING WASTEWATER: DOUBLE THE BENEFIT

A central aim for the team is to develop and implement sustainable technologies as well as best practices that will support wastewater exploitation in agriculture. This water could be a by-product of a number of activities, including agro-industrial processes. However, since the widespread treatment and subsequent use of wastewater alone is unlikely to yield much economic gain in exchange for a fairly

## INTELLIGENCE

# Water4Crops

### OBJECTIVES

- To develop innovative biotechnological wastewater treatments for improved agricultural wastewater reuse
- To initiate the co-creation of alternative combinations of bio-treatment, recycling of high value elements, and combinations for bioproducts leading to a better commercialisation of biotechnology and agricultural products in Europe and India
- To improve water use efficiency at field level through agronomics, plant breeding and locally adapted new irrigation technologies and accurate crop water requirement measurements techniques

### PARTNERS

EU: **IRSA-CNR**, Unit of Bari, Italy  
• **NERC-CEH**, UK • **FHNW** Switzerland • **UNIBO**, Italy • **VITO** – Flemish Institute for Technological Research Belgium • **TUC**, Greece • **UFZ**, Germany • **UNICT**, Italy • **GEAU-Cemagref**, France • **INRA**, France • **ALTERRA**, The Netherlands • **CER**, Italy • **GIZ**, Germany • **INOFEA GmbH**, Switzerland • **SIMA-tec GmbH**, Germany • **Bionactis**, Switzerland • **PHYTOREM SA**, Miramas, France • **VITA 34 AG**, Leipzig, Germany • **Envinhealth**, Greece • **HORTA**, Piacenza, Italy • **STEP**, Germany • **UNIRM**, Italy

India: **ICRISAT** • **Euro India Research Centre** • **Ion Exchange** • **Jain Irrigation Systems Limited** • **Larsen & Toubro** • **MS Swaminathan Research Foundation** • **CSIR-NEERI** • **SABMiller** • **The Energy and Resources Institute** • **University of Agricultural Sciences, Dharwad** • **Ugar Sugar** • **JalaSRI, Watershed Surveillance and Research Institute from Moolji Jaitha College**

### FUNDING

EU Seventh Framework Programme (FP7) – contract no. 311933

### CONTACT

**Professor Antonio Lopez**  
Project Coordinator

Consiglio Nazionale delle Ricerche  
Istituto di Ricerca sulle Acque  
Via F. De Blasio, 5  
70132 Bari, Italy

T +39 08 05 82 0550  
E antonio.lopez@ba.irsacnr.it

[www.water4crops.org](http://www.water4crops.org)

**DR ANTONIO LOPEZ** has worked at the Water Research Institute (IRSA) of the Italian National Research Council (CNR) since 1982.

significant investment – especially within rural areas – Lopez and his colleagues have developed an innovative approach that could potentially produce twice the benefits.

Rather than simply restoring wastewater in order to meet quality standards and enable its reuse, the researchers propose to further exploit the resource at their disposal. “We plan to go one step further in that we want to separate and recover valuable organic compounds as well as nutrients from the wastewater,” Lopez highlights. “As such, we can combine valorisation, treatment and reuse.” These high-value nutrients reclaimed from the wastewater have the potential to dramatically boost crop yields when put back into the land.

### DEVELOPING WASTEWATER TREATMENT SYSTEMS

W4Cs is mainly focused on two types of small, decentralised wastewater treatment system appropriate for the small settlements found in rural areas in India and Europe: technological and natural.

A variety of innovations are being developed for the technological systems, including a sequencing batch biofilter granular reactor, an environmentally-sound tool that can reduce up to 80 per cent of disposable sludge produced at a conventional plant. Nano-biocatalysts that can be used to assist with the degradation of micropollutants are also of particular interest. In addition, the researchers are keen to devise methods that combine biological treatment with surface filtration through cheap and natural membrane, which they believe could offer a greater deal of control in terms of desired water quality.

In their work on natural systems, the W4Cs team is centring its efforts on constructed wetlands (CWs), eco-friendly systems with low maintenance costs. At present, very little is known about CWs and so the group is keen to investigate how best such a natural system can be exploited. Therefore, research will be carried out to learn more about aspects including pathogens; heavy metals and nitrogen removal potential; clogging and preferential-flow phenomena; hydraulic behaviour; and design.

### THE INNOVA PLATFORM

In order for the W4Cs technologies to have a successful market uptake, Lopez and his partners are acutely aware of the need to collaborate with a range of stakeholders. Without the capacity for social changes – for example, in user practices, regulations and industrial networks – any technological developments as a result of W4Cs’ work would be effectively redundant, a fate that the team is keen to avoid.

The INNOVA stakeholder platform was established to close this gap, and lies at the heart of W4Cs. Through the platform, the researchers are able to connect and communicate with a suite of key contacts with expertise in a range of relevant sectors, including technology use, marketing and policy. Over the project’s course, two major INNOVA meetings will take place, with the aim of encouraging researchers and stakeholders to share their experiences to date, discuss and work towards solutions to any particular challenges, and identify any further opportunities to boost green growth as part of the project.

### LAYING DOWN THE GROUNDWORK

After receiving around €6 million from the European Commission under the Seventh Framework Programme (FP7), the European arm of the project, W4Cs-EU, officially began its four-year term in August 2012. The Government of India granted by its Department of BioTechnology a further €3 million to the project in November 2012, enabling W4Cs-India, coordinated by Dr S P Wani from ICRISAT, to start work.

Due to the number and variety of stakeholders involved in various aspects of the project, much of its first year was spent delegating tasks among participants to ensure that each objective is achievable. Following this organisational period, partners were then able to perform any necessary preliminary activities and ensure that all of the requisite equipment was in place. Research is now in progress in both India and Europe, and during the first joint W4Cs meeting in December, stakeholders from each side of the project will have the opportunity to discuss any findings to date.



Water4Crops

